2026 EDITION

Minimum Academic Standards for the School of Science Education

For NCE and Degree Programmes in Colleges of Education under the National Policy on Dual Mandate

FEDERAL REPUBLIC OF NIGERIA

NATIONAL COMMISSION FOR COLLEGES OF EDUCATION

(NCCE)

2026 EDITION

Minimum Academic Standards for the School of Science Education

For NCE and Degree Programmes in Colleges of Education under the National Policy on Dual Mandate

NCE (100–300 Level) • Degree (400–500 Level) • Curriculum Implementation Framework

ABUJA, NIGERIA | 2026

Foreword

The transformation of any education system begins with the quality of its teachers. Teachers shape not only what learners know, but also how they think, create, solve problems and contribute meaningfully to society. It is therefore imperative that the institutions entrusted with preparing our teachers remain responsive to the changing needs of education, the economy and national development.

The introduction of the Dual Mandate for Colleges of Education represents an important milestone in the Federal Government's continuing effort to reposition teacher education in Nigeria. By providing an enabling framework for qualified Colleges of Education to offer both the Nigeria Certificate in Education (NCE) and degree programmes, the policy creates new pathways for institutional growth, improved access, professional progression and the preparation of teachers at different levels of the education system.

The successful implementation of this policy, however, depends fundamentally on the quality and relevance of the curricula that guide teaching and learning. It is for this reason that I commend the National Commission for Colleges of Education (NCCE) for developing this new generation of curricula to provide the academic foundation for the implementation of the Dual Mandate.

The curricula have been conceived within the context of contemporary national and global realities. Beyond disciplinary knowledge, emphasis is placed on the development of competencies required of the modern teacher, including digital literacy, critical thinking, creativity, communication, entrepreneurship, inclusive education, research, innovation and practical professional competence. This reflects our determination to move teacher education increasingly from knowledge acquisition alone towards the development of practitioners who can translate knowledge into effective classroom practice and measurable learning outcomes.

Of particular importance is the opportunity presented by the Dual Mandate to strengthen the relationship between the NCE and degree pathways within the College of Education system. While each qualification retains its distinct academic and professional requirements, their implementation within appropriately resourced institutions should encourage greater coherence, efficient utilisation of facilities and personnel, stronger academic progression and a more vibrant teacher education environment.

The publication of this curriculum is therefore more than an academic exercise. It is an important instrument for translating Government policy into classroom practice and ultimately improving the quality of teaching and learning across our education system.

I urge Governing Councils, Provosts, academic staff, professional bodies and all other stakeholders to approach implementation with the seriousness it deserves. The curriculum must be supported by competent lecturers, appropriate infrastructure, modern teaching and learning resources, effective quality assurance and sustained investment in staff development. Colleges must also continue to strengthen partnerships with schools, industry, communities and other relevant institutions so that teacher preparation remains connected to the realities of the society it serves.

I congratulate the Executive Secretary and Management of NCCE, the curriculum experts, academics, professional bodies and other stakeholders whose contributions have culminated in this document. Their collective effort represents an important investment in the future of Nigerian education.

It is my expectation that the effective implementation of this curriculum will produce a new generation of professionally competent, digitally capable, innovative, inclusive and globally competitive teachers equipped to educate the Nigerian child for the opportunities and challenges of the twenty-first century.

I am pleased to commend this curriculum to all Colleges of Education and stakeholders in the Nigerian education sector.

Dr Maruf Tunji Alausa
Honourable Minister of Education

Introduction

The publication of the curricula for the implementation of the Dual Mandate in Colleges of Education marks a defining moment in the evolution of teacher education in Nigeria.

For decades, Colleges of Education have occupied a strategic position in the preparation of professional teachers, particularly for the basic education subsector. The changing demands of Nigeria's education system, advances in technology, evolving labour-market requirements and the need to create stronger opportunities for academic and professional progression have, however, made it necessary to rethink the scope, structure and delivery of teacher education.

The Dual Mandate responds to this imperative by enabling eligible Colleges of Education, subject to prescribed regulatory and quality assurance requirements, to operate NCE and degree programmes within a coherent institutional environment. The policy is not simply an expansion of programme offerings. It represents an opportunity to reposition Colleges of Education as stronger, more responsive and more innovative centres of teacher preparation, professional development, research and community engagement.

It is within this context that the National Commission for Colleges of Education (NCCE) undertook the development of the curricula for ten Schools. Across these Schools, the curricula seek to achieve an appropriate balance between theory and practice, knowledge and competence, disciplinary depth and professional pedagogy. They also recognise that the teacher of today must possess capabilities that extend beyond mastery of subject content.

The curriculum development process brought together experienced academics, teacher educators, subject specialists, professional bodies and other stakeholders to ensure that the resulting documents are academically sound, professionally relevant and responsive to contemporary educational needs. Particular attention was given to achieving appropriate alignment and progression between the NCE and degree components while preserving the standards and learning outcomes required at each level.

Accordingly, contemporary and cross-cutting competencies have been embedded across the programmes. These include digital competence and responsible application of emerging technologies; entrepreneurship and innovation; inclusive and learner-centred pedagogy; communication and collaboration; critical thinking and problem-solving;

research and evidence-based practice; environmental awareness and sustainability; and the professional values and ethics expected of teachers.

A particularly important orientation of these curricula is the emphasis on practice. Teacher education must ultimately demonstrate its value in the classroom and in improved learning outcomes. Colleges are therefore expected to ensure that teaching is supported by appropriate practical activities, laboratories, workshops, studios, technology-enabled learning environments, field experiences and sustained exposure to real educational settings.

This curriculum should consequently not be regarded merely as a document for compliance. It is intended to serve as an instrument for transforming the teaching and learning experience in our Colleges. Its successful implementation will depend on the commitment of Provosts, academic boards, Deans, Heads of Departments, lecturers and other stakeholders to translate its provisions into meaningful learning experiences for students.

The Commission will complement implementation with appropriate quality assurance, capacity building, monitoring, institutional support and periodic review. Colleges are equally expected to undertake continuous professional development of their academic staff and progressively provide the infrastructure, equipment, digital resources and learning environments required for effective delivery.

The Dual Mandate also places an increased responsibility on participating Colleges. The authority to operate programmes at different qualification levels must be accompanied by an unwavering commitment to standards. Expansion must never be pursued at the expense of quality. Every programme must therefore be delivered within the applicable regulatory framework and supported by adequate human and material resources.

I wish to express the Commission’s profound appreciation to the Honourable Minister of Education and the Honourable Minister of State, Education for the leadership and policy direction that have made this important reform possible. I also acknowledge the contributions of our partner regulatory agencies, curriculum experts, academics, professional bodies, unions (particularly COEASU), Colleges of Education and other stakeholders who devoted their knowledge, experience and time to the development and validation of this curriculum.

To our Provosts and teacher educators, the responsibility now moves from curriculum development to curriculum delivery. The ultimate measure of this document will not be its

content alone, but the quality of teachers it helps us to produce and the difference those teachers make in the lives of Nigerian learners.

The National Commission for Colleges of Education remains committed to working with all stakeholders to ensure that the Dual Mandate becomes an enduring platform for strengthening teacher education, expanding opportunities and producing the professional practitioners required to build a stronger education system and a greater Nigeria.

It is therefore my privilege to present this curriculum for implementation.

Dr (Mrs) Angela Ajala, FNAE
Executive Secretary
National Commission for Colleges of Education (NCCE)
Abuja

Acknowledgement

The successful review and development of the 2026 Minimum Standards for the Three-Year Nigeria Certificate in Education (NCE) and the Two-Year Degree Programmes under the Dual Mandate was the product of extensive consultation, technical engagement and collective commitment by a wide range of stakeholders.

On behalf of the Department of Academic Programmes, I wish to express our profound appreciation to the Executive Secretary, Dr (Mrs) Angela Ajala, FNAE, for her leadership, guidance and sustained support throughout the review, harmonisation and validation processes.

We are especially grateful to the Resource Persons, Curriculum Experts, Teacher Educators, Subject Specialists, Professional and Regulatory Bodies, Provosts and representatives of Colleges of Education who contributed their knowledge and experience to the development of these Minimum Standards. Their careful consideration of emerging educational needs, professional competencies and the requirements of the Dual Mandate greatly enriched the curricula.

Our appreciation also goes to members of the various Technical, Harmonisation and Validation Committees, whose painstaking work ensured coherence between the Three-Year NCE and the Two-Year Degree Programmes and strengthened the quality, relevance and practicability of the curricula.

We acknowledge the valuable support of the Federal Ministry of Education, National Universities Commission, development partners and other collaborating institutions whose technical and financial contributions facilitated the review process.

I also commend the staff of the Department of Academic Programmes and other Departments of the NCCE who worked tirelessly in coordinating meetings, collating inputs, reviewing drafts, managing documentation and providing the secretariat support required to bring this important national assignment to completion.

To everyone who contributed, in whatever capacity, we extend our sincere gratitude. It is our hope that the effective implementation of these Minimum Standards will further strengthen teacher preparation and contribute significantly to the production of competent, professional, innovative and globally competitive teachers for Nigeria.

Dr Umar Adamu Kwami
Director, Academic Programmes
National Commission for Colleges of Education (NCCE)

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PART I

School of Science Education

School Overview, Academic Programmes, Course Distribution and Course Descriptions for NCE (100–300 Level) and Degree (400–500 Level)

SCHOOL OF SCIENCE EDUCATION

School Overview

Overview

The School of Science Education provides professional and academic preparation for prospective teachers in science-related disciplines. The School combines sound knowledge of subject matter with professional education, practical investigation, research, digital literacy and appropriate pedagogical skills required for effective teaching and learning.

The programmes are designed to develop competent, reflective and innovative science educators who can teach scientific concepts, facilitate inquiry, conduct practical activities, assess learners' achievement and apply scientific knowledge to real-life problems. The School promotes integration of science, technology, society and the environment (STSE) and prepares graduates to contribute to STEM education, sustainable development and national transformation.

The programmes include:

1. Biology Education
2. Chemistry Education
3. Environmental Education
4. Health Education
5. Human Kinetic/Physical Education
6. Integrated Science Education
7. Mathematics Education, Physics Education, and other approved science education specialisations.

Relevance Statement

Science education is fundamental to the development of scientifically literate citizens and a skilled workforce capable of contributing to technological, economic and social development. The School of Science Education responds to the need for adequately prepared teachers who possess both strong subject-matter knowledge and the pedagogical competence required to teach science effectively.

The programmes are particularly relevant to Nigeria's educational system because they prepare teachers to address challenges such as inadequate practical science instruction,

low learner engagement, misconceptions in science, limited use of instructional technologies and the need for stronger STEM competencies.

The School also promotes the application of science to health, agriculture, industry, environmental sustainability, technology and community development, while developing teachers who can use learner-centred, inquiry-based and competency-based approaches in diverse educational settings.

Objectives

The School of Science Education aims to:

1. Develop sound knowledge and understanding of concepts, principles, theories and practices in the relevant science disciplines.
2. Develop professional competence in planning, implementing and evaluating science instruction.
3. Equip students with practical, laboratory, fieldwork and experimental skills.
4. Develop scientific reasoning, critical thinking, creativity and problem-solving abilities.
5. Enable students to use appropriate instructional materials, ICT and digital technologies in science teaching.
6. Develop competence in assessment, measurement and evaluation of learners' achievement in science.
7. Prepare students to identify and address learners' misconceptions and individual learning needs.
8. Promote inquiry, experimentation, innovation and evidence-based decision-making.
9. Develop competence in conducting educational and scientific research.
10. Promote ethical, professional, inclusive and environmentally responsible teaching practices.
11. Prepare students for effective teaching practice and lifelong professional development.
12. Enable graduates to apply science and science education to national and community development.

Learning Outcomes

At the end of the programmes, graduates should be able to:

1. Explain major concepts, principles, theories and processes in their respective science education disciplines.
2. Demonstrate appropriate practical, laboratory, fieldwork and experimental skills.
3. Plan and implement effective, learner-centred science lessons using appropriate pedagogical approaches.
4. Use appropriate instructional materials, laboratory equipment, ICT tools and digital resources in teaching and learning.
5. Apply scientific inquiry, critical thinking, creativity and problem-solving skills to educational and real-life problems.
6. Assess and evaluate learners using appropriate formative and summative assessment techniques.
7. Identify and address learners' misconceptions, individual differences, learning difficulties and special educational needs.
8. Conduct and communicate educational or scientific research using appropriate methods of data collection and analysis.
9. Integrate science, technology, society and environmental issues into teaching and learning.
10. Demonstrate professional ethics, collaboration, safety consciousness and responsibility in educational and scientific settings.
11. Communicate scientific concepts effectively through oral, written, graphical, practical and digital media.
12. Reflect on and improve their teaching practice through continuous professional development and evidence-based reflection.

School of Science Education Programme Structure

The School's curriculum should integrate professional education courses, disciplinary science courses and practical/field experiences. These includes foundations of Science Education; Foundations of Education; Science Subject Content – Biology Education, Chemistry Education, Environmental Education, Health Education, Human Kinetic/ Physical Education, Mathematics Education, Integrated Science Education, and Physics Education.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Observation

CATEGORY	DETAILS
	• Experimentation • Measurement • Data collection • Data analysis • Scientific reasoning • Problem-solving • Scientific communication • Pedagogical Competencies • Lesson planning • Lesson presentation • Classroom management • Learner engagement • Differentiated instruction • Inclusive teaching • Assessment and feedback • Reflective teaching • Practical Competencies • Laboratory techniques • Equipment handling • Experimental design • Laboratory safety • Fieldwork • Practical demonstration • Maintenance of scientific equipment • Digital Competencies • ICT integration • Digital research • Online learning • Educational software • Virtual laboratories • Digital assessment • Data-analysis tools • Multimedia presentation • Professional Competencies • Communication

CATEGORY	DETAILS
	• Teamwork • Leadership • Professional ethics • Research • Collaboration
Core Values	• Integrity • Objectivity • Scientific curiosity • Creativity • Innovation • Accuracy and precision • Critical thinking • Respect for evidence • Collaboration • Responsibility • Professionalism • Inclusiveness • Equity • Safety consciousness • Environmental responsibility • Respect for diversity • Lifelong learning • Service to society
Pedagogical Approaches	Experiential Learning Collaborative Learning Discovery Learning ICT-Enhanced Learning Blended Learning Differentiated and Inclusive Instruction Reflective Practice
Learning Resources	• Laboratories • Biology laboratories • Chemistry laboratories • Physics laboratories

CATEGORY	DETAILS
	• Integrated Science laboratories • Mathematics resource rooms • Appropriate laboratory apparatus • Scientific specimens and models • Laboratory chemicals and consumables • Safety equipment • ICT Resources • Computers • Tablets • Projectors • Interactive boards • Internet facilities • Digital libraries • Learning management systems • Educational software • Virtual laboratories • Scientific simulations • Teaching Resources • Textbooks • Laboratory manuals • Teacher guides • Curriculum documents • Models • Charts • Specimens • Maps • Globes • Manipulatives • Audio-visual resources

CATEGORY	DETAILS
Assessment Methods	• Continuous assessment • Assignments • Quizzes/tests • Laboratory practicals • Fieldwork • Projects • Presentations/seminars • Teaching demonstrations • Portfolio • Teaching practice • Research project • End-of-semester examination

PROGRAMME 1 OF 6

Biology Education

Introduction

Biology Education, like other science education programmes, is fundamental to human development, scientific advancement, environmental sustainability, and national progress. It equips learners with the knowledge, skills, values, and attitudes required to understand living organisms, their interactions with the environment, and the application of biological principles to solving real-life problems. The programme introduces prospective biology teachers to the principles of teaching and learning while developing a sound understanding of biological concepts through classroom instruction, laboratory practicals, field studies, and research activities. The curriculum exposes students to the major branches of biology, including Botany, Zoology, Microbiology, Genetics, Ecology, Physiology, Biotechnology, Environmental Biology, and Conservation Biology. It provides a balanced integration of theoretical knowledge and practical experiences necessary for effective teaching, scientific inquiry, innovation, and lifelong learning. The programme also develops competencies in critical thinking, problem-solving, communication, creativity, and the ethical application of biological knowledge to contemporary issues such as public health, food security, biodiversity conservation, climate change, and sustainable resource management.

Philosophy

The philosophy of the biology curriculum is to produce competent and innovative biology teachers equipped with the knowledge, skills values and scientific attitude needed for effective teaching, research, and national development. It emphasises scientific inquiry, critical thinking, practical laboratories skills, environmental sustainability, health awareness, entrepreneurship, and the application of biology to solve societal problems. The curriculum draws knowledge from the life sciences and related disciplines through classroom instructions, laboratory practical’s fields work, research and community engagement to prepare graduates for life-long learning and professional excellence

Regulations

Admission Requirements

General Requirements

(a) A Senior secondary school certificate SSCE/ WAEC/NECO/NABTEB or GCE O level with a minimum of four (4) credits including Mathematics and other three in any of the related areas like chemistry, biology and physics. At not more than two sittings

(b) All Candidates wishing to be considered for admission must meet the UTM (JAMB) admission requirements

(c) Colleges may, at their description, conduct additional screening, tests and /or interview as part of the candidates selection process.

(d) Candidate with NCE, cumulative grade point average (3.0) equivalent to Second Class Lower and above, shall continue into the 2-year Bachelor of Education degree programme.

NCE with cumulative grade point average (1.0-2.9) equivalent to Third Class and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme

Curriculum Components and Graduation Requirement Credits

General Studies (GSE/GST)

- Communication skills (English Proficiency), Library Skills, entrepreneurship, Information and Communication Technology (ICT), civic education, Universal Design for Learning (UDL), Social Emotional Learning (SEL), Digital Literacy and Artificial Intelligence, Inclusive Education, Edutainment.

12 credits

Education

- Foundations of Education
- Educational Psychology
- Curriculum Studies
- Measurement & Evaluation

24 credits

- Teaching Practice (TP) 6 credits

Subject Specialisation

- Discipline-based content (e.g. Biology, English, Mathematics).
- Progressive depth from NCE to Degree level.

Teaching Practice

- NCE: 6 months
- Degree: 6 weeks

Research Project

- Compulsory at NCE level
- Compulsory at Degree level

Credit Load and Progression

- NCE: Minimum of 80 credit units
- Degree: Minimum of 70 credit units

Graduation Requirement

NCE

S/N	Component	Weight/credit load
	General Education	22
	Teaching Practice (TP)	06
	General Studies (GSE)	12
	Core Courses	40
Total Units:		**80**

DEGREE

S/N	Component	Weight/credit load
1	General Education	12

2	Teaching Practice	6
3	General Studies (GSE)	04
4	Core Courses	48
Total Units:		**70**

Staffing Requirements

NCE Programme

- Minimum of First Degree (Second Class, Upper) in relevant field

Degree Programme: as provided for in the NUC Guidelines

- Curriculum review every 5 years

Facilities Needed for the Programme

Laboratory Space

- There should be at least three general laboratories, one for each level (of about 7.5 m^2), each large enough to accommodate not less than hundred students.

The following auxiliary facilities should also be provided:

- Biological garden (botanical and zoology);
- Museum;
- Aquarium;
- Herbarium;
- There should also be a stock room and preparation room adjacent to the laboratory.

i) **Lecture Hall**s

There should be at least three lecture halls each of which is large enough to accommodate sixty students. Public address system and an overhead projector should be provided in the halls.

Staff Offices

There should be an office per lecturer. The office should be equipped with bulletin board, bookshelves, filing cabinet, and seats for at least three visitors and appropriate officer's

furniture. The Head of Department should have an office with adjoining office for support staff with relevant furnishing and equipment. In addition to individual staff offices, there should be Staff Common Room with adequate furniture and convenience to comfortably accommodate all the staff of the biology department.

Books in the Library

There must be enough books to cover all the areas of the subject to the ratio of ten book titles to one student in the department and college library. In addition, there should be E-library at the departmental level.

Equipment and Material

S/N	Description	Quantity
1	Models and charts	**1**
2	Skeletal System	**1**
3	Brain and Nervous System	**1**
4	Circulatory System	**1**
5	Digestive System	**1**
6	Eye and Vision	**1**
7	Ear	**1**
8	Skin and Excretory Organs	**1**
9	Genetic Models	**1**

S/№ Description Quantity Required

Equipment and Consumables

S/N	Description	Quantity Required
1	Hand lenses	100
2	Microscopes	100
3	Incubator/Steriliser	1

S/N	Description	Quantity Required
4	Autoclave (portable)	3
5	Balances	3
6	Hot Plates	5
7	Refrigerator	2
8	Water Filter	2
9	Hygrometer	1
10	Drying Oven (30°C–120°C)	1
11	Microtome	1
12	Automatic Tissue Processor	1
13	Centrifuge	1
14	Herbarium Cabinet	9
15	Herbarium Index Boxes	2
16	Air Pumps	6
17	Photometer	2
18	UV/Visible spectrophotometer	1
19	Water quality testing kits	1
20	Kymograph	10
21	Dissecting Microscopes	2
22	Insect Light Traps	1
23	Insect Box Traps	1
24	Slide Projector	1
25	Overhead Projector	2
26	Steel Frame Aquaria	1
27	Oxygen Meter	1
28	Binocular Microscopes	4

S/N	Description	Quantity Required
29	Embedding Bath	5
30	Glass distiller	1
31	Water Bath	1
32	pH Meter	10
33	Tissue Grinder	4
34	Calorimeter	6
35	Auxanometer (electric)	4
36	Soil Augur	2
37	Plant Press	2
38	Soil Treating Kit	1
39	Wooden Quadrants	10
40	Measuring Tape	5
41	Biological Kit/Dissecting Sets	20
42	Dissecting Boards/Plate tray	40
43	Bunsen Burners	50
44	Giant Gas Cylinder	2
45	Prepared and Plane microscope slides (Assorted)	100
46	Consumables: Glass wares, stains, chemicals (Assorted)	
47	Test tube rack	50
48	Preserved plant and animal specimens (Assorted)	
49	Desiccators	3
50	Gloves	
51	Safety devices (assorted)	
52	Permanent slide of different dissected plants part	

S/N	Description	Quantity Required
53	Permanent slides of different organs of human body organs e.g. Liver, kidney lungs etc.	

Personnel

Academic/ Teaching Staff

A minimum of 14 academic staff are required to adequately implement the N.C.E. Biology and degree programme. The minimum qualification for academic staff is second class lower for first degree i.e. B.Sc., B Ed, B Sc. (Ed). The holder of B.Sc. degree must also possess either NCE or PGDE/PDE.

Non-Teaching Staff/ Administrative Staff

a) Technologist – Three

b) Technician – One

c) Junior Staff: -One

One each of the following:

– Laboratory attendant

– Laboratory assistant

– Gardener/Curator

– Cleaner

– Typist

– Office assistant

Mode of Assessment for NCE

Assessment Type	Weight / Format	Objective & Methods
Continuous Assessment (CA)	**40%** *(Formative)*	Evaluates ongoing progress via online quizzes, mid-semester tests, short essays, practical group projects, and class attendance.
Practical & Venture Projects	*Integrated into CA*	Applied evaluation for vocational or skill-based modules (e.g. producing business plans, exhibition displays, or language lab practicals).

Assessment Type	Weight / Format	Objective & Methods
Semester Final Examination	**60%** *(Summative)*	Primarily administered via **Computer-Based Testing (CBT)** using Multiple Choice Questions (MCQs) and Fill-in-the-Blank items for rapid, objective grading across thousands of students.

Mode of Assessment for Degree

Assessment Type	Weight / Format	Objective & Methods
Continuous Assessment (CA)	**30%** *(Formative)*	Evaluates ongoing progress via online quizzes, mid-semester tests, short essays, practical group projects, and class attendance.
Practical & Venture Projects	*Integrated into CA*	Applied evaluation for vocational or skill-based modules (e.g. producing business plans, exhibition displays, or language lab practicals).
Semester Final Examination	**70%** *(Summative)*	Primarily administered via **Computer-Based Testing (CBT)** using Multiple Choice Questions (MCQs) and Fill-in-the-Blank items for rapid, objective grading across thousands of students.

National Goals of Education in Nigeria:

General Goals of Education

i. Development of the individual into a morally sound, patriotic and effective citizen

ii. Total integration of the individual into the immediate community, the Nigerian society and the world

iii. Provision of equal access to qualitative educational opportunities for all citizens at all levels of education within and outside the formal school system

iv. Incubation of national consciousness, values and national unity; and

v. Development of appropriate skills, mental, physical and social abilities and competencies to empower the individual to live in and contribute positively to the society

Specific Goals of Education

a) Ensure and sustain unfettered access and equity to education for the total development of the individual

b) Ensure the quality of education delivery at all levels

c) Promote functional education for skill acquisition, job creation and poverty reduction

d) Ensure periodic review, effectiveness and relevance of the curriculum at all levels to meet the needs of society and the world of work;

e) Collaborate with development partners, the private sector, non-governmental organisations and local communities to support and fund education; and

f) Promote information technology capability at all levels

GENERAL OBJECTIVES OF THE PROGRAMME:

At the end of the programme, the Graduate. Teacher will be able to:

1. Train biology teachers with a sound foundation for professional growth and personal development
2. Equip learners with scientific inquiry, practical and entrepreneurial, and problem solving skills for safe reliance and sustainable development
3. Exhibit positive human relations, ethical behaviour, environmental responsibility, respect for diversity and the ability to work effectively with people from different socio-cultural background
4. Demonstrate excellence and professional competence in teaching biology
5. Promote positive disposition towards biological science and the scientific enterprise;
6. Apply concepts and methods acquired in the course in new areas of study and in everyday situations;
7. Critically analyse the activities of living things in their environment
8. Demonstrate practical skills in handling scientific apparatus;
9. Prepare teachers to qualify them to teach biology at pre-basic, post basic level, and for progression to post NCE/ DEGREE Programmes in Biology Education.

General Learning Outcomes for the Programme

By the end of the programme students should be able to:

1. Explain fundamental concepts, principle, and practical aspect of biology and memonstrate them through laboratory activities, fieldwork, discussion, and assessments while supporting learners intellectual, emotional and social development
2. Plan and deliver clear engaging learner-centred biology lessons that meet the needs of learners with different backgrounds and abilities

3. Communicate effectively and collaborate with learners, parent colleagues and the wider community using appropriate scientific and professional language while embracing lifelong and continues professional development
4. Use appropriate laboratory equipment, instructional material, digital technology, and field –based resources to enhance biology teaching, learning, and retention.
5. Create safe inclusion and supportive learning environment by applying teaching strategies that encourage participation, scientific inquiry, environmental awareness, and respect for individual direness
6. Demonstrate professionalism, ethical conduct, leadership and responsible citizenship while serving as positive role-model in biology education
7. Analyse problems, evaluate information, and propose appropriate solutions in biological contexts.
8. Demonstrate effective written and practical communication by presenting ideas clearly and responding appropriately in discussions'
9. Demonstrate respect for others, act ethically in practical situations, and appreciate cultural and individual difference

RELEVANCE STATEMENT OF THE PROGRAMME

The biology education programme is important because it prepares competent and professionally qualified biology teachers with the knowledge practical skills, values and attitude needed for effective teaching and learning. It equips prospective teachers with scientific inquiry laboratory competence, critical thinking, communication, environmental stewards and digital skills required to meet the demands of contemporary science education The programme also promote innovation, lifelong learning, entrepreneurship, and sustainable development, enabling graduates to contribute meaning-fully to education, scientific advancement community development and national growth. Biology is often described as the science of life and its relevance to the society is profound and all encompassing. From the food we eat, to the medicine that keep us healthy, biological principles underpin nearly every aspect of our existence. In terms of; i.e. healthcare and medicine, ii. Agriculture and food security, iii. Environmental conservation, e.g. climate change among others.

CATEGORY	DETAILS
Core Competencies	• Laboratory practical skills • Scientific inquiry and critical thinking • Observation and data interpretation • Environmental conservation • Communication and collaboration • Digital and technological competence • Research and innovation • Entrepreneurship in biology • Professional ethics • Inclusive biology teaching
Core Values	• Curiosity • Integrity • Safety consciousness • Accuracy • Honesty • Responsibility • Environmental stewardship. • Teamwork and respect • Innovation • Lifelong learning • Creativity, excellence • Self-reliance and accountability • Respect for diversity, empathy
Pedagogical Approaches	• Inquiry-based • Problem solving • Discovery learning • Demonstration • Laboratory experience • Hands –on learning • Field guided observation • Project- based learning • Field trip • Communication –based learning

CATEGORY	DETAILS
	• Project method • Cooperative learning • ICT supported learning, virtual laboratory, multimedia instruction • Research –based learning • Experimental learning • Reflective practice • Mentoring • Learner-centred instruction • JIGSAW Learning etc. • TPACK
Learning Resources	• Biology text books • Laboratory manual, charts, specimens • Laboratory equipment, microscopes, slides, reagent • Field guide, data, sheet measuring instruments • School garden • Ecological sites, videos • Posters • Multimedia interactive whiteboard • Computers, internet virtual laboratories projectors • Educational software • Journals • Research articles • Library • Code of ethics documents • Inclusive teaching guide etc.

CATEGORY	DETAILS
Assessment Methods	• Practical activities • Quizzes, tests • Practical examination, observations checklist • Field presentation assignment, test • Project, presentation, reports • Group presentations • Peer assessment • ICT tasks presentations, online quizzes • Research proposal, project report • Business plan, product demonstration • Observation, reflective journal • Lesson plan, micro teaching, practice • Etc.

NCE Course Distribution (100–300 Level)

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30	30
EDU 112	Educational Psychology	2	C	30	30
GSE 111	General English 1	1	C	15	15
GSE 112	Introduction to Library Studies	1	C	15	15
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15	15
BIO 111	General Biology I	2	C	30	-
BIO 112	Diversity, Anatomy & Histology of Spermato-phytes	2	C	-	45
BIO 113	Aquatic Biology and Ocean Resources	2	C	30	-
CHM 111	General Chemistry (Inorganic)	2	C	30	-
MTH 111	General Mathematics 1 (Number Theory)	2	C	30	-
PHY 111	General Physics I	2	C	30	-
Total		**19**			

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30	30
GSE 121	English Proficiency for Teachers	1	C	15	15
GSE 122	Digital Literacy & AI for Educators	1	C	15	15
GSE 123	Media and Information Literacy I	1	C	15	15
BIO 121	General Biology II	1	C	15	-

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
BIO 122	General Biology Practical I	1	C	15	
BIO 123A	Introduction to Biotechnology	2	E	30	
BIO 123B	Waste Management	2	E	30	45
CHM 121	General Chemistry II (Organic)	1	C	15	45
PHY 121	General Physics II	1	C	15	-
MTH 121	General Mathematics II (Algebra and Trigonometry)	1	C	15	-
Total		**16**			

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 211	Classroom Management	1	C	15	15
EDU 212	Curriculum and Curriculum Delivery	2	C	30	30
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30	30
GSE 211	General English II	1	C	15	15
GSE 212	Introduction to Foundational Literacy	1	C	15	15
GSE 213	Media and Information Literacy II	1	C	15	15
BIO 211	Laboratory Management	2	C	30	-
BIO 212	Introductory Ecology	2	C	30	45
BIO 213	General Physiology	1	C	30	0
BIO 214	General Biology Practical II	1	C	15	-
BIO 215A	Conservation and Development of Renewable Natural Resources	2	E	45	
BIO 215B	Introduction to Fisheries and Aquaculture Management	2	E	45	
CSC 211	Introduction to Computer Science	2	C		
Total		**18**			

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	
EDU 222	Educational Administration, Planning and Supervision	1	C	15	
EDU 223	Introduction to Educational Technology	1	C	15	
EDU 224	Micro Teaching: II (Practicum)	2	C	30	45
GSE 221	Introduction to Foundational Numeracy	1	C	15	
GSE 222	Entrepreneurship and Green Skills	1	C	15	
BIO 221	Introductory Developmental/ Cell Biology	2	C	30	
BIO 222	Animal Histology	2	C	30	
BIO 223	Biostatistics	2	C	30	
Total		**14**			

NCE 300 Level: First Semester

Course Code	Course Title	Credit Units	Status
EDU 311	Teaching Practice	6	C

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	15
GSE 321	Global Citizenship Education and Political Economy	1	C	15	15
BIO 321	Biology Practical III	1	C	15	-
BIO 322	General Microbiology	2	C	30	45
BIO 323	Biological Techniques	2	C	30	45
Total		**9**			

Degree Course Distribution (400–500 Level)

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours	Source
GSE 411	Peace and Conflict Resolution	2	C	30		CCMAS
SED 411	Biology Methods and Innovative Pedagogies	2	C	30	45	CCMAS
BIO 412	Genetics	2	C	30	45	CCMAS
BIO 413	Nigerian Flora and Fauna	2	C	30	-	CCMAS
BIO 414	Hydro-Biology	2	C	30	-	CCMAS
BIO 415	Introductory Parasitology & Parasitic Protozoan	2	C	30	-	CCMAS
BIO 416	Seedless Plants	2	C	30	_	CCMAS
Total		**14**				

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours	Source
EDU 421	Educational Measurement Test Research Methods and Statistics	3	C	45		NCEMAS
ENT 421	Venture Creation	2	C	30	45	CCMAS
BIO 421	Population Biology and Evolution	2	C	30	-	CCMAS
BIO 422	Bio-Geography and Soil Biology	2	C	30		CCMAS
BIO 423	Entomology	2	C	30	-	CCMAS
BIO 424	Environmental Conservation	2	C	30	-	CCMAS
BIO 425	Seed Plants	2	C	30	_	CCMAS
BIO 426	Field Course I	1	C	15	45	CCMAS
Total		**16**				

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours	Source
EDU 511	Teaching Practice	6	C		135	CCMAS
BIO 511	Nigerian Plants and Animals in Prophylactics &Therapeutics	2	C	30	45	CCMAS
BIO 512	Applied Biotechnology	1	C	15	30	CCMAS
BIO 513	Plant Anatomy and Physiology	1	C	15	-	CCMAS
BIO 514	Seminar in Biology	2	C	30	45	CCMAS
BIO 515	Systematic Biology	1	C	15	45	CCMAS
SED 511	Science, Technology and Society	1	C	15	45	CCMAS
Total		**14**				

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours	Source
EDU 521	Project	3	C	45	135	CCMAS
BIO 521	Principles of Plant and Animal Breeding	2	C	30	-	CCMAS
BIO 522	Wildlife Conservation and Management	2	C	30	-	CCMAS
BIO 523	Principles of Pest Management	2	C	30	-	CCMAS
BIO 524	Bio-Entrepreneurship Options	2	C	30	-	CCMAS
BIO 525	Bio-Informatics	2	C	30	-	CCMAS
BIO 526	Molecular Biology	2	C	30	45	CCMAS
BIO 527	Reproductive-Developmental Biology	2	C	30	_	CCMAS
BIO 528	Animal Behaviour	2	C	30	45	CCMAS
BIO 529	Field Course II	1	C	15	45	CCMAS
Total		**20**				

NCE Course Descriptions (100–300 Level)

Course Contents

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Biology I introduces students to the fundamental principles of biology that underpin the study of living organisms. The course examines the structure and organisation of cells, the functions of cellular organelles, and the characteristics and classification of living things. It also explores the concepts of chromosomes, genes, heredity, reproduction, evolution, ecological principles, and interactions among organisms. Students will gain a solid foundation in biological concepts necessary for advanced studies in biology and related disciplines.

RELEVANCE STATEMENT

This course provides students with the foundational knowledge required for understanding biological systems and life processes. It equips prospective biology teachers with essential concepts in cell biology, genetics, ecology, evolution, and taxonomy, enabling them to explain biological phenomena scientifically. The knowledge acquired will support further studies in biological sciences and enhance students' ability to apply biological principles to environmental conservation, health, agriculture, and science education.

COURSE OBJECTIVES

The objectives of this course is to:

1. Introduce students to the structure of cells and their organelles.
2. Explain the characteristics of living organisms.
3. Introduce students to ecological relationships.
4. Explain the basic principles of heredity.
5. Introduce students to the major habitat types.
6. Explain the fundamental principles of general biology.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

1. Draw and label major cell structures.
2. Describe the characteristics of living organisms.
3. Explain major ecological relationships.
4. Describe the transmission of traits from parents to offspring.
5. Identify the major habitat types.
6. Apply fundamental biological principles to biological phenomena.

COURSE CONTENT

Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes their relationships and importance, general mode of reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism); heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitat

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Observation • Classification of living things • Evaluation • Application.
Core Values	• Curiosity • Integrity • Diligence • Responsibility • Conservation • Team work

CATEGORY	DETAILS
Pedagogical Approaches	• 4- in -1 Model (TPACK) • Inquiry-based learning • Demonstration • Group discussion • Group work • Case study
Learning Resources	• Biology text book, charts, model • Specimens • Microscope • Prepared slides • Cultures • Herbarium specimens • National Curriculum for Basic Education
Assessment Methods	• Lab and field report • Class presentation of findings.

REFERENCES AND FURTHER READING

- Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Orr, R. B. (2021). *Campbell Biology (12th ed.)*. Pearson.
- Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). *Biology (13th ed.)*. McGraw-Hill

BIO 112 Diversity, Anatomy and Histology of Spermatophytes

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** - | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Diversity, Anatomy and Histology of Spermatophytes introduces students to the diversity, classification, anatomy, histology, and reproductive biology of seed plants (Spermatophytes). The course examines the characteristics and classification of gymnosperms and angiosperms, their life cycles, seed development, alternation of generations, and embryological processes. It also covers the external morphology of plant organs, flower structure, pollination, fertilisation, fruit and seed formation, dispersal mechanisms, and the

economic importance of spermatophytes. Furthermore, students study plant tissues, cell types, and the internal anatomy of monocotyledonous and dicotyledonous roots, stems, and leaves, including primary and secondary growth.

RELEVANCE STATEMENT

This course provides students with a comprehensive understanding of the structure, diversity, reproduction, and anatomy of seed plants. It equips prospective biology teachers with the knowledge and practical skills needed to identify major plant groups, explain plant growth and development, and appreciate the economic and ecological importance of spermatophytes. The course forms a foundation for advanced studies in botany, plant taxonomy, plant physiology, ecology, agriculture, forestry, horticulture, and environmental management.

COURSE OBJECTIVES

The objectives of this course is to:

1. Outline the general characteristics of Spermatophytes gymnosperms, Conifers and Angiosperms
2. Describe the morphology / physiology of Angiosperms-stem, leaf root and their modifications
3. Describe the different types of tissues and their functions
4. Explain the origin, diversity, and classification of spermatophytes
5. Explain the development of an embryo in Pinus.
6. Identify fruits in the environment according to their biological classification
7. Describe dispersal of fruits and seeds.
8. Discuss the economic importance of spermatophytes to humans and the environment.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Distinguish the major characteristics of gymnosperms, conifers, and angiosperms within the spermatophytes.
2. Differentiate the structural and functional features of angiosperm stems, roots, leaves, and their modifications.
3. Classify the major types of plant tissues and relate them to their respective roles.
4. Trace the evolutionary origin and diversity of spermatophytes and relate these to their major taxonomic groups.

5. Illustrate the major stages involved in embryo formation and development in *Pinus*.
6. Categorise commonly encountered fruits according to their biological classification.
7. Analyse the major agents and mechanisms responsible for the movement and distribution of fruits and seeds.
8. Assess the contributions of spermatophytes to human welfare, food production, medicine, timber resources, and environmental sustainability.

COURSE CONTENT

- Introduction to, and general description of, spermatophytes and their subdivisions
- General characteristics of gymnosperms and classification
- Similarities and differences with higher cryptogams
- Development of seed in gymnosperms and factors responsible for seed development
- Structure and life- cycle of a conifer e.g. Pinus.
- Development of embryo in gymnosperms
- Alternation of generation in plants
- Characteristics of different angiosperm families
- External morphology of angiosperm-stem
- Leaf, root and their modifications
- Flower
- Concept of whorls, inflorescence and types
- Pollination, fertilisation, megasporogenesis and microsporogeneiss, Development of embryo in angiosperms
- Seed and fruit formation
- Fruits and their classification
- Dispersal of fruits and seeds
- Importance of spermatophytes as sources of food, medicine, shelter, etc. Cell types, distribution, and structure in relation to function.
- Different types of tissues and their functions
- Anatomy of root, stem and leaf of monocot and dicot plants
- Primary and Secondary thickening

CATEGORY	DETAILS
Core Competencies	• Identification • Classification • Evaluation • Critical thinking • Differentiation • Application
Core Values	• Environmental stewardship • Team work • Scientific ethics • Objectivity • Accuracy
Pedagogical Approaches	• Laboratory work • 4-in-1 Model (TPACK) • Field observation • Cooperative learning • Group work • Problem solving
Learning Resources	• Charts • Audio visual materials • Biological garden/site • Videos • National Curriculum for Basic Education
Assessment Methods	Lab and field report

REFERENCES AND FURTHER READING

- Evert, R.F, & Eichhon, S.E 2013 Raven Biology of Pants 8th ed. W. H. Freeman
- Mauseth, J. D 2019 Botany: An introduction to plant biology 6thed Jones &Bartlett Learning.

BIO 113 Aquatic Biology and Ocean Resources

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Blue Biology introduces students to the principles of aquatic biology, marine biodiversity, and the sustainable use of ocean and inland water resources. The course explores aquatic ecosystems, biodiversity, blue economy concepts, conservation strategies, and practical field techniques for the management of aquatic resources.

RELEVANCE STATEMENT

This course equips students with the knowledge and practical skills required for the sustainable management of aquatic resources, biodiversity conservation, and the promotion of the blue economy. It prepares learners to contribute to environmental protection, food security, research, and the sustainable development of Nigeria's aquatic ecosystems.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the concept of Blue Biology.
2. Describe the blue economy.
3. Identify major aquatic ecosystems.
4. Explain the ecological importance of aquatic resources.
5. Identify threats to aquatic ecosystems.
6. Explain methods of aquatic resource management.

LEARNING OUTCOMES

At the end of this course the students should be able to

1. Define Blue Biology.
2. Explain the principles of the blue economy.
3. Classify major aquatic ecosystems.
4. Evaluate the ecological importance of aquatic resources.
5. Analyse threats to aquatic ecosystems.
6. Describe methods of aquatic resource management.

COURSE CONTENT

- Scope of Aquatic Biology and Ocean Resources
- Blue economy and sustainable development
- Major Aquatic Ecosystem's Coral reefs, mangroves, seagrass, estuaries, sandy/rocky shores Nigerian coastal and inland aquatic systems
- Biodiversity of Aquatic Life Seaweeds and marine plants
- Invertebrates: molluscs, crustaceans, corals Vertebrates: fishes, sea turtles, seabirds, marine mammal's adaptation
- Survival in intertidal zones, migration, and reproduction strategies Aquatic Food Webs
- Trophic levels, keystone species, role of fish in food security, Marine biotechnology
- Medicinal products, cosmetics, and biomaterials from the ocean
- Tourism, shipping, and coastal livelihoods
- Indigenous Knowledge Traditional fishing methods and resource management in Nigeria
- Threats to Aquatic Resources
- Plastic pollution, ghost fishing gear, habitat destruction, overexploitation
- Conservation and Governance
- Marine Protected Areas, community conservation, policies
- Field and Practical Skills Species identification, beach surveys, data collection, reporting

CATEGORY	DETAILS
Core Competencies	• Identification • Description • Classification • Observation • Sampling • Measurement • Interpretation

CATEGORY	DETAILS
Core Values	• Responsibility • Sustainability • Integrity • Teamwork • Respect • Accountability • Innovation • Community participation
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • 4-in-1 Model (TPACK) • Field trips and excursions • Practical demonstrations • Laboratory activities • Case studies • Project-based
Learning Resources	• Course handbook and textbooks • Charts, maps, and posters • Aquatic specimens and models • National Curriculum for Basic Education • Laboratory equipment • Internet and online databases • Nigerian coastal and inland water case studies • Assessment • 8 National Curriculum for Basic Education
Assessment Methods	• Nigerian coastal and inland water case studies • Assessment report • Report on the use of satellite/AI images to detect overfishing spots, illegal boats and plastic-polluted spots, etc.

REFERENCES AND FURTHER READING

- Levinton, J.S. (2021). *Marine Biology: Function, Biodiversity, Ecology, 5th ed. Oxford university press*
- Castro, P & Huber; M.E. (2022) *Marine Biology, 11th ed. McGraw-Hill*

CHM 111 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides a foundational understanding of the fundamental principles and concepts of chemistry. It examines atoms, molecules, elements, compounds and chemical reactions, with emphasis on modern electronic theory, electronic configuration, periodicity and the development of the periodic table. The course also covers chemical bonding, hybridisation, molecular shapes, intermolecular forces, valence forces and the structure of solids. Students are introduced to chemical equations, stoichiometry, kinetic theory of matter, properties of gases, elementary thermochemistry, reaction rates, chemical equilibrium and basic thermodynamics. Further topics include acids, bases and salts, redox reactions, introductory electrochemistry and radioactivity. The course combines conceptual understanding with appropriate calculations and applications to develop a strong foundation for further study of chemistry.

RELEVANCE STATEMENT

A sound knowledge of general chemistry is essential for understanding more advanced areas of chemistry and its applications in science, technology, health, agriculture and industry. The course equips students with the fundamental concepts, principles and problem-solving skills required to interpret chemical phenomena, perform quantitative chemical calculations and relate microscopic properties of matter to observable behaviour. It also provides the necessary foundation for subsequent courses in organic, inorganic, physical, analytical and environmental chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of atoms, molecules, elements, compounds and chemical reactions;

2. Describe the modern electronic structure of atoms, electronic configurations and periodic trends;
3. Explain chemical bonding, hybridisation, molecular shapes, intermolecular forces and the structure of solids;
4. Write and balance chemical equations and solve quantitative problems involving stoichiometry;
5. Explain the basic principles of kinetic theory, gases, thermochemistry, reaction rates, equilibrium and thermodynamics;
6. Explain the concepts of acids, bases, salts, redox reactions, electrochemistry and radioactivity and relate them to practical applications.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;
4. Justify the trends of atomic radii, ionisation energies, electronegativity of the elements based on their position in the periodic table;
5. Identify and balance oxidation – reduction equation and solve redox titration problems;
6. Illustrate shapes of simple molecules and hybridised orbitals;
7. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. Apply the principles of equilibrium to aqueous systems using le chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. Determine rates of reactions and its dependence on concentration, time and temperature.

COURSE CONTENT

- Atoms, molecules, elements and compounds and chemical reactions
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table

- Hybridisation and shapes of simple molecules
- Valence Forces
- Structure of solids
- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter
- Elementary thermochemistry: rates of reaction, equilibrium and thermodynamics
- Acids, bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry
- Radioactivity

CATEGORY	DETAILS
Core Competencies	• Knowledge • Analysis • Application
Core Values	• Objectivity and scientific inquiry • Innovation • Scientific curiosity • Integrity and discipline
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Problem-solving sessions • Use of simulations and charts. • 4-in-1 Model (TPACK)
Learning Resources	National Curriculum for Basic Education
Assessment Methods	• Class tests • Quizzes • Assignments • Oral • Questioning • Continuous assessment.

REFERENCES AND FURTHER READING

1. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2018). *Chemistry: The central science* (14th ed.). Pearson.
2. Chang, R., & Goldsby, K. A. (2016). *Chemistry* (12th ed.). McGraw-Hill Education.
3. Ebbing, D. D., & Gammon, S. D. (2017). *General chemistry* (11th ed.). Cengage Learning.
4. Flowers, P., Theopold, K., Langley, R., & Robinson, W. R. (2019). *Chemistry 2e*. OpenStax.
5. Kotz, J. C., Treichel, P. M., Townsend, J. R., & Treichel, D. A. (2015). *Chemistry & chemical reactivity* (9th ed.). Cengage Learning.
6. Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2024). *General chemistry: Principles and modern applications* (12th ed.). Pearson.

MTH 111 General Mathematics I (Number Theory)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces students to the fundamental concepts of number theory and mathematical structures. It focuses on the properties and operations of numbers, including integers, primes, divisibility, congruence's, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real-life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem-solving.

RELEVANCE STATEMENT

Number of theories enables pre-service teachers to explain number concept clearly, systematically and confidently to learners.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Demonstrate a proper understanding of the number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility, and congruence.
3. Appreciate and utilise the applications of numbers in real-life situations.

4. Solve problems using principle of mathematical induction Define and analyse congruences, including reflexive, symmetric, and transitive properties.
5. Define and analyse congruence, including reflexive, symmetric, and transitive properties

LEARNING OUTCOMES

At the end of this course the students should be able to:

1. Explain and apply the process of counting and the use of ordered pairs (Peano's Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.
3. Explore further properties of integers, including well-ordering principle and divisibility.
4. Apply mathematical induction in proving theorems and laws.
5. Understand primes, relatively prime integers, and unique factorisation.
6. State and prove the fundamental theorem of arithmetic.
7. Define and analyse congruences, including reflexive, symmetric, and transitive properties.
8. Work with residue classes and solve linear congruences using basic theorems.
9. Apply Fermat's theorem, Euler's function, and related concepts to problems in number theory.
10. Demonstrate an understanding of the use of numbers in solving practical and theoretical problems.

COURSE CONTENT

- Process of counting, Peano's Axioms using ordered pairs, Fundamental operations in Mathematical Structures, Group properties, Further properties of Integers, Well ordering principle, Mathematical Induction to Laws of trichotomy, Divisibility (Basic definitions, divisions, primes, gcd)
- **Basic theorems on gcd:** proofs may be required
- **Relatively prime integers:** unique factorisation
- **The fundamental theorem of arithmetic:** proof may be required
- **Congruences, Basic definitions and examples, Properties of Congruence:** reflexive symmetric' and transitive: the equivalence relation

- Residue classes, Linear Congruences, Basic theorems and solutions of linear Congruences, Proofs of the main theorem may be required, Fermat's theorem and applications, the proof of Fermat's theorem may be required, Euler's totient function and number (proof not required)
- Application to linear Congruences, Fundamental operation in mathematical structures, Group properties

CATEGORY	DETAILS
Core Competencies	• Creativity • **Innovation Reflective thinking** • **Critical thinking** • Communication • Collaboration • Innovation • Reflective thinking • Self-development
Core Values	• Integrity • Respect • Team spirit • Perseverance • **Transparency** • **Tolerance** • **Honesty**
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue • 4 –in-1 Model (TPACK)
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms

CATEGORY	DETAILS
Assessment Methods	• Continuous Assessment • Formative Assessment • Digital assessment (Blended/Online Assessment) • Summative assessment • Readings • Class work • Assignment • Group assignment • Presentations • Written Quiz • National curriculum for Basic Education

REFERENCES AND FURTHER READING

Current textbook on An Introduction to the Theory of Numbers.
Use of online Resources.

PHY 111 General Physics I (Mechanics)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces 100- level student to the basics principles of classical mechanics which is the branch of Physics that deals with motion of objects and the forces that cause them. The course emphasises both theoretical and practical understanding and problem – solving skills, application to real life situations.

RELEVANCE STATEMENT

Mechanics is a core foundational course designed to introduce students to the fundamental principles governing the motion of bodies and the forces that cause such motion. The course is relevant because it provides the essential theoretical background and analytical skills required for further studies in Physics, Engineering, and other applied sciences. Topics such as kinematics, dynamics, work, energy, momentum, gravitation, and rotational motion form the basis upon which advanced courses in electricity, waves, Thermody-

namics, and Quantum physics are built. Mastery of mechanics is therefore critical for academic progression in science and technology programmes.

Beyond academics, the course is professionally relevant because the laws of mechanics are applied in solving real-world problems in engineering, industry, agriculture, transportation, and energy. In the Nigerian context, understanding mechanics is vital for the design and maintenance of machines, buildings, vehicles, irrigation systems, and renewable energy devices. The course also develops students' problem-solving, critical thinking, and quantitative reasoning abilities which are important for national development, research, and teaching. Thus, PHY 111 equips students with both the conceptual foundation and practical skills needed to contribute meaningfully to technological growth and self-reliance in Nigeria.

COURSE OBJECTIVES

The objectives of this course are to:

a) Explain Fundamental and derived quantities
b) State the importance of dimensional analysis,
c) Define vector and scalar quantities,
d) Derive equations of motion,
e) Momentum, conservation principle, system of particles.
f) Planetary motion, and space travel.

LEARNING OUTCOMES

By the end of the course, the students should be able:

a) Differentiate between fundamental and derived quantities and their units
b) Solve problems involving dimensional analysis
c) Differentiate between vector and scalar quantities with examples.
d) Explain the application of Newtonian mechanics; equation of motion, momentum conservation etc.
e) Explain system of particles and applying them in problem solving.
f) Explain the planetary motion and space travel

COURSE CONTENT

- Space and time
- Units and dimension, vectors and scalars

- Differentiation of vectors: displacement, velocity, and acceleration. kinematics
- **Newton laws of motion:** Inertial frames, Impulse, force and action at a distance, momentum conservation
- Relative motion
- Application of Newtonian mechanics, Equations of motion, Conservation principles in physics, Conservative forces, conservation of linear momentum, Kinetic energy, work and Potential energy
- System of particles
- Centre of mass
- Rotational motion
- Torque, vector product, moment, rotation of coordinate axes and angular momentum
- Polar coordinates, conservation of angular momentum, circular motion, moments of inertia, gyroscopes, and precession
- Gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion, and orbits

CATEGORY	DETAILS
Core Competencies	• Relate (Application) • Construct (Skill) • (Knowledge) State and explain • Critical thinking
Core Values	• Team work • Self confidence • Responsibility • **Commitment**
Pedagogical Approaches	• Project, essay • Lab Reports, practical test • Examination • Assignment • Learner-Centred Approach • 4-in-1Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Textbooks, online books, digital ticker – timer • Graphs • Graphs • Core textbooks, on-line books • National curriculum for Basic Education
Assessment Methods	• Project, essay, class discussion • Oral questions • Written test • Performance-Based Assessment

REFERENCES AND FURTHER READING

- University Physics by Hugh D. Young and Roger Freedman (2026)
- Journal of National Institute of Physics (2020)

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Biology II provides students with a broad understanding of the diversity of living organisms through a comparative study of the Plant and Animal Kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plants and animals. The course equips students with the foundational knowledge needed to appreciate the relationship between the structure, function, and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animals. It enables prospective biology teachers to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge

gained is fundamental for advanced studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific observation, analytical thinking, and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the characteristics of plants.
2. Describe the characteristics of animals.
3. Compare plants and animals based on their external features.
4. Explain plant adaptations to different habitats.
5. Explain animal adaptations to different habitats.
6. Identify the major physiological processes in living organisms.
7. Explain the relationship between structure and function in living organisms.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify the characteristics of plants.
2. Identify the characteristics of animals.
3. Differentiate plants from animals based on their external features.
4. Describe plant adaptations to different habitats.
5. Describe animal adaptations to different habitats.
6. Evaluate the major physiological processes in living organisms.
7. Compare the relationship between structure and function in living organisms.

Course Cont\ents

Basic characteristics, identification and classification of viruses, bacteria and fungi

Generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological principle • Hygiene • Classification
Core Values	• Curiosity • Thinking • Integrity • Teamwork • Self-discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical-based instruction • 4-in-1 Model (TPACK)
Learning Resources	• Biology textbooks • Charts • Models • Videos • National curriculum for Basic Education
Assessment Methods	Practical report

• Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill.

BIO 122 General Biology Practical I

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology Practical II provides students with practical experience in plant and animal biology through laboratory-based investigations. The course focuses on the anatomy of flowering plants, emphasising the identification of primary vegetative organs

and tissues. Students will examine different types of fruits and seeds, learn the proper use and maintenance of dissecting kits and other biological apparatus, and develop skills in animal dissection and histological examination of vertebrate tissues. Practical activities also include microscopic examination and identification of lower invertebrates and other representative organisms in the Animal Kingdom, reinforcing theoretical concepts learned in General Biology.

RELEVANCE STATEMENT

This course enable the students to develops the practical laboratory skills required for the study and teaching of biology. It equips students with competencies in specimen handling, microscopy, dissection, tissue identification, biological drawing, and laboratory safety. The course strengthens students' understanding of plant and animal structure and function while preparing them for advanced practical work in botany, zoology, histology, anatomy, ecology, and biology education. It also promotes scientific inquiry, accuracy, and critical observation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the anatomy of flowering plant organs.
2. Explain the functions of major plant tissues.
3. Classify different types of fruits.
4. Classify different types of seeds.
5. Explain the use of biological laboratory equipment.
6. Describe the procedures for dissecting vertebrate specimens.
7. Explain major animal tissue types.
8. Identify lower invertebrates using a microscope.

LEARNING OUTCOMES

At the end of this course the students should be able to:

1. Identify the anatomical features of flowering plant organs.
2. Analyse the functions of major plant tissues.
3. Differentiate types of fruits.
4. Differentiate types of seeds.
5. Demonstrate the proper use of biological laboratory equipment.
6. Demonstrate ability to carry out dissection on vertebrate specimens.

7. Identify major animal tissue types.
8. Recognise lower invertebrates under a microscope.

COURSE CONTENT

- Anatomy of flowering plants, primary vegetative body: stem, leaf and root to show the mature tissues namely parenchyma, collenchyma, sclerenchyma, xylem and phloem
- Types of fruits and seeds
- Care and use of dissecting kits and other biological wares
- Dissection and general histology of animal tissues based on vertebrate forms
- Morphology and functions of epithelial, muscular, nervous and connective tissues
- Examination of various groups of lower invertebrates under microscopes, identification of various groups of organisms in Animal Kingdom
- And any experiment designed to emphasise the practical aspects of topics in diversity of spermatophyte BIO 112

CATEGORY	DETAILS
Core Competencies	• Laboratory techniques • Specimen handling • Scientific reporting • Critical thinking • Observation and drawing
Core Values	• Safety • Responsibility • Consciousness • Precision • Diligence • Self-realisation
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Hands-on practical's • Demonstration • Experimental learning • Field trip • Inquiry-based

CATEGORY	DETAILS
Learning Resources	• Laboratory equipment • Reagents • Microscope • Specimens • Laboratory manuals • National curriculum for Basic Education
Assessment Methods	• Practical and laboratory reports • Observation checklist

REFERENCES AND FURTHER READING

- Bancroft, J. D., & Gamble, M. (2020). *Theory and Practice of Histological Techniques (8th ed.)*. Elsevier.
- Evert, R. F., &Eichhorn, S. E. (2013). *Raven Biology of Plants (8th ed.)*. W. H. Freeman

BIO 123A Introduction to Biotechnology

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts, principles and applications of biotechnology. It examines the role of biotechnology in agriculture, medicine, industry and environmental management, while highlighting basic techniques, ethical issues and biosafety considerations. The course also provides practical exposure through demonstrations and case studies.

RELEVANCE STATEMENT

The course equips students with foundational knowledge and skills in biotechnology, enabling them to appreciate its contribution to food security, healthcare, environmental sustainability and industrial development. It also prepares future biology teachers to teach biotechnology concepts effectively and promote scientific innovation.

COURSE OBJECTIVES

The objective of this course is to:

1. Explain the concept and scope of biotechnology.
2. Identify the major branches and applications of biotechnology.
3. Describe basic biotechnology techniques.
4. Discuss the benefits, challenges and ethical issues associated with biotechnology.
5. Explain how biotechnology knowledge can be used to solve simple biological and environmental problems.

LEARNING OUTCOMES

At the end of this course the students should be able to;

1. Describe the concept, scope, and significance of biotechnology.
2. Differentiate the major branches of biotechnology and their applications.
3. Outline basic biotechnology techniques and their practical applications.
4. Assess the benefits, challenges, and ethical issues associated with biotechnology.
5. Demonstrate ability to apply biotechnology principles to address simple biological and environmental problems.

COURSE CONTENT

- Introduction to Biotechnology
- Concept and scope of biotechnology Importance of biotechnology in modern society
- Branches of Biotechnology Agricultural
- Basic Techniques in Biotechnology
- Tissue culture, Fermentation technology, Applications of Biotechnology, Crop improvement and genetically modified (GM) crops, Livestock improvement, Production of vaccines, antibiotics and hormones, Food processing and preservation Bioremediation, Biotechnology in Agriculture, Bio fertilisers, Bio pesticides
- Disease-resistant and drought-tolerant crops
- Sustainable agricultural practices
- Personalised medicine
- Environmental Biotechnology
- Bioremediation of polluted environments
- **Wastewater treatment Renewable energy production:** biogas and biofuels
- Ethical, Legal and Social Issues in Biotechnology
- Biosafety and biosecurity

- Ethical concerns surrounding GMOs
- Intellectual property rights public perception and regulation of biotechnology
- Current challenges and Prospects of Biotechnology
- Emerging trends and innovations
- Future prospects of biotechnology in Nigeria and globally Practical Activities to demonstration fermentation processes
- **Observation of tissue culture techniques:** where facilities are available
- Laboratory safety in biotechnology
- Seminar and case study on biotechnology applications

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Scientific inquiry • Problem-solving • Communication skills • Digital literacy • Collaboration
Core Values	• Integrity • Innovation and creativity • Environmental responsibility • Ethical responsibility • Teamwork • Lifelong learning
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lectures • Class discussions • Demonstrations • Practical laboratory activities • Case studies • Group work • Student presentations

CATEGORY	DETAILS
Learning Resources	• Equipment and materials • Charts, models and multimedia resources • Scientific journals and articles • Computers with internet access • Biology and biotechnology textbooks. • National curriculum for Basic Education
Assessment Methods	Laboratory, case study and group work presentation

REFERENCES AND FURTHER READING

- Glick, B. R., & Patten, C. L. (2022). *Molecular Biotechnology: Principles and Applications of Recombinant DNA (6th ed.)*. ASM Press.
- Primrose, S. B., &Twyman, R. M. (2020). *Principles of Gene Manipulation and Genomics (8th ed.)*. Wiley-Blackwell.
- Kumar, H. D. (2021). *A Textbook of Biotechnology*. Affiliated East-West Press.

BIO 123B Waste Management

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces students to the principles and practices of waste management, with emphasis on municipal, hazardous, and mine wastes. It examines waste generation, composition, characteristics, environmental impacts, and methods of waste reduction. Students will study waste collection, transportation, recycling, composting, landfill design and management, thermal treatment technologies such as incineration, pyrolysis, and gasification, as well as pollution control measures. The course also explores hazardous waste management and the legal frameworks governing waste management practices, particularly in Nigeria.

RELEVANCE STATEMENT

Effective waste management is essential for protecting public health, conserving natural resources, and ensuring environmental sustainability. This course equips students with knowledge and practical skills needed to address waste management challenges in Nigeria

and globally. It prepares future biologists, environmental scientists, and educators to promote sustainable waste management practices, support environmental policies, and contribute to achieving sustainable development goals through responsible waste handling and resource recovery.

COURSE OBJECTIVES

At the end of this course, students should be able to:

1. Define waste management.
2. Classify municipal, hazardous, and mine wastes.
3. Explain waste reduction methods.
4. Describe landfill design.
5. Explain waste management policies in Nigeria.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Explain the principles of waste management.
2. Identify the characteristics of municipal, hazardous, and mine wastes.
3. Apply methods of waste reduction.
4. Explain landfill design.
5. Evaluate waste management policies in Nigeria.

COURSE CONTENT

- Municipal hazardous, and mine waste management
- Waste composition and potential impacts
- Collection and transport
- Recycling and reuse
- Biological and thermal treatments isolation
- Introduction, Overview of Waste management
- Character and properties of municipal waste generation in Nigeria
- Sources reduction method and Estimating waste generation rates
- Waste Transportation and Recycling Materials separation technology
- Composting
- Landfill: Site selection

- Estimating landfill capacity
- Basic design
- Landfill: leachate and landfill gas management
- Pertinent legislation
- Incineration, pyrolysis and gasification
- Costs, pollution control technologies
- Character and properties of common hazardous wastes

CATEGORY	DETAILS
Core Competencies	• Problem-solving • Sustainability • Communication and collaboration • Scientific inquiry • Innovation • Analysis • Interpretation.
Core Values	• Environmental responsibility • Cleanliness • Resource conservation • Responsibility • Teamwork • Ethical compliance
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Group discussion • Demonstration • Field visit • Project-based learning • Problem-solving activities.

CATEGORY	DETAILS
Learning Resources	• Waste sample • Waste management facilities (where available) • Charts and posters • Recycling materials • ICT and multimedia resources • Textbooks and environmental reports. • National curriculum for Basic Education
Assessment Methods	• Field/excursion report • Case study presentation

REFERENCES AND FURTHER READING

- Tchobanoglous, G., & Kreith, F. (2022). *Handbook of solid waste management (3rd ed.)*. McGraw-Hill Education.
- Peavy, H. S., Rowe, D. R., &Tchobanoglous, G. (2020). *Environmental engineering (International ed.)*. McGraw-Hill Education

CHM 121 GENERAL CHEMISTRY II (Organic)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces students to the fundamental principles and applications of organic chemistry, beginning with its historical development, electronic theory, nomenclature, functional groups, structural determination, purification techniques, reaction mechanisms, kinetics, and stereochemistry. It covers the chemistry of major classes of organic compounds and introduces carbon nanostructures, fullerenes, nanotubes, and nanochemistry. The course also examines selected metals and non-metals, comparative chemistry of Groups IA, IIA and IVA elements, and introductory transition metal chemistry.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the structure, properties, reactions, and applications of organic and selected inorganic compounds. It develops the chemical knowledge and skills required for further study in chemistry, biochemistry, pharmacy, environmental science, materials science, and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the historical development and importance of organic chemistry.
2. Describe the electronic structure, bonding, nomenclature, and functional groups of organic compounds.
3. Apply appropriate methods for the isolation, purification, identification, and structural determination of organic compounds.
4. Explain basic organic reaction mechanisms, kinetics, and stereochemical principles.
5. Describe the properties and reactions of major classes of organic compounds.
6. Explain the chemistry and applications of fullerenes, nanotubes, nanostructures, and nanochemistry.
7. Compare the chemistry of selected metals and non-metals, including Groups IA, IIA, and IVA elements.
8. Describe the fundamental properties and chemistry of transition metals.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative structures in organic chemistry;
5. Describe rules guiding nomenclature and functional group classes of organic compounds;
6. Determine rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry;
8. Discuss comparative chemistry of group IA, IIA and IIA elements; and
9. Describe basic properties of transition metals.

COURSE CONTENT

- Historical survey of the development and importance of Organic Chemistry
- Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry
- Electronic theory in organic chemistry

- Isolation and purification of organic compounds
- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry
- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics
- Stereochemistry
- The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives
- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA, IIA and IVA elements
- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• Nomenclature • Identification • Classification • Structure • Purification • Analysis • Stereochemistry • Mechanism • Reactivity
Core Values	• Accuracy • Integrity • Safety • Responsibility • Curiosity • Creativity • Discipline • Objectivity

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • 4-in-1 Model (TPACK)
Learning Resources	• Periodic Table • Molecular Models • Laboratory Equipment • Reaction Mechanism Charts • National curriculum for Basic Education
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Carey, F. A., Giuliano, R. M., Allison, N. T., & Bane, S. L. (2023). *Organic chemistry* (12th ed.). McGraw Hill.
2. McMurry, J. E. (2023). *Organic chemistry* (10th ed.). Open Stax, Rice University.
3. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
4. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
6. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.

PHY 121 General Physics II (Electricity & Magnetism)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces the fundamental principles of electricity and magnetism. It covers electrostatics, electric circuits, magnetism and electromagnetic induction. PHY 122 provides the theoretical foundation for advanced courses in electromagnetism, electronics and communications. Emphasis is placed on laws, concepts and applications to real -life electrical and magnetic systems.

RELEVANCE STATEMENT

Electricity and Magnetism form the basis of modern technology. The course provides students with the core knowledge required to understand and development electrical, electronic, and communication systems. It connects mechanics to field theory and prepares students for advanced physics and Engineering courses. It is also a pre- requisite to many physics' courses in higher levels

Students develop competence in circuit analysis using ohm's and Kirchoff's laws, solving problems involving electric and magnetic fields, applying Faraday's and Lenz's laws to induction problems, mathematical modelling of Electrical systems, critical thinking and quantitative problem solving. Reliable power and communication are critical to National development. Graduate of PHY 122 can contribute to rural electrification, renewable energy, telecommunications and industrial automation in Nigeria. In summary the course trains students to understand, design, and troubleshoot the electrical systems that power modern society.

COURSE OBJECTIVES

The objective of this course is to:

1. State the law of electrostatics, compare electrostatics with gravitational field,
2. State Coulomb's law, Ohm's law, ampere's law, Biot-savart law and
3. Show their applications,
4. Explain the concept of dipole moment, electromagnetic induction;
5. Discuss self and mutual inductance,
6. Cover Faraday's laws, Lenz's law and Maxwell's equation

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. State the laws of electrostatics and compare electrostatic field with gravitational field.
2. State Coulomb's law, Ohm's law, Ampere law, Biot-Savart law and their applications.
3. Explain the concept of dipole moment
4. Explain the concept of electromagnetic induction; self and mutual inductance
5. State Faraday's law, Lenz's law, and Maxwell's equation
6. Calculate electric field, electric potential, and capacitance for simple geometries.
7. Demonstrate safety consciousness when handling electrical apparatus.

COURSE CONTENT

- Forces in nature. Electrostatics; electric charge and its properties, methods of charging,
- Coulomb's law and superposition, electric field and potential and Gauss's law. Capacitance;
- Electric dipoles; energy in electric fields; conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits. Magnetic fields; Lorentz force; Biot-Savart
- And Ampère's laws; magnetic dipoles; dielectrics and energy in magnetic fields.
- Electromotive force; Electromagnetic induction; Self and mutual inductances; Faraday and
- Lenz's laws; Step up and stepdown transformers: Maxwell's equations; Electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

CATEGORY	DETAILS
Core Competencies	• Leadership • Entrepreneurial skill • Social Emotional learning • Innovation • Reflection • Critical thinking

CATEGORY	DETAILS
Core Values	• Tolerance • Humility • Honesty • Freedom • Respect • Peace
Pedagogical Approaches	• Cooperative Learning • Inquiry-Based Learning • Blended learning • Discovery learning • Learner-Centred Approach • Project based learning • 4-in-1 Model (TPACK)
Learning Resources	• Classroom & Instructional Materials • Digital and online Learning Platforms • Reference Materials • Instructional Materials • Interactive board • Core textbooks • National curriculum for Basic Education
Assessment Methods	• Assignments + test • Project • Test / exam • Formative Assessments • Continuous assessment

REFERENCES AND FURTHER READING

Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

MTH 121 Elementary Mathematic I (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops students' ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomials, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series, The trigonometry component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and application of science, technology, engineering, social sciences, economics, and other disciplines. A strong understanding of elementary algebra and trigonometry enables students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher-level mathematics and discipline-specific courses that require mathematical reasoning and computation. Knowledge of algebra supports the study of functions, calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer science, and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real-life and professional situations.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain and apply the basic concepts and properties of the real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials, and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.

4. Solve linear, quadratic, simultaneous, and selected higher-order equations.
5. Solve linear and quadratic inequalities and represent their solutions appropriately.
6. Represent and interpret simple algebraic relationships using tables, graphs, and equations.
7. Define and apply the basic trigonometric ratios: sine, cosine, and tangent.
8. Use trigonometric identities to simplify expressions and solve mathematical problems.
9. Apply algebraic and trigonometric methods to practical problems in science, technology, engineering, and everyday situations.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements
- Venn diagrams
- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers
- Algebra of complex numbers
- The Argand diagram
- De-Moivre’s theorem, nth roots of unity
- Circular measure, trigonometric functions of angles of any magnitude
- Addition and factor formulae

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• **Critical thinking** • Creativity • **Innovation** • **Reflective thinking** • Collaboration • Self-development • Problem-solving skills.
Core Values	• Integrity • Team spirit • Perseverance • **Transparency** • **Tolerance** • **Honesty**
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and cooperative • Learning • Blended Learning • Discussion and Dialogue • 4-in-1 Model (TPACK)
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms

CATEGORY	DETAILS
Assessment Methods	• Continuous • Assessment • Formative Assessment • Summative assessment, Readings • Class work • Assignment • Group assignment • Presentations • Written Quiz • National curriculum for Basic Education

REFERENCES AND FURTHER READING

- College Algebra – algebraic techniques, equations, functions, and graphs.
- Elementary Trigonometry – trigonometric ratios, identities, equations, and applications.
- Schaum's Outline of Elementary Algebra – particularly good for worked examples and practice problems.
- Schaum's Outline of Trigonometry – useful for additional exercises and step-by-step solutions.
- OpenStax, Algebra and Trigonometry

CSC 211 Introduction to Computer Science

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This foundational course introduces NCE students to the basic concepts, history, and societal relevance of Computer Science. It provides learners with an understanding of how computers evolved from the first generation to modern-day systems, their classifications, and their transformative impact on education, industry, governance, and everyday life.

The course exposes students to the fundamental components of computer hardware and software, basic computer data processing systems, and emerging issues related to computer ethics and human values. It also introduces Information and Communication

Technology (ICT) as a critical tool for teaching, learning, communication, and national development in the digital age.

Through a blend of theory and practical exposure, the course promotes responsible use of technology, digital citizenship, and ethical awareness. It supports inclusive learning through Universal Design for Learning (UDL) principles and nurtures Social Emotional Learning (SEL) competencies such as responsible decision-making, self-management, and collaboration. By the end of the course, students will appreciate computer science as a problem-solving discipline and a vital tool for effective teaching and lifelong learning.

RELEVANCE STATEMENT

This course provides foundational knowledge of computer science concepts, history, and applications. It equips students with an understanding of computing systems, problem-solving approaches, and the role of computers in modern society, forming the intellectual basis for further studies in programming, software development, and information technology.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the meaning, scope, and importance of Computer Science in modern society.
2. Trace the historical development of computers from the first generation to contemporary systems.
3. Classify computers based on size, purpose, and functionality.
4. Identify and describe the basic components of computer hardware and software.
5. Explain the concept and stages of computer data processing systems.
6. Discuss the impact of computers on education, communication, and national development.
7. Explain basic principles of computer ethics and human issues related to technology use.
8. Demonstrate responsible and ethical behaviour in the use of ICT tools.
9. Apply basic ICT knowledge to support learning and teaching activities.

LEARNING OUTCOMES

The objectives of this course are to:

1. Define Computer Science and clearly explain its relevance to education and society.

2. Outline the major characteristics of each generation of computers and identify key technological breakthroughs.
3. Classify computers into appropriate categories and give practical examples of each type.
4. Identify major hardware components (input, processing, storage, output devices) and explain their functions.
5. Distinguish between system software and application software, citing common examples.
6. Explain the stages of data processing (input, processing, output, storage) with simple illustrations.
7. Identify ethical issues in computer usage, including privacy, security, plagiarism, and digital responsibility.
8. Demonstrate basic ICT literacy skills and
9. Responsible digital behaviour in academic tasks.

COURSE CONTENT

Thematic Areas and Contents

Introduction to Computer Science (Meaning and scope of Computer Science, Computer as an information processing machine, Importance of computers in education, society, and national development, *SEL focus:* self-awareness and responsible technology use**). History and Evolution of Computers (**Early computing devices, First generation computers (vacuum tubes), Second generation computers (transistors), Third generation computers (integrated circuits), Fourth generation computers (microprocessors), Fifth generation and emerging technologies, *UDL focus:* multiple means of representation using charts, timelines, and multimedia**). Classification of Computers (**Classification by size (supercomputers, mainframes, minicomputers, microcomputers), Classification by purpose (general-purpose and special-purpose computers), Classification by data handling (analogue, digital, hybrid computers), *SEL focus:* collaborative learning and peer discussion**). Computer Hardware and Software (**Meaning of computer hardware, Input devices, Processing devices (CPU components), Storage devices (primary and secondary), Output devices, Meaning of computer software, System software, Application software**,** *UDL focus:* hands-on demonstrations and visual aids**). Computer Data Processing Systems (**Meaning of data and information, Data processing cycle, Types of data processing (batch, real-time, online), Applications of data processing systems, *SEL focus:* problem-solving and critical thinking**);**

Computer Ethics and Human Issues (Meaning of computer ethics, Ethical issues in computing (privacy, security, piracy, plagiarism), Health and safety issues in computer usage,

Social implications of computer technology, *SEL focus:* responsible decision-making and ethical awareness)**. Introduction to Information and Communication Technology (ICT) (**Meaning and components of ICT. ICT tools for teaching and learning, ICT in communication and information sharing, ICT and digital citizenship, *UDL focus:* inclusive access to digital tools).

CATEGORY	DETAILS
Core Competencies	1 Digital literacy 2 Critical thinking 3 Problem-solving 4 Communication 5 Collaboration 6 Ethical reasoning 7 Lifelong learning
Core Values	8 Responsibility 9 Integrity 10 Respect for intellectual property 11 Discipline 12 Team spirit 13 Accountability
Pedagogical Approaches	• 1 Learner-centred approach 2 Experiential and practical learning 3 Collaborative learning 4 Inquiry-based learning 5 Blended learning • 6 Guided practical sessions • 7 Multimedia presentations and videos • Interactive lectures with visual illustrations • Demonstrations of computer components • UDL- and SEL-informed teaching • 4 in 1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Core textbooks and reference materials • Computer laboratory facilities • Digital and online learning platforms • Multimedia instructional resources • Policy and ICT guideline documents • Capron, H. L., & Johnson, J. A. (2019). *Computers: Tools for an Information Age*. • Shelly, G. B., & Vermaat, M. E. (2018). *Discovering Computers*. • Federal Republic of Nigeria (2013). *National Policy on Education*. • UNESCO (2018). *ICT Competency Framework for Teachers* • National curriculum for Basic Education
Assessment Methods	• Continuous assessment • Quizzes and short tests • Practical demonstrations • Group assignments • End-of-course examination

BIO 211 Laboratory Management

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course equips students with the knowledge and skills for effective management of a biology laboratory. It covers laboratory planning, design, equipment procurement and maintenance, safety procedures, first aid, electrical knowledge, and improvisation of simple biological equipment. The course also includes setting up a biological garden, school museum, and herbarium for teaching and preservation of specimens.

RELEVANCE STATEMENT

This course enables the student to plan and organise a functional biology laboratory for teaching. Manage laboratory equipment through proper ordering, inventory, care and maintenance. Apply safety rules and first aid measures to prevent and manage laboratory accidents. Knowledge acquired in this course will help the students to improvise in production of simple biological equipment using local materials. Establish and maintain a

school biological garden, museum, and herbarium. Promote safety consciousness and resourcefulness in school laboratories.

COURSE OBJECTIVES

The objectives of this course is to:

1. Outline procedures for effective laboratory management.
2. Describe ideal laboratory facilities.
3. Explain procedures for laboratory inventory.
4. Identify common laboratory accidents.
5. Demonstrate the use of laboratory safety devices.
6. Explain electrical safety in the laboratory.
7. Demonstrate skills in laboratory equipment improvisation.
8. Describe procedures for establishing a biological garden.

LEARNING OUTCOMES

At the end of this course the students should be able to:

1. Demonstrate ability to effectively manage laboratory
2. Identify ideal laboratory facilities
3. Demonstrate ability to produce laboratory inventory
4. Manage laboratory accidents.
5. Use laboratory safety devices.
6. Maintain electrical safety in the laboratory
7. Improvise laboratory equipment from local materials.
8. Establishing a biological garden.

COURSE CONTENT

- Outline procedures in effective laboratory management
- The planning of a biology laboratory
- Location, size, height, spacing and facilities such as windows, doors
- Lighting and other fittings like cupboard and working benches
- Ordering of equipment
- Inventory, care and maintenance of the equipment

- Common accidents in the Laboratory-fire, acid & alkaline burns, animal bites, stings, inhalation of dangerous gases, cuts, electrical shocks etc. Safety in the laboratory.
- Safety devices such as fire-extinguisher, fire blankets and bucket
- **First aid:** first aid kit, first aid measures
- Knowledge of electrical wiring in the laboratory: fuses, bulbs and fluorescent tubes
- Improvisation in biology laboratory: importance of local production, basic skills in improvisation and local production of local production, basic skills in improvisation and local production in wood work, glassblowing, brick laying, metal work and electrical/electronics
- Such skills should be usable in construction simple biological equipment
- Biological garden and outdoor laboratory
- **Setting up of a school biological museum and preparation of museum materials, preservation, display etc.:** Taxidermy
- **The herbarium:** construction and setting up of a herbarium

CATEGORY	DETAILS
Core Competencies	• Laboratory skills • Planning and design • Hazard identification • Setting skills.
Core Values	• Safety • Professionalism • Responsibility • Safety consciousness • Integrity • Resourcefulness • Creativity • Accountability • Accuracy • Teamwork • Documentation

CATEGORY	DETAILS
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Demonstration • Practical work • Cooperative learning • Problem solving • Project-base • Field/visit method • Discussion etc.
Learning Resources	• Laboratory equipment • Safety devices and manuals • Laboratory inventory, charts • Garden tools and outdoors materials • Textbooks • Herbarium cabinet, mounting boards and press. • National curriculum for Basic Education
Assessment Methods	• Report on laboratory design • Safety measures, inventory and maintenance • Herbarium and report on museum portfolio.

REFERENCES AND FURTHER READING

- Biology for Senior Secondary Schools Book 3. (2021). *University Press Plc*. Laboratory
- Biosafety Manual. (2020). *World Health Organization (WHO)*.

BIO 212 Introductory Ecology

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Introductory ecology introduces students to the fundamental concepts and principles of ecology, emphasising the structure and functioning of ecosystems and the interactions between living organisms and their environment. It covers the concept and definition of

ecosystems, community ecology, ecological classification of habitats, terrestrial and aquatic biomes, and biotic components of habitats, natural disturbances, community interactions, natural cycles, and population dynamics. Practical activities provide students with hands-on experience in ecological observation, field studies, habitat assessment, and data collection.

RELEVANCE STATEMENT

This course will enables students to understand ecological principles that govern the distribution and abundance of organisms. Develop practical skills in ecological field studies and environmental assessment. Appreciate the importance of biodiversity and ecosystem conservation. Apply ecological knowledge to environmental management and sustainable development and build a foundation for advanced studies in ecology, environmental biology, and conservation biology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Define ecology and ecosystem.
2. Describe ecology at the community level.
3. Classify different habitat types.
4. Differentiate between terrestrial and aquatic biomes.
5. Identify the biotic components of various habitats.
6. Explain the causes of natural disturbances in ecosystems.
7. Describe factors influencing community structure.
8. Explain ecological succession.
9. Describe the carbon cycle.
10. Explain the principles of population dynamics.

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Discuss the fundamental concepts of ecology.
2. Examine ecological characteristics at the community level.
3. Distinguish major habitat types.
4. Compare terrestrial and aquatic biomes.
5. Recognise the major biotic components found in different habitats.

6. Analyse the causes of natural disturbances in ecosystems.
7. Identify factors influencing community structure.
8. Outline the stages of ecological succession.
9. Describe how the carbon cycle occurs.
10. Analyse population dynamics.

COURSE CONTENT

- Concept and definition of ecosystem
- Ecology at community level
- Ecological classification of habitat types
- Terrestrial and aquatic biomass
- Specific features of each
- Biotic components of habitat. Natural destruction
- Factors of communities
- Success of community interaction
- Natural cycle
- Dynamics of population

.

CATEGORY	DETAILS
Core Competencies	• Environmental literacy • Analysis • Observation • Interpretation • Problem –solving • Classification
Core Values	• Environmental stewardship • Responsibility • Teamwork • Awareness • Respect

CATEGORY	DETAILS
Pedagogical Approaches	• Fieldwork • Project-based learning • Group discussion • Laboratory practical • Simulate • 4-in-1 Model (TPACK)
Learning Resources	• Field guides, ecological sites • Specimens • Charts • Textbooks • Multimedia • National curriculum for Basic Education
Assessment Methods	• Lab and field reports • Projects • Presentations.

REFERENCES AND FURTHER READING

- Cain, M. L., Bowman, W. D., & Hacker, S. D. (2023). *Ecology (6th ed.)*. Oxford University Press.
- Molles, M. C., Jr. (2022). *Ecology: Concepts and applications (9th ed.)*. McGraw-Hill Education.

BIO 213 General Physiology

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 0

COURSE OVERVIEW

This course introduces students to the physiological processes that govern the functioning of living organisms. It focuses on the chemistry and biological significance of carbohydrates, lipids, proteins, and nucleic acids, as well as the characteristics and functions of enzymes. The course also examines nutrition, digestion, absorption, photosynthesis, protein synthesis, cell membrane structure and function, osmoregulation, excretion,

transport systems, homeostasis, hormonal regulation, plant water relations, growth, and growth regulation in plants and animals.

RELEVANCE STATEMENT

The study of this course will enable students to understand the biochemical and physiological processes essential for life. Explain how plants and animals obtain, utilise, and regulate nutrients and energy. Apply physiological principles in biology teaching, agriculture, medicine, and environmental science. Develop practical knowledge of biological processes necessary for advanced biological studies it is a foundational course in the study of biochemistry, anatomy, molecular biology, and physiology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Discuss the biological importance of carbohydrates, lipids, proteins, and nucleic acids.
2. Describe the characteristics of enzymes.
3. Explain nutrition in plants and animals.
4. Describe photosynthesis.
5. Explain the structure of the cell membrane.
6. Describe transport across cell membranes.
7. Explain osmoregulation in animals.
8. Discuss the roles of hormones in growth.
9. Explain water relations in plants.
10. Describe plant growth.

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Explain the biological significance of carbohydrates, lipids, proteins, and nucleic acids.
2. Classify enzymes.
3. Describe nutrition in plants and animals.
4. Outline the process of photosynthesis.
5. Describe the structure of the cell membrane as a medium of cell communication.
6. Identify mechanisms of transport across cell membranes.
7. Describe the role of osmoregulation in animals.

8. Analyse the roles of hormones in growth.
9. Describe how water moves in and out of plants.
10. Explain the stages involve in plant growth.

COURSE CONTENT

- Chemicals of life: The chemistry of Carbohydrates, lipids, proteins and nucleic acids and their biological importance
- General characteristics of enzymes
- Nutrition, digestion, and absorption in plants and animals
- Biosynthesis: Photosynthesis and protein synthesis
- Cell membrane structure and function
- A general study of osmoregulation, excretion, transport, growth hormones and enzymology, homeostasis and their co-ordination in animals
- Plant water relation, growth and growth regulation

PRE-REQUISITE: BIO 111 AND BIO 112

CATEGORY	DETAILS
Core Competencies	• Understanding • Correlation • Laboratory skills • Problem-solving • Practical skills • Demonstration • Explanation
Core Values	• Accuracy, and precision • Responsibility • Integrity.
Pedagogical Approaches	• Demonstration • Laboratory practical • Inquiry-based learning • Project-based • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Laboratory equipment • Charts • Models • Specimens • Videos etc. • National curriculum for Basic Education
Assessment Methods	• Laboratory practical report

REFERENCES AND FURTHER READING

- Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Orr, R. B. (2024). *Campbell biology (13th ed.)*. Pearson.
- Widmaier, E. P., Raff, H., &Strang, K. T. (2023). *Vander's human physiology: The mechanisms of body function (16th ed.)*. McGraw-Hill.

BIO 214 General Biology Practical II

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General biology practical course provides students with hands-on experience in plant and animal biology through laboratory and field investigations. Students will prepare and observe temporary and permanent slides of monocot and dicot plant tissues, identify and draw representatives of chordates, and study primary and secondary thickening in plants. The course also involves the observation of living and preserved specimens of fishes, birds, and mammals, with emphasis on their external morphology, adaptive features, and classification. The practical sessions are designed to develop laboratory techniques, scientific observation, specimen handling, recording, and biological illustration skills.

RELEVANCE STATEMENT

The study of this course will enable students to develop practical laboratory and field skills in biology. Identify major structural features of plants and chordates. Acquire competence in preparing and interpreting microscope slides. Understand the relationship

between structure, function, and adaptation in living organisms. Develop practical skills required for biology teaching, research, and further studies in biological sciences.

COURSE OBJECTIVES

The objectives of this Course is to:

1. Prepare temporary slides of root tissues.
2. Observe permanent slides of plant tissues.
3. Discuss representatives of chordates.
4. Distinguish between monocot and dicot plant structures.
5. Explain primary thickening in plants.
6. Identify the characteristics of bony fishes.
7. Examine the external features of birds.
8. Identify the characteristics of mammals.
9. Handle biological specimens appropriately.
10. Explain record of biological observations

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Demonstrate the ability to prepare temporary slides of root tissues.
2. Interpret permanent plant tissue slides.
3. Identify representatives of chordates.
4. Differentiate monocot plants from dicot plants.
5. Describe primary thickening in plants.
6. Distinguish bony fishes from cartilaginous fishes.
7. Describe the external features of birds.
8. Evaluate the characteristics of mammals.
9. Demonstrate appropriate handling of biological specimens.
10. Record biological observations accurately.

COURSE CONTENT

- Prepare and observed slides of different plants parts
- Identify and draw different types of organisms in chordates
- Preparation of temporary slides for T.S. of root, stem and leaf of monocots and dicots.

- Observation of permanent slides of root, stem and leaf of dicots and monocots field observation of Primary and Secondary Thickening
- Observation of living forms of fishes (bony and cartilaginous e.g. Tilapia and dogfish), observation of Primary and Secondary thickening.
- Observation of living forms of birds (Aves) e.g. Pigeon/chicken for external and adaptive features in flight.
- Examination of the various types of mammals
- Observation of living and preserved specimens of mammals

CATEGORY	DETAILS
Core Competencies	• Laboratory skills • Observation • Scientific inquiry • Identification • Microscopy • Description
Core Values	• Safety consciousness Professionalism • Accuracy • Appreciate • Curiosity • Teamwork • Appreciation
Pedagogical Approaches	• Hands-on practical's • Experimental learning • Laboratory method • Demonstration • Project-based • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Microscopes • Laboratory equipment • Reagents • Laboratory manuals • Videos • Plant and animals specimen • National curriculum for Basic Education
Assessment Methods	Laboratory, field, and project report

REFERENCES AND FURTHER READING

- James, D., & Mends-Cole, J. (2021). *Practical biology for schools and colleges*. University Press.
- Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Orr, R. B. (2024). *Campbell biology (13th ed.)*. Pearson.

BIO 215A Conservation and Development of Renewable Natural Resources

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Elective | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the principles and practices of biodiversity conservation and sustainable natural resources management. It examines conservation and preservation concepts, forest and wildlife management, desertification control, afforestation and reforestation, plant genetic resources, seed preservation, germplasm conservation, and the economic valuation of natural resources. The course also explores international biodiversity agreements and Nigerian environmental laws guiding conservation efforts.

RELEVANCE STATEMENT

The course equips students with the knowledge and practical skills needed to conserve biological diversity and manage natural resources sustainably. It prepares future biology educators and environmental professionals to address environmental degradation, biodiversity loss, climate change, and resource depletion through informed decision-making, policy implementation, and conservation practices.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain biodiversity conservation.
2. Explain natural resource management.
3. Describe the causes of deforestation.
4. Describe the causes of desertification.
5. Discuss strategies for conserving plant resources.
6. Identify policies relating to biodiversity conservation.
7. Explain the principles of natural resource economic

LEARNING OUTCOMES

At the end of the course, students should be able to

1. Demonstrate ability to conserve biodiversity.
2. Manage natural resources.
3. Analyse the causes of deforestation.
4. Analyse the causes of desertification.
5. Apply strategies for conserving plant resources.
6. Examine policies relating to biodiversity conservation.
7. Apply the principles of natural resource economics.

COURSE CONTENT

- Conservation versus preservation
- Deforestation and its attendant problems
- Afforestation and reforestation
- Principles, problems and prospects of forestry conservation
- Desertification and its control
- World outlook on conservation

- Biodiversity conservation: international biodiversity conventions and treaties
- Nigerian laws as applicable to natural resources management
- Management and utilisation of forest resources
- Plant genetic resources in breeding
- Seed preservation, preservation of endangered species, viability and health
- Important food crops and domestic animals and their wild relatives
- Captive breeding of threatened flora and fauna in botanical and zoological gardens, Wildlife parks and arboreta
- Field gene banks
- Safe movement of germplasm
- Basic Principles of Natural Resources Economics and Natural Resources Valuation Methods

CATEGORY	DETAILS
Core Competencies	• Environmental literacy • Afforestation • Differentiate • Preservation • Description • Valuation • Management • Communication and collaboration • Explanation
Core Values	• Responsibility • Stewardship • Integrity • Respect • Service • Ethics • Forward thinking • Patriotism • Sustainability

CATEGORY	DETAILS
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Fieldwork • Group discussion • Project-based learning • Case study • Problem-solving
Learning Resources	• Activities • Learning Resources • Field sites • Charts and maps • Environmental reports • Multimedia resources • Biology textbooks • ICT facilities • Seed bank and gene bank materials • Tools for seed • Preservation and germplasm handling • National curriculum for Basic Education
Assessment Methods	Fieldwork, Laboratory and practical report reports

REFERENCES AND FURTHER READING

- Primack, R. B., & Sherwood, G. H. (2021). *An Introduction to Conservation Biology (3rd ed.)*
- Federal Ministry of Environment, Nigeria. National Policy on the Environment (latest edition)

BIO 215B Introduction to Fisheries and Aquaculture Management

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Elective | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the principles and practices of aquaculture and fisheries management. It covers the history and development of aquaculture in Nigeria, fisheries policies and regulations, fish anatomy and physiology, pond design and management, fish nutrition, breeding techniques, culture systems, fishing gears, fish processing, fish health management, and the economic aspects of aquaculture. The course equips students with the theoretical knowledge and practical skills required for sustainable fish production and fisheries resource management.

RELEVANCE STATEMENT

Aquaculture is one of the fastest-growing agricultural sectors and plays a significant role in ensuring food security, employment generation, and economic development. This course prepares students to contribute to sustainable fisheries and aquaculture development through effective fish production, resource conservation, and disease management in line with national and global best practices.

COURSE OBJECTIVES

At the end of this course, students should be able to:

1. Explain the legal framework of aquaculture in Nigeria.
2. Describe the anatomy of economically important fish species.
3. Explain fish pond design using appropriate aquaculture techniques.
4. Explain fish breeding practices.
5. Evaluate the economic viability of aquaculture enterprises.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Describe the legal framework of aquaculture in Nigeria.
2. Identify the anatomical features of economically important fish species.
3. Demonstrate the ability to design a fish pond using appropriate aquaculture techniques.
4. Practice fish breeding

5. Assess the economic viability of aquaculture enterprises.

COURSE CONTENT

- History, present organisation and status of aquaculture in Nigeria
- Fisheries policy and laws in Nigeria
- International laws of the sea
- Introduction to exotic species and their implications
- The gross external morphology of bony and cartilaginous fishes
- Basic functions of piscine organs and major organ systems in fish
- Fish farm design
- Fish pond construction and management
- Liming and pond fertilisation
- Selection of culture species
- Food and feeding habits of fishes
- Fish feed formulation
- Growth rate and food conversion
- Age and growth determination
- Hatchery management
- Induced breeding and hybridisation techniques
- Fish culture techniques e.g. monoculture and polyculture.
- Types of fishing gears
- Construction of fishing gears
- Major fish processing techniques
- Economic consideration of aquaculture
- Some common fish diseases, their prevention and control

CATEGORY	DETAILS
Core Competencies	• Management skills • Production skills • Entrepreneurial competence • Critical thinking and problem-solving • Design and construction • Breeding • Processing • Liming • Culturing
Core Values	• Innovation • Responsibility • Sustainability • Hard work • Integrity • Teamwork • Economic mindset • Conservation • Hygiene
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Demonstration • Practical activities • Field visits • Group discussion • Project-based learning • Case study

CATEGORY	DETAILS
Learning Resources	• National Curriculum for Basic Education • Fish ponds or demonstration units • Aquaculture tools and equipment • Charts and models • Multimedia resources • Textbooks • ICT facilities • Water testing kit • Fishing gears • Fish specimen.
Assessment Methods	• Field report • Report on design and construction of fish pond and aquarium

REFERENCES AND FURTHER READING

- Boyd, C. E., & Tucker, C. S. (2023). *Pond aquaculture water quality management (2nd ed.)*. Springer.
- Food and Agriculture Organization. (2024). *The State of World Fisheries and Aquaculture 2024. FAO*. https://doi.org/10.4060/cd0683en
- Lucas, J. S., & Southgate, P. C. (2024). *Aquaculture: Farming aquatic animals and plants (4th ed.)*. Wiley-Blackwell.

BIO 221 Introductory Developmental Cell Biology

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of cell and developmental biology. It examines the historical development and current trends in cell biology, the ultrastructure of plant and animal cells, cell organelles and their functions, cell division through mitosis and meiosis, cell differentiation, cell growth, and the molecular basis of cell structure and development. The course provides a foundation for understanding cellular organisation, growth, reproduction, and development in living organisms.

RELEVANCE STATEMENT

Learning this course enables students to understand the structure and functions of cells as the basic units of life. Explain the mechanisms of cell growth, division, and differentiation. Apply knowledge of cell biology in genetics, physiology, biotechnology, medicine, and agriculture. Develop microscopy and analytical skills necessary for biological studies and enhance knowledge for advanced courses in molecular biology, genetics, embryology, and physiology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the historical development of cell biology.
2. Describe the ultrastructure of plant and animal cells.
3. Explain cell organelles.
4. Differentiate between plant and animal cells.
5. Explain mitosis.
6. Describe cell differentiation.
7. Explain the molecular basis of cell structure.
8. Discuss the role of cells in growth.

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Trace the historical development of cell biology.
2. Illustrate the ultrastructure of plant and animal cells.
3. Identify major cell organelles.
4. Distinguish between plant and animal cells.
5. Describe the process of mitosis.
6. Outline the process of cell differentiation.
7. Examine the molecular components of cell structure.
8. Explain the role of cells in growth.

COURSE CONTENT

- History and present trends in cell biology
- Ultra-structure of the plant and animal cells, Organelles and their basic structures and functions

- Mitosis and meiosis, cell differentiation and growth of cells
- A brief study of the molecular basis of cell structure and development

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• Differentiation • Observation • Critical thinking • Scientific inquiry • Comparison • Analysis • Identification • Microscopy • Concept formation
Core Values	• Curiosity • Accuracy • Responsibility • Scientific inquiry
Pedagogical Approaches	• Demonstration • Laboratory practical • 4-in-1 Model (TPACK) • Discovery learning • Project-based • Lectures • Discussion
Learning Resources	• Microscopes • Prepared slides • Charts • National Curriculum for Basic Education • Models • Textbook • Videos

CATEGORY	DETAILS
Assessment Methods	Field, laboratory and project report presentation

REFERENCES AND FURTHER READING

- Alberts, B., Heald, R., Johnson, A., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). *Molecular biology of the cell (7th ed.)*. W. W. Norton & Company.
- Karp, G. (2021). *Cell and molecular biology: Concepts and experiments (9th ed.)*. John Wiley & Sons.

BIO 222 Animal Histology

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the microscopic structure (histology) of animal tissues and organs, with emphasis on the human body. It examines the characteristics, classification, structure, and functions of the major tissue types, including epithelial, connective, muscular, and nervous tissues. The course also covers the histology of important organs such as the skin, liver, kidney, ovary, and testis, as well as specialised tissues including blood, bone, cartilage, muscle, and nerve. Students acquire the knowledge and skills required to recognise tissues under the microscope and relate their structures to their functions.

RELEVANCE STATEMENT

The course enables students to comprehend the microscopic organisation of animal tissues and organs. Relate tissue structure to physiological functions. Enhance competency in the identification of tissues using prepared slides and microscopes. Build a foundation for studies in anatomy, physiology, pathology, medicine, and veterinary sciences and foster practical skills required for biology teaching, laboratory work, and biological research.

COURSE OBJECTIVES

The objectives of this course is to:

1. Introduce the concept of animal histology.
2. Outline the structure of epithelial tissues.

3. Classify connective tissues.
4. Explain the structural features of muscular tissues.
5. Summarise the functions of nervous tissue.
6. Present the histological features of the skin.
7. Highlight the microscopic characteristics of blood.
8. Establish the relationship between tissue structure and organ function.
9. Demonstrate tissue identification using prepared microscopic slides

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Define animal histology.
2. Identify the structural characteristics of epithelial tissues.
3. Categorise connective tissues.
4. Describe the structure of muscular tissues.
5. Explain the functions of nervous tissue.
6. Identify the histological features of the skin.
7. Recognise the microscopic characteristics of blood.
8. Explain the relationship between tissue structure and organ function.
9. Identify tissues using prepared microscopic slides.

COURSE CONTENT

- Describe the various tissues and organs of human body
- History of various tissues should be studied e.g. Epithelia, Connective tissue, Muscular Tissue.
- Histology of the following organs
- Skin, Liver, Kidney, Ovary and testis
- Histology of the following: Blood, Bones, Cartilages, Muscles, Nerves

CATEGORY	DETAILS
Core Competencies	• Observation • Laboratory skills • Analysis • Identification • Microscopy • Correlation
Core Values	• Accuracy • Safety consciousness • Responsibility • Respect • Appreciate • Teamwork
Pedagogical Approaches	• Demonstration • Laboratory practical • Project-base • 4-in-1 Model (TPACK)
Learning Resources	• Microscopes • Prepared slides • Histology atlas • Textbooks • Reagent • National Curriculum for Basic Education
Assessment Methods	• Field, laboratory and project reports

REFERENCES AND FURTHER READING

- Ross, M. H., & Pawlina, W. (2024). *Histology: A text and atlas (9th ed.)*. Wolters Kluwer.
- Mescher, A. L. (2024). *Junqueira's basic histology: Text and atlas (17th ed.)*. McGraw-Hill.

BIO 223 Biostatistics

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the principles of biological research and the application of statistical methods in biological sciences. It covers the meaning, purpose, and relevance of research and biometry, research designs, topic selection, hypothesis formulation, methods of data collection, population and sampling techniques, data presentation, measures of central tendency and dispersion, statistical tests of relationship, and scientific report writing. The course equips students with the knowledge and skills required to conduct, analyse, interpret, and report biological research.

RELEVANCE STATEMENT

The course enables students to understand the principles and procedures of scientific research. Develop skills in designing and conducting biological research. Apply appropriate statistical methods to analyse biological data. Interpret research findings for informed decision-making. Prepare scientific reports and research projects using accepted academic standards. Build a foundation for final-year research projects and postgraduate studies.

COURSE OBJECTIVES

The objectives of this course is to:

1. Introduce the meaning of research and biostatistics.
2. Describe the procedures for conducting scientific research.
3. Identify the different types of research.
4. Guide students in selecting research topics.
5. Present methods of data collection.
6. Describe population and sampling techniques.
7. Illustrate methods of data presentation.
8. Demonstrate the calculation of measures of central tendency.
9. Introduce statistical tests used in biological research.
10. Outline the structure of scientific research reports

LEARNING OUTCOMES

At the end of the course, students will be able to:

1. Discuss the meaning, purpose, and significance of research and biostatistics.
2. Outline the major steps involved in conducting scientific research.
3. Distinguish among the different types of research.
4. Formulate appropriate research topics and testable hypotheses.
5. Identify suitable methods and sources for collecting research data.
6. Differentiate between population, sample, and various sampling techniques.
7. Construct tables, charts, and graphs for data presentation.
8. Compute and interpret measures of central tendency and dispersion.
9. Perform statistical tests, including Chi-square, correlation, t-test, and ANOVA.
10. Compile scientific research findings in an appropriate report format.

COURSE CONTENT

- Describe procedure involved in conducting research
- Carryout scientific research
- Meaning, Purpose and relevance of Research and Biometry
- **Types of Research:** Experimental, Survey, Case Study etc
- **Choice of Research Topic Hypothesis:** Types, Source, Formulation
- **Data Collection:** Types and Sources
- Population, Sample and Sampling techniques
- Data Presentation: Frequency Distribution, Cumulative frequency, graphs (line, histograms), Bar Charts, Pie Charts etc. Measures of Central tendency (Mean and Median).
- **Measures of Dispersion:** Mean Deviation, Variance and Standard Deviation
- **Measures of Relationship:** Chi square (x2) Correlation Coefficient, T-test and ANOVA
- Project reporting

CATEGORY	DETAILS
Core Competencies	• Quantitative reasoning • Description • Critical thinking • Problem-solving • Digital literacy • Interpretation • Scientific report
Core Values	• Honesty • Accuracy • Objectivity • Integrity • Curiosity • Teamwork
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Problem-solving • ICT-supported learning • Guided practice • Computer-based simulation • Case study method
Learning Resources	• Computers • Statistical software • Calculators • Datasets • National Curriculum for Basic Education • Textbooks • Charts • Journals • Past research projects
Assessment Methods	Project research report and presentation

REFERENCES AND FURTHER READING

- Pagano, M., Gourneau, K., & Mattie, H. (2022). *Principles of biostatistics (3rd ed.)*. CRC Press.
- Daniel, W. W., & Cross, C. L. (2020). *Biostatistics: A foundation for analysis in the health sciences (11th ed.)*. John Wiley & Sons

BIO 321 General Biology Practical III

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This practical course provides hands-on experience in evolution, parasitology, microbiology, ecology, genetics, and laboratory management. Students will examine fossil materials, study evolutionary trends, observe parasitic organisms, practice sterilisation and safety techniques, carry out ecological and population studies, investigate pollution, conduct genetic experiments, and improvise laboratory materials. Field trips to zoological gardens, national parks, and hospitals are included to link theory with real-life biological applications.

RELEVANCE STATEMENT

The study of this course will help the student to develop practical skills in biological observation, experimentation and data collection. Relate structural and adaptive features of organisms to evolution and parasitism. Apply laboratory safety, sterilisation and first aid procedures in school and hospital settings. Conduct ecological investigations on pollution, population and environmental impact. Perform genetic experiments and interpret patterns of inheritance. Improvise and prepare biological materials for teaching and laboratory use. Build competence for biology teaching, laboratory work and field research.

COURSE OBJECTIVES

The objectives of this course is to:

1. Examine fossil materials.
2. Identify common parasites using prepared slides.
3. Demonstrate laboratory sterilisation techniques.
4. Describe adaptations of parasitic insects and arachnids.
5. Estimate population size.

6. Measure environmental pollutants in aquatic habitats.
7. Identify lower plants used as pollution bio-indicators.
8. Perform monohybrid crosses.
9. Examine meiosis in grasshopper testes or pollen grains.
10. Culture *Drosophila melanogaster* for genetic studies.
11. Demonstrate safe handling of laboratory equipment.
12. Prepare museum specimens.

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Describe evolutionary trends in animals using fossil evidence.
2. Identify major human parasites.
3. Apply appropriate laboratory sterilisation procedures.
4. Identify adaptations of parasitic insects and arachnids.
5. Conduct ecological population surveys.
6. Assess the effects of fertilisers on aquatic communities.
7. Identify lower plants that serve as pollution bio-indicators.
8. Demonstrate monohybrid inheritance patterns.
9. Describe meiotic cell division.
10. Culture *Drosophila melanogaster* for laboratory studies.
11. Handle laboratory equipment safely.
12. Apply genetic principles to population studies.

COURSE CONTENT

- Examination of any fossil material, if available
- Excursion to zoological garden to study evolutionary trend among animals
- Observation of slides of Plasmodium, Trypanosome, Taenia, Fasciola, Ascaris, Ancyclostoma, Wuchereria etc. Observe sterilisation techniques in hospitals especially with reference to prevention of HIV infection.
- Observation of structures and adaptive features of some parasitic insects and arachnids e.g. Bed bugs, lice, ticks.
- Study of population growth in Nigeria

- Town ecology i.e. measurement of pollutants e.g. CO2, CO, SO2 at various site in a town.
- Use of lower plants e.g. Lichens and mosses as indicators of pollution level.
- Pollutants in a stream e.g. Detergents, fertiliser, chemical containers, dyes.
- Effects of various fertilisers and herbicides as pollutants in aquatic habitat on biotic community
- **Estimation of population:** school or college
- Excursion to National Park, Lakes and are as of apparent gully erosion
- Examination of models/charts to illustrate monohybrid and dihybrid crosses in plants and animals
- **Observation of variations:** height, weight, fingerprints, tongue rolling etc
- Microscopic examination of the squashed testes of grasshopper or pollen grains for meiosis, other suitable experiments on monohybrid crosses in using suitable plant and animal materials such as maize, guinea pigs and beans
- **Culturing of fruit fly:** Drosophila melanogaster
- Students should be guided to practice ordering of equipment for the laboratory
- Students should be familiar with safety and first aid devices in the laboratory
- Students should carry out exercises on handling glass wares and chemicals, electrical wiring and fuses
- Observation should be made on sterilisation techniques in hospital especially with reference to prevention of HIV infection
- Organise special lectures/exhibitions on STDs/AIDS prevention and control
- Students should be guided to construct biological materials that can be used in the laboratory i.e. improvisation e.g. test tubes, beakers specimen bottles, etc. Preparation of specimens such as herbarium, skeletons, stuffed materials etc. Outline procedures in effective laboratory management
- The planning of a biology laboratory

CATEGORY	DETAILS
Core Competencies	• Manipulative skills • Scientific investigation • Analysis • Critical thinking • Communication skills • Observation • Measuring • Assessment • Microscopy • Improvisation • Preparation and preservation.
Core Values	• Curiosity • Accuracy • Integrity • Safety consciousness • Responsibility • Teamwork • Safety • Appreciation.
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Practical demonstration • Laboratory experiments • Guided inquiry • Cooperative learning • Project-based learning • Exhibition/ lecture • Field trip/excursion method • Case study.

CATEGORY	DETAILS
Learning Resources	• Fossils, models and chart • Laboratory equipment and reagents • Specimens • Microscopes • Practical manuals • ICT facilities • Cultured materials • Improvisation materials • Video • National Curriculum for Basic Education
Assessment Methods	• Field report • Project report on improvisation • Specimen, herbarium and, museum portfolio • Genetic cross experiment report.

REFERENCES AND FURTHER READING

- Biology Laboratory Manual. (2021). *McGraw-Hill Education*.
- Campbell Biology. (2020). *Pearson*

BIO 322 General Microbiology

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces students to the principles and applications of microbiology. It covers the history and development of microbiology, classification of microorganisms, structure and characteristics of bacteria, fungi, and viruses, microbial growth and reproduction, laboratory techniques, sterilisation and disinfection, microbial nutrition, microbial genetics, immunology, and the role of microorganisms in air, food, water, milk, dairy products, and soil. Students also gain practical knowledge of microbial isolation, culture, staining, identification, and the use of microbiology laboratory equipment.

RELEVANCE STATEMENT

This course provides students with the knowledge and practical skills needed to understand microorganisms and their roles in health, agriculture, industry, food production, and the environment. It equips learners with laboratory competencies required for microbiological investigations, disease prevention, environmental monitoring, and quality control in biological and medical sciences.

COURSE OBJECTIVES

The objectives of this course is to:

1. Outline the history of microbiology.
2. Classify microorganisms.
3. Describe the morphology of bacteria.
4. Outline the principles of sterilisation.
5. Demonstrate microbial isolation techniques.
6. Describe microbial nutrition.
7. Discuss the ecological importance of microorganisms.

LEARNING OUTCOMES

At the end of the course, students will be able to

1. Trace the historical development of microbiology.
2. Differentiate prokaryotic microorganisms from eukaryotic microorganisms.
3. Identify the morphological features of bacteria.
4. Carry out sterilisation
5. Isolate selected microorganisms using standard laboratory techniques.
6. Explain microbial nutrition.
7. Assess the ecological importance of microorganisms.

COURSE CONTENT

- History of the science of microbiology, Classification of organism into prokaryotes and eukaryote
- Classification of prokaryote into archaea and eubacteria
- Anatomy and cytochemistry of bacteria and fungi
- Shapes groupings and colonial morphology of bacteria and fungi
- Structure of viruses, sterilisation and disinfection

- Structure, ecology and reproduction of representative microbial genera
- **Culture of micro-organisms, Isolation of micro-organism, isolation of bacteria, viruses fungi:** Yeast and mould
- Nutrition and biochemical activities of microorganisms
- Antigens and antibodies
- Identification and economic importance of selected microbial groups
- Microbial variation and heredity
- Study of laboratory equipment
- Introduction to microbiology of air food, milk dairy products, water and soil
- Staining techniques, antibiotics sensitivity tests, serological tests, and antimicrobial agents

CATEGORY	DETAILS
Core Competencies	• Classification • Identification of microorganisms. • Application staining, isolation and culturing techniques • Interpretation • Understanding
Core Values	• Safety • Hygiene. • Accuracy • Critical thinking. • Teamwork and collaboration • Responsibility and ethical handling of microorganisms. • Environmental and public health awareness.
Pedagogical Approaches	• Interactive lectures. • Demonstrations of laboratory procedures. • Practical laboratory sessions. • Group discussions and presentations. • Inquiry-based and problem-solving activities. • 4-in -1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Laboratory. • Microscope. • Culture media and Petri dishes. • Inoculating loops and sterile glassware. • Autoclave and hot air oven. • Staining reagents and microscopes. • Charts • Model • Multimedia • 10microbiology textbooks • 11National Curriculum for Basic Education
Assessment Methods	• Practical laboratory exercises. • Assignments. • Quizzes and tests. • Laboratory reports.

REFERENCES AND FURTHER READING

- Tortora, G. J., Funke, B. R., & Case, C. L. (2019). *Microbiology: An introduction (13th ed.)*. Pearson.
- Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2021). *Brock biology of microorganisms (16th ed.)*. Pearson.
- Wiley, J. M., Sherwood, L. M., & Woolverton, C. J. (2020). *Prescott's microbiology (11th ed.)*. McGraw Hill.

BIO 323 Biological Techniques

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Biological Techniques introduces students to fundamental techniques, instruments, procedures, and practical skills required for biological investigations. The course covers microscopy, preparation and examination of biological specimens, biological drawings, spectrophotometry, colorimetry, photometry, polarimetry, chromatography, refractometry,

determination of melting points and colligative properties. It also introduces students to the collection, identification, preservation and documentation of biological materials in herbaria and museums. In addition, students are introduced to experimental design, scientific report writing, data presentation and effective communication of biological findings. The practical component provides students with opportunities to develop competence in the safe and appropriate use of laboratory equipment and biological materials.

RELEVANCE STATEMENT

Biological Techniques is relevant because practical investigation is central to the study and teaching of biology. Knowledge of biological techniques enables students to observe biological structures, prepare specimens, conduct basic laboratory analyses, collect and preserve biological materials, and communicate scientific findings accurately. The course provides practical skills that are applicable in biological research, education, environmental studies, and agriculture, and biotechnology, medical and laboratory-related fields. It also prepares students for more advanced laboratory courses and independent biological investigations.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the major parts of a light microscope.
2. Describe procedures for microscope maintenance.
3. Outline the stages of biological slide preparation.
4. Explain the use of hand lenses.
5. Produce accurate biological drawings.
6. Outline the principles of spectrophotometry.
7. Describe the principles of chromatography.
8. Describe the determination of melting points.
9. Demonstrate procedures for collecting biological specimens.
10. Explain the functions of herbaria.
11. Describe experimental design in biological investigations.
12. Outline the structure of scientific reports.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Recognise the major parts of a light microscope.
2. Maintain microscopes appropriately.
3. Prepare biological slides.
4. Operate hand lenses for biological observations.
5. Construct accurate biological drawings.
6. Apply the principles of spectrophotometry.
7. Apply the principles of chromatography.
8. Determine melting points.
9. Collect biological specimens.
10. Describe the functions of herbaria.
11. Design biological experiments.
12. Prepare scientific reports.

COURSE CONTENT

- Microscopy
- Handling microscopes
- Preparation of microscope slides (microtome) for microscopic examinations
- Use of hand lens
- Biological drawings and diagrams
- Spectrophotometry
- Colorimetry
- Photometry
- Polarimetry
- Chromatography
- Refractometry
- Melting points and colligative properties
- Herbarium and museum techniques
- Experimental designs, report writing and presentations

CATEGORY	DETAILS
Core Competencies	• Laboratory safety • Sample collection • Record keeping • Accuracy • Performance • Identification.
Core Values	• Responsibility • Patience • Teamwork • Integrity • Resourcefulness • Curiosity • Environmental consciousness • Communication
Pedagogical Approaches	• Demonstration • Practical laboratory method • Guided discovery • Cooperative learning • Hands-on-learning • Discussion • Field-based • Peer learning • Problem solving learning 10 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Microscope • Prepared temporary slides • Glassware • Colorimeter • Photometer • Chromatography apparatus • Reagents • Chart • Textbooks • Computers • 11 Laboratory safety equipment. • 12 National curriculum for Basic Education
Assessment Methods	• Class practical presentation report • Assignment

REFERENCES AND FURTHER READING

- Bajah, S. T. (Ed.). Practical Biology for Schools and Colleges. Longman.
- Cain, M. L., Bowman, W. D., & Hacker, S. D. Ecology. Sinauer Associates.
- Evert, R. F. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body. Wiley.
- Glover, D. M., &Hames, B. D. DNA Cloning: A Practical Approach. Oxford University Press.
- Plummer, D. T. An Introduction to Practical Biochemistry. McGraw-Hill.
- Wilson, K., & Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

Degree Course Descriptions (400–500 Level)

SED 411 Biology Methods and Innovative Pedagogies

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Biology Methods and Innovative Pedagogies is a 2-credit-unit compulsory course for 400-level students. It focuses on the principles, methods and practices involved in effective Biology teaching and learning. The course covers the history and relevance of Biology Education in Nigeria, analysis of the SSS Biology curriculum, lesson planning, laboratory activities, contemporary teaching methods, assessment and evaluation, instructional resources, improvisation, micro-teaching, teaching practice and innovative approaches to Biology instruction.

RELEVANCE STATEMENT

The course is relevant because it prepares prospective Biology teachers with the knowledge, pedagogical skills and practical competencies required for effective Biology instruction. It enables students to understand the Biology curriculum, prepare effective lessons, use appropriate instructional resources, conduct practical activities, and assess learners and address misconceptions and difficult concepts in Biology. It also exposes students to innovative teaching approaches and ICT-supported instruction.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Trace the history of Biology Education in Nigeria.
2. Describe the aims of Biology Education.
3. Explain the organisation of the SSS Biology curriculum.
4. Differentiate between a curriculum and a syllabus.
5. Explain Biology lesson plans.
6. Identify appropriate resources for teaching Biology.
7. Describe innovative methods of teaching Biology.
8. Identify common misconceptions in Biology learning

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Describe the historical development of Biology Education in Nigeria.
2. State the aims of Biology Education.
3. Analyse the organisation of the SSS Biology curriculum.
4. Distinguish between a curriculum and a syllabus.
5. Prepare Biology lesson plans.
6. Select appropriate resources for Biology instruction.
7. Apply innovative methods of teaching Biology.
8. Clarify common misconceptions in Biology learning.

COURSE CONTENT

- History and development of Biology education in Nigeria
- Aims and objectives of Biology Education
- The teaching of Biology in schools and its relevance
- Critical analysis of the SSS Biology curriculum
- Review of some concepts in the SSS Biology curriculum
- The thematic approach and spiral nature of the Biology curriculum
- Pre-active and interactive teaching in Biology
- Lesson planning and preparation
- Laboratory activities in Biology teaching
- Introduction to contemporary methods of teaching Biology
- Test, measurement and evaluation of Biology learning
- Resources for Biology teaching and learning
- Improvisation of instructional materials
- Challenges of teaching Biology in Nigeria
- Difficulties of learning Biology
- Major problems of Biology education in Nigeria
- Micro-teaching sessions for demonstration of teaching skills and preparation for teaching practices
- Assessment and review of teaching practice exercise
- Best practices in Biology teaching

- Perception of Biology as a difficulty science subject
- Difficult concepts in SSS Biology syllabus
- Misconceptions in teaching and learning Biology
- Innovative methods of teaching Biology and the supporting theories
- Practical skills in Biology teaching
- Laboratory equipment, facilities and common reagents used for practicals
- Practical sessions using past WASSCE examination papers
- Review of research outcomes and recommendations on Biology instructions

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Problem solving • Scientific inquiry • Practical skills • Communication
Core Values	1. Responsibility 2. Integrity 3. Teamwork 4. Accuracy 5. Environmental awareness
Pedagogical Approaches	• Cooperative learning • Micro teaching • Group discussion • Concept mapping • ICT supported searching • Analysis of past WAEC Biology examination questions • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Videos • Internet facilities • Computers • Lesson plan and micro teaching materials • Charts models etc. • SSS Biology curriculum and syllabus
Assessment Methods	• Microteaching presentation • Lesson plan preparation • Assignment

REFERENCES AND FURTHER READING

- Adeoye, G. A. (2022). *Introduction to Biology Pedagogy*. – Particularly suitable because it covers Biology pedagogy, teaching resources, instructional materials and approaches.
- ResearchGate
- Uche, S. C., & Umoren, G. U. (2015). *A Handbook on Biology Teaching Methods*. – Useful for Biology teaching methods, textbook selection, instructional resources, cooperative activities and lesson preparation.

BIO 412 Genetics

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course builds on the principles of genetics with emphasis on human genetics and molecular aspects. It covers pedigree analysis, deviations from Mendelian principles, gene interactions, biochemical mutants, structure and replication of DNA, mutation, protein synthesis, and regulation of gene expression, DNA technology and genetic engineering. Practical work focuses on problem solving and laboratory techniques.

RELEVANCE STATEMENT

At the end of this course, students will be able to analyse human inheritance patterns using pedigrees. Understand molecular basis of heredity and gene action. Explain how genes are regulated and how mutations occur. Apply knowledge of DNA technology and genetic

engineering in medicine, agriculture and research. Solve complex genetic problems involving gene interactions. Build foundation for advanced studies in molecular biology and biotechnology. **Pre-requisite: BIO 201**

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain human genetic traits using pedigree charts.
2. Describe deviations from Mendelian principles.
3. Describe gene interactions.
4. Explain the structure of nucleic acids.
5. Describe DNA replication.
6. Explain gene expression.
7. Outline DNA technology.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Interpret human genetic traits using pedigree charts.
2. Identify deviations from Mendelian inheritance.
3. Analyse gene interactions.
4. Describe the structure of nucleic acids.
5. Explain DNA replication.
6. Examine gene expression.
7. Apply DNA technology.

COURSE CONTENT

- Aspect of human genetics
- Pedigree analysis
- Further consideration of various deviations from basic principles
- Gene interactions, including biochemical mutants, nucleic acids and nucleotides, DNA replication, mutation of DNA, proteins and regulation of gene expression
- DNA technology and genetic engineering
- Pre- requisite –BIO 201

CATEGORY	DETAILS
Core Competencies	• Analysis • Description • Explanation • Synthesis • Regulation.
Core Values	• Reasoning • Accuracy • Critical thinking • Innovation • Ethical responsibility • Appreciation • Curiosity.
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Discussion • Problem-solving • Demonstration • Laboratory practical • Case studies • Group work.
Learning Resources	• Charts • Models, of DNA • Textbooks • Laboratory materials for DNA experiments • Calculator • Statistical tables • National curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Quiz • Oral questions • Written test • Class exercises • Project on genetic engineering applications.

REFERENCES AND FURTHER READING

- Brooker, R. J. – Genetics: Analysis and Principles.
- Pierce, B. A. – Genetics: A Conceptual Approach.
- Watson, J. D. et al. – Molecular Biology of the Gene.

BIO 413 Nigerian Fauna and Flora

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides a comprehensive survey of the plants and animals found in Nigeria. It focuses on the diversity, distribution, classification, ecological adaptations, economic importance, and conservation of Nigerian fauna and flora. Emphasis is placed on major plant and animal groups across different ecological zones such as rainforest, savanna, Sahel, and aquatic habitats.

RELEVANCE STATEMENT

The study of this course, will enable students identify and classify common plants and animals in Nigeria. Understand the ecological distribution of Nigerian fauna and flora. Appreciate the economic, medicinal, and cultural importance of local biodiversity. Explain the adaptive features of organisms to Nigerian environments. Apply knowledge of conservation for sustainable use of natural resources. Build foundation for careers in wildlife management, forestry, agriculture, and environmental biology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the ecological zones of Nigeria.
2. Describe common plant species in Nigeria.

3. Explain morphological adaptations of Nigerian organisms.
4. Discuss the ecological importance of Nigerian plants.
5. Identify threats to biodiversity in Nigeria.
6. Describe conservation strategies for Nigerian fauna.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Characterise the ecological zones of Nigeria.
2. Identify common Nigerian plant species.
3. Describe morphological adaptations of Nigerian organisms.
4. Evaluate the ecological significance of Nigerian plants.
5. Analyse threats to biodiversity in Nigeria.
6. Recommend conservation measures for Nigerian fauna.

COURSE CONTENT

- Field identification of Nigerian plants and animals
- **Plant and animal indicators of Nigerian biomes:** i.e. association of habitats with specific plants and animals
- Identification of plants through preserved herbarium specimens and keys, identification of animals through signs left by them such as footprints, trails, scats, runways and museum specimens
- Life history strategies of selected Nigerian plants and animals
- Nigerian protected area system, their prospects, problems and problem alleviation strategies

CATEGORY	DETAILS
Core Competencies	• Survey • Identification • Classification • Explanation • Analysis

CATEGORY	DETAILS
Core Values	• Appreciation • Stewardship • Conservation ethics • Awareness • Resourcefulness • National pride • Natural heritage
Pedagogical Approaches	• Group work • Discussion • Specimen observation • Field excursion • Case study • Project-based learning • 4-in-1 Model (TPACK)
Learning Resources	• National curriculum for Basic Education • Chart • Herbarium specimens • Preserved • Animals • Field guide • Maps of Nigeria • Photographs • Video • Textbooks • Live plants, botanical garden • Zoo visit.
Assessment Methods	• Quiz • Oral questions • Field report • Class assignment • Practical identification test • Project report plants.

REFERENCES AND FURTHER READING

- Hutchinson, J., Dalziel, J. M., & Keay, R. W. J. – Flora of West Tropical Africa.
- AR bonnier, M. – Trees, Shrubs and Lianas of West African Dry Zones.
- Happold, D. C. D. – Mammals of Africa.

BIO 414 Hydrobiology

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces the principles of aquatic biology with emphasis on limnology. It covers the physical and chemical properties of water and their biological significance. Topics include thermal stratification, waves, currents, dissolved gases, pH, nutrient cycles, and types of lakes. The course also examines freshwater and marine/estuarine communities, factors affecting distribution and productivity of aquatic organisms, and ecological processes such as colonisation and succession in aquatic ecosystems.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand the physical and chemical characteristics of aquatic environments. Explain how water properties influence aquatic life and productivity. Describe the structure and function of freshwater and marine communities. Analyse factors affecting distribution of aquatic plants and animals. Apply hydrobiological knowledge to fisheries, water quality management and conservation. Build foundation for careers in aquatic biology, oceanography and environmental management.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the physical properties of water.
2. Explain thermal stratification in lakes.
3. Discuss dissolved oxygen in freshwater.
4. Describe oligotrophic lakes.
5. Explain factors influencing macrophyte distribution.
6. Describe marine communities.
7. Explain ecological succession in aquatic ecosystems.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Identify the physical properties of water.
2. Evaluate thermal stratification in lakes.
3. Describe dissolved oxygen in freshwater.
4. Distinguish oligotrophic lakes from other lake types.
5. Identify factors influencing macrophyte distribution.
6. Analyse marine communities.
7. Describe ecological succession in aquatic ecosystem

COURSE CONTENT

- Principles of aquatic biology with particular reference to limnology
- The physical discus properties of water and their biological significance
- Thermal stratification of lakes
- Waves and currents and their effects on substratum
- Dissolved oxygen, carbon-dioxide and inorganic ions in freshwater
- The carbonate-bicarbonate system and pH
- Oligotrophic and Eutrophic lakes
- The chemical composition of African lake waters
- Freshwater communities, factors influencing the distribution and productivity of aquatic macrophytes, phytoplanktons, benthic algae
- Zooplanktons in freshwater
- Marine brackish water/estuarine communities and their chemical factors
- Colonisation and succession in aquatic ecosystems, adaptations and interrelationships

CATEGORY	DETAILS
Core Competencies	• Explanation • Analysis • Differentiation • Discussion

CATEGORY	DETAILS
Core Values	• Conservation • Inquiry • Appreciation • Responsibility • Critical thinking
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Discussion • Demonstration • Field trip to lake/stream • Laboratory analysis of water samples • Group work.
Learning Resources	• National curriculum for Basic Education • Chart • Water testing kits • Microscope • Plankton • Nets • Water samples • Maps • Textbooks.
Assessment Methods	• Field report • Laboratory practical • Written test • Assignment.

REFERENCES AND FURTHER READING

- Wetzel, R. G. – Limnology: Lake and River Ecosystems.
- Dodds, W. K., & Whiles, M. R. – Freshwater Ecology.
- Goldman, C. R., & Horne, A. J. – Limnology.

BIO 415 Parasitic Protozoans

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course examines the biology, life cycles and pathogenicity of parasitic protozoa that cause diseases in humans, animals and plants. It covers classification, morphology, physiology, epidemiology and transmission of major parasites such as Plasmodium Trypanosoma Giardia and Entamoeba The course also treats host-parasite interactions, immune responses, diagnostic methods, treatment options and challenges in disease control.

RELEVANCE STATEMENT

This course, will expose students to the understanding of the biology and significance of parasitic protozoa. Identify major human and animal protozoan pathogens. Explain transmission, epidemiology and host-parasite relationships.

Describe diagnostic techniques and treatment strategies. Apply knowledge to public health education and disease control programmes. Appreciate current challenges in managing protozoan diseases.

COURSE OBJECTIVES

The objectives of this course is to:

1. Classify parasitic protozoa.
2. Describe the life cycles of *Plasmodium*.
3. Discuss the epidemiology of protozoan diseases.
4. Explain host – parasite interactions.
5. Describe laboratory diagnosis of protozoan infections.
6. Analyse challenges in controlling protozoan diseases.

LEARNING OUTCOMES

At the end of this course, the students should able to:

1. Identify major pathogenic protozoa.
2. Illustrate the life cycle of *Plasmodium*.
3. Describe the transmission of protozoan diseases.

4. Relate immune responses to protozoan infections.
5. Apply diagnostic methods for protozoan parasites.
6. Identify challenges in controlling protozoan diseases.

COURSE CONTENT

- Life cycles, and pathogenicity of parasitic protozoa, focusing on organisms that cause diseases in humans, animals, and plants
- Classification, morphology, and physiology of major protozoan parasites, such as Plasmodium, Trypanosoma, Giardia, and Entamoeba
- The epidemiology, transmission mechanisms, host-parasite interactions, and the immune responses of hosts
- Diagnostic methods, treatment options, and current challenges in controlling protozoan parasitic diseases

CATEGORY	DETAILS
Core Competencies	• Classification • Explanation • Discussion • Measurement.
Core Values	• Health consciousness • Scientific inquiry • Responsibility • Hygiene • Critical thinking.
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Group work • Discussion • Microscopy • Demonstration • Case studies • Problem-solving.

CATEGORY	DETAILS
Learning Resources	• Microscope • Prepared slides • Charts, life cycle • Diagrams • Textbooks • Laboratory • Materials for diagnosis. • National curriculum for Basic Education
Assessment Methods	• Quiz, oral questions • Practical identification report • Written test • Case study report • Assignment.

REFERENCES AND FURTHER READING

- Roberts, L. S., & Janovy, J. – Foundations of Parasitology.
- Loker, E. S., & Hofkin, B. V. – Parasitology: A Conceptual Approach.
- Cox, F. E. G. – Modern Parasitology.

BIO 416 Seedless Plants

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** _

COURSE OVERVIEW

This course explores the diversity, evolution, physiology and ecological roles of seedless plants. Major groups covered include mosses, liverworts, hornworts, ferns and lycophytes. Students will study their life cycles, reproduction, structural adaptations, and evolutionary significance in the transition from aquatic to terrestrial life. The course also highlights their contributions to ecosystem development.

RELEVANCE STATEMENT

The study of this course will enable students to understand the diversity and classification of seedless plants. Explain life cycles and reproductive strategies of bryophytes and pteridophytes. Describe structural adaptations to land life.

Appreciate the evolutionary and ecological importance of seedless plants. Apply knowledge in plant taxonomy, ecology and conservation. Build foundation for advanced plant biology and environmental studies.

COURSE OBJECTIVES

The objectives of this course is to:

1. Classify major groups of seedless plants.
2. Describe the life cycles of seedless plants.
3. Explain structural adaptations of seedless plants.
4. Discuss the evolutionary significance of seedless plants.
5. Explain the ecological roles of seedless plants.

LEARNING OUTCOMES

At the end of this course, students will be able to:

1. Identify common seedless plants.
2. Illustrate alternation of generations in bryophytes.
3. Describe adaptations of seedless plants to terrestrial habitats.
4. Trace the evolutionary history of seedless plants.
5. Analyse the role of seedless plants in soil formation.

COURSE CONTENT

- In-depth exploration of seedless plants, focusing on their diversity, evolution, physiology, and ecological roles
- Examination of major groups such as mosses, liverworts, hornworts, ferns, and lycophytes, learning about their life cycles, reproduction, and structural adaptations
- Evolutionary significance of seedless plants in the transition from aquatic to terrestrial life and their contributions to the development of ecosystems

CATEGORY	DETAILS
Core Competencies	• Classification • Description • Explanation
Core Values	• Appreciate • Observation • Environmental conservation • Curiosity
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Concept mapping • Discussion • Specimen observation • Field collection • Demonstration • Group work • Multimedia presentation.
Learning Resources	• Live specimens • Herbarium • Charts • Microscope • Slides • Field guides • Textbooks • Botanical garden. • National curriculum for Basic Education
Assessment Methods	• Class presentation • Practical identification, report • Field report • Written test, assignment.

REFERENCES AND FURTHER READING

- Raven, P. H., Evert, R. F., & Eichhorn, S. E. – Biology of Plants.
- Mauseth, J. D. – Botany: An Introduction to Plant Biology.
- Simpson, M. G. – Plant Systematics

BIO 421 Population Biology and Evolution

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course examines the biological properties of species and the mechanisms of evolution. It covers natural selection, variation, isolation mechanisms, speciation, adaptation, adaptive radiation, and the origin of life and species. It also treats the evolution of selected plant and animal groups including humans. The second part focuses on population dynamics and factors affecting population growth.

RELEVANCE STATEMENT

This course, will enable students to: understand the proceses driving evolution and species diversity. Explain mechanisms of speciation and adaptation in plants and animals. Analyse population growth patterns and factors affecting them. Apply evolutionary and population concepts in ecology, conservation and genetics. Appreciate human evolution and biodiversity. Build foundation for advanced studies in evolutionary biology and ecology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the biological properties of species.
2. Explain natural selection.
3. Discuss hybridisation.
4. Explain theories on the origin of life.
5. Describe evolution in selected plant groups.
6. Explain population dynamics.

LEARNING OUTCOMES

At the end of this course the students should be able to:

1. Analyse the biological characteristics of species.

2. Interpret natural selection.
3. Evaluate hybridisation.
4. Examine theories concerning the origin of life.
5. Trace evolutionary patterns in selected plant groups.
6. Analyse population dynamics.

COURSE CONTENT

- Biological properties of species
- **Natural selection, variations, isolation mechanisms:**
  - Including their breakdown resulting in hybridisation
  - Adaptation
  - Origin of life
  - Origin of species and adaptive radiation
  - Evolution of selected groups of plants and animals
  - Including humans
- Population dynamics, factors affecting population growth

CATEGORY	DETAILS
Core Competencies	• Explanation • Description • Selection • Discussion • Isolation • Analysis
Core Values	• Inquiry • Critical thinking • Appreciation • Understanding • Environmental awareness.

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lecture • Discussion • Case studies • Group work • Problem-solving • Brainstorming • 4-in-1 Model (TPACK)
Learning Resources	• Charts, of evolutionary trees, fossils, etc. • Textbooks, a • Population data, graphs. • National Curriculum for Basic Education
Assessment Methods	• Class presentation • Practice report.

. Reference Materials

- Futuyma, D. J., & Kirkpatrick, M. – Evolution.
- Freeman, S., & Herron, J. C. – Evolutionary Analysis.
- Ridley, M. – Evolution.

BIO 422 Biogeography and Soil Biology

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course covers the distribution of plants and animals in relation to geological history and ecological factors. It examines Gondwanaland, continental drift, land bridges, and zoogeographical and phytogeographical regions. It also covers succession, colonisation, dispersal, endemicity, and island biogeography. The soil biology aspect treats physical and chemical properties of soil, detritus organisms, nutrient cycling, soil-water relations, sampling techniques, and causes and control of soil erosion.

RELEVANCE STATEMENT

The study of this course, exposes students to understanding of the factors influencing global distribution of flora and fauna. Explain historical and ecological basis of biogeography. Describe soil properties and biological processes in soil. Apply knowledge of soil biology to agriculture and conservation. Understand causes and methods of controlling soil erosion. Build foundation for ecology, forestry, agriculture and environmental science.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain continental drift.
2. Discuss major flora groups.
3. Describe succession in plants.
4. Explain endemicity.
5. Describe the physical properties of soil.
6. Explain nutrient cycling in soil.
7. Describe soil-water relationships.
8. Explain soil erosion.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Examine the theory of continental drift.
2. Identify major global flora groups.
3. Analyse succession in plants.
4. Describe endemicity.
5. Identify the physical properties of soil.
6. Interpret nutrient cycling in soil.
7. Describe how plants absorb and release water to the environment
8. Identify the causes of soil erosion

COURSE CONTENT

- Gondwanaland and theory of continental drift
- Theory of land bridges
- Distribution of world key floral and faunal groups including factors affecting distribution

- Phyto- and zoogeographical regions of the world
- **Relationships between plants and animal distributions:** emphasising local examples
- Concept of succession, colonisation and dispersal in terrestrial plants and animals
- Concept of endemicity and refugia
- Island biogeography
- Physical and chemical nature of soil
- Detritus organisms
- Cycling of minerals and nutrient pools
- Plant and animal soil water relationship, soil sampling techniques
- Causes of soil erosion and alleviation methods/techniques

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• 1 Distribution • 2 Explanation • 3 Description • 4 Demonstrate • 4 Sampling • Control
Core Values	• 1 Stewardship • 2 Observation • 3 Conservation • 4Resource management • 5 Appreciation
Pedagogical Approaches	• 1 Interactive lecture, discussion • 2 Field trip • 3Demonstration • 4 Laboratory practical • 5 Group work • Case studies • 6 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• 1 Maps • 2 Charts • 3 Soil samples • 4 Sampling tools • 5 Textbooks • 6 Multimedia, field guides. • 7 National curriculum for Basic Education
Assessment Methods	• 1 Field report • 2 Practical assessment • 3 Written test • Assignment

REFERENCES AND FURTHER READING

- Cox, C. B., Moore, P. D., & Ladle, R. J. – Biogeography: An Ecological and Evolutionary Approach
- Lomolino, M. V. et al. – Biogeography: Biological Diversity Across Space and Time.
- Ricklefs, R. E. – The Economy of Nature.

BIO 423 Entomology

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides a comprehensive study of insects, the most diverse animal group. It covers insect anatomy, physiology, development, taxonomy, behaviour, ecology and evolution. Emphasis is placed on insect adaptations, communication, reproduction and interactions with plants, animals and humans. Special focus is given to the role of insects in agriculture, public health and biodiversity. Laboratory work includes collection, identification, classification and study of life cycles.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand insect diversity, structure and function. Identify and classify common insects. Explain ecological and economic importance of insects. Apply knowledge of insect biology in pest control and environmental monitoring. Understand insect roles in pollination and disease transmission. Build foundation for careers in agriculture, public health and conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe insect anatomy.
2. Classify insects using taxonomic keys.
3. Explain insect behaviour.
4. Discuss the ecological roles of insects.
5. Explain the agricultural importance of insects.
6. Demonstrate insect collection techniques.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Identify major insect orders.
2. Apply taxonomy keys to identify insect life cycles.
3. Analyse insect – plant interactions.
4. Identify the role of insect in the environment
5. Relate insect biology to agriculture.
6. Collect insects

COURSE CONTENT

- Comprehensive introduction to the study of insects, the largest and most diverse group of animals on Earth
- Insect anatomy, physiology, development, taxonomy, and behaviour, as well as their ecological roles in various ecosystems
- Insect evolution, adaptations, communication, reproduction, and their interactions with plants, animals, and humans
- Special attention is to be given to the significance of insects in agriculture, public health, and biodiversity

- Insect collection, identification, and classification, using both traditional and modern techniques
- Hands-on experience studying insect morphology, life cycles, and behaviour, while also learning methods for pest control and environmental monitoring
- The course will also cover the impact of insects on human life, from pollination to disease transmission

CATEGORY	DETAILS
Core Competencies	• Description • Classification • Explanation • Discussion • Demonstration • Collection • Identification • Control.
Core Values	• Scientific observation • Accuracy • Appreciation of responsibility • Problem-solving • Environmental awareness.
Pedagogical Approaches	• Laboratory • Practical • Demonstration • Field collection • Group work • Case studies. • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Insect specimens, collection nets, killing • Jars • Microscope • Identification keys • Charts • Textbooks • National curriculum for Basic Education
Assessment Methods	• Quiz • Oral questions • Laboratory report • Field collection report.

REFERENCES AND FURTHER READING

- Gullan, P. J., & Cranston, P. S. – The Insects: An Outline of Entomology.
- Triplehorn, C. A., & Johnson, N. F. – Borror and DeLong's Introduction to the Study of Insects.
- Chapman, R. F. – The Insects: Structure and Function.

BIO 424 Environmental Conservation

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course explores principles and practices of environmental conservation for sustainable management of natural resources and protection of ecosystems. It covers biodiversity, habitat preservation, wildlife conservation, climate change, and human impacts. Emphasis is on the interconnectedness of ecological systems and conservation of air, water, soil and biodiversity. Students will also study conservation policies, ethics, and global efforts including protected areas, reforestation and species recovery programmes through case studies.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand principles of environmental conservation and sustainability. Analyse human impacts on natural environments. Apply conservation strategies to real-world environmental problems. Appreciate the importance of biodiversity and ecosystem services. Understand environmental policies and ethics. Participate in conservation and restoration efforts.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain biodiversity and ecosystem conservation.
2. Identify the causes of habitat loss and climate change.
3. Describe wildlife and habitat conservation strategies.
4. Explain conservation policies and environmental ethics.
5. Analyse conservation case studies.
6. Explain sustainable resource management practices.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Explain the importance of air, water, soil, and biodiversity conservation.
2. Analyse the environmental effects of human activities.
3. Evaluate conservation programmes.
4. Discuss global and local conservation policies.
5. Propose solutions to environmental degradation.
6. Recommend environmental ethics and sustainability.

COURSE CONTENT

- Principles and practices of environmental conservation, sustainable management of natural resources and the protection of ecosystems. key topics such as biodiversity, habitat preservation, wildlife conservation, climate change, and the human impact on natural environments.
- Interconnectedness of ecological systems and the importance of conserving air, water, soil, and biodiversity
- Conservation policies, environmental ethics, and global efforts to mitigate environmental degradation

- Case studies from around the world on challenges and successes in conservation efforts, including protected areas, reforestation, and species recovery programmes
- Understanding of conservation strategies and their applications in solving real-world environmental problems

CATEGORY	DETAILS
Core Competencies	• Principles • Analysis • Impact • Description • Conservation • Discussion • Evaluation.
Core Values	• Responsibility • Sustainability • Ethics • Teamwork • Global awareness • Stewardship • Critical thinking.
Pedagogical Approaches	• Case study • Lecture, and discussion • Group work • Documentary • Field trip • Project-based learning. • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• National curriculum for Basic Education • Charts • Videos • Case study materials • Textbooks • Policy documents • Multimedia • Field sites.
Assessment Methods	• Assignment • Case study and Project report presentation.

REFERENCES AND FURTHER READING

- Primack, R. B. – Essentials of Conservation Biology.
- Van Dyke, F. – Conservation Biology: Foundations, Concepts, and Applications.
- Groom, M. J., Meffe, G. K., & Carroll, C. R. – Principles of Conservation Biology.

BIO 425 Seed Plants

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** _

COURSE OVERVIEW

This course provides a detailed study of seed plants with focus on their evolution, diversity, structure, reproduction and ecological importance. It covers both gymnosperms and angiosperms, including seed development, pollination, and dispersal mechanisms. Topics also include anatomy and physiology of roots, stems, leaves and reproductive organs, and adaptations to different environments. Laboratory work involves identification, classification, study of plant tissues and life cycles. The role of seed plants in ecosystems, agriculture and human society is emphasised.

RELEVANCE STATEMENT

At the end of this course, students will be able to: understand the diversity and evolutionary history of seed plants. Explain the structure, function and reproduction of gymnosperms and angiosperms. Identify and classify common seed plants. Appreciate the ecological and economic importance of seed plants.

Apply knowledge of seed plants in agriculture, medicine and conservation.

Build foundation for plant taxonomy, botany and environmental biology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the evolution of seed plants.
2. Explain seed development.
3. Describe the anatomy and physiology of seed plant organs.
4. Explain the structural adaptations of seed plants to different habitats.
5. Discuss gymnosperms and angiosperms using morphological features.
6. Discuss the ecological and economic importance of seed plants.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Differentiate gymnosperms from angiosperms.
2. Describe the life cycle of seed plants.
3. Identify plant tissues.
4. Analyse the adaptations of seed plants to terrestrial environments.
5. Classify common seed plants in the field and laboratory.
6. Evaluate the importance of seed plants to humans and the environment.

COURSE CONTENT

- Detailed study of seed plants, focusing on their evolution, diversity, structure, reproduction, and ecological importance
- Gymnosperms and angiosperms, key concepts such as seed development, pollination, and dispersal mechanisms
- Anatomy and physiology of roots, stems, leaves, and reproductive organs, as well as the adaptations that allow seed plants to thrive in various environments

- Hands-on experience in identifying and classifying seed plants, studying plant tissues, and understanding their life cycles
- The role of seed plants in ecosystems, agriculture, and human society, with special attention to their contributions to food production, medicine, and ecosystem services

CATEGORY	DETAILS
Core Competencies	• Description • Development • Identification • Classification • Discussion • Explanation.
Core Values	• Appreciation • Observation • Conservation • Resourcefulness • Value.
Pedagogical Approaches	• Discussion • Laboratory practical • Specimen observation • Field collection • Demonstration • Group work. • 4-in-1 Model (TPACK)
Learning Resources	• National curriculum for Basic Education • Live plant specimens • Herbarium • Microscope, slides • Charts, and models • Field guides • Textbooks.

CATEGORY	DETAILS
Assessment Methods	• Practical, laboratory report • Field report • Written test

REFERENCES AND FURTHER READING

- Raven, P. H., Evert, R. F., & Eichhorn, S. E. – Biology of Plants.
- Simpson, M. G. – Plant Systematics.
- Mauseth, J. D. – Botany: An Introduction to Plant Biology.

BIO 426 Field Course I

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course provides practical field experience in biological sampling and observation within a 20km radius of the University. Students will visit local habitats, research institutes and industries to observe applications of biology in different areas of specialisation. The course emphasises hands-on skills in data collection, specimen handling, and scientific reporting.

RELEVANCE STATEMENT

At the end of this course, students will be able to apply sampling techniques in different local habitats. Relate classroom knowledge to real-world biological practices. Observe and understand how biological research is conducted in institutes and industries. Develop skills in field data collection, teamwork and report writing. Appreciate the diversity of career opportunities in biological sciences. Gain exposure to ecological, agricultural, medical and environmental biology practices.

COURSE OBJECTIVES

The objectives of this course is to:

1. Apply appropriate sampling techniques to field studies.
2. Identify organisms in their natural habitats.
3. Describe the research activities of visited institutes and industries.

4. Analyse field data.
5. Demonstrate teamwork during field activities.
6. Prepare comprehensive field reports.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Conduct field sampling in terrestrial, aquatic, and aerial environments.
2. Collect biological specimens for identification and preservation.
3. Explain the relevance of visited institutes and industries to Biology.
4. Interpret field data.
5. Relate field experiences to areas of specialisation in Biology.
6. Present field reports

COURSE CONTENT

- **Sampling techniques in local habitats:** i.e. not more than 20 km radius of the Institution
- Also involve visits to research institutes, industries and other related institute
- This should cover several areas of specialisation in Biology
- Assessment by examination (objectives, short answer questions, fill in the gaps) in addition to group report

CATEGORY	DETAILS
Core Competencies	1 Identification 2 Report writing 4 Collection 5 Analysis.
Core Values	1 Teamwork 2 Inquiry 3 Responsibility 4 Environmental awareness 5 Professionalism 6 Communication skills.

CATEGORY	DETAILS
Pedagogical Approaches	1 Fieldwork 2 Excursion 3 Demonstration 4 Group project 5 Observation, guided report writing 6 Interaction with professionals. 7 4-in-1 Model (TPACK)
Learning Resources	1 Sampling tools: 2 Field notebook 3 Specimen containers 4 Camera 5 Map. 6 National curriculum for Basic Education
Assessment Methods	1 Field practical report 2 Group report 3 Questions.

REFERENCES AND FURTHER READING

- Souhwood, T.R.E, & Henderson, P.A.(2000).*Ecological methods* (3rd.ed). *Blackwell Science*
- Krebs, C.J. (2014). *Ecological methodology* (3RD. ed). *Addison-Wesley.*
- Miller-Dombois, D, & Elenberg, H.(2003).Aims and methods of vegetation. Blackburm press

BIO 511 Nigerian Plants and Animals in Prophylactics and Therapeutics

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course examines the historical development and scope of pharmacognosy with emphasis on Nigerian plants and animals used in prophylaxis and therapeutics. It covers terminologies, classification, traditional and modern methods of preparation and use. The course also treats evaluation, adulteration, deterioration and quality control of crude drugs

through extraction methods, phytochemical screening, and proximate, mineral, organoleptic, microscopic, physical, chemical and biological analyses.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand the role of Nigerian plants and animals in traditional and modern medicine. Apply methods of crude drug preparation, evaluation and quality control. Identify adulteration and deterioration in medicinal materials. Appreciate the economic and health importance of pharmacognosy. Build foundation for careers in phytomedicine, pharmaceutical biology and ethnobotany. Promote the sustainable use of local medicinal resources.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the historical development of pharmacognosy.
2. Define key terminologies in pharmacognosy.
3. Explain Nigerian plants and animals used in prophylaxis and therapeutics.
4. Describe traditional methods of drug preparation.
5. Explain methods of phytochemical extraction.
6. Identify causes of crude drug deterioration and adulteration

LEARNING OUTCOMES

At the end of the lectures in this course, students should be able to:

1. Trace the historical development of pharmacognosy.
2. Describe key terminologies in pharmacognosy.
3. Classify medicinal plants and animals used in Nigeria.
4. Apply methods of preparing traditional drugs
5. Identify modern methods of drug preparation.
6. Discuss the causes of crude drug adulteration.

COURSE CONTENT

- **Historical development and scope of plants and animals in prophylactics and therapeutics:** Phamacognosy
- Some terminologies used in pharmacognosy
- Classification and uses of plants and animals in prophylactics and therapeutics in Nigeria

- Crude traditional methods of preparation and uses
- Modern methods of preparation and uses of plants and animals as prophylactics and therapeautics
- **Evaluation and adulteration of crude drugs:** extraction methods, identification of phytochemicals, proximate analysis, minerals, organoleptic, microscopic, physical, chemical and biological
- Deterioration and adulteration of crude drugs
- Quality control

CATEGORY	DETAILS
Core Competencies	• Identification • Description • Explanation • Differentiation • Evaluation
Core Values	• 1 Service • 2 Integrity • 3 Honesty and honour • 3 Respect • 4 Tolerance and • 5 Inclusion.
Pedagogical Approaches	• Interactive lecture, and demonstration • Laboratory practical • Field collection • Group work • Case studies. • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Medicinal plant specimens • Animal products • Laboratory reagents • Microscope • Extraction apparatus • Charts • Textbooks • Field guides. • National curriculum for Basic Education
Assessment Methods	• Quiz • Oral questions • Practical assessment • Laboratory report • Written test and assignment.

REFERENCES AND FURTHER READING

- Harborne, J. B. (1998). *Phytochemical methods: A guide to modern techniques of plant analysis (3rd ed.)*. Springer.
- Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2008). *Pharmacognosy*. NiraliPrakashan.
- Shah, B., & Seth, A. K. (2012). *Textbook of pharmacognosy and photochemistry*. Elsevier. – Covers medicinal plants, extraction, phytochemicals, herbal products, and medicinal plant biotechnology.

BIO 512 Applied Biotechnology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course provides practical and theoretical training in modern biotechnology. Topics include extraction and quantification of DNA and proteins, molecular biology techniques such as chromatography, electrophoresis, PCR, DNA identification and genomic sequencing. It also covers DNA transformation and cloning, protein engineering, and biotechnological applications in medicine, forensic science, food and industrial

production. Environmental applications include treatment of solid, liquid, chemical and nuclear waste.

RELEVANCE STATEMENT

At the end of this course, students will be able to apply molecular biology techniques in research and industry. Understand DNA and protein manipulation for medicine, agriculture and forensics. Use biotechnology for production of pharmaceuticals and food products. Apply biotechnological methods for environmental protection and waste treatment. Build skills for careers in biotech, biomedical and environmental industries. Appreciate ethical and safety issues in biotechnology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Extract and quantify DNA and proteins from tissues.
2. Demonstrate paper chromatography, thin-layer chromatography, and electrophoresis.
3. Perform DNA amplification using PCR.
4. Describe DNA transformation and cloning techniques.
5. Discuss the applications of biotechnology in protein engineering, medicine, and industry.
6. Describe biotechnological methods for waste treatment.

LEARNING OUTCOMES

At end of this course the student should be able to:

1. Conduct DNA extraction from different issues;
2. Quantify DNA and proteins concentration
3. Outline the types of chromatography techniques
4. Describe DNA amplification methods
5. Apply biotechnology principles in protein engineering, medicine, food science and forensic science;
6. Incorporate the knowledge of biotechnology in the treatment of wastes.

COURSE CONTENT

- Extraction of DNA and proteins from various tissues, quantification of DNA and proteins
- **Molecular biology techniques including chromatography:** paper and thin layer

- Electrophoresis
- Amplification of DNA using polymerase chain reaction
- Identification and genomic sequencing
- Introduction of DNA into and cloning in cell
- Application of biotechnology in protein engineering and production, medicine and forensic science, bioindustrial production of genetically engineered medicinal and food products using living factories
- Environmental protection and cleansing through biotechnological treatment of solid, liquid, chemical and nuclear waste

CATEGORY	DETAILS
Core Competencies	• Demonstration • Application • Identification • Analysis • Safety.
Core Values	• Service • Innovation • Awareness • Integrity, honesty and honour • Respect, tolerance and inclusion.
Pedagogical Approaches	• Lecture, and demonstration • Laboratory practical • Group work • Case studies, multimedia presentation. • Problem-based learning • Field visit • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• DNA extraction kits • PCR machine • Electrophoresis apparatus • Chromatography materials • Reagents • Textbooks • Videos • Digital resources. • National curriculum for Basic Education
Assessment Methods	• Quiz • Oral questions • Laboratory practical, and field report • Written test • Seminar presentation.

REFERENCES AND FURTHER READING

- Thiemann, W. J., & Palladino, M. A. (2013). *Introduction to biotechnology (3rd ed.)*. Pearson.
- Brown, C. M., Campbell, I., & Priest, F. G. (2015). *Introduction to biotechnology*. Oxford University Press.
- Slater, A., Scott, N. W., & Fowler, M. R. (2008). *Plant biotechnology: The genetic manipulation of plants (2nd ed.)*. Oxford University Press.
- Stewart, C. N., Jr. (Ed.). (2008). *Plant biotechnology and genetics: Principles, techniques, and applications*. Wiley

BIO 513 Plant Anatomy and Physiology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces students to the internal structure and physiological processes of plants. It examines the organisation of plant tissues and organs, including roots, stems, leaves, flowers, fruits, and seeds, and explains how these structures support plant growth,

development, and survival. The course also explores essential physiological processes such as water and mineral uptake, transpiration, photosynthesis, respiration, hormone regulation, and plant responses to environmental factors. Practical laboratory activities provide students with hands-on experience in plant anatomical studies and physiological experiments.

RELEVANCE STATEMENT

The course equips students with the knowledge and practical skills required to understand the relationship between plant structure and function. It provides a strong foundation for teaching biology, conducting plant-based research, improving agricultural productivity, managing natural resources, and addressing environmental challenges. The knowledge gained is applicable in agriculture, biotechnology, forestry, environmental management, and science education.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe plant tissue organisation.
2. Compare the anatomical features of monocotyledonous and dicotyledonous plants.
3. Explain plant physiological processes.
4. Discuss the roles of plant hormones.
5. Describe plant responses to environmental stimuli.
6. Conduct plant anatomy and physiology experiments.
7. Explain plant anatomy and physiology principles to agricultural problems.

LEARNING OUTCOMES

At the end of this course the students should be able to:

1. Characterise plant tissues and organs.
2. Differentiate monocotyledonous plants from dicotyledonous plants based on anatomical features.
3. Interpret plant physiological processes.
4. Relate plant hormones to plant development.
5. Analyse plant responses to environmental stress.
6. Perform plant anatomy and physiology experiments.
7. Apply plant anatomy and physiology principles to agriculture.

COURSE CONTENT

Introduction to plant anatomy and physiology and their significance.

- Organisation of the plant body
- Tissues and tissue systems
- Structure and functions of meristematic and permanent tissues
- Anatomy of roots, stems, and leaves in monocotyledonous and dicotyledonous plants
- Primary and secondary growth in plants
- Internal structure of flowers, fruits, and seeds
- Structure and functions of xylem and phloem
- Water relations in plants: diffusion, osmosis, imbibition, water potential, absorption, and transport of water
- Mineral nutrition and uptake of essential elements
- Transpiration and factors affecting transpiration
- Photosynthesis: mechanisms, factors affecting photosynthesis, and significance
- Respiration in plants: aerobic and anaerobic respiration
- Plant hormones (phytohormones): auxins, gibberellins, cytokinins, abscisic acid, and ethylene
- Growth, development, and differentiation in plants
- Photoperiodism, vernalization, dormancy, and seed germination
- Plant movements: tropic and nastic movements
- Environmental physiology: responses of plants to light, temperature, water, salinity, and other environmental stresses
- Practical studies involving microscopic examination of plant tissues, anatomical sectioning, stomatal studies, transpiration, photosynthesis, respiration, and mineral nutrition experiments

CATEGORY	DETAILS
Core Competencies	• Identification • Description • Explanation • Performance.

CATEGORY	DETAILS
Core Values	• Service • Application • Resourcefulness • Conservation • Responsibility • Team work • Entrepreneurship • Health well being • Integrity, honesty and honour. • Respect, tolerance and inclusion.
Pedagogical Approaches	• Laboratory practical sessions. • Demonstrations. • Microscopic observations and specimen studies. • Group discussions and collaborative learning. • Problem-solving and inquiry-based learning. • Assignments • Seminars, and project-based activities. • 4-in-1 Model (TPACK)
Learning Resources	• Textbooks. • Microscopes • Prepared slides. • Fresh plant specimens. • Laboratory reagents and glassware. • Charts, diagrams, and anatomical models. • Journal. • National curriculum for Basic Education
Assessment Methods	• Assignments • Quizzes and class presentation • Practical laboratory exercises and reports.

REFERENCES AND FURTHER READING

- Evert, R. F. (2006). *Esau's plant anatomy: Meristems, cells, and tissues of the plant body: Their structure, function, and development (3rd ed.)*. Wiley.
- Cutler, D. F., Botha, T., & Stevenson, D. W. (2008). *Plant anatomy: An applied approach*. Blackwell Publishing.
- Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). *Plant physiology and development (6th ed.)*. Sinauer Associates.
- Hopkins, W. G., & Hüner, N. P. A. (2008). *Introduction to plant physiology (4th ed.)*. Wiley.

BIO 514 Seminar in Biology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This seminar-style course engages students in advanced discussions and presentations on current topics in biological research. Themes vary each semester and may include molecular biology, ecology, evolution, biotechnology and conservation. Students critically evaluate recent literature, discuss emerging trends, and explore ethical and societal implications of biological research. The course emphasises communication, analytical skills, peer feedback and independent research through student-led presentations and expert guest lectures.

RELEVANCE STATEMENT

At the end of this course, students will be able to critically analyse and present current biological research. Communicate scientific ideas effectively in oral and written form. Evaluate ethical and societal implications of biological advances. Develop skills in literature review and scientific argument. Engage in collaborative learning and peer critique. Prepare for postgraduate study and professional presentations.

COURSE OBJECTIVES

The objectives of this course is to:

1. Review recent publications in a selected area of Biology.
2. Present biological research findings to peers.
3. Evaluate scientific arguments during academic discussions.
4. Discuss ethical issues in biological research.

5. Synthesise information from scientific sources.
6. Demonstrate professional seminar presentation skills

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Deliver oral presentations on biological topics.
2. Evaluate scientific papers.
3. Participate in academic discussions.
4. Defend a seminar paper on a biological sub-discipline.
5. Describe current trends in Biology.
6. Apply ethical reasoning to biological issues.

COURSE CONTENT

- This seminar-style course provides an opportunity for students to engage in advanced discussions and presentations on current topics in biological research
- Each semester, the course focuses on different themes, ranging from molecular biology, ecology, and evolutionary biology to biotechnology and conservation
- Students will critically evaluate recent scientific literature, discuss emerging trends in biological science, and explore the ethical and societal implications of biological research
- Through student-led presentations, group discussions, and guest lectures from experts in the field, participants will refine their communication and analytical skills
- The seminar emphasises collaborative learning, peer feedback, and independent research, with students expected to present their own research or review current studies within a biological sub-discipline of their choice
- This course is ideal for upper-level biology majors seeking to deepen their understanding of contemporary issues and developments in biology

CATEGORY	DETAILS
Core Competencies	• Knowledge • Research • Analysis • Communication • Scientific writing.

CATEGORY	DETAILS
Core Values	• Service. • Appreciation • Resourcefulness • Scientific attitudes • Responsibility • Respect, tolerance and inclusion
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Guided • Seminar paper writing • Group discussion • Literature review • Peer critique • Independent research.
Learning Resources	• Scientific journals • Internet databases • Presentation tools • Textbooks • National curriculum for Basic Education
Assessment Methods	• Seminar presentation • Class participation • Peer evaluation.

REFERENCES AND FURTHER READING

- Day, R. A., & Gastel, B. (2012). *How to write and publish a scientific paper (7th ed.)*. Greenwood.
- Hofmann, A. H. (2017). *Scientific writing and communication: Papers, proposals, and presentations (3rd ed.)*. Oxford University Press.
- Peat, J., Elliott, E., Baur, L., & Keena, V. (2002). *Scientific writing – Easy when you know how*. BMJ Books.
- Glasman-Deal, H. (2020). *Science research writing: For non-native speakers of English (2nd ed.)*. Imperial College Press.
- Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners (5th ed.)*. SAGE.

BIO 515 Systematic Biology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Systematic Biology introduces students to the principles and practices used in the identification, classification, nomenclature and evolutionary interpretation of organisms. The course traces the historical development of biological classification from pre-Linnaean systems through the Linnaean and Darwinian periods to modern systematic. It examines species concepts, taxonomic hierarchies, biological nomenclature, binomial nomenclature, numerical taxonomy and the use of identification keys. Emphasis is placed on developing students' practical ability to identify and classify biological specimens using appropriate taxonomic procedures and keys.

RELEVANCE STATEMENT

The course provides essential knowledge and practical skills for understanding biological diversity and evolutionary relationships among organisms. It prepares students for further studies and professional activities in botany, zoology, ecology, biodiversity conservation, environmental management, agriculture, forestry, wildlife management and biological research. Knowledge of systematic biology also enables students to accurately identify organisms, communicate biological information using internationally accepted names and contribute to biodiversity documentation and conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the historical development of biological classification.
2. Explain taxonomic categories and biological nomenclature.
3. Discuss the binomial system of nomenclature to organisms.
4. Differentiate traditional, numerical, and modern approaches to taxonomy.
5. Develop simple dichotomous keys for organism identification.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Trace the historical development of biological classification.
2. Describe taxonomic categories and nomenclature rules.
3. Apply the binomial system of nomenclature to organisms.
4. Compare traditional, numerical, and modern approaches to taxonomy.
5. Construct dichotomous keys for organism identification.

COURSE CONTENT

- Historical background, pre-Linnaean, Linnaean and Darwinian taxonomic hierarchies
- Species concept, categories below species and categories above species
- Biological nomenclature, new systematic
- Numerical and binomial taxonomy
- Keys and keying

CATEGORY	DETAILS
Core Competencies	• Identification: • Classification: • Observation • Application • Constructing • Record keeping • Communication: • Critical thinking: • Comparison. • .

CATEGORY	DETAILS
Core Values	• Accurate understanding and documentation • Knowledge • Conservation and environmental management. • Economic value:
Pedagogical Approaches	• Lectures and guided discussions. • Specimen-based practical activities. • Demonstration. • Field study • Practical exercises • Group. Work • Problem-based learning • Field visits to botanical gardens herbaria, museums or relevant biodiversity sites. • Use of digital taxonomic databases and identification resources • Project-based learning. • 4-in-1 Model (TPACK)
Learning Resources	• Preserved plant and animal specimens. • Fresh biological specimens. • Herbarium specimens. • Botanical and zoological identification keys. • Hand lenses and microscopes. • Specimen jars and preservation materials. • Charts, posters and taxonomic diagrams. • Textbooks and taxonomic manual. • National curriculum for Basic Education
Assessment Methods	• Class tests and quizzes: • Individual/group exercises: • Practical identification and keying exercises: • Fieldwork/project/seminar:

REFERENCES AND FURTHER READING

- Simpson, M. G. (2019). *Plant systematics (3rd ed.)*. Academic Press.
- Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2016). *Plant systematics: A phylogenetic approach (4th ed.)*. Sinauer Associates.
- Schuh, R. T., & Brower, A. V. Z. (2009). *Biological systematics: Principles and applications (2nd ed.)*. Cornell University Press.
- Wiley, E. O., & Lieberman, B. S. (2011). *Phylogenetics: Theory and practice of phylogenetic systematics (2nd ed.)*. Wiley-Blackwell.
- Stuessy, T. F. (2009). *Plant taxonomy: The systematic evaluation of comparative data (2nd ed.)*. Columbia University Press.

SED 511 Science, Society and Technology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course will examine the dynamic relationship between science, technology, and society, with particular emphasis on their influence on human life, culture, ethics, and national development. It explores how scientific discoveries and technological innovations shape social structures, economic growth, public policy, and environmental sustainability, while also considering how societal needs, values, and challenges influence advancement.

This course addresses key issues such as ethical considerations in science, responsible use of technology, scientific literacy, environmental stewardship, and the role of science in addressing contemporary societal challenges. It also highlights the contribution of science education to national development, citizenship, and sustainable development goals, particularly within the Nigerian context.

RELEVANCE STATEMENT

The course provides students with an understanding of the historical development of science technology and society, its contributions to national and global development, and the ethical, social, environmental, and economic implications of scientific discoveries and technological innovations. It also examines contemporary issues such as artificial intelligence, biotechnology, renewable energy, climate change, information and communication technology (ICT), sustainable development, and responsible innovation.

Students are encouraged to develop critical thinking, scientific literacy, ethical reasoning, and problem-solving skills to evaluate the benefits, risks, and challenges associated with emerging technologies. The course prepares learners to make informed decisions, participate actively in societal discourse on science and technology, and apply scientific knowledge responsibly in addressing local and global challenges. For prospective Integrated Science teachers, the course provides the knowledge and pedagogical foundation needed to relate scientific concepts to everyday life and societal needs.

COURSE OBJECTIVES

The objectives of this course are to:

1) Examine the relationship between science, technology, and society
2) Promote ethical awareness in scientific practices
3) Emphasise the role of science in national development.
4) Discuss Contemporary issues such as Artificial Intelligence, biotechnology etc.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the impact of science and technology on society.
2. Discuss ethical issues related to scientific advancement.
3. Relate science education to social and economic development in Nigeria.
4. Demonstrate responsible scientific attitudes and citizenship.

COURSE CONTENT

- Meaning and nature of science
- Meaning and nature of technology
- Meaning and characteristics of society
- Relationship between science
- Society and technology
- Historical development of science and technology
- Traditional and indigenous science and technology
- Contributions of African societies to science and technology
- Major scientific and technological revolutions
- Industrial Revolution
- Development of modern science and technology

- Food and agriculture
- Health and medicine
- Housing and construction
- Transportation
- Communication
- Energy production and utilisation
- Water supply and sanitation
- Development of science and technology in Nigeria and Indigenous technologies in Nigeria

CATEGORY	DETAILS
Core Competencies	• Scientific Literacy. • Critical Thinking and Problem-Solving • Critically evaluate scientific and technological issues • Digital and Technological Competence • Utilise information and communication technologies (ICT)
Core Values	• Scientific Integrity • Upholding honesty • Objectivity • Critical Thinking • Applying logical reasoning • Innovation and
Pedagogical Approaches	• Interactive Lecture Method • Discussion and Debate Method • Case Study Approach • Inquiry-Based Learning • Project-Based Learning (preferably group-based) • Use of ICT and Media • Analysis, Role Play and Simulation • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Textbooks • Reference Materials such as UNESCO publications on Science, Technology, and Society • Federal Ministry of Education (Nigeria) policy documents. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	End-of-Semester Examination. short quizzes and class tests, written assignments and reflective essays, class participation and attendance, project and practical assessment, individual or group projects on science – society topics,

REFERENCES AND FURTHER READING

- Sismondo, S. (2021). *An Introduction to Science and Technology Studies* (3rd ed.). Wiley-Blackwell.
- Cutcliffe, S. H. (2020). *Ideas, Machines, and Values: An Introduction to Science, Technology, and Society Studies* (2nd ed.). Rowman & Littlefield.
- National Research Council. (2019). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. National Academies Press

BIO 521 Principles of Plant and Animal Breeding

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces the principles and practices of plant and animal breeding for genetic improvement. It covers the importance of breeding with examples, cytogenetic principles, heterosis, inbreeding, incompatibility mechanisms, sterility, and breeding methods. The course also treats disease and pest resistance, breeding practices for major domestic plants and animals, selection of desired traits, and general farm management including record keeping.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand the importance of plant and animal breeding in agriculture and food security. Apply cytogenetic principles to breeding programmes. Use breeding methods to improve yield, quality and resistance in crops and

livestock Manage inbreeding, sterility and incompatibility in breeding. Select and sustain desirable traits in domestic plants and animals. Apply proper farm management and record keeping practices.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain plant and animal breeding principles.
2. Describe heterosis.
3. Identify pest management strategies.
4. Conduct basic plant breeding exercises.
5. Apply appropriate animal breeding practices.
6. Explain accurate farm records.

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Analyse plant and animal breeding principles.
2. Evaluate inbreeding.
3. Analyse disease management strategies.
4. Perform basic animal breeding exercises.
5. Implement appropriate plant breeding practices.
6. Maintain adequate farm records.

COURSE CONTENT

- Importance of plant and animal breeding with examples
- Cytogenetic principles of breeding, heterosis, inbreeding consequences, incompatibility mechanisms, sterility, breeding methods, disease and pest resistance and their management, major domestic plants and animals' breeding practices, and desired traits used to sustain their qualities
- General management and farm record keeping

CATEGORY	DETAILS
Core Competencies	• Explanation • Description • Discussion • Demonstration • Selection • Management • Application • Record keeping.
Core Values	• Security • Innovation • Inquiry • Responsibility • Sustainability • Entrepreneur • Accountability.
Pedagogical Approaches	• 4-in-1 Model (TPACK) • Interactive lecture • Discussion • Demonstration • Case studies • Farm visit • Group work • Problem-solving.
Learning Resources	• Charts • Seeds • Livestock breeds • Breeding manuals • Farm tools • Textbooks. • National curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Oral questions • Assignment • Farm report • Written test.

REFERENCES AND FURTHER READING

- Acquaah, G. – Principles of Plant Genetics and Breeding.
- Allard, R. W. – Principles of Plant Breeding.
- Falconer, D. S., & Mackay, T. F. C. – Introduction to Quantitative Genetics.

BIO 522 Wildlife Conservation and Management

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course covers general principles of ecosystem and wildlife management with focus on Nigeria and global perspectives. Topics include biological gardens, wildlife diseases, conservation policies, problems and prospects of wildlife resources, and conflicts related to wildlife use. It also examines climate change impacts, international and national wildlife laws, and the use of fire as a management tool in terrestrial ecosystems.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand principles and practices of wildlife conservation and management. Appreciate the role of wildlife in ecosystems and human society. Analyse problems affecting wildlife resources in Nigeria and globally. Apply knowledge of wildlife laws and policies to conservation. Understand the relationship between climate change and wildlife. Build foundation for careers in wildlife management, conservation and ecotourism.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the principles of ecosystem and wildlife management.
2. Describe the functions of biological gardens.
3. Discuss common wildlife diseases.

4. Explain wildlife conservation policies in Nigeria.
5. Identify conflicts in wildlife resource use.
6. Describe the effects of climate change on wildlife.
7. Discuss laws governing wildlife protection.
8. Explain controlled fire in wildlife habitat management.

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Describe the principles of wildlife management.
2. Evaluate the roles of protected areas in wildlife conservation.
3. Identify common wildlife diseases.
4. Examine national wildlife conservation policies.
5. Analyse challenges associated with wildlife resource use.
6. Assess the effects of climate change on wildlife.
7. Identify laws governing wildlife protection.
8. Describe the use of controlled fire in wildlife habitat management.

COURSE CONTENT

- General principles/glossaries of ecosystem management
- Biological gardens
- Wildlife diseases
- Principles of wildlife management
- Wildlife in Nigeria: conservation policies
- Problems and prospects
- World wildlife resources and their protection
- Conflicts related to wildlife resources
- Climate change and wildlife resources
- International and national laws related to wildlife resources
- Fire as tool in terrestrial wildlife management

CATEGORY	DETAILS
Core Competencies	• Explanation • Management • Description • Analysis • Discussion • Interpretation • Conservation
Core Values	• Ethics • Stewardship • Responsibility • Appreciation of Critical thinking • Sustainability
Pedagogical Approaches	• Interactive lecture • Discussion • Case studies • Field trip to game reserve/biological garden • Group work. • 4-in -1 Model (TPACK)
Learning Resources	• Charts • Videos • Policy documents • Textbooks • Maps • Specimens • Guest speakers from wildlife agencies. • National Curriculum for Basic Education
Assessment Methods	• Oral questions • Field report • Assignment • Class presentation.

REFERENCES AND FURTHER READING

- Bolen, E. G., & Robinson, W. L. – Wildlife Ecology and Management.
- Sinclair, A. R. E. et al. – Wildlife Ecology, Conservation, and Management.
- Caughley, G., & Sinclair, A. R. E. – Wildlife Ecology and Management.

BIO 523 Principles of Pest Management

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces foundational concepts and strategies of pest management in agriculture, urban and environmental settings. It covers identification, biology and control of insect pests, weeds, plant pathogens and vertebrate pests. Emphasis is on Integrated Pest Management (IPM) combining biological, chemical, cultural and mechanical methods for sustainable control. Topics include pest life cycles, behaviour, economic and environmental impacts. Laboratory and fieldwork focus on pest identification, monitoring and IPM application. The course also examines pesticides, biological control agents and regulatory frameworks for safe pest management.

RELEVANCE STATEMENT

At the end of this course, students will be able to identify and understand the biology of major pests. Apply IPM strategies to minimise crop and environmental damage. Evaluate economic and ecological impacts of pest control methods. Use monitoring techniques and control agents effectively. Promote pest management practices that protect human health and the environment. Build skills for careers in agriculture, forestry, public health and urban pest control.

COURSE OBJECTIVES

The objectives of his course is to:

1. Identify major agricultural pests.
2. Describe the life cycles of insect pests.
3. Explain the principles of Integrated Pest Management.
4. Compare biological pest control methods.
5. Explain the environmental impacts of pest control practices.
6. Demonstrate pest monitoring techniques.

7. Discuss the role of pesticides in pest management

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Characterise major agricultural pests.
2. Determine pest population levels.
3. Evaluate the principles of Integrated Pest Management.
4. Differentiate biological pest control methods.
5. Evaluate the environmental consequences of pest control practices.
6. Apply pest monitoring techniques.
7. Apply pesticides to management pest

COURSE CONTENT

- Concepts and strategies of pest management, focusing on the identification, biology, and control of agricultural, urban, and environmental pests
- Students will explore integrated pest management (IPM) techniques that combine biological, chemical, cultural, and mechanical control methods to minimise pest damage while promoting ecological sustainability
- Topics covered include the life cycles and behaviour of insect pests, weeds, plant pathogens, and vertebrate pests, as well as the environmental and economic impacts of pest control practices
- Laboratory sessions and fieldwork emphasise practical skills in pest identification, monitoring techniques, and the application of IPM strategies
- Students will also examine the role of pesticides, biological control agents, and regulatory frameworks in managing pest populations, with a focus on reducing the risks to human health and the environment
- By the end of the course, students will have a comprehensive understanding of modern pest management practices and their application in various sectors, including agriculture, forestry, and urban environments

CATEGORY	DETAILS
Core Competencies	• Identification • Description • Explanation • Principles • Demonstration • Monitoring • Comparison • Control
Core Values	• Sustainability • Responsibility • Problem-solving • Accuracy • Health consciousness • Economic awareness.
Pedagogical Approaches	• Demonstration • Laboratory practical • Fieldwork • Case studies • Group work • Jigsaw • 4-in-1 Model (TPACK)
Learning Resources	• Pest specimens • Hand lenses, traps • Field guides • Pesticides • Reagents • Charts • Textbooks. • National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Oral question • Practical report • Class presentation • Field report • Written test • Assignment.

REFERENCES AND FURTHER READING

- Dent, D. – Insect Pest Management.
- Pedigo, L. P., & Rice, M. E. – Entomology and Pest Management.
- Flint, M. L., & Gouveia, P. – IPM in Practice: Principles and Methods of Integrated Pest Management.

BIO 524 Bio- Entrepreneurship Options

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides hands-on entrepreneurial training in selected areas of applied biology. Students choose 2 units from available options based on staff and facility. Options include but are not limited to: Mushroom farming, Tissue culture, Apiculture, Weed management, Ornithology/Poultry, Environmental Impact Assessment, Horticulture/ Landscape ecology, Orchards/Vegetable production, Herpetology, Vaccine and anti-venom production, Heliciculture, Disease diagnosis techniques, Slide and Photomicrography production, and Ruminant/Monogastric animal production and management. The goal is to develop practical skills and business mindset for self-employment.

RELEVANCE STATEMENT

At the end of this course, students will be able to: Acquire practical skills in a chosen bio-enterprise. Understand the economic potential of biological resources. Develop business plans for small-scale biological enterprises. Apply scientific knowledge to solve community problems. Promote self-reliance and job creation after graduation. . Link biological training to entrepreneurship and industry.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain practical techniques for the chosen bio-enterprise.
2. Identify appropriate materials for the enterprise.
3. Prepare a simple business plan.
4. Demonstrate appropriate safety measures.

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Demonstrate practical techniques in the chosen bio-enterprise.
2. Select suitable materials for the enterprise.
3. Develop a business plan for the enterprise.
4. Apply safety measures in the chosen bio-enterprise.

COURSE CONTENT

- Students are required to take 2 Units of direct studies in any one of the areas listed below
- Availability of each area depends on staff on the ground
- Examples of these options include but not limited to
- Mushroom farming, Tissue culture, Apiculture
- Weed management and control, Introduction to ornithology/poultry production
- Environmental impact assessment
- Horticulture/Applied horticulture and landscape ecology
- Orchards/ Production of vegetables
- Herpetology
- Introduction to Vaccine and anti-venom production
- Heliciculture Techniques in disease diagnosis
- Production of slides and Photomicrography
- Production and management of ruminants/monogastric animals

CATEGORY	DETAILS
Core Competencies	• Entrepreneur • Explanation • Management • Production • Preparation • Planning • Application • Safety • Measurement • Evaluation.
Core Values	• Creativity. • Innovation • Self-reliance • Hard work • Ethics • Problem-solving • Service to community.
Pedagogical Approaches	• Hands-on practical • Demonstration • Apprenticeship • Project-based learning • Group work • Business • Clinic, and field visit. • 4 –in- 1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Farm tools • Culture media • Seeds • Chemicals • Incubators • Diagnostic kits • Slides • Camera • Textbooks, business guides. • National Curriculum for Basic Education
Assessment Methods	• Practical demonstration • Production record • Business plan presentation • Project report • Oral interview.

REFERENCES AND FURTHER READING

- Hickman, C.P., Roberts, L.S., Keen, S.L., Lanson, A. IAnson, H. & Eisenhour, D.J. (2017). *Integrated principles of zoology (17th ed)*. McGraw-Hill. Edition
- Raven, P.H., Evert. R.F., & Eichon, S.E (2013).Biology of plants (8th ed). W.H. Freeman and company
- Roberts, M.B.V., & Reiss, M.J (2006) *Advanced biology (2nd ed)*. Nelson Thomes

BIO 525 Bioinformatics

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces computer-based analysis and management of molecular biological data. It covers the history of bioinformatics, PC applications, DNA and protein databases, data storage, file formats, and information retrieval. Topics also include genomics and proteomics and their application in biological research.

RELEVANCE STATEMENT

At the end of this course, students will be able to use computer tools for biological data analysis. Access and retrieve information from DNA and protein databases. Understand genomics and proteomics applications. Apply bioinformatics to research in medicine, agriculture and conservation. Manage and interpret large biological datasets. Build foundation for careers in computational biology and biotechnology.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain the history of bioinformatics.
2. Use PC applications.
3. Describe biological data formats.
4. Analyse molecular biological data.
5. Explain the concepts of genomics.
6. Explain bioinformatics tools to biological problems.

LEARNING OUTCOMES

At the end of this course students will be able to:

1. Trace the historical development of bioinformatics.
2. Operate basic PC applications.
3. Differentiate common biological file formats.
4. Interpret molecular biological data.
5. Discuss the fundamental concepts of genomics.
6. Apply bioinformatics tools to biological problems.

COURSE CONTENT

- Introduction to computer-based analyses and management applications of molecular biological data
- History of bioinformatics
- Instrumentation: PC applications, resources, introduction to DNA and protein databases
- Data storage
- File formats and information retrieval
- Genomics and proteomics

CATEGORY	DETAILS
Core Competencies	• Applications • Access • Retrieval • Analysis • Explanation.
Core Values	• Accuracy • Innovation • Problem-solving • Analytical thinking • Technological literacy.
Pedagogical Approaches	• Interactive lecture • Computer practical • Demonstration • Group work • Case studies • 4-in-1 Model (TPACK).
Learning Resources	• Computers • Internet • Bioinformatics • Software • Databases • Textbooks • Multimedia. • National Curriculum for Basic Education
Assessment Methods	• Quiz • Practical assessment • Assignment • Written test.

REFERENCES AND FURTHER READING

- Mount, D. W. – Bioinformatics: Sequence and Genome Analysis.
- Lesk, A. M. – Introduction to Bioinformatics.
- Compeau, P., & Pevzner, P. – Bioinformatics Algorithms: An Active Learning Approach.

BIO 526 Molecular Biology

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course examines biological systems at the molecular level with emphasis on DNA and RNA structure and function. It covers gene regulation, DNA replication, genetic transformation, recombinant DNA technology, and interactions of nucleic acids and proteins in cell division, growth and development. The course also treats genome evolution and practical applications in food production, plant and animal breeding, medicine and genetics.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand molecular mechanisms underlying life processes. Apply molecular biology techniques in research and industry. Use genetic engineering to address food, health and agricultural problems. Explain how genes regulate growth and development.

Appreciate applications of molecular biology in medicine and breeding. Build foundation for biotechnology and genetic research.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the structure of DNA and RNA.
2. Explain gene regulation.
3. Describe genetic transformation.
4. Explain the interactions between nucleic acids and proteins.
5. Discuss genome evolution.
6. Explain molecular biology principles to food security.

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Explain the structure of DNA and RNA.
2. Analyse gene regulation.
3. Apply genetic transformation principles.
4. Relate nucleic acids to cellular processes.
5. Examine genome evolution.
6. Apply molecular biology principles to food security.

COURSE CONTENT

Structure and role of DNA. Structure and role of RNA.

- Describe gene regulation, DNA replication, genetic transformation and recombinant DNA technology
- Describe biological systems at the molecular level
- Nucleic acids and proteins and how they interactively regulate cell division, growth and development
- Evolution of genomes
- **Practical applications of the knowledge of molecular Biology:** in alleviation of food shortages, plant breeding, disease resistant crops, animal breeding, marriage, medicine, genetic

CATEGORY	DETAILS
Core Competencies	• Explanation • Description • Demonstration • Techniques • Discussion • Applications.
Core Values	• Scientific inquiry • Innovation • Accuracy • Ethical responsibility • Problem-solving.

CATEGORY	DETAILS
Pedagogical Approaches	• 4 in 1 Model (TPACK) • Demonstration • Laboratory practical • Discussion • Discovery learning
Learning Resources	• National Curriculum for Basic Education • DNA models • Laboratory reagents • Electrophoresis apparatus • PCR machine • Textbooks.
Assessment Methods	• Laboratory practical, report • Written test • Assignment.

REFERENCES AND FURTHER READING

- Alberts, B. et al. – Molecular Biology of the Cell.
- Watson, J. D. et al. – Molecular Biology of the Gene.
- Krebs, J. E. et al. – Lewin's GENES

BIO 527 Reproductive Developmental Biology

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** _

COURSE OVERVIEW

This course examines biological principles underlying reproduction in animals with focus on humans. Topics include anatomy and physiology of male and female reproductive systems, gametogenesis, hormonal regulation, fertilisation, development, parturition and lactation. The course also addresses factors affecting fertility, assisted reproductive technologies and current topics in reproductive biology.

RELEVANCE STATEMENT

At the end of this course, students will be able to understand human reproductive anatomy and physiology. Explain hormonal control of reproduction. Describe processes of gamete formation, fertilisation and development. Discuss factors affecting fertility and reproductive health. Identify assisted reproductive technologies. Apply knowledge to health education and counselling.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the male reproductive system.
2. Explain gametogenesis.
3. Describe fertilisation.
4. Discuss lactation.
5. Explain the causes of infertility.
6. Describe current reproductive technologies

LEARNING OUTCOMES

At the end of this course students should be able to:

1. Outline the major processes of human reproduction.
2. Associate reproductive hormones with reproductive functions.
3. Trace the stages of embryonic development.
4. Examine issues related to reproductive health.
5. Identify causes of infertility.
6. Analyse current reproductive technologies.

COURSE CONTENT

- Biological principles underlying reproduction in animals, with a focus on humans
- Explore the anatomy and physiology of the male and female reproductive systems, gametogenesis (sperm and egg production), hormonal regulation, fertilisation, development, parturition (birth), and lactation
- The course will also address factors affecting fertility, human assisted reproductive technologies, and current topics in reproductive biology

Evaluate assisted reproductive techniques.

CATEGORY	DETAILS
Core Competencies	• Description • Explanation • Discussion
Core Values	• Health awareness • Responsibility • Respect for life, scientific understanding • Ethical reasoning.
Pedagogical Approaches	• Lecture and, discussion • Group work • Project-based • Case-based learning • Peer teaching • 4- in- 1 Model (TPACK)
Learning Resources	• National Curriculum for Basic Education • Charts • Models • Textbooks • Videos.
Assessment Methods	• Project report presentation • Oral questions • Written test • Assignment.

REFERENCES AND FURTHER READING

- Jones, R. E., & Lopez, K. H. – Human Reproductive Biology.
- Sadler, T. W. – Langman's Medical Embryology.
- Gardner, D. K., & Elliott, A. – texts on reproductive biology and assisted reproduction.

BIO 528 Animal Behaviour

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course explores the diverse behaviours exhibited by animals across the animal kingdom. From social interactions of primates to courtship rituals of birds, students will study the evolutionary and ecological forces shaping behaviour. The course combines lectures, discussions and hands-on activities.

RELEVANCE STATEMENT

This course will introduce the students to the understanding of the causes and functions of animal behaviour. Explain how behaviour evolves and adapts. Relate behaviour to ecology and survival. Apply knowledge in wildlife management and conservation. Develop observational and analytical skills in behavioural studies.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe types of animal behaviour.
2. Explain the evolutionary basis of animal behaviour.
3. Discuss social behaviour in animals.
4. Explain learning in animals.
5. Discuss behavioural principles to wildlife conservation.

LEARNING OUTCOMES

At the end of the course students should able to:

1. Characterise patterns of animal behaviour.
2. Analyse the evolutionary basis of animal behaviour.
3. Examine social behaviour in animals.
4. Differentiate learned behaviour from innate behaviour.
5. Apply behavioural principles to wildlife conservation.

COURSE CONTENT

Embark on a fascinating exploration of the intricate world of animal behaviour in this comprehensive course! Diverse behaviours exhibited by animals across the entire animal

kingdom, from the complex social interactions of primates to the elaborate courtship rituals of birds. Through a combination of lectures, discussions, and hands-on activities, you'll gain a deeper understanding of the evolutionary and ecological forces that shape animal behaviour.

CATEGORY	DETAILS
Core Competencies	• Description • Observation • Analysis.
Core Values	• Curiosity • Appreciation of Inquiry
Pedagogical Approaches	• Lecture and discussion • Field Observation • Video analysis • Group activities • 4-in-1 Model (TPACK).
Learning Resources	• Videos • Field guides • Charts • Textbooks • Zoo/park visit. • National Curriculum for Basic Education
Assessment Methods	• Quiz • Observation report • Assignment • Written test.

REFERENCES AND FURTHER READING

- Adcock, J. – Animal Behavior: An Evolutionary Approach.
- Davies, N. B., Krebs, J. R., & West, S. A. – An Introduction to Behavioral Ecology.
- Dugatkin, L. A. – Principles of Animal Behavior

BIO 529 Field Course II

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Field trips to meet requirements of various aspects of Biology taught in class. Covers ecology, hydrobiology, wildlife, forestry, taxonomy and systematics. Activities include guided visits to observe plants and animals, sampling techniques, collection, classification, preservation in herbarium and museum. Includes field research, data collection and analysis. Visits to industries, wildlife parks, zoos, afforestation fields, reservoirs, farms and environmental sites. Individual or group field projects, report writing and examination.

RELEVANCE STATEMENT

At the end of this course, students will be able to apply field techniques in ecolgy and taxonomy. Collect, preserve and classify biological samples. Conduct field research and analyse data. Relate classroom knowledge to real-world biological settings. Develop skills in scientific reporting.

COURSE OBJECTIVES

The objectives of this course is to:

1. Explain field methods used in biological studies.
2. Describe sampling methods for biological data collection.
3. Demonstrate procedures for biological specimen preservation.
4. Discuss simple biological field investigations.
5. Describe procedures for biological field report writing

LEARNING OUTCOMES

At the end of this course the students should be able to

1. Describe field methods used in biological studies.
2. Apply appropriate sampling methods for biological data collection.
3. Preserve biological specimens collected from the field.
4. Conduct simple biological field investigations.
5. Prepare biological field reports based on field observations

COURSE CONTENT

- Field trips should be conducted to meet the requirements of various aspects of Biology taught in the classroom
- The field course should add to, and fulfil other practical aspects of ecology, hydrobiology, wildlife and forestry, taxonomy and systematics and others
- Guided field visits by students to observe plants and animals, learn sampling techniques as related to plants and animals, collect samples, classify, preserve in herbarium and museum accordingly
- Conduct field researches, collect data and analyse
- Visit to industries, wildlife parks, zoological gardens, afforestation fields/woodlot parks, reservoirs /dams, farms, environmental control establishments and sites, and other areas of biological importance
- Field projects (individual or grouped), report writing and examination

CATEGORY	DETAILS
Core Competencies	• Sampling, technique • Collection • Preservation • Analysis • Report writing.
Core Values	• Teamwork • Responsibility • Scientific reporting • Environmental awareness.
Pedagogical Approaches	• Fieldwork • Excursion • Project • Group work • Cooperative learning. • 4-in-1 Model (TPACK)

CATEGORY	DETAILS
Learning Resources	• Sampling tools • Specimen containers • Herbarium materials • Field notebook • National Curriculum for Basic Education
Assessment Methods	• Field report • Practical examination • Project presentation.

REFERENCES AND FURTHER READING

- Krebs, C. J. – Ecological Methodology.
- Brower, J. E., Zar, J. H., & von Ende, C. N. – Field and Laboratory Methods for General Ecology.
- Southwood, T. R. E., & Henderson, P. A. – Ecological Methods.

PROGRAMME 2 OF 6

Chemistry Education

Overview

The Chemistry Education dual mandate programme is designed to provide a coherent and progressive pathway for the preparation of highly competent, innovative and professionally grounded Chemistry educators. The programme integrates the Nigeria Certificate in Education (NCE) and Bachelor of Science in Education (B.Sc.(Ed.)) Chemistry within a continuous five-year structure, comprising an initial three-year NCE stage followed by a two-year degree stage. The NCE component establishes a strong foundation in Chemistry, general education and professional teaching competencies, while the B.Sc.(Ed.) component builds progressively on this foundation through advanced Chemistry, specialised laboratory work, educational studies, research and higher-level professional preparation.

Philosophy

The philosophy of the Dual Mandate NCE–B.Sc. (Ed) Chemistry programme is to produce competent and professionally committed Chemistry teachers with sound content knowledge, pedagogical skills, and practical competence for effective teaching and learning at basic and post-basic levels. The programme integrates theoretical and practical knowledge, scientific inquiry, problem-solving, and relevant technological skills to develop adaptable, innovative, and digitally competent Chemistry teachers capable of responding to the changing needs of learners, schools, society, and national development.

Regulations

Admission and Graduation Requirements

Admission Requirements

NCE Programme

Candidates must satisfy the UTME and O’ Level admission requirements for NCE and Bachelor of Education degrees in their various departments.

NCE-Degree Programme

i. Candidates must satisfy the UTME and O' Level admission requirements for Degree Education programme in the area of specialisation to be pursued.

ii. Candidates with NCE cumulative grade point average (2.40-5.00) equivalent to Merit and above, shall continue into the 2-year Bachelor of Education degree programme.

iii. NCE candidates with cumulative grade point average (1.50-2.39) equivalent to Pass and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme.

Graduation Requirements

NCE Programme: Candidates for the award of NCE certificates are required, among others, to earn at least 40 credits units in Chemistry and foundational science courses,22 credits in General Education courses, 6 credits in Teaching Practice and 12 credits in General Studies Education (totalling credits in the Education component of the NCE programme) to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	Core Courses	40
2	General Education	22
3	Teaching Practice (TP)	06
4	General Studies (GSE)	12
Total Units:		**80**

Total Minimum Credit Units Required for NCE graduation: **80 credit units**

Degree Programme: Candidates for the award of the Bachelor of Science (Education) degree are required, among others, to earn at least 54 credit units in Chemistry, 6 credits in General Education, 6 credits in Teaching Practice and 4 credits in General Studies Education (70 credit units in all) to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	Chemistry	54
2	General Education	06
3	General Studies (GSE)	04

4	Teaching practice	06
Total Units:		**70**

Total Minimum Credit Units Required for NCE-Degree graduation: 150 credit units

National Goals of Education in Nigeria

ii. Total integration of the individual into the immediate community, the Nigerian society and the world.

iii. Provision of equal access to qualitative educational opportunities for all citizens at all levels of education within and outside the formal school system.

iv. Incubation of national consciousness, values and national unity; and

v. Development of appropriate skills, mental, physical and social abilities and Core Competences to empower the individual to live in and contribute positively to the society.

b) Ensure the quality of education delivery at all levels.

c) Promote functional education for skill acquisition, job creation and poverty reduction.

d) Ensure periodic review, effectiveness and relevance of the curriculum at all levels to meet the needs of society and the world of work;

e) Collaborate with development partners, the private sector, non-governmental organisations and local communities to support and fund education; and

f) Promote information technology capability at all levels.

Objectives of Chemistry Education Programme

The objectives of this course are to:

i. Develop sound and progressively advanced knowledge of Chemistry and its applications in education, industry, agriculture, health, environmental management and technology;

ii. Develop competent Chemistry educators with the pedagogical knowledge and skills required for effective teaching and learning at basic and post-basic education levels;

iii. Develop practical and laboratory competence in chemical experimentation, instrumentation, laboratory management, safety and responsible handling of chemicals;

iv. Develop critical thinking, scientific reasoning, problem-solving and research skills for addressing chemical, educational and societal challenges;

v. Integrate ICT, artificial intelligence, virtual laboratories and other emerging technologies into Chemistry teaching, learning, experimentation and research;

vi. Develop innovative, creative and entrepreneurial graduates capable of applying Chemistry knowledge to real-life, industrial and environmental problems;

vii. Promote professional ethics, environmental responsibility, inclusiveness, collaboration and lifelong learning among Chemistry educators; and

viii. Prepare graduates for further education, professional practice, scientific research and meaningful contribution to national development.

Learning Outcomes of Chemistry Education Programmes

At the end of the **five-year NCE–B.Sc.(Ed.) Chemistry programme**, graduates should be able to:

i. Demonstrate sound and progressively advanced knowledge of Chemistry, including theoretical concepts, principles, laws, reactions and their applications.

ii. Apply Chemistry knowledge to real-life problems in education, agriculture, health, industry, petroleum and petrochemicals, environmental management, energy and materials development.

iii. Conduct chemical experiments safely and competently, using appropriate laboratory equipment, techniques, chemicals and instrumentation.

iv. Apply scientific reasoning, critical thinking and problem-solving skills to chemical and educational challenges.

v. Use ICT, artificial intelligence, virtual laboratories, simulations and other digital technologies appropriately to enhance Chemistry teaching, learning, experimentation and research.

vi. Design and conduct independent research in Chemistry, Chemistry Education or related interdisciplinary areas, including literature review, experimental design, data analysis and scientific reporting.

vii. Develop and evaluate innovative approaches to Chemistry teaching and learning, taking account of learners' diverse abilities, needs and learning environments.

viii. Apply entrepreneurial, innovative and research skills to identify opportunities for the application of Chemistry in solving societal, industrial and environmental problems.

ix. Demonstrate readiness for professional teaching, further academic study, research and lifelong learning in Chemistry, Chemistry Education and related fields.

Relevance Statement

The NCE–B.Sc.(Ed.) Chemistry programme is relevant for producing competent Chemistry educators with strong theoretical, practical, pedagogical, research and digital skills. It prepares graduates to teach Chemistry effectively and apply chemical knowledge to health, agriculture, industry, petroleum, environmental management, technology and sustainable national development**.**

NCE-MAS (Minimum Academic Standards) for NCE Programme

Staffing Requirements (Personnel)

Institutions offering this programme shall employ adequate, qualified, and competent personnel to ensure effective programme delivery and administration. Such personnel shall include:

1. Course Lecturers
2. Laboratory Technologist
3. Laboratory Assistants
4. Laboratory Attendant

Academic Staff

At least eight (8) core staff with a Minimum of Master's degree with relevant teaching qualification is required for appointment as a Lecturer in a College of Education in department of Chemistry. For the degree programme, at least 5 core staff with a Ph.D. degree in relevant sub-discipline of chemistry among whom there must be at least one full time professor is required. The programme must be administered by a staff not lower than a Senior Lecturer cadre.

The NUC guidelines on staff/student ratio of 1:30 for department of Chemistry shall apply. It is expected that all academic staff should possess PhD degree. However, the proportion of academic staff with PhD degree should not be less than 70%. Staff should have a maximum of 15 contact hours per week for lectures, tutorials, practical, and supervision of projects.

Administrative Support Staff (Non- Academic)

The services of the administrative support staff are indispensable in the proper administration of the departments and school offices. It is important to recruit very competent senior staff that are computer literate. At the least, a secretary, a clerical officer and a messenger/cleaner are the minimum administrative staff expected for the programme.

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories and workshop/studios are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

Library

Colleges should leverage on available technology to put in place rich databases and other electronic/digital library and information resources. In addition, well stock and current hardcopies of reference and other textual materials in Organic Chemistry, inorganic, physical, environmental, analytical, industrial, natural products etc. should be provide centrally at the college level. A well network digital library should serve the college community. Availability of wireless facilities (Wi-Fi) with adequate bandwidth should enhance access to these electronic resources.

There should be School/Departmental Library in addition to the university main library. Current basic textbooks, reference books, journals, newspapers, periodicals and other relevant textual and non-textual materials should be readily available in the libraries. A virtual/automated library is also needed.

Equipment

- The Periodic Table of Elements
- Mettler analytical balance
- Centrifuge
- Laptop and desktop computers
- Fume hood/fume cupboard
- Microwave oven
- Paper chromatography ink

- Electronic microscope
- Pipette bulb
- Spectrophotometer
- Bomb calorimeter
- Goethe barometer/storm glass
- Weights or masses
- Spring weighing scale
- Steel ruler
- Thermometer with Celsius and Fahrenheit scales
- Desiccator and Vacuum Desiccator Glassware
- Microscope
- Gas equipment and bunsen burner
- Water supply
- Bunsen Burners
- Test Tubes
- Test Tube Racks (Plastic)
- Fire Extinguisher Big
- Sand Buckets
- Water Bath
- Ph Meter
- Hand Lens
- Table Sinks
- White Board
- Gas Fitting (Big)
- First Aid Kit (Big)
- Retort Stands Complete
- Beakers
- Petri Dishes
- Flat/Round Bottom Flask 500ml
- Spatula Stainless 150mm
- Chromatography Apparatus

- Wet And Dry Bulb Thermometer
- Measuring Cylinder, Funnels
- Bench Centrifuge
- Shelves For Reagents
- Laboratory Tables
- Hot Plate
- Micrometer Screw Guage
- Vernier 0–18cm
- Hacksaw Blades
- Plain Goggles
- Engraver
- Gas Cylinder
- Muffler Furnace (Model 5xl)
- Heating Mantle (5lflask)
- Heating Mantle (2l Flask)
- Heating Mantle (1l Flask)
- Water Bath (Dk-8a)
- Dessicator
- Refrigerator
- Stabiliser (2000va)
- Manesty (Distillatory)
- Chromatography Tank With Accessories
- Column Chromatography
- Centrifuge
- First Aid Box
- Metre Rule
- Adaptor (15amp)
- Petri Dishes
- Washing Brush
- Microscope (Binocular)
- Incubator/Steriliser

- Water Filter
- Drying Oven (30°C–120°C)
- Sechi Disc
- Test tubes
- Watch glasses
- Crucibles (with lids)
- Volumetric glasses
- Beakers
- Bunsen burner
- Spatulas and Scopulas
- Magnifying glasses
- Spring balance
- Droppers
- Latex gloves
- Safety goggles
- Brushes for test tubes
- Funnels
- Tongs and Forceps
- Wash bottles
- Burettes
- Thermometer
- Measuring Cylinders
- Pipettes
- Conical flasks
- Boiling flasks
- Ring stands, rings and clamps
- Litmus and filter papers
- Mass spectrometers
- Nuclear Magnetic Resonance
- Batch reactor
- Rheometer

- Polymer Extrusion
- Injection Moulding
- Infrared spectrometer
- Personal Protective Equipment
- Water heater
- Water hardness tester
- Light box
- PH meter
- Distilled Water maker
- Washing machine
- Sample dyeing machine
- Data Colour (Spectrophotometer)
- Water bath
- BIO-XPS photoelectron spectrometer
- X-ray diffraction/X-ray reflection
- JSPM-5400 Scanning Probe Microscope MFP-3D Atomic Force Microscope
- Microcal VP-ITC Microcalorimeter
- Chromatographic systems HPLC and GC-MS
- The Bruker FT-IR Spectrometer
- Fluorescence Spectrometer FLS 900
- Laser Flash Photolysis Spectrometer LP920
- The Finnigan LXQ Mass Spectrometer
- DESI-MS
- The Thermo Scientific Exactive high resolution MS
- The JEOL JSM-5600LV SEM
- Ion Chromatography equipment with three detection units (Conductivity, Amperometry and Spectrometry)
- Atomic Absorption Spectrophotometer
- Total Organic C and N analysers
- Flow Injection Analyser
- UV Spectrophotometer

- Automated Titration System
- Physical Properties Measurement Systems, Electrical furnaces, Polarimeters and Magnetometers
- Digital Refractometers
- Flash point tester
- Fuel Analyser
- Vapour Pressure Analyser

Laboratory Chemicals

- Mineral acids
- Bases
- Simple salts
- Phenylhydrazine Hydrochloride
- Iodine solution
- Fehling's Reagent A and B
- Barfoed's Reagent
- Seliwanoff's Reagent
- Bial's Reagent
- Sodium acetate
- Glacial acetic acid
- Glucose and Fructose

Facilities

Institutions offering this programme shall provide adequate, functional, safe, and well-maintained facilities to support effective teaching, learning, and professional practice. These facilities shall include, but not be limited to, the following:

1. Office Spaces.
2. Lecture Rooms & Equipment.
3. Demonstration Laboratory

Classroom Facilities

Lecture theatres and classrooms should be adequate in number, well-spaced and adequately ventilated with necessary public address system, projectors and other audio-visual aids.

Pedagogical Approaches, Modes of Assessment and Instructional Materials for Chemistry Education

Pedagogical Approaches

The programme shall employ diverse teaching and learning approaches that develop both chemistry knowledge and professional teaching competence.

1. **Learner-centred approach:** Places learners actively at the centre of the teaching and learning process, encouraging participation, independent learning, questioning, and reflection.
2. **Inquiry-based learning:** Engages students in asking questions, investigating chemical phenomena, collecting evidence, analysing results, and drawing scientific conclusions.
3. **Problem-based learning:** Uses real-life and chemistry-related problems to develop students' critical thinking, reasoning, and problem-solving abilities.
4. **Experiential and hands-on learning:** Provides opportunities for students to learn through direct experience, particularly through laboratory experiments, field activities, demonstrations, and practical tasks.
5. **Collaborative learning:** Encourages students to work in pairs or groups to discuss concepts, conduct experiments, solve problems, and complete projects.
6. **Demonstration method:** Uses teacher-led demonstrations to illustrate chemical reactions, processes, apparatus handling, safety procedures, and concepts that may be difficult or unsafe for students to perform independently.
7. **Discussion method:** Promotes interaction between teachers and learners through questioning, dialogue, debate, and interpretation of chemical concepts and phenomena.
8. **Project-based learning:** Enables students to undertake extended investigations or practical projects that integrate chemistry knowledge, research skills, creativity, and problem-solving.

9. **Laboratory-based learning:** Develops practical competence through experiments involving observation, measurement, experimentation, data analysis, interpretation, and reporting.
10. **Micro-teaching and teaching practice:** Provides prospective teachers with opportunities to develop and demonstrate lesson planning, classroom management, communication, assessment, and instructional skills.
11. **ICT- and AI-supported learning:** Integrates digital technologies and appropriate artificial intelligence tools to enhance research, content understanding, lesson preparation, assessment, simulations, and personalised learning.
12. **Virtual laboratory and simulation-based learning:** Uses digital simulations and virtual experiments to complement physical laboratory activities and provide access to experiments that may be costly, hazardous, or difficult to perform.

Modes of Assessment

Assessment in Chemistry Education combines ongoing diagnostic evaluation with comprehensive knowledge testing to evaluate both core concepts and soft skills.

Assessment Category	Type	Purpose and Specific Methods
Diagnostic Assessment	Entry/Pre-assessment	Determine learners' prior knowledge, skills, and misconceptions before instruction. Interview, concept map and diagnostics questions
Formative Assessment	Continuous Assessment	Monitor learning progress and provide timely feedback during instruction. Class exercises, quizzes, oral questioning, tutorials, assignments, observation
Summative Assessment	End-of-course assessment	Determine the extent to which course learning outcomes have been achieved. Semester examinations, end-of-course tests
Performance Assessment	Competency-based assessment	Assess students' ability to apply knowledge and skills in authentic situations. Practical demonstrations, teaching demonstrations, problem-solving tasks

Assessment Category	Type	Purpose and Specific Methods
Reflective/Developmental Assessment	Reflective	Promote self-evaluation, critical reflection, identification of learning gaps, and continuous professional improvement. Reflective journals, learning logs, self-assessment forms, teaching-practice reflections, laboratory reflections

Instructional Materials

Instructional materials shall include conventional, practical, digital, and emerging technologies to support effective chemistry teaching and learning.

i. **Chemistry textbooks and reference books:** Provide foundational knowledge, detailed explanations, examples, and additional learning resources.

ii. **Course manuals and lecture notes:** Provide structured materials aligned with the content and learning outcomes of individual courses.

iii. **Periodic tables and chemistry charts:** Help learners understand periodic trends, element properties, chemical relationships, and other important concepts.

iv. **Molecular models and ball-and-stick kits:** Facilitate the understanding of molecular structures, bonding, geometry, stereochemistry, and spatial relationships.

v. **Laboratory equipment and reagents:** Provide essential resources for developing students' experimental and practical chemistry skills.

vi. **Charts, diagrams, and posters:** Present abstract concepts, structures, processes, and relationships in visual forms that facilitate understanding.

vii. **Computers, tablets, and mobile devices:** Support digital learning, research, data analysis, simulations, presentations, and access to online resources.

viii. **Projectors and interactive boards:** Facilitate multimedia presentations, demonstrations, animations, videos, and interactive classroom activities.

ix. **Educational videos and animations:** Provide visual representations of chemical processes, experiments, molecular interactions, and industrial applications.

x. **Virtual laboratory simulations:** Provide opportunities for students to practise experimental procedures and explore chemical phenomena in a controlled digital environment.

NCE Course Distribution (100–300 Level)

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30	30
EDU 112	Educational Psychology	2	C	30	30
GSE 111	General English 1	1	C	15	15
GSE 112	Introduction to Library Studies	1	C	15	15
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15	15
CHM 111	General Chemistry I	2	C	30	
CHM 107	General Practical Chemistry I	1	C		45
BIO 111	General Biology I	2	C	30	
MTH 111	General Mathematics I (Number and Numeration)	2	C	30	
PHY 107	General Physics I (Mechanics)	2	C		45
Total		**16**			

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30	30
GSE 121	English Proficiency for Teachers	1	C	15	15
GSE 122	Digital Literacy & AI for Educators	1	C	15	15
GSE 123	Media and Information Literacy	1	C	15	15
CHM 121	General Chemistry II	2	C	30	
CHM 128	General Chemistry Practical II	1	C		45

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
CHM 123	Chemistry Laboratory Techniques	1	C	15	
MTH 121	General Mathematics II (Calculus)	2	C	30	
CHM 125	Chemistry Methods I	1	C	30	
BIO 121	General Biology II	2	C	30	
Total		**16**			

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 211	Classroom Management	1	C	15	15
EDU 212	Curriculum and Curriculum Delivery	2	C	30	30
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30	30
GSE 211	General English II	1	C	15	15
GSE 212	Introduction to Foundational Literacy	1	C	15	15
GSE 213	Media and Information Literacy II	1	C	15	15
CHM 210	Physical Chemistry I	2	C	15	45
CHM 211	Organic Chemistry I	2	C	15	45
CHM 217	General Chemistry Practical III	1	C		45
CSC 211	Introduction to Computer Science	3	C	30	45
Total		**16**			

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	30
EDU 222	Educational Administration, Planning and Supervision	1	C	15	15
EDU 223	Introduction to Educational Technology	1	C	15	15
EDU 224	Micro Teaching: II (Practicum)	2	C	30	30

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 221	Introduction to Foundational Numeracy	1	C	15	15
GSE 222	Entrepreneurship and Green Skills	1	C	15	15
CHM 221	Inorganic Chemistry I	2	C	15	45
CHM 223	Liquid State and Colloids	1	C	30	
CHM 208	General Chemistry Practical IV	1	C		45
STA 202	Statistics for Physical Science and Engineering	2	C	30	
Total		**14**			

NCE 300 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 311	Teaching Practice (TPD)	6	C	90	90
Total		**6**			

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	15
GSE 321	Global Citizenship Education and Political Economy	1	C	15	15
CHM 313	Analytical Chemistry I	2	C	15	45
CHM 314	Structure and Bonding	2	C	30	
CHM 323	Chemical Kinetics	2	C		
CHM 324	Thermodynamics	2	C	15	
CHM 325	Chemistry Practical V	1	C		45
Total		**13**			

Degree Course Distribution (400–500 Level)

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 412	Peace and Conflict Resolution	2	C	30	30
CHM 401	Physical Chemistry II	2	C	15	45
CHM 402	Inorganic Chemistry II	2	C	15	45
CHM 403	Organic Chemistry II	2	C	15	45
CHM 404	Atomic & Molecular Structure & Symmetry	2	C	30	
CHM 413	Industrial Chemistry	2	C	30	
CHM 415	Petroleum Chemistry	2	C	30	
CHM 416	Chemistry of Soaps and Detergents	1	C	15	
Total		**15**			

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 402	Educational Measurements, Tests, Research Methods and Statistics	3	C	45	45
ENT 412	Venture Creation	2	C	30	30
CHM 412	Analytical Atomic Spectroscopy	2	C	30	
CHM 414	Entrepreneurship Skill in Chemistry	2	C	30	
CHM 422	Metals, Alloys & Transition Elements	2	C	30	
CHM 423	Introduction to Rubber Technology	2	C	30	-
CHM 419	Environmental Chemistry	2	C	30	
CHM 425	SIWES Industrial Attachment	2	C	30	
CHM 426	Chemistry Method II	2	C	15	
Total		**19**			

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 501	Teaching Practice	6	C	90	90
CHM 511	Heterocyclic Compounds	2	C	30	
CHM 512	Physical Organic Chemistry and Reaction Mechanism	2	C	30	
CHM 513	Reaction Kinetics	2	C	30	
CHM 514	Electrochemistry	2	C	15	
SED 502	Science, Technology and Society	2	C	30	
CHM 515	Nuclear and Radiation Chemistry	2	C	30	
Total		**18**			

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 500	Research Project	3	C	45	45
CHM 521	Applied Spectroscopy	2	C	30	-
CHM 522	Chemistry of Pulp and Paper Making	2	C	30	-
CHM 523	Natural Products	2	C	30	
CHM 524	Biomass and Renewal Energy Technology	2	C	30	
CHM 525	Carbohydrates and Lipids Chemistry	3	C	30	
CHM 526	Organometallic Chemistry	2	C	30	-
CHM 527	Co-Ordination Chemistry	2	C	30	-
Total		**18**			

NCE Course Descriptions (100–300 Level)

CHM 111 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a foundational understanding of the fundamental principles and concepts of chemistry. It examines atoms, molecules, elements, compounds and chemical reactions, with emphasis on modern electronic theory, electronic configuration, periodicity and the development of the periodic table. The course also covers chemical bonding, hybridisation, molecular shapes, intermolecular forces, valence forces and the structure of solids. Students are introduced to chemical equations, stoichiometry, kinetic theory of matter, properties of gases, elementary thermochemistry, reaction rates, chemical equilibrium and basic thermodynamics. Further topics include acids, bases and salts, redox reactions, introductory electrochemistry and radioactivity. The course combines conceptual understanding with appropriate calculations and applications to develop a strong foundation for further study of chemistry.

RELEVANCE STATEMENT

A sound knowledge of general chemistry is essential for understanding more advanced areas of chemistry and its applications in science, technology, health, agriculture and industry. The course equips students with the fundamental concepts, principles and problem-solving skills required to interpret chemical phenomena, perform quantitative chemical calculations and relate microscopic properties of matter to observable behaviour. It also provides the necessary foundation for subsequent courses in organic, inorganic, physical, analytical and environmental chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of atoms, molecules, elements, compounds and chemical reactions;
2. Describe the modern electronic structure of atoms, electronic configurations and periodic trends;

3. Explain chemical bonding, hybridisation, molecular shapes, intermolecular forces and the structure of solids;
4. Write and balance chemical equations and solve quantitative problems involving stoichiometry;
5. Explain the basic principles of kinetic theory, gases, thermochemistry, reaction rates, equilibrium and thermodynamics;
6. Explain the concepts of acids, bases, salts, redox reactions, electrochemistry and radioactivity and relate them to practical applications.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms and justify the trends of atomic radii, ionisation energies, electronegativity of the elements based on their position in the periodic table;
3. Identify and balance oxidation – reduction equation and solve redox titration problems;
4. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
5. Apply the principles of equilibrium to aqueous systems using le chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
6. Explain the concepts of acids, bases, salts, redox reactions, electrochemistry and radioactivity and relate them to practical applications.

COURSE CONTENT

- Atoms, molecules, elements and compounds and chemical reactions
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table
- Hybridisation and shapes of simple molecules
- Valence Forces
- Structure of solids
- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter

- Elementary thermochemistry: rates of reaction, equilibrium and thermodynamics
- Acids, bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry
- Radioactivity

CATEGORY	DETAILS
Core Competencies	• Knowledge • Analysis • Application
Core Values	• Objectivity and scientific inquiry • Innovation • Scientific curiosity • Integrity and discipline
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Problem-solving sessions • Use of simulations and charts.
Learning Resources	• Core chemistry textbooks and reference materials • Lecture notes and digital learning platforms • Periodic table charts and molecular models • Laboratory manual, equipment and reagents • Online tutorials and open educational resources
Assessment Methods	• Class tests • Quizzes • Assignments • Oral • Questioning • Continuous assessment.

REFERENCES AND FURTHER READING

1. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2018). *Chemistry: The central science* (14th ed.). Pearson.
2. Chang, R., & Goldsby, K. A. (2016). *Chemistry* (12th ed.). McGraw-Hill Education.
3. Ebbing, D. D., & Gammon, S. D. (2017). *General chemistry* (11th ed.). Cengage Learning.
4. Flowers, P., Theopold, K., Langley, R., & Robinson, W. R. (2019). *Chemistry 2e*. OpenStax.
5. Kotz, J. C., Treichel, P. M., Townsend, J. R., & Treichel, D. A. (2015). *Chemistry & chemical reactivity* (9th ed.). Cengage Learning.
6. Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2024). *General chemistry: Principles and modern applications* (12th ed.). Pearson.

CHM 107 General Practical Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This practical chemistry course provides hands-on laboratory experiences designed to reinforce and complement the theoretical concepts covered in CHM 101 and CHM 102. It develops students' competence in fundamental chemical laboratory techniques through experiments involving acid – base titrations, qualitative analysis, redox reactions, gravimetric analysis, and chemical data analysis and presentation**.** Emphasis is placed on accurate measurement, safe laboratory practices, observation, experimental design, quantitative calculations, interpretation of results, error analysis, and scientific reporting.

RELEVANCE STATEMENT

The course bridges the gap between theoretical chemistry and practical application by enabling students to verify chemical principles experimentally. It equips them with essential laboratory, analytical, numerical, and scientific communication skills required for further study in chemistry and related disciplines. The practical experience also promotes accuracy, critical thinking, problem-solving, safe handling of chemicals, and responsible laboratory practice.

COURSE OBJECTIVES

The objectives of this course are to:

1. Apply appropriate laboratory techniques in carrying out basic chemistry experiments.
2. Perform acid – base titrations and accurately determine unknown concentrations.
3. Conduct qualitative tests for common ions and interpret experimental observations.
4. Investigate redox reactions and apply oxidation – reduction principles to chemical analysis.
5. Perform simple gravimetric analyses and calculate quantities from experimental data.
6. Record, analyse, interpret, and present experimental data using appropriate scientific methods.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Describe the general laboratory rules and safety procedures;
2. Collect scientific data and correctly carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. Tell the differences between primary and secondary standards;
5. Perform redox titration;
6. Record observations and measurements in the laboratory notebooks; and
7. Analyse the data to arrive at scientific conclusions.

COURSE CONTENT

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CATEGORY	DETAILS
Core Competencies	• Experimentation • Measurement • Titration • Observation • Analysis • Calculation • Accuracy • Interpretation • Reporting • Safety • Problem-solving
Core Values	• Accuracy • Honesty and integrity • Safety consciousness • Responsibility • Discipline • Patience • Objectivity • Teamwork
Pedagogical Approaches	• Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • Project-Based Learning • Experiential Learning • Peer Learning

CATEGORY	DETAILS
Learning Resources	• Laboratory Manual • Laboratory Equipment • Chemicals and Reagents • Glassware • Analytical Balance • Titration Apparatus • Safety Equipment
Assessment Methods	• Practical Tests • Laboratory Reports • Practical Quizzes • Assignments • Data Analysis • Oral Tests • Continuous Assessment • Group Work • Practical Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., Stoltzfus, M. W., & Johnson, S. (2023). *Chemistry: The central science* (15th ed.). Pearson.
3. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
4. Housecroft, C. E., & Sharpe, A. G. (2024). *Inorganic chemistry* (6th ed.). Pearson.
5. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
6. Tro, N. J. (2023). *Chemistry: Structure and properties* (3rd ed.). Pearson.
7. Zumdahl, S. S., Zumdahl, S. A., & DeCoste, D. J. (2023). *Chemistry* (11th ed.). Cengage Learning.

MTH 111 General Mathematics I (Number and Numeration)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of number theory and mathematical structures. It focuses on the properties and operations of numbers, including integers, primes, divisibility, congruences, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real-life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem-solving.

RELEVANCE STATEMENT

Number of theory enables pre-service teachers to explain number concept clearly, systematically and confidently to learners.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Demonstrate a proper understanding of the number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility, and congruence.
3. Appreciate and utilise the applications of numbers in real-life situations.
4. Solve problems using principle of mathematical induction Define and analyse congruences, including reflexive, symmetric, and transitive properties.
5. Define and analyse congruence, including reflexive, symmetric, and transitive properties

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and apply the process of counting and the use of ordered pairs (Peano’s Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.

3. Explore further properties of integers, including well-ordering principle and divisibility.
4. Apply mathematical induction in proving theorems and laws.
5. Understand primes, relatively prime integers, and unique factorisation.
6. State and prove the fundamental theorem of arithmetic.
7. Define and analyse congruences, including reflexive, symmetric, and transitive properties.
8. Work with residue classes and solve linear congruences using basic theorems.
9. Apply Fermat's theorem, Euler's function, and related concepts to problems in number theory.
10. Demonstrate an understanding of the use of numbers in solving practical and theoretical problems.

COURSE CONTENT

- Process of counting, Peano's Axioms using ordered pairs, Fundamental operations in Mathematical Structures, Group properties, Further properties of Integers, Well ordering principle, Mathematical Induction to Laws of trichotomy, Divisibility (Basic definitions, divisions, primes, gcd)
- **Basic theorems on gcd:** proofs may be required
- **Relatively prime integers:** unique factorisation
- **The fundamental theorem of arithmetic:** proof may be required
- **Congruences, Basic definitions and examples, Properties of Congruence:** reflexive symmetric' and transitive: the equivalence relation
- Residue classes, Linear Congruences, Basic theorems and solutions of linear Congruences, Proofs of the main theorem may be required, Fermat's theorem and applications, the proof of Fermat's theorem may be required, Euler's totient function and number (proof not required)
- Application to linear Congruences, Fundamental operation in mathematical structures, Group properties

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• Creativity • **Innovation 3.Reflective thinking** • **Critical thinking** • Communication • Collaboration • Innovation • Reflective thinking • Self-development
Core Values	• Integrity • Respect • .3. Team spirit • Perseverance • **Transparency** • **Tolerance** • **Honesty**
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms

CATEGORY	DETAILS
Assessment Methods	• Continuous Assessment • Formative Assessment • Digital assessment (Blended/Online Assessment) • Summative assessment • **Readings** • Class work • Assignment • Group assignment • Presentations • Written Quiz

REFERENCES AND FURTHER READING

1. ***Current textbook on An Introduction to the Theory of Numbers.***
2. Use of online Resources.

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

RELEVANCE STATEMENT

This course provides students with the foundational knowledge required for understanding biological systems and life processes. It equips prospective biology teachers with essential concepts in cell biology, genetics, ecology, evolution, and taxonomy, enabling them to explain biological phenomena scientifically. The knowledge acquired will support further studies in biological sciences and enhance students' ability to apply biological principles to environmental conservation, health, agriculture, and science education.

COURSE OBJECTIVES

The objectives of this course is to:

1. Provide students with a fundamental understanding of the structure, organisation, and functions of cells and their organelles.
2. Introduce the characteristics, classification, and modes of reproduction of living organisms.

3. Explain the ecological relationships and interactions among organisms and their environment.
4. Familiarise students with the basic principles of heredity and evolution.
5. Expose students to the different habitat types and their distinguishing characteristics.
6. Develop students' understanding of the fundamental concepts and principles of general biology.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

1. Explain cells structures and organisations;
2. Summarise functions of cellular organelles;
3. Characterise living organisms and state their general reproduction;
4. Describe the interrelationship that exists between organisms;
5. Discuss the concept of heredity and evolution; and
6. Enumerate habitat types and their characteristics

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Observation • Classification of living things • Evaluation • Application.
Core Values	• Curiosity • Integrity • Diligence • Responsibility • Conservation • Team work
Pedagogical Approaches	• Inquiry-based learning • Demonstration • Group discussion • Group work • Case study

CATEGORY	DETAILS
Learning Resources	• Biology text book, charts, model • Specimens • Multimedia facilities • Microscope, prepared slides • Laboratory manual • Cultures • Herbarium specimens
Assessment Methods	• Lab and field report • Class presentation of findings.

1. Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

CHM 121 General Chemistry II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental principles and applications of organic chemistry**,** beginning with its historical development, electronic theory, nomenclature, functional groups, structural determination, purification techniques, reaction mechanisms, kinetics, and stereochemistry. It covers the chemistry of major classes of organic compounds and introduces carbon nanostructures, fullerenes, nanotubes, and nanochemistry**.** The course also examines selected metals and non-metals, comparative chemistry of Groups IA, IIA and IVA elements, and introductory transition metal chemistry.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the structure, properties, reactions, and applications of organic and selected inorganic compounds. It develops the chemical knowledge and skills required for further study in chemistry, biochemistry, pharmacy, environmental science, materials science, and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the historical development and importance of organic chemistry.
2. Describe the electronic structure, bonding, nomenclature, and functional groups of organic compounds.
3. Apply appropriate methods for the isolation, purification, identification, and structural determination of organic compounds.
4. Explain basic organic reaction mechanisms, kinetics, and stereochemical principles.
5. Describe the properties and reactions of major classes of organic compounds.
6. Explain the chemistry and applications of fullerenes, nanotubes, nanostructures, and nanochemistry.
7. Compare the chemistry of selected metals and non-metals, including Groups IA, IIA, and IVA elements.
8. Describe the fundamental properties and chemistry of transition metals.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative structures in organic chemistry;
5. Describe rules guiding nomenclature and functional group classes of organic compounds;
6. Determine rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry; 8. Discuss comparative chemistry of group IA, IIA and IIA elements; and
8. Describe basic properties of transition metals.

COURSE CONTENT

- Historical survey of the development and importance of Organic Chemistry
- Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry
- Electronic theory in organic chemistry
- Isolation and purification of organic compounds
- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry

- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics
- Stereochemistry
- The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives
- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA, IIA and IVA elements
- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• Nomenclature • Identification • Classification • Structure • Purification • Analysis • Stereochemistry • Mechanism • Reactivity
Core Values	• Accuracy • Integrity • Safety • Responsibility • Curiosity • Creativity • Discipline • Objectivity
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method

CATEGORY	DETAILS
Learning Resources	• Periodic Table • Molecular Models • Laboratory Equipment • Reaction Mechanism Charts
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Carey, F. A., Giuliano, R. M., Allison, N. T., & Bane, S. L. (2023). *Organic chemistry* (12th ed.). McGraw Hill.
2. McMurry, J. E. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
4. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
6. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.

CHM 128 General Chemistry Practical II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This practical course is a continuation of CHM 107, providing students with further laboratory experience in organic and analytical chemistry. It focuses on functional group analysis and quantitative analysis using volumetric methods, with emphasis on experimental techniques, accurate measurements, observations, calculations, interpretation of results, laboratory safety, and scientific reporting.

RELEVANCE STATEMENT

The course develops students' practical competence in identifying organic functional groups and carrying out quantitative chemical analysis**.** It strengthens the connection between theoretical chemistry and laboratory practice while preparing students for advanced chemistry courses, research, industrial applications, and professional laboratory work.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify common functional groups using appropriate chemical tests.
2. Perform qualitative analysis of organic compounds.
3. Carry out volumetric analysis using appropriate laboratory techniques.
4. Prepare and standardise solutions accurately.
5. Perform quantitative calculations from experimental data.
6. Analyse, interpret, and report laboratory results.
7. Apply appropriate safety procedures during laboratory operations.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Identify the general laboratory rules and safety procedures;
2. Collect scientific data and correctly carrying out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. Identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. Execute solubility tests on known and unknown organic compounds;
6. Execute elemental tests on known and unknown compounds; and
7. Conduct functional group/confirmatory test on known and unknown compounds which could be acidic/basic /neutral organic compounds.

COURSE CONTENT

Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

CATEGORY	DETAILS
Core Competencies	• Identification • Observation • Measurement • Titration • Analysis • Calculation • Accuracy • Interpretation • Reporting
Core Values	• Accuracy • Honesty and integrity • Safety consciousness • Responsibility • Discipline • Patience • Objectivity • Teamwork
Pedagogical Approaches	• Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • Project-Based Learning • Experiential Learning • Peer Learning

CATEGORY	DETAILS
Learning Resources	• Laboratory Manual • Laboratory Equipment • Chemicals and Reagents • Glassware • Analytical Balance • Titration Apparatus • Safety Equipment
Assessment Methods	• Practical Tests • Laboratory Reports • Practical Quizzes • Assignments • Data Analysis • Oral Tests • Continuous Assessment • Group Work • Practical Examination

REFERENCES AND FURTHER READING

1. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
2. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. J. K. (2000). *Vogel's quantitative chemical analysis* (6th ed.). Prentice Hall.
4. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2015). *Introduction to organic laboratory techniques: A microscale approach* (5th ed.). Cengage Learning.
5. Svehla, G. (1996). *Vogel's qualitative inorganic analysis* (7th ed.). Prentice Hall.
6. Tro, N. J. (2023). *Chemistry: Structure and properties* (3rd ed.). Pearson.

CHM 123 Chemistry Laboratory Techniques

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course develops practical skills in chemistry laboratory management, equipment maintenance, apparatus improvisation and experimental techniques. It covers the preparation of gases and salts, steam distillation, sublimation, fractional crystallisation, paper chromatography, reflux, use of drying agents, determination of melting and boiling points, and tests for oxidising and reducing agents.

RELEVANCE STATEMENT

This course equips students with the practical confidence and competence needed to become effective chemistry teachers and laboratory practitioners**.** It develops the ability to manage a laboratory, maintain and improvise apparatus, carry out essential chemical preparations and apply appropriate experimental techniques. The skills gained enable students to turn chemistry concepts into meaningful practical experiences, solve laboratory problems creatively, use locally available resources effectively, and promote safe, engaging and sustainable chemistry teaching and learning.

COURSE OBJECTIVES

The objectives of this course, are to:

1. Explain and apply the principles of effective management, organisation, and maintenance of a chemistry laboratory.
2. Demonstrate safe and appropriate handling, use, storage, and care of chemistry laboratory equipment, chemicals, and materials.
3. Improvise and construct simple laboratory apparatus from locally available materials for carrying out basic chemistry experiments.
4. Set up and operate laboratory apparatus for the preparation and collection of common gases in accordance with the SSCE Chemistry syllabus.
5. Prepare, purify, and obtain salts using appropriate laboratory techniques and explain the principles involved.
6. Set up and perform common separation and purification techniques, including steam distillation, sublimation, fractional crystallisation, and paper chromatography.

7. Demonstrate the use of heating under reflux in appropriate chemical preparations and explain its purpose.
8. Select and apply suitable drying agents for drying gases, liquids, and other laboratory products where appropriate.
9. Determine the melting and boiling points of substances using appropriate apparatus and experimental procedures.
10. Carry out qualitative tests for oxidising and reducing agents and correctly interpret the observations obtained.
11. Record, analyse, and report experimental observations and results accurately using appropriate scientific conventions.
12. Develop practical problem-solving and laboratory skills necessary for effective teaching and demonstration of chemistry experiments at the secondary-school level.

LEARNING OUTCOMES

By the end of the course the students should be able to:

1. Organise and manage a chemistry laboratory effectively for teaching, learning, and practical activities.
2. Identify, use, clean, maintain, and safely store common chemistry laboratory equipment and materials.
3. Apply laboratory safety rules and procedures when handling chemicals, equipment, and conducting experiments.
4. Construct and improvise simple laboratory apparatus using locally available materials for chemistry experiments.
5. Set up and demonstrate the preparation, collection, and testing of common gases in accordance with the SSCE Chemistry syllabus.
6. Prepare and purify salts using appropriate laboratory methods and techniques.
7. Perform separation and purification processes, including steam distillation, sublimation, fractional crystallisation, and paper chromatography.
8. Set up and carry out heating under reflux and explain its importance in chemical preparation.
9. Select and use appropriate drying agents for drying gases and organic liquids.
10. Determine the melting and boiling points of substances and interpret the results obtained.

11. Carry out qualitative tests for oxidising and reducing agents and correctly interpret experimental observations.
12. Record, analyse, and present experimental results accurately using appropriate tables, calculations, observations, and conclusions.

COURSE CONTENT

- Management and organisation of the chemistry laboratory
- Maintenance, care and safe handling of laboratory equipment
- Improvisation and construction of simple laboratory apparatus using locally available materials
- Setting up and demonstrating the preparation of common gases in line with the SSCE Chemistry syllabus
- Preparation and purification of salts
- Steam distillation
- Sublimation
- Fractional crystallisation
- Paper chromatography
- Heating under reflux
- Selection and use of suitable drying agents
- Determination of melting points
- Determination of boiling points
- Tests for oxidising agents
- Tests for reducing agents

CATEGORY	DETAILS
Core Competencies	• Chemistry Laboratory Management and Organisation • Laboratory Safety and Risk Management • Equipment Handling, Care and Maintenance • Improvisation and Construction of Laboratory Apparatus • Chemical Preparation and Purification Skills

CATEGORY	DETAILS
Core Values	• Accuracy and Precision • Scientific Integrity • Critical Thinking • Responsibility • Diligence • Curiosity and Inquiry • Problem-Solving • Teamwork
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach • Cooperative Learning • Demonstration Method
Learning Resources	• Laboratory Glassware and Apparatus • Chemicals, Reagents and Locally Available Materials • Gas Preparation and Collection Apparatus • Distillation and Steam Distillation Apparatus • Sublimation and Fractional Crystallisation Equipment
Assessment Methods	• Class Tests and Quizzes • End of semester Examination • Improvisation and Construction of Simple Apparatus

REFERENCES AND FURTHER READING

1. Harris, D. C. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
2. National Research Council. (2011). *Prudent practices in the laboratory: Handling and management of chemical hazards*. National Academies Press.
3. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2015). *Introduction to organic laboratory techniques: A microscale approach* (5th ed.). Cengage Learning.

CHM 125 Chemistry Methods I

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course develops the knowledge, skills and professional competencies required for effective teaching of chemistry at the secondary-school level. It examines the aims, goals and objectives of science and chemistry teaching; the nature, relevance and societal value of chemistry; critical analysis of the Senior Secondary School (SSS) Chemistry curriculum; pre-active and interactive phases of teaching; lesson planning and preparation; laboratory innovations; contemporary chemistry teaching methods; and the use, improvisation and evaluation of instructional resources. It also introduces test, measurement and evaluation of chemistry learning, examines major challenges confronting science and chemistry education in Nigeria, and provides opportunities for learners to practise teaching through micro-teaching sessions and demonstrations of acquired teaching skills.

RELEVANCE STATEMENT

The course is essential for preparing competent and reflective chemistry teachers who can translate chemical knowledge into meaningful learning experiences. It enables prospective teachers to understand the chemistry curriculum, plan effective lessons, select appropriate teaching strategies and instructional resources, conduct practical activities safely, assess learners' achievement and respond creatively to challenges in chemistry education. The emphasis on micro-teaching, laboratory innovation and improvisation provides practical preparation for effective classroom teaching, particularly in schools with limited resources.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the aims, goals and objectives of science and chemistry education and relate them to effective classroom practice.
2. Examine the nature, relevance and contribution of chemistry to individual, national and technological development.
3. Critically analyse the SSS Chemistry curriculum and relate its content, objectives, methods and assessment strategies to learners' needs.
4. Demonstrate competence in pre-active and interactive teaching, lesson planning, classroom management and the use of contemporary chemistry teaching methods.

5. Select, develop, improvise and effectively use appropriate laboratory and instructional resources for teaching chemistry.
6. Apply appropriate principles of test, measurement and evaluation to assess chemistry learning and demonstrate effective teaching skills through micro-teaching.

LEARNING OUTCOMES

By the end of the course, students should be able to:

1. Distinguish between the aims, goals and objectives of science teaching.
2. Identify strengths, weaknesses, gaps and implementation challenges within the chemistry curriculum.
3. Prepare comprehensive and learner-centred chemistry lesson plans.
4. Apply appropriate contemporary methods such as inquiry-based, problem-based, cooperative, discovery and project-based learning.
5. Design and conduct meaningful chemistry laboratory activities and demonstrations.
6. Identify major challenges confronting chemistry education in Nigeria and propose realistic solutions.
7. Conduct micro-teaching sessions and critically evaluate personal and peer teaching performance.

COURSE CONTENT

- Aims, goals and objectives in science teaching
- The teaching of chemistry in schools and the relevance of the subject
- Critical analysis of the SSS chemistry curriculum
- Pre-active and interactive teaching in chemistry
- Lesson planning and preparation
- Laboratory innovations in chemistry teaching
- Contemporary methods of teaching chemistry
- Test, measurement and evaluation of chemistry learning
- Resources for chemistry teaching and learning
- Improvisation of instructional materials
- Challenges of science teaching and problems confronting chemistry education in Nigeria
- Micro-teaching sessions for demonstration of teaching skills and teaching methods learns

CATEGORY	DETAILS
Core Competencies	• Ethical awareness • Professional development • Creativity and innovation • Scientific literacy • Critical thinking
Core Values	• Objectivity • Professionalism • Respect • Integrity • Curiosity
Pedagogical Approaches	• Learner-centred approach • Peer teaching • Technology-enhanced learning • Reflective learning • Blended learning
Learning Resources	• Computers, laptops and tablets • Smartphones and relevant educational applications • Virtual chemistry laboratory platforms • Projectors and interactive displays • Educational videos and animations • Science club and science fair materials
Assessment Methods	• Class tests • Assignments • Individual presentations • Examination

REFERENCES AND FURTHER READING

1. Federal Republic of Nigeria. (2013). *National policy on education* (6th ed.). Nigerian Educational Research and Development Council.
2. Federal Republic of Nigeria. (2012). *Senior secondary school chemistry curriculum*. Nigerian Educational Research and Development Council.
3. Eze, S. O. (2020). *Teaching methods and strategies in science education*. Enugu State University Press.
4. West African Examinations Council. (2023). *Chemistry syllabus for the West African Senior School Certificate Examination (WASSCE)*. WAEC.
5. UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO.
6. Taber, K. S. (2019). *The nature of the chemical concept: Reconstructing chemical knowledge*. Routledge.
7. National Research Council. (2012). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. The National Academies Press.

MTH 121 Elementary I (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops students' ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomials, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series, The trigonometry component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and application of science, technology, engineering, social sciences, economics, and other disciplines. A strong understanding of elementary algebra and trigonometry enables

students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher-level mathematics and discipline-specific courses that require mathematical reasoning and computation. Knowledge of algebra supports the study of functions, calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer science, and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real-life and professional situations.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain and apply the basic concepts and properties of the real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials, and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.
4. Solve linear, quadratic, simultaneous, and selected higher-order equations.
5. Solve linear and quadratic inequalities and represent their solutions appropriately.
6. Represent and interpret simple algebraic relationships using tables, graphs, and equations.
7. Define and apply the basic trigonometric ratios: sine, cosine, and tangent.
8. Use trigonometric identities to simplify expressions and solve mathematical problems.
9. Apply algebraic and trigonometric methods to practical problems in science, technology, engineering, and everyday situations.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements

- Venn diagrams
- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers
- Algebra of complex numbers
- The Argand diagram
- De-Moivre's theorem, nth roots of unity
- Circular measure, trigonometric functions of angles of any magnitude
- Addition and factor formulae

CATEGORY	DETAILS
Core Competencies	• **Critical thinking** • Creativity • **Innovation 4. Reflective thinking** • **5**Collaboration • Reflective thinking • Self-development • Problem-solving skills.
Core Values	• Integrity • Team spirit • Perseverance • **Transparency** • **Tolerance** • **Honesty**
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms
Assessment Methods	• Continuous assessment • Formative Assessment • Summative assessment • **Readings** • Class work • Assignment • Group assignment • Presentations • Written Quiz

REFERENCES AND FURTHER READING

1. College Algebra – algebraic techniques, equations, functions, and graphs.
2. Elementary Trigonometry – trigonometric ratios, identities, equations, and applications.
3. Schaum's Outline of Elementary Algebra – particularly good for worked examples and practice problems.
4. Schaum's Outline of Trigonometry – useful for additional exercises and step-by-step solutions.
5. OpenStax, Algebra and Trigonometry

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology II provides students with a broad understanding of the diversity of living organisms through a comparative study of the Plant and Animal Kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plants and animals. The course equips

students with the foundational knowledge needed to appreciate the relationship between the structure, function, and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animals. It enables prospective biology teachers to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge gained is fundamental for advanced studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific observation, analytical thinking, and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the general characteristics of the Plant and Animal Kingdoms.
2. Compare the similarities and differences between plants and animals based on their external features.
3. Explain the ecological adaptations of plants and animals to different habitats.
4. Describe the basic physiological processes in living organisms, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development.
5. Explain how structure and function are related in plants and animals.
6. Discuss the importance of physiological processes in the survival of living organisms.
7. Explain the diversity and ecological significance of plants and animals.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. State the unique characteristics of plant and animal kingdoms;
3. Describe ecological adaptations in the plant and animal kingdoms;
4. Explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. Describe growth and development in plants and animals.
6. Appreciate the diversity and ecological significance of plants and animals.

COURSE CONTENT

A generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological principle • Hygiene • Classification
Core Values	• Curiosity • Thinking • Integrity • Teamwork • Self-discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical-based instruction
Learning Resources	• Biology textbooks • Charts • Models • Videos
Assessment Methods	Practical report

1. Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

CHM 210 Physical Chemistry I

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces the fundamental principles of physical chemistry, with emphasis on the kinetic behaviour of gases, thermodynamics, chemical equilibrium, reaction kinetics, photochemistry, and electrochemistry. Students examine the behaviour of real and ideal gases, thermodynamic laws, entropy, free energy, phase and reaction equilibria, reaction rates and mechanisms, elementary photochemical processes, and basic electrochemical principles.

RELEVANCE STATEMENT

The course provides a foundation for understanding the energy, spontaneity, equilibrium, and rates of chemical processes. It develops quantitative and analytical skills needed to explain chemical phenomena and supports further study in chemistry, biochemistry, materials science, environmental science, and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the kinetic theory and behaviour of ideal and real gases.
2. Apply the laws of thermodynamics to chemical processes.
3. Explain entropy, free energy, spontaneity, and equilibrium.
4. Analyse reaction rates, rate laws, and elementary reaction mechanisms.
5. Explain the basic principles of photochemical reactions.
6. Describe fundamental principles of electrochemistry and apply them to simple electrochemical systems.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. State the kinetic theory of gases and solve problems related to ideal and real gases;
2. Derive the formula for molecular velocity of gases and use the derived formula to solve problems;
3. Describe and explain the fundamental concepts of physical chemistry including those of statistical mechanics, chemical kinetics, quantum mechanics and spectroscopy;

4. Apply simple models to predict properties of chemical systems;
5. Define and state type of solutions; define different concentration terms which include molarity, normality and others, explain vapour pressure lowering of the solvent, boiling point elevation of solutions, freezing point depression of solution and measurement of osmotic pressure;
6. State ohms law and describe the electrolytic conduction, states the faraday's law and conductance law of solution and calculation on electrical conductance on different electrolyte solution.

COURSE CONTENT

- Kinetic theory of gases. science of real gases.
- The laws of thermodynamics
- Entropy and free energy
- Reactions and phase equilibria
- Reaction rates
- Rate laws
- Mechanism and theories of elementary processes
- Photochemical reactions
- Basic electrochemistry

CATEGORY	DETAILS
Core Competencies	• Calculation • Measurement • Prediction • Problem-solving • Graphing • Reasoning
Core Values	• Accuracy • Integrity • Objectivity • Discipline • Responsibility • Critical Thinking • Professionalism

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • Concept Mapping
Learning Resources	• Scientific Calculator • Periodic Table • Thermodynamic Data Tables • Electrochemical Cells • Laboratory Equipment
Assessment Methods	• Assignment • Class Tests • Quizzes • Problem-Solving Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Engel, T., & Reid, P. (2020). *Physical chemistry* (4th ed.). Pearson.
3. McQuarrie, D. A., & Simon, J. D. (1997). *Physical chemistry: A molecular approach*. University Science Books.
4. Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2017). *General chemistry: Principles and modern applications* (11th ed.). Pearson.
5. Silbey, R. J., Alberty, R. A., & Bawendi, M. G. (2005). *Physical chemistry* (4th ed.). John Wiley & Sons.
6. Zumdahl, S. S., Zumdahl, S. A., & DeCoste, D. J. (2023). *Chemistry* (11th ed.). Cengage Learning.

CHM 211 Organic Chemistry I

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course provides an advanced foundation in organic chemistry, focusing on aromatic compounds, carbohydrates, peptides and proteins, bifunctional compounds, alicyclic compounds, reaction energetics and kinetics, and organic reaction mechanisms. It develops students' understanding of substitution, elimination, addition, and rearrangement reactions, stereochemistry, and important named reactions including the Grignard and Aldol reactions. Emphasis is placed on relating molecular structure to reactivity, reaction mechanisms, synthesis, and applications.

RELEVANCE STATEMENT

The course develops students' ability **to** understand, predict, and apply organic reactions and synthetic principles. It provides essential knowledge for advanced study and applications in chemistry, biochemistry, pharmaceuticals, materials science, agriculture, and related fields.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the structures, properties, and reactions of aromatic, alicyclic, and bifunctional organic compounds.
2. Describe the structures and chemical properties of carbohydrates, peptides, and proteins.
3. Explain organic reaction energetics, kinetics, and mechanisms.
4. Apply mechanisms of substitution, elimination, addition, and rearrangement reactions.
5. Explain stereochemical principles and their applications in organic reactions.
6. Describe and apply selected named organic reactions, including Grignard and Aldol reactions.
7. Apply appropriate principles to the synthesis and transformation of simple organic compounds.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Describe and solve problems in chemistry of aromatic compounds;
2. Describe the structures of simple sugars, starch and cellulose, peptides and proteins and show the difference in their conformation structure;
3. Describe and solve problems in chemistry of bifunctional compounds;
4. Explain the mechanisms of substitution, elimination, addition and rearrangement;
5. Describe stereochemistry and its application;
6. Describe condition and pathways of the following organic reactions – Grignard reaction, Aldol and related reactions; and
7. Describe simple alicyclic carbon compounds and their synthesis.

COURSE CONTENT

- Chemistry of aromatic compounds
- Structures of simple sugars, starch and cellulose, peptides and proteins
- Chemistry of bifunctional compounds
- Energetics, kinetics and the investigation of reaction mechanisms
- Mechanisms of substitution, elimination, addition and rearrangement reactions
- Stereochemistry
- Examples of various named organic reactions such as Grignard reaction, Aldol and related reactions
- Simple alicyclic carbon compounds and their synthesis

CATEGORY	DETAILS
Core Competencies	• Synthesis • Mechanisms • Stereochemistry • Analysis • Prediction • Reactivity • Interpretation

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Objectivity • Discipline • Responsibility • Critical Thinking • Professionalism
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • Concept Mapping
Learning Resources	• Molecular Models • Reaction Mechanism Charts • Periodic Table • Laboratory Equipment • Chemicals and Reagents • Spectroscopic Data
Assessment Methods	• Assignment • Class Tests • Quizzes • Problem-Solving Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
2. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Solomons, T. W. G., Fryhle, C. B., & Snyder, S. A. (2017). *Organic chemistry* (12th ed.). John Wiley & Sons.
4. Smith, M. B. (2020). *March's advanced organic chemistry: Reactions, mechanisms, and structure* (8th ed.). John Wiley & Sons.
5. Vollhardt, K. P. C., & Schore, N. E. (2018). *Organic chemistry: Structure and function* (8th ed.). W. H. Freeman and Company.
6. Wade, L. G., Jr., & Simek, J. W. (2017). *Organic chemistry* (9th ed.). Pearson.
7. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2015). *Introduction to organic laboratory techniques: A microscale approach* (5th ed.). Cengage Learning.

CHM 217 General Chemistry Practical III

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This practical physical chemistry course develops students' competence in measuring and interpreting physicochemical properties and thermodynamic quantities through laboratory experiments. It covers pH measurement, colligative properties, partition coefficients, temperature and heat measurements, heat of neutralisation, critical solution temperature, and experimental verification of the ideal gas law. Emphasis is placed on accurate measurement, experimental procedures, quantitative calculations, data analysis, error evaluation, and scientific reporting.

RELEVANCE STATEMENT

The course connects physical chemistry theories with experimental practice, enabling students to determine important chemical and thermodynamic quantities from laboratory measurements. It develops practical, analytical, and quantitative skills essential for chemistry, chemical analysis, research, and related scientific disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Measure and determine the pH of chemical solutions accurately.

2. Determine relative molar mass using colligative properties.
3. Demonstrate partitioning between immiscible solvents and determine partition coefficients.
4. Determine temperature changes and heats of dissolution and neutralisation.
5. Determine the critical solution temperature of the water – phenol system.
6. Verify the ideal gas law and determine molar volume and the universal gas constant.
7. Analyse, interpret, and report experimental data accurately.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Describe the measurement of pH;
2. Determine the relative molar mass from the colligative properties;
3. Demonstrate the partition coefficient of two immiscible solvents;
4. Demonstrate temperature measurements and heat of dissolution, heat of neutralisation and others;
5. Determine the critical solution temperature of water-Phenol system; and
6. Measure the molar volume of a gas and universal gas constant.

COURSE CONTENT

- pH Measurement
- Determination of Relative Molar Mass from Colligative Properties
- Demonstration of Partition Coefficient in two Immiscible Solvents
- Temperature Measurement and Heat of Dissolution
- Heat of Neutralisation
- Determination of Critical Solution
- Temperature of Water- Phenol System
- Ideal Gas Law: Measuring the Molar Volume of a Gas and the Universal Gas Constant

CATEGORY	DETAILS
Core Competencies	• Measurement • Titration • Observation • Calculation • Analysis • Experimentation • Interpretation • Graphing • Accuracy • Data-handling
Core Values	• Accuracy • Integrity • Objectivity • Discipline • Responsibility • Critical Thinking • Professionalism
Pedagogical Approaches	• Practical Method • Demonstration • Inquiry-Based Learning • Guided Discovery • Problem-Based Learning • Collaborative Learning • Experiential Learning • Discussion Method • Peer Learning

CATEGORY	DETAILS
Learning Resources	• Laboratory Equipment • pH Meter • Thermometer • Calorimeter • Burettes • Pipettes • Measuring Cylinders • Volumetric Flasks • Gas Collection Apparatus • Analytical Balance • Chemicals and Reagents • Scientific Calculator • Graph Paper
Assessment Methods	• Practical Tests • Laboratory Reports • Practical Quizzes • Assignment • Data Analysis • Calculations • Graphical Analysis • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Engel, T., & Reid, P. (2020). *Physical chemistry* (4th ed.). Pearson.
3. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
4. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2015). *Introduction to organic laboratory techniques: A microscale approach* (5th ed.). Cengage Learning.
5. Shoemaker, D. P., Garland, C. W., Nibler, J. W., & McGlothlin, M. L. (2009). *Experiments in physical chemistry* (8th ed.). McGraw-Hill.
6. Zumdahl, S. S., Zumdahl, S. A., & DeCoste, D. J. (2023). *Chemistry* (11th ed.). Cengage Learning.

CHM 221 Inorganic Chemistry I

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course introduces students to the chemistry of transition metals, coordination compounds, selected p-block elements, and organometallic compounds. It covers the chemistry of first-row transition metals, basic coordination chemistry and crystal field theory, comparative chemistry of Groups 13–16 elements, organometallic chemistry, metal ions in biological systems, hard and soft acids and bases, and oxidation – reduction reactions. Emphasis is placed on understanding the relationship between electronic structure, bonding, properties, reactivity, and applications of inorganic compounds.

RELEVANCE STATEMENT

The course provides essential knowledge of inorganic and coordination chemistry and develops students' ability to explain the behaviour and applications of metals and their compounds. It provides a foundation for further study and applications in analytical chemistry, biochemistry, materials science, environmental chemistry, catalysis, and pharmaceutical chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the electronic structures, properties, and chemistry of first-row transition metals.
2. Describe the principles of coordination chemistry and elementary crystal field theory.
3. Compare the chemical properties of Ga, In, Tl; Ge, Sn, Pb; As, Sb, Bi; and Se, Te, Po.
4. Explain the basic principles and applications of organometallic chemistry.
5. Describe the roles of metal ions in selected biochemical systems.
6. Apply the concepts of hard and soft acids and bases to chemical reactions.
7. Explain oxidation – reduction processes and determine oxidation states in inorganic compounds.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. List the first-row transition elements and explain their characteristics and properties;
2. Explain crystal field theory (CFT) and draw the diagram to illustrate with examples of coordination compounds;
3. State the advantages of cft over other bonding theories;
4. Discuss the comparative Chemistry of the following elements. (I) Ga, In, Tl (II). Ge, Sn, Pb (III). As, Sb, Bi (IV). Se, Te, Po;
5. Define organometallic chemistry;
6. List the roles of metals in biochemical systems;
7. Discuss the concepts of hard and soft acids and bases;
8. Explain oxidation and reduction reactions; and
9. Illustrate the above (8) with appropriate reactions.

COURSE CONTENT

- Chemistry of first row transition metals
- Introduction to coordination chemistry including elementary treatment of crystal field theory
- Comparative Chemistry of the following elements: (a) Ga, In, TI, (b) Ge, Sn, Pb, (c) As, Sb, Bi (d) Se, Te, Po
- Elementary introduction to organometallic chemistry
- Role of metals in biochemical systems
- Concepts of hard and soft acids and bases

- Oxidation and reduction reactions

CATEGORY	DETAILS
Core Competencies	• Comparison • Bonding • Interpretation • Reactivity • Problem-solving
Core Values	• Accuracy • Integrity • Objectivity • Discipline • Curiosity • Creativity • Teamwork • Professionalism
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method • Concept Mapping
Learning Resources	• Periodic Table • Molecular Models • Crystal Field Diagrams
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
2. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
3. Weller, M., Overton, T., Rourke, J., & Armstrong, F. (2018). *Inorganic chemistry* (7th ed.). Oxford University Press.
4. Greenwood, N. N., & Earnshaw, A. (2012). *Chemistry of the elements* (2nd ed.). Butterworth-Heinemann.
5. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F., & Hagerman, M. (2018). *Shriver & Atkins' inorganic chemistry* (6th ed.). Oxford University Press.
6. Elschenbroich, C. (2020). *Organometallics* (4th ed.). Wiley-VCH.
7. Huheey, J. E., Keiter, E. A., & Keiter, R. L. (1993). *Inorganic chemistry: Principles of structure and reactivity* (4th ed.). HarperCollins.

CHM 208 General Chemistry Practicals IV

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This practical organic chemistry course develops students' laboratory skills through experiments involving the preparation, identification, separation, and analysis of organic compounds. It covers the preparation of esters, aldehydes and ketones, dehydration of alcohols, vinegar analysis, chromatography, thin-layer chromatography, and qualitative analysis of common functional groups. Emphasis is placed on laboratory techniques, chemical reactions, observation, quantitative analysis, data interpretation, safety, and scientific

RELEVANCE STATEMENT

The course provides practical experience in organic synthesis, separation, purification, and chemical analysis. It enables students to apply theoretical organic chemistry principles in the laboratory and develops skills relevant to research, pharmaceutical chemistry, industrial chemistry, food analysis, and quality control.

COURSE OBJECTIVES

The objectives of this course are to:

1. Prepare simple esters, aldehydes, and ketones using appropriate laboratory procedures.
2. Demonstrate the dehydration of alcohols and explain the reaction involved.
3. Determine the acidity of vinegar through quantitative analysis.
4. Separate and identify organic compounds using chromatography and thin-layer chromatography.
5. Identify common functional groups using appropriate qualitative tests.
6. Apply appropriate laboratory techniques and safety procedures.
7. Record, analyse, interpret, and report experimental results accurately.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Identify general laboratory rules;
2. Describe the processes involved in the preparation of simple organic compounds (esters, aldehydes and ketones);
3. Describe the analysis of vinegar;
4. Demonstrate a simple experiment on thin layer chromatography;
5. Perform an experiment on the dehydration of alcohol; and
6. Conduct experiments on qualitative analysis of common functional groups.

COURSE CONTENT

- The Preparation of Esters
- The preparation of Aldehydes and Ketones
- Vinegar Analysis
- Chromatography
- Thin Layer Chromatography
- Dehydration of Alcohol
- Qualitative Analysis of Common Functional Groups

CATEGORY	DETAILS
Core Competencies	• Synthesis • Analysis • Identification • Separation • Purification • Experimentation • Reporting • Safety
Core Values	• Accuracy • Integrity • Discipline • Patience • Objectivity • Teamwork • Creativity • Professionalism
Pedagogical Approaches	• Practical Method • Demonstration • Guided Discovery • Problem-Based Learning • Collaborative Learning • Experiential Learning • Discussion Method • Peer Learning

CATEGORY	DETAILS
Learning Resources	• Laboratory Equipment • Chemicals and Reagents • Glassware • Heating Apparatus • Distillation Apparatus • Chromatography Materials • TLC Plates • Developing Chambers • Indicators • Analytical Balance
Assessment Methods	• Practical Tests • Laboratory Reports • Practical Quizzes • Assignments • End-of-Course Examination

REFERENCES AND FURTHER READING

1. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2015). *Introduction to organic laboratory techniques: A microscale approach* (5th ed.). Cengage Learning.
2. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Mayo, D. W., Pike, R. M., & Forbes, D. C. (2011). *Microscale organic laboratory: With multistep and multiscale syntheses* (5th ed.). John Wiley & Sons.
4. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (1989). *Vogel's textbook of practical organic chemistry* (5th ed.). Longman Scientific & Technical.
5. Williamson, K. L., & Masters, K. M. (2017). *Macroscale and microscale organic experiments* (7th ed.). Cengage Learning.
6. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.

CHM 313 Analytical Chemistry I

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course introduces the fundamental principles and applications of analytical chemistry, with emphasis on errors and statistical treatment of experimental data, sampling theory, chemical methods of analysis, physicochemical methods, optical methods, and separation techniques. Students develop skills in quantitative analysis using volumetric and gravimetric methods, as well as data processing, interpretation, presentation, and evaluation of analytical results.

RELEVANCE STATEMENT

The course develops students' ability to **obtain** accurate, precise, reliable, and meaningful analytical results. It provides essential skills for chemical analysis in research, environmental monitoring, pharmaceutical analysis, food chemistry, industrial quality control, and other laboratory-based fields.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain sources and types of errors in chemical measurements.
2. Apply statistical methods to analyse and interpret experimental data.
3. Explain sampling principles and apply appropriate sampling techniques.
4. Perform volumetric and gravimetric analyses accurately.
5. Describe fundamental physicochemical and optical methods of analysis.
6. Apply appropriate separation techniques in chemical analysis.
7. Present and interpret analytical data using appropriate scientific methods.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Explain analytical processes which include description of chemist as a problem solver;
2. Describe and differentiate forms of error;
3. Explain its implication on laboratory analysis;
4. State different statistical tool use in treatment of data;

5. Solve practical problems using the statistical tools;
6. Define sampling and give reasons for sampling in field work;
7. State and describe different sampling techniques;
8. State different forms of sample collection and processing;
9. Describe volumetric method of analysis and solve some practical problems; and
10. Describe gravimetric method of analysis and solve some practical problems.

COURSE CONTENT

Pre-Requisite CHM 101 and 102

Theory of errors; and statistical treatment of data: Theory of sampling. Chemical methods of analysis including volumetric, gravimetric, data analysis and presentation. Physico-chemical methods. Optical methods of analysis. separation methods.

CATEGORY	DETAILS
Core Competencies	• Measurement • Sampling • Titration • Gravimetry • Calculation • Statistics • Analysis • Separation • Accuracy • Precision
Core Values	• Integrity • Objectivity • Responsibility • Discipline • Reliability • Transparency • Professionalism

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Case-Based Learning
Learning Resources	• Analytical Balance • Volumetric Glassware • Titration Apparatus • Gravimetric Equipment • Spectrophotometer • Colorimeter • Chromatography Equipment • Separation Apparatus
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
2. Harvey, D. (2020). *Analytical chemistry 2.1*. DePauw University.
3. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2014). *Fundamentals of analytical chemistry* (9th ed.). Cengage Learning.
4. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
5. Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. J. K. (2000). *Vogel's quantitative chemical analysis* (6th ed.). Prentice Hall.
6. Miller, J. N., & Miller, J. C. (2018). *Statistics and chemometrics for analytical chemistry* (7th ed.). Pearson.
7. Christian, G. D., Dasgupta, P. K., & Schug, K. A. (2014). *Analytical chemistry* (7th ed.). John Wiley & Sons.

CHM 314 Structure and Bonding

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course introduces the fundamental principles of quantum chemistry and molecular structure, focusing on quantum states, atomic orbitals, orbital shapes and energies, valence theory, electron-pair repulsion, atomic spectra, symmetry, molecular geometry, and molecular orbital theory. It also examines experimental methods for determining molecular structures, bond lengths and bond angles, together with the structure and chemistry of selected main-group element compounds. Emphasis is placed on relating electronic structure to molecular geometry, bonding, properties, and chemical behaviour**.**

RELEVANCE STATEMENT

The course provides a foundation for understanding why atoms bond, how molecules acquire their shapes, and how molecular structure influences chemical properties. It develops conceptual and analytical skills essential for further study in inorganic chemistry, organic chemistry, spectroscopy, materials chemistry, and related fields.

COURSE OBJECTIVES

1. Explain quantum states, atomic orbitals, orbital shapes, and orbital energies.

2. Apply simple valence theories and electron-pair repulsion principles to molecular structures.
3. Explain atomic spectra and their relationship to electronic transitions.
4. Describe symmetry elements and molecular symmetry.
5. Apply molecular orbital theory to explain chemical bonding.
6. Determine and interpret molecular geometry, bond lengths, and bond angles.
7. Explain the structures and chemistry of selected main-group element compounds.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Explain the idea of quantum states, orbital, shape and energy;
2. Explain simple valency theory, electron repulsion theory and atomic spectra;
3. Explain symmetry, molecular geometry and structure, and molecular orbital theory of bonding;
4. Sketch to illustrate with specific examples for item (3) above;
5. Express how molecular orbital theory of bounding explains the magnetic properties in main group compounds;
6. Explain the methods used in the determination of molecular shapes. bond lengths and angles; and
7. Explain with the use model the structure and chemistry of some of the representatives of main group elements.

COURSE CONTENT

Pre-Requisite CHM 101 and 102

Idea of quantum states, orbitals, shape; and energy. Simple valence theory, electron repulsion theory, atomic spectra. Symmetry, molecular geometry and structure, molecular orbital theory of bonding. Methods of determining molecular shape, bond lengths and angles. The structure and chemistry of some representative main group element compounds.

CATEGORY	DETAILS
Core Competencies	• Reasoning • Modelling • Prediction • Interpretation • Visualisation • Classification • Comparison • Communication
Core Values	• Accuracy • Integrity • Curiosity • Objectivity • Creativity • Discipline • Critical thinking • Teamwork
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Case-Based Learning
Learning Resources	• Molecular Models • Periodic Table • Orbital Diagrams • Molecular Orbital Diagrams • Symmetry Charts • Spectroscopic Data

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
3. Levine, I. N. (2014). *Quantum chemistry* (7th ed.). Pearson.
4. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
5. McQuarrie, D. A., & Simon, J. D. (1997). *Physical chemistry: A molecular approach*. University Science Books.
6. Weller, M., Overton, T., Rourke, J., & Armstrong, F. (2018). *Inorganic chemistry* (7th ed.). Oxford University Press.
7. Hollas, J. M. (2004). *Modern spectroscopy* (4th ed.). John Wiley & Sons.

CHM 323 Chemical Kinetics

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces the principles of chemical kinetics, focusing on reaction rates, reaction order, molecularity and rate laws. It examines methods for determining reaction order, integrated rate equations and half-life, as well as factors affecting reaction rates. The course also covers Arrhenius, collision and transition state theories, activated complexes, unimolecular gaseous reactions, steady-state approximation and reaction mechanisms.

RELEVANCE STATEMENT

The course provides students with the knowledge needed to understand why chemical reactions occur at different rates and how their rates can be controlled**.** It is relevant to

industrial chemistry, catalysis, pharmaceutical chemistry, environmental chemistry and laboratory practice. Understanding reaction kinetics also enables students to interpret experimental data, predict reaction behaviour and explain reaction mechanisms.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain reaction rate, reaction order, molecularity and rate laws.
2. Determine reaction order using appropriate experimental and mathematical methods.
3. Derive and apply integrated rate equations for first-, second- and third-order reactions, including half-life calculations.
4. Explain the factors affecting reaction rates, including concentration, temperature, catalysts and solvent effects.
5. Explain the Arrhenius, collision and transition state theories of reaction rates and their relationship.
6. Describe activated complexes and the factors influencing their formation.
7. Explain unimolecular gaseous decomposition reactions and the steady-state approximation.
8. Analyse reaction mechanisms and relate proposed mechanisms to experimentally determined rate laws.

LEARNING OUTCOMES

By the end of the course the students should be able to:

1. Define and distinguish reaction rate, reaction order, molecularity and rate law.
2. Determine the order of a reaction from experimental data using appropriate methods.
3. Derive and apply integrated rate equations for first-, second- and third-order reactions and calculate their half-lives.
4. Explain how concentration, temperature, catalysts and solvent effects influence reaction rates.
5. Use the Arrhenius equation to determine activation energy and related kinetic parameters.
6. Explain and compare collision theory and transition state theory, including the formation of the activated complex.
7. Analyse unimolecular gaseous decomposition reactions, apply the steady-state approximation and relate reaction mechanisms to observed rate laws.

COURSE CONTENT

- The reaction rate: Reaction order
- Molecularity The rate law
- Experimental techniques for determining order reactions
- Derivation of first-order kinetic equation
- Example of first order reactions, second order reactions, third order reactions
- The half-lite of a reaction
- Methods for determining the reaction order
- Factors affecting rates of reactions
- Solvent effects
- The Arrhenius theory of reaction rates
- The collision theory of reaction rates
- The transition state theory of reaction rates, the activated complex relationship between Arrhenius and Transition state theories Unimolecular gaseous decomposition reactions Steady state of approximation Reaction mechanisms

CATEGORY	DETAILS
Core Competencies	• Reaction Mechanism Analysis • Quantitative and Mathematical Skills • Experimental and Data Analysis Skills • Scientific Reasoning and Critical Thinking • Problem-Solving Skills
Core Values	• Scientific Integrity • Accuracy and Precision • Critical Thinking • Curiosity and Inquiry • Responsibility

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach • Cooperative Learning • Demonstration Method
Learning Resources	• Physical Chemistry Textbooks • Chemistry Laboratory Equipment and Chemicals • Graphs, Charts and Reaction Profiles • Molecular and Reaction Models • Calculators and Data Analysis Tools
Assessment Methods	• Class Tests and Quizzes • Assignments and Tutorial Exercises • Kinetic Calculations and Problem-Solving Exercises • Practical/Laboratory Assessment • Data Analysis and Interpretation

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2018). *Atkins' physical chemistry* (11th ed.). Oxford University Press.
2. Engel, T., & Reid, P. (2019). *Physical chemistry* (4th ed.). Pearson.
3. Levine, I. N. (2009). *Physical chemistry* (6th ed.). McGraw-Hill.

CHM 324 Thermodynamics

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course introduces the principles of thermodynamics and chemical equilibrium, covering the laws of thermodynamics, thermodynamic properties, thermochemistry, entropy, Gibbs free energy and equilibrium. It also examines phase equilibria, the Clapeyron equation, equilibrium constants, factors affecting chemical equilibrium, buffer solutions, polyfunctional acids and bases, and hydrolysis of salts.

RELEVANCE STATEMENT

The course provides a foundation for understanding energy changes, spontaneity and equilibrium in chemical systems. It enables students to explain and predict chemical processes and has applications in industrial chemistry, environmental chemistry, biological systems, energy conversion and laboratory practice**.** The knowledge gained also supports further study of physical chemistry and related scientific disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain fundamental thermodynamic concepts, terms and the laws of thermodynamics.
2. Apply the first law of thermodynamics to enthalpy, heat capacity, thermochemistry and energy changes in chemical reactions.
3. Explain and apply Hess's law, bond energies and enthalpies of formation, solution and reaction.
4. Explain entropy, the second and third laws of thermodynamics, and the criteria for spontaneity and equilibrium.
5. Apply Gibbs free energy and the equilibrium constant to chemical and phase equilibria.
6. Explain the law of chemical equilibrium and the effects of pressure, temperature, concentration and catalysts on equilibrium systems.
7. Explain buffer solutions, polyfunctional acids and bases, and salt hydrolysis.
8. Apply thermodynamic and equilibrium principles to solve quantitative and practical chemical problems.

LEARNING OUTCOMES

By the end of the course the students should be able to:

1. Define and explain fundamental thermodynamic terms and concepts, including temperature, heat, work, system, surroundings and thermodynamic functions.
2. Apply the first law of thermodynamics to calculate heat, work, internal energy and enthalpy changes.
3. Calculate heat capacities and energy changes for gases and reversible adiabatic processes.
4. Determine enthalpy changes using Hess's law, standard enthalpies of formation, bond energies and heats of solution.
5. Explain entropy and use the second and third laws of thermodynamics to assess spontaneity and equilibrium.
6. Calculate and interpret Gibbs free energy and relate it to the equilibrium constant and phase equilibrium, including applications of the Clapeyron equation.
7. Explain and apply the principles of chemical equilibrium, including equilibrium constants and the effects of concentration, pressure, temperature and catalysts.
8. Explain and solve problems involving buffer solutions, polyfunctional acids and bases, and hydrolysis of salts of weak acids and weak bases.

COURSE CONTENT

- The nature of thermodynamics
- And definition of some thermodynamic terms, including temperature
- The first law of thermodynamics
- Enthalpy
- Heat capacity of gases
- Reversible adiabatic processes, thermochemistry
- Standard states Enthalpy of reactions
- Hess's law
- Relationship between hear of reaction at constant pressure and at constant volume
- Heat of solution
- Enthalpy of formation of ions in solution Bond energies
- The second law of thermodynamics
- Bohr Energy Circle

- Molecular interpretation of entropy Examples of entropy calculations Criteria for equilibrium
- The work function and Gibb's Free Energy Free energy and the equilibrium constant
- Equilibrium between phases
- The Clapeyron equation
- The third law of thermodynamics Law of chemical equilibrium
- Equilibrium constants expressed in different units Variables affecting chemical equilibrium Effects of pressure, temperature, concentration and catalyst Buffer solutions
- Poly functional acids and bases
- Hydrolysis: Salts of a weak acid and a weak base

CATEGORY	DETAILS
Core Competencies	• Thermodynamic Knowledge and Understanding • Quantitative and Mathematical Skills • Chemical Equilibrium Analysis • Problem-Solving Skills • Scientific Reasoning and Critical Thinking • Experimental and Data Analysis Skills • Scientific Communication Skills • Application of Thermodynamic Principles
Core Values	• Scientific Integrity • Accuracy and Precision • Critical Thinking • Creativity and Innovation • Curiosity and Inquiry
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach

CATEGORY	DETAILS
Learning Resources	• Physical Chemistry and Thermodynamics Textbooks • Thermodynamics Laboratory Equipment and Chemicals • Thermodynamic Models and Molecular Kits • Graphs, Charts and Thermodynamic Tables • Calculators and Data Analysis Tools
Assessment Methods	• Class Tests and Quizzes • Assignments and Tutorial Exercises • Thermodynamic Calculations and Problem-Solving Exercises • Practical/Laboratory Assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2018). *Atkins' physical chemistry* (11th ed.). Oxford University Press.
2. Engel, T., & Reid, P. (2019). *Physical chemistry* (4th ed.). Pearson.
3. Levine, I. N. (2009). *Physical chemistry* (6th ed.). McGraw-Hill.
4. Smith, J. M., Van Ness, H. C., Abbott, M. M., & Swihart, M. T. (2018). *Introduction to chemical engineering thermodynamics* (8th ed.). McGraw-Hill Education.

CHM 325 Chemistry Practical V

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course develops practical skills in inorganic, physical and organic chemistry, with emphasis on synthesis, characterisation and chemical analysis. It covers the synthesis and characterisation of inorganic complexes, determination of enthalpies of neutralisation and combustion, preparation of selected benzene derivatives, and qualitative tests for proteins, carbohydrates, sucrose, glucose and lipids.

RELEVANCE STATEMENT

The course provides students with hands-on laboratory experience in chemical synthesis, characterisation, thermochemical measurements and biochemical analysis. It strengthens

practical competence in handling chemicals, carrying out experiments, analysing results and applying chemical principles to real substances. These skills are relevant to teaching, research, industrial chemistry, pharmaceuticals, food analysis and quality control.

COURSE OBJECTIVES

The objectives of this course are to:

1. Develop practical skills in the synthesis and characterisation of inorganic complexes.
2. Apply appropriate laboratory techniques for determining enthalpies of neutralisation and combustion.
3. Develop skills in the synthesis and purification of selected benzene derivatives.
4. Perform qualitative tests for proteins, carbohydrates, sucrose, glucose and lipids.
5. Apply appropriate laboratory safety procedures during chemical experiments.
6. Develop skills in observation, measurement, data collection and interpretation.
7. Relate experimental observations to relevant chemical principles and reactions.
8. Communicate experimental findings accurately through laboratory reports and scientific discussions.

LEARNING OUTCOMES

By the end of the course the students should be able to:

1. Synthesise and characterise selected inorganic complexes using appropriate laboratory techniques.
2. Determine and calculate enthalpies of neutralisation and combustion from experimental data.
3. Carry out the synthesis and basic characterisation of selected benzene derivatives.
4. Perform and interpret qualitative tests for proteins, carbohydrates, sucrose, glucose and lipids.
5. Demonstrate safe and appropriate handling of laboratory equipment, chemicals and experimental materials.
6. Record, analyse and interpret experimental observations and results using appropriate chemical principles.
7. Identify sources of experimental error and suggest measures for improving the accuracy and reliability of results.
8. Prepare and present clear laboratory reports containing appropriate procedures, results, calculations, discussions and conclusions.

COURSE CONTENT

- Synthesis and characterisation of inorganic complexes
- Determination of enthalpies of neutralisation and combustion
- Synthesis of some benzene derivatives
- Tests for proteins, carbohydrates, sucrose, glucose and lipids

CATEGORY	DETAILS
Core Competencies	• Chemical Synthesis and Characterisation Skills • Thermochemical Measurement Skill • Qualitative Analytical Skills • Experimental and Data Analysis Skills • Laboratory Safety and Equipment Handling
Core Values	• Scientific Integrity • Accuracy and Precision • Critical Thinking • Creativity and Innovation • Curiosity and Inquiry
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach
Learning Resources	• Calorimeter and Thermochemical Apparatus • Molecular Models and Structural Charts • Qualitative Analysis Reagents • Laboratory Manuals and Practical Guides
Assessment Methods	• Practical/Laboratory Assessment • Laboratory Reports • Chemical Synthesis Exercises • Thermochemical Calculations • Qualitative Analysis Tests • Class Tests and Quizzes • End of semester examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2018). *Atkins' physical chemistry* (11th ed.). Oxford University Press.
2. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
3. Housecroft, C. E., & Sharpe, A. G. (2018). *Inorganic chemistry* (5th ed.). Pearson.
4. McMurry, J. (2016). *Organic chemistry* (9th ed.). Cengage Learning.

Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2014). *Inorganic chemistry* (5th ed.). Pearson.

Degree Course Descriptions (400–500 Level)

CHM 401 Physical Chemistry II

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course provides an advanced treatment of chemical thermodynamics and statistical thermodynamics, focusing on the Gibbs function, ideal and non-ideal solutions, electrolytes, colligative properties, and applications to biochemical systems. Students explore the relationship between macroscopic thermodynamic properties and molecular behaviour, with emphasis on chemical equilibrium, solution properties, activity, ionic interactions, and thermodynamic principles relevant to biological processes.

RELEVANCE STATEMENT

The course develops students' ability to apply thermodynamic principles to chemical and biochemical systems. It provides a foundation for understanding solution behaviour, electrolyte properties, molecular interactions, and biochemical processes, with applications in chemistry, biochemistry, pharmaceuticals, environmental science, and chemical research.

COURSE OBJECTIVES

1. Explain the Gibbs function and apply it to chemical processes and equilibrium.
2. Apply the principles of chemical thermodynamics to chemical and biochemical systems.
3. Explain the basic concepts of statistical thermodynamics and their relationship to molecular behaviour.
4. Distinguish between ideal and non-ideal solutions and explain their properties.
5. Explain the properties and behaviour of electrolyte solutions.
6. Apply colligative property principles to chemical systems.
7. Apply thermodynamic principles to selected biochemical processes.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Explain Gibbs Energy; describe spontaneous process;

2. Describe position entropy and why it si an oversimplification of true entropy; predict the sign of entropy change for the system (ΔSsys) for physical and chemical changes;
3. Describe why the entropy of a gas is greater than that of a liquid and a solid, and why the entropy of a liquid is greater than that of a solid;
4. State the Third Law of Thermodynamics and describe its significance;
5. Describe the relationship between the change in free energy and the maximum amount of work that can be done by the system;
6. Describe why a physical or chemical change is spontaneous only if δg is negative;
7. Calculate standard free energy changes by using: δgo = δho – tδso
8. Predict whether a physical or chemical change is spontaneous given the temperature and the enthalpy and entropy changes;

COURSE CONTENT

Pre-requisite –CHM 210

- A review of Gibbs Function
- Chemical thermodynamics
- Introduction to statistical thermodynamics
- Ideal solutions and non-Ideal solutions
- Properties of electrolytes
- Colligative Properties
- Studies on biochemical systems

CATEGORY	DETAILS
Core Competencies	• Calculation • Analysis • Interpretation • Prediction • Modelling • Problem-solving • Data Analysis • Reasoning

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking • Scientific Creativity • Teamwork
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning
Learning Resources	• Thermodynamic Data Tables • Molecular Models • Statistical Thermodynamics Charts • Scientific Calculator
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Calculations • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Engel, T., & Reid, P. (2020). *Physical chemistry* (4th ed.). Pearson.
3. McQuarrie, D. A., & Simon, J. D. (1997). *Physical chemistry: A molecular approach*. University Science Books.
4. McQuarrie, D. A. (2000). *Statistical mechanics*. University Science Books.
5. Levine, I. N. (2009). *Physical chemistry* (6th ed.). McGraw-Hill.
6. Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman.

CHM 402 Inorganic Chemistry II

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course provides a comprehensive foundation in inorganic chemistry, covering the electronic structures, properties, reactions, and applications of the elements and their compounds. It examines the noble gases, hydrogen, Groups IA and IIA, Groups 13–16, halogens, and transition elements. The course also introduces metal extraction and separation, coordination chemistry, ligand and crystal field theories, organometallic chemistry, radiochemistry, radioactivity, and the role of metals in biological systems. Emphasis is placed on periodic trends, comparative chemistry, bonding, reactivity, and applications of inorganic compounds.

RELEVANCE STATEMENT

The course provides essential knowledge for understanding the structure, properties, reactions, and applications of inorganic substances**.** It develops students' ability to relate periodic trends and electronic structure to chemical behaviour and provides a foundation for further study in coordination chemistry, materials chemistry, analytical chemistry, radiochemistry, biochemistry, environmental chemistry, and related fields.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the electronic structures and general properties of the major groups of elements.

2. Compare the chemistry and periodic trends of Groups IA, IIA, and Groups 13–17 elements.
3. Explain the chemistry and applications of transition elements and their compounds.
4. Describe the principles of metal extraction and separation.
5. Explain the basic principles of coordination and organometallic chemistry, including ligand and crystal field theories.
6. Explain radioactivity, radiochemistry, and the relationship between radioactivity and the periodic table.
7. Describe the roles and importance of selected metals in living systems.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Analyse inorganic chemistry information;
2. Demonstrate and apply knowledge of inorganic chemistry;
3. Explain the electronic structure and general properties of group 1A and Group IIA elements;
4. Compare Group IA and Group IIA in terms of the parameters mentioned in 3 above;
5. Explain the chemistry of Boron; carbon and Silicon; Nitrogen and phosphorus; Oxygen and sulphur;
6. Explain the periodic properties of the transition metals and to use these to predict and/or rationalise the chemistry of these metal ions and their complexes;
7. Use Crystal Field Theory to explain and understand some of the key features of complexes of the first-row transition metals including their shapes, colours, and magnetic properties;
8. Explain the roles of metals in living systems;

COURSE CONTENT

Pre-requisite –CHM 212

The Noble gases. Hydrogen. Electronic structure and general properties and comparative study of Group IA and Group IIA elements. Chemistry of Boron; Carbon and Silicon; Nitrogen and Phosphorus; Oxygen and Sulphur. The halogens. Transition elements. Separation of metals. Introduction to co-ordination chemistry. Introductory organo-metallic chemistry. Ligand and Crystal field theories. Introduction to radiochemistry. Radioactivity and the periodic table. Role of metals in living systems.

CATEGORY	DETAILS
Core Competencies	• Classification • Comparison • Prediction • Analysis • Extraction • Separation • Reactivity • Problem-solving
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking • Scientific Creativity • Teamwork
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning
Learning Resources	• Periodic Table • Molecular Models • Crystal Field Diagrams • Coordination Models • Reaction Charts

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Calculations • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
2. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
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4. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F., & Hagerman, M. (2018). *Shriver & Atkins' inorganic chemistry* (6th ed.). Oxford University Press.
5. Greenwood, N. N., & Earnshaw, A. (2012). *Chemistry of the elements* (2nd ed.). Butterworth-Heinemann.
6. Elschenbroich, C. (2020). *Organometallics* (4th ed.). Wiley-VCH.
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CHM 403 Organic Chemistry II

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course provides an advanced study of organic and heterocyclic chemistry, focusing on aromatic and alicyclic compounds, polycyclic systems, heterocyclic compounds, reactive intermediates, and organic rearrangement reactions. It examines the structures, properties, reactivities, and mechanisms of selected organic compounds, including Beckmann and Baeyer–Villiger rearrangements. The course also introduces the application of organic and analytical chemistry to forensic analysis of biological, pharmaceutical, organic, and macromolecular samples.

RELEVANCE STATEMENT

The course develops students' ability to understand and apply advanced organic reaction mechanisms and analytical principles**.** It provides relevant knowledge and skills for applications in pharmaceutical chemistry, forensic science, biochemistry, environmental analysis, chemical research, and industrial quality control.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the structures, properties, and reactions of aromatic, alicyclic, polycyclic, and heterocyclic compounds.
2. Classify and explain the chemistry of oxygen-, nitrogen-, and sulfur-containing heterocycles.
3. Explain the formation, stability, and reactions of major reactive intermediates.
4. Describe selected organic rearrangement reactions and their mechanisms.
5. Apply mechanistic principles to predict products of organic reactions.
6. Explain basic approaches to the forensic analysis of biological, pharmaceutical, organic, and macromolecular samples.
7. Interpret analytical data for the identification of organic compounds.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Distinguish between aromatic and Alicyclic compounds by their structures;
2. Identify the properties of aromatic and Alicyclic compounds, and the chemical
3. Outline the completed electrophilic aromatic substitution reactions of the
4. Describe the Reactive intermediates – carbocations, carbanions, carbenes, nitrenes;
5. Express the rearrangement reactions such as, Beckmann, Baeyer-Villiger and others;
6. Illustrate with various reaction mechanisms and types; and
7. Organise Forensic analysis of biological samples, pharmaceutical samples, organic analytes and macromolecular samples.

COURSE CONTENT

Pre –requisite –CHM 211

Aromatic and Alicyclic chemistry. Survey of representative polycyclic compounds. Heterocyclic Chemistry (3,4,5 and 6-membered ring of O, N, S heterocyclic compounds).

Reactive intermediates – carbocations, carbanions, carbenes, nitrenes and others. Selected rearrangement reactions such as Beckmann, Baeyer-Villiger and others to illustrate various reaction mechanisms and types. Forensic analysis of biological samples, pharmaceutical samples, organic analytes and macromolecular samples.

CATEGORY	DETAILS
Core Competencies	• Classification • Synthesis • Mechanisms • Analysis • Identification • Interpretation • Prediction • Separation • Characterisation • Reporting
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking • Scientific Creativity • Teamwork
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning

CATEGORY	DETAILS
Learning Resources	• Molecular Models • Reaction Mechanism Charts • Spectroscopic Data • Chromatography Equipment • Spectrometers
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Calculations • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
2. Joule, J. A., & Mills, K. (2010). *Heterocyclic chemistry* (5th ed.). Wiley-Blackwell.
3. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
4. Smith, M. B. (2020). *March's advanced organic chemistry: Reactions, mechanisms, and structure* (8th ed.). John Wiley & Sons.
5. Silverstein, R. M., Webster, F. X., Kiemle, D. J., & Bryce, D. L. (2014). *Spectrometric identification of organic compounds* (8th ed.). John Wiley & Sons.
6. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
7. Saferstein, R. (2018). *Criminalistics: An introduction to forensic science* (13th ed.). Pearson.
8. Houck, M. M., & Siegel, J. A. (2015). *Fundamentals of forensic science* (3rd ed.). Academic Press.

CHM 404 Atomic & Molecular Structure & Symmetry

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an advanced foundation in quantum chemistry, molecular orbital theory, spectroscopy, and chemical symmetry. It examines the Schrödinger equation, the electronic structure of the helium atom, spin and the Pauli exclusion principle, the hydrogen molecule, and the comparison of molecular orbital and valence bond theories. The course also covers resonance, configuration interaction, Coulson–Fischer functions, molecular orbitals of diatomic molecules, π-electron theory, Hückel theory, Walsh rules, atomic and molecular spectroscopy, angular momentum, Russell–Saunders coupling, and applications of symmetry in chemistry.

RELEVANCE STATEMENT

The course develops students' ability to relate quantum-mechanical principles to molecular structure, bonding, spectroscopy, and chemical behaviour. It provides essential theoretical and analytical skills for advanced studies in physical chemistry, inorganic chemistry, spectroscopy, computational chemistry, materials science, and molecular research.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the basic principles and applications of the Schrödinger equation to simple atomic and molecular systems.
2. Describe the electronic structure of helium and hydrogen molecules, including spin and the Pauli exclusion principle.
3. Compare molecular orbital and valence bond theories and explain resonance and configuration interaction.
4. Apply Coulson–Fischer, Hückel, and Walsh approaches to molecular bonding and structure.
5. Explain atomic and molecular spectra, including rotational, vibrational, and electronic transitions.
6. Explain orbital and spin angular momentum and Russell–Saunders coupling.
7. Apply spectroscopic data to determine molecular bond lengths and bond angles.

8. Apply symmetry principles to the analysis of chemical structures and molecular properties.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Illustrate the Schrodinger wave equation for the hydrogen molecule and ion;
2. Define Pauli Exclusion Principle and the Hund's rule;
3. Illustrate electron configurations for atoms in either the subshell or orbital box notations;
4. Draw molecular orbital diagrams for diatomic molecules;
5. Define modern valence theory;
6. Illustrate Walsh rules with specific examples;
7. Explain the theory of electronic spectroscopy;
8. Explain Franck-Condon Principle;

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COURSE CONTENT

- Schrödinger equation
- Helium atom, ground and excited states, Spin and Pauli Exclusion Principle
- Hydrogen molecule
- Comparison of molecular orbital and valence bond theory, concept of resonance and configuration interaction
- Coulson Fischer function
- Molecular orbitals for diatomic molecules
- Simple pi electron theory, Huckel theory
- Walsh rules
- Rotational, vibrational and electronic spectra
- Applications for determining bond lengths and angles
- Atomic spectra, Russell Saunders coupling, orbital and spin angular momentum
- Use of symmetry in Chemistry

CATEGORY	DETAILS
Core Competencies	• Calculation • Modelling • Analysis • Interpretation • Prediction • Spectroscopy • Symmetry • Visualisation • Reasoning
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking • Scientific Creativity • Teamwork
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning
Learning Resources	• Molecular Models • Molecular Orbital Diagrams • Symmetry Charts • Character Tables • Spectroscopic Data • Spectrometers

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Calculations • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Levine, I. N. (2014). *Quantum chemistry* (7th ed.). Pearson.
3. McQuarrie, D. A., & Simon, J. D. (1997). *Physical chemistry: A molecular approach*. University Science Books.
4. McWeeny, R. (1989). *Methods of molecular quantum mechanics* (2nd ed.). Academic Press.
5. Hollas, J. M. (2004). *Modern spectroscopy* (4th ed.). John Wiley & Sons.
6. Herzberg, G. (1989). *Molecular spectra and molecular structure: Vol. 1. Spectra of diatomic molecules* (2nd ed.). Krieger Publishing Company.
7. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.

CHM 415 Petroleum Chemistry

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the **chemistry, technology, applications, and industrial significance of petroleum and petrochemical resources.** It covers the nature, classification, composition, and distribution of crude petroleum and natural gas, petroleum biomarkers, refining processes and products, petrochemical feedstocks, aviation fuels, lubricants, hydraulics in fuel transportation, and the fundamentals of electricity and electrical safety in petroleum operations. Emphasis is placed on the **Nigerian petroleum industry, industrial applications, safety, sustainability, and future energy prospects.**

Reference Statement

The course provides students with knowledge and practical understanding of the **petroleum and petrochemical industry and its role in energy supply and industrial development**. It develops competencies relevant to petroleum operations, refining, petrochemical production, fuel technology, lubrication, pipeline systems, industrial safety, and Nigeria's energy sector.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the nature, composition, classification, and formation indicators of crude petroleum and natural gas.
2. Describe the distribution and importance of petroleum and natural gas resources globally and in Nigeria.
3. Explain major petroleum refining processes and identify important refinery products.
4. Describe the role of petrochemicals as industrial raw materials and assess prospects for Nigeria's petrochemical industry.
5. Explain the properties, applications, and future development of aviation fuels and lubricants.
6. Apply basic principles of hydraulics, fuel transportation, lubrication, and wear to petroleum operations.
7. Explain basic electrical principles and apply appropriate electrical safety practices in petroleum environments.

LEARNING OUTCOMES

After completing the course, the students will be able to:

1. Give an overview of the chemical composition and physical properties of petroleum, petroleum products and renewable motor fuels;
2. Specify quality criteria for petroleum products and renewable motor fuels;
3. Present the chemistry of the most important refinery processes;
4. Give an overview of the resource base for petroleum and renewable alternatives;
5. Find information and perform individual evaluations of questions pertaining to production and use of petroleum from different sources and renewable motor fuels;
6. Use geophysical and geological knowledge to interpret and map data for identification of potential prospects;

7. Contribute to development of geo-based technology for exploration and improved recovery of petroleum resources;
8. Explain the theory of hydraulics applied to fuels in pump-pipeline systems;
9. Explain the fundamentals of electricity with emphases on electrical safety in petroleum; and
10. List lubrication and wear with importance attached to physical and chemical properties of lubricants.

COURSE CONTENT

- Petroleum in the contemporary energy scene
- Nature, classification and composition of crude petroleum and natural gases
- Natural product chemical markers of petroleum and geological sediments
- **Distribution of petroleum and natural gas resources:** the global and Nigerian situations
- Petroleum technology, survey of refinery products and process
- Petrochemicals in industrial raw materials
- Prospects for the petrochemical industry in Nigeria
- Aviation fuels
- Present and future
- Formulation of Lubricants
- Theory of Hydraulics, as applied to fuels in pump-pipeline systems
- Fundamentals of electricity with emphases on electrical safety in petroleum
- Lubrication and wear, with importance attached to the physical and chemical properties of lubricants

CATEGORY	DETAILS
Core Competencies	• Analysis • Refining • Processing • Formulation • Safety • Maintenance • Evaluation

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Teamwork • Innovation • Efficiency • Sustainability
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning
Learning Resources	• Petroleum Samples • Crude Oil Samples • Refinery Process Charts • Petroleum Product Samples • Lubricant Samples • Fuel Testing Equipment
Assessment Methods	• Assignments • Class Tests • Quizzes • Problem-Solving Exercises • Calculations • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Gary, J. H., Handwerk, G. E., & Kaiser, M. J. (2007). *Petroleum refining: Technology and economics* (5th ed.). CRC Press.
2. Speight, J. G. (2020). *The chemistry and technology of petroleum* (5th ed.). CRC Press.
3. Speight, J. G. (2021). *Handbook of industrial hydrocarbon processes* (2nd ed.). Gulf Professional Publishing.
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5. Fahim, M. A., Al-Sahhaf, T. A., & Elkilani, A. (2010). *Fundamentals of petroleum refining*. Elsevier.
6. Jones, D. S. J., & Pujadó, P. R. (Eds.). (2006). *Handbook of petroleum processing*. Springer.
7. International Energy Agency. (2024). *World energy outlook 2024*. IEA.
8. Organization of the Petroleum Exporting Countries. (2024). *Annual statistical bulletin 2024*. OPEC.
9. Nigerian Upstream Regulatory Commission. (2024). *Annual report*. NUPRC.

CHM 416 Chemistry of Soaps and Detergents

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces **the** chemistry, raw materials, properties, formulation, and manufacturing processes of soaps and detergents. It examines oils, fats, linear alkylbenzenes, builders, and other additives used in their production, together with micelle formation, surface activity, and the mechanism of detergency. Emphasis is placed on different types of soaps and detergents, their chemical properties, manufacturing processes, performance, and applications.

RELEVANCE STATEMENT

The course provides students with practical knowledge of surfactant chemistry and soap and detergent technology. It is relevant to household and industrial cleaning products, cosmetics, food processing, textile industries, water treatment, pharmaceuticals, and chemical manufacturing. It also provides a foundation for product formulation and small-scale chemical entrepreneurship.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify and describe the raw materials used in soap and detergent manufacture.
2. Explain the chemical structures and properties of soaps, detergents, and surfactants.
3. Explain micelle formation and the mechanism of detergency.
4. Differentiate between major types of soaps and detergents.
5. Describe the manufacturing processes of soaps and detergents.
6. Explain the functions of builders, additives, and other formulation ingredients.
7. Relate the chemical structure of surfactants to their cleaning performance.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify suitable oils, fats, organic compounds, and additives for soap and detergent production.
2. Explain saponification and its role in soap manufacture.
3. Distinguish between soaps and synthetic detergents.
4. Explain the formation and structure of micelles.
5. Describe the mechanism by which soaps and detergents remove dirt and grease.
6. Explain the functions of builders, fillers, fragrances, colourants, preservatives, and other additives.
7. Describe major industrial and laboratory methods of soap and detergent production.
8. Evaluate the properties and performance of different cleaning products.

COURSE CONTENT

- Raw materials for soap and detergents such as oil, fats and organic compounds Eg linear alkyl benzenes and additives, etc. Micelle formation and detergency process.
- Various types of soaps and detergents
- Mechanism of detergency
- The manufacturing processes of soaps and detergents

CATEGORY	DETAILS
Core Competencies	• Formulation • Saponification • Processing • Classification • Analysis • Manufacturing • Evaluation • Problem-solving
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Teamwork • Innovation • Efficiency • Sustainability
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning

CATEGORY	DETAILS
Learning Resources	• Soap and Detergent Samples • Oils and Fats • Surfactants • Formulation Ingredients • Laboratory Equipment • Saponification Apparatus • pH Meter • Measuring Equipment • Process Flow Charts • Molecular Models
Assessment Methods	• Assignments • Class Tests • Quizzes • Formulation Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Myers, D. (2020). *Surfactant science and technology* (4th ed.). Wiley.
2. Rosen, M. J., & Kunjappu, J. T. (2012). *Surfactants and interfacial phenomena* (4th ed.). John Wiley & Sons.
3. Spitz, L. (Ed.). (2016). *Soap manufacturing technology* (2nd ed.). AOCS Press.
4. Dunn, K. M. (2010). *Scientific soapmaking: The chemistry of the cold process*. Clavicula Press.
5. Showell, M. S. (Ed.). (2006). *Handbook of detergents, part D: Formulation*. CRC Press.
6. Showell, M. S. (Ed.). (2005). *Handbook of detergents, part A: Properties*. CRC Press.
7. Holmberg, K. (Ed.). (2001). *Handbook of applied surface and colloid chemistry*. John Wiley & Sons.
8. Tadros, T. F. (2013). *Emulsion formation and stability*. Wiley-VCH.

CHM 412 Analytical Atomic Spectroscopy

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the principles and applications of atomic spectrometric techniques based on the interaction of atoms with electromagnetic radiation. It covers atomic absorption spectrometry (AAS), atomic emission spectrometry (AES), atomic fluorescence spectrometry (AFS), and X-ray fluorescence spectrometry (XRF), with emphasis on instrumentation, operating principles, sample preparation, spectral interpretation, quantitative analysis, applications, advantages, limitations, and analytical interferences.

RELEVANCE STATEMENT

The course equips students with practical knowledge of instrumental elemental analysis for qualitative and quantitative determination of metals and other elements. It is relevant to environmental monitoring, pharmaceutical analysis, food and agricultural analysis, geological studies, clinical chemistry, industrial quality control, forensic analysis, and research.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the interaction of atoms with electromagnetic radiation.
2. Describe the principles and instrumentation of AAS, AES, AFS, and XRF.
3. Explain atomization, excitation, emission, absorption, and fluorescence processes.
4. Apply appropriate atomic spectrometric techniques to elemental analysis.
5. Interpret analytical signals and perform quantitative calculations.
6. Identify major sources of interference and methods of minimising them.
7. Evaluate the advantages, limitations, and applications of atomic spectrometric methods.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Explain atomic energy levels and their interaction with electromagnetic radiation.
2. Distinguish between absorption, emission, fluorescence, and X-ray fluorescence processes.

3. Identify the major components of atomic spectrometers.
4. Explain the operating principles of AAS, AES, AFS, and XRF.
5. Prepare samples appropriately for atomic spectrometric analysis.
6. Identify and control common spectral and chemical interferences.
7. Select appropriate atomic spectrometric techniques for specific analytical problems.

COURSE CONTENT

- Introduction of concept of interaction of atoms with electromagnetic radiation
- Atomic absorption spectrometry
- Atomic emission spectrometry
- Atomic fluorescence spectrometry and X-ray fluorescence spectrometry

CATEGORY	DETAILS
Core Competencies	• Spectroscopy • Instrumentation • Measurement • Calibration • Analysis • Quantification • Interpretation • Sampling • Problem-solving • Data-analysis
Core Values	• Accuracy • Precision • Integrity • Objectivity • Safety • Discipline • Reliability

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping • Case-Based Learning
Learning Resources	• Atomic Spectrometer • AAS Equipment • AES Equipment • AFS Equipment • XRF Equipment • Hollow-Cathode Lamps • Gas and Flame Systems • Elemental Standards • Certified Reference Materials
Assessment Methods	• Assignments • Class Tests • Quizzes • Numerical Exercises • Calibration Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
2. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). Macmillan Learning.
3. Welz, B., & Sperling, M. (1999). *Atomic absorption spectrometry* (3rd ed.). Wiley-VCH.
4. Boss, C. B., & Fredeen, K. J. (2004). *Concepts, instrumentation and techniques in inductively coupled plasma optical emission spectrometry* (3rd ed.). PerkinElmer.
5. Winefordner, J. D. (Ed.). (1976). *Atomic fluorescence spectroscopy*. Wiley.
6. Jenkins, R. (1999). *X-ray fluorescence spectrometry* (2nd ed.). John Wiley & Sons.
7. de Hoffmann, E., & Stroobant, V. (2007). *Mass spectrometry: Principles and applications* (3rd ed.). John Wiley & Sons.

CHM 413 Industrial Chemistry

LEVEL 400L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces NCE Chemistry students to the interface between chemistry, environmental science, and industrial production practical's. It examines the composition of soil, water, and air; the sources, chemistry, and control of pollution; and the chemical principles behind Major Nigerian and global industrial processes including trioxonitrate (V) acid, sodium hydroxide, soap and detergent manufacture, glass, alcohol, matches, and iron and steel production. The course also covers acid rain formation, oil pollution, timber production and utilisation, solvent extraction and ion exchange as applied to industry, sources and growth of e-waste; hazardous components (lead, mercury, cadmium, brominated flame retardants), Green chemistry 3Rs+ (reduce, reuse, recycle, recover, redesign) and health education components on HIV/STI transmission and prevention. A supervised industrial visit and written report form a compulsory practical component.

RELEVANCE STATEMENT

Environmental and Industrial Chemistry equips the pre-service chemistry teacher to connect classroom chemistry to real-world industrial and environmental issues that students encounter daily from factory processes in their communities to pollution and public health challenges. It builds the teacher's capacity to explain natural and man-made

chemical phenomena, promotes scientifically literate citizens, and supports Nigeria's Education for Sustainable Development and green economy goals. As industries increasingly emphasise environmental compliance and sustainability, this course keeps trainee-teachers current with the chemistry underlying pollution control, resource conservation, and responsible industrial practice.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Explain the composition and chemistry of soil, water, and air, and how these are altered by pollution.
2. Identify major air, water, and soil pollutants, their sources, and their environmental and health effects.
3. Describe the chemical processes involved in major industrial productions (acids, alkalis, soaps/detergents, glass, alcohol, matches, iron and steel).
4. Explain solvent extraction and ion exchange and their industrial applications.
5. Discuss the chemistry of acid rain formation and its environmental consequences.
6. Explain the causes and effects of oil pollution and outline control/remediation measures.
7. Explain modes of HIV/STI transmission and appropriate prevention and control measures within the context of environmental/health education.
8. Plan, undertake, and report on a supervised industrial visit, linking observed processes to classroom chemistry.
9. Explain the chemistry behind E- waste and 12 principle of green chemistry

LEARNING OUTCOMES

On successful completion of this course, students will be able to:

1. Teach the chemistry of industrial processes and environmental pollution effectively at the Junior/Senior Secondary level, using local examples.
2. Analyse real industrial or environmental case studies and identify the underlying chemical principles.
3. Assess pollution sources in a given environment and propose scientifically sound control measures.
4. Produce a professional industrial visit report demonstrating observation, analysis, and reflection skills.

5. Apply awareness of health and environmental safety issues (including HIV/STI prevention) in guiding learners.
6. State the 12 principles of green chemistry
7. Apply green chemistry principles to evaluate a given industrial or lab process
8. Define e-waste and green chemistry and classify common categories

COURSE CONTENT

(industrial visit is major requirement of this course)

- A study of the composition of soil and water
- Environmental pollution: air, water and soil
- Solvent extraction
- Ion exchange and their applications in industries
- Production of trioxonitrate (V) acid, tetraoxosulphate vi acid, sodium hydroxide, washing soda, baking soda, soaps, detergents, matches
- Production and utilisation of allied products by students as assignment or project
- Reports on visits to Industries (Field Trip) as 20 % of the CA.
- Acid rain formation and its effects on the environment
- Oil pollution and its hazards
- **Environmental studies and HIV education:** i.e. HIV Transmission, other sexually transmitted infections, Body Abuse, prevention and control

CATEGORY	DETAILS
Core Competencies	• Understanding environmental pollution and industrial processes. • Conducting environmental analysis • Applying safety protocols • Developing sustainable solutions • Interpreting chemical data in environmental contexts
Core Values	• Commitment to environmental protection • Responsibility in industrial practices • Ethical conduct in chemical analysis • Sustainability and innovation • Professional integrity and safety consciousness

CATEGORY	DETAILS
Pedagogical Approaches	• Lectures and interactive discussions • Practical laboratory sessions • Case study analysis • Industrial attachment and field visits • Group projects and presentations • Problem-based learning (PBL).
Learning Resources	• Textbooks • Equipment and chemicals • Journals and research articles • Regulatory standards (NAFDAC, NESREA) • Industry partnerships
Assessment Methods	• Continuous assessment • Practical examination • Mid-term • Project work and case study analysis • Participation in discussions and presentations.

REFERENCES AND FURTHER READING

1. Ahmed, S. &Idris, A. *Fundamentals of Industrial and Environmental Chemistry*. Zaria: ABU Press.
2. Manahan, S., & Manahan, S. E. (2009). *Environmental chemistry*. CRC press.
3. Baird, C. &Cann, M. *Environmental Chemistry*. New York: W.H. Freeman.

CHM 414 Entrepreneurship Skills in Chemistry

LEVEL 400L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the principles and practices of entrepreneurship in chemistry and chemistry education. It develops entrepreneurial knowledge, skills, and attitudes through the identification and development of chemistry-based business ideas that address societal needs in areas such as education, water, health, food and beverages,

agriculture, packaging, textiles, electronics, and waste management. Students engage in individual and group entrepreneurship projects, proposal development, product development, and exhibition of innovative products.

RELEVANCE STATEMENT

The course equips chemistry students with the ability to transform chemical knowledge and skills into innovative products, services, and business opportunities. It promotes self-reliance, creativity, employability, and economic development while demonstrating the practical contribution of chemistry to solving societal problems.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concepts, principles, and importance of entrepreneurship and entrepreneurship education.
2. Identify chemistry-based business opportunities from different areas of chemistry.
3. Apply entrepreneurial knowledge, skills, and attitudes to chemistry-related opportunities.
4. Develop innovative chemistry products and services that address societal needs.
5. Identify barriers to entrepreneurship and develop strategies for overcoming them.
6. Develop individual and group business proposals based on chemistry-related ideas.
7. Demonstrate the economic and social benefits of chemistry entrepreneurship.
8. Present and exhibit products developed through entrepreneurship projects.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define entrepreneurship, chemistry entrepreneurship and entrepreneurship education;
2. Appreciate the role of entrepreneurship in chemistry education;
3. Discuss entrepreneurship knowledge, skills and attitudes and their roles in successful chemistry education;
4. Formulate and present business ideas from different aspects/topics of chemistry;
5. Identify specific societal needs of business interests to chemistry students;
6. Enumerate the economic benefits of entrepreneurship in chemistry;
7. Discuss the strategies for developing entrepreneurship skills in chemistry education;

8. List and discuss with possible solutions the barriers to entrepreneurship in Chemistry and chemistry education;

COURSE CONTENT

- Concepts of entrepreneurship, chemistry entrepreneurship and entrepreneurship education
- Rationale for entrepreneurship
- Entrepreneurship knowledge, skills and attitudes
- Business Ideas from different aspects/topics of chemistry
- Specific societal needs of business interests to chemistry students-Education, water, health, food and drinks, farming, packaging, textiles, electronics, waste management
- Economic benefits of entrepreneurship in chemistry
- Strategies for developing entrepreneurship skills in chemistry education
- Barriers to entrepreneurship in Chemistry and chemistry education
- Individual and group works on entrepreneurship proposals and projects
- Exhibition of products from entrepreneurship projects

CATEGORY	DETAILS
Core Competencies	• Creativity • Innovation • Planning • Leadership • Marketing • Teamwork • Production • Networking • Presentation

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Teamwork • Innovation • Efficiency • Sustainability • Resourcefulness
Pedagogical Approaches	• Lecture Method • Demonstration • Brainstorming • Project-Based Learning • Field-Based Learning • Mentorship
Learning Resources	• Business Proposal Templates • Business Models • Product Samples • Laboratory Equipment • Chemicals and Reagents • Production Materials

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Proposals • Group Projects • Individual Projects • Product Development • Project Reports • Product Exhibition • Presentations • Continuous Assessment End-of-Course Project

REFERENCES AND FURTHER READING

1. Barringer, B. R., & Ireland, R. D. (2021). *Entrepreneurship: Successfully launching new ventures* (6th ed.). Pearson.
2. Burns, P. (2022). *Entrepreneurship and small business: Start-up, growth and maturity* (5th ed.). Red Globe Press.
3. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). *Entrepreneurship* (11th ed.). McGraw-Hill Education.
4. Kuratko, D. F. (2023). *Entrepreneurship: Theory, process, practice* (12th ed.). Cengage Learning.
5. Scarborough, N. M., & Cornwall, J. R. (2019). *Essentials of entrepreneurship and small business management* (9th ed.). Pearson.
6. European Commission. (2016). *EntreComp: The entrepreneurship competence framework*. Publications Office of the European Union.
7. International Labour Organization. (2021). *Start and improve your business (SIYB): Generate your business idea*. International Labour Office.

CHM 422 Metals, Alloys & Transition Metals

LEVEL 400L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

This course examines ionic solids, crystal structures, electrochemistry, transition elements and coordination chemistry**.** It covers ion formation, crystal geometry, X-ray diffraction, Bragg's equation, electrolytic solutions, galvanic cells and Faraday's laws. It also focuses on the properties and extraction of transition elements, with emphasis on Crystal Field Theory (CFT)**,** complex formation, isomerism, stability of complexes and the chemistry of lanthanides, including lanthanide contraction.

RELEVANCE STATEMENT

The course provides essential knowledge of ionic structures, crystal chemistry, electrochemistry, transition elements and coordination compounds**.** It is relevant to understanding materials, batteries, electrolysis, metallurgy, catalysis and industrial processes. It also equips students with the knowledge needed to explain the structure, bonding, colour, magnetic properties and stability of inorganic compounds**.**

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the formation of ions, ionic solids and crystal structures, including the effects of ionic size on crystal geometry.
2. Describe the principles and applications of X-ray diffraction, including Bragg's equation and the determination of crystal parameters.
3. Explain electrolytic solutions, acid – base dissociation, galvanic cells, electromotive force and electrode reactions.
4. Apply Faraday's laws to solve problems involving electrolysis and electrode processes.
5. Describe the position, electronic structure, general characteristics and extraction of first-row transition elements, with emphasis on iron.
6. Explain bonding in transition-metal complexes using Crystal Field Theory (CFT) and briefly identify the principles of ACFT and LFT.
7. Explain the formation, isomerism and stability of coordination complexes.

8. Describe the lanthanide contraction, chemical behaviour of lanthanides and their periodic relationships.

LEARNING OUTCOMES

By the end of the course the student should be able to:

1. Explain the formation of ions, ionic solids and crystal structures and relate ionic size to crystal geometry.
2. Apply Bragg's equation and X-ray diffraction principles to determine crystal dimensions and related parameters.
3. Explain electrolytic solutions, acid – base dissociation, electromotive force and the operation of galvanic cells.
4. Apply Faraday's laws to calculate quantities involved in electrolysis and explain electrode reactions.
5. Describe the position, electronic structure, general characteristics and extraction of transition elements, particularly iron.
6. Use Crystal Field Theory (CFT) to explain the bonding, geometry, colour, magnetic properties and stability of selected transition-metal complexes.
7. Explain the formation, isomerism and stability of coordination complexes and describe the lanthanide contraction and chemical behaviour of lanthanides.

COURSE CONTENT

- Formation of ions
- Ionisation Potential and electron affinity
- Formation of an ionic solid
- Arrangement of ions in crystals
- Diffraction of electro-magnetic radiation
- Experimental methods of X-ray diffraction
- Bragg's equation
- The structure of Sodium Chloride from X-ray diffraction
- Avogadro's number from lattice dimensions
- Effects of ionic size on crystal geometry
- Electrolytic solutions
- Dissociation of strong and weak acids and bases
- Electromotive force and Galvanic cells

- Faraday's laws and electrode reactions
- Position of transition elements in the Periodic Table
- General characteristics (1st, 2nd and 3rd row) transition elements
- Electronic structure of the atoms and ions (1st – row only) Extraction of Iron (Fe)
- Bonding in transition elements-Crystal Field Theory (CFT), Adjusted Crystal Field Theory (ACFT), Ligand Field Theory (LFT)
- Emphasis should be on CFT, while ACFT and LFT should be mentioned only
- Formation of complexes: Isomerism and stability of complexes
- Lanthanide contraction, chemical behaviour and periodic comparison

CATEGORY	DETAILS
Core Competencies	• Chemical Knowledge and Understanding • Problem-Solving Skills • Practical and Laboratory Skills
Core Values	• Scientific Integrity • Accuracy and Precision • Critical Thinking • Responsibility
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Practical/Experimental Approach • Inquiry-Based Learning • Problem-Based Learning • Cooperative Learning
Learning Resources	• Periodic table • Inorganic Chemistry Textbooks • Periodic Tables • Crystal Structure Models • X-ray Diffraction Diagrams and Charts

CATEGORY	DETAILS
Assessment Methods	• Class Tests and Quizzes • Assignments and Tutorial Exercises • Practical/Laboratory Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2018). *Atkins' physical chemistry* (11th ed.). Oxford University Press.
2. Housecroft, C. E., & Sharpe, A. G. (2018). *Inorganic chemistry* (5th ed.). Pearson.
3. Lee, J. D. (2016). *Concise inorganic chemistry* (5th ed.). Wiley.
4. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2014). *Inorganic chemistry* (5th ed.). Pearson.
5. Shriver, D. F., Weller, M. T., Overton, T. L., Rourke, J. P., & Armstrong, F. A. (2014). *Inorganic chemistry* (6th ed.). W. H. Freeman and Company.
6. Smart, L. E., & Moore, E. A. (2005). *Solid state chemistry: An introduction* (3rd ed.). CRC Press.

CHM 423 Introduction to Rubber Technology

LEVEL 400L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides a comprehensive study of **natural and synthetic rubber,** focusing on the chemical composition and coagulation of rubber latex, principles of rubber compounding, processing additives, synthetic rubbers, rubber processing techniques, and the theory of rubber elasticity. Emphasis is placed on understanding how compounding ingredients and processing conditions influence the physical, chemical, and mechanical properties of rubber and its applications in industry.

RELEVANCE STATEMENT

The course equips students with knowledge of the **chemistry, formulation, processing, and properties of rubber materials**. It provides a foundation for applications in polymer science, tyre and footwear manufacturing, automotive components, construction, medical products, industrial materials, and other rubber-processing industries.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the chemical composition and theories of coagulation of rubber latex.
2. Describe the principles and processes of rubber compounding.
3. Explain the functions of cross-linking agents, accelerators, activators, fillers, plasticizers, and stabilisers.
4. Evaluate the effects of processing additives on the properties and performance of rubber.
5. Describe the preparation, properties, manufacture, and applications of selected synthetic rubbers.
6. Explain major rubber-processing techniques.
7. Explain the molecular and thermodynamic basis of rubber elasticity.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify the major chemical components of natural rubber latex.
2. Explain mechanisms and factors affecting latex coagulation.
3. Select appropriate additives for specific rubber formulations.
4. Relate compounding ingredients to rubber properties.
5. Distinguish between natural and major synthetic rubbers.
6. Describe common rubber-processing operations.
7. Explain vulcanisation and its effect on rubber performance.
8. Explain rubber elasticity using molecular and thermodynamic principles.
9. Relate rubber structure and processing conditions to industrial applications.

COURSE CONTENT

- Rubber latex: chemical composition and theories of latex coagulation
- Principles of rubber compounding
- Rubber processing additives: cross linking agents, accelerators, activators, filers, plasticizers and stabilisers influence of compound additives on rubber properties
- Outline of useful synthetic rubbers
- Manufacture and applications
- Examples of rubber processing techniques

- Rubber elasticity: theory and thermodynamics of rubber elasticity

CATEGORY	DETAILS
Core Competencies	• Formulation • Compounding • Processing • Characterisation • Analysis • Synthesis • Evaluation • Problem-solving
Core Values	• Accuracy • Safety • Integrity • Innovation • Responsibility • Quality • Creativity • Sustainability
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Guided Discovery • Collaborative Learning

CATEGORY	DETAILS
Learning Resources	• Rubber and Latex Samples • Compounding Ingredients • Laboratory Equipment • Rubber Processing Equipment • Vulcanisation Apparatus • Tensile Testing Equipment • Hardness Tester • Microscopes • Molecular Models • Process Flow Charts
Assessment Methods	• Assignments • Class Tests • Quizzes • Compounding Exercises • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

- Mark, J. E., Erman, B., Roland, C. M., & Elsevier. (Eds.). (2013). *The science and technology of rubber* (4th ed.). Academic Press.
- Blow, C. M., & Hepburn, C. (1982). *Rubber technology and manufacture* (2nd ed.). Butterworth Scientific.
- Morton, M. (Ed.). (1987). *Rubber technology* (3rd ed.). Springer.
- Hofmann, W. (2019). *Rubber technology handbook*. Hanser Publishers.
- Rodgers, B. (Ed.). (2015). *Rubber compounding: Chemistry and applications* (2nd ed.). CRC Press.
- Coran, A. Y. (2005). Vulcanization. In J. E. Mark, B. Erman, & F. R. Eirich (Eds.), *Science and technology of rubber* (3rd ed., pp. 321–366). Elsevier.
- Franta, I. (2012). *Elastomers and rubber compounding materials: Manufacture, properties and applications*. Elsevier.
- International Organization for Standardization. (2020). *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties* (ISO 37:2020). ISO.

CHM 419 Environmental Chemistry

LEVEL 400L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the fundamental principles of **environmental chemistry and environmental management,** focusing on elementary biogeochemical cycles, atmospheric characteristics, environmental pollution, wastewater treatment, solid and industrial waste management, water chemistry, and environmental analysis. It also introduces chemical and physical instrumentation used in environmental studies, Environmental Impact Assessment (EIA), and the **Twelve Principles of Green Chemistry**. Emphasis is placed on understanding environmental processes, pollution prevention, sustainable resource management, and the application of chemistry to environmental challenges.

RELEVANCE STATEMENT

The course equips students with the knowledge and skills required to **understand, monitor, assess, and manage environmental problems**. It promotes sustainable practices and prepares students to apply chemical principles in water quality assessment, pollution control, waste management, environmental monitoring, impact assessment, and green chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the major biogeochemical cycles and characteristics of the atmosphere.
2. Identify sources, types, effects, and control measures of environmental pollution.
3. Explain the principles and processes involved in wastewater treatment.
4. Describe the composition, management, and treatment of domestic and industrial wastes.
5. Apply basic principles of water chemistry and environmental water analysis.
6. Explain the use of chemical and physical instruments in environmental analysis.
7. Describe the principles and importance of Environmental Impact Assessment.
8. Apply the Twelve Principles of Green Chemistry to environmental and chemical processes.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Explain the elementary circle of the following element oxygen, nitrogen, sulphur and others;
2. Describe the stratification of the earth atmosphere and state characteristics of each strata;
3. State and describe different sources of environmental pollution;
4. State and describe different types of environmental pollution and their effect on the environment;
5. Describe water and state qualities that define the uses of water;
6. Describe and explain different sources of water contamination and its impact on agricultural land crops;
7. State and describe different methods use in treatment of waste water – chemical, biological and physical methods;
8. State and justify chemical and physical instrumentation in environmental chemistry;
9. Describe environmental impact assessment; and
10. State and describe twelve principles of green chemistry and its practical applications.

COURSE CONTENT

- Concepts of elementary cycles
- Characteristics of the atmosphere
- Sources, types and effects of environmental pollution
- Wastewater treatment
- Composition of domestic/industrial wastes and waste management
- Water chemistry and analysis
- Chemical and physical instrumentation in environmental sciences
- Introduction to Environmental Impact Assessment
- Twelve principles of green chemistry

CATEGORY	DETAILS
Core Competencies	• Analysis • Monitoring • Sampling • Interpretation • Identification • Instrumentation • Evaluation • Waste-management • Sustainability
Core Values	• Integrity • Objectivity • Curiosity • Discipline • Teamwork • Innovation • Efficiency • Sustainability • Resourcefulness • Conservation
Pedagogical Approaches	• Lecture Method • Demonstration • Brainstorming • Project-Based Learning • Field-Based Learning • Mentorship • Field-base learning

CATEGORY	DETAILS
Learning Resources	• Water Samples • Waste Samples • Laboratory Equipment • pH Meter • Conductivity Meter • Spectrophotometer • Dissolved Oxygen Meter • Water Testing Kits • Wastewater Treatment Models • Environmental Monitoring Equipment
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Manahan, S. E. (2022). *Environmental chemistry* (11th ed.). CRC Press.
2. Mihelcic, J. R., & Zimmerman, J. B. (2021). *Environmental engineering: Fundamentals, sustainability, design* (3rd ed.). John Wiley & Sons.
3. Sawyer, C. N., McCarty, P. L., & Parkin, G. F. (2003). *Chemistry for environmental engineering and science* (5th ed.). McGraw-Hill.
4. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
5. Harris, D. C., & Lucy, C. A. (2020). *Quantitative chemical analysis* (10th ed.). W. H. Freeman and Company.
6. United States Environmental Protection Agency. (2023). *Green chemistry*. U.S. Environmental Protection Agency.
7. United Nations Environment Programme. (2024). *Global environment outlook 7: Navigating new horizons for a planet under pressure*. United Nations Environment Programme.
8. International Union of Pure and Applied Chemistry. (2019). *The 12 principles of green chemistry*. IUPAC.

CHM 426 Chemistry Methodology II

LEVEL 400L | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course develops the **pedagogical knowledge and practical skills required for effective teaching of chemistry.** It covers current trends in chemistry education, lesson preparation, teaching methods, laboratory organisation and management, record keeping, use of multimedia and computer-assisted instruction, educational games and simulations, concept mapping, textbook evaluation, and microteaching/practicum.

RELEVANCE STATEMENT

The course prepares prospective chemistry teachers to become **confident, innovative and effective classroom practitioners**. It equips students with practical strategies for presenting abstract chemistry concepts through appropriate teaching methods, laboratory activities, multimedia, simulations and other digital resources. The course also develops the ability to plan lessons, manage laboratories, evaluate instructional materials and reflect on teaching practice.

COURSE OBJECTIVES

1. Explain current trends and developments in the teaching and learning of chemistry.
2. Develop effective chemistry lesson notes and instructional plans.
3. Apply appropriate methods and strategies for teaching different chemistry concepts.
4. Demonstrate effective organisation and management of the chemistry laboratory.
5. Explain the roles and responsibilities of chemistry laboratory personnel and maintain appropriate laboratory records.
6. Apply multimedia, computer-assisted instruction, games, simulations and concept mapping in chemistry teaching.
7. Evaluate chemistry textbooks and other instructional materials using appropriate criteria.
8. Develop and demonstrate effective chemistry teaching skills through microteaching and practicum experiences.

LEARNING OUTCOMES

By the end of the course, the students should be able to:

1. Identify and discuss current trends and innovations in chemistry teaching and learning.
2. Prepare well-structured chemistry lesson notes based on appropriate instructional objectives and learning activities.
3. Select and apply suitable teaching methods, including demonstration, guided discovery, discussion, activity, tutorial, project and team teaching.
4. Organise and manage a chemistry laboratory effectively and explain the duties of laboratory technologists, assistants and attendants.
5. Maintain and use appropriate chemistry laboratory records for effective teaching and laboratory management.
6. Integrate multimedia, computer-assisted instruction, educational games, simulations and concept mapping into chemistry lessons.
7. Evaluate chemistry textbooks and instructional resources based on relevance, accuracy, organisation, suitability and curriculum alignment.
8. Demonstrate effective chemistry teaching through microteaching, practicum and reflective evaluation of classroom performance.

COURSE CONTENT

- Trends in the teaching of chemistry
- Lesson note preparation
- Methods of teaching Chemistry
- Demonstration, Guided discovery, Discussion, Activity, Tutorial, Project, team teaching
- Organisation of the chemistry laboratory
- **Duties of laboratory personnel:** technologist, assistant, attendant
- Record keeping in the chemistry laboratory
- **Use of multimedia in chemistry teaching:** use of films, slides and overhead projector during a chemistry lesson
- Computer Assisted Instruction (CAI)
- **Games and simulations, concept mapping:** Evaluation of chemistry textbooks
- **Practicum in Chemistry teaching:** Microteaching

CATEGORY	DETAILS
Core Competencies	• Lesson Planning and Instructional Design • Instructional Technology and Digital Literacy • Classroom Communication and Management • Assessment and Evaluation Skills • Creativity and Innovation • Collaborative and Reflective Teaching Skills
Core Values	• Professionalism • Responsibility • Creativity and Innovation • Integrity • Collaboration • Commitment to Learner Success
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach • Cooperative Learning • Demonstration Method • Microteaching and Practicum
Learning Resources	• Chemistry Textbooks and Teachers' Guides • Chemistry Curriculum and Syllabus Documents • Lesson Note and Lesson Plan Templates
Assessment Methods	• Lesson Note Preparation • Microteaching Assessment • Teaching Practicum Assessment • Classroom Observation • Chemistry Laboratory Management Tasks • Instructional Material Development

REFERENCES AND FURTHER READING

1. Abell, S. K., & Lederman, N. G. (Eds.). (2007). *Handbook of research on science education*. Lawrence Erlbaum Associates.
2. Bybee, R. W. (2013). *The case for STEM education: Challenges and opportunities*. NSTA Press.
3. Childs, P. E., & Sheehan, M. (2009). What's difficult about chemistry? A study of the implications for teaching and learning chemistry. *Chemistry Education Research and Practice*, *10*(2), 204–213.
4. Gilbert, J. K., & Treagust, D. F. (Eds.). (2009). *Multiple representations in chemical education*. Springer.
5. Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education*, *88*(1), 28–54.

CHM 511 Heterocyclic Compounds

LEVEL 500L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a comprehensive study of **heterocyclic chemistry**, covering the definition, classification, nomenclature, structure, bonding, aromaticity, synthesis, reactions, and applications of heterocyclic compounds. Emphasis is placed on three-, four-, five-, and six-membered heterocycles, including pyrrole, furan, thiophene, azoles, pyridine, diazines, triazines, indole, quinoline, isoquinoline, benzofuran, and benzothiophene. The course also examines heterocycles in medicinal chemistry, natural products, pharmaceuticals, agrochemicals, materials science, and nanotechnology, together with spectroscopic and chromatographic methods for their structural identification and analysis.

RELEVANCE STATEMENT

Heterocyclic compounds constitute an important class of organic compounds found extensively in **medicines, natural products, agrochemicals, dyes, polymers, and advanced materials**. The course equips students with knowledge and skills for understanding, synthesising, identifying, and applying heterocyclic compounds in pharmaceutical research, biotechnology, chemical industries, medicinal chemistry, and materials science.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define, classify, name, and identify common heterocyclic compounds.
2. Explain the structure, bonding, aromaticity, resonance, and electronic properties of heterocycles.
3. Describe general and specific methods for synthesising common heterocyclic compounds.
4. Explain the mechanisms and products of major reactions of heterocyclic compounds.
5. Describe the chemistry of five-, six-membered, and fused heterocyclic systems.
6. Apply spectroscopic and chromatographic techniques to the identification and analysis of heterocyclic compounds.
7. Explain the roles of heterocycles in medicinal chemistry, natural products, agrochemicals, materials science, and nanotechnology.
8. Evaluate emerging developments and research trends in heterocyclic chemistry.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Classify heterocyclic compounds according to ring size, heteroatom, saturation, and structural features.
2. Apply IUPAC and common nomenclature to heterocyclic compounds.
3. Draw and interpret structures of important heterocyclic systems.
4. Apply Hückel’s rule to determine aromaticity.
5. Explain electron delocalisation and resonance in heterocycles.
6. Describe and apply important synthetic routes for pyrrole, furan, thiophene, pyridine, and related compounds.
7. Predict products of electrophilic, nucleophilic, addition, oxidation, reduction, and rearrangement reactions.
8. Explain the chemistry of azoles, diazines, triazines, indoles, quinolines, isoquinolines, and benzofused heterocycles.
9. Interpret NMR, IR, UV–Vis, and mass spectra of selected heterocyclic compounds.
10. Explain the applications of heterocycles in drugs and naturally occurring compounds.
11. Describe emerging applications of heterocyclic compounds in materials science and nanotechnology.

COURSE CONTENT

- Introduction to heterocyclic chemistry
- Definition and classification of heterocyclic compounds
- Importance and applications in pharmaceuticals, agrochemicals and material science
- Nomenclature of heterocyclic compounds
- IUPAC naming conventions, common names and structures
- Three membered, four membered, five membered and six membered rings, structure and bonding in heterocycles
- Aromaticity and non-aromatic heterocycles, electron delocalization and resonance
- Huckel rule for aromaticity, synthesis of heterocyclic compounds
- **General methods of synthesis, specific synthetic routes for common heterocylces:** pyrrole, furan, thiophene, pyridine etc
- Ring closure reactions and cyclization techniques, reactions of heterocyclic compounds
- Electrophilic and nucleophilic substitution reactions, addition reactions, oxidation and reduction of heterocycles, rearrangement and other reactions, five membered heterocycles
- Structure, synthesis and reactions of pyrrole, furan, thiophene, azoles, imidazole, pyrazole, oxazole, thiazole and their derivatives, six membered heterocycles
- Structure, synthesis and reactions of pyridine, pyridazine, pyrimidine, pyrazine, diazine and triazines, fused heterocycles
- Structure, synthesis and reactions of indole, quinoline, isoquinoline, benzofused heterocycles (benzofuran, benzothiophene etc.) heterocylces in medical chemistry
- Role of heterocycles in drug design and development
- Case studies of hetero cylicdrugs (antibiotic, antivirals, anticancer agents etc.), heterocycles in natural products
- Occurrence of hetero cyclic compounds in nature
- Biosynthesis of natural heterocycles
- Examples of naturally occurring hetero cyclic compounds
- Analytical techniques for heterocyclic compounds
- Spectroscopic methods (NMR, IR, UV-Vis, MS) for structural elucidation, chromatographic techniques for separation and analysis, advanced topics in heterocyclic chemistry

- Recent development and research trends, heterocycles in material science and nanotechnology

CATEGORY	DETAILS
Core Competencies	• Classification • Nomenclature • Structure • Synthesis • Aromaticity • Reactivity • Spectroscopy • Identification
Core Values	• Accuracy • Integrity • Curiosity • Creativity • Objectivity • Discipline • Innovation
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Guided Discovery • Collaborative Learning
Learning Resources	• Molecular Models • Periodic Table • Reaction Mechanism Charts • Heterocycle Structure Charts • Spectroscopic Data • NMR Spectra • IR Spectra • UV–Vis Spectra • Mass Spectra

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Nomenclature Exercises • Structure Exercises • Continuous Assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Joule, J. A., & Mills, K. (2010). *Heterocyclic chemistry* (5th ed.). Wiley-Blackwell.
2. Katritzky, A. R., Ramsden, C. A., Scriven, E. F. V., & Taylor, R. J. K. (Eds.). (2010). *Comprehensive heterocyclic chemistry III* (Vols. 1–13). Elsevier.
3. Gilchrist, T. L. (1997). *Heterocyclic chemistry* (3rd ed.). Addison Wesley Longman.
4. Li, J. J. (2021). *Heterocyclic chemistry in drug discovery*. Wiley.
5. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
6. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
7. Silverstein, R. M., Webster, F. X., Kiemle, D. J., & Bryce, D. L. (2014). *Spectrometric identification of organic compounds* (8th ed.). John Wiley & Sons.
8. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage

CHM 512 Physical Organic Chemistry and Reaction Mechanism

LEVEL 500L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an advanced study of **organic reaction mechanisms, kinetics, stereochemistry, linear free-energy relationships, and pericyclic reactions**. It examines stepwise and concerted mechanisms, nucleophilic displacement reactions, SN1, SN2, and related processes, with emphasis on the effects of molecular structure, reaction environment, nucleophile, solvation, and salts on reaction rates and pathways. The course also covers ester hydrolysis, the Hammett equation and linear free-energy relationships,

mechanistic analysis, orbital symmetry, electrocyclic reactions, sigmatropic rearrangements, and the Woodward–Hoffmann rules.

RELEVANCE STATEMENT

The course develops students' ability to **interpret, predict, and evaluate organic reaction mechanisms using kinetic, stereochemical, electronic, and quantitative approaches**. It provides essential knowledge for advanced organic synthesis, medicinal chemistry, pharmaceutical chemistry, chemical research, and mechanistic studies.

COURSE OBJECTIVES

The objectives of this course are to:

1. Distinguish between stepwise and concerted reaction mechanisms.
2. Explain and compare SN1, SN2, and related nucleophilic substitution processes.
3. Analyse the effects of structure, nucleophile, solvent, solvation, and salts on reaction rates and mechanisms.
4. Explain the mechanisms and kinetics of unimolecular and bimolecular ester hydrolysis.
5. Apply linear free-energy relationships and the Hammett equation to mechanistic studies.
6. Explain stereochemical consequences of organic reaction mechanisms.
7. Apply orbital symmetry principles and Woodward–Hoffmann rules to pericyclic reactions.
8. Explain electrocyclic reactions and sigmatropic rearrangements.

LEARNING OUTCOMES

1. Identify stepwise and concerted reaction pathways.
2. Derive and apply appropriate rate equations to selected organic reactions.
3. Predict the products and stereochemical outcomes of SN1 and SN2 reactions.
4. Evaluate the effects of substrate structure, solvent, nucleophile, and added salts on reaction rates.
5. Distinguish between kinetic and non-kinetic evidence for reaction mechanisms.
6. Explain unimolecular and bimolecular ester hydrolysis mechanisms.
7. Determine substituent and reaction constants using the Hammett equation.
8. Interpret the signs and magnitudes of Hammett reaction constants.
9. Use linear free-energy relationships to evaluate competing mechanistic pathways.

10. Apply orbital symmetry and Woodward–Hoffmann rules to electrocyclic and sigmatropic reactions.

COURSE CONTENT

- Stepwise and concerted reaction mechanism
- Kinetic and non-kinetic studies, nucleophilic displacement reactions
- The mechanisms of SN1, SN2 and SN processes
- The effect of structure, environment, nature of the nucleophile, solvation factors, added salts etc. on the course and rates of reactions, stereochemical concepts.
- **Ester hydrolysis:** unimolecular and bimolecular processes
- Linear free energy relationships
- The Hammett equation
- Determination of substituents and reaction constants
- Significance and use of the signs and symbols to 6M/P+O+6+M/O application to evaluation of mechanistic pathways, orbital symmetry in pericyclic reactions
- Electrocyclic reactions
- Sigmatropic rearrangements
- Woodward Hoffmann rule

CATEGORY	DETAILS
Core Competencies	• Mechanisms • Kinetics • Stereochemistry • Calculation • Analysis • Prediction • Interpretation • Modelling

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Curiosity • Creativity • Objectivity • Discipline • Innovation
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Guided Discovery • Collaborative Learning
Learning Resources	• Reaction Mechanism Charts • Molecular Models • Energy Profile Diagrams • Stereochemical Models • Kinetic Data • Hammett Plots • Molecular Orbital Diagram
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous Assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Anslyn, E. V., & Dougherty, D. A. (2006). *Modern physical organic chemistry*. University Science Books.
2. Carey, F. A., & Sundberg, R. J. (2007). *Advanced organic chemistry: Part A: Structure and mechanisms* (5th ed.). Springer.

3. Smith, M. B. (2020). *March's advanced organic chemistry: Reactions, mechanisms, and structure* (8th ed.). John Wiley & Sons.
4. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
5. Lowry, T. H., & Richardson, K. S. (1987). *Mechanism and theory in organic chemistry* (3rd ed.). Harper & Row.
6. Fleming, I. (2010). *Molecular orbitals and organic chemical reactions: Reference edition*. Wiley.
7. Woodward, R. B., & Hoffmann, R. (1970). *The conservation of orbital symmetry*. Verlag Chemie.
8. March, J. (1992). *Advanced organic chemistry: Reactions, mechanisms, and structure* (4th ed.). John Wiley & Sons.

CHM 513 Reaction Kinetics

LEVEL 500L | **SEMESTER** Firs | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an advanced treatment of **chemical kinetics and reaction mechanisms**, focusing on first-, second-, and third-order rate equations, rate and equilibrium constants, collision theory, transition state theory, reaction coordinates, and mechanisms of unimolecular, bimolecular, and chain reactions. It also examines catalysis, heterogeneous reactions, and photochemical reaction mechanisms. Emphasis is placed on the quantitative analysis of reaction rates and the relationship between **molecular-level mechanisms and observed reaction behaviour.**

RELEVANCE STATEMENT

The course develops students' ability to **analyse reaction rates and explain chemical reactions at the molecular level.** It provides essential knowledge for applications in catalysis, industrial chemistry, atmospheric chemistry, combustion, photochemistry, pharmaceuticals, environmental chemistry, and chemical research.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Identify the first, second and third order rate equations;
2. Distinguish between instantaneous rates and average rates from a graph;

3. Determine the rate law from initial rate data and be able to determine
4. The order of reaction with respect to each reactant;
5. The overall order of reaction; and
6. The rate constant with units;
7. Recognise the integrated rate laws and be able to

   Use integrated first-order and second-order rate laws to find the value of one variable, given;

   .

COURSE CONTENT

- Review of first, second and third order rate equations
- Rate constants and equilibrium constants
- Collision theory, transition state theory, reaction co-ordinates
- Unimolecular reaction mechanisms, bimolecular reaction mechanisms, chain reaction mechanisms
- Catalysis and heterogeneous reactions
- Photochemical reaction mechanisms

CATEGORY	DETAILS
Core Competencies	• Calculation • Analysis • Kinetics • Modelling • Prediction • Interpretation • Mechanisms • Graphing
Core Values	• Professionalism • Responsibility • Creativity and Innovation • Integrity • Collaboration • Commitment to Learner Success

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping
Learning Resources	• Chemistry Textbooks and Teachers' Guides • Chemistry Curriculum and Syllabus Documents • Lesson Note and Lesson Plan Templates
Assessment Methods	• Rate Law Charts • Reaction Coordinate Diagrams • Molecular Models • Kinetic Data Tables • Laboratory Equipment

REFERENCES AND FURTHER READING

1. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
2. Masel, R. I. (2001). *Chemical kinetics and catalysis*. Wiley-Interscience.
3. Espenson, J. H. (1995). *Chemical kinetics and reaction mechanisms* (2nd ed.). McGraw-Hill.
4. Houston, P. L. (2006). *Chemical kinetics and reaction dynamics*. Dover Publications.
5. Steinfeld, J. I., Francisco, J. S., & Hase, W. L. (1999). *Chemical kinetics and dynamics* (2nd ed.). Prentice Hall.
6. Laidler, K. J. (1987). *Chemical kinetics* (3rd ed.). Harper & Row.
7. Levine, I. N. (2009). *Physical chemistry* (6th ed.). McGraw-Hill.
8. Turro, N. J., Ramamurthy, V., & Scaiano, J. C. (2010). *Principles of molecular photochemistry: An introduction*. University Science Books.

CHM 514 Electrochemistry

LEVEL 500L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a comprehensive study of **fundamental and advanced electrochemistry**, focusing on electrochemical cells, electrode potentials, the Nernst equation, electrolysis, Faraday's laws, conductance, and electrochemical measurements. It also examines industrial applications of electrochemistry in electroplating, batteries, and fuel cells, as well as emerging applications in **electrochemical sensors and biosensors**.

RELEVANCE STATEMENT

The course equips students with knowledge and skills for understanding and applying **electrochemical principles in energy conversion, materials processing, chemical analysis, environmental monitoring, and biomedical applications**. It provides a foundation for applications in industrial chemistry, analytical chemistry, corrosion science, energy technology, and sensor development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the principles and types of electrochemical cells.
2. Determine and apply electrode potentials in electrochemical systems.
3. Apply the Nernst equation to electrochemical calculations and equilibria.
4. Explain electrolysis and apply Faraday's laws to quantitative problems.
5. Explain conductance and methods for its measurement.
6. Describe the applications of electrochemistry in electroplating, batteries, and fuel cells.
7. Explain the principles and applications of modern electrochemical sensors and biosensors.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Distinguish between galvanic and electrolytic cells.
2. Represent electrochemical cells using appropriate cell notation.
3. Calculate cell potentials under standard and non-standard conditions.

4. Apply the Nernst equation to electrochemical systems.
5. Perform quantitative calculations involving electrolysis and Faraday's laws.
6. Determine and interpret conductance and conductivity measurements.
7. Explain the operation and applications of batteries and fuel cells.
8. Describe the principles and applications of electroplating.
9. Explain the operating principles of electrochemical sensors and biosensors.
10. Analyse basic electrochemical data and solve related problems.

COURSE CONTENT

- Fundamental and advanced topics in electrochemistry. Study of: Electrochemical cells and their types
- Electrode potentials and their applications
- Nernst equation
- Electrolysis and Faraday's laws
- Conductance and its measurement
- Applications of electrochemistry in industries
- Such as electroplating
- Batteries
- Fuel cells
- Recent advances in electrochemical sensors and biosensors

CATEGORY	DETAILS
Core Competencies	• Calculation • Measurement • Electrolysis • Conductance • Instrumentation • Experimentation • Application • Innovation

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Safety • Objectivity • Discipline • Innovation • Responsibility • Sustainability
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping
Learning Resources	• Electrochemical Cells • Electrodes • Potentiometers • Conductivity Meters • Power Supplies • Electrolysis Apparatus • Batteries • Fuel Cells • Electroplating Equipment • Electrochemical Sensors
Assessment Methods	• Assignments • Class Tests • Quizzes • Electrochemical Calculations • Problem-Solving Exercises • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Bard, A. J., Faulkner, L. R., White, H. S., & Zoski, C. G. (2022). *Electrochemical methods: Fundamentals and applications* (3rd ed.). Wiley.
2. Brett, C. M. A., & Brett, A. M. O. (1993). *Electrochemistry: Principles, methods, and applications*. Oxford University Press.
3. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.
4. Wang, J. (2023). *Analytical electrochemistry* (4th ed.). Wiley-VCH.
5. Compton, R. G., & Banks, C. E. (2018). *Understanding voltammetry* (3rd ed.). World Scientific.
6. Pletcher, D., & Walsh, F. C. (1990). *Industrial electrochemistry* (2nd ed.). Springer.

CHM 515 Nuclear and Radiation Chemistry

LEVEL 500L | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a comprehensive study of **nuclear chemistry and radiochemistry**, beginning with the structure of the proton – neutron nucleus, neutron excess, nuclear shell model, and nuclear spin. It examines radioactive decay modes and properties of emitted particles, including alpha particles, beta particles (electrons and positrons), gamma radiation, electron capture, and internal conversion. The course further covers radiation shielding, health effects, permissible dose levels, radiation risks, radioactive decay kinetics, half-life, decay curves, radiation detection using solid and liquid scintillation systems, counting corrections, natural and induced radioactivity, nuclear binding energy, mass – energy relationships, nuclear fission and fusion, and nuclear reactor types. It also introduces activation analysis and the use of isotopes in reaction mechanisms, analytical chemistry, and other scientific and industrial applications of radioactivity.

RELEVANCE STATEMENT

The course develops students' understanding of **nuclear processes, radioactive decay, radiation measurement, and applications of radioisotopes**. It provides a foundation for applications in nuclear energy, medical diagnosis and treatment, analytical chemistry, environmental monitoring, agriculture, industry, research, and radiation protection.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain nuclear structure, neutron excess, nuclear spin, shell model, and binding energy.
2. Describe the major modes of radioactive decay and the properties of emitted radiation.
3. Apply radioactive decay kinetics, half-life relationships, and decay curves to nuclear processes.
4. Explain radiation detection systems, counting methods, and appropriate correction procedures.
5. Describe natural and induced radioactivity, nuclear fission, fusion, and the basic principles of nuclear reactors.
6. Explain radiation health effects, shielding principles, permissible exposure levels, and radiation risks.
7. Describe the principles and applications of activation analysis and isotope techniques.
8. Evaluate applications of radioactivity in scientific, medical, industrial, agricultural, and environmental fields.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Describe the composition and basic structure of the atomic nucleus.
2. Explain neutron excess and its relationship to nuclear stability.
3. Describe the nuclear shell model and nuclear spin.
4. Identify and distinguish alpha, beta-minus, positron, gamma, and electron-capture decay.
5. Explain annihilation, radiation range, shielding, and energy deposition.
6. Calculate decay constants, half-lives, and remaining quantities of radioactive substances.
7. Interpret radioactive decay curves.
8. Explain the operation of solid and liquid scintillation counting systems.
9. Apply appropriate counting and channel-ratio corrections to radioactivity measurements.
10. Distinguish between natural and induced radioactivity. .

COURSE CONTENT

- **Revision of proton:** neutron nucleus, Neutron excess, shell model and nuclear spin
- Alpha, negatron, positron, electron capture, gamma and internal conversion, decay modes of the properties of particles produced – annihilation, range, shielding etc. Health effects, permissible dose level, risk estimates.
- Kinetics of decay, half-life and decay curves
- Detection systems, solid and liquid scintillation counting
- Quentin and channels ratio correction
- Natural radioactivity
- **Induced radioactivity:** mass energy balance including recoil
- Binding energy
- Fission and fission
- Reactor types classified by fuel, moderator coolant
- Introduction to activation analysis
- The use of isotopes in reaction mechanism and analysis
- Application of radioactivity

CATEGORY	DETAILS
Core Competencies	• Nuclear Analysis • Calculation • Measurement • Detection • Interpretation
Core Values	• Accuracy • Integrity • Safety • Objectivity • Discipline • Innovation • Responsibility • Sustainability

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping
Learning Resources	• Periodic Table • Nuclear Decay Charts • Nuclide Charts • Radiation Detectors
Assessment Methods	• Test • Continuous Assessment • End of Semester Examination

REFERENCES AND FURTHER READING

1. Lilley, J. (2013). *Nuclear physics: Principles and applications* (2nd ed.). John Wiley & Sons.
2. Friedlander, G., Kennedy, J. W., Macias, E. S., & Miller, J. M. (2003). *Nuclear and radiochemistry* (3rd ed.). John Wiley & Sons.
3. Choppin, G. R., Liljenzin, J.-O., Rydberg, J., & Ekberg, C. (2013). *Radiochemistry and nuclear chemistry* (4th ed.). Academic Press.
4. Krane, K. S. (1988). *Introductory nuclear physics*. John Wiley & Sons.
5. Turner, J. E. (2007). *Atoms, radiation, and radiation protection* (3rd ed.). Wiley-VCH.
6. International Atomic Energy Agency. (2022). *Radiation protection and safety of radiation sources: International basic safety standards*. IAEA.

CHM 521 Applied Spectroscopy

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces the **principles, instrumentation, interpretation, and applications of spectroscopic techniques** for the identification and structural elucidation of organic compounds. It focuses on UV–Visible, infrared (IR), nuclear magnetic resonance (NMR), and mass spectrometry, with emphasis on how spectral data are combined to determine molecular structures. The course also provides an introduction to hyphenated techniques such as **GC–MS, LC–MS, and LC–NMR**, as well as the diagnostic applications of NMR in medicine.

RELEVANCE STATEMENT

The course equips students with essential skills for **identifying and elucidating the structures of organic compounds using instrumental techniques**. These skills are relevant to organic synthesis, pharmaceutical analysis, forensic science, biochemistry, environmental analysis, quality control, medical diagnostics, and chemical research.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental principles of UV–Visible, IR, NMR, and mass spectrometry.
2. Identify characteristic spectral features of organic functional groups.
3. Interpret UV, IR, NMR, and mass spectra for structural elucidation.
4. Integrate data from different spectroscopic techniques to determine organic structures.
5. Explain the basic principles and applications of GC–MS, LC–MS, and LC–NMR.
6. Describe selected diagnostic applications of NMR in medicine.
7. Apply spectroscopic techniques to qualitative identification of organic compounds.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify the major components and functions of spectroscopic instruments.
2. Explain the interaction of electromagnetic radiation with matter.
3. Interpret UV–Visible spectra and relate absorption to molecular structure.
4. Use IR absorption bands to identify important functional groups.

5. Interpret ^1H and ^13C NMR spectra for structural determination.
6. Interpret molecular ions, fragment ions, and isotope patterns in mass spectra.
7. Combine UV, IR, NMR, and MS data to elucidate unknown organic structures.
8. Explain the applications of GC–MS, LC–MS, and LC–NMR.
9. Identify selected applications of NMR in medical diagnosis and biomedical research.

COURSE CONTENT

Principles and applications of UV, IR, NMR and mass spectroscopy in the determination and elucidation of structures of organic compounds. Brief mention of hyphenated systems: GC-MS, LC-MS and LC-NMR, and diagnostic use of NMR in medicine.

CATEGORY	DETAILS
Core Competencies	• Analysis • Interpretation • Identification • Structure-elucidation • Measurement • Instrumentation • Data-analysis • Problem-solving • Research
Core Values	• Accuracy • Integrity • Objectivity • Precision • Safety • Discipline • Curiosity

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Discussion Method • Concept Mapping
Learning Resources	• Spectral Interpretation Charts • UV–Vis Spectra • IR Spectra • NMR Spectra • Mass Spectra • Spectrometers • NMR Spectrometer • Mass Spectrometer • Chromatography Equipment • Molecular Models
Assessment Methods	• Assignments • Class Tests • Quizzes • Spectral Interpretation Exercises • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. R. (2015). *Introduction to spectroscopy* (5th ed.). Cengage Learning.
2. Silverstein, R. M., Webster, F. X., Kiemle, D. J., & Bryce, D. L. (2014). *Spectrometric identification of organic compounds* (8th ed.). John Wiley & Sons.
3. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
4. Claridge, T. D. W. (2016). *High-resolution NMR techniques in organic chemistry* (3rd ed.). Elsevier.

5. Field, L. D., Sternhell, S., & Kalman, J. R. (2013). *Organic structures from spectra* (5th ed.). John Wiley & Sons.
6. Gross, J. H. (2017). *Mass spectrometry: A textbook* (3rd ed.). Springer.
7. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2018). *Principles of instrumental analysis* (7th ed.). Cengage Learning.
8. Lambert, J. B., Mazzola, E. P., & Ridge, C. D. (2019). *Nuclear magnetic resonance spectroscopy: An introduction to principles, applications, and experimental methods*. Pearson.

CHM 522 Chemistry of Pulp and Paper Making

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces the **chemistry and technology of the pulp and paper industry**, focusing on the properties and preparation of raw materials, pulp production from hardwood and softwood, pulping processes, bleaching, stock preparation, paper recycling, and the utilisation of by-products. Emphasis is placed on the chemical principles underlying pulp and paper production, resource efficiency, waste reduction, recycling, and sustainable industrial practices.

RELEVANCE STATEMENT

The course provides students with knowledge of the **chemical and industrial processes involved in paper production and recycling**. It develops skills relevant to the paper, packaging, forestry, printing, recycling, and environmental industries while promoting sustainable utilisation of lignocellulosic resources and industrial by-products.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the properties and suitability of raw materials used in papermaking.
2. Describe the preparation of pulpwood from hardwood and softwood.
3. Explain major mechanical, chemical, and semi-chemical pulping processes.
4. Describe the principles of pulp bleaching and stock preparation.
5. Explain the processes involved in paper formation, recycling, and recovery.
6. Identify useful by-products of the pulp and paper industry.

7. Evaluate environmental and sustainability issues associated with pulp and paper production.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify and characterise major papermaking raw materials.
2. Differentiate between hardwood and softwood pulp.
3. Describe major stages of pulp production.
4. Explain the chemical principles of pulping and bleaching.
5. Describe stock preparation and paper recycling processes.
6. Identify potential uses of pulp and paper industry by-products.
7. Assess waste minimisation and resource recovery options in the industry.

COURSE CONTENT

- Papermaking industry: Properties of raw materials utilised in paper making, paper recycling
- Pulp making from hard and soft wood: Preparation of pulpwood and pulping processes, bleaching of pulps and stock preparations
- Utilisation of bye-products from pulp and paper industry

CATEGORY	DETAILS
Core Competencies	• Identification • Characterisation • Processing • Pulping • Bleaching • Recycling • Analysis
Core Values	• Sustainability • Efficiency • Responsibility • Safety • Integrity • Innovation

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Project-Based Learning • Collaborative Learning • Experiential Learning • Field-Based Learning • Case Study • Discussion Method
Learning Resources	• Wood and Fibre Samples • Pulp Samples • Paper Samples • Pulping Equipment • Bleaching Materials • Microscopes • pH Meter • Fibre Testing Equipment • Recycling Materials • Process Flow Charts
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

1. Biermann, C. J. (1996). *Handbook of pulping and papermaking* (2nd ed.). Academic Press.
2. Smook, G. A. (2002). *Handbook for pulp & paper technologists* (3rd ed.). Angus Wilde Publications.
3. Sixta, H. (Ed.). (2006). *Handbook of pulp*. Wiley-VCH.

4. Bajpai, P. (2018). *Biermann's handbook of pulp and paper: Volume 1: Raw material and pulp making*. Elsevier.
5. Bajpai, P. (2018). *Biermann's handbook of pulp and paper: Volume 2: Paper and board making*. Elsevier.
6. Bajpai, P. (2014). *Recycling and deinking of recovered paper*. Elsevier.
7. Hubbe, M. A., Venditti, R. A., & Rojas, O. J. (2007). What happens to cellulosic fibers during papermaking and recycling? A review. *Bio Resources, 2*(4), 739–788.
8. Food and Agriculture Organization of the United Nations. (2022). *The state of the world's forests 2022: Forest pathways for green recovery and building inclusive, resilient and sustainable economies*. FAO.

CHM 523 Natural Products

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the chemistry of **lipids, carbohydrates, proteins, amino acids, amines and related nitrogen compounds.** It examines their structures, properties, classification, reactions, synthesis and biological functions, with emphasis on triglycerides, fatty acids, sugars, polysaccharides, amino acids and proteins. The course also covers the chemistry of aliphatic and aromatic amines, their nucleophilic reactions, quaternary ammonium compounds, Hofmann reactions and benzene diazonium salts.

RELEVANCE STATEMENT

The course provides essential knowledge for understanding the **chemistry of major biomolecules and nitrogen-containing organic compounds** that are important in living organisms and everyday life. It relates chemical structures to biological functions and applications in **food production, soap and detergent manufacture, brewing, pharmaceuticals, agriculture and other industries.** The knowledge gained provides a foundation for understanding biochemistry, medicinal chemistry, nutrition and related areas of applied chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the structure, composition, classification and functions of lipids, triglycerides and fatty acids.

2. Describe the structure, classification, configuration and reactions of carbohydrates, including mono-, di- and polysaccharides.
3. Explain the properties, structures, synthesis and functions of amino acids and proteins.
4. Describe the general characteristics, nomenclature, structures and properties of aliphatic and aromatic amines.
5. Explain the nucleophilic behaviour and reactions of amines and the formation and applications of quaternary ammonium compounds.
6. Explain the chemistry and reactions of benzene diazonium salts, including their importance in organic synthesis.
7. Relate the chemistry of biomolecules to biological processes and industrial applications such as soaps, edible oils, fats and brewing.
8. Apply knowledge of the chemistry of biomolecules and amines to solve simple chemical and practical problems.

LEARNING OUTCOMES

By the end of the course the students should be able to:

1. Identify and describe the structures, composition, types and functions of triglycerides and fatty acids.
2. Explain the chemical properties and commercial applications of lipids, including their use in soaps, edible oils and fats.
3. Classify and describe aldoses, ketoses, aldoses and ketoses, and explain carbohydrate configuration in relation to glyceraldehyde.
4. Explain the structures and reactions of aldohexoses and distinguish among important disaccharides and polysaccharides such as sucrose, maltose, lactose, starch and cellulose.
5. Describe the structure, properties, nomenclature, synthesis and biological functions of amino acids and proteins.
6. Explain the structure, nomenclature, physical and chemical properties and nucleophilic behaviour of aliphatic and aromatic amines.
7. Describe and explain the formation and reactions of quaternary ammonium compounds, Hofmann products and benzene diazonium salts.
8. Relate the chemistry of lipids, carbohydrates, proteins, amino acids and amines to biological functions and practical applications, including food processing, brewing, pharmaceuticals and industry.

COURSE CONTENT

- Lipids-Triglycerides: structure, composition and functions in living organisms
- Types of fatty acids encountered in lipids
- Commercial application as soaps, edible oils and fats, etc. Carbohydrates: aldoses and ketones.
- General features, configuration in relation to glyceraldehyde's
- Aldohexoses structure and chemical reaction
- Disaccharides, sucrose, maltose, lactose, etc. Polysaccharides starch, cellulose, etc. Brewing.
- Proteins: Properties, structure, nomenclature, synthesis and uses
- Amino-acids: their dipolar nature and relationship to proteins
- Amines and derivations: General characteristics and nomenclature of amines
- Structure, physical and chemical properties
- Amines as nucleophiles: General reaction of aliphatic and aromatic amines
- Quatemacy ammonium compounds
- Hoffman Benzene diazonium salts and their reactions

CATEGORY	DETAILS
Core Competencies	• Biomolecular Chemistry Knowledge • Structural and Reaction Analysis • Organic Chemistry Problem-Solving • Practical and Laboratory Skills • Scientific Reasoning and Critical Thinking
Core Values	• Scientific Integrity • Accuracy and Precision • Critical Thinking • Creativity and Innovation • Curiosity and Inquiry

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach • Cooperative Learning • Demonstration Method
Learning Resources	• Organic and Biochemistry Textbooks • Molecular Models and Kits • Laboratory Equipment and Chemicals • Carbohydrate, Lipid and Protein Structural Charts • Reaction Mechanism Charts
Assessment Methods	• Class Tests and Quizzes • Assignments and Tutorial Exercises • Organic Reaction and Mechanism Exercises • Practical/Laboratory Assessment • End semester examination

REFERENCES AND FURTHER READING

1. Berg, J. M., Tymoczko, J. L., Gatto, G. J., Jr., & Stryer, L. (2019). *Biochemistry* (9th ed.). W. H. Freeman and Company.
2. Campbell, M. K., Farrell, S. O., & McDougal, O. M. (2018). *Biochemistry* (9th ed.). Cengage Learning.
3. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
4. McMurry, J. (2016). *Organic chemistry* (9th ed.). Cengage Learning.
5. Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman and Company.
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7. Solomons, T. W. G., Fryhle, C. B., & Snyder, S. A. (2016). *Organic chemistry* (12th ed.). John Wiley & Sons.

8. Voet, D., Voet, J. G., & Pratt, C. W. (2016). *Fundamentals of biochemistry: Life at the molecular level* (5th ed.). John Wiley & Sons.

CHM 524 Biomass and Renewal Energy Technology

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (NCEMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the **chemistry, technology, availability, conversion, and applications of biomass and renewable energy resources**, with particular emphasis on Nigeria. It examines biomass resources, starch and other natural products as industrial feedstocks, modern thermochemical, biochemical, and agrochemical conversion technologies, renewable energy types and applications, and their potential for rural development. The course also covers charcoal production and uses, alternative fuels such as synthetic hydrocarbons, alcohols, and hydrogen, biogas production from organic wastes, and the environmental implications of renewable resource utilisation.

RELEVANCE STATEMENT

The course equips students with knowledge and skills for the **sustainable utilisation of Nigeria's biomass and renewable energy resources**. It promotes alternative energy development, waste-to-energy technologies, rural development, environmental protection, industrial innovation, and reduction of dependence on conventional petroleum-based fuels.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify and characterise major biomass resources and their potential in Nigeria.
2. Explain the industrial importance of starch and other natural products as biomass feedstocks.
3. Describe thermochemical, biochemical, and agrochemical biomass conversion technologies.
4. Classify renewable energy resources and explain their applications.
5. Evaluate renewable energy technologies for rural development in Nigeria.
6. Explain the preparation, properties, uses, and environmental implications of charcoal and fuel wood.
7. Describe alternative fuels including synthetic hydrocarbons, alcohols, hydrogen, and biogas.

8. Assess the environmental benefits and challenges associated with renewable resource utilisation.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify major biomass resources available in Nigeria.
2. Assess the potential of biomass resources for industrial and energy applications.
3. Explain the conversion of biomass into fuels, chemicals, and other useful products.
4. Differentiate between thermochemical and biochemical conversion processes.
5. Classify renewable energy technologies and identify their appropriate applications.
6. Explain the production and industrial uses of charcoal and biogas.
7. Compare renewable and petroleum-based fuels.
8. Evaluate the suitability of renewable energy technologies for rural communities.
9. Explain the environmental impacts of biomass and renewable energy utilisation.

COURSE CONTENT

- Sources, availability and characterisation of Biomass resources potential of Nigeria
- Starch biomass and other natural products and their potential industrial feedstock
- Modern biomass conversion technologies involving thermo chemical, biochemical and agrochemical processes
- Renewable energy classification and applications
- Resource availability and potential application of renewable energy technology for rural development in Nigeria
- Charcoal preparation, industrial uses and its differences with fuel wood
- Brief treatment of potential alternatives to conventional petroleum based fuels such as synthetic Hydrocarbons, alcohols from wood and molasses and hydrogen as fuels of the future
- Biogas from organic resources including brewery waste
- Environmental aspects of utilisation of renewable resources aspects

CATEGORY	DETAILS
Core Competencies	• Identification • Characterisation • Classification • Analysis • Conversion • Processing • Evaluation
Core Values	• Sustainability • Innovation • Responsibility • Environmental Stewardship • Resourcefulness • Safety
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Project-Based Learning • Collaborative Learning • Discussion Method
Learning Resources	• Biomass Samples • Natural Product Samples • Renewable Energy Models • Biogas Digester Model • Charcoal Production Equipment • Laboratory Equipment • Chemicals and Reagents • Fuel Samples

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class test • Continuous assessment • End of semester examination • Biomass Characterisation

REFERENCES AND FURTHER READING

1. Basu, P. (2018). *Biomass gasification, pyrolysis and torrefaction: Practical design and theory* (3rd ed.). Academic Press.
2. McKendry, P. (2002). Energy production from biomass (part 1): Overview of biomass. *Bioresource Technology, 83*(1), 37–46. https://doi.org/10.1016/S0960-8524(01)00118-3
3. International Energy Agency. (2024). *Renewables 2024: Analysis and forecasts to 2030*. OECD Publishing.
4. International Renewable Energy Agency. (2023). *Renewable energy statistics 2023*. IRENA.
5. Food and Agriculture Organization of the United Nations. (2022). *The state of the world's forests 2022: Forest pathways for green recovery and building inclusive, resilient and sustainable economies*. FAO.
6. Speight, J. G. (2020). *The chemistry and technology of petroleum* (5th ed.). CRC Press.
7. Demirbas, A. (2009). *Biofuels: Securing the planet's future energy needs*. Springer.
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CHM 525 Carbohydrate and Lipids Chemistry

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the **chemistry of carbohydrates**, with emphasis on their classification, structure, nomenclature, stereochemistry, preparation, reactions, and reaction mechanisms. It covers monosaccharide, disaccharides, polysaccharides, configuration, epimerization, and important derivatives of starch and cellulose, including dextrins. The

course also examines the **industrial applications of starch and cellulose** in food, pharmaceutical, textile, paper, packaging, and other industries.

RELEVANCE STATEMENT

The course provides essential knowledge of the **structure, properties, reactions, and applications of carbohydrates**. It enables students to relate carbohydrate chemistry to biological processes and industrial production, with applications in food technology, pharmaceuticals, agriculture, biotechnology, textiles, paper, and materials science.

COURSE OBJECTIVES

The objectives of this course are to:

1. Classify and name carbohydrates based on their structures and functional groups.
2. Describe the structures and properties of monosaccharides, disaccharides, and polysaccharides.
3. Explain carbohydrate configuration, stereochemistry, and epimerization.
4. Explain the preparation, reactions, and mechanisms of important carbohydrates.
5. Describe the structures and properties of starch, cellulose, dextrins, and their derivatives.
6. Explain the industrial applications of starch and cellulose.
7. Apply appropriate chemical principles to identify and distinguish carbohydrate compounds.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Identify and classify common carbohydrates.
2. Represent monosaccharide structures using appropriate structural and stereochemical conventions.
3. Explain the formation and hydrolysis of glycosidic bonds.
4. Differentiate between structural and stereochemical relationships among carbohydrates.
5. Explain the mechanism and significance of epimerization.
6. Describe the structures and properties of starch and cellulose.
7. Explain the preparation and applications of starch and cellulose derivatives.
8. Relate carbohydrate structure to chemical reactivity and industrial applications.

COURSE CONTENT

- Carbohydrates: Classification
- Optical isomerism of monosaccharides and projection formulae
- Chemistry of monosaccharides including osazone formation and its stereochemical implication
- Cyclic forms and anomerism
- Determination of Ring Size in D-glucose, Pyranose and furanose sugar
- Mutarotation
- Epimerisation
- Chemical methods of ascending and descending the sugar series
- Alkaline-induced rearrangements of sugar
- Disaccharides: sucrose, with techniques to establish the structure of sucrose: maltose, lactose, cellobiose
- Polysaccharides: starch, glycogen, cellulose
- Structure of cotton
- Vitamin C: structure and chemistry, synthesis from L-xylose

CATEGORY	DETAILS
Core Competencies	• Classification • Nomenclature • Structure • Stereochemistry • Identification • Mechanisms • Synthesis • Reactivity • Application

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Curiosity • Creativity • Objectivity • Discipline • Responsibility
Pedagogical Approaches	• Learner-Centred Approach • Interactive Lecture Method • Problem-Based Learning • Inquiry-Based Learning • Practical/Experimental Approach • Cooperative Learning • Demonstration Method
Learning Resources	• Molecular Models • Structural Formula Charts • Reaction Mechanism Charts • Laboratory Equipment • Carbohydrate Samples • Chemicals and Reagents
Assessment Methods	• Assignments • Class Tests • Quizzes • Structure Exercises • Nomenclature Exercises • Continuous assessment • End of semester examination

REFERENCES AND FURTHER READING

1. McMurry, J. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
2. Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman.

3. Voet, D., Voet, J. G., & Pratt, C. W. (2019). *Fundamentals of biochemistry: Life at the molecular level* (5th ed.). John Wiley & Sons.
4. Berg, J. M., Tymoczko, J. L., Gatto, G. J., Jr., & Stryer, L. (2019). *Biochemistry* (9th ed.). W. H. Freeman.
5. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
6. Stick, R. V., & Williams, S. J. (2010). *Carbohydrates: The essential molecules of life* (2nd ed.). Elsevier.
7. BeMiller, J. N. (2018). *Carbohydrate chemistry for food scientists* (3rd ed.). AACC International.
8. Tester, R. F., Karkalas, J., & Qi, X. (2004). Starch – composition, fine structure and architecture. *Journal of Cereal Science*, *39*(2), 151–165.

CHM 527 Coordination Chemistry

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides an advanced study of **coordination chemistry**, focusing on the recognition, nomenclature, structure, bonding, stereochemistry, properties, preparation, reactions, stability, kinetics, and mechanisms of coordination compounds. It examines coordination theories, isomerism, magnetic properties, electronic and vibrational spectra, spectrochemical and nephelauxetic series, Jahn–Teller distortions, unusual oxidation states, thermodynamic stability, stability constants, and the chelate effect. Emphasis is placed on relating **structure and bonding to the physical and chemical behaviour of coordination compounds**.

RELEVANCE STATEMENT

The course develops students' ability **to interpret, predict, and explain the structure, bonding, stability, reactivity, and properties of coordination compounds**. It provides essential knowledge for applications in analytical chemistry, bioinorganic chemistry, catalysis, materials science, medicinal chemistry, and industrial chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define, recognise, classify, and name coordination compounds using appropriate nomenclature.

2. Determine coordination formulae, stereochemistry, and isomerism of complex compounds.
3. Explain major theories of coordination structure and bonding.
4. Interpret magnetic properties and electronic, absorption, and vibrational spectra of complexes.
5. Explain the spectrochemical series, nephelauxetic effect, and Jahn–Teller distortions.
6. Explain the stabilisation of unusual oxidation states through complex formation.
7. Describe thermodynamic stability, stability constants, and the chelate effect.
8. Explain the preparation, reactions, kinetics, and mechanisms of coordination compounds.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define coordination componds;
2. Recognise coordination compounds and their application;
3. Understand the nomenclature, coordination formula and isomerism in complexes;
4. Explain the stereochemistry of complex molecules;
5. Identify theories of bonding: werner, valence bond, crystal field / ligand field and molecular bond theories;
6. Discuss their advantages, disadvantages, and their limitations;
7. Discuss the physiochemical methods for structural elucidation of coordination compounds;
8. Identify spectrochemicalseries, nephelauxetic series and jahn- teller distortions;
9. Identify stabilisation of unusual oxidation states by complex formation, thermodynamic stability of complex compounds, the stability constant, the chelate effect;
10. Discuss preparation and reactions of complexes, kinetics and mechanisms;
11. Discuss domain structures, magnetostrictions, magnetic relaxation, magnetohydrodynamics and others; and
12. Identify technological applications of magnetohydrodynamics.

COURSE CONTENT

- Definition, recognition and applications of co-ordination compounds
- Nomenclature, coordination formula and isomerism in complexes
- Stereochemistry of complex molecules

- Theories of structure and bonding
- Physical methods of structural investigation
- Magnetic properties
- Absorption and vibrational spectra
- The spectrochemical series
- The Nephelauxetic series and the Jahn-Teller distortions
- Stabilisation of unusual oxidation states by complex formation
- Thermodynamic stability of complex compounds, the stability constant, the chelate effect
- Preparation and reactions of complexes
- Kinetics and mechanisms

CATEGORY	DETAILS
Core Competencies	• Nomenclature • Classification • Coordination • Bonding • Stereochemistry • Analysis • Prediction
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Guided Discovery • Collaborative Learning • Discussion Method • Concept Mapping

CATEGORY	DETAILS
Learning Resources	• Molecular Models • Crystal Field Diagrams • Molecular Orbital Diagrams • Spectrochemical Series Charts • Periodic Table • Spectroscopic Data • Magnetic Susceptibility Data • Spectrometers
Assessment Methods	• Assignments • Class Tests • Nomenclature Exercises • Structure and Bonding Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
2. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
3. Weller, M., Overton, T., Rourke, J., & Armstrong, F. (2018). *Inorganic chemistry* (7th ed.). Oxford University Press.
4. Figgis, B. N., & Hitchman, M. A. (2000). *Ligand field theory and its applications*. Wiley-VCH.
5. Huheey, J. E., Keiter, E. A., & Keiter, R. L. (1993). *Inorganic chemistry: Principles of structure and reactivity* (4th ed.). HarperCollins.
6. Cotton, F. A. (1990). *Chemical applications of group theory* (3rd ed.). John Wiley & Sons.
7. Lever, A. B. P. (1984). *Inorganic electronic spectroscopy* (2nd ed.). Elsevier.

CHM 503 Organometallic Chemistry

LEVEL 500L | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the principles of **organometallic chemistry**, focusing on compounds containing metal – carbon bonds and their applications in organic synthesis and catalysis. It covers the classification, preparation, structure, bonding, reactions, and synthetic utility of organometallic compounds, with particular emphasis on transition-metal organometallics. The course also examines ligand classification, electron-counting rules, ferrocene and related compounds, and the role of organometallic compounds in important catalytic reactions.

RELEVANCE STATEMENT

The course develops students' understanding of the **relationship between metal – carbon bonding, structure, reactivity, and catalytic activity**. It provides essential knowledge for applications in organic synthesis, catalysis, pharmaceutical chemistry, polymer chemistry, materials science, and industrial chemical processes.

COURSE OBJECTIVES

The objectives of this course are to:

1. Classify organometallic compounds based on their structures, ligands, and metal – carbon interactions.
2. Explain the preparation, structures, bonding, and reactions of organometallic compounds.
3. Apply electron-counting rules to transition-metal organometallic complexes.
4. Explain the synthetic applications of organometallic compounds in organic chemistry.
5. Describe the chemistry of ferrocene and related organometallic compounds.
6. Explain the reactions and mechanisms of selected transition-metal organometallic compounds.
7. Describe the role of organometallic compounds in important catalytic processes.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Identify the classifications of organometallic compounds by bonding and ligands;

2. Explain Preparation, structure and reactions including abnormal science of organo-metallic compounds;
3. Identify electron rule, bonding, chemistry of ferrocene and related compounds; and 4. explain the roles of organometallic compounds in some catalytic reaction;

COURSE CONTENT

- Classification of organometallic compounds
- Preparation, structure and reactions including abnormal science of organometallic compounds
- Synthetic utility of organometallics
- Introduction to organometallic compounds of the transition elements
- Classification of ligands, electron rule, bonding, preparation of organic transition metal compounds
- Reaction and structures of organometallic compounds of transition elements
- The organic chemistry of ferrocene and related compounds
- The role of organometallic compounds in some catalytic reaction

CATEGORY	DETAILS
Core Competencies	• Classification • Electron-counting • Bonding • Synthesis • Analysis • Mechanisms • Reactivity • Prediction • Catalysis • Interpretation • Problem-solving • Application

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Objectivity • Curiosity • Discipline • Critical Thinking • Innovation
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Guided Discovery • Collaborative Learning • Discussion Method • Concept Mapping
Learning Resources	• Molecular Models • Electron-Counting Charts • Ligand Classification Charts • Reaction Mechanism Charts • Periodic Table • Laboratory Equipment • Chemicals and Reagents • Spectroscopic Data
Assessment Methods	• Assignments • Class Tests • Nomenclature Exercises • Electron counting Exercises • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Elschenbroich, C. (2020). *Organometallics* (4th ed.). Wiley-VCH.

2. Hartwig, J. F. (2010). *Organotransition metal chemistry: From bonding to catalysis*. University Science Books.
3. Crabtree, R. H. (2014). *The organometallic chemistry of the transition metals* (6th ed.). John Wiley & Sons.
4. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
5. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
6. Astruc, D. (2007). *Organometallic chemistry and catalysis*. Springer.
7. Bochmann, M. (1994). *Organometallics 1: Complexes with transition metal-carbon σ-bonds*. Oxford University Press.
8. Bochmann, M. (1994). *Organometallics 2: Complexes with transition metal-carbon π-bonds*. Oxford University Press.

SED 521 Science, Society and Technology

LEVEL *not stated* | **SEMESTER** *not stated* | **CREDIT UNITS** 3 | **STATUS** *not stated* | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course will examined the dynamic relationship between science, technology, and society, with particular emphasis on their influence on human life, culture, ethics, and national development. It explores how scientific discoveries and technological innovations shape social structures, economic growth, public policy, and environmental sustainability, while also considering how societal needs, values, and challenges influence advancement.

This course addresses key issues such as ethical considerations in science, responsible use of technology, scientific literacy, environmental stewardship, and the role of science in addressing contemporary societal challenges. It also highlights the contribution of science education to national development, citizenship, and sustainable development goals, particularly within the Nigerian context.

RELEVANCE STATEMENT

The course provides students with an understanding of the historical development of science technology and society, its contributions to national and global development, and the ethical, social, environmental, and economic implications of scientific discoveries and technological innovations. It also examines contemporary issues such as artificial intelligence, biotechnology, renewable energy, climate change, information and communication technology (ICT), sustainable development, and responsible innovation.

Students are encouraged to develop critical thinking, scientific literacy, ethical reasoning, and problem-solving skills to evaluate the benefits, risks, and challenges associated with emerging technologies. The course prepares learners to make informed decisions, participate actively in societal discourse on science and technology, and apply scientific knowledge responsibly in addressing local and global challenges. For prospective Integrated Science teachers, the course provides the knowledge and pedagogical foundation needed to relate scientific concepts to everyday life and societal needs.

COURSE OBJECTIVES

The objectives of this course are to:

1. Examine the relationship between science, technology, and society
2. Promote ethical awareness in scientific practices
3. Emphasise the role of science in national development.
4. Discuss Contemporary issues such as Artificial Intelligence, biotechnology etc.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the impact of science and technology on society.
2. Discuss ethical issues related to scientific advancement.
3. Relate science education to social and economic development in Nigeria.
4. Demonstrate responsible scientific attitudes and citizenship.

COURSE CONTENT

- Meaning and nature of science
- Meaning and nature of technology
- Meaning and characteristics of society
- Relationship between science
- Society and technology
- Historical development of science and technology
- Traditional and indigenous science and technology
- Contributions of African societies to science and technology
- Major scientific and technological revolutions
- Industrial Revolution
- Development of modern science and technology

- Food and agriculture
- Health and medicine
- Housing and construction
- Transportation
- Communication
- Energy production and utilisation
- Water supply and sanitation
- Development of science and technology in Nigeria and Indigenous technologies in Nigeria

CATEGORY	DETAILS
Core Competencies	• Scientific Literacy. • Critical Thinking and Problem-Solving, Critically evaluate scientific and technological issues • Digital and Technological Competence; Utilise information and communication technologies (ICT) • Analytical Skills, Analyse the social, economic, ethical, cultural.
Core Values	• Scientific Integrity; Upholding honesty, objectivity • Critical Thinking; Applying logical reasoning • Innovation and Creativity; Encouraging curiosity, creativity
Pedagogical Approaches	Interactive Lecture Method, Discussion and Debate Method, Case Study Approach, Inquiry-Based Learning, Project-Based Learning (preferably group-based), Use of ICT and Media Analysis, Role Play and Simulation
Learning Resources	Textbooks like Ogunniyi, M. B. (2011). Science Education in Nigeria: Historical and Contemporary Issues, and Miller, J. D. (2012). Civic Scientific Literacy. Springer can be used. Reference Materials such as UNESCO publications on Science, Technology, and Society, Federal Ministry of Education (Nigeria) policy documents. National curriculum for Basic Education (Integrated Science)
Assessment Methods	End-of-Semester Examination. short quizzes and class tests, written assignments and reflective essays, class participation and attendance, project and practical assessment, individual or group projects on science – society topics,

REFERENCES AND FURTHER READING

Sismondo, S. (2021).*An Introduction to Science and Technology Studies* (3rd ed.). Wiley-Blackwell.

Cutcliffe, S. H. (2020). *Ideas, Machines, and Values: An Introduction to Science, Technology, and Society Studies* (2nd ed.). Rowman& Littlefield.

National Research Council. (2019). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. National Academies Press.

PROGRAMME 3 OF 6

Health Education

Overview of Health Education Programme

Health Education is an interdisciplinary academic and professional programme designed to prepare competent health educators, teachers, public health practitioners, community health promoters, and researchers who can improve the health and well-being of individuals, families, schools, workplaces, and communities. The programme provides students with the knowledge, practical skills, and professional values required to promote healthy behaviours, prevent diseases, improve health literacy, and support sustainable health development.

The programme integrates concepts from health sciences, behavioural sciences, education, environmental health, nutrition, epidemiology, public health, reproductive health, mental health, and community health. It equips students with the competencies to assess community health needs, design and implement health education programmes, promote disease prevention, advocate for healthy lifestyles, and evaluate health promotion interventions.

Health Education emphasises preventive healthcare through education, communication, behaviour change, and community participation. Students gain knowledge of personal, family, school, occupational, environmental, and community health while learning strategies for addressing contemporary health challenges such as communicable and non-communicable diseases, malnutrition, substance abuse, mental health disorders, reproductive health issues, environmental hazards, and emerging public health emergencies.

The programme combines classroom instruction with practical experiences through fieldwork, health education practicum, community outreach, seminars, research projects, school health programmes, and public health campaigns. These experiences enable students to apply theoretical knowledge in real-life settings while developing professional competence in health promotion and disease prevention.

Graduates are prepared to serve as health educators, community health officers, school health coordinators, public health advocates, programme officers, researchers, and policy implementers in educational institutions, healthcare facilities, government agencies, non-governmental organisations (NGOs), international development organisations, and the private sector.

Philosophy of Health Education

The philosophy of Health Education Programme is to provide personnel with the highest academic and professional standards in designing and implementing sound health education intervention programmes that empowers people intellectually to make enlightened choices about their behaviours for a healthful society on individual and community levels.

Regulation (Programme Structure)

Admission and Graduation Requirements

Admission Requirements

NCE Programme

Candidates must satisfy the UTME and O' Level admission requirements for NCE and Bachelor of Education degrees in their various departments.

NCE-Degree Programme

i. Candidates must satisfy the UTME and O' Level admission requirements for Degree Education programme in the area of specialisation to be pursued.
ii. Candidates with NCE cumulative grade point average (2.40-5.00) equivalent to Merit and above, shall continue into the 2-year Bachelor of Education degree programme.
iii. NCE candidates with cumulative grade point average (1.50-2.39) equivalent to Pass and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme.

Graduation Requirements

NCE Programme:_ Candidates for the award of NCE certificates are required, among others, to earn at least 22 credits in General Education courses, 6 credits in Teaching Practice and 12 credits in General Studies Education (totalling credits in the Education component of the NCE programme) to qualify for graduation, viz:

S/N	Component	Weight/credit load
	General Education	22

S/N	Component	Weight/credit load
	Teaching Practice (TP)	06
	General Studies (GSE)	12
	Health Education	40
Total Units:		**80**

Total Minimum Credit Units Required for NCE graduation: **40 credit units**

Degree Programme: Candidates for the award of Bachelor Degree in Education certificates are required among others, to earn at least 12 credits in General Education 4 credits in General Studies Education (totalling credits in the Education component of the B. Ed programme) and 54 credits in Health Education courses to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	General Education	12
2	General Studies (GSE)	04
3	Health Education	54
Total Units:		**70**

National Goals of Health Education in Nigeria

General Goals of Health Education:

The objectives of Health Education programme are to:

a) Equip students with the historical and philosophical foundations of health education;

b) Offer the student the skills and competencies needed to function effectively as a graduate teacher of health education in schools and colleges;

c) Cultivate in students the ability to apply knowledge and skills to solving health challenges;

d) Sufficiently prepare the student to take up a career in academics as a health education lecturer/tutor;

e) Provide expert advice and consultancy services to local, national and international organisations on global health issues;

f) Train health counsellors/resource persons for schools, hospitals, industries and communities;

g) Produce safety personnel for industries, produce health programme officers, assistants and consultants for health;

h) Instil in students an appreciation of the importance of health education in industrial, economic, environmental, technological and social development; and

i) Develop in students a range of transferable skills that are of value in health profession.

Learning Outcomes of Health Education Programme

By the end of General Education courses, students should be able to:

The objectives of Health Education programme are to:

a) Equip students with the historical and philosophical foundations of health education;

b) Offer the student the skills and competencies needed to function effectively as a graduate teacher of health education in schools and colleges;

c) Cultivate in students the ability to apply knowledge and skills to solving health challenges;

d) Sufficiently prepare the student to take up a career in academics as a health education lecturer/tutor;

e) Provide expert advice and consultancy services to local, national and international organisations on global health issues;

f) Train health counsellors/resource persons for schools, hospitals, industries and communities;

g) Produce safety personnel for industries, produce health programme officers, assistants and consultants for health;

h) Instil in students an appreciation of the importance of health education in industrial, economic, environmental, technological and social development; and

i) Develop in students a range of transferable skills that are of value in health profession.

Relevance Statement for Health Education

The Health Education programme is designed to prepare competent professionals with the knowledge, practical skills, and ethical values required to promote health, prevent diseases, and improve the quality of life of individuals and communities. The programme

is highly relevant to national and global health priorities as it equips graduates to address contemporary public health challenges through health promotion, disease prevention, health communication, behavioural change, and community-based interventions.

The programme provides students with a strong foundation in public health, environmental health, nutrition, reproductive health, mental health, epidemiology, health promotion, and health education methodologies. This multidisciplinary preparation enables graduates to design, implement, monitor, and evaluate health education programmes that improve health literacy, encourage healthy lifestyles, reduce risk factors for communicable and non-communicable diseases, and strengthen preventive healthcare systems.

In response to emerging health challenges such as infectious disease outbreaks, non-communicable diseases, substance abuse, poor sanitation, malnutrition, mental health disorders, and environmental health risks, the programme develops professionals who can provide evidence-based health education, advocate for healthy public policies, and mobilise communities to adopt healthier behaviours. It also equips graduates with research, communication, leadership, and programme management skills needed to support effective public health interventions.

The programme contributes significantly to national development by strengthening school health programmes, improving community health services, supporting maternal and child health, promoting environmental sustainability, and enhancing the capacity of educational and healthcare institutions to deliver quality health education. It also creates opportunities for employment and professional practice in schools, healthcare facilities, government ministries, public health agencies, non-governmental organisations, international development agencies, corporate organisations, and research institutions.

Furthermore, the Health Education programme aligns with Nigeria’s national health policies and the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 6 (Clean Water and Sanitation). By promoting preventive healthcare, health equity, and lifelong healthy behaviours, the programme contributes to sustainable human development and improved population health.

NCE-MAS (Minimum Academic Standards) for NCE Programme

Facilities and Equipment Required for the Health Education Programme

The successful implementation of a Health Education Programme requires adequate physical facilities, teaching resources, laboratories, information technology infrastructure, and community-based learning resources. The following are the essential facilities and equipment:

Teaching and Learning Facilities

1. Lecture classrooms
2. Seminar rooms
3. Smart classrooms with multimedia facilities
4. Tutorial rooms
5. Academic staff offices
6. Students' common room
7. Boardroom/meeting room

Laboratories and Practical Facilities

1. Health Education Laboratory
2. Human Anatomy and Physiology Laboratory
3. Nutrition and Food Science Laboratory
4. First Aid and Emergency Care Laboratory
5. Environmental Health Laboratory
6. Health Communication and Media Laboratory
7. Computer Laboratory
8. Research and Statistics Laboratory

Library and Information Resources

1. Departmental library
2. Central university/college library
3. Digital library/e-library
4. Internet and Wi-Fi facilities
5. Online databases and e-journals

ICT Facilities

1. Desktop and laptop computers
2. Multimedia projectors
3. Interactive smart boards
4. Public address (PA) system
5. Printers and scanners
6. Photocopiers
7. Internet-enabled learning facilities

Laboratory Equipment

1. Human skeleton model
2. Anatomical charts and models
3. Human torso models
4. First aid manikins (adult, child, infant)
5. CPR training manikins
6. First aid kits
7. Wheelchairs and stretchers
8. Thermometers (digital and clinical)
9. Sphygmomanometers (manual and digital)
10. Stethoscopes
11. Glucometers
12. Weighing scales (adult and infant)
13. Height measuring stadiometers
14. Body Mass Index (BMI) equipment
15. Measuring tapes
16. Pulse oximeters

Nutrition Laboratory Equipment

1. Food models
2. Kitchen weighing scales
3. Food preparation equipment
4. Measuring cups and spoons

5. Refrigerator
6. Cooking stove/hot plate
7. Food nutrient charts

Environmental Health Equipment

1. Water quality testing kits
2. Air quality monitoring devices
3. Waste management demonstration materials
4. Environmental sanitation tools
5. Personal protective equipment (PPE)

Health Communication Materials

1. Health education posters
2. Flip charts
3. Whiteboards
4. Notice boards
5. Public awareness banners
6. Audio-visual teaching materials
7. Educational videos
8. Health education pamphlets and brochures

Research and Statistics Resources

1. Statistical software (SPSS, R, Jamovi, Stata)
2. Reference management software (Mendeley, Zotero)
3. Data collection devices (tablets, smartphones)
4. Survey and questionnaire materials

J. Sports and Physical Activity Equipment

1. Exercise mats
2. Stopwatches
3. Measuring tapes
4. Pedometers
5. Heart rate monitors

6. Blood pressure monitors
7. Fitness testing equipment

K. Fieldwork and Community Outreach Facilities

1. Community health demonstration centre
2. School health practice centre
3. Health promotion outreach kits
4. Mobile health education equipment
5. Transportation for field visits

L. Safety Facilities

1. Fire extinguishers
2. Emergency exits
3. First aid stations
4. Safety signage
5. Personal protective equipment (gloves, face masks, goggles)

M. Office and Administrative Equipment

1. Office furniture
2. Filing cabinets
3. Computers and printers
4. Internet connectivity
5. Telephone facilities
6. Record management systems

N. Recommended Instructional Materials

1. WHO and UNICEF health education manuals
2. National health policy documents
3. Anatomy and physiology charts
4. Disease prevention and health promotion models
5. Health education curriculum guides
6. Scientific journals and textbooks
7. Multimedia instructional packages

8. Educational software and simulation programmes

O. Recommended Software

1. IBM SPSS Statistics
2. Microsoft Office Suite
3. R Statistical Software
4. Jamovi
5. Zotero or Mendeley
6. Learning Management System (LMS) such as Moodle or Google Classroom

Staff Offices

Each senior staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (typists, clerks) with relevant equipment e.g. duplicating machines, Computers, Photocopier.

Books in the Library

There must be enough books to cover all the areas of the subject in the ratio of one student to ten books minimum. The conditions under (F) above should be adhered to in all cases.

Personnel

Academic Staff

A minimum of twelve (12) academic staff for Double Major subject combination, each with a qualification of not less than a bachelor's degree in Physical and Health Education. The Head of Department should have a Higher Degree and be at least of the rank of a Senior Lecturer. It is encouraged to have at least one female Lecturer in the Department. The qualification should not be less than Second Class Lower division.

Training and retraining of personnel in PHE should take cognisance of the various areas of specialisation i.e. Health, Physical Education, Exercise physiology, Sport Management, Recreation etc.

Other Personnel

1. A minimum of 5 grounds men
2. A minimum of 1 lab attendant/assistant
3. A minimum of 1 sports equipment curator

4. A computer operator
5. A Secretary
6. One Office Assistant/attendant
7. One Cleaner
8. A Sports instructor should be attached to the PHE department

Pedagogical Approaches, Modes of Assessment and Instructional Materials for Health Education

Health Education delivery relies on student-centred instruction, continuous skill-based evaluation, and multi-format learning resources to engage large, diverse student cohorts effectively.

Pedagogical Approaches

Modern General Education shifts away from passive rote learning toward interactive frameworks that build critical thinking and collaborative problem-solving skills.

i. **Active Learning:** Employs techniques such as Think-Pair-Share, peer instruction, and interactive class polling to engage large lecture classes directly.
ii. **Problem-Based & Case-Based Learning (PBL):** Uses real-world scenario analysis (e.g. ethical dilemmas, environmental challenges) to teach cross-disciplinary problem-solving.
iii. **Flipped Classroom:** Assigns foundational readings or short recorded lectures prior to class, reserving live contact hours for structured discussions, debates, and practical application.
iv. **Interdisciplinary & Seminar-Style Instruction:** Facilitates guided debates, panel discussions, and collaborative projects that bridge the humanities, social sciences, and natural sciences.
v. **Service-Learning & Community Engagement:** Integrates community-focused projects (such as local civic initiatives or public health campaigns) into course activities to foster social responsibility.
vi. Experiential Learning
vii. Blended Learning
viii. Discussion and Dialogue
ix. Project-based Learning

x. UDL & SEL Based Teaching

xi. Reflective practices

Modes of Assessment

Assessment in General Education combines ongoing diagnostic evaluation with comprehensive knowledge testing to evaluate both core concepts and soft skills.

Assessment Category	Type	Purpose and Specific Methods
Formative Assessment	Continuous (Assessment *for* Learning)	Evaluates ongoing progress through weekly reflections, quick quizzes, class participation rubrics, and draft feedback.
Summative Assessment	Outcome-Based (Assessment *of* Learning)	Measures cumulative mastery via midterm/ final exams, analytical essays, capstone research papers, or term projects.
Performance Assessment	Skill-Based & Authentic	Tests practical capabilities through oral presentations, structured group debates, e-Portfolios, and multimedia exhibits.
Peer & Self-Assessment	Reflective	Builds metacognitive awareness using peer-review rubrics for group work and individual self-reflection logs.

Instructional Materials

Instructors utilise a mix of print, digital, and practical tools to accommodate varied learning styles and maintain access across large student populations.

i. **Core Courseware & Textbooks:** Standardised multi-author textbooks, customised institutional readers, and Open Educational Resources (OER) like OpenStax to minimise financial barriers.

ii. **Digital & Multimedia Resources:** Video lectures, podcasts, documentary clips, interactive simulations (e.g. virtual labs for non-science majors), and slide decks.

iii. **LMS Platforms:** Canvas, Moodle, or Google Classroom for automated quiz administration, discussion boards, rubric distribution, and assignment submission.

iv. **Primary Sources & Applied Datasets:** Historical manuscripts, policy briefs, case study archives, and real-world datasets for quantitative analysis.

v. **Assessment Aids:** Scoring rubrics, writing guides, citation manuals, and peer-evaluation templates provided directly to students at the start of the course.

Dual Mandate Curriculum Course Distribution Structure for Health Education (100–500) Levels)

Curriculum Design Framework

The Health Education component of the teacher education programme under the Dual Mandate covers the following **Three key areas**: General Education, General Studies Education (GSE), and Health Education. Courses for the NCE programme were also properly aligned with the Bachelor of Education degree, education component to ensure that there are no repetitions on the one hand and systematic progression is guaranteed during implementation. The courses for the NCE programmes, therefore, naturally dovetail into the degree ones. The NCE Health Education curriculum component is as shown in the table below and the subsequent description of the courses:

NCE Course Distribution (100–300 Level)

Compulsory Courses

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30
EDU 112	Educational Psychology	2	C	30
GSE 111	General English 1	1	C	15
GSE 112	Introduction to Library Studies	1	C	15
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15
BIO 101	General Biology I	2	C	30
CHE 111	General Chemistry 1	2	C	30
MAT 111	General Mathematics (Number and Numeration)	2	C	30
PHY 111	General Physics I (Mechanics)	2	C	30
EHE 111	Introduction to Health Education	2	C	30
EHE 113	Personal Health & Dental Education	2	C	30
HEE 114	Human Anatomy and Physiology	2	C	30
Total		**21**		

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30
GSE 121	English Proficiency for Teachers	1	C	15
GSE 122	Digital Literacy & AI for Educators	1	C	15
GSE 123	Media and Information Literacy I	1	C	15

Course Code	Course Title	Credit Units	Status	Lecture Hours
BIO 121	General Biology II	1	C	30
CHE 121	General Chemistry II	1	C	
MAT 102	General Mathematics II (Algebra and Trigonometry)	2	C	30
PHY 102	General Physics II (Electricity and Magnetism)	1	C	30
HEE 124	First Aid and Safety Education	2	E	30
HEE 125	Personal, Mental and Emotional Health	2	E	30
Total		**16**		

NCE 100 Level: Second Semester

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours
EDU 211	Classroom Management	1	C	15
EDU 212	Curriculum and Curriculum Delivery	2	C	30
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30
GSE 211	General English II	1	C	15
GSE 212	Introduction to Foundational Literacy	1	C	15
GSE 213	Media and Information Literacy II	1	C	15
EHE 211	Methods and Resources in Health Education	2	C	30
EHE 215	Family Life, Reproductive Health & Population Education	2	C	30
HEE 215	Community Health	1	C	15
Total		**13**		

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	30

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 222	Educational Administration, Planning and Supervision	1	C	15	15
EDU 223	Introduction to Educational Technology	1	C	15	15
EDU 224	Micro Teaching: II (Practicum)	2	C	30	30
GSE 221	Introduction to Foundational Numeracy	1	C	15	15
GSE 222	Entrepreneurship and Green Skills	1	C	15	15
EHE 212	School Health Education Programme	2	C	30	-
EHE 218	Human Diseases & Health Protection	2	C	30	-
HEE 220	Food and Human Nutrition	2	C	30	-
Total		**14**			

NCE 300 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 311	Teaching Practice (TPD)	6	C	90	90
Total		**6**			

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	15
GSE 321	Global Citizenship Education and Political Economy	1	C	15	15
HEE 321	Communicable and Non-Communicable Diseases	2	C	30	
HEE 322	Health Education Curriculum and Instructions	2	C	30	-
HEE 323	Emotional, Mental and Social Health	2	C	30	-
Total		**10**			

The following are the core courses for general education, general studies and Health Education as stipulated in the NUC Benchmark Minimum Academic Standards. These courses must be taught in Years 4 and 5 of all bachelor's degree programmes in Education under the Dual Mandate Minimum Academic Standards.

Degree Course Distribution (400–500 Level)

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 412	Peace and Conflict Resolution	2	C	30	30
SED 411	Methods of Teaching Physical Education	2	C	30	
EHE 413	Research Methods in Health Education	2	C	30	-
EHE 414	Substance Use and Abuse Prevention	2	C	30	-
HEE 413	Health Practice and School Child	2	C	45	
EHE 421	Application of Computer Skills & Informatics in Health Education	2	C	30	
EHE 420	First Aid, Accident Prevention and Safety Education	2	C	30	-
EHE 422	Life Skills and Ski Based Health Education	2	C	30	-
Total		**16**			

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 501	Teaching Practice	6	C	90	90
SED 511	Science Technology and Society	2	C	30	
EHE 510	Contemporary National Health Courses, Issues and Problems in Public Health	2	C	30	-
EHE 507	Seminar in Health Education	2	C	30	-
EHE 513	Health Economics & Consumerism	2	C	30	
HEE 514	Nutrition in Health and Disease	2	C	15	30
EHE 524	Epidemiology of Public Health and Human Biometric	2	C	30	
Total		**18**			

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 500	Research Project	3	C	45	45
EHE 504	Organisation, Planning and Evaluation of Health Education Courses	2	C	30	-
EHE 502	Occupational and Industrial Health	2	C	30	-
HEE 523	Environmental Monitoring Systems and Techniques	2	C	15	45
HEE 524	Water Analysis	2	C	30	
EHE 510	Geriatrics & Death Education	2	C	30	
EHE 509	Curriculum Development & Innovation in Health Education	2	C	30	
Total		**15**			

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 500	Research Project	3	C	45	45
EHE 504	Organisation, Planning and Evaluation of Health Education Courses	2	C	30	-
EHE 502	Occupational and Industrial Health	2	C	30	-
HEE 523	Environmental Monitoring Systems and Techniques	2	C	15	45
HEE 524	Water Analysis	2	C	30	
EHE 510	Geriatrics & Death Education	2	C	30	
EHE 509	Curriculum Development & Innovation in Health Education	2	C	30	
Total		**15**			

NCE Course Descriptions (100–300 Level)

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology I introduces students to the fundamental principles of biology that underpin the study of living organisms. The course examines the structure and organisation of cells, the functions of cellular organelles, and the characteristics and classification of living things. It also explores the concepts of chromosomes, genes, heredity, reproduction, evolution, ecological principles, and interactions among organisms. Students will gain a solid foundation in biological concepts necessary for advanced studies in biology and related disciplines.

RELEVANCE STATEMENT

This course provides students with the foundational knowledge required for understanding biological systems and life processes. It equips prospective biology teachers with essential concepts in cell biology, genetics, ecology, evolution, and taxonomy, enabling them to explain biological phenomena scientifically. The knowledge acquired will support further studies in biological sciences and enhance students' ability to apply biological principles to environmental conservation, health, agriculture, and science education.

COURSE OBJECTIVES

The objectives of this course is to:

1. Provide students with a fundamental understanding of the structure, organisation, and functions of cells and their organelles.
2. Introduce the characteristics, classification, and modes of reproduction of living organisms.
3. Explain the ecological relationships and interactions among organisms and their environment.
4. Familiarise students with the basic principles of heredity and evolution.
5. Expose students to the different habitat types and their distinguishing characteristics.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

1. Explain cells structures and organisations;
2. Summarise functions of cellular organelles;
3. Characterise living organisms and state their general reproduction;
4. Describe the interrelationship that exists between organisms;
5. Discuss the concept of heredity and evolution; and
6. Enumerate habitat types and their characteristics

COURSE CONTENT

Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes their relationships and importance, general mode of reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism); heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitat

COMPETENCIES AND VALUES

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Observation • Classification of living things • Evaluation • Application.
Core Values	• Curiosity • Integrity • Diligence • Responsibility • Conservation • Team work

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-based learning • Demonstration • Group discussion • Group work • Case study
Learning Resources	• Biology text book, charts, model • Specimens • Multimedia facilities • Microscope, prepared slides • Laboratory manual • Cultures • Herbarium specimens
Assessment Methods	• Lab and field report • Class presentation of findings.

REFERENCES AND FURTHER READING

Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Orr, R. B. (2021). *Campbell Biology (12th ed.)*. Pearson.

Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). *Biology (13th ed.)*. McGraw-Hill

CHE 111 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a foundational understanding of the fundamental principles and concepts of chemistry. It examines atoms, molecules, elements, compounds and chemical reactions, with emphasis on modern electronic theory, electronic configuration, periodicity and the development of the periodic table. The course also covers chemical bonding, hybridisation, molecular shapes, intermolecular forces, valence forces and the structure of solids. Students are introduced to chemical equations, stoichiometry, kinetic theory of matter, properties of gases, elementary thermochemistry, reaction rates, chemical

equilibrium and basic thermodynamics. Further topics include acids, bases and salts, redox reactions, introductory electrochemistry and radioactivity. The course combines conceptual understanding with appropriate calculations and applications to develop a strong foundation for further study of chemistry.

RELEVANCE STATEMENT

A sound knowledge of general chemistry is essential for understanding more advanced areas of chemistry and its applications in science, technology, health, agriculture and industry. The course equips students with the fundamental concepts, principles and problem-solving skills required to interpret chemical phenomena, perform quantitative chemical calculations and relate microscopic properties of matter to observable behaviour. It also provides the necessary foundation for subsequent courses in organic, inorganic, physical, analytical and environmental chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of atoms, molecules, elements, compounds and chemical reactions;
2. Describe the modern electronic structure of atoms, electronic configurations and periodic trends;
3. Explain chemical bonding, hybridisation, molecular shapes, intermolecular forces and the structure of solids;
4. Write and balance chemical equations and solve quantitative problems involving stoichiometry;
5. Explain the basic principles of kinetic theory, gases, thermochemistry, reaction rates, equilibrium and thermodynamics;
6. Explain the concepts of acids, bases, salts, redox reactions, electrochemistry and radioactivity and relate them to practical applications.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Justify the trends of atomic radii, ionisation energies, electronegativity of the elements based on their position in the periodic table;

4. Identify and balance oxidation – reduction equation and solve redox titration problems;
5. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
6. Determine rates of reactions and its dependence on concentration, time and temperature.

COURSE CONTENT

- Atoms, molecules, elements and compounds and chemical reactions
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table
- Hybridisation and shapes of simple molecules
- Valence Forces
- Structure of solids
- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter
- Elementary thermochemistry: rates of reaction, equilibrium and thermodynamics
- Acids, bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry
- Radioactivity

CATEGORY	DETAILS
Core Competencies	• Knowledge • Analysis • Application
Core Values	• Objectivity and scientific inquiry • Innovation • Scientific curiosity • Integrity and discipline

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Problem-solving sessions • Use of simulations and charts.
Learning Resources	
Assessment Methods	• Class tests • Quizzes • Assignments • Oral • Questioning • Continuous assessment.

REFERENCES AND FURTHER READING

1. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2018). *Chemistry: The central science* (14th ed.). Pearson.
2. Chang, R., & Goldsby, K. A. (2016). *Chemistry* (12th ed.). McGraw-Hill Education.
3. Ebbing, D. D., & Gammon, S. D. (2017). *General chemistry* (11th ed.). Cengage Learning.
4. Flowers, P., Theopold, K., Langley, R., & Robinson, W. R. (2019). *Chemistry 2e*. OpenStax.
5. Kotz, J. C., Treichel, P. M., Townsend, J. R., & Treichel, D. A. (2015). *Chemistry & chemical reactivity* (9th ed.). Cengage Learning.
6. Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2024). *General chemistry: Principles and modern applications* (12th ed.). Pearson.

MTH 111 General Mathematics I (Number Theory)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of number theory and mathematical structures. It focuses on the properties and operations of numbers, including

integers, primes, divisibility, congruences, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real-life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem-solving.

RELEVANCE STATEMENT

Number of theory enables pre-service teachers to explain number concept clearly, systematically and confidently to learners.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Demonstrate a proper understanding of the number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility, and congruence.
3. Appreciate and utilise the applications of numbers in real-life situations.
4. Solve problems using principle of mathematical induction Define and analyse congruences, including reflexive, symmetric, and transitive properties.
5. Define and analyse congruence, including reflexive, symmetric, and transitive properties

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and apply the process of counting and the use of ordered pairs (Peano's Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.
3. Explore further properties of integers, including well-ordering principle and divisibility.
4. Define and analyse congruences, including reflexive, symmetric, and transitive properties.
5. Demonstrate an understanding of the use of numbers in solving practical and theoretical problems.

COURSE CONTENT

- Process of counting, Peano's Axioms using ordered pairs, Fundamental operations in Mathematical Structures, Group properties, Further properties of Integers, Well ordering principle, Mathematical Induction to Laws of trichotomy, Divisibility (Basic definitions, divisions, primes, gcd)
- **Basic theorems on gcd:** proofs may be required
- **Relatively prime integers:** unique factorisation
- **The fundamental theorem of arithmetic:** proof may be required
- **Congruences, Basic definitions and examples, Properties of Congruence:** reflexive symmetric' and transitive: the equivalence relation
- Residue classes, Linear Congruences, Basic theorems and solutions of linear Congruences, Proofs of the main theorem may be required, Fermat's theorem and applications, the proof of Fermat's theorem may be required, Euler's totient function and number (proof not required)
- Application to linear Congruences, Fundamental operation in mathematical structures, Group properties

CATEGORY	DETAILS
Core Competencies	• Creativity • Innovation 3.Reflective thinking • Critical thinking • Communication • Collaboration • Innovation • Reflective thinking • Self-development
Core Values	• Integrity • Respect • .3. Team spirit • Perseverance • Transparency • Tolerance • Honesty

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms
Assessment Methods	• Continuous Assessment • Formative Assessment • Digital assessment (Blended/Online Assessment) • Summative assessment • **Readings** • Class work • Assignment

Suggested

1. ***Current textbook on An Introduction to the Theory of Numbers.***
2. Use of online Resources.

PHY 111 General Physics I (Mechanics)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Physics: Mechanics is an introductory course that provides students with fundamental knowledge of the principles governing the motion and interaction of physical bodies. The course examines the basic concepts of space, time, motion, force, mass, energy and momentum, and applies mathematical principles to describe and predict the behaviour of mechanical systems. Topics include units and dimensions, vectors and scalars, kinematics, dynamics, Newton's laws of motion, work, energy and power, momentum and collisions, circular motion, gravitation, equilibrium, elasticity, simple harmonic motion and an introduction to fluid mechanics. Emphasis is placed on problem-

solving, practical investigation, experimentation and the application of mechanics to everyday life, technology and other scientific disciplines.

Course-Relevant Statement

Mechanics is fundamental to the study of physics and many related disciplines, including engineering, technology, environmental science, medicine and education. A sound understanding of mechanics enables students to explain natural phenomena, analyse physical systems and develop quantitative problem-solving skills. The course is particularly relevant to students preparing for advanced studies in physics and science-related programmes because it provides the conceptual and mathematical foundation required for subsequent courses in electricity, magnetism, thermodynamics, waves and modern physics.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts and principles of mechanics.
2. Distinguish between scalar and vector quantities and perform basic vector operations.
3. Describe and mathematically analyse linear, projectile, circular and rotational motion.
4. Apply Newton's laws of motion to solve problems involving forces and equilibrium.
5. Explain the concepts of work, energy and power and apply the principle of conservation of energy.
6. Analyse momentum, impulse and collisions using appropriate physical principles.
7. Explain the principles of gravitation and apply them to planetary and satellite motion.
8. Describe elasticity and the mechanical properties of materials.
9. Explain simple harmonic motion and identify its basic characteristics.
10. Apply basic principles of fluid mechanics to simple physical situations.
11. Use appropriate mathematical techniques, graphs and equations to solve mechanics problems.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Define and correctly use fundamental mechanical quantities, units and dimensions.
2. Represent and resolve vectors and use them in solving mechanics problems.

3. Calculate displacement, velocity, acceleration and related quantities from physical data and graphs.
4. Solve problems involving uniformly accelerated motion and projectile motion.
5. Apply Newton's laws to determine forces, acceleration and conditions for equilibrium.
6. Calculate work done, kinetic energy, potential energy and power in mechanical systems.
7. Analyse collisions and explain the relationship between impulse and change in momentum.
8. Explain circular and rotational motion and solve basic related problems.
9. Describe simple harmonic motion and calculate its basic parameters.
10. Explain elementary principles of pressure, density, buoyancy and fluid flow.
11. Design and perform simple mechanics experiments using appropriate measuring instruments.

COURSE CONTENT

- Space and time
- Units and dimension
- Vectors and Scalars
- Differentiation of vectors
- Displacement
- Velocity and acceleration
- Kinematics
- **Newton laws of motion:** Inertial frames, Impulse, force and action at a distance, momentum conservation
- Relative motion
- Application of Newtonian mechanics
- Equations of motion
- Conservation principles in physics
- Conservative forces
- Conservation of linear momentum
- Kinetic energy and work
- Potential energy
- System of particles

- Centre of mass
- Rotational motion
- Torque
- Vector product
- Moment
- Rotation of coordinate axes and angular momentum
- Polar coordinates
- Conservation of angular momentum
- Circular motion
- Moments of inertia
- Gyroscopes and precession
- Gravitation
- Newton’s Law of Gravitation
- Kepler’s Laws of Planetary Motion
- Gravitational Potential Energy
- Escape velocity
- Satellites motion and orbits

CATEGORY	DETAILS
Core Competencies	• Scientific reasoning • Problem-solving competence • Mathematical competence • Experimental competence • Measurement competence • Data analysis competence • Critical-thinking competence

CATEGORY	DETAILS
Core Values	• Accuracy and precision • Honesty and integrity • Curiosity • Creativity and innovation • Teamwork and cooperation • Respect for safety rules • Responsibility and accountability • Critical and independent thinking
Pedagogical Approaches	• Interactive lectures • Problem-based learning (PBL) • Inquiry-based learning • Practical/laboratory learning • Demonstration method • Collaborative learning • Project-based learning • Simulation-based learning
Learning Resources	• Laboratory equipment • Metre rules and measuring tapes • Stopwatches • Masses and balances • Spring balances • Trolleys and dynamics tracks • Pulley systems • Inclined-plane apparatus • Simple pendulum apparatus • Projectile-motion apparatus • Elastic springs
Assessment Methods	• Short quizzes and classroom exercises. • Numerical and conceptual problem-solving tests • Graph construction and interpretation. • Mid-semester examinations. • End-of-semester written examinations.

REFERENCES AND FURTHER READING

Young, H. D., & Freedman, R. A. (2020). *University Physics with Modern Physics* (15th ed.). Pearson.

Halliday, D., Resnick, R., & Walker, J. (2021). *Fundamentals of Physics* (12th ed.). Wiley.

Serway, R. A., & Jewett, J. W. (2018). *Physics for Scientists and Engineers with Modern Physics* (10th ed.). Cengage Learning.

EHE 111 Introduction to Health Education

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introduction to Health Education is a foundational course designed to acquaint students with the concept, principles, scope, objectives, philosophy, and practice of health education. The course helps learners understand how health knowledge, attitudes, values, and skills can be developed to promote healthy living and prevent diseases among individuals, families, schools, and communities. The course is particularly relevant to students in Physical and Health Education, Education, Nursing, Community Health, and related programmes, because it establishes the basic knowledge required for understanding health promotion and health-related behaviour.

RELEVANCE STATEMENT

Introduction to Health Education is a foundational course that is relevant to students because it equips them with essential knowledge, skills, attitudes, and values required to understand, promote, maintain, and improve individual, family, school, and community health. The course provides students with an understanding of the relationship between health, education, lifestyle, environment, and quality of life.

The course is particularly relevant in addressing contemporary health challenges such as communicable and non-communicable diseases, malnutrition, substance abuse, poor sanitation, mental health challenges, unhealthy lifestyles, reproductive health problems, and environmental hazards. Through health education, students learn how informed decisions and positive behavioural changes can contribute to disease prevention and improved well-being.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of health, health education, health promotion, and wellness.
2) Identify the physical, mental, social, emotional, and other dimensions of health.
3) Explain factors that influence individual and community health.
4) Discuss the principles and importance of health education.
5) Demonstrate appropriate personal and environmental health practices.
6) Explain the importance of proper nutrition and healthy lifestyles.
7) Identify common communicable and non-communicable diseases and their preventive measures.
8) Discuss major health problems affecting individuals, schools, and communities.
9) Apply effective communication strategies in health education.
10) Explain the role of teachers and health educators in promoting healthy behaviour.

LEARNING OUTCOMES

Upon successful completion of this course, the students will have reliably demonstrated the ability to:

1) Explain the meaning of health and health education;
2) Discuss basic principles, history, prominent philosophies, and issues related to health education;
3) Identify key historical events that have contributed to modern health education;
4) Explain the scientific, behavioural, cultural, social, legal and educational foundations of health education;
5) Assess individual and community needs for health education;
6) Explain the role of the health educator in health care as well as within culturally diverse populations and numerous settings;
7) Develop health attitudes and habits among students;
8) Act as a resource person in health education;
9) Organise health education activities; and
10) Build a good healthy condition through classroom and school environment.

COURSE CONTENT

- Introductory concepts related to the field of health education
- Basic principles, philosophies, and issues related to health education
- The concept and meaning of health education
- Importance of health education
- Aims and objectives of health education
- Health literacy
- Life skills conducive to individual and community health are discussed
- Frameworks, principles and practice of health education in schools
- The historical, philosophical and biological foundations of health and health education
- History of man's struggle for health through the ages
- History of health education in Nigeria
- Development of public health definitions
- Goals
- Rationale and philosophical basis of health and health education
- Principles and components of health education are explored
- Health education as a career option is examined
- The role of the health educator in numerous settings discussed
- Development of health attitudes and habits among students and build a good healthy condition via the classroom and school environment

CATEGORY	DETAILS
Core Competencies	• Health knowledge and understanding • Health promotion competence • Health communication competence • Personal health and self-care competence • Critical thinking and decision-making competence • Disease prevention and safety competence • Environmental health competence • Nutrition competence • Mental and social health competence
Core Values	• Commitment to healthy living • Personal responsibility

CATEGORY	DETAILS
	• Self-discipline • Integrity and honesty • Respect for human dignity • Empathy and compassion • Respect for diversity and inclusion • Accountability • Teamwork and cooperation • Professionalism • Confidentiality and trust • Social responsibility • Community service • Environmental responsibility • Safety consciousness
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Collaborative and cooperative learning • Problem-based learning • Case study analysis • Demonstration and practical activities • Experiential and field-based learning • Health education projects and assignments
Learning Resources	• Recommended textbooks on health education and health promotion • Lecture notes and course handouts • National Policy on Education and relevant health education policies • National health policies, guidelines, and programme documents • World Health Organization (WHO) health education and health promotion resources

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Bailey, R., & Kirk, D. (2009). *The Routledge Physical Education Reader*. Routledge.
2. Bucher, C. A., & Krotee, M. L. (2002). *Management of Physical Education and Sport (13th ed.)*. McGraw-Hill.
3. Bucher, C. A., & Krotee, M. L. (2002). *Management of Physical Education and Sport (13th ed.)*. McGraw-Hill.
4. Freeman, W. H. (2014). *Physical Education, Exercise and Sport Science in a Changing Society*. Jones & Bartlett Learning.
5. Freeman, W. H. (2014). *Physical Education, Exercise and Sport Science in a Changing Society*. Jones & Bartlett Learning.
6. Hardman, K., & Green, K. (Eds.). (2011). *Contemporary Issues in Physical Education: International Perspectives*. Meyer & Meyer Sport.
7. Lumpkin, A. (2017). *Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.)*. McGraw-Hill Education.
8. Lumpkin, A. (2017). *Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.)*. McGraw-Hill Education.
9. McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). *Exercise Physiology: Nutrition, Energy, and Human Performance*. Lippincott Williams & Wilkins.
10. Nixon, H. L., & Jewett, A. E. (1980). *An Introduction to Physical Education*. Saunders College Publishing.
11. Sharkey, B. J., & Gaskill, S. E. (2013). *Fitness and Health*. Human Kinetics.
12. Wuest, D. A., & Bucher, C. A. (2019). *Foundations of Physical Education, Exercise Science, and Sport (20th ed.)*. McGraw-Hill Education.
13. Wuest, D. A., & Bucher, C. A. (2019). *Foundations of Physical Education, Exercise Science, and Sport (20th ed.)*. McGraw-Hill.
14. National Policy on Education (Federal Republic of Nigeria).

15. National Sports Development Code of Nigeria.

EHE 113 Personal Health & Dental Education

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Personal Health & Dental Education is a foundational course designed to equip students with the knowledge, skills, attitudes, and values required to maintain and promote personal health, oral health, and overall well-being. The course emphasises the development of healthy habits, preventive health practices, personal hygiene, dental hygiene, nutrition, safety, and responsible health behaviour.

The course examines the relationship between personal health, oral health, nutrition, lifestyle, environment, and quality of life. Students are introduced to common health and dental problems, their causes, signs and symptoms, prevention, and appropriate measures for seeking professional care. Particular emphasis is placed on oral hygiene and dental health, including proper tooth-brushing techniques, use of dental floss, care of the gums and tongue, prevention of dental caries and periodontal diseases, healthy dietary practices, and the importance of regular dental check-ups.

RELEVANCE STATEMENT

Personal Health & Dental Education is relevant because it equips students with essential knowledge, skills, attitudes, and values for maintaining good personal hygiene, oral health, and overall well-being. The course helps students understand the relationship between personal health practices, nutrition, lifestyle, oral hygiene, disease prevention, and quality of life.

The course is particularly important in promoting the prevention of common health and dental problems such as dental caries, gum diseases, bad breath, poor hygiene, malnutrition, obesity, and other lifestyle-related health conditions. It enables students to develop appropriate daily health practices and make informed decisions concerning their health.

For student-teachers and prospective health educators, the course provides competencies needed to teach and promote personal and dental hygiene among children, adolescents, families, and communities. Students are prepared to serve as positive role models and to organise health education activities that encourage healthy behaviours.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of personal health, personal hygiene, oral health, and dental health.
2) Identify the major dimensions and determinants of personal health.
3) Explain the importance of personal hygiene in maintaining health and preventing diseases.
4) Demonstrate appropriate practices for maintaining body, skin, hair, eye, ear, hand, and foot hygiene.
5) Explain the relationship between mental, emotional, social, physical, and oral health.

LEARNING OUTCOMES

Upon successful completion of this course, the students will have the ability to:

1) Demonstrate understanding of health principles incorporating some aspects of personal health maintenance;
2) Identify risk behaviours that affect health;
3) Rate his or her understanding of self-responsibility for personal health and wellness; and
4) Indicate the implication of personal and societal behaviours on dental and oral health diseases.

COURSE CONTENT

- Overview of personal health
- The application of the principles of health to the promotion and maintenance of personal health
- Personal health needs and problems of students, including methods of determining health status
- Issues in healthy living cutting across food, clothing, environment, water and bathing that promote personal health of school children
- Exposure of students to causes of disease and prevention/control of disease
- Concept of holistic health
- Dental education and dental care
- Dentistry, oral health/hygiene
- Behaviour guidance of the dental patient

- Mechanical and chemotherapeutic home oral hygiene
- Essence and importance of dental education

CATEGORY	DETAILS
Core Competencies	• Personal health knowledge and understanding • Personal hygiene and self-care competence • Oral and dental health competence • Preventive health competence • Nutrition and healthy lifestyle competence • Health communication competence
Core Values	• Commitment to personal health and well-being • Personal responsibility and self-care • Cleanliness and personal hygiene • Discipline and healthy lifestyle • Respect for human dignity • Self-respect and self-confidence • Responsibility for oral and dental health • Prevention and health consciousness • Safety and caution • Healthy eating and nutritional responsibility • Integrity and honesty
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Demonstration and practical skills training • Question-and-answer sessions • Group discussion and cooperative learning • Case study analysis • Problem-based learning • Role-play and simulation activities • Peer teaching and peer learning • Health education projects and assignments

CATEGORY	DETAILS
Learning Resources	• Recommended textbooks on health education and health promotion • Lecture notes and course handouts • National Policy on Education and relevant health education policies • National health policies, guidelines, and programme documents • World Health Organization (WHO) health education and health promotion resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Anspaugh, D. J., Hamrick, M. H., & Rosato, F. D. – Wellness: Concepts and Applications.
2. Baranowski, T., & others – readings on health behaviour, health promotion, and healthy lifestyle education.
3. Glanz, K., Rimer, B. K., & Viswanath, K. – Health Behavior: Theory, Research, and Practice.
4. Green, L. W., & Kreuter, M. W. – Health Program Planning: An Educational and Ecological Approach.
5. Hoeft, K. S., Barker, J. C., & Masterson, E. E. – readings on cultural and social dimensions of oral health.
6. McKenzie, J. F., Neiger, B. L., & Thackeray, R. – Planning, Implementing, and Evaluating Health Promotion Programs.
7. Park, K. – Park's Textbook of Preventive and Social Medicine.
8. Pinkham, J. R., et al. – Pediatric Dentistry: Infancy Through Adolescence.
9. Soben, P. – Oral Health Education: Principles and Practice.
10. World Health Organization (WHO) – publications and guidelines on oral health, personal hygiene, nutrition, health promotion, and disease prevention.

11. Federal Ministry of Health and Social Welfare, Nigeria – national guidelines and policy documents on oral health, school health, nutrition, and health promotion.
12. National Primary Health Care Development Agency (NPHCDA), Nigeria – resources on primary health care and community health promotion.
13. Current peer-reviewed articles from journals such as Community Dentistry and Oral Epidemiology, International Journal of Dental Hygiene, BMC Oral Health, Health Education Research, and Health Promotion International.
14. Relevant textbooks and course materials on personal health, hygiene, nutrition, dental health, first aid, and school health education.

HEE 114 Human Anatomy and Physiology

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Fundamentals of Human Anatomy and Physiology is an introductory course that provides students with a comprehensive understanding of the structure (anatomy) and function (physiology) of the human body. It introduces the organisation of the human body from the cellular level to the organ systems and explains how these systems work together to maintain life through homeostasis. The course serves as a foundation for students in Physical Education, Health Education, Exercise and Sport Science, Nursing, Medicine, Biology, and other health-related disciplines. It emphasises the relationship between body structure and function and the physiological changes that occur during physical activity, growth, development, and ageing.

RELEVANCE STATEMENT

The course Fundamentals of Human Anatomy and Physiology is highly relevant as it provides students with the foundational knowledge of the structure and functions of the human body, which is essential for understanding health, physical activity, and human performance. It equips learners with the scientific principles necessary to appreciate how body systems interact to maintain normal physiological functions and respond to exercise, disease, and environmental changes.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define anatomy and physiology and explain their relationship.
2) Describe the levels of structural organisation of the human body.

3) Explain the concept of homeostasis and its importance.
4) Explain the anatomy and physiology of the skeletal and muscular systems.
5) Explain the roles of the digestive, urinary, endocrine, and reproductive systems.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1) Identify the characteristics of the anatomy and physiology systems to sport performance and health related activities of human;
2) Describe the anatomical structure of human in relation to sport performance and health related activities;
3) Identify the various components of the anatomy and physiology systems in relation to sport performance and health related activities of human; and
4) Explain the functions of the physiology systems to sport performance and health related activities of human.

COURSE CONTENT

- Structure and functions of the human body
- Circulatory system: Blood and lymphatic systems
- Blood type
- Cardiovascular system
- Anatomy of heart and cardiac conduction system
- Cardiac cycle, blood vessels, blood pressure, exercise and the heart
- Cadio-Pulmonary-resuscitation and heart attacks
- Nervous systems
- Overview of central nervous system, peripheral nervous system, and autonomic nervous systems
- Nervous tissue and organs and neural reflexes
- Neural transmission concussion, brain injury, nerve regeneration
- Bones and joints of the axial and appendicular skeleton, bone formation, bone injury and fractures
- Joint replacements and reconstructions
- Cells, tissues and organs of the following systems: endocrine, respiratory, digestive, urinary, reproductive system

- The emphasis of the concept of both anatomy and physiology in this course is the relevance in sport, exercise and physical fitness

CATEGORY	DETAILS
Core Competencies	• Scientific literacy in human anatomy and physiology. • Observation and analytical skills. • Critical thinking and problem-solving abilities. • Practical laboratory and measurement skills. • Communication and teamwork skills. • Ethical awareness in health and biological sciences.
Core Values	• Human movement and biomechanics. • Muscle actions during exercise. • Cardiovascular adaptations to training. • Respiratory efficiency during physical activity. • Energy systems used during sports. • Injury prevention and rehabilitation.
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Guyton, A. C., & Hall, J. E. (2021). *Textbook of Medical Physiology (14th ed.)*. Elsevier.
2. Marieb, E. N., & Hoehn, K. (2023). *Human Anatomy & Physiology (12th ed.)*. Pearson.
3. Martini, F. H., Nath, J. L., & Bartholomew, E. F. (2024). *Fundamentals of Anatomy & Physiology (12th ed.)*. Pearson.
4. Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2022). *Clinically Oriented Anatomy (9th ed.)*. Wolters Kluwer.
5. Patton, K. T., & Thibodeau, G. A. (2022). *Anatomy & Physiology (11th ed.)*. Elsevier.
6. Ross, J., & Wilson, A. (2022). *Anatomy and Physiology in Health and Illness (14th ed.)*. Elsevier.
7. Saladin, K. S. (2024). *Anatomy & Physiology: The Unity of Form and Function (10th ed.)*. McGraw-Hill Education.
8. Seeley, R. R., Stephens, T. D., & Tate, P. (2023). *Anatomy & Physiology (12th ed.)*. McGraw-Hill Education.
9. Standring, S. (Ed.). (2024). *Gray's Anatomy: The Anatomical Basis of Clinical Practice (43rd ed.)*. Elsevier.
10. Tortora, G. J., & Derrickson, B. (2021). *Principles of Anatomy and Physiology (16th ed.)*. John Wiley & Sons.

Second Semester

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology II provides students with a broad understanding of the diversity of living organisms through a comparative study of the Plant and Animal Kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plants and animals. The course equips students with the foundational knowledge needed to appreciate the relationship between the structure, function, and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animals. It enables prospective biology teachers to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge gained is fundamental for advanced studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific observation, analytical thinking, and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the general characteristics of the Plant and Animal Kingdoms.
2. Explain the ecological adaptations of plants and animals to different habitats.
3. Describe the basic physiological processes in living organisms, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development.
4. Explain how structure and function are related in plants and animals.
5. Discuss the importance of physiological processes in the survival of living organisms.
6. Explain the diversity and ecological significance of plants and animals.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. State the unique characteristics of plant and animal kingdoms;
3. Describe ecological adaptations in the plant and animal kingdoms;
4. Explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. Describe growthanddevelopmentinplantsandanimals.
6. Appreciate the diversity and ecological significance of plants and animals.

COURSE CONTENT

A generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological principle • Hygiene • Classification
Core Values	• Curiosity • Thinking • Integrity • Teamwork • Self-discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical-based instruction
Learning Resources	• Biology textbooks • Charts • Models • Videos

CATEGORY	DETAILS
Assessment Methods	Practical report

1. Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

CHE 121 General Chemistry II

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course introduces students to the fundamental principles and applications of organic chemistry**,** beginning with its historical development, electronic theory, nomenclature, functional groups, structural determination, purification techniques, reaction mechanisms, kinetics, and stereochemistry. It covers the chemistry of major classes of organic compounds and introduces carbon nanostructures, fullerenes, nanotubes, and nanochemistry. The course also examines selected metals and non-metals, comparative chemistry of Groups IA, IIA and IVA elements, and introductory transition metal chemistry.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the structure, properties, reactions, and applications of organic and selected inorganic compounds. It develops the chemical knowledge and skills required for further study in chemistry, biochemistry, pharmacy, environmental science, materials science, and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the historical development and importance of organic chemistry.
2. Describe the electronic structure, bonding, nomenclature, and functional groups of organic compounds.
3. Apply appropriate methods for the isolation, purification, identification, and structural determination of organic compounds.
4. Explain basic organic reaction mechanisms, kinetics, and stereochemical principles.
5. Describe the properties and reactions of major classes of organic compounds.

6. Explain the chemistry and applications of fullerenes, nanotubes, nanostructures, and nanochemistry.
7. Compare the chemistry of selected metals and non-metals, including Groups IA, IIA, and IVA elements.
8. Describe the fundamental properties and chemistry of transition metals.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative structures in organic chemistry;
5. Describe rules guiding nomenclature and functional group classes of organic compounds;
6. Determine rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry; 8. Discuss comparative chemistry of group IA, IIA and IIA elements; and
8. Describe basic properties of transition metals.

COURSE CONTENT

- Historical survey of the development and importance of Organic Chemistry
- Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry
- Electronic theory in organic chemistry
- Isolation and purification of organic compounds
- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry
- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics
- Stereochemistry
- The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives
- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA, IIA and IVA elements

- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• Nomenclature • Identification • Classification • Structure • Purification • Analysis • Stereochemistry • Mechanism • Reactivity
Core Values	• Accuracy • Integrity • Safety • Responsibility • Curiosity • Creativity • Discipline • Objectivity
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method
Learning Resources	• Periodic Table • Molecular Models • Laboratory Equipment • Reaction Mechanism Charts

CATEGORY	DETAILS
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Carey, F. A., Giuliano, R. M., Allison, N. T., & Bane, S. L. (2023). *Organic chemistry* (12th ed.). McGraw Hill.
2. McMurry, J. E. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
4. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
6. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.

MTH 121 General Mathematics II (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops students' ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomials, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series, The trigonometry component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and application of science, technology, engineering, social sciences, economics, and other disciplines. A strong understanding of elementary algebra and trigonometry enables students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher-level mathematics and discipline-specific courses that require mathematical reasoning and computation. Knowledge of algebra supports the study of functions, calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer science, and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real-life and professional situations.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain and apply the basic concepts and properties of the real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials, and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.
4. Define and apply the basic trigonometric ratios: sine, cosine, and tangent.
5. Apply algebraic and trigonometric methods to practical problems in science, technology, engineering, and everyday situations.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements
- Venn diagrams

- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers
- Algebra of complex numbers
- The Argand diagram
- De-Moivre's theorem, nth roots of unity
- Circular measure, trigonometric functions of angles of any magnitude
- Addition and factor formulae

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Creativity • Innovation 4. Reflective thinking • 5Collaboration • Reflective thinking • Self-development • Problem-solving skills.
Core Values	• Integrity • Team spirit • Perseverance • Transparency • Tolerance • Honesty
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms
Assessment Methods	• Continuous assessment • Formative Assessment • Summative assessment • **Readings** • Class work • Assignment • Group assignment • Presentations • Written Quiz

REFERENCES AND FURTHER READING

1. College Algebra – algebraic techniques, equations, functions, and graphs.
2. Elementary Trigonometry – trigonometric ratios, identities, equations, and applications.
3. Schaum's Outline of Elementary Algebra – particularly good for worked examples and practice problems.
4. Schaum's Outline of Trigonometry – useful for additional exercises and step-by-step solutions.
5. OpenStax, Algebra and Trigonometry

PHY 121 General Physics II (Electricity and Magnetism)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Physics: Electricity and Magnetism introduces students to the fundamental principles governing electric charges, electric fields, electric potential, current electricity, magnetic fields, and electromagnetic interactions. The course develops students' understanding of how electrical and magnetic phenomena are generated, measured, and applied in scientific, technological, and everyday contexts. It covers basic laws and principles such as Coulomb's law, Ohm's law, Kirchhoff's laws, Ampère's law, Faraday's law of electro-

magnetic induction, and Lenz's law. Practical activities and problem-solving are used to develop students' ability to analyse electrical and magnetic systems and relate theoretical concepts to technological applications.

Course-Relevant Statement

The study of electricity and magnetism is essential for understanding many natural phenomena and modern technologies, including electrical power generation and distribution, electric motors, transformers, communication systems, electronic devices, sensors, and renewable-energy technologies. The course equips students with foundational knowledge and practical skills needed for further study in physics, chemistry, biology, engineering, technology, and Integrated Science. It also promotes scientific reasoning, quantitative problem-solving, safe laboratory practice, and the ability to apply physics principles to real-life situations.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of electric charge, electric force, electric field, and electric potential.
2. State and apply Coulomb's law to problems involving electric charges.
3. Describe electric field patterns and calculate electric field strength and potential.
4. Describe electric current, electromotive force, resistance, and electrical energy.
5. Explain the principles of series and parallel electrical connections.
6. Describe the relationship between electric current and magnetic fields.
7. Explain magnetic field patterns and determine the forces acting on current-carrying conductors.
8. Describe the operating principles of electromagnets, electric motors, and related devices.

Learning Outcomes

By the end of this course, Student should be able to;

1. Describe the electric field and potential, and related concepts, for stationary charges;
2. Calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law and electric potential;
3. Describe and determine the magnetic field for steady and moving charges;

4. Determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. Describe electromagnetic induction and related concepts, and make calculations using Faraday and Lenz's laws;
6. Explain the basic physical of Maxwell's equations in integral form;
7. Evaluate DC circuits to determine the electrical parameters; and
8. Determine the characteristics of ac voltages and currents in resistors, capacitors, and inductors.

Contents

Forces in nature; Electrostatics; electric charge and its properties, methods of charging; Coulomb's law and superposition; electric field and potential; Gauss's law; Capacitance; Electric dipoles; Energy in electric fields; Conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits; Magnetic fields; Lorentz force; Biot-Savart and Ampère's laws; magnetic dipoles; Dielectrics; Energy in magnetic fields; Electromotive force; Electromagnetic induction; Self and mutual inductances; Faraday and Lenz's laws; Step up and step down transformers: Maxwell's equations; Electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

CATEGORY	DETAILS
Core Competencies	• Conceptual competence • Problem-solving competence • Experimental competence • Measurement competence • Circuit-analysis competence • Scientific inquiry competence • Technological competence • Safety competence • Communication competence

CATEGORY	DETAILS
Core Values	• Scientific curiosity • Accuracy and precision • Critical thinking • Creativity and innovation • Teamwork and cooperation • Responsibility • Safety consciousness • Integrity • Environmental responsibility • Perseverance
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Demonstration method • Practical/laboratory method • Collaborative learning • Project-based learning • Discussion method • Simulation and multimedia learning • Concept mapping • Blended learning
Learning Resources	• Laboratory resources • Instructional materials • Digital resources • NERDC e-Curriculum and learner resources
Assessment Methods	• Class tests • Assignments • Laboratory work • Practical reports • Quizzes • Group projects • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

Nigerian Educational Research and Development Council (NERDC). (2025). *New Revised Senior Secondary Education Curriculum*. Abuja: NERDC.

National Commission for Colleges of Education (NCCE). (2024). *Minimum Standards for Nigeria Certificate in Education: Science Education – Physics*. Abuja: NCCE. The curriculum specifically includes electrostatics, magnetostatics, current electricity, electrolysis and capacitance.

HEE 124 First Aid and Safety Education

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

First Aid and Safety Education is a foundational course designed to equip students with the knowledge, practical skills, attitudes, and values required to prevent accidents, respond appropriately to emergencies, and provide immediate assistance to individuals who are injured or suddenly ill before professional medical care becomes available.

The course introduces students to the principles and objectives of first aid, emergency preparedness, accident prevention, personal and environmental safety, and basic life-support procedures. It emphasises the importance of rapid assessment, appropriate decision-making, personal safety, and timely referral to health professionals.

Students learn how to recognise and respond to common emergencies such as bleeding, wounds, burns, fractures, sprains and strains, choking, fainting, shock, poisoning, seizures, drowning, heat-related emergencies, animal and insect bites, and sudden illness. Basic cardiopulmonary resuscitation (CPR) and other emergency response procedures are also introduced, subject to appropriate practical training and current guidelines.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define first aid, safety education, accident, injury, emergency, and related concepts.
2) Explain the principles, objectives, scope, and importance of first aid.
3) Identify different types of wounds and bleeding and describe appropriate first-aid measures.
4) Identify fractures, dislocations, sprains, and strains and describe appropriate immediate care.

5) Explain appropriate first-aid responses to poisoning, bites, stings, and chemical exposure.
6) Explain the importance of emergency preparedness and disaster management.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1) Explain the concepts, principles, objectives, and importance of first aid and safety education.
2) Identify common causes of accidents, injuries, and emergencies in schools, homes, workplaces, sports facilities, and communities.
3) Assess an emergency situation and prioritise appropriate actions while maintaining personal and scene safety.
4) Identify and appropriately use the contents of a basic first-aid kit.
5) Identify hazards and apply basic risk-assessment and accident-prevention strategies.
6) Explain the importance of emergency preparedness and disaster response.

COURSE CONTENT

- Introduction to First Aid and Safety Education
- Emergency Assessment and Response
- First-Aid
- Basic Life Support and CPR
- Choking and Airway Emergencies. Wounds and Bleeding
- Burns and Scalds
- Musculoskeletal Injuries
- Shock
- Fainting and Unconsciousness
- Common Medical Emergencies
- Environmental and Weather-Related Emergencies
- Eye
- Ear
- Nose and Dental Emergencies
- Sports and Physical Activity Safety
- School and Laboratory Safety

- Home
- Road and Community Safety
- Disaster Preparedness and Emergency Management
- Safety Education and Accident Prevention
- Principles of safety education
- Practical First Aid and Safety Activities
- Demonstration and practice of CPR
- Bandaging and dressing techniques
- Splinting and immobilisation
- Recovery position
- Management of simulated emergencies
- First-aid kit preparation and inspection
- Emergency drills and simulations
- Development of school/community safety plans
- Practical assessment of first-aid competencies

CATEGORY	DETAILS
Core Competencies	• First-aid knowledge and understanding • Emergency assessment and response competence • Basic life support and CPR competence • Choking and airway management competence • Wound and bleeding management competence
Core Values	• Respect for human life and dignity • Commitment to preservation of life • Responsibility and accountability • Safety consciousness • Self-discipline • Calmness and emotional control • Courage and confidence • Empathy and compassion • Willingness to help others

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Inquiry-based learning • Problem-based learning • Case study analysis • Demonstration and practical activities • Field visits and environmental observation • Community-based learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American Red Cross – First Aid/CPR/AED Participant's Manual.
2. American Heart Association – Basic Life Support (BLS) Provider Manual.
3. American Heart Association – Heartsaver First Aid, CPR & AED.
4. British Red Cross – First Aid Manual and Emergency Response Resources.
5. St John Ambulance – First Aid Manual.
6. International Federation of Red Cross and Red Crescent Societies (IFRC) – International First Aid, Resuscitation and Education Guidelines.

7. World Health Organization (WHO) – resources on emergency care, injury prevention, and community first aid.
8. National Safety Council – First Aid, CPR and AED training resources.
9. Park, K. – Park's Textbook of Preventive and Social Medicine, particularly sections on accidents, injuries, occupational health, and community safety.
10. Relevant institutional First Aid and Safety Education Laboratory/Practical Manual.
11. World Health Organization (WHO) – emergency care, injury prevention, and road-safety resources.
12. International Federation of Red Cross and Red Crescent Societies (IFRC) – first-aid and emergency-response guidelines.
13. American Heart Association (AHA) – current CPR and basic-life-support guidance.
14. American Red Cross – first-aid, CPR, AED, and emergency preparedness resources.
15. St John Ambulance – first-aid education and emergency-care resources.
16. International Liaison Committee on Resuscitation (ILCOR) – evidence-based resuscitation recommendations.
17. Federal Ministry of Health and Social Welfare, Nigeria – relevant health and emergency-care policies and guidelines.
18. Nigeria Red Cross Society – first-aid, disaster preparedness, and community emergency-response resources.

HEE 125 Personal, Mental and Emotional Health

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Personal, Mental and Emotional Health is a foundational course that explores the principles and practices of maintaining holistic well-being through the promotion of personal health, mental wellness, and emotional resilience. The course examines the interrelationship between physical, mental, emotional, social, and spiritual dimensions of health, emphasising healthy lifestyles, self-awareness, stress management, emotional intelligence, interpersonal relationships, and positive mental health. The course equips students with the knowledge, attitudes, and practical skills required to make informed health decisions, manage emotions effectively, cope with stress and life challenges, build healthy relationships, and promote mental well-being in educational, sporting, workplace, and community settings. It also addresses contemporary issues such as substance abuse, depression, anxiety, suicide prevention, digital well-being, and mental health promotion.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the relationship between physical activity, mental health, emotional well-being, and athletic performance. It prepares future teachers, coaches, fitness professionals, and sports administrators to recognise the psychological needs of learners and athletes, foster supportive and inclusive environments, and promote resilience, motivation, and healthy lifestyles.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts of personal, mental, and emotional health.
2. Describe the dimensions and determinants of health and well-being.
3. Demonstrate knowledge of healthy lifestyle practices that promote lifelong wellness.
4. Explain the importance of self-awareness, self-esteem, and emotional intelligence.
5. Identify common mental and emotional health challenges and their risk factors.
6. Promote mental health awareness and reduce stigma associated with mental illness.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Explain the concepts and dimensions of personal, mental, and emotional health.
2. Demonstrate healthy lifestyle practices that promote physical and psychological well-being.
3. Apply emotional intelligence and stress management strategies in daily life.
4. Identify common mental health challenges and recommend appropriate support strategies.
5. Promote healthy relationships, resilience, and positive communication.
6. Advocate for mental health awareness and inclusive health practices in educational and community settings.

COURSE CONTENT

- Definitions and meanings of personal health, mental health and emotional health
- Characteristics, of a healthy person e.g. ability to work without being easily fatigued, ability to comprehend mental task and resistance to infection.
- Personal Hygiene: care of the teeth, skin, eyes, ears, nose and the entire body

- Care of clothing and clothes, care of rooms, kitchens and surroundings, care of the school surroundings: classroom toilet etc. Health Hazards and their preventions: flood, earthquakes, oil spillages etc. Health appraisal and understanding of health problems.
- Ways of achieving a satisfactory emotional and social adjustment
- Problems of changes in health behaviour and keeping of simple health records
- Maintenance and improvement of emotional and social health
- Methods of handling the mentally and emotionally disturbed persons Excursions to psychiatric hospitals/Clinics/wards/homes

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CATEGORY	DETAILS
Core Competencies	• Environmental health knowledge • Environmental risk assessment • Disease prevention and health promotion • Water, Sanitation, and Hygiene (WASH) Competence • Pollution Prevention and Environmental Management • Occupational Health and Safety Skills
Core Values	• Environmental responsibility • Health consciousness • Personal and community hygiene • Safety consciousness • Professional ethics • Social responsibility • Respect for human life and dignity • Teamwork and collaboration
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations • Field Visits and Experiential Learning • Technology-Enhanced Learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American Psychiatric Association. (2022). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR)*. American Psychiatric Publishing.
2. Corey, G. (2021). *Theory and Practice of Counseling and Psychotherapy (10th ed.)*. Cengage Learning.
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4. Hales, D. (2022). *An Invitation to Health (20th ed.)*. Cengage Learning.
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6. Myers, D. G., & DeWall, C. N. (2023). *Psychology (14th ed.)*. Worth Publishers.
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8. Santrock, J. W. (2024). *Life-Span Development (19th ed.)*. McGraw-Hill Education.
9. Seligman, M. E. P. (2018). *Flourish: A Visionary New Understanding of Happiness and Well-being*. Atria Books.
10. The standard reference for the classification and diagnosis of mental disorders.

11. UNICEF. (2021). *The State of the World's Children 2021: On My Mind – Promoting, Protecting and Caring for Children's Mental Health*.
12. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
13. Weiten, W., Dunn, D. S., & Hammer, E. Y. (2021). *Psychology Applied to Modern Life: Adjustment in the 21st Century (12th ed.)*. Cengage Learning.
14. World Health Organization (WHO). (2020). *Guidelines on Physical Activity and Sedentary Behaviour*.
15. World Health Organization (WHO). (2022). *World Mental Health Report: Transforming Mental Health for All*.

EHE 211 Methods and Resources in Health Education

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Methods and Resources in Health Education is a foundational professional course that equips students with the knowledge and practical competencies required to plan, select, develop, use, and evaluate appropriate methods and instructional resources for effective health education.

The course examines the principles of teaching and learning in health education, with emphasis on learner-centred approaches, effective communication, behaviour change, participatory learning, and the use of appropriate instructional materials. Students are introduced to various teaching methods and learn how to select methods according to the learning objectives, content, characteristics of learners, available resources, and teaching environment.

The course also focuses on the identification, development, adaptation, utilisation, and evaluation of print, audio, visual, audio-visual, digital, community-based, and locally available resources for health education. Students learn how to use resources to make health messages understandable, engaging, culturally appropriate, and relevant to individuals and communities.

RELEVANCE STATEMENT

Methods and Resources in Health Education is highly relevant because effective health education depends not only on what is taught but also on how health information is communicated and the resources used to facilitate learning. Appropriate teaching methods and instructional materials make health messages clearer, more interesting, memorable, culturally appropriate, and applicable to real-life situations.

The course is particularly important for student-teachers, health educators, community health workers, and other professionals involved in health promotion. It equips them with the skills required to communicate health information effectively to individuals, groups, schools, families, and communities with different levels of knowledge, literacy, culture, and health needs.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of teaching methods, instructional resources, health education, health communication, and health promotion.
2) Explain the principles and characteristics of effective health education methods.
3) Identify and describe various teaching methods applicable to health education.
4) Explain the advantages, limitations, and appropriate uses of different teaching methods.
5) Explain the importance of learner-centred approaches in health education.
6) Explain the principles for selecting appropriate instructional resources.
7) Evaluate the effectiveness, suitability, accessibility, and cultural appropriateness of health education resources.
8) Apply knowledge of teaching methods and instructional resources to real-life health education and health promotion situations.

LEARNING OUTCOMES

In completion of this course the student is expected to:

1) Describe many aspects of fundamental strategies for health education, including conceptualising instruction, developing instructional objectives, planning units/ lessons and presentations; becoming familiar with various traditional and digital instructional methods and materials; and evaluating the effectiveness of health instruction in schools and community and other settings;

2) Develop print health educational materials for teaching, learning and communicating health information;
3) Practice a variety of in-person as well as digital, health education methods;
4) Apply the principles of developing and delivering effective multimedia hybrid presentation and educational intervention;
5) Select appropriate learning materials and methods in health education programmes;
6) Evaluate health education resources available from a variety of sources including the internet and mobile apps;
7) Outline the technical and production aspects of materials and media considered in laboratory sessions; and
8) Develop health education materials and learning activities though fieldwork in addition to in-class and laboratory session.

COURSE CONTENT

- Various methods and resources used in teaching and practising health education
- Pedagogic and teaching/learning materials are emphasised
- The selection and use learning materials and methods in health education programmes
- Technical and production aspects of materials and media are considered in laboratory sessions
- Students are required to produce health education materials or develop learning activities though fieldwork in addition to in-class and laboratory session
- Strategies and approaches to health instruction
- Selection and utilisation of instructional materials in teaching health education, health promotion and health maintenance are explored
- Organisation of health instructions from curriculum content to specific lesson plans are carried out
- Aspects of fundamental strategies for health education, including conceptualising instruction, developing instructional objectives, planning units/lessons and presentations
- Becoming familiar with various traditional and digital instructional methods and materials
- Evaluating the effectiveness of health instruction in schools and community and other settings

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Problem-Based Learning (PBL)
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Cottrell, R. R., Girvan, J. T., McKenzie, J. F., & Seabert, D. M. (2022). *Principles and Foundations of Health Promotion and Education (8th ed.)*. Pearson.
2. Edelman, C. L., Kudzma, E. C., & Mandle, C. L. (2021). *Health Promotion Throughout the Life Span (10th ed.)*. Elsevier.
3. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2024). *Health Behavior: Theory, Research, and Practice (6th ed.)*. Jossey-Bass.
4. Green, J., & Tones, K. (2018). *Health Promotion: Planning and Strategies (4th ed.)*. Sage Publications.
5. Insel, P. M., & Roth, W. T. (2023). *Core Concepts in Health (17th ed.)*. McGraw-Hill Education.
6. McKenzie, J. F., Neiger, B. L., & Thackeray, R. (2022). *Planning, Implementing, and Evaluating Health Promotion Programs: A Primer (8th ed.)*. Pearson.
7. Naidoo, J., & Wills, J. (2016). *Foundations for Health Promotion (4th ed.)*. Elsevier.
8. Park, K. (2023). *Park's Textbook of Preventive and Social Medicine (27th ed.)*. Banarsidas Bhanot Publishers.
9. Schneider, M. J. (2021). *Introduction to Public Health (6th ed.)*. Jones & Bartlett Learning.
10. World Health Organization (WHO). (2021). *Health Promotion Glossary of Terms*.

EHE 215 Family Life, Reproductive Health & Population Education

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Family Life, Reproductive Health and Population Education is an interdisciplinary course designed to provide students with knowledge, values, attitudes, and life skills related to family life, human sexuality, reproductive health, population dynamics, and responsible decision-making. The course examines the biological, psychological, social, cultural, and ethical dimensions of family life and reproductive health while emphasising healthy relationships, responsible parenthood, gender equality, adolescent health, and population issues. The course also explores population growth, demographic trends, fertility, mortality, migration, and their implications for sustainable development, education, health, and national planning. Students develop the knowledge and practical skills required to promote healthy lifestyles, prevent reproductive health problems, support informed decision-making, and contribute to population education and family well-being.

RELEVANCE STATEMENT

The course provides essential knowledge on personal health, reproductive health, family well-being, and population issues that influence physical, emotional, and social development. It prepares future teachers, coaches, and health educators to provide age-appropriate health education, promote healthy lifestyles, prevent risky behaviours, and support the well-being of learners and athletes.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts, scope, and importance of family life, reproductive health, and population education.
2. Describe the structure, functions, and values of the family in society.
3. Explain human growth, development, sexuality, and reproductive health across the lifespan.
4. Identify common reproductive health issues affecting adolescents and adults.
5. Promote responsible sexual behaviour, healthy relationships, and responsible parenthood.
6. Explain population concepts, demographic processes, and population trends.
7. Examine the relationship between population growth, resource utilisation, and sustainable development.
8. Analyse the influence of cultural, social, economic, and environmental factors on reproductive health and population dynamics.
9. Promote healthy lifestyles, gender equity, and disease prevention within families and communities.

LEARNING OUTCOMES

Upon completion of this course, the student is expected to:

1. Explain the major concepts, theories and perspectives guiding a multidisciplinary understanding of human sexuality across the life course;
2. Develop skills and knowledge needed for healthy functioning which include: strong communication skills, positive self-esteem, parenting, sexuality, gender and healthy inter-personal relationships;
3. Explain global burden of reproductive ill-health, the social ecology of reproductive risk, and clinical health practice and components of reproductive health;

4. Describe the value of the home and family as primary sources of enrichment and personal renewal;
5. Analyse the effect of culture and family patterns on individual and family development;
6. Demonstrate understanding of reproductive health from a public health and social prospective;
7. Demonstrate understanding of the occurrence and prevention of sexually transmitted disease and unwanted pregnancy;
8. Explain the demographic changes in the world (with particular attention to Africa); and
9. Evaluate the use of demographic concepts and population theories to understand contemporary socio-health issues.

COURSE CONTENT

- The framework of family life education that embraces healthy family functioning within a family system as well as a primarily preventive approach to diseases
- Emphasis is given to biological, psychological and educational aspects of human sexuality with special emphasis on instructional activities related to interpersonal communication, decision making ability and clarification of values
- Skills and knowledge needed for healthy functioning which include: strong communication skills, positive self-esteem, parenting, sexuality, gender and healthy interpersonal relationships are explored
- Definition and aims of sex education are provided
- The phenomenon of puberty and conception
- Types of marriage as well as health roles of family members, reproductive organs and genetic inheritance are included
- Sexually transmitted diseases including Acquired Immune Deficiency Syndrome (AIDS) are also discussed
- Historical trends in the global burden of reproductive ill-health, the social ecology of reproductive risk, and clinical health practice
- The concept, rationale, goal, objectives of reproductive health (RH) should be discussed
- Critical detail discussion of the components of RH including techniques for strong and stable family

- Gender actualisation, gender identity and roles, sexual orientation and issues surrounding sex education are explored
- Adolescents' problems, responsible parenthood, pregnancy and child birth-related complications, congenital, abnormalities and family planning
- Concept of population education
- Objectives of population education
- Population distributions and patterns as they affect health and social life, and effects of population growth or health resources
- Family planning methods and practice

CATEGORY	DETAILS
Core Competencies	• Gender equality and social inclusion • Maternal, child, and adolescent health promotion • Critical thinking and problem-solving • Community health education and advocacy Knowledge of family life and reproductive health
Core Values	• Professionalism • Integrity and ethical conduct • Respect for human dignity • Empathy and compassion • Self-discipline and self-control • Emotional intelligence • Resilience and perseverance • Confidence and positive self-belief • Teamwork and collaboration
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning • Independent study and reflective learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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9. UNESCO. (2018). *International Technical Guidance on Sexuality Education: An Evidence-Informed Approach (Revised ed.)*. UNESCO.

10. UNICEF. (2023). *The State of the World's Children*.
11. United Nations Population Fund (UNFPA). (2022). *State of World Population Report*.
12. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
13. World Health Organization (WHO). (2022). *Sexual Health, Human Rights and the Law*. WHO.
14. World Health Organization (WHO). Global Reproductive Health Strategy (Latest Edition).

HEE 215 Community Health

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Community Health is a foundational course that examines the health status, health needs, health problems, and health services of individuals, families, and populations within communities. The course introduces students to the principles and practices of promoting, protecting, and improving the health and well-being of communities through preventive, promotive, curative, and rehabilitative approaches.

The course emphasises the relationship between individual health and community conditions, including socioeconomic status, culture, education, environment, sanitation, nutrition, housing, lifestyle, and access to health services. Students examine common health problems affecting communities and explore strategies for disease prevention, health promotion, health education, community participation, and effective use of health resources.

RELEVANCE STATEMENT

Community Health is highly relevant because the health of individuals is closely connected to the conditions in which people live, learn, work, and interact. Many health problems cannot be adequately addressed at the individual level alone and require coordinated community-based approaches involving health education, prevention, environmental improvement, appropriate health services, and community participation.

The course is particularly important in the Nigerian context, where communities may experience challenges related to access to health services, sanitation, unsafe water,

communicable diseases, maternal and child health, malnutrition, non-communicable diseases, environmental hazards, health misinformation, and socioeconomic inequalities.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of community health, public health, health promotion, and disease prevention.
2) Explain the scope, principles, objectives, and importance of community health.
3) Describe the major determinants of individual and community health.
4) Explain the relationship between socioeconomic, cultural, environmental, and behavioural factors and community health.
5) Identify and assess major health needs and problems within a community.
6) Explain the principles and components of primary health care.
7) Explain the principles and processes of community mobilisation.
8) Describe basic approaches to community diagnosis and health assessment.
9) Identify major non-communicable diseases and explain appropriate preventive measures.
10) Explain the importance of adequate nutrition in promoting community health.
11) Explain the importance of referral systems and coordination among health-care providers.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1) Explain the concepts, scope, principles, and importance of community health.
2) Describe the major determinants of individual, family, and community health.
3) Distinguish between community health, public health, and primary health care.
4) Identify and assess common health needs and problems within a community.
5) Explain the principles and components of primary health care.
6) Describe the importance of community participation, mobilisation, and empowerment in health development.
7) Identify major communicable diseases and explain their prevention and control.
8) Identify major non-communicable diseases and recommend appropriate preventive measures.

9) Explain the relationship between environmental sanitation, hygiene, safe water, and community health.
10) Demonstrate appropriate health education and communication strategies for individuals, groups, and communities.
11) Identify available community health resources and explain how they can be appropriately utilised.

COURSE CONTENT

- Introduction to Community Health
- Determinants of Community Health
- Community Health Assessment and Diagnosis
- Concept of community health
- Primary Health Care
- Community Participation and Mobilisation
- Epidemiology and Disease Surveillance
- Communicable Diseases
- Meaning and characteristics of communicable diseases
- Non-Communicable Diseases
- Maternal and Newborn Health
- Child Health
- Adolescent and Reproductive Health
- Community Nutrition
- Environmental Health and Sanitation
- Mental and Social Health
- Health Education and Communication
- Community Health Services and Resources
- School and Occupational Community Health
- Health Policy
- Programmes and Legislation
- Monitoring and Evaluation of Community Health Programmes
- Contemporary Issues in Community Health
- Community health assessment

- Community mapping
- Identification of community health problems
- Household health survey
- Environmental sanitation assessment
- Water and sanitation observation
- Health education campaign
- Community mobilisation exercise
- Visit to primary health-care facilities
- Health facility observation and report writing
- Community health project
- Preparation of a community health intervention plan
- Monitoring and evaluation of a simulated community health programme

CATEGORY	DETAILS
Core Competencies	• First-aid knowledge and understanding • Emergency assessment and response competence • Basic life support and CPR competence • Choking and airway management competence • Wound and bleeding management competence • Burn and scald management competence
Core Values	• Respect for human life and dignity • Commitment to preservation of life • Responsibility and accountability • Safety consciousness • Self-discipline • Calmness and emotional control • Courage and confidence • Empathy and compassion • Willingness to help others • Promptness and responsiveness • Alertness and situational awareness

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Inquiry-based learning • Problem-based learning • Case study analysis • Demonstration and practical activities • Field visits and environmental observation • Community-based learning • Project-based learning • Group work and cooperative learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1) American Red Cross – First Aid/CPR/AED Participant's Manual.
2) American Heart Association – Basic Life Support (BLS) Provider Manual.
3) American Heart Association – Heartsaver First Aid, CPR & AED.
4) British Red Cross – First Aid Manual and Emergency Response Resources.
5) St John Ambulance – First Aid Manual.

6) International Federation of Red Cross and Red Crescent Societies (IFRC) – International First Aid, Resuscitation and Education Guidelines.
7) World Health Organization (WHO) – resources on emergency care, injury prevention, and community first aid.
8) National Safety Council – First Aid, CPR and AED training resources.
9) Park, K. – Park's Textbook of Preventive and Social Medicine, particularly sections on accidents, injuries, occupational health, and community safety.
10) Relevant institutional First Aid and Safety Education Laboratory/Practical Manual.
11) World Health Organization (WHO) – emergency care, injury prevention, and road-safety resources.
12) International Federation of Red Cross and Red Crescent Societies (IFRC) – first-aid and emergency-response guidelines.
13) American Heart Association (AHA) – current CPR and basic-life-support guidance.
14) American Red Cross – first-aid, CPR, AED, and emergency preparedness resources.
15) St John Ambulance – first-aid education and emergency-care resources.
16) International Liaison Committee on Resuscitation (ILCOR) – evidence-based resuscitation recommendations.
17) Federal Ministry of Health and Social Welfare, Nigeria – relevant health and emergency-care policies and guidelines.
18) Nigeria Red Cross Society – first-aid, disaster preparedness, and community emergency-response resources.

EHE 212 School Health Education Programme

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

School Health Education Programme is a professional course that examines the principles, components, planning, implementation, and evaluation of health education and health promotion activities within the school environment. The course introduces students to the concept of the school as a health-promoting setting and emphasises the role of education in improving the physical, mental, emotional, social, and environmental health of learners.

The course examines the major components of a comprehensive school health programme, including health education, school health services, healthy school environment, nutrition services, physical activity, mental health, personal hygiene, disease prevention, safety,

counselling, and community involvement. Students learn how schools can identify health needs, develop appropriate interventions, and create supportive environments that enhance learners' health, well-being, attendance, and academic performance.

RELEVANCE STATEMENT

School Health Education Programme is highly relevant because the school provides an important setting for promoting the health, well-being, development, and academic success of children and adolescents. Learners spend a significant proportion of their formative years in school, making the school an effective setting for developing healthy behaviours and preventing health problems.

The course equips prospective teachers and health educators with the knowledge and skills required to identify learners' health needs and provide appropriate health education, preventive services, supportive environments, and referrals. It recognises that health and education are closely interconnected: poor health can contribute to absenteeism, poor concentration, low participation, and reduced academic achievement, while a healthy school environment can support learning and overall development.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of school health, health education, school health services, and health-promoting schools.
2) Explain the nature, scope, principles, objectives, and importance of school health education programmes.
3) Identify and explain the major components of a comprehensive school health programme.
4) Explain the relationship between learners' health, well-being, school attendance, and academic performance.
5) Explain the role of school health services, health screening, referral, and follow-up.
6) Explain principles of school nutrition, healthy eating, and food safety.

LEARNING OUTCOMES

In completion of this course the student is expected to:

1) Explain the factors for operating effective school health programme including the teacher's role in health appraisal and in effecting healthful school living;
2) Develop a school health programme;

3) Plan school health programme activities;
4) Implement case examples of school health counselling; and
5) Evaluate an existing school health programme.

COURSE CONTENT

- The value of comprehensive health education rather than disease specific units in school
- Promotion of good healthy living in and out of school
- The framework and components of school health education programme and how best it can be managed via employment of health personnel, drugs, clinic and encouraging body cleanliness
- The factors for operating effective school health programme including the teacher's role in health appraisal and in effecting healthful school living
- Mechanisms for sustainable school health programme
- Medical inspection
- Assessment of handicapped children
- Safe school environment
- School feeding and control of infections
- Organisation of school health services
- Co-ordination, assessment and evaluation of school health programme
- Typical health problems of school age children are examined including typical intervention measures, such as: having school friendly environment, accident prevention and treatment of minor ailments of school children

CATEGORY	DETAILS
Core Competencies	• School health knowledge and understanding • Health education and promotion competence • School health programme planning competence • School health needs assessment competence • Health screening and referral competence • Personal hygiene and sanitation promotion competence

CATEGORY	DETAILS
Core Values	• Respect for human life and dignity • Commitment to preservation of life • Responsibility and accountability • Safety consciousness • Self-discipline • Calmness and emotional control • Courage and confidence • Empathy and compassion • Willingness to help others • Promptness and responsiveness • Alertness and situational awareness
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Inquiry-based learning • Problem-based learning • Case study analysis • Demonstration and practical activities • Field visits and environmental observation • Community-based learning • Project-based learning • Group work and cooperative learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American Red Cross – First Aid/CPR/AED Participant's Manual.
2. American Heart Association – Basic Life Support (BLS) Provider Manual.
3. American Heart Association – Heartsaver First Aid, CPR & AED.
4. British Red Cross – First Aid Manual and Emergency Response Resources.
5. St John Ambulance – First Aid Manual.
6. International Federation of Red Cross and Red Crescent Societies (IFRC) – International First Aid, Resuscitation and Education Guidelines.
7. World Health Organization (WHO) – resources on emergency care, injury prevention, and community first aid.
8. National Safety Council – First Aid, CPR and AED training resources.
9. Park, K. – Park's Textbook of Preventive and Social Medicine, particularly sections on accidents, injuries, occupational health, and community safety.
10. Relevant institutional First Aid and Safety Education Laboratory/Practical Manual.
11. World Health Organization (WHO) – emergency care, injury prevention, and road-safety resources.
12. International Federation of Red Cross and Red Crescent Societies (IFRC) – first-aid and emergency-response guidelines.
13. American Heart Association (AHA) – current CPR and basic-life-support guidance.
14. American Red Cross – first-aid, CPR, AED, and emergency preparedness resources.
15. St John Ambulance – first-aid education and emergency-care resources.
16. International Liaison Committee on Resuscitation (ILCOR) – evidence-based resuscitation recommendations.
17. Federal Ministry of Health and Social Welfare, Nigeria – relevant health and emergency-care policies and guidelines.

18. Nigeria Red Cross Society – first-aid, disaster preparedness, and community emergency-response resources.

EHE 218 Human Diseases and Health Protection

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Human Diseases and Health Protection is a foundational course that examines the causes, transmission, prevention, control, and management of common human diseases and the principles of protecting and promoting individual, family, and community health. The course provides students with knowledge of communicable and non-communicable diseases, emerging and re-emerging diseases, environmental and occupational health risks, and public health measures for disease prevention. The course explores the concepts of health and disease, disease causation, epidemiology, immunity, infection control, vaccination, nutrition, sanitation, environmental health, health education, and healthy lifestyle practices. Students also study the role of health systems, health policies, community participation, and health promotion strategies in improving public health outcomes.

RELEVANCE STATEMENT

The course provides essential knowledge for safeguarding the health of learners, athletes, and communities. It equips future teachers, coaches, health educators, and sports administrators with the skills to recognise health risks, prevent disease transmission, promote healthy behaviours, and ensure safe participation in physical activity and sports.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts of health, disease, and health protection.
2. Describe the causes, transmission, signs, symptoms, prevention, and control of common communicable and non-communicable diseases.
3. Explain the principles of epidemiology, immunity, infection prevention, and disease surveillance.
4. Identify environmental, occupational, nutritional, and lifestyle factors that influence health and disease.

5. Demonstrate knowledge of vaccination, sanitation, hygiene, and infection control measures.
6. Explain the roles of national and international agencies in disease prevention and health protection.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the epidemiology and prevention of major communicable and non-communicable diseases.
2. Apply health protection principles to promote individual and community well-being.
3. Identify health risks and recommend preventive interventions.
4. Design and implement health education programmes for disease prevention.
5. Promote hygiene, sanitation, vaccination, and healthy lifestyle practices.
6. Collaborate with relevant stakeholders in advancing public health and health protection.

COURSE CONTENT

- Concept of Physical Fitness, Components of Physical Fitness: Definitions and Examples, Programme of Physical Fitness, Assessing Physical Fitness, Cardiovascular Fitness, Cardiovascular Diseases, Physiological Training Principles and Adaptation to Exercise, Weight Control and Exercise, Exercise Metabolism, what cardiovascular is, its risk factors such as Cardiomyopathy, hypertensive heart disease, heart failure, pulmonary heart disease, cardiac dysrhythmias, inflammatory heart disease, valvular heart disease, congenital heart disease and rheumatic heart disease
- You also learnt about the risk factors such as age, sex, smoking, diet, physical inactivity, socioeconomic status and air pollution
- Measures in preventing cardiovascular diseases

CATEGORY	DETAILS
Core Competencies	• Knowledge of human diseases and health protection • Disease prevention and control • Health risk assessment and management • Health promotion and health education • Health screening and basic health assessment

CATEGORY	DETAILS
Core Values	• Scientific integrity • Professionalism • Precision and accuracy • Critical thinking • Ethical practice • Safety consciousness
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Detels, R., Gulliford, M., Karim, Q. A., & Tan, C. C. (Eds.). (2022). *Oxford Textbook of Global Public Health (7th ed.)*. Oxford University Press.
2. Friis, R. H., & Sellers, T. A. (2021). *Epidemiology for Public Health Practice (6th ed.)*. Jones & Bartlett Learning.
3. Gordis, L. (2019). *Epidemiology (6th ed.)*. Elsevier.
4. Heymann, D. L. (Ed.). (2022). *Control of Communicable Diseases Manual (21st ed.)*. American Public Health Association.

5. Kumar, V., Abbas, A. K., & Aster, J. C. (2024). *Robbins & Cotran Pathologic Basis of Disease (11th ed.)*. Elsevier.
6. Lucas, A. O., & Gilles, H. M. (2020). *Short Textbook of Public Health Medicine for the Tropics (5th ed.)*. CRC Press.
7. Park, K. (2023). *Park's Textbook of Preventive and Social Medicine (27th ed.)*. Banarsidas Bhanot.
8. Schneider, M. J. (2020). *Introduction to Public Health (6th ed.)*. Jones & Bartlett Learning.
9. Stanhope, M., & Lancaster, J. (2022). *Public Health Nursing: Population-Centered Health Care in the Community (11th ed.)*. Elsevier.
10. UNICEF. (Latest Edition). State of the World's Children Report.
11. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
12. World Health Organization (WHO). (2020). *Guidelines on Physical Activity and Sedentary Behaviour*.
13. World Health Organization (WHO). (2023). *World Health Statistics*.
14. World Health Organization. (2023). *Basic Emergency Care: Approach to the Acutely Ill and Injured*.

HEE 220 Food and Human Nutrition

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Food and Human Nutrition is a foundational course that introduces students to the principles of nutrition and the role of food in promoting health, growth, development, physical performance, and disease prevention. The course examines the composition of foods, the functions and sources of nutrients, digestion, absorption, metabolism, energy balance, and the nutritional requirements of individuals across different stages of life. The course also explores food selection, meal planning, food safety, food preservation, nutrition-related diseases, public health nutrition, and the relationship between nutrition, physical activity, and overall well-being. Special emphasis is placed on the nutritional needs of physically active individuals, athletes, children, adolescents, adults, older persons, and vulnerable populations.

RELEVANCE STATEMENT

This course provides essential knowledge of nutrition as a key determinant of health, physical fitness, athletic performance, and recovery. It prepares future teachers, coaches, fitness instructors, and health educators to guide individuals in making informed dietary choices, improving physical performance, preventing nutrition-related diseases, and promoting lifelong healthy lifestyles.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts, principles, and importance of food and human nutrition.
2. Describe the composition, functions, and food sources of major nutrients.
3. Explain the processes of digestion, absorption, metabolism, and energy production.
4. Identify the nutritional requirements of individuals at different stages of life.
5. Explain the relationship between nutrition, health, physical activity, and sports performance.
6. Demonstrate knowledge of food safety, hygiene, preservation, and handling.

LEARNING OUTCOMES

In completion of this course, the student is expected to:

1. Acquire good knowledge of diet, balanced diet, nutrition, classes of food and the importance of each food class to the development of the human physiology and health sustenance;
2. Have comprehended the application of nutritional principles/concepts at community and population level;
3. Have a knowledge of the metabolic basis of food demand through the life cycle;
4. Be knowledgeable of the nutrients and nutrient content of food and beverages and how they affect health;
5. Explain the biochemistry of food spoilage, preventive strategies and processes; and
6. Develop an appropriate nutritional plan for selected disease conditions.

COURSE CONTENT

- The fundamentals of human nutrition
- Different methods of dietary assessment and analysis, enabling them to collect analyses and interpret dietary information

- Nutritional challenges of vulnerable population groups and the importance of nutrition policy both locally and in a global context
- The concepts of diet, balanced diet, nutrition, classes of food and the importance of each food class to the development of the human physiology and health sustenance
- This course covers metabolic needs and supplementation
- Special attention is given to the effects of familial, cultural and regional influences on dietary habits
- The role of nutrition in health promotion and maintenance
- Fundamentals of nutrition
- Essentials of nutrients and utilisation
- Maintenance of good nutrition
- **Consequences of faulty nutrition for health:** such as nutritional deficiencies, nutritional disorders and stunted growth
- Development of appropriate nutrition for different age groups and conditions and diet appropriate for selected disease conditions (diabetes mellitus and hypertension)
- Therapeutic diets
- Implications of food fads and fallacies for health
- Malnutrition and types
- Breastfeeding and complementary feeding
- Nutrition surveillance
- Nutrition programmes for various sites, such as: community, workplace should be studied
- Food security and safety, cultural and environmental factors in food and nutrition
- Problems of over nutrition and diseases of the affluence
- Health policies and principles of food choices
- International/ national food policies and programmes are discussed

CATEGORY	DETAILS
Core Competencies	• Health promotion and disease prevention • Communication and interpersonal skills • Life skills and responsible decision-making • Knowledge of family life and reproductive health

CATEGORY	DETAILS
Core Values	• Professionalism • Integrity and ethical conduct • Respect for human dignity • Empathy and compassion • Self-discipline and self-control • Emotional intelligence • Resilience and perseverance • Confidence and positive self-belief • Teamwork and collaboration
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (pbl) • Project-based learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Bean, A. (2022). *The Complete Guide to Sports Nutrition (9th ed.)*. Bloomsbury Sport.
2. Brown, J. E. (2022). *Nutrition Through the Life Cycle (8th ed.)*. Cengage Learning.
3. Food and Agriculture Organization (FAO). (2023). *The State of Food Security and Nutrition in the World*.
4. Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (Eds.). (2023). *Introduction to Human Nutrition (3rd ed.)*. Wiley-Blackwell.
5. Gropper, S. S., & Smith, J. L. (2023). *Advanced Nutrition and Human Metabolism (8th ed.)*. Cengage Learning.
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9. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
10. Wardlaw, G. M., & Smith, A. M. (2022). *Contemporary Nutrition (12th ed.)*. McGraw-Hill Education.
11. Whitney, E., & Rolfes, S. R. (2023). *Understanding Nutrition (16th ed.)*. Cengage Learning.
12. Williams, M. H. (2017). *Nutrition for Health, Fitness and Sport (11th ed.)*. McGraw-Hill Education.
13. World Health Organization (WHO). (2023). *Healthy Diet Fact Sheet and Nutrition Guidelines*.
14. World Health Organization (WHO). Guideline: Sodium Intake for Adults and Children (Latest Edition).

HEE 321 Communicable and Non-Communicable Diseases

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Communicable and Non-Communicable Diseases is a health education course that introduces students to the nature, causes, modes of transmission, risk factors, signs and symptoms, prevention, control, and management of major diseases affecting individuals, families, and communities.

The course examines communicable diseases, which can be transmitted directly or indirectly from an infected person, animal, or environmental source to another susceptible person, as well as non-communicable diseases (NCDs), which are generally long-term conditions influenced by genetic, physiological, behavioural, and environmental factors.

RELEVANCE STATEMENT

Communicable and Non-Communicable Diseases is highly relevant because diseases remain major determinants of morbidity, mortality, disability, educational participation, productivity, and quality of life. Effective disease prevention requires individuals and communities to understand how diseases occur, how they spread or develop, and what measures can be taken to reduce their occurrence and consequences.

The course is particularly important because communicable diseases and NCDs can coexist within the same population and require complementary prevention strategies. While communicable diseases may be addressed through immunisation, sanitation, hygiene, vector control, early diagnosis, treatment, surveillance, and infection prevention, NCDs require attention to healthy lifestyles, nutrition, physical activity, tobacco and alcohol prevention, screening, early detection, and long-term management.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of communicable and non-communicable diseases.
2) Classify diseases according to their major causes, characteristics, and modes of transmission.
3) Identify major communicable diseases of public-health importance.
4) Describe the causes, signs, symptoms, transmission, prevention, and control of common communicable diseases.

5) Describe the role of personal hygiene, environmental sanitation, safe water, and food safety in preventing communicable diseases.
6) Explain the role of vector control in preventing vector-borne diseases.
7) Identify major risk factors associated with non-communicable diseases.
8) Describe the causes, manifestations, prevention, and control of major NCDs.
9) Explain the relationship between nutrition, physical inactivity, tobacco, alcohol, obesity, and chronic diseases.
10) Explain the importance of screening, early detection, treatment, referral, and follow-up.
11) Describe basic principles of disease surveillance and reporting.
12) Explain the roles of individuals, families, schools, communities, health professionals, and government agencies in disease prevention and control.

LEARNING OUTCOMES

In completion of this course the student is expected to:

1) Explain the concepts, characteristics, and differences between communicable and non-communicable diseases.
2) Identify major communicable and non-communicable diseases affecting individuals and communities.
3) Explain the causes, risk factors, signs, symptoms, and consequences of selected diseases.
4) Describe the chain of infection and different modes of disease transmission.
5) Explain appropriate methods of preventing and controlling common communicable diseases.
6) Describe the importance of immunisation, sanitation, hygiene, safe water, food safety, and vector control.
7) Identify major behavioural, genetic, physiological, and environmental risk factors for NCDs.
8) Explain strategies for preventing cardiovascular diseases, diabetes, cancer, chronic respiratory diseases, and obesity.
9) Explain the importance of screening and early detection of selected diseases.
10) Explain basic principles of disease surveillance, notification, and outbreak response.

COURSE CONTENT

- Introduction to Diseases
- Epidemiology of Diseases
- Communicable Diseases and the Chain of Infection
- Respiratory and Airborne Diseases
- Vector-Borne Diseases
- Water-
- Food- and Environmentally Transmitted Diseases
- Sexually and Blood-Borne Infections
- Vaccine-Preventable Diseases
- Principles of Communicable Disease Prevention and Control
- Introduction to Non-Communicable Diseases
- Cardiovascular Diseases and Hypertension
- Diabetes Mellitus
- Cancer
- Chronic Respiratory Diseases
- Obesity
- Nutrition and Lifestyle-Related Diseases
- Mental Health and Other Chronic Conditions
- Screening
- Early Detection and Referral
- Health Education and Behaviour Change
- Community-Based Disease Prevention and Control
- Emerging Issues and Integrated Disease Control
- Identification of disease risk factors in the school or community
- Disease-prevention health education campaign
- Community disease-risk assessment
- Demonstration of infection-prevention practices
- Development of health education materials

CATEGORY	DETAILS
Core Competencies	• School health knowledge and understanding • Health education and promotion competence • School health programme planning competence • School health needs assessment competence • Health screening and referral competence • Personal hygiene and sanitation promotion competence
Core Values	• Respect for human life and dignity • Commitment to preservation of life • Responsibility and accountability • Safety consciousness • Self-discipline • Calmness and emotional control • Courage and confidence • Empathy and compassion • Willingness to help others • Promptness and responsiveness • Alertness and situational awareness
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Inquiry-based learning • Problem-based learning • Case study analysis • Demonstration and practical activities • Field visits and environmental observation • Community-based learning • Project-based learning • Group work and cooperative learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American Red Cross – First Aid/CPR/AED Participant's Manual.
2. American Heart Association – Basic Life Support (BLS) Provider Manual.
3. American Heart Association – Heartsaver First Aid, CPR & AED.
4. British Red Cross – First Aid Manual and Emergency Response Resources.
5. St John Ambulance – First Aid Manual.
6. International Federation of Red Cross and Red Crescent Societies (IFRC) – International First Aid, Resuscitation and Education Guidelines.
7. World Health Organization (WHO) – resources on emergency care, injury prevention, and community first aid.
8. National Safety Council – First Aid, CPR and AED training resources.
9. Park, K. – Park's Textbook of Preventive and Social Medicine, particularly sections on accidents, injuries, occupational health, and community safety.
10. Relevant institutional First Aid and Safety Education Laboratory/Practical Manual.
11. World Health Organization (WHO) – emergency care, injury prevention, and road-safety resources.
12. International Federation of Red Cross and Red Crescent Societies (IFRC) – first-aid and emergency-response guidelines.

13. American Heart Association (AHA) – current CPR and basic-life-support guidance.
14. American Red Cross – first-aid, CPR, AED, and emergency preparedness resources.
15. St John Ambulance – first-aid education and emergency-care resources.
16. International Liaison Committee on Resuscitation (ILCOR) – evidence-based resuscitation recommendations.
17. Federal Ministry of Health and Social Welfare, Nigeria – relevant health and emergency-care policies and guidelines.
18. Nigeria Red Cross Society – first-aid, disaster preparedness, and community emergency-response resources.

HEE 322 Health Education Curriculum and Instruction

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Health Education Curriculum and Instruction is a professional course that examines the principles, processes, theories, and practices involved in the planning, development, implementation, and evaluation of health education curricula and instructional programmes. The course equips students with the knowledge and practical skills required to design and deliver effective health education experiences in schools, communities, and other learning environments.

The course introduces students to the concept, nature, scope, principles, foundations, and components of curriculum, with particular emphasis on health education. It examines curriculum development processes, curriculum models, curriculum organisation, selection and sequencing of content, formulation of objectives, instructional strategies, learning experiences, instructional resources, assessment, and curriculum evaluation.

RELEVANCE STATEMENT

Health Education Curriculum and Instruction is highly relevant because the effectiveness of health education depends largely on the quality of its curriculum and the competence of teachers in translating curriculum objectives and content into meaningful learning experiences.

The course prepares prospective health educators and teachers to understand what should be taught, why it should be taught, how it should be taught, and how learning should be assessed. It enables students to develop health education programmes that respond to the

health needs, developmental characteristics, cultural backgrounds, and learning abilities of individuals and communities.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Define and explain the concepts of curriculum, instruction, teaching, learning, and health education.
2) Explain the nature, scope, purposes, and principles of health education curriculum.
3) Identify and explain the major components of a curriculum.
4) Examine the philosophical, psychological, sociological, and health foundations of curriculum development.
5) Explain major principles and processes involved in curriculum planning and development.
6) Identify and describe major curriculum models and approaches.
7) Explain the principles guiding the selection, organisation, and sequencing of health education content.
8) Select appropriate instructional methods for teaching different health education topics.
9) Explain the role of the teacher in curriculum implementation.
10) Identify factors affecting successful implementation of health education curricula.

LEARNING OUTCOMES

In completion of this course the student is expected to:

1) Explain the concepts, nature, scope, and functions of curriculum and instruction.
2) Describe the major foundations and principles of health education curriculum.
3) Identify and explain the major components of a health education curriculum.
4) Analyse different curriculum models and approaches.
5) Identify appropriate health education content based on learners' needs and curriculum objectives.
6) Formulate measurable learning objectives for health education lessons.
7) Organise health education content logically and appropriately.
8) Design meaningful learning experiences for health education.
9) Prepare effective schemes of work, lesson plans, and instructional units.
10) Select appropriate teaching methods for specific health education topics and learners.

COURSE CONTENT

- Introduction to Curriculum and Instruction
- Health Education Curriculum
- Foundations
- Principles of Curriculum Development
- Curriculum Models and Approaches
- Health Education Curriculum Content
- Instructional Objectives and Learning Experiences
- Methods of Teaching Health Education
- Lesson Planning and Instructional Design
- Instructional Resources
- Curriculum Implementation
- Assessment in Health Education
- Curriculum Evaluation
- Inclusive and Culturally Responsive Health Education
- Technology and Innovation in Health Education
- Contemporary Issues in Health Education Curriculum

CATEGORY	DETAILS
Core Competencies	• Curriculum knowledge and understanding • Curriculum planning and development competence • Curriculum analysis and evaluation competence • Instructional design competence
Core Values	• Professionalism • Responsibility and accountability • Integrity and honesty • Commitment to quality education • Respect for human dignity • Respect for diversity and inclusion • Equity and fairness

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-centred teaching and learning • Interactive lectures and guided discussions • Inquiry-based learning • Problem-based learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Tyler, R. W. Basic Principles of Curriculum and Instruction. University of Chicago Press.
2. Taba, H. Curriculum Development: Theory and Practice. Harcourt, Brace & World.
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4. Print, M. Curriculum Development and Design.
5. Posner, G. J. Analyzing the Curriculum.
6. Oliva, P. F., & Gordon, W. R. Developing the Curriculum.
7. McNeil, J. D. Contemporary Curriculum: In Thought and Action.
8. Glatthorn, A. A., Boschee, F., Whitehead, B. M., & Boschee, B. F. Curriculum Leadership: Strategies for Development and Implementation.
9. Green, L. W., & Kreuter, M. W. Health Program Planning: An Educational and Ecological Approach.
10. Glanz, K., Rimer, B. K., & Viswanath, K. Health Behavior: Theory, Research, and Practice.
11. McKenzie, J. F., Neiger, B. L., & Thackeray, R. Planning, Implementing, and Evaluating Health Promotion Programs.

12. World Health Organization. Current resources on health promotion, health education, health literacy, and school health.
13. UNESCO. Current resources on curriculum development, teacher education, and quality education.
14. Relevant Nigerian national curriculum, education policy, and health education documents.

HEE 323 Emotional, Mental and Social Health

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Emotional, Mental and Social Health is a foundational course that examines the psychological, emotional, and social dimensions of health and their influence on individual well-being, learning, interpersonal relationships, and quality of life. The course provides students with an understanding of the concepts of emotional, mental, and social health, the factors that influence them, and practical strategies for promoting psychological well-being and healthy social functioning. The course explores emotional intelligence, self-awareness, self-esteem, stress and stress management, resilience, mental health promotion, personality development, communication skills, interpersonal relationships, conflict resolution, social support systems, and mental health disorders. It also examines contemporary issues such as anxiety, depression, substance abuse, bullying, violence, suicide prevention, digital well-being, and psychosocial challenges affecting individuals and communities.

RELEVANCE STATEMENT

The course provides essential knowledge for promoting psychological resilience, emotional stability, and positive social interactions among learners, athletes, and community members. It equips future teachers, coaches, fitness professionals, and health educators with the competencies to recognise psychosocial challenges, foster supportive learning and sporting environments, and encourage healthy behaviours that enhance performance, participation, and overall quality of life.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1) Explain the concepts and dimensions of emotional, mental, and social health.

2) Identify factors influencing psychological well-being and social adjustment.
3) Explain the importance of emotional intelligence, self-awareness, and self-esteem in healthy living.
4) Demonstrate effective stress management, coping, and resilience strategies.
5) Promote healthy interpersonal relationships, communication, and conflict resolution.
6) Recognise common mental health challenges and appropriate support strategies.
7) Apply principles of mental health promotion and psychosocial well-being in educational and community settings.
8) Promote healthy behaviours that enhance emotional stability and social responsibility.
9) Demonstrate empathy, ethical behaviour, and respect for diversity and inclusion.
10) Apply knowledge of emotional, mental, and social health to improve quality of life and community well-being.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1) Explain the meaning, concepts and characteristics of emotional, mental and social health;
2) Examine the determinants of emotional and mental health which form a basis for health and healthy choices;
3) Identify the risk factors for emotional disturbance mental illness and self-abuse/ suicide;
4) Describe the principles of promoting emotional health and preventing mental illness and the relationship between emotional health and social health;
5) Explain the crucial developmental periods characterised by physical, emotional and intellectual changes during adolescent and young adulthood;
6) Describe the effects of anger anxiety, grief and depression on health and well-being;
7) Analyse the importance of promoting social and emotional well-being in schools;
8) Design teaching strategies and activities to support social and emotional learning needs of students;
9) Evaluate the strategies for enhancing social health in various settings and planning for social health, mental health and mental illness, and emotional rehabilitation techniques.

COURSE CONTENT

- Concepts, meaning and characteristics of emotional health, mental health and social health respectively
- This course will explore emotional well-being and mental health issues including stress, anxiety, depression, grief, self-abuse/suicide, eating disorders, anger and oppositional defiance disorders
- The determinants of emotional and mental health which form a basis for health and healthy choices
- The principles of promoting emotional health and preventing mental illness and the relationship between emotional health and social health will be discussed
- Emphasis needs to be placed on such social relationships as social integration or involvement, social support and social networking
- Strategies for enhancing social health in various settings and planning for social health, mental health and mental illness, and emotional rehabilitation techniques
- The crucial developmental periods characterised by physical, emotional and intellectual changes during adolescent and young adulthood
- The changes in social roles, relationships and expectations during this stage of human life
- The health needs and health problems arising from the developmental characteristics of adolescents and adults should be discussed
- Resiliency, health choices, lifestyle factors affecting overall health and well-being along with identification, intervention and referral strategies will be examined
- Social and emotional learning (SEL) five lifelong skills: self-awareness self-management, responsible decision-making, social awareness and relationship skills will equally be discussed

CATEGORY	DETAILS
Core Competencies	• Emotional intelligence and self-awareness • Mental health literacy • Stress management and resilience building • Social and interpersonal relationship skills • Effective communication skills • Problem-solving and decision-making • Conflict resolution and mediation • Health promotion and behaviour change

CATEGORY	DETAILS
Core Values	• Scientific integrity • Professionalism • Precision and accuracy • Critical thinking • Ethical practice • Safety consciousness • Commitment to excellence • Innovation and creativity • Analytical and evidence-based decision-making • Teamwork and collaboration • Responsibility and accountability
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Corey, G. (2021). *Theory and Practice of Counseling and Psychotherapy (10th ed.)*. Cengage Learning.
2. Gladding, S. T. (2020). *Counseling: A Comprehensive Profession (9th ed.)*. Pearson.
3. Goleman, D. (2006). *Emotional Intelligence: Why It Can Matter More Than IQ (10th Anniversary ed.)*. Bantam Books.
4. Hockenbury, D. H., & Hockenbury, S. E. (2021). *Discovering Psychology (8th ed.)*. Worth Publishers.
5. Myers, D. G., & DeWall, C. N. (2022). *Psychology (14th ed.)*. Worth Publishers.
6. Santrock, J. W. (2023). *Life-Span Development (19th ed.)*. McGraw-Hill Education.
7. Sarafino, E. P., & Smith, T. W. (2023). *Health Psychology: Biopsychosocial Interactions (11th ed.)*. Wiley.
8. Sue, D., Sue, D. W., Neville, H. A., & Smith, L. (2022). *Counseling the Culturally Diverse: Theory and Practice (9th ed.)*. Wiley.
9. Taylor, S. E. (2021). *Health Psychology (11th ed.)*. McGraw-Hill Education.
10. UNICEF. (Latest Edition). The State of the World's Children.
11. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
12. World Health Organization (WHO). (2022). *World Mental Health Report: Transforming Mental Health for All*.
13. World Health Organization (WHO). (2023). *Mental Health: Strengthening Our Response*.

Degree Course Descriptions (400–500 Level)

SED 411 Methods of Teaching Physical & Health Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Methods of Teaching Physical and Health Education is a professional education course designed to equip students with the knowledge, skills, and competencies required for effective teaching of Physical and Health Education (PHE) at the primary, secondary, and tertiary levels. The course emphasises modern teaching methodologies, lesson planning, instructional strategies, classroom and field management, assessment techniques, and the effective use of instructional resources in delivering Physical and Health Education. The course integrates educational theories with practical teaching experiences, enabling prospective teachers to design, implement, and evaluate learner-centred instructional programmes that promote physical fitness, health literacy, motor skill development, lifelong participation in physical activity, and healthy living.

RELEVANCE STATEMENT

For students of Physical Education, Exercise Science, and Sport Development, this course provides the pedagogical foundation required for effective teaching, coaching, and sports instruction. It equips future educators with the skills to design age-appropriate learning experiences, foster motor skill development, promote healthy lifestyles, and encourage lifelong participation in physical activity.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the philosophy, aims, and objectives of Physical and Health Education.
2. Describe the principles and methods of teaching Physical and Health Education.
3. Prepare effective schemes of work, lesson plans, and instructional materials.
4. Apply learner-centred teaching strategies appropriate to Physical and Health Education.
5. Demonstrate effective classroom, gymnasium, and field management techniques.

6. Assess learners' cognitive, affective, and psychomotor outcomes using appropriate evaluation techniques.
7. Organise and supervise practical activities, sports, games, and health education programmes safely.
8. Demonstrate professional ethics and effective communication in Physical and Health Education teaching.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Design effective schemes of work and lesson plans for Physical and Health Education.
2. Apply a variety of learner-centred teaching methods.
3. Demonstrate competence in teaching practical and theoretical aspects of Physical and Health Education.
4. Manage classes, sports facilities, and practical activities safely and efficiently.
5. Use appropriate instructional materials and digital technologies to enhance learning.
6. Assess and evaluate learners' knowledge, skills, and attitudes using valid and reliable methods.
7. Demonstrate professionalism, ethical conduct, and effective communication in teaching.

COURSE CONTENT

- **Aims and objectives of Teaching Physical education in Primary and Secondary Schools:** Basic 1–9
- Methods of Teaching Physical Education: Demonstration, manual guidance, Lecture, Fieldwork, verbalisation, field trip etc. Materials for teaching Physical Education (Computer-based Training (CBT) and Improvisation.
- Minor Games and Sports: Perceptual skills refined motor skills and gross foot work
- **Content of the Physical Education syllabus in primary and secondary schools:** Basic 1–9
- Preparation of lesson notes in Physical Education: tabular and essay format with emphasis on preparation, organisation, lesson presentation and evaluation
- **Aims and objectives of teaching Health Education in Primary and Secondary Schools:** Basic 1–9
- Methods of teaching Health Education: Incidental, discussion projects, field trip, audio Visual, demonstration, lecture, micro-teaching: use of filmstrips

- **Improvisation of materials, Evaluation in Health Education and preparation of lesson notes:** as above

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL)
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

1. Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.
2. Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.
3. Freeman, W. H. (2014). Physical Education, Exercise and Sport Science in a Changing Society. Jones & Bartlett Learning.
4. Freeman, W. H. (2014). Physical Education, Exercise and Sport Science in a Changing Society. Jones & Bartlett Learning.
5. Hardman, K., & Green, K. (Eds.). (2011). Contemporary Issues in Physical Education: International Perspectives. Meyer & Meyer Sport.
6. Lumpkin, A. (2017). Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.). McGraw-Hill Education.
7. Lumpkin, A. (2017). Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.). McGraw-Hill Education.
8. McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise Physiology: Nutrition, Energy, and Human Performance. Lippincott Williams & Wilkins.
9. Nixon, H. L., & Jewett, A. E. (1980). An Introduction to Physical Education. Saunders College Publishing.
10. Sharkey, B. J., & Gaskill, S. E. (2013). Fitness and Health. Human Kinetics.
11. Wuest, D. A., & Bucher, C. A. (2019). Foundations of Physical Education, Exercise Science, and Sport (20th ed.). McGraw-Hill Education.
12. Wuest, D. A., & Bucher, C. A. (2019). Foundations of Physical Education, Exercise Science, and Sport (20th ed.). McGraw-Hill.
13. National Policy on Education (Federal Republic of Nigeria).
14. National Sports Development Code of Nigeria.

EHE 413 Research Methods in Health Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Research Methods in Health Education is a foundational course that introduces students to the principles, processes, techniques, and applications of research in health education and health promotion. The course equips learners with the knowledge and practical skills required to identify health-related problems, formulate researchable questions, review relevant literature, select appropriate research designs, develop research instruments, collect and analyse data, interpret findings, and communicate research results.

The course covers both quantitative and qualitative approaches to research, with emphasis on research designs commonly used in health education, including survey, experimental, correlational, descriptive, quasi-experimental, case study, and action research designs. Students are also introduced to sampling procedures, validity and reliability, research ethics, basic statistical procedures, report writing, and the application of research findings to health education practice.

RELEVANCE STATEMENT

Research is essential for identifying health problems, understanding health behaviours, evaluating health education programmes, and developing evidence-based interventions. Health educators require research competencies to assess community health needs, determine factors influencing health behaviour, evaluate educational interventions, and provide evidence for health policies and programmes.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the meaning, nature, scope, and purposes of research.
2) Discuss the importance of research in health education and health promotion.
3) Identify health education problems that require systematic investigation.
4) Formulate researchable problems, questions, objectives, and hypotheses.
5) Conduct an appropriate review of related literature.
6) Explain major quantitative and qualitative research approaches.
7) Identify and select appropriate research designs for health education studies.
8) Explain concepts of population, sample, sampling frame, and sampling techniques.

9) Establish the validity and reliability of research instruments.
10) Explain ethical principles governing research involving human participants.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define research and explain its characteristics.
2) Identify researchable health education problems.
3) Formulate clear research questions, objectives, and hypotheses.
4) Conduct a systematic search and review of relevant literature.
5) Differentiate between quantitative, qualitative, and mixed-methods research.
6) Select suitable research designs for specific health education problems.
7) Determine appropriate sample sizes and sampling procedures.
8) Develop questionnaires, interview guides, observation schedules, and other research instruments.
9) Explain and assess the validity and reliability of research instruments.
10) Collect research data systematically and ethically.

COURSE CONTENT

- Introduction to Research
- Meaning and definitions of research
- Nature and characteristics of scientific research
- Purpose and functions of research
- Scope of health education research
- Importance of research in health education
- Types of research
- Basic
- Applied
- Action
- Evaluation research
- Characteristics of good research
- Research process. Research Problems and Questions
- Literature Review
- Theoretical and Conceptual Frameworks

- Research Approaches
- Research Designs
- Population and Sampling
- Research Instruments and Data Collection
- Validity and Reliability
- Research Ethics
- Data Management and Analysis
- Qualitative Data Analysis
- Presentation and Interpretation of Research Findings
- Research Proposal and Report Writing
- Application of Research in Health Education

CATEGORY	DETAILS
Core Competencies	• Research Competency • Critical-Thinking Competency • Research Design Competency • Data Management Competency
Core Values	• Integrity • Objectivity • Accountability • Respect for human dignity • Confidentiality • Accuracy • Intellectual honesty • Professionalism.
Pedagogical Approaches	• Interactive lectures • Guided discussions • Brainstorming • Case-study analysis • Role-play and simulation • Problem-based learning • Guest presentations by relevant professionals • Video/documentary analysis

CATEGORY	DETAILS
Learning Resources	• Research methods textbooks • Health education and health promotion textbooks • Research methodology manuals • Peer-reviewed journal articles • Research reports and theses • WHO health research resources • Government health statistics and reports
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Creswell, J. W., & Creswell, J. D. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.
2. Polit, D. F., & Beck, C. T. *Nursing Research: Generating and Assessing Evidence for Nursing Practice*. Wolters Kluwer.
3. Kumar, R. *Research Methodology: A Step-by-Step Guide for Beginners*. SAGE Publications.
4. Cohen, L., Manion, L., & Morrison, K. *Research Methods in Education*. Routledge.
5. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. *How to Design and Evaluate Research in Education*. McGraw-Hill.
6. McKenzie, J. F., Neiger, B. L., & Thackeray, R. *Planning, Implementing, and Evaluating Health Promotion Programs*. Jones & Bartlett Learning.
7. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
8. World Health Organization. Relevant publications on health research, health promotion, research ethics, and evidence-based health interventions.
9. American Psychological Association. *Publication Manual of the American Psychological Association* (current edition).

10. Relevant current Nigerian health research policies, ethical guidelines, institutional research manuals, and publications from appropriate health and education agencies.

EHE 414 Substance Use and Abuse Prevention

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Substance Use and Abuse Prevention is a course designed to provide learners with knowledge, skills, attitudes, and practical strategies for understanding, preventing, and responding to the use and misuse of psychoactive substances. The course examines commonly used substances, reasons people initiate substance use, risk and protective factors, patterns of substance misuse, consequences for individuals and society, and evidence-informed prevention approaches.

The course also introduces learners to the roles of families, schools, communities, health professionals, government agencies, non-governmental organisations, and peer groups in preventing substance misuse. Emphasis is placed on health education, early intervention, life skills, counselling, community mobilisation, policy, and referral mechanisms. Learners are expected to develop competencies for promoting healthy lifestyles and supporting individuals and communities affected by substance-related problems.

RELEVANCE STATEMENT

Substance misuse constitutes an important public health, educational, social, and developmental concern. The use of alcohol, tobacco, cannabis, prescription medicines, inhalants, and other psychoactive substances can adversely affect physical and mental health, academic achievement, relationships, productivity, safety, and community development.

The course is particularly relevant to students preparing for careers in health education, physical and health education, teaching, counselling, community development, and other helping professions. It equips learners to identify risk factors, challenge misconceptions, promote healthy decision-making, design prevention programmes, recognise early warning signs, and appropriately refer individuals who require professional assistance. The course therefore contributes to healthier individuals, safer schools, and more resilient communities.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of substance use, misuse, abuse, dependence, and addiction.
2) Identify common psychoactive substances and describe their effects on the body and behaviour.
3) Explain the biological, psychological, social, cultural, and environmental factors associated with substance use.
4) Examine the risk and protective factors influencing substance use among young people.
5) Discuss the physical, psychological, social, educational, economic, and legal consequences of substance misuse.
6) Explain major theories and models of substance-use prevention.
7) Develop effective personal and interpersonal skills for resisting harmful substance use.
8) Examine the roles of families, schools, peers, communities, and government in substance-use prevention.
9) Apply health education strategies to substance-use prevention programmes.
10) Identify signs that may indicate problematic substance use and appropriate referral pathways.
11) Develop evidence-informed substance-use prevention activities for schools and communities.
12) Promote non-stigmatising, ethical, and health-centred approaches to individuals affected by substance-related problems.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define and distinguish key concepts related to substance use and abuse.
2) Classify commonly misused psychoactive substances.
3) Describe the effects of substances on physical, psychological, social, and academic functioning.
4) Analyse factors that increase or reduce vulnerability to substance use.
5) Explain the relationship between substance use and risky behaviours.
6) Demonstrate effective communication, decision-making, refusal, and coping skills.
7) Analyse different approaches to primary, secondary, and tertiary prevention.
8) Design simple substance-use prevention programmes for schools and communities.

9) Demonstrate appropriate responses to substance-use-related situations through role-play and case studies.
10) Identify when professional counselling, treatment, or referral may be necessary.
11) Evaluate substance-use prevention messages and campaigns.
12) Advocate for healthy lifestyles and supportive environments that reduce substance-use risks.

COURSE CONTENT

- The basic and detailed concepts of drug, substance use and abuse, drug misuse
- Rehabilitation techniques employed on victims of drug abuse and the effect of drug abuse on the body
- Introducing social, psychological, pharmaceutical and cultural aspects of drug use, misuse and abuse
- The methods, materials and theories of drug abuse prevention in the school and community will be introduced
- Illicit (e. g. Opiates, marijuana, methamphetamines) and licit (such as alcohol, tobacco, caffeine) substances.
- Drug addiction and drug dependency
- Harmful effects of alcohol and tobacco and other narcotic, sedatives, depressants and stimulant drugs will be explored
- Critical examination of the factors associated with the use of these substances and methods of prevention
- Skills for avoiding destructive behaviours, including substance control and cessation need to be developed
- The chemical pharmacologic, physiological, and socio-economic use, misuse and abuse of alcohol and such psychoactive substances as opiates and opium, such as: synthetic narcotics, barbiturates, tranquillisers marijuana lysergic and diethylamide (LSD) and tranquillisers/stimulant (cocaine, amphetamine and caffeine)

CATEGORY	DETAILS
Core Competencies	• Knowledge competency • Communication competency • Programme-planning competency • Advocacy competency • Research and evaluation competency • Teamwork competency
Core Values	• Respect for human dignity • Responsibility and self-discipline • Accountability • Community responsibility • Resilience • Self-efficacy
Pedagogical Approaches	• Interactive lectures • Guided discussions • Brainstorming • Health campaign development • Debate and structured argument • Guest presentations by relevant professionals • Video/documentary analysis • Field observation and community assessment • Reflective learning activities
Learning Resources	• Course handbook and lecture notes • Resources • UNODC drug-prevention and treatment resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *Global status report on alcohol and health and treatment of substance use disorders*. WHO.
2. United Nations Office on Drugs and Crime. *World Drug Report*. UNODC.
3. United Nations Office on Drugs and Crime & World Health Organization. *International Standards on Drug Use Prevention*. UNODC/WHO.
4. National Institute on Drug Abuse. *Drugs, Brains, and Behaviour: The Science of Addiction*. National Institutes of Health.
5. National Institute on Drug Abuse. *Preventing Drug Use among Children and Adolescents: A Research-Based Guide*. National Institutes of Health.
6. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
7. McKenzie, J. F., Neiger, B. L., & Thackeray, R. *Planning, Implementing, and Evaluating Health Promotion Programs*. Jones & Bartlett Learning.
8. DiClemente, R. J., Salazar, L. F., & Crosby, R. A. *Health Behavior Theory for Public Health: Principles, Foundations, and Applications*. Jones & Bartlett Learning.
9. Relevant current publications of the World Health Organization (WHO), United Nations Office on Drugs and Crime (UNODC), and Nigerian agencies responsible for drug-control, health promotion, and substance-use prevention.

HEE 413 Health Practice and School Child

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Health Practice and School Child is a course designed to provide learners with knowledge and practical skills for promoting, maintaining, and improving the health and wellbeing of school-age children. The course examines the physical, mental, emotional, social, and environmental health needs of children in school settings and explores the role of teachers, health educators, parents, school administrators, health professionals, and communities in meeting these needs.

The course covers principles of child health, personal hygiene, nutrition, physical activity, common childhood illnesses, communicable and non-communicable diseases, school health services, environmental sanitation, mental health, safety, first aid, immunisation, health screening, child protection, and health education. Emphasis is placed on preventive

health practices and the creation of a safe, healthy, inclusive, and supportive school environment.

RELEVANCE STATEMENT

Children spend a significant proportion of their formative years in school, making the school an important setting for health promotion, disease prevention, health education, and healthy behaviour development. Poor hygiene, malnutrition, unsafe environments, infectious diseases, mental health challenges, injuries, substance use, and inadequate access to health services can adversely affect children's attendance, learning, development, and academic achievement.

This course is therefore particularly relevant to students preparing for careers in health education, physical and health education, teaching, school health services, community health, counselling, and related professions. It equips learners with competencies for identifying children's health needs, promoting healthy practices, preventing common health problems, responding appropriately to health emergencies, and supporting effective school health programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of child health, school health, and health practice.
2) Describe the physical, mental, emotional, and social health needs of school-age children.
3) Identify factors influencing the health and development of school children.
4) Explain principles of personal hygiene and healthy living among school children.
5) Discuss the nutritional requirements of school-age children.
6) Identify common diseases and health problems affecting school children.
7) Explain methods of preventing communicable and non-communicable diseases among children.
8) Explain the components and functions of school health services.
9) Explain the importance of environmental sanitation and safety in schools.
10) Describe the roles of teachers, parents, health professionals, and communities in promoting school-child health.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define child health and school health.
2) Explain the dimensions of health and their relevance to children.
3) Identify factors affecting children's growth, development, and wellbeing.
4) Explain appropriate nutritional practices for school children.
5) Identify common childhood diseases and their preventive measures.
6) Explain the importance of physical activity, adequate rest, and sleep.
7) Identify potential health and safety hazards within school environments.
8) Explain basic principles of school health screening and referral.
9) Explain appropriate approaches to child safeguarding and protection.
10) Participate in planning and implementing school health programmes.

COURSE CONTENT

- Concepts of Child and School Health
- Meaning of health
- Meaning of child health
- Meaning of school health
- Dimensions of child health
- Importance of health during childhood
- Relationship between health and learning
- Determinants of child health
- Child health indicators. Growth and Development of School Children
- Personal Hygiene Practices
- Nutrition and School Children
- Communicable Diseases
- Non-Communicable Diseases and Other Health Conditions
- Physical Activity
- Exercise
- Rest and Sleep
- Mental
- Emotional and Social Health
- School Health Services
- Environmental Health and Safety in Schools

- First Aid and Management of Common School Emergencies
- Child Protection and Safeguarding
- Health Education for School Children
- School Health Programme

CATEGORY	DETAILS
Core Competencies	• Health Promotion Competency • Child Health Assessment Competency • Health Education Competency • First-Aid Competency • Communication Competency • Disease Prevention Competency • Inclusive Practice Competency
Core Values	• Respect for children and their dignity • Compassion and empathy • Responsibility • Self-discipline • Cleanliness and personal responsibility • Safety consciousness
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Practical first-aid sessions • Role-play and simulation • Case-study analysis • Problem-based learning • Video and multimedia presentations
Learning Resources	• Course textbooks and lecture notes • School health manuals • Child health and development textbooks • Health education materials • WHO and UNICEF child-health resources • School health programme guidelines

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *WHO Guideline on School Health Services*. WHO.
2. World Health Organization. *Global Standards for Health-Promoting Schools*. WHO.
3. World Health Organization & United Nations Educational, Scientific and Cultural Organization. *Making Every School a Health-Promoting School: Global Standards and Indicators*. WHO/UNESCO.
4. UNICEF. Relevant publications on child health, nutrition, child protection, water, sanitation and hygiene, and school health.
5. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
6. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
7. McKenzie, J. F., Neiger, B. L., & Thackeray, R. *Planning, Implementing, and Evaluating Health Promotion Programs*. Jones & Bartlett Learning.

EHE 421 Application of Computer Skills & Health Informatics

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Application of Computer Skills & Health Informatics is a practical course designed to equip students with essential computer literacy and health informatics competencies required for effective learning, teaching, health education practice, research, administration, and health promotion. The course introduces students to the use of computers, digital technologies, information systems, electronic health records, health databases, digital communication tools, and data-management applications in health-related settings.

The course combines fundamental computer skills with the principles and applications of health informatics. Students learn how to use word-processing, spreadsheet, presentation, internet, database, and communication applications while developing competencies in health data collection, storage, retrieval, analysis, interpretation, security, and dissemination. Attention is also given to digital health, telehealth, electronic health records, health information systems, data privacy, cybersecurity, and the ethical use of health information.

RELEVANCE STATEMENT

The increasing digitisation of health and education services has made computer literacy and health informatics essential competencies for health educators and other health professionals. Computers and digital information systems support health education, research, record keeping, programme planning, disease surveillance, health communication, monitoring and evaluation, and evidence-based decision-making.

This course is therefore relevant to students preparing for careers in health education, physical and health education, public health, community health, teaching, health promotion, research, and health administration. It enables learners to use digital tools effectively, manage health information responsibly, analyse health data, communicate health messages through digital platforms, and participate meaningfully in modern health information systems.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts of computer applications, information technology, and health informatics.
2) Identify major components of computer hardware and software.
3) Demonstrate basic computer operating skills.
4) Use word-processing applications to prepare professional health and academic documents.
5) Prepare effective presentations using presentation software.
6) Explain the principles and applications of health informatics.
7) Identify major types of health information systems.
8) Explain the uses of electronic health records and electronic medical records.
9) Collect, manage, store, retrieve, and communicate health information appropriately.
10) Apply basic database concepts to health information management.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define computer literacy, information technology, and health informatics.
2) Identify and explain the functions of basic computer hardware and software.
3) Conduct reliable online searches for health and academic information.
4) Communicate professionally using email and other digital platforms.
5) Explain the structure and functions of health information systems.
6) Describe the role of electronic health records in health services.
7) Use digital technologies in health education and health promotion.
8) Explain basic concepts of telehealth and digital health.
9) Apply principles of data privacy, confidentiality, and cybersecurity.
10) Use digital information to support evidence-based health education practice.

COURSE CONTENT

- The basic and detailed concepts of computer application and breaking edge
- Application of computer in health diagnostics and treatment of complicated ailments
- Usage of data to improve human health and health care services
- Concept of health informatics
- Application of medical concepts in conjunction with health information technology is explored
- Roles and goals of health informatics
- Consumer, clinical, nursing and public health informatics
- Applicable decision analysis techniques and decision support systems
- Trends in health informatics
- Health informatics technology in population
- Human computer interaction
- Information system in health care
- IT and cyber security
- Web technologies and cloud computing
- Geographic Information System (GIS)
- Modern information technology
- Health service statistics

- The internet
- **Modern methods for data collection, analysis and data transmission:** Google survey form
- Resource management within the health care field

CATEGORY	DETAILS
Core Competencies	• Computer Literacy Competency • Digital Productivity Competency • Data Management Competency • Health Informatics Competency • Data Analysis Competency • Digital Communication Competency • Information Literacy Competency
Core Values	• Accuracy • Confidentiality • Integrity • Accountability • Professionalism • Respect for privacy • Responsible use of technology • Digital citizenship • Information security consciousness • Innovation • Collaboration • Efficiency • Critical thinking

CATEGORY	DETAILS
Pedagogical Approaches	• Demonstrations • Hands-on computer practicals • Guided tutorials • Interactive lectures • Problem-based learning • Individual practical exercises • Group projects • Case studies • Data-management exercises
Learning Resources	• Desktop and laptop computers • Computer laboratory • Internet connectivity • Projectors and interactive displays • Microsoft Windows or equivalent operating systems • Microsoft Word or equivalent
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Shortliffe, E. H., & Cimino, J. J. (Eds.). *Biomedical Informatics: Computer Applications in Health Care and Biomedicine*. Springer.
2. Hoyt, R. E., & Yoshihashi, A. K. *Health Informatics: Practical Guide*. Lulu/related current editions.
3. Wager, K. A., Lee, F. W., & Glaser, J. P. *Health Care Information Systems: A Practical Approach for Health Care Management*. Jossey-Bass.
4. Nelson, R., & Staggers, N. *Health Informatics: An Interprofessional Approach*. Elsevier.
5. World Health Organization. *Global Strategy on Digital Health*. WHO.

6. World Health Organization. Relevant publications on digital health, health information systems, data governance, and health information management.
7. World Health Organization. Relevant resources on digital health interventions and health-system strengthening.
8. Centers for Disease Control and Prevention. Relevant resources on public health informatics, health information systems, and digital data management.
9. Relevant current Nigerian policies and guidelines on digital health, health information management, data protection, electronic health records, and health information systems.

EHE 420 First Aid, Accident Prevention and Safety Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

First Aid, Accident Prevention and Safety Education is a practical and skill-oriented course designed to equip learners with the knowledge, attitudes, and competencies required to prevent accidents, respond appropriately to injuries and emergencies, and promote safety in schools, homes, workplaces, sports environments, and communities. The course introduces the principles of first aid, emergency response, accident prevention, risk assessment, personal and environmental safety, and health and safety education.

The course covers the recognition and management of common injuries and emergencies such as bleeding, wounds, burns, fractures, sprains, choking, fainting, seizures, poisoning, drowning, heat-related emergencies, and sports injuries. It also emphasises accident investigation, emergency preparedness, safety rules, safe school environments, road safety, fire safety, and the role of health educators in developing safety-conscious individuals and communities.

RELEVANCE STATEMENT

Accidents and emergencies can occur at any time in schools, homes, sports facilities, workplaces, roads, and communities. Prompt and appropriate first aid can reduce the severity of injuries, prevent complications, and potentially save lives before professional medical assistance becomes available. At the same time, many accidents are preventable through effective safety education, environmental modification, risk assessment, and responsible behaviour.

The course is therefore particularly relevant to students preparing for careers in health education, physical and health education, teaching, sports, community health, public health, and related professions. It prepares learners to respond effectively to common emergencies and to design and implement accident-prevention and safety-education programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of first aid, accidents, safety, hazards, and risk.
2) Discuss the principles and objectives of first aid.
3) Identify common causes and types of accidents in schools, homes, workplaces, sports, and communities.
4) Explain the principles of accident prevention and risk reduction.
5) Identify and assess common safety hazards.
6) Explain the contents and appropriate use of a first-aid kit.
7) Explain the importance of emergency preparedness and response planning.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define first aid, accident, safety, hazard, risk, and emergency.
2) Explain the objectives and principles of first aid.
3) Identify common hazards and accident risks.
4) Demonstrate basic principles of CPR and choking response in accordance with current recognised first-aid guidance.
5) Explain methods of preventing accidents in schools, homes, sports environments, workplaces, and communities.
6) Identify appropriate safety measures for fire, electricity, water, roads, and recreational activities.
7) Develop simple emergency-response procedures.

COURSE CONTENT

- The basic and detailed concepts of health and safety
- Meaning and principles of first aid and first aid management of selected emergency situations

- Accidents, accident prevention and management techniques
- Safety tasks of teachers, accident reporting, safety measures
- Concepts of safety education and related terminologies
- Principles and practice of safety in the homes, schools, industries, hospitals, sports/ homes and other settings
- Safety skills and programmes in schools and general safety skills and techniques in schools and environment
- Analysis of the importance and relevance of safety programmes in schools
- Safety approaches to environmental hazards
- The critical need for safety and what the school can do to improve safety conditions
- Community and industrial safety will be briefly analysed
- Practical situated sessions are provided to promote efficiency in management situations

CATEGORY	DETAILS
Core Competencies	• First-Aid Competency • Emergency-Response Competency • Accident-Prevention Competency • Risk-Assessment Competency • Safety-Education Competency • Communication Competency • Problem-Solving Competency • Leadership Competency • Teamwork Competency

CATEGORY	DETAILS
Core Values	• Responsibility • Alertness • Compassion • Self-discipline • Courage • Respect for human life • Teamwork • Accountability • Prevention consciousness • Preparedness • Professionalism • Community responsibility
Pedagogical Approaches	• Interactive lectures • Demonstrations • Hands-on practical sessions • First-aid simulations • Role-play • Emergency-response drills • Case-study analysis • Problem-based learning • Group discussions
Learning Resources	• First-aid kits • CPR manikins • Bandages and dressings • Splints and immobilisation materials • Gloves and personal protective equipment • Training AEDs where available • Fire-safety demonstration equipment

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American Heart Association. *Guidelines for CPR and Emergency Cardiovascular Care*. American Heart Association.
2. International Federation of Red Cross and Red Crescent Societies. *International First Aid, Resuscitation and Education Guidelines*. IFRC.
3. American Red Cross. *First Aid/CPR/AED Participant's Manual*. American Red Cross.
4. World Health Organization. Relevant publications on injury prevention, road safety, emergency care, drowning prevention, and community safety.
5. World Health Organization. *Global Status Report on Road Safety*. WHO.
6. World Health Organization. Relevant resources on drowning prevention and injury prevention.
7. National Highway Traffic Safety Administration. Relevant resources on road safety and injury prevention.
8. Relevant current Nigerian guidelines and publications on road safety, emergency response, school safety, occupational safety, disaster preparedness, and injury prevention.
9. Current textbooks on first aid, emergency care, accident prevention, sports injuries, school health, and safety education.
10. Current peer-reviewed journal articles on first aid education, injury prevention, emergency response, school safety, sports injuries, road safety, and community-based safety promotion.

EHE 422 Life Skills & Skill-Based Health Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Life Skills & Skill-Based Health Education is a practical and learner-centred course designed to equip students with the knowledge, attitudes, values, and practical skills required to make informed and responsible decisions about their health and wellbeing. The course moves beyond the transmission of health information by emphasising the development of competencies that enable learners to apply health knowledge to real-life situations.

The course explores major life skills such as self-awareness, self-esteem, empathy, effective communication, interpersonal relationships, critical thinking, creative thinking, decision-making, problem-solving, coping with stress and emotions, conflict resolution, negotiation, refusal skills, and responsible decision-making. It also examines the application of these skills to health-related issues, including personal hygiene, nutrition, physical activity, mental health, substance-use prevention, sexual and reproductive health, disease prevention, safety, and healthy lifestyles.

RELEVANCE STATEMENT

Traditional health education that focuses primarily on providing information may not always result in sustained healthy behaviour. Individuals require practical skills that enable them to interpret health information, resist negative influences, solve problems, communicate effectively, manage emotions, cope with stress, and make healthy choices.

Life skills and skill-based health education are therefore essential components of effective health promotion, particularly among children, adolescents, and young adults. The course is relevant to students preparing for careers in health education, physical and health education, teaching, counselling, community health, public health, youth development, and health promotion.

It enables learners to become effective health educators who can facilitate participatory learning, strengthen protective factors, promote resilience, and help individuals and communities translate health knowledge into appropriate behaviour.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Define life skills and skill-based health education.
2) Explain the importance of life skills to individual and community health.
3) Identify major life skills required for healthy living.
4) Explain the relationship between knowledge, attitudes, skills, and health behaviour.
5) Develop self-awareness and positive self-esteem.
6) Demonstrate effective communication and interpersonal skills.
7) Apply appropriate techniques for managing stress and emotions.
8) Explain the role of life skills in preventing substance use and other risky behaviours.
9) Apply life skills to sexual and reproductive health and responsible relationships.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and explain the concept of life skills.
2) Identify core life skills relevant to health and wellbeing.
3) Explain how life skills influence health behaviour.
4) Demonstrate self-awareness and positive self-concept.
5) Communicate health information effectively.
6) Demonstrate active listening and interpersonal communication.
7) Apply critical-thinking and creative-thinking skills to health problems.
8) Make informed and responsible health decisions.
9) Apply problem-solving strategies to everyday health challenges.

COURSE CONTENT

- Concept and Principles of Life Skills
- Self-Awareness and Self-Concept
- Effective Communication Skills
- Interpersonal Relationships
- Critical and Creative Thinking
- Decision-Making Skills
- Problem-Solving Skills
- Coping with Stress and Emotions
- Assertiveness

- Negotiation and Refusal Skills
- Conflict Resolution
- Meaning and causes of conflict
- Life Skills and Mental Health
- Life Skills and Substance-Use Prevention
- Life Skills and Sexual and Reproductive Health
- Life Skills
- Nutrition and Physical Activity
- Skill-Based Health Education
- Planning and Implementing Life-Skills Programmes
- Assessment and Evaluation of Life Skills

CATEGORY	DETAILS
Core Competencies	• Self-Management Competency • Communication Competency • Critical-Thinking Competency • Creative-Thinking Competency • Decision-Making Competency • Problem-Solving Competency • Interpersonal Competency • Emotional Competency
Core Values	• Self-respect • Respect for others • Responsibility • Empathy • Integrity • Honesty • Tolerance • Cooperation • Self-discipline • Responsible citizenship • Commitment to lifelong learning

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive discussions • Role-play • Simulation • Case-study analysis • Group discussions • Brainstorming • Problem-based learning • Video and multimedia resources
Learning Resources	• Life-skills education textbooks • Health education textbooks • WHO and UNICEF life-skills and health-education resources • Lesson plans and facilitator guides • Case studies • Role-play scenarios • Simulation materials • Computers and internet resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *Life Skills Education for Children and Adolescents in Schools*. WHO.
2. World Health Organization. Relevant resources on health-promoting schools, adolescent health, mental health, life skills, and health education.
3. UNICEF. Relevant publications on life skills, adolescent development, education, resilience, and social-emotional learning.
4. UNESCO. Relevant publications on skills-based health education, sexuality education, adolescent wellbeing, and education for health and wellbeing.

5. United Nations Office on Drugs and Crime. Relevant resources on life-skills education and substance-use prevention among young people.
6. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
7. Bandura, A. Relevant works on social cognitive theory, self-efficacy, and human behaviour.
8. Relevant current Nigerian publications and policy documents on health education, adolescent health, school health, life-skills education, and health promotion.

HEE 421 Environmental Health Education Strategy

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Environmental Health Education is a course designed to equip learners with knowledge, skills, attitudes, and values for understanding the relationship between the environment and human health. The course examines environmental factors that influence health and wellbeing, including water, sanitation, waste management, air quality, food safety, housing, pollution, climate change, occupational hazards, vectors, and environmental emergencies.

The course also emphasises the role of health education in promoting environmentally responsible behaviour and preventing environment-related diseases. Learners are introduced to environmental health assessment, risk identification, community mobilisation, environmental sanitation, health communication, and the development of environmental health education programmes for schools and communities.

RELEVANCE STATEMENT

Environmental conditions significantly influence the health and quality of life of individuals and communities. Poor sanitation, unsafe water, improper waste disposal, air pollution, inadequate housing, contaminated food, vector breeding sites, and climate-related hazards contribute to numerous health problems.

Environmental Health Education is therefore essential for preparing health educators and teachers to promote healthy environments and environmentally responsible behaviours. The course enables learners to identify environmental health hazards, educate individuals and communities about preventive practices, participate in environmental health programmes, and contribute to sustainable solutions to environmental health challenges.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of environment, environmental health, and environmental health education.
2) Describe the relationship between environmental conditions and human health.
3) Identify major environmental factors that affect health.
4) Explain the importance of safe water supply and sanitation.
5) Discuss appropriate methods of solid and liquid waste management.
6) Explain the health effects of air, water, soil, noise, and other forms of pollution.
7) Describe the principles of food hygiene and environmental sanitation.
8) Explain the relationship between housing and human health.
9) Identify common vectors and vector-borne diseases and their prevention.
10) Explain occupational and school environmental health hazards.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define environmental health and environmental health education.
2) Explain the major environmental determinants of health.
3) Identify environmental hazards in homes, schools, workplaces, and communities.
4) Explain the importance of safe drinking water and adequate sanitation.
5) Describe appropriate methods of waste collection, disposal, recycling, and management.
6) Identify major sources and health effects of environmental pollution.
7) Explain appropriate food hygiene and safety practices.
8) Describe healthy housing requirements.
9) Identify common disease vectors and recommend appropriate control measures.
10) Explain the relationship between climate change and human health.

COURSE CONTENT

- Concepts of Environmental Health
- Environmental Health Hazards
- Water Supply and Water Safety
- Environmental Sanitation

- Solid Waste Management
- Liquid Waste and Wastewater Management
- Food Hygiene and Safety
- Air Pollution and Health
- Housing and Health
- Vector and Pest Control
- Pollution and Environmental Contamination
- Noise
- Radiation and Other Physical Hazards
- Climate Change and Human Health
- Occupational and School Environmental Health
- Environmental Health and Community Health
- Environmental Health Education
- Environmental Health Programme Planning and Evaluation
- Emerging Environmental Health Issues
- Environmental health challenges in Nigeria

CATEGORY	DETAILS
Core Competencies	• Environmental Health Assessment Competency • Health Promotion Competency • Sanitation Competency • Risk-Assessment Competency • Community Mobilisation Competency • Communication Competency • Programme-Planning Competency • Problem-Solving Competency

CATEGORY	DETAILS
Core Values	• Environmental responsibility • Cleanliness • Personal responsibility • Social justice • Prevention consciousness • Respect for nature • Resource conservation • Healthy living • Civic responsibility • Intergenerational responsibility
Pedagogical Approaches	• Interactive lectures • Group discussions • Brainstorming • Community surveys • Problem-based learning • Project-based learning • Role-play • Peer education
Learning Resources	• Environmental health textbooks • Health education textbooks • WHO environmental health publications • Nigerian environmental health policies and guidelines • Water-quality testing materials
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *Environmental Health*. WHO.
2. World Health Organization. Relevant publications on water, sanitation and hygiene (WASH), air pollution, climate change, environmental risks, food safety, and healthy environments.
3. World Health Organization. *Guidelines for Drinking-water Quality*. WHO.
4. World Health Organization. Relevant resources on health and climate change.
5. World Health Organization. Relevant publications on household air pollution and health.
6. Friis, R. H. *Essentials of Environmental Health*. Jones & Bartlett Learning.
7. Friis, R. H. *Essentials of Environmental Health*. Current edition.
8. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
9. Relevant current Nigerian environmental health policies, regulations, and guidelines relating to water and sanitation, waste management, pollution control, food safety, environmental sanitation, and public health.
10. Current peer-reviewed journal articles on environmental health education, sanitation, climate change and health, pollution, water and food safety, environmental risk, and community environmental health.

EHE 417 Health Psychology and Counselling

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Health Psychology and Counselling is a course designed to introduce learners to the psychological, behavioural, emotional, and social factors that influence health, illness, coping, treatment adherence, and wellbeing. The course integrates principles of health psychology with basic counselling knowledge and skills relevant to health education, health promotion, disease prevention, and supportive interventions.

The course examines major psychological theories of health behaviour, personality and health, stress and coping, emotions, motivation, beliefs and attitudes, lifestyle behaviours, psychosomatic relationships, chronic illness, pain, health communication, patient and client behaviour, and adjustment to illness. It also introduces learners to basic counselling

principles, communication skills, helping relationships, ethical practice, referral, and supportive counselling in health and educational settings.

RELEVANCE STATEMENT

Health is influenced not only by biological and environmental factors but also by people's thoughts, emotions, beliefs, attitudes, relationships, and behaviours. Understanding these psychological factors enables health educators to design more effective health-promotion interventions and support individuals in adopting and maintaining healthy behaviours.

The course is particularly relevant to students preparing for careers in health education, physical and health education, teaching, counselling, public health, community health, health promotion, and related professions. It equips learners with skills for effective communication, behaviour change, stress management, supportive interaction, health counselling, and appropriate referral.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of health psychology and counselling.
2) Describe the relationship between psychological factors and physical health.
3) Explain major theories and models of health behaviour.
4) Examine the influence of personality, attitudes, beliefs, and emotions on health behaviour.
5) Explain the psychological effects of stress, illness, pain, and chronic disease.
6) Discuss psychological factors influencing health-risk behaviours.
7) Explain the role of motivation in health behaviour change.
8) Describe coping mechanisms and strategies for psychological adjustment.
9) Explain the principles, goals, and processes of counselling.
10) Explain ethical principles and professional boundaries in counselling.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define health psychology and counselling.
2) Explain the biopsychosocial approach to health and illness.
3) Describe psychological factors that influence health and disease.
4) Explain major theories of health behaviour and behaviour change.

5) Explain the psychological effects of stress and methods of coping.
6) Describe psychological responses to acute and chronic illness.
7) Explain the relationship between psychological wellbeing and lifestyle behaviours.
8) Establish appropriate helping relationships.
9) Explain ethical issues, confidentiality, and professional boundaries.
10) Apply health psychology principles to health education programmes.

COURSE CONTENT

- Introduction to Health Psychology
- Psychological Determinants of Health
- Theories and Models of Health Behaviour
- Health Behaviour and Lifestyle
- Stress and Health
- Coping and Psychological Adjustment
- Psychology of Illness and Chronic Disease
- Mental Health and Wellbeing
- Introduction to Counselling
- Counselling Relationship and Communication
- Basic Counselling Skills and Techniques
- Counselling Approaches
- Health Behaviour Change and Counselling
- Counselling for Specific Health Issues
- Ethics and Professional Practice
- Counselling Practice and Referral
- Application of Health Psychology to Health Education
- Evidence-based health psychology practice

CATEGORY	DETAILS
Core Competencies	• Psychological Literacy • Communication Competency • Counselling Competency • Active Listening • Behaviour-Change Competency • Stress-Management Competency • Problem-Solving Competency
Core Values	• Empathy • Respect for human dignity • Compassion • Confidentiality • Integrity • Acceptance • Non-judgemental attitudes • Patience • Responsibility • Professionalism • Cultural sensitivity
Pedagogical Approaches	• Interactive lectures • Guided discussions • Case-study analysis • Role-play • Counselling simulations • Demonstrations • Group discussions • Problem-based learning • Reflective exercises

CATEGORY	DETAILS
Learning Resources	• Health psychology textbooks • Counselling textbooks • Health education textbooks • WHO mental-health and health-promotion resources • Counselling manuals • Case studies • Counselling role-play scenarios
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Taylor, S. E. *Health Psychology*. McGraw-Hill Education.
2. Sarafino, E. P., & Smith, T. W. *Health Psychology: Biopsychosocial Interactions*. Wiley.
3. Marks, D. F., Murray, M., Evans, B., & Willig, C. *Health Psychology: Theory, Research and Practice*. SAGE Publications.
4. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
5. Corey, G. *Theory and Practice of Counseling and Psychotherapy*. Cengage Learning.
6. Rogers, C. R. Relevant works on person-centred counselling, empathy, therapeutic relationships, and personal development.
7. Miller, W. R., & Rollnick, S. *Motivational Interviewing: Helping People Change and Grow*. Guilford Press.
8. World Health Organization. Relevant publications on mental health promotion, psychological wellbeing, health behaviour, and integrated health services.
9. Relevant Nigerian professional and institutional guidelines on counselling, mental health, health education, confidentiality, safeguarding, and referral.

10. Current peer-reviewed journal articles on health psychology, health behaviour, counselling, behaviour change, stress and coping, mental health, and health promotion.

HEE 423 Mental, Infant and Child Health

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Mental, Infant and Child Health is a comprehensive course designed to equip learners with the knowledge, skills, attitudes, and values required to understand, promote, and protect the mental and physical health of infants and children. The course adopts a holistic and developmental approach, recognising that the health and wellbeing of children are influenced by biological, psychological, social, family, school, cultural, and environmental factors.

The course covers maternal and infant wellbeing, newborn care, growth and development, nutrition, immunisation, hygiene, common childhood illnesses, child safety, mental health, emotional and social development, developmental difficulties, child protection, parenting, school health, and health promotion. It also introduces learners to early identification of health and developmental concerns, appropriate health education, referral, and community-based interventions.

RELEVANCE STATEMENT

Infancy and childhood are critical stages of human development. Experiences during these periods can have lasting effects on physical growth, cognitive development, emotional wellbeing, learning, behaviour, and future health. Preventable childhood illnesses, malnutrition, unsafe environments, inadequate caregiving, developmental difficulties, and untreated mental-health concerns can negatively affect children’s survival, development, and educational outcomes.

Mental, Infant and Child Health is therefore important for preparing health educators and teachers to promote healthy development, recognise early warning signs, educate parents and caregivers, support safe and nurturing environments, and facilitate timely referral to appropriate health and child-development services.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of mental, infant, and child health.
2) Describe the principles of infant and child growth and development.
3) Explain factors influencing physical, cognitive, emotional, and social development.
4) Discuss essential newborn and infant-care practices.
5) Explain the nutritional requirements of infants and children.
6) Describe the importance of immunisation and preventive child healthcare.
7) Identify common health problems and illnesses affecting infants and children.
8) Explain the importance of hygiene, sanitation, and safe environments for children.
9) Describe major aspects of child mental health and psychological wellbeing.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define mental health, infant health, child health, and child wellbeing.
2) Explain the major stages of infant and child growth and development.
3) Identify factors affecting child development.
4) Describe essential newborn and infant-care practices.
5) Explain the importance of breastfeeding and appropriate complementary feeding.
6) Identify major nutritional needs and common nutritional problems in children.
7) Explain the importance of routine immunisation and preventive healthcare.
8) Identify common childhood illnesses and their prevention.
9) Promote personal hygiene, sanitation, and environmental safety.

COURSE CONTENT

- Concepts of Mental
- Infant and Child Health
- Growth and Development of Infants and Children
- Newborn and Infant Health
- Child Nutrition and Growth
- Immunisation and Preventive Child Health
- Common Infant and Childhood Illnesses
- Hygiene
- Sanitation and Environmental Health

- Mental Health in Infancy and Childhood
- Emotional and Behavioural Health
- Developmental and Learning Difficulties
- Parenting and Family Health
- Child Protection and Safeguarding
- Child Safety and Injury Prevention
- School Mental and Physical Health
- Health Promotion and Health Education for Children
- Community and Public Health Approaches to Child Health
- Emerging Issues in Infant and Child Health

CATEGORY	DETAILS
Core Competencies	• Child Health Promotion Competency • Developmental Assessment Competency • Mental Health Awareness Competency • Health Education Competency • Communication Competency • Parenting and Caregiving Education Competency
Core Values	• Respect for children • Compassion • Empathy • Responsibility • Patience • Protection of human dignity • Respect for child rights • Non-discrimination • Inclusion

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Role-play • Video presentations • Storytelling • Educational games • Peer education • Parent-education simulations
Learning Resources	• Child-health textbooks • Developmental psychology textbooks • National immunisation schedules and guidelines • Growth-monitoring charts • Child-development milestone charts
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. Relevant publications on child health, infant health, mental health, early childhood development, immunisation, nutrition, and health promotion.
2. World Health Organization. *Improving the Mental and Health of Children and Young People*. WHO.
3. UNICEF. Relevant publications on early childhood development, child protection, child nutrition, mental health, and child wellbeing.
4. UNICEF & World Health Organization. Relevant resources on infant and young child feeding, immunisation, WASH, and child survival.

5. American Academy of Paediatrics. Relevant publications on child health, developmental assessment, preventive paediatrics, and child wellbeing.
6. Hockenberry, M. J., Wilson, D., & Rodgers, C. C. *Wong's Nursing Care of Infants and Children*. Elsevier.
7. Berk, L. E. *Development Through the Lifespan*. Pearson.
8. Santrock, J. W. *Child Development*. McGraw-Hill.
9. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
10. Relevant current Nigerian policies, guidelines, and publications on maternal, newborn, infant and child health, immunisation, nutrition, child protection, school health, and mental health.

HEE 425 Alcohol and Drugs

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Alcohol and Drugs is a health education course designed to provide learners with evidence-based knowledge about alcohol, psychoactive substances, medicines, and other drugs, with particular emphasis on their effects on physical, mental, emotional, social, and academic wellbeing. The course examines the concepts of drug use, misuse, harmful use, dependence, addiction, tolerance, withdrawal, and substance-use disorders.

It explores commonly used substances, their sources, forms, routes of administration, effects, risk factors, protective factors, prevention strategies, treatment and rehabilitation, and the role of families, schools, health professionals, communities, and government agencies in addressing substance-related problems. Particular attention is given to health promotion, life skills, risk reduction, early identification, counselling, referral, and prevention of alcohol and drug-related harm, especially among young people.

RELEVANCE STATEMENT

Alcohol and drug misuse can have serious consequences for physical and mental health, relationships, education, employment, safety, and community wellbeing. Young people may be particularly vulnerable to substance-related risks because of peer influence, experimentation, social pressures, misinformation, stress, availability of substances, and other social and environmental factors.

The course is relevant to students preparing for careers in health education, physical and health education, teaching, counselling, public health, community health, youth development, and health promotion. It equips learners to provide accurate health information, challenge misconceptions, identify risk and protective factors, promote healthy lifestyles, support prevention programmes, and recognise situations requiring professional intervention.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Define alcohol, drugs, psychoactive substances, drug use, misuse, and substance-use disorders.
2) Classify commonly used psychoactive substances.
3) Explain the effects of alcohol and drugs on the body and brain.
4) Discuss the psychological, social, educational, and economic consequences of harmful substance use.
5) Explain the concepts of tolerance, dependence, withdrawal, and addiction.
6) Identify major risk and protective factors associated with substance use.
7) Examine the influence of family, peers, media, culture, and environment on substance-use behaviour.
8) Explain the relationship between alcohol/drug use and mental health.
9) Discuss the effects of substance use on adolescents and young adults.
10) Explain principles of alcohol and drug-use prevention.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define key concepts related to alcohol and drugs.
2) Differentiate between medicinal, recreational, therapeutic, and harmful use of substances.
3) Classify psychoactive substances according to their effects.
4) Explain the short- and long-term effects of alcohol and other drugs.
5) Describe the relationship between substance use and physical and mental health.
6) Identify risk factors associated with harmful substance use.
7) Identify protective factors that reduce substance-use risk.
8) Explain the influence of peer pressure, family, media, and social environment.

9) Explain the consequences of alcohol and drug use for academic and social functioning.
10) Demonstrate appropriate refusal, assertiveness, decision-making, and coping skills.

COURSE CONTENT

- Introduction to Alcohol and Drugs
- Classification of Psychoactive Substances
- Alcohol
- Drugs and the Human Body
- Common Psychoactive Substances and Their Effects
- Prescription and Over-the-Counter Medicines
- Tobacco
- Nicotine and Emerging Products
- Risk and Protective Factors
- Risk Factors
- Adolescents
- Young People and Substance Use
- Alcohol
- Drugs and Mental Health
- Alcohol
- Drugs and Social Consequences
- Dependence
- Tolerance and Withdrawal
- Prevention of Alcohol and Drug Misuse
- Life Skills and Substance-Use Prevention
- Treatment
- Rehabilitation and Recovery
- Harm Reduction and Public Health Approaches
- Alcohol and Drug Education
- Policy
- Law and Professional Practice

CATEGORY	DETAILS
Core Competencies	• Drug Literacy Competency • Risk-Assessment Competency • Prevention Competency • Health-Promotion Competency • Communication Competency • Life-Skills Competency • Early-Identification Competency
Core Values	• Responsibility • Self-discipline • Self-respect • Respect for others • Integrity • Accountability • Empathy • Compassion
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Role-play • Simulation • Debate • Problem-based learning • Peer education
Learning Resources	• Alcohol and drug education textbooks • Health education textbooks • WHO substance-use resources • UNODC drug-prevention and treatment resources • National drug-control policies and guidelines • Manuals

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. Relevant publications on alcohol, psychoactive substances, substance-use disorders, prevention, treatment, and public health.
2. United Nations Office on Drugs and Crime. Relevant publications on drug prevention, treatment, rehabilitation, youth substance use, and evidence-based prevention.
3. National Institute on Drug Abuse. Relevant resources on drugs, addiction, prevention, treatment, and the effects of psychoactive substances.
4. National Institute on Alcohol Abuse and Alcoholism. Relevant resources on alcohol use, alcohol-related harms, prevention, and treatment.
5. World Health Organization. *Global Status Report on Alcohol and Health and Treatment of Substance Use Disorders*. WHO.
6. Relevant current Nigerian policies, guidelines, and publications on drug abuse prevention, substance-use disorders, tobacco control, alcohol-related harm, and treatment and rehabilitation.
7. Botvin, G. J., & Griffin, K. W. Relevant works on school-based substance-use prevention and life-skills education.
8. Miller, W. R., & Rollnick, S. *Motivational Interviewing: Helping People Change and Grow*. Guilford Press.

EHE 408 Global Health, National Health Laws, Policies and Advocacy

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Global Health, National Health Laws, Policies and Advocacy is a course designed to equip learners with knowledge and skills for understanding health issues from local, national,

regional, and global perspectives. The course examines the determinants of health, major global health challenges, health systems, international health organisations, national health laws and policies, public health regulations, human rights, health equity, and advocacy.

The course introduces learners to the relationship between health, law, policy, governance, human rights, and social development. It examines how laws and policies influence health promotion, disease prevention, healthcare access, environmental health, maternal and child health, mental health, communicable and non-communicable diseases, substance use, and other public health priorities.

RELEVANCE STATEMENT

Health problems increasingly transcend national boundaries. Disease outbreaks, climate change, migration, environmental degradation, antimicrobial resistance, pandemics, malnutrition, health inequalities, and other global challenges require coordinated responses at international, national, community, and individual levels.

Health professionals and educators therefore need to understand not only health science but also the laws, policies, institutions, rights, and advocacy processes that shape health outcomes. Knowledge of national health laws and policies enables learners to understand their professional responsibilities, citizens' health rights, regulatory requirements, and mechanisms for promoting equitable access to health services.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of global health, health policy, health law, governance, and advocacy.
2) Describe major determinants and indicators of global and national health.
3) Examine major contemporary global health challenges.
4) Explain the structure and functions of national and global health systems.
5) Identify major international organisations involved in health.
6) Explain the relationship between health, human rights, equity, and social justice.
7) Examine the role of laws and regulations in protecting public health.
8) Identify major Nigerian health laws, policies, strategies, and regulatory frameworks.
9) Analyse the relationship between health policies and health outcomes.
10) Explain the health-policy development process.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define global health, national health, health law, health policy, governance, and advocacy.
2) Explain major determinants of health at global, national, and community levels.
3) Identify major global health challenges and their implications for Nigeria.
4) Describe the roles of key international and national health organisations.
5) Explain the relationship between health and human rights.
6) Discuss the principles of health equity and social justice.
7) Identify major Nigerian health laws and policy frameworks relevant to health practice.
8) Explain the processes involved in health-policy formulation and implementation.
9) Analyse the implications of selected health laws for individuals, communities, schools, and health professionals.
10) Identify stakeholders in health-policy processes.

COURSE CONTENT

- Introduction to Global Health
- Global Health Systems and Governance
- Major Global Health Challenges
- Global Health Organisations
- Global Health and Sustainable Development
- Health
- Human Rights and Social Justice
- Introduction to Health Laws
- Nigerian National Health Laws and Regulatory Framework
- National Health Policies in Nigeria
- Health Policy Development
- Health Governance and Regulation
- Health Advocacy
- Advocacy Communication and Stakeholder Engagement
- Health Policy and Advocacy in Schools and Communities
- Global Health Emergencies and International Health Regulations

- Emerging Global Health Issues
- Policy Analysis and Advocacy Project

CATEGORY	DETAILS
Core Competencies	• Global Health Literacy • Health-Law Literacy • Policy Analysis • Advocacy Competency • Communication Competency • Stakeholder Engagement • Human Rights Competency
Core Values	• Respect for human dignity • Equity • Social justice • Accountability • Transparency • Integrity • Professionalism • Respect for the rule of law • Participation • Inclusiveness
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Policy-document analysis • Legal-case analysis • Debates • Mock parliamentary/policy hearings
Learning Resources	• Nigerian health laws and legislation • National health policies and strategic plans • WHO publications • UNICEF publications • World Bank health reports • Africa CDC resources

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *World Health Statistics*. WHO.
2. World Health Organization. *World Health Report* and relevant current global health reports.
3. World Health Organization. *International Health Regulations (2005)*, as amended/currently applicable.
4. World Health Organization. Relevant publications on health systems, universal health coverage, health equity, health governance, and global health policy.
5. United Nations. *Sustainable Development Goals*, particularly SDG 3: Good Health and Well-being.
6. World Bank. Relevant reports on health systems, health financing, universal health coverage, and health development.
7. Gostin, L. O. *Public Health Law: Power, Duty, Restraint*. University of California Press.
8. Fried, L. P., & colleagues. Relevant works on global health, public health, health equity, and health systems.
9. Federal Republic of Nigeria. National Health Act, 2014.
10. Federal Republic of Nigeria. National Health Insurance Authority Act, 2022.
11. Federal Republic of Nigeria. Nigeria Centre for Disease Control and Prevention Act, 2018.
12. Federal Republic of Nigeria. Mental Health Act, 2023.
13. Federal Republic of Nigeria. Tobacco Control Act, 2015.
14. Current National Health Policy and National Strategic Health Development Plan of Nigeria.

SED 511 Science, Technology and Society

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Science, Technology and Society (STS) is an interdisciplinary course that examines the relationships among scientific knowledge, technological development, and human society. It explores how science and technology influence social, economic, political, cultural, environmental, and health-related development, while also examining how society shapes scientific research and technological innovation.

The course introduces students to the nature, meaning, history, philosophy, methods, and development of science and technology. It examines major scientific discoveries and technological innovations, their applications, benefits, limitations, risks, ethical implications, and consequences for individuals and society. Particular attention is given to contemporary issues such as information and communication technology, artificial intelligence, biotechnology, energy, environmental sustainability, health technology, digital transformation, innovation, globalisation, and responsible use of science and technology.

RELEVANCE STATEMENT

Science and technology have become central to contemporary life and national development. Advances in areas such as digital technology, artificial intelligence, communication, transportation, medicine, agriculture, energy, industry, education, and environmental management continue to transform the way people live, work, learn, and interact.

However, scientific and technological development also presents challenges, including environmental degradation, digital inequality, misinformation, unemployment resulting from automation, cyber risks, privacy concerns, ethical controversies, and inappropriate use of technology.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain the concepts, nature, scope, development, and interrelationships of science, technology, and society.
2. Examine the historical development and contributions of science and technology to human civilisation and societal development.

3. Analyse the influence of social, cultural, economic, political, and environmental factors on scientific and technological development.
4. Evaluate the benefits, limitations, risks, and consequences of scientific discoveries and technological innovations on society.
5. Apply scientific and technological knowledge to identify and propose solutions to contemporary social, health, environmental, and developmental problems.
6. Demonstrate critical thinking, scientific literacy, technological literacy, innovation, and responsible decision-making in relation to science and technology.
7. Assess ethical, social, environmental, and sustainability issues associated with scientific research and technological development.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Define science, technology, and society and explain the relationship among them.
2. Describe major stages in the historical development of science and technology and their contributions to human development.
3. Analyse how social, cultural, political, economic, and environmental conditions influence scientific and technological advancement.
4. Evaluate the positive and negative effects of scientific discoveries and technological innovations on individuals and society.
5. Apply scientific and technological principles to address selected real-life and community problems.
6. Demonstrate critical thinking, scientific inquiry, technological awareness, creativity, and innovation in responding to contemporary challenges.
7. Evaluate ethical and sustainability implications of scientific and technological developments and advocate responsible use.

COURSE CONTENT

- Definition of science, ethics and science process skills as ways of finding but about the environment and attempt to put structure on it
- Assumptions of Science concerning nature and the processes and products of scientific investigations
- Ethics of science and scientific attitudes Knowing the ethics of science and developing scientific attitudes know the assumptions of science concerning nature and the processes and products of scientific investigations/implication

- Science process skills Application of science process skills to emphasis on communicating, interpreting data, designing experiments, reporting completely, and accurately, formulating hypotheses, generalising, predicting and others

CATEGORY	DETAILS
Core Competencies	• Scientific literacy • Technological literacy • Critical-thinking • Problem-solving • Research and inquiry • Innovation • Digital literacy • Information literacy
Core Values	• Professionalism • Creativity • Innovation • Accountability • Integrity • Equity • Inclusiveness • Respect for diversity • Learner-centredness
Pedagogical Approaches	• Interactive lectures • Group discussions • Curriculum case studies • Problem-based learning • Project-based learning • Curriculum-design workshops
Learning Resources	• Curriculum Documents • National curriculum frameworks • Health education curriculum documents • Teacher education curriculum guidelines • Institutional curriculum templates • C

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Sismondo, S. (2010). *An introduction to science and technology studies* (2nd ed.). Wiley-Blackwell.
2. Cutcliffe, S. H., & Mitcham, C. (Eds.). (2001). *Visions of STS: Counterpoints in science, technology, and society studies*. State University of New York Press.
3. Wajcman, J. (2004). *Techno Feminism*. Polity Press.
4. Jasanoff, S. (Ed.). (2004). *States of knowledge: The co-production of science and the social order*. Routledge.
5. Bijker, W. E., Hughes, T. P., & Pinch, T. J. (Eds.). (1987). *The social construction of technological systems*. MIT Press.
6. Chalmers, A. F. (2013). *What is this thing called science?* (4th ed.). Hackett Publishing.
7. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*.

EHE 510 Contemporary National Health Courses, Issues and Problems in Public Health

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Contemporary National Health Issues and Problems in Public Health is a course designed to provide learners with an understanding of current health conditions, emerging public health challenges, and major health problems affecting Nigeria and other developing countries. The course examines the magnitude, causes, determinants, consequences,

prevention, control, and management of contemporary health problems from individual, community, national, and global perspectives.

The course covers major public health concerns including communicable and non-communicable diseases, maternal and child health, adolescent health, mental health, substance use, malnutrition, environmental health, health inequalities, health-system challenges, emerging infectious diseases, antimicrobial resistance, climate change, injuries, health misinformation, and access to healthcare.

RELEVANCE STATEMENT

Nigeria faces a complex combination of communicable diseases, non-communicable diseases, maternal and child health challenges, malnutrition, environmental risks, mental-health concerns, health inequalities, and emerging public health threats. These challenges are influenced by poverty, education, environmental conditions, cultural practices, population growth, urbanisation, insecurity, healthcare access, and other social determinants.

Health educators play an important role in addressing these challenges through health promotion, disease prevention, community mobilisation, health communication, advocacy, behaviour change, and support for public health programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of contemporary health issues and public health problems.
2) Describe the major determinants of health in Nigeria.
3) Identify major current health problems affecting Nigerian populations.
4) Analyse the causes and consequences of important public health problems.
5) Examine current trends in communicable and non-communicable diseases.
6) Explain major maternal, newborn, infant, child, and adolescent health challenges.
7) Discuss contemporary mental-health and substance-use problems.
8) Explain major environmental and occupational health challenges.
9) Examine the effects of climate change, urbanisation, and population growth on health.
10) Examine emerging and re-emerging infectious diseases.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define contemporary public health issues and problems.
2) Explain the major determinants of health in Nigeria.
3) Identify and prioritise significant public health problems.
4) Analyse the magnitude, distribution, causes, and consequences of selected health problems.
5) Explain current trends in communicable and non-communicable diseases.
6) Discuss major maternal and child health challenges.
7) Explain contemporary adolescent and youth health problems.
8) Analyse mental-health and substance-use challenges.
9) Explain the relationship between environmental conditions and public health.
10) Discuss climate change and its health implications.

COURSE CONTENT

- Introduction to Contemporary Public Health
- Nigeria's National Health Profile
- Communicable Diseases
- Emerging Infectious Diseases and Public Health Emergencies
- Non-Communicable Diseases
- Maternal and Reproductive Health
- Infant and Child Health
- Adolescent and Youth Health
- Mental Health and Psychological Wellbeing
- Alcohol
- Drugs and Substance Use
- Nutrition and Food Security
- Environmental Health Problems
- Climate Change and Health
- Occupational Health and Safety
- Injuries
- Violence and Public Safety
- Health Inequalities and Vulnerable Populations
- Health-System Challenges in Nigeria

- Health Information
- Technology and Misinformation
- Antimicrobial Resistance
- Contemporary Public Health Interventions
- National Health Policies and Programmes
- Emerging Public Health Issues

CATEGORY	DETAILS
Core Competencies	• Public Health Literacy • Health Problem Identification • Epidemiological Thinking • Critical Thinking • Health Promotion • Disease Prevention • Health Communication • Community Mobilisation • Policy Awareness
Core Values	• Responsibility • Equity • Social justice • Integrity • Accountability • Compassion • Empathy • Respect for human dignity • Community participation • Inclusiveness • Non-discrimination • Evidence-based decision-makin

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Problem-based learning • Current-health issue debates • Community health surveys • Field visits • Data interpretation exercises
Learning Resources	• Public health textbooks • Community health textbooks • WHO publications • UNICEF publications • Nigeria Centre for Disease Control and Prevention resources • Federal Ministry of Health and Social Welfare publications
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *World Health Statistics*. WHO.
2. World Health Organization. Relevant current publications on global health, public health, health systems, disease prevention, health promotion, and health emergencies.
3. World Health Organization. Relevant reports on non-communicable diseases, mental health, environmental health, climate change, and universal health coverage.
4. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
5. Gordis, L. *Epidemiology*. Elsevier.
6. Friis, R. H., & Sellers, T. A. *Epidemiology for Public Health Practice*. Jones & Bartlett Learning.

7. Detels, R., Gulliford, M., Karim, Q. A., & Tan, C. C. (Eds.). *Oxford Textbook of Global Public Health*. Oxford University Press.
8. Centers for Disease Control and Prevention. Current resources on public health surveillance, disease prevention, health promotion, and programme evaluation.
9. Nigeria Centre for Disease Control and Prevention. Current publications and surveillance reports on communicable diseases, outbreaks, and public health emergencies in Nigeria.
10. Federal Ministry of Health and Social Welfare, Nigeria. Current National Health Policy and National Strategic Health Development Plan.
11. Africa Centres for Disease Control and Prevention. Current reports on African public health priorities, disease surveillance, health security, and emerging health threats.
12. World Bank. Current reports on health systems, health financing, poverty, health equity, and human development.

EHE 507 Seminars in Health Education

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Seminars in Physical and Health Education is an advanced academic and professional development course designed to strengthen students' research, communication, critical thinking, and scholarly presentation skills through the exploration of contemporary issues in Physical and Health Education. The course provides a forum for students to investigate, analyse, and present current trends, challenges, innovations, and emerging research in physical education, health education, sports science, exercise science, and related disciplines.

Students are guided in selecting relevant seminar topics, conducting literature reviews, synthesising research findings, preparing scholarly seminar papers, and delivering oral presentations using appropriate academic conventions. The course emphasises evidence-based practice, academic writing, presentation techniques, professional ethics, and constructive peer evaluation.

RELEVANCE STATEMENT

The course provides an essential platform for integrating knowledge acquired throughout the programme while developing professional research and communication skills. It prepares future teachers, coaches, health educators, sports administrators, and researchers

to investigate contemporary issues, disseminate scientific knowledge, and contribute to evidence-based improvements in education, sports, health promotion, and community development.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the purpose, structure, and significance of academic seminars in Physical and Health Education.
2. Identify and select contemporary issues relevant to Physical and Health Education and sports development.
3. Conduct systematic literature reviews using credible academic sources.
4. Prepare well-organised seminar papers that adhere to accepted academic writing standards.
5. Deliver effective oral presentations using appropriate communication and presentation technologies.
6. Demonstrate critical thinking and analytical skills in discussing current issues in Physical and Health Education.
7. Engage in scholarly discussions, peer review, and constructive academic critique.
8. Demonstrate professionalism, ethical conduct, and academic integrity in seminar preparation and presentation.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Prepare and present high-quality seminar papers on contemporary issues in Physical and Health Education.
2. Conduct systematic literature reviews using credible academic sources.
3. Critically analyse and synthesise research evidence.
4. Communicate research findings effectively to academic and professional audiences.
5. Demonstrate confidence in scholarly discussions and constructive peer evaluation.
6. Apply research evidence to improve professional practice in education, health, and sport.
7. Apply research evidence to address practical problems in education, health, exercise, and sport.

8. Develop lifelong learning skills through independent inquiry and continuous professional development.

COURSE CONTENT

- Discuss contemporary issues in the field of Physical and Health Education
- Equip students the skills require for academic papers presentations
- Enable students to have a wider scope in matters related to physical and Health Education
- **Present and defend a proposal on related topics of choice:** Practical presentation
- The lecturers teaching the course should expose students to current Issues in physical and Health Education Sports and Dance in order to develop their art of writing and paper presentation

CATEGORY	DETAILS
Core Competencies	• Academic research and inquiry • Literature review and information literacy • Scholarly writing and academic communication • Oral presentation and public speaking • Critical thinking and analytical reasoning • Evidence-based decision-making
Core Values	• Academic integrity • Professionalism • Commitment to excellence • Critical thinking • Scientific inquiry and evidence-based practice • Honesty and ethical scholarship • Effective communication • Respect for diverse perspectives • Collaboration and teamwork • Leadership and responsibility

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. American College of Sports Medicine (ACSM). (2021). *ACSM's Guidelines for Exercise Testing and Prescription (11th ed.)*. Wolters Kluwer.
2. American Psychological Association. (2020). *Publication Manual of the American Psychological Association (7th ed.)*. American Psychological Association.
3. Bell, J., & Waters, S. (2018). *Doing Your Research Project (7th ed.)*. Open University Press.

4. Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (6th ed.)*. Sage Publications.
5. Mertler, C. A. (2024). *Introduction to Educational Research (3rd ed.)*. Sage Publications.
6. Murray, R. (2020). *How to Write a Thesis (4th ed.)*. Open University Press.
7. Punch, K. F. (2020). *Introduction to Social Research: Quantitative and Qualitative Approaches (4th ed.)*. Sage Publications.
8. Silverman, D. (2021). *Interpreting Qualitative Data (6th ed.)*. Sage Publications.
9. Thomas, G. (2022). *How to Do Your Research Project: A Guide for Students (4th ed.)*. Sage Publications.
10. Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2022). *Research Methods in Physical Activity (8th ed.)*. Human Kinetics.
11. UNESCO. (2015). *Quality Physical Education (QPE): Guidelines for Policy-Makers*.
12. United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
13. Walliman, N. (2021). *Research Methods: The Basics (3rd ed.)*. Routledge.
14. World Health Organization (WHO). (2020). *Guidelines on Physical Activity and Sedentary Behaviour*.

EHE 513 Health Economics and Consumerism

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Health Economics and Consumerism is a course designed to introduce learners to the application of economic principles to health, healthcare delivery, health education, and health-related decision-making. The course examines how scarce resources are allocated to meet competing health needs and how individuals, families, communities, healthcare providers, governments, and other stakeholders make decisions about health and healthcare.

The course covers concepts such as scarcity, opportunity cost, demand and supply, utility, efficiency, equity, healthcare financing, health insurance, healthcare expenditure, cost-effectiveness, cost-benefit analysis, and resource allocation. It also examines the concept of health consumerism, including consumer rights and responsibilities, health literacy,

informed choice, patient safety, healthcare quality, health information, medical products, advertising, digital health services, and protection against misleading health claims.

RELEVANCE STATEMENT

Healthcare resources are limited while health needs are numerous and continuously changing. Individuals and governments must therefore make choices concerning the allocation and use of available health resources. Understanding health economics enables health educators and other professionals to appreciate how economic factors influence healthcare access, health behaviour, health outcomes, financing, and resource distribution.

At the same time, healthcare consumers increasingly encounter a wide range of health products, services, medicines, supplements, insurance schemes, digital health platforms, and health information. This makes consumer education and protection increasingly important.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the meaning and scope of health economics.
2) Describe basic economic concepts and their application to healthcare.
3) Explain scarcity, choice, opportunity cost, efficiency, and equity in healthcare.
4) Examine the demand for and supply of healthcare services.
5) Explain factors influencing healthcare utilisation.
6) Discuss healthcare financing and expenditure.
7) Explain the principles of health insurance.
8) Examine the role of government in financing and regulating healthcare.
9) Explain economic evaluation in healthcare.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define health economics and health consumerism.
2) Explain fundamental economic principles as they apply to health.
3) Describe scarcity and opportunity cost in healthcare decision-making.
4) Explain demand and supply of healthcare services.
5) Identify factors influencing healthcare utilisation.
6) Explain different sources of healthcare financing.

7) Discuss health insurance and risk pooling.
8) Explain the relationship between healthcare expenditure and health outcomes.
9) Distinguish between efficiency and equity in healthcare.

COURSE CONTENT

- Introduction to Health Economics
- Basic Economic Concepts in Healthcare
- Demand for Healthcare
- Supply of Healthcare Services
- Healthcare Markets and Market Failure
- Healthcare Financing
- Health Insurance
- Healthcare Costs and Expenditure
- Economic Evaluation in Healthcare
- Resource Allocation in Healthcare
- Health Economics and Health Behaviour
- Health Consumerism
- Rights and Responsibilities of Health Consumers
- Health Literacy and Consumer Decision-Making
- Health Products
- Services and Advertising
- Healthcare Quality and Consumer Protection
- Digital Health Consumerism
- Health Consumerism in Nigeria
- Contemporary Issues in Health Economics and Consumerism

CATEGORY	DETAILS
Core Competencies	• Health-Economic Literacy • Consumer Health Literacy • Financial Decision-Making • Resource-Allocation Competency • Economic Evaluation Competency • Consumer-Protection Competency • Critical Thinking • Advocacy Competency
Core Values	• Responsibility • Integrity • Accountability • Transparency • Equity • Fairness • Consumer empowerment • Respect for human dignity • Informed choice • Professionalism • Ethical conduct • Critical thinking • Financial responsibility • Health consciousness • Self-reliance
Pedagogical Approaches	• Pedagogical Approach • Interactive lectures • Group discussions • Case-study analysis • Problem-based learning • Health-product advertisement analysis • Consumer decision-making exercises

CATEGORY	DETAILS
Learning Resources	• Health economics textbooks • Public health textbooks • Health financing reports • Health insurance documents • National health expenditure reports • WHO health economics resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Folland, S., Goodman, A. C., & Stano, M. *The Economics of Health and Health Care*. Routledge.
2. Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. *Methods for the Economic Evaluation of Health Care Programmes*. Oxford University Press.
3. Getzen, T. E. *Health Economics and Financing*. Wiley.
4. Morris, S., Devlin, N., Parkin, D., & Spencer, A. *Economic Analysis in Health Care*. Wiley.
5. World Health Organization. Relevant publications on health financing, health economics, universal health coverage, health systems, and financial protection.
6. World Bank. Current reports on health financing, healthcare expenditure, universal health coverage, and health-system performance.
7. Federal Republic of Nigeria. National Health Insurance Authority Act, 2022 and relevant current regulations and guidelines.
8. Federal Ministry of Health and Social Welfare, Nigeria. Current publications on health financing, healthcare reform, health insurance, and universal health coverage.
9. Relevant Nigerian health expenditure, health financing, and consumer-protection reports.

HEE 514 Nutrition in Health and Diseases

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

Nutrition in Health and Diseases is a course designed to provide learners with an understanding of the relationship between food, nutrients, health, disease prevention, disease management, and overall wellbeing. The course examines the principles of human nutrition, nutrient requirements, balanced diets, nutritional assessment, dietary patterns, and the role of nutrition throughout the life course.

It explores the relationship between nutrition and communicable and non-communicable diseases, including obesity, diabetes, cardiovascular diseases, hypertension, anaemia, malnutrition, gastrointestinal disorders, and selected nutrition-related conditions. The course also addresses food safety, nutrition education, dietary behaviour, nutrition across different stages of life, and the Nigerian nutritional context.

RELEVANCE STATEMENT

Good nutrition is fundamental to growth, development, learning, productivity, disease prevention, and quality of life. Poor nutrition can contribute to undernutrition, micronutrient deficiencies, overweight and obesity, and a range of chronic diseases. Nigeria faces a complex nutritional situation in which undernutrition and micronutrient deficiencies coexist with increasing overweight, obesity, and diet-related non-communicable diseases.

Health educators have an important role in promoting healthy dietary practices, correcting nutrition misinformation, encouraging food safety, supporting healthy lifestyles, and contributing to community nutrition programmes. This course therefore provides essential knowledge and skills for students preparing for careers in health education, physical and health education, teaching, public health, community health, health promotion, and related fields.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts and principles of nutrition.
2) Identify the major nutrients and describe their functions.
3) Explain the relationship between nutrition and health.
4) Describe digestion, absorption, metabolism, and utilisation of nutrients.

5) Explain energy balance and factors influencing energy requirements.
6) Identify sources and functions of major nutrients.
7) Explain nutritional requirements at different stages of life.
8) Describe methods of assessing nutritional status.
9) Explain causes and consequences of malnutrition.
10) Discuss major nutrition-related diseases.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define nutrition, nutrients, balanced diet, malnutrition, and related concepts.
2) Identify carbohydrates, proteins, fats, vitamins, minerals, water, and other essential components of the diet.
3) Explain the functions and sources of major nutrients.
4) Explain digestion, absorption, metabolism, and nutrient utilisation.
5) Calculate or estimate basic energy requirements where appropriate.
6) Explain the principles of energy balance.
7) Identify signs and risk factors associated with nutritional deficiencies and excesses.
8) Describe nutritional requirements during infancy, childhood, adolescence, adulthood, pregnancy, lactation, and old age.
9) Explain causes and consequences of undernutrition and overnutrition.
10) Identify nutrition-related diseases and their risk factors.

COURSE CONTENT

- Introduction to Nutrition
- Nutrients and Their Functions
- Digestion
- Absorption and Metabolism
- Energy and Energy Balance
- Balanced Diet and Meal Planning
- Nutrition Across the Life Course
- Infancy
- Nutritional Assessment
- Malnutrition

- Micronutrient Deficiencies
- Nutrition and Non-Communicable Diseases
- Nutrition and cardiovascular diseases
- Nutrition and Communicable Diseases
- Nutrition and immunity
- Nutrition in Selected Diseases
- Nutrition in diabetes
- Food Safety and Hygiene
- Nutrition and Physical Activity
- Nutrition
- Lifestyle and Behaviour
- Nutrition Education and Communication
- Nutrition and Public Health in Nigeria
- Food Security and Sustainable Nutrition
- Nutrition Education Programme Development

CATEGORY	DETAILS
Core Competencies	• Nutrition Literacy • Dietary Assessment Competency • Health-Promotion Competency • Nutrition Education Competency • Food-Safety Competency • Disease-Prevention Competency • Communication Competency • Critical-Appraisal Competency
Core Values	• Healthy living • Self-discipline • Responsibility • Food safety • Moderation • Evidence-based decision-making • Cultural sensitivity

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Food and nutrition demonstrations • Case-study analysis • Meal-planning exercises • Dietary assessment exercises • Food-label interpretation
Learning Resources	• Human nutrition textbooks • Public health nutrition textbooks • Food composition tables • Nutrition assessment tools • WHO nutrition resources • UNICEF nutrition resources • FAO nutrition and food-security resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Whitney, E., & Rolfes, S. R. *Understanding Nutrition*. Cengage Learning.
2. Gropper, S. S., & Smith, J. L. *Advanced Nutrition and Human Metabolism*. Cengage Learning.
3. Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. *Introduction to Human Nutrition*. Wiley-Blackwell.
4. Mahan, L. K., & Raymond, J. L. *Krause's Food & the Nutrition Care Process*. Elsevier.
5. World Health Organization. Current publications on healthy diets, nutrition, malnutrition, obesity, maternal and child nutrition, micronutrients, and nutrition-related non-communicable diseases.

6. Food and Agriculture Organization of the United Nations. Current publications on food security, nutrition, sustainable diets, and food systems.
7. UNICEF. Current reports and resources on maternal, infant, child, and adolescent nutrition.
8. Federal Ministry of Health and Social Welfare, Nigeria. Current National Policy on Food and Nutrition and related nutrition strategies and guidelines.
9. Relevant Nigerian food-based dietary guidelines and national nutrition programme documents.

EHE 524 Epidemiology of Public Health and Human Biometry

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Epidemiology of Public Health and Human Biometry is a course designed to introduce learners to the principles and applications of epidemiology and human biometry in understanding health, disease, and health-related conditions within populations. The course examines the distribution, frequency, determinants, and patterns of diseases and health events, as well as methods for measuring and interpreting health information.

The epidemiology component focuses on concepts such as disease occurrence, incidence, prevalence, morbidity, mortality, risk factors, surveillance, screening, outbreak investigation, and epidemiological study designs. The human biometry component introduces learners to the measurement of human characteristics, including height, weight, body mass index, body composition, growth patterns, physical fitness indicators, and selected physiological measurements.

RELEVANCE STATEMENT

Understanding the distribution and determinants of health problems is essential for effective public health practice. Epidemiology provides the scientific basis for identifying health problems, determining risk factors, monitoring disease trends, planning interventions, and evaluating health programmes. Human biometry, on the other hand, provides objective measurements that can be used to assess growth, nutritional status, physical development, health risks, and population health characteristics.

The course is particularly relevant to students of Health Education, Physical and Health Education, Public Health, Community Health, and related disciplines, because it develops their ability to collect, measure, analyse, interpret, and communicate health information.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts, scope, and principles of epidemiology.
2) Explain the epidemiological triad and other models of disease causation.
3) Describe patterns and determinants of disease occurrence.
4) Explain morbidity, mortality, case fatality, and survival measures.
5) Explain the concepts and applications of human biometry.
6) Identify major anthropometric and biometric measurements.
7) Demonstrate appropriate techniques for measuring height, weight, BMI, body circumferences, and selected physiological variables.
8) Explain principles of measurement validity, reliability, accuracy, and precision.
9) Analyse and interpret basic epidemiological and biometric data.
10) Apply epidemiological and biometric information to health promotion, disease prevention, and research.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define epidemiology, public health, biometry, and related concepts.
2) Explain the historical development and uses of epidemiology.
3) Explain mortality and morbidity measures.
4) Explain relative risk and odds ratio at an introductory level.
5) Describe major epidemiological study designs.
6) Explain the importance of anthropometric measurement.
7) Interpret basic growth and body-composition measurements.
8) Explain measurement error, reliability, validity, sensitivity, and specificity.
9) Organise and present epidemiological and biometric data.
10) Apply epidemiological evidence to health education and disease prevention.

COURSE CONTENT

- Introduction to Epidemiology
- Basic Concepts in Public Health Epidemiology
- Models of Disease Causation
- Distribution of Disease

- Measurement of Disease Frequency
- Measures of Association and Public Health Impact
- Epidemiological Study Designs
- Bias
- Confounding and Validity
- Screening and Diagnostic Testing
- Disease Surveillance
- Outbreak Investigation
- Introduction to Human Biometry
- Principles of Human Measurement
- Anthropometric Measurements
- Growth and Development Measurements

Growth and development, Body Composition, Physiological and Health-Related Measurements, Biometric Data Management and Interpretation, Epidemiology and Biometry in Health Research, Applications to Public Health and Health Education

CATEGORY	DETAILS
Core Competencies	• Epidemiological Literacy • Data Collection Competency • Measurement Competency • Statistical Literacy • Disease Surveillance Competency • Risk Assessment Competency • Research Competency
Core Values	• Accuracy • Objectivity • Scientific integrity • Professionalism • Accountability • Confidentiality • Respect for human dignity • Ethical research practice • Evidence-based decision-making

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Practical demonstrations • Laboratory measurement sessions • Field surveys • Case studies • Epidemiological problem-solving
Learning Resources	• Epidemiology textbooks • Public health textbooks • Human anatomy and physiology texts • Biometry and anthropometry manuals • WHO epidemiological resources • WHO growth standards
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Gordis, L. *Epidemiology*. Elsevier.
2. Friis, R. H., & Sellers, T. A. *Epidemiology for Public Health Practice*. Jones & Bartlett Learning.
3. Rothman, K. J., Greenland, S., & Lash, T. L. *Modern Epidemiology*. Wolters Kluwer.
4. Bonita, R., Beaglehole, R., & Kjellström, T. *Basic Epidemiology*. World Health Organization.
5. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
6. World Health Organization. *Basic Epidemiology* and current resources on disease surveillance, health measurement, and public health.

7. World Health Organization. *WHO Child Growth Standards* and related growth-assessment resources.
8. Centers for Disease Control and Prevention. Current resources on epidemiology, surveillance, outbreak investigation, screening, and public health practice.
9. Ulijaszek, S. J., & Kerr, D. A. Relevant literature on anthropometry and human body measurement.
10. Norton, K., & Olds, T. *Anthropometrica: A Textbook of Body Measurement for Sports and Health Courses*. UNSW Press.
11. Relevant Nigerian epidemiological surveillance reports, national health statistics, and public health publications.

EHE 504 Organisation, Planning and Evaluation of Health Education Courses

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Organisation, Planning and Evaluation of Health Education Courses is a course designed to equip learners with the knowledge, skills, and competencies required to systematically organise, plan, implement, monitor, and evaluate health education programmes and courses in schools, communities, healthcare settings, and other institutions.

The course examines the principles and processes of health education programme planning, curriculum organisation, needs assessment, goal and objective setting, content selection and sequencing, instructional planning, resource allocation, implementation, monitoring, and evaluation. It introduces learners to different approaches and models for planning health education interventions and provides practical experience in developing health education courses and programmes.

RELEVANCE STATEMENT

Effective health education requires more than knowledge of health issues. Health educators must be able to determine what learners or communities need to know, establish measurable objectives, select appropriate content and teaching methods, organise learning experiences, provide appropriate resources, implement programmes, and determine whether intended outcomes have been achieved.

This course is therefore essential for preparing competent health educators, teachers, programme officers, curriculum developers, community health promoters, and health

education practitioners. It provides learners with practical competencies for designing health education courses that are relevant, learner-centred, evidence-based, culturally appropriate, measurable, and responsive to changing health needs.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts of organisation, planning, implementation, monitoring, and evaluation in health education.
2) Describe principles of effective health education programme organisation.
3) Identify health education needs of individuals, groups, schools, and communities.
4) Explain different approaches and models of health education programme planning.
5) Conduct basic health education needs assessments.
6) Formulate appropriate goals, objectives, and expected outcomes.
7) Select and organise relevant health education content.
8) Develop appropriate instructional plans and learning experiences.
9) Identify and allocate human, material, financial, and technological resources.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define health education programme organisation, planning, implementation, monitoring, and evaluation.
2) Explain principles of effective health education programme management.
3) Identify and prioritise health education needs.
4) Conduct basic learner and community needs assessments.
5) Develop programme goals and SMART objectives.
6) Select, sequence, and organise appropriate course content.
7) Develop course outlines, schemes of work, lesson plans, and programme plans.
8) Select teaching strategies appropriate to different learners and health topics.
9) Identify appropriate learning resources.

COURSE CONTENT

- Introduction to Health Education Programme Organisation
- Principles of Organising Health Education Courses
- Health Education Needs Assessment

- Health Education Programme Planning
- Health Education Planning Models
- Goals
- Objectives and Learning Outcomes
- Organisation and Selection of Course Content
- Curriculum and Course Organisation
- Instructional Planning in Health Education
- Teaching and Learning Strategies
- Resources for Health Education Programmes
- Programme Implementation
- Programme Monitoring
- Evaluation of Health Education Programmes
- Evaluation Design and Methods
- Evaluation Instruments and Data Collection
- Data Analysis and Interpretation
- Programme Reporting and Quality Improvement
- Practical Health

CATEGORY	DETAILS
Core Competencies	• Programme Planning Competency • Needs Assessment Competency • Curriculum Organisation Competency • Instructional Design Competency • Programme Implementation Competency • Monitoring Competency • Evaluation Competency • Data Management Competency • Resource Management Competency

CATEGORY	DETAILS
Core Values	• Professionalism • Accountability • Transparency • Integrity • Responsibility • Evidence-based decision-making • Inclusiveness • Equity • Collaboration • Respect for learners • Cultural sensitivity
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Programme-planning workshops • Problem-based learning • Project-based learning • Simulation exercises • Role-play • Fieldwork
Learning Resources	• Health education textbooks • Programme planning manuals • Curriculum development textbooks • Evaluation textbooks • WHO health education and health-promotion resources • UNICEF programme-planning resources • Health education curriculum documents

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Green, L. W., & Kreuter, M. W. *Health Program Planning: An Educational and Ecological Approach*. McGraw-Hill.
2. Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.
3. McKenzie, J. F., Neiger, B. L., & Thackeray, R. *Planning, Implementing, and Evaluating Health Promotion Programs: A Primer*. Pearson.
4. Bartholomew Eldredge, L. K., Markham, C. M., Ruiter, R. A. C., Fernández, M. E., Kok, G., & Parcel, G. S. *Planning Health Promotion Programmes: An Intervention Mapping Approach*. Jossey-Bass.
5. World Health Organization. Relevant publications on health promotion, health education, programme planning, monitoring, and evaluation.
6. World Health Organization. *Health Promotion: A Discussion Document on the Concept and Principles*. WHO.
7. UNICEF. Relevant resources on programme planning, monitoring, evaluation, and results-based management.
8. Centers for Disease Control and Prevention. Relevant resources on programme evaluation and health promotion planning.
9. Relevant Nigerian national health policies, strategic plans, health education curricula, and programme-planning guidelines.
10. Current peer-reviewed journal articles on health education programme planning, curriculum development, implementation, monitoring, evaluation, behaviour change, and health promotion.

EHE 502 Occupational and Industrial Health

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Occupational and Industrial Health is a course designed to provide learners with knowledge and skills for promoting and protecting the health, safety, and wellbeing of workers in different occupational and industrial environments. The course examines the relationship between work, workplace conditions, occupational hazards, diseases, injuries, productivity, and quality of life.

It introduces learners to the identification, assessment, prevention, and control of physical, chemical, biological, ergonomic, mechanical, psychosocial, and environmental hazards in workplaces. The course also covers occupational diseases, industrial accidents, workplace health promotion, personal protective equipment, occupational hygiene, emergency preparedness, rehabilitation, workers' compensation, and relevant occupational health and safety policies and legislation.

RELEVANCE STATEMENT

Workers spend a substantial proportion of their lives in occupational environments where exposure to hazardous conditions can result in injuries, diseases, disability, stress, and premature death. Unsafe workplaces can also reduce productivity, increase absenteeism, increase healthcare costs, and negatively affect families and communities.

Occupational and industrial health is therefore important for preparing health educators, teachers, public health practitioners, occupational health personnel, administrators, and community health professionals to identify workplace hazards, promote safe work practices, educate workers, and participate in occupational disease and injury prevention programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts and principles of occupational and industrial health.
2) Describe the relationship between work, health, safety, and productivity.
3) Identify major occupational and industrial hazards.
4) Explain the causes and prevention of occupational injuries and diseases.
5) Describe principles of occupational hygiene.

6) Explain methods of identifying and assessing workplace hazards.
7) Discuss physical, chemical, biological, ergonomic, and psychosocial hazards.
8) Explain the importance of personal protective equipment.
9) Describe principles of workplace health promotion.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define occupational health, industrial health, occupational hygiene, and workplace safety.
2) Explain the importance of occupational health to workers, organisations, and society.
3) Identify common workplace hazards.
4) Classify occupational hazards into appropriate categories.
5) Conduct a basic workplace hazard assessment.
6) Explain common occupational diseases and injuries.
7) Describe methods of preventing and controlling workplace hazards.
8) Demonstrate appropriate selection and use of personal protective equipment.
9) Explain principles of occupational health surveillance.

COURSE CONTENT

- Introduction to Occupational and Industrial Health
- Workplace Health and Safety
- Occupational Hazards
- Principles of Occupational Hygiene
- Risk Assessment and Management
- Occupational Diseases
- Occupational Injuries and Industrial Accidents
- Personal Protective Equipment
- Ergonomics and Occupational Health
- Occupational Stress and Mental Wellbeing
- Occupational Health Surveillance
- Workplace Health Promotion
- Occupational Health in Selected Industries
- Occupational Health in the Informal Sector

- Occupational Health and Vulnerable Workers
- Workplace Emergency Preparedness and First Aid
- Environmental Health in Industry
- Occupational Health Policies
- Laws and Standards
- Occupational Health Services
- Rehabilitation
- Disability and Return to Work
- Occupational Health Education Programme

CATEGORY	DETAILS
Core Competencies	• Hazard Identification • Risk Assessment • Occupational Hygiene • Accident Prevention • Safety Education • PPE Competency • Health Promotion • Emergency Preparedness • Occupational Health Surveillance • Teamwork
Core Values	• Safety consciousness • Responsibility • Accountability • Professionalism • Integrity • Respect for human life • Respect for workers' rights • Equity • Inclusiveness • Teamwork • Prevention • Environmental responsibility

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Workplace hazard identification exercises • Risk-assessment simulations • Practical PPE demonstrations
Learning Resources	• Occupational health textbooks • Industrial hygiene manuals • Occupational safety manuals • Public health textbooks • WHO occupational health resources • International Labour Organization resources • Nigerian occupational health and safety policies and regulations • Workplace safety manuals
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Levy, B. S., Wegman, D. H., Baron, S. L., & Sokas, R. K. (Eds.). *Occupational and Environmental Health: Recognizing and Preventing Disease and Injury*. Oxford University Press.
2. LaDou, J., & Harrison, R. J. *Current Occupational & Environmental Medicine*. McGraw-Hill.
3. Rosenstock, L., Cullen, M. R., Brodkin, C. A., & Redlich, C. A. (Eds.). *Textbook of Clinical Occupational and Environmental Medicine*. Elsevier.
4. World Health Organization. Current resources on occupational health, healthy workplaces, occupational diseases, and worker health protection.

5. International Labour Organization. Current resources on occupational safety and health, workplace hazards, workers' rights, and occupational health standards.
6. Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
7. Federal Republic of Nigeria. Relevant current occupational health, workplace safety, labour, and workers' compensation legislation and regulations.
8. Federal Ministry of Labour and Employment, Nigeria. Current occupational safety and health guidelines and publications.

HEE 523 Environmental Monitoring Systems and Techniques

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Environmental Monitoring Systems and Techniques is a course designed to equip learners with the knowledge, skills, and competencies required to systematically observe, measure, record, analyse, and interpret environmental conditions that may affect human health and ecological wellbeing. The course introduces the principles and practical techniques used in monitoring air, water, soil, noise, waste, sanitation, radiation, and other environmental hazards.

The course covers environmental sampling, monitoring instruments, field and laboratory techniques, quality assurance and quality control, environmental data management, environmental standards, risk assessment, and reporting. It also examines the application of environmental monitoring in environmental health education, disease prevention, pollution control, environmental impact assessment, community health, and public health decision-making.

RELEVANCE STATEMENT

Environmental conditions have a direct influence on human health and quality of life. Poor air quality, contaminated water, unsafe waste disposal, excessive noise, soil contamination, and other environmental hazards can contribute to disease, disability, discomfort, and environmental degradation. Effective environmental monitoring provides reliable evidence for identifying hazards, assessing exposure, determining health risks, enforcing environmental standards, and evaluating control measures.

The course is particularly relevant to students in Health Education, Environmental Health, Public Health, Physical and Health Education, Community Health, and related disciplines.

It develops practical competencies that enable graduates to participate in environmental assessment, health education, pollution prevention, community mobilisation, environmental advocacy, and evidence-based public health interventions.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts, principles, scope, and importance of environmental monitoring systems and techniques in environmental and public health.
2) Identify and classify major environmental hazards and select appropriate indicators and monitoring techniques for their assessment.
3) Demonstrate appropriate procedures for environmental sampling, measurement, preservation, transportation, and documentation.
4) Use and maintain basic environmental monitoring instruments and equipment while observing appropriate safety procedures.
5) Apply quality assurance and quality-control procedures to ensure the reliability and validity of environmental monitoring data.
6) Analyse and interpret environmental monitoring data and relate findings to relevant environmental health standards and potential health risks.
7) Design and communicate basic environmental monitoring programmes and use their findings to support environmental health education, pollution prevention, advocacy, and decision-making.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define and explain environmental monitoring systems and their applications in environmental and public health.
2) Identify and assess major environmental hazards and select suitable environmental indicators for monitoring.
3) Demonstrate basic environmental sampling and measurement techniques for air, water, soil, noise, waste, and other environmental parameters.
4) Operate and care for selected environmental monitoring instruments and apply appropriate calibration and safety procedures.
5) Apply quality assurance and quality-control principles during environmental sampling, measurement, and data collection.

6) Analyse, interpret, and report environmental monitoring data and determine their potential implications for human health.
7) Develop and implement a basic environmental monitoring plan for a school, workplace, community, or other selected environment.

COURSE CONTENT

- Introduction to Environmental Monitoring
- Environmental Monitoring Systems
- Environmental Hazards and Indicators
- Environmental Sampling Techniques
- Air Quality Monitoring
- Water Quality Monitoring
- Soil and Land Monitoring
- Noise and Vibration Monitoring
- Waste and Sanitation Monitoring
- Radiation and Electromagnetic Field Monitoring
- Environmental Microbiological Monitoring
- Environmental Monitoring Instruments
- Quality Assurance and Quality Control
- Environmental Data Management and Analysis
- Environmental Standards and Guidelines
- Environmental Risk Assessment

Meaning of environmental risk, Environmental Monitoring in Schools and Communities, Digital Environmental Monitoring, Environmental Monitoring and Climate Change, Environmental Monitoring Programme Development.

CATEGORY	DETAILS
Core Competencies	• Environmental Assessment • Sampling and Measurement • Instrumentation • Data Management • Quality Assurance • Environmental Risk Assessment • Problem-Solving • Communication • Digital Competency • Reporting
Core Values	• Environmental responsibility • Scientific integrity • Accuracy • Objectivity • Accountability • Professionalism • Safety consciousness • Sustainability • Respect for human life • Community participation • Transparency • Ethical conduct
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Workplace hazard identification exercises • Risk-assessment simulations • Practical PPE demonstrations • Workplace inspection exercises

CATEGORY	DETAILS
Learning Resources	• Texts and Reference Materials • Environmental health textbooks • Environmental monitoring manuals • Public health textbooks • Environmental standards and guidelines • WHO environmental health publications
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Bartram, J., & Ballance, R. (Eds.). *Water Quality Monitoring: A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes*. United Nations Environment Programme/World Health Organization.
2. World Health Organization. *Guidelines for Drinking-water Quality*. WHO.
3. World Health Organization. Current publications on air quality, environmental noise, water safety, environmental health, and environmental monitoring.
4. United Nations Environment Programme. Current publications on environmental assessment, pollution, ecosystems, and environmental monitoring.
5. Manahan, S. E. *Environmental Chemistry*. CRC Press.
6. Spellman, F. R. *Environmental Monitoring and Characterization*. Government Institutes.
7. Federal Ministry of Environment, Nigeria. Current environmental standards, regulations, monitoring guidelines, and environmental assessment publications.
8. National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigeria. Current environmental standards, regulations, and technical guidelines.
9. Relevant Nigerian environmental health and environmental monitoring reports.

HEE 524 Water Analysis

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Water Analysis is a course designed to provide learners with the knowledge, skills, and practical competencies required to assess the physical, chemical, biological, and microbiological characteristics of water and determine its suitability for drinking, domestic use, industrial purposes, agriculture, recreation, and environmental sustainability.

The course introduces learners to the principles of water sampling, sample preservation, laboratory and field analysis, interpretation of results, water-quality standards, pollution assessment, and public health implications of contaminated water. It covers important parameters such as temperature, colour, odour, turbidity, pH, electrical conductivity, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, hardness, alkalinity, nutrients, heavy metals, and microbiological indicators.

RELEVANCE STATEMENT

Safe and adequate water is fundamental to human health, sanitation, food production, economic development, and environmental sustainability. Contamination of water sources can expose populations to pathogens, toxic chemicals, heavy metals, and other hazards capable of causing waterborne diseases and long-term health problems.

Water analysis provides scientific evidence for determining the quality, safety, and suitability of water and for identifying sources and levels of contamination. The course is therefore highly relevant to students of Health Education, Environmental Health, Public Health, Community Health, Physical and Health Education, and related disciplines.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the principles, scope, importance, and applications of water analysis in environmental and public health.
2) Identify and describe the major physical, chemical, and microbiological characteristics of water and their significance to water quality.
3) Demonstrate appropriate techniques for water sampling, preservation, transportation, preparation, and laboratory handling.

4) Perform basic physical, chemical, and microbiological analyses of water using appropriate instruments, procedures, and safety precautions.
5) Apply quality assurance and quality-control procedures to ensure accuracy, reliability, and validity of water-analysis results.
6) Analyse and interpret water-quality data and compare findings with relevant national and international water-quality standards and guidelines.
7) Apply and communicate water-analysis findings to water-safety education, pollution prevention, risk assessment, disease prevention, and public health interventions.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Explain the principles and importance of water analysis in environmental health and public health.
2) Identify and classify major physical, chemical, and microbiological water-quality parameters and explain their health significance.
3) Collect, preserve, label, and transport water samples using appropriate standard procedures.
4) Conduct basic physical, chemical, and microbiological tests on water using appropriate equipment and laboratory techniques.
5) Apply appropriate laboratory safety, calibration, quality assurance, and quality-control procedures during water analysis.
6) Analyse, interpret, and report water-quality results and determine the suitability of water for specified uses.

COURSE CONTENT

Introduction to Water Analysis, Water Quality and Water Pollution, Water Sampling Techniques, Physical Analysis of Water, pH, Acidity and Alkalinity, Water Hardness and Major Ions, Dissolved Oxygen and Oxygen-Demand Parameters, Nutrients in Water, Heavy Metals and Toxic Substances, Microbiological Analysis of Water, Waterborne Diseases, Chemical Contaminants in Water, Laboratory Techniques and Equipment, Quality Assurance and Quality Control, Water Treatment and Analysis, Wastewater Analysis, Drinking-Water Quality, Water-Quality Standards and Guidelines, Data Analysis and Interpretation, Water-Quality Monitoring Programme

CATEGORY	DETAILS
Core Competencies	• Water-Sampling Competency • Laboratory Competency • Instrumentation Competency • Analytical Competency • Quality-Control Competency • Environmental Health Competency • Risk-Assessment Competency • Water-Safety Competency
Core Values	• Accuracy • Scientific integrity • Environmental responsibility • Safety consciousness • Accountability • Professionalism • Ethical conduct • Objectivity • Transparency • Community responsibility • Sustainability • Respect for human life • Evidence-based decision-making
Pedagogical Approaches	• Interactive lectures • Laboratory demonstrations • Practical laboratory sessions • Field water-sampling exercises • Case-study analysis • Problem-based learning • Group discussions • Water-quality investigation projects
Learning Resources	• Laboratory Equipment • pH meters • Turbidity meters

CATEGORY	DETAILS
	• Conductivity meters • Dissolved oxygen meters • Spectrophotometers • Analytical balances • Thermometers • Incubators • Microscopes • Titration equipment • Water-testing kits • Measuring cylinders • Pipettes • Burettes • Sampling bottles
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *Guidelines for Drinking-water Quality*. WHO.
2. American Public Health Association, American Water Works Association, & Water Environment Federation. *Standard Methods for the Examination of Water and Wastewater*.
3. Bartram, J., & Ballance, R. (Eds.). *Water Quality Monitoring: A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes*. UNEP/WHO.
4. Spellman, F. R. *Handbook of Water and Wastewater Treatment Plant Operations*. CRC Press.
5. Sawyer, C. N., McCarty, P. L., & Parkin, G. F. *Chemistry for Environmental Engineering and Science*. McGraw-Hill.
6. Manahan, S. E. *Environmental Chemistry*. CRC Press.

7. World Health Organization. Current publications on drinking-water safety, water-quality monitoring, waterborne diseases, and Water Safety Plans.
8. Federal Ministry of Water Resources and Sanitation, Nigeria. Current publications and guidelines on water quality, drinking-water safety, sanitation, and water-resource management.
9. National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigeria. Current environmental standards and regulations relevant to water quality and pollution control.

EHE 510 Geriatrics and Death Education

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Geriatrics and Death Education is a course designed to provide learners with foundational knowledge, skills, and appropriate attitudes for understanding the ageing process, health and wellbeing of older adults, end-of-life care, death, dying, bereavement, and grief. The course examines the physical, psychological, social, emotional, and spiritual dimensions of ageing and death, with emphasis on health promotion, disease prevention, independence, dignity, quality of life, and supportive care.

The course introduces learners to common health conditions affecting older adults, principles of geriatric care, healthy ageing, nutrition, physical activity, mental and social wellbeing, medication safety, abuse and neglect of older persons, palliative and end-of-life care, advance care planning, grief and bereavement, and culturally appropriate death education. It also prepares learners to communicate sensitively with older adults, families, caregivers, and communities about ageing, dying, death, and bereavement.

RELEVANCE STATEMENT

Population ageing is increasing the need for professionals who understand the health, social, emotional, and care needs of older adults. Older persons may experience chronic illnesses, functional limitations, loneliness, social isolation, cognitive changes, financial difficulties, abuse, and dependency. At the same time, death and dying are universal experiences that can generate fear, anxiety, grief, and cultural or ethical challenges for individuals, families, and communities.

Geriatrics and Death Education is therefore relevant to Health Education, Public Health, Community Health, Nursing, Physical and Health Education, and related disciplines. The

course equips learners to promote healthy ageing, prevent avoidable health problems, support caregivers, educate communities, and approach death and bereavement with knowledge, empathy, dignity, cultural sensitivity, and professionalism.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts, principles, scope, and importance of geriatrics, gerontology, healthy ageing, and death education.
2) Describe the physical, psychological, social, emotional, and functional changes associated with normal ageing and distinguish them from common pathological conditions.
3) Identify major health problems, risk factors, disabilities, and social challenges affecting older adults and discuss appropriate preventive and health-promotive measures.
4) Demonstrate appropriate communication, counselling, caregiving, and health-education approaches for older adults, families, and caregivers.
5) Explain the principles of palliative care, end-of-life care, death, dying, bereavement, grief, and loss.
6) Examine ethical, cultural, social, legal, and spiritual issues associated with ageing, dying, death, and bereavement.
7) Develop appropriate health-education and community-based interventions for promoting healthy ageing, dignified end-of-life experiences, and effective coping with grief and bereavement.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define and explain geriatrics, gerontology, ageing, healthy ageing, death education, palliative care, and end-of-life care.
2) Identify and describe normal age-related physical, psychological, cognitive, and social changes.
3) Recognise common health problems and risk factors affecting older adults and recommend appropriate preventive measures.
4) Demonstrate effective communication and health-education strategies for older adults and their caregivers.

5) Analyse ethical, cultural, legal, social, and spiritual issues related to ageing, death, and end-of-life care.
6) Design basic health-promotion, death-education, caregiver-support, and bereavement interventions for individuals, families, and communities.

COURSE CONTENT

- Introduction to Geriatrics and Gerontology
- Theories and Processes of Ageing
- Physical Changes Associated with Ageing
- Psychological and Cognitive Changes
- Common Health Problems of Older Adults
- Nutrition and Physical Activity in Older Adults
- Social and Environmental Issues of Older Adults
- Elder Abuse and Neglect
- Geriatric Health Promotion
- Geriatric Care and Caregiving
- Communication and Counselling of Older Adults
- Death Education
- Death
- Dying and the End-of-Life Process
- Palliative and End-of-Life Care
- Ethical and Legal Issues in Death and Dying
- Grief
- Bereavement and Loss
- Theories and Models of Grief
- Death
- Funeral Practices and Cultural Diversity
- Death Education and Health Education
- Practical Application

CATEGORY	DETAILS
Core Competencies	• Geriatric Health Assessment • Healthy Ageing Promotion • Communication • Counselling and Support • Caregiving • Death Education • Ethical Competence • Cultural Competence • Advocacy • Programme Development • Problem-Solving
Core Values	• Respect for human dignity • Compassion • Empathy • Patience • Respect for older persons • Integrity • Confidentiality • Professionalism • Cultural sensitivity • Tolerance • Non-discrimination • Autonomy • Justice • Responsibility • Kindness

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Case-study analysis • Role-play • Simulation • Reflective exercises • Storytelling and guided discussion • Problem-based` learning • Seminars
Learning Resources	• Textbooks and Reference Materials • Geriatric medicine and gerontology textbooks • Public health and health education textbooks • Palliative-care manuals • Bereavement and grief counselling texts
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. World Health Organization. *World Report on Ageing and Health*. WHO.
2. World Health Organization. *Decade of Healthy Ageing: Baseline Report*. WHO.
3. World Health Organization. Current resources on healthy ageing, integrated care for older people, age-friendly environments, and palliative care.
4. Hazzard, W. R., Halter, J. B., Ouslander, J. G., Tinetti, M. E., Studenski, S., High, K. P., & Asthana, S. *Hazzard's Geriatric Medicine and Gerontology*. McGraw-Hill.
5. Birren, J. E., & Schaie, K. W. (Eds.). *Handbook of the Psychology of Aging*. Academic Press.
6. Corr, C. A., Nabe, C. M., & Corr, D. M. *Death and Dying, Life and Living*. Cengage Learning.

7. Kübler-Ross, E., & Kessler, D. *On Grief and Grieving: Finding the Meaning of Grief Through the Five Stages of Loss*. Scribner.
8. Neimeyer, R. A. *Techniques of Grief Therapy: Assessment and Intervention*. Routledge.
9. International Association for Hospice and Palliative Care. Current resources on palliative and end-of-life care.

EHE 509 Curriculum Development & Innovation in Health Education

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Curriculum Development and Innovation in Health Education is a course designed to equip learners with the theoretical knowledge, practical skills, and professional competencies required to understand, design, develop, implement, evaluate, and continuously improve health education curricula. The course examines the principles, processes, models, components, determinants, and contemporary issues involved in curriculum development, with particular attention to the needs of learners, schools, communities, health systems, and society.

The course explores curriculum planning, needs assessment, curriculum design, objectives and learning outcomes, content selection and organisation, teaching and learning experiences, instructional resources, curriculum implementation, assessment and evaluation, curriculum review, innovation, technology integration, competency-based education, inclusive curriculum development, and emerging trends in health education.

RELEVANCE STATEMENT

Health challenges are constantly changing as a result of demographic transitions, emerging and re-emerging diseases, technological developments, environmental changes, changing lifestyles, and evolving social and cultural conditions. Consequently, health education curricula must be regularly reviewed and innovated to remain relevant, evidence-based, inclusive, practical, and responsive to the needs of individuals and communities.

This course is particularly relevant to students and professionals in Health Education, Public Health, Teacher Education, Physical and Health Education, Community Health, and related disciplines. It prepares learners to participate effectively in curriculum planning, implementation, evaluation, and innovation at school, community, institutional, and policy levels.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Explain the concepts, principles, foundations, scope, and importance of curriculum development and innovation in health education.
2) Examine major curriculum development models, theories, approaches, and processes and their application to health education.
3) Conduct basic health education needs assessments and use the findings to determine appropriate curriculum goals, objectives, content, and learning experiences.
4) Develop appropriate health education curricula by selecting, organising, sequencing, and integrating relevant content, learning experiences, instructional resources, and assessment strategies.
5) Apply innovative teaching approaches, digital technologies, competency-based education, and learner-centred strategies in health education curriculum implementation.
6) Evaluate health education curricula and identify areas requiring modification, improvement, innovation, or reform.
7) Design an innovative, inclusive, evidence-based, and contextually relevant health education curriculum or curriculum component that responds to contemporary health challenges.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1) Define and explain curriculum, curriculum development, curriculum innovation, curriculum reform, curriculum implementation, and curriculum evaluation.
2) Compare and apply major curriculum development theories, principles, and models to health education.
3) Conduct and interpret a basic health education needs assessment for curriculum planning.
4) Formulate appropriate curriculum goals, objectives, competencies, and learning outcomes for health education.
5) Design and organise health education content, learning experiences, teaching strategies, instructional resources, and assessment activities.
6) Evaluate existing health education curricula and recommend appropriate improvements and innovations.

7) Develop and present an innovative, inclusive, technology-supported health education curriculum or curriculum unit appropriate to a specific learner or community context.

COURSE CONTENT

- Concept of Curriculum
- Curriculum Development in Health Education
- Foundations of Health Education Curriculum
- Curriculum Development Models
- Curriculum Needs Assessment
- Curriculum Aims
- Goals
- Objectives and Learning Outcomes
- Selection and Organisation of Curriculum Content
- Organisation of Learning Experiences
- Curriculum Design and Planning
- Curriculum Implementation
- Teaching and Learning Strategies in Health Education
- Instructional Resources and Technology
- Assessment in Health Education Curriculum
- Curriculum Evaluation
- Curriculum Innovation
- Contemporary Innovations in Health Education
- Inclusive and Responsive Health Education Curriculum
- Emerging Health Issues and Curriculum Responsiveness
- Stakeholder Participation and Curriculum Governance

CATEGORY	DETAILS
Core Competencies	• Curriculum Planning • Needs Assessment • Curriculum Design • Curriculum Implementation • Curriculum Evaluation • Innovation and Creativity • Digital Competency • Assessment Competency • Research and Evidence Use • Communication • Collaboration • Problem-Solving
Core Values	• Professionalism • Creativity • Innovation • Accountability • Integrity • Equity • Inclusiveness • Respect for diversity • Learner-centredness • Collaboration • Critical thinking • Evidence-based practice • Lifelong learning • Adaptability

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions • Curriculum case studies • Problem-based learning • Project-based learning • Curriculum-design workshops • Brainstorming • Role-play • Microteaching • Peer review • Curriculum critique • Concept mapping • Simulation • Field visits
Learning Resources	• Curriculum Documents • National curriculum frameworks • Health education curriculum documents • Teacher education curriculum guidelines • Institutional curriculum templates • Course outlines • Curriculum evaluation reports • Education policies
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

1. Tyler, R. W. *Basic Principles of Curriculum and Instruction*. University of Chicago Press.

2. Taba, H. *Curriculum Development: Theory and Practice*. Harcourt, Brace & World.
3. Ornstein, A. C., & Hunkins, F. P. *Curriculum: Foundations, Principles, and Issues*. Pearson.
4. Posner, G. J. *Analyzing the Curriculum*. McGraw-Hill.
5. Print, M. *Curriculum Development and Design*. Allen & Unwin.
6. Wiggins, G., & McTighe, J. *Understanding by Design*. ASCD.
7. World Health Organization. Current resources on health education, health promotion, health literacy, school health, and health-promoting schools.
8. UNESCO. Current publications on curriculum development, curriculum innovation, education for sustainable development, digital education, and inclusive education.
9. Federal Ministry of Education, Nigeria. Current National Policy on Education, curriculum frameworks, and relevant curriculum-development guidelines.
10. Relevant National Commission for Colleges of Education (NCCE) curriculum documents and standards for teacher education and health-related programmes in Nigeria.

PROGRAMME 4 OF 6

Human Kinetics/Physical Education

Overview of Human Kinetic Education/Physical Education Programme

Human Kinetics Education is a multidisciplinary academic and professional programme that focuses on the scientific study of human movement, physical activity, exercise, sports, health, and their application to teaching, learning, and human performance. The programme prepares competent educators, coaches, exercise specialists, sports administrators, recreation managers, and researchers who can promote physical fitness, healthy lifestyles, sports excellence, and lifelong participation in physical activity.

The programme integrates knowledge from the biological, behavioural, educational, and social sciences to help students understand how the human body moves, adapts to exercise, acquires motor skills, and responds to physical activity. Students study disciplines such as anatomy, physiology, biomechanics, kinesiology, exercise physiology, motor learning, sports psychology, sports sociology, health education, nutrition, recreation, coaching, sports management, and curriculum studies.

Human Kinetics Education emphasises both theoretical knowledge and practical experiences. Students participate in laboratory work, sports and games, coaching practice, fitness assessment, teaching practice, research projects, seminars, and community engagement activities. The programme develops the pedagogical skills required to teach physical education effectively while also preparing graduates to promote health, manage sports programmes, and contribute to community development through physical activity and exercise.

Graduates are equipped with professional competencies in teaching, coaching, officiating, fitness assessment, programme planning, leadership, communication, research, and sports administration. The programme also fosters ethical conduct, innovation, teamwork, and lifelong learning, enabling graduates to adapt to the changing demands of education, sports, recreation, health promotion, and the global fitness industry.

Philosophy of Human Kinetic Education/Physical Education

The philosophy of the Human Kinetics Education programme is to produce professionally competent graduates who possess the scientific knowledge, pedagogical skills, practical competencies, and ethical values necessary to promote physical activity, healthy living, sports participation, and holistic human development. The programme is founded on the belief that regular physical activity and quality physical education are essential for improving physical, mental, emotional, and social well-being and for enhancing individual and national productivity.

Regulation (Programme Structure)

Admission and Graduation Requirements

Admission Requirements

i. Candidates with NCE cumulative grade point average (2.40-5.00) equivalent to Merit and above, shall continue into the 2-year Bachelor of Science Education degree programme.

ii. NCE candidates with cumulative grade point average (1.50-2.39) equivalent to Pass and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme.

Graduation Requirements

NCE Programme:_ Candidates for the award of NCE certificates are required, among others, to earn at least 22 credits in General Education courses, 6 credits in Teaching Practice, 12 credits in General Studies Education (totalling credits in the Education component of the NCE programme) and 103 credits in Human Kinetic Education/Physical Education to qualify for graduation, viz:

S/N	Component	Weight/credit load
	General Education	22
	Teaching Practice (TP)	06
	General Studies (GSE)	12

S/N	Component	Weight/credit load
	Human Kinetic Education/Physical Education	40
Total Units:		**80**

Total Minimum Credit Units Required for NCE graduation: **40 credit units**

Degree Programme: Candidates for the award of Bachelor Degree in Human Kinetic Education/Physical Education certificates are required among others, to earn at least 12 credits in General Education 4 credits in General Studies Education (totalling credits in the Education component of the B. Sc. Ed programme) and 102 credits in Health Education courses to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	General Education	12
2	General Studies (GSE)	04
3	Human Kinetic Education/Physical Education	54
Total Units:		**70**

National Goals of Human Kinetic Education/Physical Education

General Goals of Human Kinetic Education/Physical Education:

The objectives of Human Kinetic/Physical Education programme are to:

a) Produce competent Human Kinetics educators and professionals.

b) Develop scientific knowledge of human movement, exercise, and sports performance.

c) Prepare graduates to teach Physical and Human Kinetics Education effectively at different educational levels.

d) Promote healthy lifestyles through physical activity, exercise, and wellness education.

e) Develop practical skills in coaching, officiating, sports management, and recreation.

f) Equip students with competencies in exercise prescription, fitness assessment, and performance improvement.

g) Foster leadership, ethical conduct, teamwork, and professional responsibility.

h) Develop research skills for solving educational, sports, and health-related problems.

i) Promote innovation, entrepreneurship, and technology integration in sports and physical activity.

j) Prepare graduates for advanced studies and professional careers in education, sports, health, recreation, and exercise science

Relevance Statement for Human Kinetic Education/Physical Education

The Health Education programme is designed to prepare competent professionals with the knowledge, practical skills, and ethical values required to promote health, prevent diseases, and improve the quality of life of individuals and communities. The programme is highly relevant to national and global health priorities as it equips graduates to address contemporary public health challenges through health promotion, disease prevention, health communication, behavioural change, and community-based interventions.

The programme provides students with a strong foundation in public health, environmental health, nutrition, reproductive health, mental health, epidemiology, health promotion, and health education methodologies. This multidisciplinary preparation enables graduates to design, implement, monitor, and evaluate health education programmes that improve health literacy, encourage healthy lifestyles, reduce risk factors for communicable and non-communicable diseases, and strengthen preventive healthcare systems.

NCE-MAS (Minimum Academic Standards) for NCE Programme

Facilities

- **Play Areas, Courts and Fields**

Item	Minimum No. Required
Football field	1
Basketball court	1
Volleyball court	1
Handball court	1

Badminton courts (indoor)	1
Tennis courts	2
Large indoor teaching space (40m x 50m) for gymnastics	1
Swimming pool (where local resources permit)	1
Squash court	1
Hockey field	1
Cricket pitch	1
Gymnasium	1
Lecture Theatre (large, well ventilated)	1
Storage room (large, well ventilated)	1
Equipped Exercise Physiology Laboratory	1
6–8 lane standard athletic track	1
PHE Resource Centre (for Audio-Visual equipment for effective teaching of skills)	1
• **Equipment And Supplies**	
(A) **Gymnastics Items**	
Tripod (horses)	2
Agility boxes	2
Bucks	3
Landing mats	15
Take-off boards	2
Trampolines	2
Long benches	2
Agility mattresses	20
Horizontal bars	2
Agility rings	4
(B) **Exercise Physiology Laboratory Equipment**	

Digital sphygmomanometer	2
Cycle Ergometer	2
Skinfold calipers	2
Stethoscopes	2
Weights of different sizes	2 sets
Balance Beam	2
Flex meter	2
Padded tables	2
Step Benches	2
Tapes, 30m, 50m, & 100m	3 each
Stopwatches etc.	15
(C) **Athletics**	
Starting blocks	10
Starting guns	4
Javelin (male)	4
Javelin (female)	4
Shot puts	4
Discus (male)	4
Discus (female)	4
Tracksuits	6
Pairs of high jump stands	4
Aluminium crossbars	4
Landing foams for high jump and pole-vaults	40 pairs
Canvases	20 pairs
Shin guards	20 pairs
Stockings etc.	8 pairs

Exchange batons	60
Hurdle stands	10
(D) **Ball Games**	
Soccer balls	10
Inflators	2
Handballs (male)	10
Handballs (female)	10
Volleyballs	10
Basketball (Male and Female)	10
Hockey balls	10
Handball Protectors	6
Table Tennis tables	4
Table Tennis eggs	12
Cricket kits, balls, bats, protective devices	2 sets
(E) **Racket Games, etc.**	
Tennis rackets	12
Badminton rackets	12
Hockey sticks	30
Table tennis bats	12
Hockey keeper kits	2 sets
(F) **Books, Journals and Periodicals**	
It is recommended that at least fifteen (15) book titles on each of the following areas and six (6) journals in each area be made available to compliment teachers' efforts:	
Exercise Physiology	
Principles of physical education	
Nutrition and sports	

Women and sports	
Sports psychology	
Movement education	
Administration of sports	
Coaching techniques (all sports)	
Sport officiating (all sports)	
Health Education	
Sociology of sports	
Biomechanics of sports	
Human anatomy	
Human physiology	
Drug education	
Adapted Physical Education	
Sports Injuries and Management	
Recreation	
Methods and materials in Physical and Health Education	
Tests and measurements	
(G) **General Supplies for all Sports**	
Stopwatches	10
Measuring tapes	2
Weighing scales	5
Maintenance equipment	5
Whistles (all kinds)	12
Recording sheets – For all sports	
Sleeping bags	16
Mosquito nets	35

Tents	160
Camp bed	160
Life jackets	3
First Aid boxes	3
Multi Gym	35
Back Packs	20
Tape recorders	2
Empty tapes – All systems	
Anatomy and Physiology charts – All systems	
Physiology Models – All systems	
Stove	3
Lanterns	16
Camping boots	1 set
Television set	1 set
Video set	1 set
A set of multimedia computer + CD's	2
Lawn mowers	5
Wheel Barrows	5
Flags (various colours) – As required	
Scoring boards for various games – As required	

Staff Offices

Each senior staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (typists, clerks) with relevant equipment e.g. duplicating machines, Computers, Photocopier.

Books in the Library

There must be enough books to cover all the areas of the subject in the ratio of one student to ten books minimum. The conditions under (F) above should be adhered to in all cases.

Personnel

Academic Staff

A minimum of twelve (12) academic staff for Double Major subject combination, each with a qualification of not less than a bachelor's degree in Physical and Health Education. The Head of Department should have a Higher Degree and be at least of the rank of a Senior Lecturer. It is encouraged to have at least one female Lecturer in the Department. The qualification should not be less than Second Class Lower division.

Training and retraining of personnel in PHE should take cognisance of the various areas of specialisation i.e. Health, Physical Education, Exercise physiology, Sport Management, Recreation etc.

Other Personnel

i) A minimum of 5 grounds men
ii) A minimum of 1 lab attendant/assistant
iii) A minimum of 1 sports equipment curator
iv) A computer operator
v) A Secretary
vi) One Office Assistant/attendant
vii) One Cleaner
viii) A Sports instructor should be attached to the PHE department

Pedagogical Approaches, Modes of Assessment and Instructional Materials for Human Kinetic Education/ Physical Education

Human Kinetic Education/Physical Education delivery relies on student-centred instruction, continuous skill-based evaluation, and multi-format learning resources to engage large, diverse student cohorts effectively.

Pedagogical Approaches

Modern General Education shifts away from passive rote learning toward interactive frameworks that build critical thinking and collaborative problem-solving skills.

i. **Active Learning:** Employs techniques such as Think-Pair-Share, peer instruction, and interactive class polling to engage large lecture classes directly.

ii. **Problem-Based & Case-Based Learning (PBL):** Uses real-world scenario analysis (e.g. ethical dilemmas, environmental challenges) to teach cross-disciplinary problem-solving.

iii. **Flipped Classroom:** Assigns foundational readings or short recorded lectures prior to class, reserving live contact hours for structured discussions, debates, and practical application.

iv. **Interdisciplinary & Seminar-Style Instruction:** Facilitates guided debates, panel discussions, and collaborative projects that bridge the humanities, social sciences, and natural sciences.

v. **Service-Learning & Community Engagement:** Integrates community-focused projects (such as local civic initiatives or public health campaigns) into course activities to foster social responsibility.

vi. Experiential Learning

vii. Blended Learning

viii. Discussion and Dialogue

ix. Project-based Learning

x. UDL & SEL Based Teaching

xi. Reflective practices

Modes of Assessment

Assessment in General Education combines ongoing diagnostic evaluation with comprehensive knowledge testing to evaluate both core concepts and soft skills.

Assessment Category	Type	Purpose and Specific Methods
Formative Assessment	Continuous (Assessment *for* Learning)	Evaluates ongoing progress through weekly reflections, quick quizzes, class participation rubrics, and draft feedback.

Assessment Category	Type	Purpose and Specific Methods
Summative Assessment	Outcome-Based (Assessment *of* Learning)	Measures cumulative mastery via midterm/final exams, analytical essays, capstone research papers, or term projects.
Performance Assessment	Skill-Based & Authentic	Tests practical capabilities through oral presentations, structured group debates, e-Portfolios, and multimedia exhibits.
Peer & Self-Assessment	Reflective	Builds metacognitive awareness using peer-review rubrics for group work and individual self-reflection logs.

Instructional Materials

Instructors utilise a mix of print, digital, and practical tools to accommodate varied learning styles and maintain access across large student populations.

i. **Core Courseware & Textbooks:** Standardised multi-author textbooks, customised institutional readers, and Open Educational Resources (OER) like OpenStax to minimise financial barriers.

ii. **Digital & Multimedia Resources:** Video lectures, podcasts, documentary clips, interactive simulations (e.g. virtual labs for non-science majors), and slide decks.

iii. **LMS Platforms:** Canvas, Moodle, or Google Classroom for automated quiz administration, discussion boards, rubric distribution, and assignment submission.

iv. **Primary Sources & Applied Datasets:** Historical manuscripts, policy briefs, case study archives, and real-world datasets for quantitative analysis.

v. **Assessment Aids:** Scoring rubrics, writing guides, citation manuals, and peer-evaluation templates provided directly to students at the start of the course.

Dual Mandate Curriculum Course Distribution Structure for Human Kinetic Education/Physical Education (100–500) Levels)

Curriculum Design Framework

The Health Education component of the teacher education programme under the Dual Mandate covers the following **Three key areas**: General Education, General Studies Education (GSE), and Human Kinetic Education/Physical Education. Courses for the NCE programme were also properly aligned with the Bachelor of Education degree, education

component to ensure that there are no repetitions on the one hand and systematic progression is guaranteed during implementation. The courses for the NCE programmes, therefore, naturally dovetail into the degree ones. The NCE Health Education curriculum component is as shown in the table below and the subsequent description of the courses:

NCE Course Distribution (100–300 Level)

Compulsory Courses

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30	-
EDU 112	Educational Psychology	2	C	30	-
GSE 111	General English 1	1	C	15	-
GSE 112	Introduction to Library Studies	1	C	15	-
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15	-
BIO 101	General Biology I	2	C	30	-
CHE 111	General Chemistry 1	2	C	30	-
MAT 111	General Mathematics I (Number Theory)	2	C	30	-
PHY 111	General Physics I	2	C	30	-
HKE 101	Foundations of Physical Education, Exercise and Sport Development	2	C	30	-
HKE 103	Fundamentals of Human Anatomy and Physiology	2	C	15	-
Total		**19**			

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30	30
GSE 121	English Proficiency for Teachers	1	C	15	15
GSE 122	Digital Literacy & AI for Educators	1	C	15	15

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 123	Media and Information Literacy I	1	C	15	15
BIO 121	General Biology II	1	C	30	-
CHE 121	General Chemistry II	1	C		
MAT 102	General Mathematics II (Algebra and Trigonometry)	2	C		
PHY 102	General Physics II	1	C		
HKE 102	Skill Development and Techniques of (Track and Field Events)	2	C	15	45
HKE 104	Skill Development and Techniques in Gymnastics	2	C	15	45
HKE 106	Inclusive Physical Education and Sport	2	C	15	45
Total		**18**			

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 211	Classroom Management	1	C	15	
EDU 212	Curriculum and Curriculum Delivery	2	C	30	
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30	
GSE 211	General English II	1	C	15	
GSE 212	Introduction to Foundational Literacy	1	C	15	
GSE 213	Media and Information Literacy II	1	C	15	
HKE 201	Skill Development and Techniques in Swimming	2	C	15	45
HKE 203	Organisation and Administration and Facility Construction in Sport	2	C	30	
HKE 213	Coaching and Officiating of Sports	2	C	15	30
Total		**14**			

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	
EDU 222	Educational Administration, Planning and Supervision	1	C	15	
EDU 223	Introduction to Educational Technology	1	C	15	
EDU 224	Micro Teaching: II (Practicum)	2	C	30	
GSE 221	Introduction to Foundational Numeracy	1	C	15	
GSE 222	Entrepreneurship and Green Skills	1	C	15	
HKE 202	Introduction to Biomechanics and Kinesiology	2	C	15	
HKE 223	Citizenship and Leadership Training	3	C		120
Total		**13**			

NCE 300 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 311	Teaching Practice (TPD)	6	C	90	90
Total		**6**			

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	
GSE 321	Global Citizenship Education and Political Economy	1	C	15	
HKE 321	Introduction to Psychology and Sociology of Sports & Exercise	2	C	30	
HKE 322	Exercise Physiology	2	C	30	

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
HKE 323	Combat Sport, Traditional Sport and Dance Education	2	C	30	
Total		**10**			

The following are the core courses for general education, general studies, entrepreneurship as stipulated and Human Kinetic Education/Physical Education in the NUC Benchmark Minimum Academic Standards. These courses must be taught in Years 4 and 5 of all bachelor's degree programmes in Human Kinetic Education/Physical Education under the Dual Mandate Minimum Academic Standards.

Degree Course Distribution (400–500 Level)

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 412	Peace and Conflict Resolution	2	C	30	
SED 411	Methods of Teaching Physical Education	2	C	30	
HKE 403	Business of Sport Management and Communication, Community Recreation, Leisure and Tourism	2	C	30	
HKE 412	Communicable and Non-Communicable Diseases	2	C	30	
HKE 413	Application of Computer Skills & Informatics in Health Education	2	C	30	
HKE 420	First Aid, Accident Prevention and Safety Education	2	C	20	
HKE 421	Life Skills and Skilled Based Health Education	3	C	30	90
Total		**15**	**2**		

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 402	Educational Measurements, Tests, Research Methods and Statistics	3	C	45	45
ENT 412	Venture Creation	3	C	30	30
HKE 402	Physical Activity, Wellness Exercise Physiology and Physical Conditioning	3	C	15	45
HKE 404	Skill Development and Techniques in Selected Racquet and Stick Games	3	C	15	45
HKE 405	Research Methods and Statistics in Sports Exercise and Physical Activity	3	C	30	
HKE 423	Substance Use and Abuse Prevention	2	C	30	
HKE 424	Recreational Management	2	C	20	
Total		**19**			

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 501	Teaching Practice	6	C	90	90
SED 511	Science Technology and Society	2	C	30	
HKE 501	Alcohol and Drugs and Doping in Sports	3	C	30	
HKE 511	Skill Development and Techniques in Selected Ball Games	3	C	15	45
HKE 512	Introductory Sports Biomechanics	3	C	60	
HKE 513	Physiology of Exercise	3	C	60	
HKE 521	Organisation and Administration of Physical Education and Sports	3	C	30	
Total		**23**			

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 500	Research Project	3	C	45	45
HKE 502	Nutrition in Sport and Exercise	2	C	30	
HKE 503	Psychology of Coaching and Mental Skill Training	2	C	15	45
HKE 504	Test, Monitoring and Evaluation in Sport and Physical Education	2	C	15	45
HKE 526	Sports Officiating	2	C	15	60
EMT 521	Environmental Education and Awareness	2	C	30	
Total		**13**			

NCE Course Descriptions (100–300 Level)

Course Contents

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology I introduces students to the fundamental principles of biology that underpin the study of living organisms. The course examines the structure and organisation of cells, the functions of cellular organelles, and the characteristics and classification of living things. It also explores the concepts of chromosomes, genes, heredity, reproduction, evolution, ecological principles, and interactions among organisms. Students will gain a solid foundation in biological concepts necessary for advanced studies in biology and related disciplines.

COURSE OBJECTIVES

The objectives of this course is to:

1. Provide students with a fundamental understanding of the structure, organisation, and functions of cells and their organelles.
2. Introduce the characteristics, classification, and modes of reproduction of living organisms.
3. Explain the ecological relationships and interactions among organisms and their environment.
4. Familiarise students with the basic principles of heredity and evolution.
5. Expose students to the different habitat types and their distinguishing characteristics.
6. Develop students' understanding of the fundamental concepts and principles of general biology.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

1. Explain cells structures and organisations;
2. Summarise functions of cellular organelles;

3. Characterise living organisms and state their general reproduction;
4. Describe the interrelationship that exists between organisms;
5. Discuss the concept of heredity and evolution; and
6. Enumerate habitat types and their characteristics

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Observation • Classification of living things • Evaluation • Application.
Core Values	• Curiosity • Integrity • Diligence • Responsibility • Conservation • Team work
Pedagogical Approaches	• Inquiry-based learning • Demonstration • Group discussion • Group work • Case study
Learning Resources	• Biology text book, charts, model • Specimens • Multimedia facilities • Microscope, prepared slides • Laboratory manual • Cultures • Herbarium specimens
Assessment Methods	• Lab and field report • Class presentation of findings.

Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

CHE 111 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course provides a foundational understanding of the fundamental principles and concepts of chemistry. It examines atoms, molecules, elements, compounds and chemical reactions, with emphasis on modern electronic theory, electronic configuration, periodicity and the development of the periodic table. The course also covers chemical bonding, hybridisation, molecular shapes, intermolecular forces, valence forces and the structure of solids. Students are introduced to chemical equations, stoichiometry, kinetic theory of matter, properties of gases, elementary thermochemistry, reaction rates, chemical equilibrium and basic thermodynamics. Further topics include acids, bases and salts, redox reactions, introductory electrochemistry and radioactivity. The course combines conceptual understanding with appropriate calculations and applications to develop a strong foundation for further study of chemistry.

RELEVANCE STATEMENT

A sound knowledge of general chemistry is essential for understanding more advanced areas of chemistry and its applications in science, technology, health, agriculture and industry. The course equips students with the fundamental concepts, principles and problem-solving skills required to interpret chemical phenomena, perform quantitative chemical calculations and relate microscopic properties of matter to observable behaviour. It also provides the necessary foundation for subsequent courses in organic, inorganic, physical, analytical and environmental chemistry.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of atoms, molecules, elements, compounds and chemical reactions;
2. Describe the modern electronic structure of atoms, electronic configurations and periodic trends;

3. Explain chemical bonding, hybridisation, molecular shapes, intermolecular forces and the structure of solids;
4. Write and balance chemical equations and solve quantitative problems involving stoichiometry;
5. Explain the basic principles of kinetic theory, gases, thermochemistry, reaction rates, equilibrium and thermodynamics;
6. Explain the concepts of acids, bases, salts, redox reactions, electrochemistry and radioactivity and relate them to practical applications.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;
4. Justify the trends of atomic radii, ionisation energies, electronegativity of the elements based on their position in the periodic table;
5. Identify and balance oxidation – reduction equation and solve redox titration problems;
6. Illustrate shapes of simple molecules and hybridised orbitals;
7. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. Apply the principles of equilibrium to aqueous systems using le chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. Determine rates of reactions and its dependence on concentration, time and temperature.

COURSE CONTENT

- Atoms, molecules, elements and compounds and chemical reactions
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table
- Hybridisation and shapes of simple molecules

- Valence Forces
- Structure of solids
- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter
- Elementary thermochemistry: rates of reaction, equilibrium and thermodynamics
- Acids, bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry
- Radioactivity

CATEGORY	DETAILS
Core Competencies	• Knowledge • Analysis • Application
Core Values	• Objectivity and scientific inquiry • Innovation • Scientific curiosity • Integrity and discipline
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Problem-solving sessions • Use of simulations and charts.
Learning Resources	
Assessment Methods	• Class tests • Quizzes • Assignments • Oral • Questioning • Continuous assessment.

REFERENCES AND FURTHER READING

1. Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2018). *Chemistry: The central science* (14th ed.). Pearson.
2. Chang, R., & Goldsby, K. A. (2016). *Chemistry* (12th ed.). McGraw-Hill Education.
3. Ebbing, D. D., & Gammon, S. D. (2017). *General chemistry* (11th ed.). Cengage Learning.
4. Flowers, P., Theopold, K., Langley, R., & Robinson, W. R. (2019). *Chemistry 2e*. OpenStax.
5. Kotz, J. C., Treichel, P. M., Townsend, J. R., & Treichel, D. A. (2015). *Chemistry & chemical reactivity* (9th ed.). Cengage Learning.
6. Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2024). *General chemistry: Principles and modern applications* (12th ed.). Pearson.

MAT 111 General Mathematics I (Number Theory)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

This course introduces students to the fundamental concepts of number theory and mathematical structures. It focuses on the properties and operations of numbers, including integers, primes, divisibility, congruences, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real-life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem-solving.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Demonstrate a proper understanding of the number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility, and congruence.
3. Appreciate and utilise the applications of numbers in real-life situations.
4. Solve problems using principle of mathematical induction Define and analyse congruences, including reflexive, symmetric, and transitive properties.

5. Define and analyse congruence, including reflexive, symmetric, and transitive properties

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and apply the process of counting and the use of ordered pairs (Peano's Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.
3. Explore further properties of integers, including well-ordering principle and divisibility.
4. Apply mathematical induction in proving theorems and laws.
5. Understand primes, relatively prime integers, and unique factorisation.
6. State and prove the fundamental theorem of arithmetic.
7. Define and analyse congruences, including reflexive, symmetric, and transitive properties.
8. Work with residue classes and solve linear congruences using basic theorems.
9. Apply Fermat's theorem, Euler's function, and related concepts to problems in number theory.
10. Demonstrate an understanding of the use of numbers in solving practical and theoretical problems.

CATEGORY	DETAILS
Core Competencies	• Creativity • Innovation 3.Reflective thinking • Critical thinking • Communication • Collaboration • Innovation • Reflective thinking • Self-development

CATEGORY	DETAILS
Core Values	• Integrity • Respect • .3. Team spirit • Perseverance • Transparency • Tolerance • Honesty
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms
Assessment Methods	• Continuous Assessment • Formative Assessment • Digital assessment (Blended/Online Assessment) • Summative assessment • **Readings** • Class work • Assignment

Suggested

1. ***Current textbook on An Introduction to the Theory of Numbers.***
2. Use of online Resources.

PHY 111 General Physics I (Mechanics)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Physics: Mechanics is an introductory course that provides students with fundamental knowledge of the principles governing the motion and interaction of physical

bodies. The course examines the basic concepts of space, time, motion, force, mass, energy and momentum, and applies mathematical principles to describe and predict the behaviour of mechanical systems. Topics include units and dimensions, vectors and scalars, kinematics, dynamics, Newton's laws of motion, work, energy and power, momentum and collisions, circular motion, gravitation, equilibrium, elasticity, simple harmonic motion and an introduction to fluid mechanics. Emphasis is placed on problem-solving, practical investigation, experimentation and the application of mechanics to everyday life, technology and other scientific disciplines.

Course-Relevant Statement

Mechanics is fundamental to the study of physics and many related disciplines, including engineering, technology, environmental science, medicine and education. A sound understanding of mechanics enables students to explain natural phenomena, analyse physical systems and develop quantitative problem-solving skills. The course is particularly relevant to students preparing for advanced studies in physics and science-related programmes because it provides the conceptual and mathematical foundation required for subsequent courses in electricity, magnetism, thermodynamics, waves and modern physics.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts and principles of mechanics.
2. Distinguish between scalar and vector quantities and perform basic vector operations.
3. Describe and mathematically analyse linear, projectile, circular and rotational motion.
4. Apply Newton's laws of motion to solve problems involving forces and equilibrium.
5. Explain the concepts of work, energy and power and apply the principle of conservation of energy.
6. Analyse momentum, impulse and collisions using appropriate physical principles.
7. Explain the principles of gravitation and apply them to planetary and satellite motion.
8. Describe elasticity and the mechanical properties of materials.
9. Explain simple harmonic motion and identify its basic characteristics.
10. Apply basic principles of fluid mechanics to simple physical situations.
11. Use appropriate mathematical techniques, graphs and equations to solve mechanics problems.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Define and correctly use fundamental mechanical quantities, units and dimensions.
2. Represent and resolve vectors and use them in solving mechanics problems.
3. Calculate displacement, velocity, acceleration and related quantities from physical data and graphs.
4. Solve problems involving uniformly accelerated motion and projectile motion.
5. Apply Newton's laws to determine forces, acceleration and conditions for equilibrium.
6. Calculate work done, kinetic energy, potential energy and power in mechanical systems.
7. Apply conservation laws of energy and momentum to physical problems.
8. Analyse collisions and explain the relationship between impulse and change in momentum.
9. Explain circular and rotational motion and solve basic related problems.
10. Apply Newton's law of universal gravitation to simple planetary and satellite problems.
11. Explain elasticity and determine basic mechanical properties of materials from experimental data.
12. Describe simple harmonic motion and calculate its basic parameters.
13. Explain elementary principles of pressure, density, buoyancy and fluid flow.
14. Design and perform simple mechanics experiments using appropriate measuring instruments.

COURSE CONTENT

- Space and time
- Units and dimension
- Vectors and Scalars
- Differentiation of vectors
- Displacement
- Velocity and acceleration
- Kinematics
- **Newton laws of motion:** Inertial frames, Impulse, force and action at a distance, momentum conservation

- Relative motion
- Application of Newtonian mechanics
- Equations of motion
- Conservation principles in physics
- Conservative forces
- Conservation of linear momentum
- Kinetic energy and work
- Potential energy
- System of particles
- Centre of mass
- Rotational motion
- Torque
- Vector product
- Moment
- Rotation of coordinate axes and angular momentum
- Polar coordinates
- Conservation of angular momentum
- Circular motion
- Moments of inertia
- Gyroscopes and precession
- Gravitation
- Newton’s Law of Gravitation
- Kepler’s Laws of Planetary Motion
- Gravitational Potential Energy
- Escape velocity
- Satellites motion and orbits

CATEGORY	DETAILS
Core Competencies	• Scientific reasoning • Problem-solving competence • Mathematical competence • Experimental competence • Measurement competence • Data analysis competence • Critical-thinking competence
Core Values	• Accuracy and precision • Honesty and integrity • Curiosity • Creativity and innovation • Teamwork and cooperation • Respect for safety rules • Responsibility and accountability • Critical and independent thinking
Pedagogical Approaches	• Interactive lectures • Problem-based learning (PBL) • Inquiry-based learning • Practical/laboratory learning • Demonstration method • Collaborative learning • Project-based learning • Simulation-based learning

CATEGORY	DETAILS
Learning Resources	• Laboratory equipment • Metre rules and measuring tapes • Stopwatches • Masses and balances • Spring balances • Trolleys and dynamics tracks • Pulley systems • Inclined-plane apparatus • Simple pendulum apparatus • Projectile-motion apparatus • Elastic springs
Assessment Methods	• Short quizzes and classroom exercises. • Numerical and conceptual problem-solving tests • Graph construction and interpretation. • Mid-semester examinations. • End-of-semester written examinations.

Halliday, D., Resnick, R., & Walker, J. (2021). *Fundamentals of Physics* (12th ed.). Wiley.

Serway, R. A., & Jewett, J. W. (2018). *Physics for Scientists and Engineers with Modern Physics* (10th ed.). Cengage Learning.

HKE 101 Foundations of Physical Education, Exercise and Sport Development

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Foundations of Physical Education, Exercise and Sport Development is an introductory course that examines the philosophical, historical, sociological, scientific, and professional foundations of physical education, exercise science, and sports. It provides students with a broad understanding of how physical activity has evolved from traditional forms of recreation to modern educational, competitive, and health-promoting practices. Students are introduced to the various disciplines within physical education, including exercise physiology, biomechanics, sports psychology, sports sociology, sports management,

adapted physical education, and sports medicine. The course further discusses the role of physical education in schools, communities, and national development, emphasising its contribution to healthy lifestyles, character formation, leadership, and economic development.

RELEVANCE STATEMENT

The course equips students with foundational knowledge necessary for advanced studies in physical education, sports science, exercise physiology, coaching, sports management, recreation, and health promotion. It enables future teachers, coaches, administrators, and researchers to understand the scientific principles and educational values underpinning physical activity.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain the meaning and scope of physical education, exercise, and sports.
2. Describe the philosophical and historical foundations of physical education.
3. Discuss the development of physical education and sports in Nigeria and other countries.
4. Differentiate among physical education, physical activity, exercise, recreation, leisure, dance, and sports.
5. Explain the biological, psychological, sociological, and educational foundations of physical education.

LEARNING OUTCOMES

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:

1. Demonstrate a comprehensive understanding of the foundations of physical education.
2. Analyse the historical development of sports and exercise.
3. Apply scientific principles to physical activity and exercise.
4. Evaluate the educational and social value of sports.
5. Explain the relationship between physical activity and health.
6. Identify emerging trends and challenges in sports development.
7. Recommend strategies for improving physical education and sports programmes in educational institutions and communities.

8. Describe the nature, structure, and scope of physical education, exercise and sport;
9. Identify the foundations, careers and professional considerations and opportunities therein; and
10. Explain the goals, principles and objectives of physical education, sport and exercise.

COURSE CONTENT

- Definitions and scope of physical education, sport and exercise
- Structure and principles, goals and objectives
- Philosophy of health and physical activity in our society
- Historical foundations, motor behaviour and biomechanical foundations
- Exercise physiology and fitness, sociological foundations, sport and exercise psychology
- Physical education and pedagogy, career and professional development, teaching and coaching careers as they contribute to sports development
- Biological Foundations, Psychological Foundations, Sociological Foundations, Scientific Foundations of Exercise, Components of Physical Fitness, Recreation and Leisure Studies, Sports Development and Administration, International Sports Organisations, Olympic Movement, Sports Ethics and Fair Play, Sports Injuries and Safety, Contemporary Issues in Physical Education, and Career Opportunities in Physical Education and Sports

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking

CATEGORY	DETAILS
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility • Commitment to Health and Wellness • Respect and Sportsmanship • Critical Thinking and Lifelong Learning • Safety and Risk Awareness • Community Service and National Development • Environmental Responsibility
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations • Field Visits and Experiential Learning • Technology-Enhanced Learning • Independent Study and Reflective Learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.

Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.

Freeman, W. H. (2014). Physical Education, Exercise and Sport Science in a Changing Society. Jones & Bartlett Learning.

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Hardman, K., & Green, K. (Eds.). (2011). Contemporary Issues in Physical Education: International Perspectives. Meyer & Meyer Sport.

Lumpkin, A. (2017). Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.). McGraw-Hill Education.

Lumpkin, A. (2017). Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.). McGraw-Hill Education.

McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise Physiology: Nutrition, Energy, and Human Performance. Lippincott Williams & Wilkins.

Nixon, H. L., & Jewett, A. E. (1980). An Introduction to Physical Education. Saunders College Publishing.

Sharkey, B. J., & Gaskill, S. E. (2013). Fitness and Health. Human Kinetics.

Wuest, D. A., & Bucher, C. A. (2019). Foundations of Physical Education, Exercise Science, and Sport (20th ed.). McGraw-Hill Education.

Wuest, D. A., & Bucher, C. A. (2019). Foundations of Physical Education, Exercise Science, and Sport (20th ed.). McGraw-Hill.

National Policy on Education (Federal Republic of Nigeria).

National Sports Development Code of Nigeria.

HKE 103 Fundamentals of Human Anatomy and Physiology

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

Fundamentals of Human Anatomy and Physiology is an introductory course that provides students with a comprehensive understanding of the structure (anatomy) and function (physiology) of the human body. It introduces the organisation of the human body from the cellular level to the organ systems and explains how these systems work together to maintain life through homeostasis. The course serves as a foundation for students in Physical Education, Health Education, Exercise and Sport Science, Nursing, Medicine, Biology, and other health-related disciplines. It emphasises the relationship between body structure and function and the physiological changes that occur during physical activity, growth, development, and ageing.

RELEVANCE STATEMENT

The course Fundamentals of Human Anatomy and Physiology is highly relevant as it provides students with the foundational knowledge of the structure and functions of the human body, which is essential for understanding health, physical activity, and human performance. It equips learners with the scientific principles necessary to appreciate how body systems interact to maintain normal physiological functions and respond to exercise, disease, and environmental changes.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Define anatomy and physiology and explain their relationship.
2. Describe the levels of structural organisation of the human body.
3. Explain the concept of homeostasis and its importance.
4. Identify the major body systems and describe their structures and functions.
5. Explain the anatomy and physiology of the skeletal and muscular systems.
6. Apply anatomical and physiological knowledge to health promotion and disease prevention.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Identify the characteristics of the anatomy and physiology systems to sport performance and health related activities of human;
2. Describe the anatomical structure of human in relation to sport performance and health related activities;
3. Identify the various components of the anatomy and physiology systems in relation to sport performance and health related activities of human; and
4. Explain the functions of the physiology systems to sport performance and health related activities of human.

COURSE CONTENT

- Structure and functions of the human body
- Circulatory system: Blood and lymphatic systems
- Blood type
- Cardiovascular system
- Anatomy of heart and cardiac conduction system
- Cardiac cycle, blood vessels, blood pressure, exercise and the heart
- Cadio-Pulmonary-resuscitation and heart attacks
- Nervous systems
- Overview of central nervous system, peripheral nervous system, and autonomic nervous systems
- Nervous tissue and organs and neural reflexes
- Neural transmission concussion, brain injury, nerve regeneration
- Bones and joints of the axial and appendicular skeleton, bone formation, bone injury and fractures
- Joint replacements and reconstructions
- Cells, tissues and organs of the following systems: endocrine, respiratory, digestive, urinary, reproductive system
- The emphasis of the concept of both anatomy and physiology in this course is the relevance in sport, exercise and physical fitness

CATEGORY	DETAILS
Core Competencies	• Scientific literacy in human anatomy and physiology. • Observation and analytical skills. • Critical thinking and problem-solving abilities. • Practical laboratory and measurement skills. • Communication and teamwork skills. • Ethical awareness in health and biological sciences.
Core Values	• Human movement and biomechanics. • Muscle actions during exercise. • Cardiovascular adaptations to training. • Respiratory efficiency during physical activity. • Energy systems used during sports. • Injury prevention and rehabilitation. • Physical fitness assessment. • Exercise prescription. • Sports performance enhancement
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations • Field Visits and Experiential Learning • Technology-Enhanced Learning • Independent Study and Reflective Learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Guyton, A. C., & Hall, J. E. (2021). *Textbook of Medical Physiology (14th ed.)*. Elsevier.

Marieb, E. N., & Hoehn, K. (2023). *Human Anatomy & Physiology (12th ed.)*. Pearson.

Martini, F. H., Nath, J. L., & Bartholomew, E. F. (2024). *Fundamentals of Anatomy & Physiology (12th ed.)*. Pearson.

Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2022). *Clinically Oriented Anatomy (9th ed.)*. Wolters Kluwer.

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Saladin, K. S. (2024). *Anatomy & Physiology: The Unity of Form and Function (10th ed.)*. McGraw-Hill Education.

Seeley, R. R., Stephens, T. D., & Tate, P. (2023). *Anatomy & Physiology (12th ed.)*. McGraw-Hill Education.

Standring, S. (Ed.). (2024). *Gray's Anatomy: The Anatomical Basis of Clinical Practice (43rd ed.)*. Elsevier.

Tortora, G. J., & Derrickson, B. (2021). *Principles of Anatomy and Physiology (16th ed.)*. John Wiley & Sons.

HKE 105 Introduction to Psychology and Sociology of Sport and Exercise

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introduction to Psychology and Sociology of Sport and Exercise is an interdisciplinary course that examines the psychological and sociological factors that influence participation, performance, and behaviour in sport, exercise, and physical activity. The course explores how individual thoughts, emotions, motivation, personality, and mental processes interact with social institutions, culture, gender, media, family, and community to shape experiences in sport and exercise. The course introduces students to the fundamental theories and principles of sport psychology and sport sociology, emphasising their application in enhancing athletic performance, promoting lifelong physical activity, improving mental well-being, fostering social inclusion, and understanding the broader role of sport in society.

RELEVANCE STATEMENT

For students of Physical Education, Exercise Science, and Sport Development, this course provides an understanding of the behavioural and social factors that affect learning, participation, coaching, and performance. It equips future educators, coaches, fitness professionals, and sports administrators with the knowledge and skills to motivate participants, build cohesive teams, manage diverse groups, promote inclusion, and enhance both performance and well-being. The course also highlights the transformative role of sport in education, public health, youth development, community engagement, and national integration.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts of psychology, sociology, sport, exercise, and physical activity.
2. Describe the relationship between psychological and sociological principles in sport and exercise.

3. Explain the influence of motivation, personality, emotion, and self-confidence on sports performance.
4. Examine the role of socialisation agents such as family, schools, peers, and the media in sport participation.
5. Discuss the effects of culture, gender, ethnicity, and social class on participation in sport and exercise.
6. Identify psychological techniques used to improve performance and mental well-being.
7. Analyse the social values and functions of sport in national development and community cohesion.
8. Apply psychological and sociological concepts to coaching, teaching, leadership, and sports management.
9. Recognise ethical issues and challenges affecting sport and exercise participation.
10. Promote positive attitudes toward healthy lifestyles and lifelong physical activity.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the concept of sport and exercise psychology;
2. Describe the behavioural responses and adaptations to sport and exercise;
3. Explain the various theories used to describe behaviour in sport and exercise psychology;
4. Discuss factors causing stress and anxiety in sport skill learning and performance;
5. Demonstrate the knowledge of group and individual behaviour in sport and exercise environment.
6. Define the concept of sociology;
7. Describe the basic sociological theories;
8. Explain the concept of sociology of sports and goals of sociology of sport;
9. Describe the social values and sports, socialisation agents in sport;
10. Explain the common social problems in sports, drugs use and violence in sports;
11. Demonstrate the knowledge of stratification and social mobility, sports, race and ethnicity; and
12. Analyse sports and gender, the future of sports and leisure participation in the society.

COURSE CONTENT

- Concept of sport and exercise psychology
- Behavioural responses and adaptations to sport and exercise
- (Personality-psychological core, typical responses and role-related)
- **Theories:** Trait, situational and interactional approach, psycho-dynamic, social learning
- Performance and exercise adherence to promote health, motivation (intrinsic and extrinsic), self-confidence, achievement-motivation
- Arousal-theories drive, inverted-U hypothesis, the catastrophe theory, individual zone of optimal functioning)
- Stress and causes of stress and anxiety learning and performance process, feedback techniques, attention and concentration, aggression and violence in sport
- Social facilitation, cohesion and factors affecting cohesion and audience effects
- Definition of sociology, application of basic sociological theories (functionalist theory, conflict theory, interactionist theory and feminist theory) concept of sociology of sports, goals of sociology of sport, social values and sports, socialisation agents and sport
- Social problems and sports, drugs use and violence in sports
- Stratification and social mobility, sports, race and ethnicity
- Sports and Gender, Future of Sports and Leisure participation

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking

CATEGORY	DETAILS
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility • Commitment to Health and Wellness • Respect and Sportsmanship
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American Psychological Association (2020). *Publication Manual of the American Psychological Association (7th ed.)*. APA.

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Hagger, M. S., & Chatzisarantis, N. L. D. (2005). *The Social Psychology of Exercise and Sport*. Open University Press.

Horn, T. S., & Smith, A. L. (Eds.). (2019). *Advances in Sport and Exercise Psychology (4th ed.)*. Human Kinetics.

Jarvis, M. (2023). *Sport Psychology: A Student's Handbook (3rd ed.)*. Routledge.

Lüschen, G., & Sage, G. H. (Eds.). (1981). *Handbook of Social Science of Sport*. Stipes Publishing.

Moran, A. P. (2012). *Sport and Exercise Psychology: A Critical Introduction (2nd ed.)*. Routledge.

Sage, G. H., & Eitzen, D. S. (2016). *Sociology of North American Sport (10th ed.)*. Routledge.

Wann, D. L., Melnick, M. J., Russell, G. W., & Pease, D. G. (2001). *Sport Fans: The Psychology and Social Impact of Spectators*. Routledge.

Weinberg, R. S., & Gould, D. (2023). *Foundations of Sport and Exercise Psychology (8th ed.)*. Human Kinetics.

HKE 114 Physical Fitness

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Physical Fitness is a foundational course that introduces learners to the principles, components, assessment, development, and maintenance of physical fitness for health, wellbeing, and optimal physical performance. The course examines the major components of fitness – including cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, body composition, balance, agility, speed, power, coordination, and reaction time – and their relevance to daily living and sporting activities.

Learners are exposed to principles of exercise prescription and training, fitness testing, warm-up and cool-down procedures, body conditioning, lifestyle factors affecting fitness, nutrition and hydration, injury prevention, and the development of individualised fitness

programmes. Emphasis is placed on practical participation, safe exercise practices, lifelong physical activity, and the application of scientific principles to improve health-related and skill-related fitness.

RELEVANCE STATEMENT

Physical fitness is essential for maintaining good health, preventing lifestyle-related diseases, improving physical and mental wellbeing, and enhancing performance in sports and everyday activities. The course is particularly relevant to students of Physical and Health Education because it equips them with the knowledge and practical skills required to assess, develop, monitor, and promote fitness among individuals and groups.

The course also prepares prospective teachers and health educators to design appropriate fitness programmes for children, adolescents, adults, and special populations. In the Nigerian context, where physical inactivity, sedentary lifestyles, obesity, and other non-communicable health challenges are increasing, knowledge of physical fitness is important for promoting active and healthy lifestyles in schools and communities.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concept, meaning, importance, and principles of physical fitness.
2) Identify and describe the health-related and skill-related components of physical fitness.
3) Demonstrate appropriate techniques for developing various components of physical fitness.
4) Apply basic principles and methods of exercise and fitness training in practical situations.
5) Conduct and interpret selected physical fitness tests using appropriate procedures.
6) Design simple and individualised physical fitness programmes based on age, ability, needs, and fitness goals.
7) Promote and maintain safe, healthy, and physically active lifestyles through appropriate exercise, nutrition, rest, and recovery practices.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define physical fitness and explain its significance to health, wellbeing, and physical performance.

2) Distinguish between health-related and skill-related components of physical fitness.
3) Demonstrate exercises and training methods for improving strength, endurance, flexibility, speed, agility, balance, coordination, and power.
4) Perform selected field-based physical fitness tests correctly and safely.
5) Calculate and interpret basic fitness indicators and test results.
6) Develop a basic fitness programme using appropriate training principles such as overload, progression, specificity, individuality, and reversibility.
7) Apply safety, nutritional, hydration, recovery, and injury-prevention principles during physical activity and fitness training.

COURSE CONTENT

- Concept and Principles of Physical Fitness
- Components of Physical Fitness
- Principles of Physical Fitness Training
- Exercise and Conditioning Methods
- Physical Fitness Assessment and Testing
- Fitness Programme Design
- Nutrition
- Hydration and Recovery
- Safety and Injury Prevention
- Lifestyle and Lifelong Fitness
- Practical Fitness Activities

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Assessment • Programme-design • Communication • Safety • Problem-solving • Self-management • Teamwork • Digital

CATEGORY	DETAILS
Core Values	• Discipline • Commitment • Self-confidence • Responsibility • Perseverance • Cooperation • Fair play • Respect for others • Healthy living • Self-care • Safety consciousness
Pedagogical Approaches	• Interactive lectures • Demonstration and practice • Guided discovery • Cooperative learning • Problem-based learning • Experiential learning • Peer teaching • Small-group activities
Learning Resources	• Physical Resources • Sports field and gymnasium • Exercise mats • Skipping ropes • Cones and markers • Stopwatches • Measuring tapes • Weighing scales

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

American College of Sports Medicine. (2022). *ACSM's resources for the personal trainer* (6th ed.). Wolters Kluwer.

Corbin, C. B., Welk, G. J., Corbin, W. R., & Welk, K. A. (2016). *Concepts of fitness and wellness: A comprehensive lifestyle approach* (12th ed.). McGraw-Hill Education.

Faigenbaum, A. D., & Myer, G. D. (2010). Resistance training among young athletes: Safety, efficacy and injury prevention effects. *British Journal of Sports Medicine*, *44*(1), 56–63.

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Powers, S. K., & Howley, E. T. (2021). *Exercise physiology: Theory and application to fitness and performance* (11th ed.). McGraw-Hill.

World Health Organization. (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization.

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HKE 115 History and Philosophy of Physical Education

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

History and Philosophy of Physical Education is a foundational course that examines the historical development, philosophical foundations, principles, and changing concepts of physical education from ancient civilisations to the contemporary period. The course explores the contributions of major civilisations, philosophers, educators, and physical education movements to the development of physical education as an academic discipline and professional field.

The course introduces students to major philosophical perspectives such as idealism, realism, pragmatism, naturalism, existentialism, and humanism, and examines their implications for the aims, content, methods, and organisation of physical education. It also considers the development of physical education in Nigeria, including traditional Nigerian physical activities, colonial influences, post-independence developments, curriculum reforms, and the contemporary status of physical education.

RELEVANCE STATEMENT

Physical education has evolved in response to changing social, cultural, educational, political, and philosophical circumstances. Understanding its historical development enables students to appreciate the origins of contemporary physical education and the factors that have shaped its aims, curriculum, teaching methods, and professional practices.

Knowledge of the philosophy of physical education helps prospective physical and health educators develop a clear understanding of why physical education is taught, what it should accomplish, and how it contributes to the total development of learners. The course is therefore essential for students preparing for careers in physical education, sports, health education, coaching, and related professions. It also promotes appreciation of Nigerian indigenous physical activities and their place in contemporary physical education.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, nature, scope, aims, and objectives of physical education.

2) Trace the historical development of physical education from ancient civilisations to the modern era.
3) Examine the contributions of major philosophers, educators, and physical education movements to the development of the field.
4) Explain major philosophical schools of thought and their implications for physical education.
5) Analyse the historical development of physical education in Nigeria, including indigenous, colonial, and post-independence developments.
6) Evaluate contemporary issues, trends, and challenges influencing the philosophy and practice of physical education.
7) Apply historical and philosophical knowledge in developing informed professional perspectives on the role and future direction of physical education.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and distinguish between physical education, physical activity, exercise, recreation, and sport.
2) Describe major stages in the historical development of physical education across different civilisations.
3) Identify major individuals, movements, and institutions that contributed to the development of physical education.
4) Explain the fundamental principles of major philosophical schools and relate them to physical education.
5) Discuss the development of physical education in Nigeria from indigenous practices through colonial and post-independence periods.
6) Critically examine how historical, cultural, philosophical, and societal factors influence contemporary physical education.
7) Formulate and defend a personal philosophy of physical education based on sound educational and professional principles.

COURSE CONTENT

- Introduction to Physical Education
- Physical Education in Ancient Civilisations
- Physical Education During the Medieval and Renaissance Periods
- Development of Modern Physical Education

- Major Contributors to Physical Education
- Philosophy and Physical Education
- Major Philosophies and Their Implications
- Indigenous Nigerian Physical Education
- Historical Development of Physical Education in Nigeria
- Contemporary Physical Education in Nigeria
- Philosophy and Professional Practice
- Emerging Issues and Future Directions

CATEGORY	DETAILS
Core Competencies	• Historical analysis • Philosophical reasoning • Critical thinking • Research • Communication • Professional competency • Cultural • Problem-solving • Reflective • Ethical
Core Values	• Discipline • Integrity • Respect • Fairness • Tolerance • Responsibility • Teamwork • Cooperation • Cultural appreciation • Equity • Inclusion • Professionalism • Critical inquiry

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Guided discussions • Socratic questioning • Group discussions and debates • Historical case studies • Comparative analysis • Problem-based learning
Learning Resources	• Physical Resources • Lecture rooms • Library • Sports facilities • Indigenous games and sporting equipment • Instructional Resources • Physical education textbooks • History and philosophy textbooks • Academic journals • Curriculum documents
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Bucher, C. A., & Koenig, C. R. (2005). *Foundations of physical education, exercise science, and sport*. McGraw-Hill.

Freeman, W. H. (2014). *Physical education, exercise and sport science: History, philosophy and theory*. Jones & Bartlett Learning.

Mechikoff, R. A. (2014). *A history and philosophy of sport and physical education: From ancient civilizations to the modern world*. McGraw-Hill Education.

Naul, R. (2003). Concepts of physical education in Europe. In R. Naul (Ed.), *Concepts of physical education in Europe*. Meyer & Meyer Sport.

Park, R. J. (2007). *Historical perspectives on sport and physical education*. Routledge.

Siedentop, D. (2009). *Introduction to physical education, fitness, and sport* (7th ed.). McGraw-Hill.

Zeigler, E. F. (2007). *History and status of American physical education and educational sport*. Trafford Publishing.

Wuest, D. A., & Bucher, C. A. (2009). *Foundations of physical education, exercise science, and sport*. McGraw-Hill.

Hardman, K., & Green, K. (Eds.). (2011). *Contemporary issues in physical education: International perspectives*. Meyer & Meyer Sport.

Relevant Nigerian educational policies, National Commission for Colleges of Education (NCCE) curriculum documents, and institutional curriculum guidelines should be consulted to contextualise the historical and philosophical development of physical education within Nigeria.

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core Course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Biology II provides students with a broad understanding of the diversity of living organisms through a comparative study of the Plant and Animal Kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plants and animals. The course equips students with the foundational knowledge needed to appreciate the relationship between the structure, function, and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animals. It enables prospective biology teachers to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge gained is fundamental for advanced studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific

observation, analytical thinking, and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course is to:

1. Describe the general characteristics of the Plant and Animal Kingdoms.
2. Compare the similarities and differences between plants and animals based on their external features.
3. Explain the ecological adaptations of plants and animals to different habitats.
4. Describe the basic physiological processes in living organisms, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development.
5. Explain how structure and function are related in plants and animals.
6. Discuss the importance of physiological processes in the survival of living organisms.
7. Explain the diversity and ecological significance of plants and animals.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. State the unique characteristics of plant and animal kingdoms;
3. Describe ecological adaptations in the plant and animal kingdoms;
4. Explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. Describe growthanddevelopmentinplantsandanimals.
6. Appreciate the diversity and ecological significance of plants and animals.

COURSE CONTENT

A generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological principle • Hygiene • Classification
Core Values	• Curiosity • Thinking • Integrity • Teamwork • Self-discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical-based instruction
Learning Resources	• Biology textbooks • Charts • Models • Videos
Assessment Methods	Practical report

Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

CHE 121 General Chemistry II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental principles and applications of organic chemistry, beginning with its historical development, electronic theory, nomenclature, functional groups, structural determination, purification techniques, reaction mechanisms, kinetics, and stereochemistry. It covers the chemistry of major classes of organic compounds and introduces carbon nanostructures, fullerenes, nanotubes, and nanochem-

istry. The course also examines selected metals and non-metals, comparative chemistry of Groups IA, IIA and IVA elements, and introductory transition metal chemistry.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the structure, properties, reactions, and applications of organic and selected inorganic compounds. It develops the chemical knowledge and skills required for further study in chemistry, biochemistry, pharmacy, environmental science, materials science, and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the historical development and importance of organic chemistry.
2. Describe the electronic structure, bonding, nomenclature, and functional groups of organic compounds.
3. Apply appropriate methods for the isolation, purification, identification, and structural determination of organic compounds.
4. Explain basic organic reaction mechanisms, kinetics, and stereochemical principles.
5. Describe the properties and reactions of major classes of organic compounds.
6. Explain the chemistry and applications of fullerenes, nanotubes, nanostructures, and nanochemistry.
7. Compare the chemistry of selected metals and non-metals, including Groups IA, IIA, and IVA elements.
8. Describe the fundamental properties and chemistry of transition metals.

LEARNING OUTCOMES

At the end of this course, the students should be able to:

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative structures in organic chemistry;
5. Describe rules guiding nomenclature and functional group classes of organic compounds;
6. Determine rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry; 8. Discuss comparative chemistry of group IA, IIA and IIA elements; and

8. Describe basic properties of transition metals.

COURSE CONTENT

- Historical survey of the development and importance of Organic Chemistry
- Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry
- Electronic theory in organic chemistry
- Isolation and purification of organic compounds
- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry
- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics
- Stereochemistry
- The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives
- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA, IIA and IVA elements
- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• Nomenclature • Identification • Classification • Structure • Purification • Analysis • Stereochemistry • Mechanism • Reactivity

CATEGORY	DETAILS
Core Values	• Accuracy • Integrity • Safety • Responsibility • Curiosity • Creativity • Discipline • Objectivity
Pedagogical Approaches	• Lecture Method • Demonstration • Inquiry-Based Learning • Problem-Based Learning • Collaborative Learning • Guided Discovery • Discussion Method
Learning Resources	• Periodic Table • Molecular Models • Laboratory Equipment • Reaction Mechanism Charts
Assessment Methods	• Assignments • Class Tests • Quizzes • Continuous Assessment • End-of-Semester Examination

REFERENCES AND FURTHER READING

1. Carey, F. A., Giuliano, R. M., Allison, N. T., & Bane, S. L. (2023). *Organic chemistry* (12th ed.). McGraw Hill.
2. McMurry, J. E. (2023). *Organic chemistry* (10th ed.). OpenStax, Rice University.
3. Housecroft, C. E., & Sharpe, A. G. (2025). *Inorganic chemistry* (6th ed.). Pearson.
4. Clayden, J., Greeves, N., & Warren, S. (2012). *Organic chemistry* (2nd ed.). Oxford University Press.
5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2022). *Inorganic chemistry* (6th ed.). Pearson.
6. Atkins, P., de Paula, J., & Keeler, J. (2023). *Atkins' physical chemistry* (12th ed.). Oxford University Press.

MTH 121 General Mathematics II (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops students' ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomials, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series, The trigonometry component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and application of science, technology, engineering, social sciences, economics, and other disciplines. A strong understanding of elementary algebra and trigonometry enables students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher-level mathematics and discipline-specific courses that require mathematical reasoning and computation. Knowledge of algebra supports the study of functions,

calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer science, and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real-life and professional situations.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain and apply the basic concepts and properties of the real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials, and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.
4. Solve linear, quadratic, simultaneous, and selected higher-order equations.
5. Solve linear and quadratic inequalities and represent their solutions appropriately.
6. Define and apply the basic trigonometric ratios: sine, cosine, and tangent.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements
- Venn diagrams
- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers

- Algebra of complex numbers
- The Argand diagram
- De-Moivre's theorem, nth roots of unity
- Circular measure, trigonometric functions of angles of any magnitude
- Addition and factor formulae

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Creativity • Innovation 4. Reflective thinking • 5Collaboration • Reflective thinking • Self-development • Problem-solving skills.
Core Values	• Integrity • Team spirit • Perseverance • Transparency • Tolerance • Honesty
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and Dialogue
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms

CATEGORY	DETAILS
Assessment Methods	• Continuous assessment • Formative Assessment • Summative assessment • **Readings** • Class work • Assignment • Group assignment • Presentations • Written Quiz

Suggested

College Algebra – algebraic techniques, equations, functions, and graphs.

Elementary Trigonometry – trigonometric ratios, identities, equations, and applications.

Schaum's Outline of Elementary Algebra – particularly good for worked examples and practice problems.

Schaum's Outline of Trigonometry – useful for additional exercises and step-by-step solutions.

OpenStax, Algebra and Trigonometry

PHY 111 General Physics II (Electricity and Magnetism)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Physics: Electricity and Magnetism introduces students to the fundamental principles governing electric charges, electric fields, electric potential, current electricity, magnetic fields, and electromagnetic interactions. The course develops students' understanding of how electrical and magnetic phenomena are generated, measured, and applied in scientific, technological, and everyday contexts. It covers basic laws and principles such as Coulomb's law, Ohm's law, Kirchhoff's laws, Ampère's law, Faraday's law of electromagnetic induction, and Lenz's law. Practical activities and problem-solving are used to

develop students' ability to analyse electrical and magnetic systems and relate theoretical concepts to technological applications.

Course-Relevant Statement

The study of electricity and magnetism is essential for understanding many natural phenomena and modern technologies, including electrical power generation and distribution, electric motors, transformers, communication systems, electronic devices, sensors, and renewable-energy technologies. The course equips students with foundational knowledge and practical skills needed for further study in physics, chemistry, biology, engineering, technology, and Integrated Science. It also promotes scientific reasoning, quantitative problem-solving, safe laboratory practice, and the ability to apply physics principles to real-life situations.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the fundamental concepts of electric charge, electric force, electric field, and electric potential.
2. State and apply Coulomb's law to problems involving electric charges.
3. Describe electric field patterns and calculate electric field strength and potential.
4. Explain the principles of capacitance and the operation of capacitors.
5. Describe electric current, electromotive force, resistance, and electrical energy.
6. Apply Ohm's law and Kirchhoff's laws to analyse simple electrical circuits.
7. Explain the principles of series and parallel electrical connections.
8. Describe the relationship between electric current and magnetic fields.

LEARNING OUTCOMES

By the end of this course, Student should be able to;

1. Describe the electric field and potential, and related concepts, for stationary charges;
2. Calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law and electric potential;
3. Describe and determine the magnetic field for steady and moving charges;
4. Determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;

5. Describe electromagnetic induction and related concepts, and make calculations using Faraday and Lenz's laws;
6. Explain the basic physical of Maxwell's equations in integral form;
7. Evaluate DC circuits to determine the electrical parameters; and
8. Determine the characteristics of ac voltages and currents in resistors, capacitors, and inductors.

COURSE CONTENT

- Forces in nature
- Electrostatics
- Electric charge and its properties, methods of charging
- Coulomb's law and superposition
- Electric field and potential
- Gauss's law
- Capacitance
- Electric dipoles
- Energy in electric fields
- Conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits
- Magnetic fields
- Lorentz force
- Biot-Savart and Ampère's laws
- Magnetic dipoles
- Dielectrics
- Energy in magnetic fields
- Electromotive force
- Electromagnetic induction
- Self and mutual inductances
- Faraday and Lenz's laws
- Step up and step down transformers: Maxwell's equations
- Electromagnetic oscillations and waves
- AC voltages and currents applied to inductors, capacitors, resistance, and combinations

CATEGORY	DETAILS
Core Competencies	• Conceptual competence • Problem-solving competence • Experimental competence • Measurement competence • Circuit-analysis competence • Scientific inquiry competence • Technological competence • Safety competence • Communication competence
Core Values	• Scientific curiosity • Accuracy and precision • Critical thinking • Creativity and innovation • Teamwork and cooperation • Responsibility • Safety consciousness • Integrity • Environmental responsibility • Perseverance
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Demonstration method • Practical/laboratory method • Collaborative learning • Project-based learning • Discussion method • Simulation and multimedia learning • Concept mapping • Blended learning

CATEGORY	DETAILS
Learning Resources	• Laboratory resources • Instructional materials • Digital resources • NERDC e-Curriculum and learner resources
Assessment Methods	• Class tests • Assignments • Laboratory work • Practical reports • Quizzes • Group projects • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

Nigerian Educational Research and Development Council (NERDC). (2025). *New Revised Senior Secondary Education Curriculum*. Abuja: NERDC.

National Commission for Colleges of Education (NCCE). (2024). *Minimum Standards for Nigeria Certificate in Education: Science Education – Physics*. Abuja: NCCE. The curriculum specifically includes electrostatics, magnetostatics, current electricity, electrolysis and capacitance.

HKE 102 Skill Development and Techniques of Track and Field Events

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Skill Development and Techniques of Track and Field Events is a practical and theoretical course designed to develop students' knowledge, skills, techniques, and competencies in selected track and field events. The course introduces learners to the fundamental skills, technical principles, rules, officiating procedures, safety measures, and training methods associated with running, jumping, and throwing events.

The course emphasises the systematic development of basic motor skills and event-specific techniques through demonstration, guided practice, drills, conditioning, and

performance analysis. Students are exposed to sprinting, middle- and long-distance running, hurdles, relays, jumps, and throws, with appropriate attention to biomechanics, physical conditioning, event rules, and injury prevention.

RELEVANCE STATEMENT

Track and field is one of the fundamental areas of physical education and forms an important component of school and competitive sports. Competence in track and field enables prospective physical and health education teachers to teach, demonstrate, coach, assess, and officiate athletic events effectively.

The course is relevant because it develops speed, endurance, strength, flexibility, agility, coordination, balance, power, discipline, teamwork, and competitive skills. It also prepares students to organise athletic competitions and identify and develop sporting talents. Through practical participation, students acquire transferable skills that can support lifelong physical activity, sports development, and healthy living.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the fundamental concepts, classification, characteristics, and importance of track and field events.
2) Demonstrate fundamental skills and techniques required for selected track and field events.
3) Apply appropriate training methods and practice drills for improving performance in track and field events.
4) Execute correct techniques in running, jumping, and throwing events while observing relevant rules and safety procedures.
5) Analyse individual performance and identify technical errors that affect performance in track and field events.
6) Apply official rules, procedures, and basic officiating skills in the conduct of track and field competitions.
7) Develop and demonstrate appropriate attitudes of discipline, fair play, teamwork, perseverance, and sportsmanship in track and field activities.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Identify and classify the major track and field events and explain their basic characteristics.
2) Demonstrate appropriate starting, running, jumping, and throwing techniques.
3) Perform selected track and field skills with reasonable technical proficiency.
4) Apply appropriate drills and conditioning exercises to improve event-specific performance.
5) Identify common technical errors and suggest appropriate corrective measures.
6) Demonstrate knowledge of basic rules, facilities, equipment, safety procedures, and officiating requirements.
7) Participate effectively in track and field competitions while demonstrating sportsmanship, discipline, teamwork, and respect for rules.

COURSE CONTENT

- Introduction to Track and Field
- Fundamental Athletic Skills
- Basic body movement patterns
- Sprint Events
- Middle- and Long-Distance Events
- Hurdles
- Relay Events
- Long Jump
- High Jump
- Triple Jump
- Shot Put
- Discus Throw
- Javelin Throw
- Athletic Training and Conditioning
- Competition
- Officiating and Performance Evaluation

CATEGORY	DETAILS
Core Competencies	• Technical • Motor • Coaching • Performance-analysis • Training • Officiating • Safety • Communication
Core Values	• Discipline • Perseverance • Commitment • Fair play • Sportsmanship • Teamwork • Cooperation • Respect • Self-confidence • Responsibility • Integrity
Pedagogical Approaches	• Interactive lectures • Demonstration and imitation • Guided practice • Individualised instruction • Video-based performance analysis • Problem-solving activities • Circuit training • Skill stations • Practical competitions

CATEGORY	DETAILS
Learning Resources	• Facilities • Standard athletics track • Long-jump pit • High-jump area • Throwing circles and sectors • Hurdles • Relay batons • Stopwatches • Measuring tapes
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

International Association of Athletics Federations. (2019). *IAAF competition and technical rules*. World Athletics.

International Olympic Committee. (2021). *Olympic athletics and sport development resources*. International Olympic Committee.

McGill, D. (2017). *Track and field coaching manual*. Human Kinetics.

Rogers, J. L. (2000). *USA Track & Field coaching manual*. Human Kinetics.

Schmolinsky, G. (2003). *Track and field: The East German textbook of athletics*. Sport Books Publisher.

Tellez, K., & Doolittle, D. (1984). *Sprint training and technique*. Track and Field Coaches Association.

World Athletics. (2026). *Competition and technical rules*. World Athletics.

World Athletics. (2026). *Coaching and development resources*. World Athletics.

Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training* (6th ed.). Human Kinetics.

Gambetta, V. (2020). *Athletic development: The art and science of functional sports conditioning*. Human Kinetics.

Relevant National Commission for Colleges of Education (NCCE) curriculum documents and institutional guidelines on Physical and Health Education should also be consulted to ensure that the course content aligns with Nigerian teacher-education requirements.

HKE 104 Skill Development and Techniques in Gymnastics

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Skill Development and Techniques in Gymnastics is a practical and theory-based course that introduces students to the fundamental skills, techniques, and teaching methods of gymnastics. The course develops learners' proficiency in basic gymnastic movements, body control, balance, flexibility, coordination, agility, strength, and spatial awareness while emphasising safety, proper technique, and progressive skill acquisition. Students are introduced to floor exercises, apparatus work, rhythmic and educational gymnastics, spotting techniques, conditioning exercises, and the organisation of gymnastics activities. The course also highlights the role of gymnastics in physical fitness, motor development, injury prevention, and sports performance. It is designed to prepare students to teach, coach, and supervise gymnastics activities in schools, clubs, and community settings.

RELEVANCE STATEMENT

For students of Physical Education, Exercise Science, and Sport Development, this course provides practical competencies in one of the core activity areas of physical education. Gymnastics enhances motor skill development, body awareness, flexibility, balance, coordination, muscular strength, and confidence, which are transferable to many other sports and physical activities.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain the history, philosophy, and importance of gymnastics.
2. Demonstrate fundamental gymnastic skills using correct techniques.
3. Apply the principles of skill acquisition and progression in gymnastics.
4. Develop strength, flexibility, balance, coordination, agility, and body control through gymnastics activities.
5. Demonstrate proper spotting and safety techniques during gymnastics instruction.

6. Perform basic floor and apparatus exercises with confidence and precision.
7. Organise and teach gymnastics lessons suitable for different age groups and ability levels.
8. Apply the rules and regulations governing gymnastics competitions.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Demonstrate fundamental gymnastics skills with proper technique.
2. Apply progressive teaching methods in gymnastics instruction.
3. Organise safe and effective gymnastics lessons.
4. Perform spotting techniques and implement safety procedures.
5. Evaluate gymnastics performances using established criteria.
6. Apply the rules and regulations governing gymnastics competitions.
7. Promote gymnastics as a lifelong physical activity for health and fitness.

COURSE CONTENT

- Performance of skills in gymnastics activities such as hand balance, head stand, hand stand, vaults, uneven bars, balance beam and floor exercise events
- Pommel horse, still rings, parallel and high bar
- Forward and backward roll, cartwheel, crab walk, and spring exercises
- The theoretical and practical skills and techniques of gymnastics
- The rules and regulations of gymnastics
- The facilities and equipment for participation

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking

CATEGORY	DETAILS
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Critical Thinking and Lifelong Learning • Safety and Risk Awareness • Community Service and National Development • Environmental Responsibility
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Field Visits and Experiential Learning • Technology-Enhanced Learning • Independent Study and Reflective Learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American College of Sports Medicine (ACSM). (2021). *ACSM's Guidelines for Exercise Testing and Prescription (11th ed.)*. Wolters Kluwer.

Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and Methodology of Training (6th ed.)*. Human Kinetics.

Caine, D., Russell, K., & Lim, L. (2013). *Handbook of Sports Medicine and Science: Gymnastics*. Wiley-Blackwell.

Federation Internationale de Gymnastique (FIG). (2025). *FIG Code of Points (latest editions for Men's Artistic Gymnastics, Women's Artistic Gymnastics, Rhythmic Gymnastics, and Trampoline Gymnastics)*. Lausanne, Switzerland: FIG.

Gallahue, D. L., Ozmun, J. C., & Goodway, J. D. (2019). *Understanding Motor Development: Infants, Children, Adolescents, Adults (8th ed.)*. Jones & Bartlett Learning.

George, G. S. (2018). *Championship Gymnastics: Biomechanical Techniques for Shaping Winners*. Coaches Choice.

Kirby, R. F., Hines, K. G., & Colby, E. A. (2019). *Educational Gymnastics (2nd ed.)*. Human Kinetics.

Magill, R. A., & Anderson, D. (2021). *Motor Learning and Control: Concepts and Applications (12th ed.)*. McGraw-Hill Education.

National Strength and Conditioning Association (NSCA). (2021). *Essentials of Strength Training and Conditioning (4th ed.)*. Human Kinetics.

Offers guidance on fitness assessment and exercise prescription applicable to gymnastics training.

Russell, K. (2018). *Teaching Fundamental Gymnastics Skills (3rd ed.)*. Human Kinetics.

Sands, W. A., Caine, D. J., & Borms, J. (Eds.). (2019). *Scientific Aspects of Women's Gymnastics*. Karger Publishers.

Smither, G. (2017). *Gymnastics: Skills, Techniques and Conditioning*. Crowood Press.

Werner, P. H., Williams, L. H., & Hall, T. J. (2021). *Teaching Children Gymnastics (4th ed.)*. Human Kinetics.

HKE 106 Inclusive Physical Education and Sport

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Inclusive Physical Education and Sport is a course designed to equip students with the knowledge, skills, attitudes, and professional competencies required to provide meaningful participation in physical education and sport for all learners, regardless of ability, disability, gender, age, socioeconomic background, culture, or other individual differences.

The course examines the principles and practices of inclusion, adapted physical education, disability and sport, inclusive curriculum development, differentiated instruction, accessible facilities and equipment, assessment and evaluation, assistive technologies, and strategies for removing barriers to participation. It emphasises respect for diversity, equity, participation, safety, dignity, and the right of every learner to access quality physical education and sport.

RELEVANCE STATEMENT

Inclusive physical education and sport are essential for ensuring that every learner has equitable opportunities to participate in physical activity, develop motor skills, improve health and fitness, and experience the social and psychological benefits of sport. Traditional approaches to physical education may unintentionally exclude learners with disabilities or other special needs because of inappropriate activities, inaccessible facilities, limited equipment, or inadequate teacher preparation.

This course is therefore relevant to prospective physical and health education teachers because it prepares them to identify barriers to participation, adapt activities and teaching strategies, provide appropriate support, and create safe and inclusive learning environments. It also promotes social integration, equality, respect for human diversity, and lifelong participation in physical activity.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, and importance of inclusive physical education and sport.
2) Identify the diverse physical, sensory, cognitive, behavioural, social, and learning needs of participants in physical education and sport.

3) Apply appropriate teaching strategies, modifications, and adaptations to facilitate participation by learners with diverse needs.
4) Demonstrate appropriate skills for planning and implementing inclusive physical education and sporting activities.
5) Evaluate physical education facilities, equipment, activities, and instructional materials in terms of accessibility, safety, and inclusiveness.
6) Apply appropriate assessment and evaluation strategies that accommodate individual differences and abilities.
7) Promote equity, dignity, respect, cooperation, social inclusion, and lifelong participation in physical activity and sport.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define inclusive physical education, adapted physical education, adaptive sport, integration, and inclusion.
2) Identify major categories of disabilities and other individual differences relevant to participation in physical education and sport.
3) Explain barriers that prevent individuals from participating fully in physical activity and sport.
4) Modify rules, equipment, space, instructions, and activities to accommodate diverse learners.
5) Design and implement inclusive physical education lessons and sporting activities.
6) Conduct appropriate assessment and provide constructive feedback based on individual capabilities and progress.
7) Demonstrate professional attitudes and practices that promote equality, safety, dignity, participation, and respect for diversity.

COURSE CONTENT

- Introduction to Inclusive Physical Education and Sport
- Understanding Diversity and Individual Differences
- Disability and Physical Education
- Barriers to Participation
- Physical and environmental barriers
- Inclusive Physical Education Curriculum

- Teaching Strategies for Inclusive Physical Education
- Adaptation of Physical Activities and Sports
- Inclusive Sport and Competition
- Facilities
- Equipment and Assistive Technology
- Principles of accessible facilities
- Assessment and Evaluation
- Safety
- Health and Risk Management
- Professional Roles and Collaboration
- Inclusion
- Equity and Social Development
- Inclusive Physical Education in Nigeria

CATEGORY	DETAILS
Core Competencies	• Inclusive teaching • Adaptation • Assessment • Empathy and interpersonal • Leadership • Technology • Advocacy
Core Values	• Equality • Equity • Inclusion • Professional ethics • Respect for diversity
Pedagogical Approaches	• Interactive lectures • Demonstration and practical activities • Cooperative learning • Micro-teaching • Group projects • Practical adaptation exercises

CATEGORY	DETAILS
Learning Resources	• Physical Resources • Accessible sports facilities • Sports fields and courts • Modified bats and rackets • Wheelchairs where appropriate
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Block, M. E. (2016). *A teacher's guide to adapted physical education: Including students with disabilities in sports and recreation* (4th ed.). Paul H. Brookes Publishing.

Haegele, J. A., Hodge, S. R., & Shapiro, D. R. (2017). *Inclusion in physical education: A review of the literature*. Routledge.

Lieberman, L. J., & Houston-Wilson, C. (2018). *Strategies for inclusion: A handbook for physical educators* (3rd ed.). Human Kinetics.

Winnick, J. P., & Porretta, D. L. (Eds.). (2017). *Adapted physical education and sport* (6th ed.). Human Kinetics.

World Health Organization. (2020). *Disability and health*. World Health Organization.

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UNESCO. (2015). *Quality physical education: Guidelines for policy-makers*. UNESCO.

UNESCO. (2020). *Inclusion and education: All means all*. Global Education Monitoring Report.

International Paralympic Committee. (2021). *IPC handbook and classification resources*. International Paralympic Committee.

Sherrill, C. (2004). *Adapted physical activity, recreation and sport: Crossdisciplinary and lifespan* (6th ed.). McGraw-Hill.

Relevant Nigerian National Commission for Colleges of Education (NCCE) curriculum documents, inclusive education policies, and institutional guidelines should be

consulted to ensure that the course reflects Nigerian teacher-education requirements and the local context.

HKE 124 Methods of Teaching Physical Education

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Methods of Teaching Physical Education is a professional course designed to equip prospective physical education teachers with the knowledge, skills, attitudes, and competencies required for effective teaching and learning of physical education in schools and other educational settings. The course examines the principles of teaching physical education, lesson planning, instructional methods, teaching styles, classroom and activity management, demonstration, questioning, feedback, assessment, safety, inclusion, and the effective use of teaching resources.

Emphasis is placed on the integration of theory and practical activities through micro-teaching, peer teaching, demonstrations, supervised practice, and reflective teaching. Students learn how to select appropriate teaching methods based on learners' age, ability, learning objectives, content, facilities, equipment, and environmental conditions.

RELEVANCE STATEMENT

Physical education requires specialised teaching approaches because much of its learning occurs through movement, practical participation, demonstration, practice, feedback, and performance. Effective physical education teachers must therefore possess both subject-matter knowledge and pedagogical skills for organising safe, inclusive, motivating, and productive learning experiences.

This course is relevant to prospective physical and health education teachers because it prepares them to translate curriculum objectives into meaningful practical lessons, manage large and diverse classes, improvise instructional resources, assess learners' physical and cognitive development, and promote lifelong participation in physical activity. It also strengthens professional competence in lesson planning, teaching, evaluation, classroom management, and reflective practice.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the principles, nature, scope, and objectives of teaching physical education.

2) Identify and select appropriate teaching methods, styles, and strategies for different physical education content and learners.
3) Prepare effective physical education lesson plans based on stated learning objectives, learner characteristics, and available resources.
4) Demonstrate appropriate teaching skills, including demonstration, explanation, questioning, feedback, reinforcement, and correction of errors.
5) Apply effective strategies for managing physical education classes, facilities, equipment, time, space, and learner behaviour.
6) Apply appropriate assessment and evaluation techniques to measure learners' cognitive, affective, and psychomotor development.
7) Plan and deliver safe, inclusive, learner-centred, and technology-supported physical education lessons in school and community settings.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Explain major principles and theories underlying effective teaching and learning in physical education.
2) Distinguish between major teaching methods, styles, strategies, and approaches used in physical education.
3) Prepare comprehensive lesson plans and schemes of work for physical education.
4) Demonstrate effective instructional skills during practical physical education lessons.
5) Organise and manage learners, facilities, equipment, space, time, and activities safely and effectively.
6) Develop and use appropriate assessment strategies for evaluating physical education learning outcomes.
7) Conduct reflective, inclusive, and learner-centred physical education lessons and use feedback to improve teaching effectiveness.

COURSE CONTENT

- Introduction to Teaching Physical Education
- Principles of Teaching and Learning Physical Education
- Teaching Methods in Physical Education
- Teaching Styles and Instructional Strategies
- Lesson Planning in Physical Education

- Teaching Skills and Techniques
- Teaching Motor Skills and Physical Activities
- Class and Activity Management
- Safety and Risk Management
- Inclusive Teaching in Physical Education
- Teaching Resources and Improvisation
- Assessment and Evaluation in Physical Education
- Micro-Teaching and Peer Teaching
- Professional Practice and Reflective Teaching

CATEGORY	DETAILS
Core Competencies	• Pedagogical • Lesson-planning • Demonstration • Communication • Class-management • Assessment • Inclusive teaching
Core Values	• Professionalism • Responsibility • Discipline • Integrity • Fairness • Respect • Patience • Cooperation • Teamwork • Tolerance

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Demonstration and practice • Guided discovery • Cooperative learning • Case studies • Role-play • Video analysis • Practical field activities
Learning Resources	• Physical Resources • Physical education fields • Sports courts • Gymnasium • Athletics facilities • Swimming facilities where available • Sports • Ropes • Hurdles • Markers
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Mosston, M., & Ashworth, S. (2008). *Teaching physical education* (1st online ed.). Spectrum Institute for Teaching and Learning.

Siedentop, D., Hastie, P. A., & van der Mars, H. (2020). *Complete guide to sport education* (3rd ed.). Human Kinetics.

Rink, J. E. (2019). *Teaching physical education for learning* (8th ed.). McGraw-Hill Education.

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Relevant National Commission for Colleges of Education (NCCE) curriculum documents, Nigerian educational policies, and institutional guidelines for Physical and Health Education should be consulted to ensure alignment with Nigerian teacher-education requirements.

HKE 201 Skill Development and Techniques in Swimming

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Skill Development and Techniques in Swimming is a practical and theory-based course designed to develop students' knowledge, skills, and competencies in swimming as a lifelong physical activity, competitive sport, and survival skill. The course introduces learners to the principles of aquatic safety, water confidence, swimming techniques, skill progression, coaching methods, and the physiological and biomechanical principles underlying swimming performance. Students are trained in the fundamental and advanced techniques of the four competitive swimming strokes – freestyle (front crawl), backstroke, breaststroke, and butterfly – as well as starts, turns, finishes, treading water, floating, diving, rescue techniques, and basic lifesaving skills. The course also emphasises water safety, injury prevention, officiating, and the organisation of swimming programmes and competitions.

RELEVANCE STATEMENT

The course develops practical competencies in one of the core activity areas of physical education. Swimming enhances cardiovascular fitness, muscular endurance, flexibility, coordination, respiratory efficiency, and overall physical well-being. It is also a critical life skill that contributes to water safety and drowning prevention.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the history, development, and importance of swimming as a sport and life skill.
2. Demonstrate confidence and competence in aquatic environments.
3. Perform the four competitive swimming strokes using correct techniques.
4. Apply the principles of skill acquisition and progression in swimming instruction.
5. Demonstrate safe entry, floating, treading water, diving, and water survival skills.
6. Apply water safety principles and basic lifesaving procedures.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Demonstrate proficiency in the four competitive swimming strokes.
2. Apply appropriate teaching methods for swimming instruction.
3. Implement water safety and lifesaving procedures effectively.
4. Organise and officiate swimming competitions.
5. Assess swimming performance and provide corrective feedback.
6. Promote swimming as a lifelong activity for health, recreation, and competitive sport.

COURSE CONTENT

- The fundamental concepts, principles, and practical skills of swimming, history, scope, and significance of swimming, contribution to physical fitness, health promotion, and sports development
- Water orientation and aquatic safety practices, fundamental swimming skills, basic diving skills, underwater swimming, water rescue procedures, lifesaving techniques, emergency response, and cardiopulmonary resuscitation (CPR) awareness, the principles and methods of teaching and coaching swimming, rules and regulations governing swimming competitions, officiating procedures, competition organisation, timing and scoring systems, ethical standards in aquatic sports
- Role of swimming in health promotion, fitness development, recreation, rehabilitation, and inclusive physical education for individuals of all ages and abilities
- Application of biomechanics and exercise physiology in swimming performance, contemporary issues in swimming, talent identification and athlete development, anti-doping education, and sustainable management of aquatic facilities

CATEGORY	DETAILS
Core Competencies	• Swimming technical proficiency • Aquatic safety and lifesaving skills • Teaching and coaching competence • Motor skill development • Physical fitness and conditioning • Safety and risk management
Core Values	• Safety consciousness • Discipline and self-control • Professionalism • Commitment to excellence • Integrity and fair play • Respect for rules and regulations • Respect for diversity and inclusion
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American College of Sports Medicine (ACSM). (2021). *ACSM's Guidelines for Exercise Testing and Prescription (11th ed.)*. Wolters Kluwer.

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HKE 203 Organisation, Administration and Facility Construction in Sports

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Organisation, Administration and Facility Construction in Sport is a professional course that introduces students to the principles, processes, and practices involved in planning, organising, administering, managing, and developing sports programmes and facilities. The course examines organisational structures, leadership, management functions, budgeting, scheduling, personnel management, facility planning, construction, maintenance, safety, and utilisation of sports facilities.

The course also provides students with basic knowledge of sports facility design and construction, including site selection, planning requirements, dimensions and specifications, construction materials, accessibility, environmental considerations, equipment installation, maintenance, and facility management. Emphasis is placed on efficient resource utilisation, safety, sustainability, inclusiveness, and the effective administration of sports programmes in schools, communities, clubs, and other sporting organisations.

RELEVANCE STATEMENT

Effective sport development depends not only on athletes and coaches but also on sound administration, appropriate facilities, competent personnel, adequate funding, and effective organisational structures. Poor planning, inadequate facilities, weak maintenance systems, and ineffective administration can limit participation, reduce performance, and increase safety risks.

This course is therefore relevant to students of Physical and Health Education, Sports Management, and related disciplines because it equips them with competencies required to organise sporting events, manage sports organisations, plan and maintain facilities, prepare budgets, supervise personnel, and ensure the safe and efficient use of sports infrastructure. It is particularly valuable in the Nigerian context, where many schools and communities require effective management, maintenance, rehabilitation, and development of sports facilities using available resources.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, functions, and importance of sports organisation and administration.
2) Describe organisational structures, leadership functions, and administrative processes in sports organisations.
3) Apply appropriate management principles in planning, organising, staffing, directing, coordinating, and controlling sports programmes.
4) Demonstrate skills in budgeting, scheduling, personnel management, record keeping, communication, and organisation of sporting events.
5) Explain the principles and stages involved in the planning, design, construction, and development of sports facilities.
6) Apply appropriate principles of facility maintenance, safety, accessibility, sustainability, and resource management.
7) Develop basic plans for the organisation and administration of sports programmes and the development or improvement of sports facilities.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and explain the major concepts and principles of sports organisation and administration.

2) Identify appropriate organisational structures and leadership approaches for different sporting organisations.
3) Plan, organise, coordinate, and evaluate sporting programmes and competitions.
4) Prepare basic sports budgets, schedules, inventories, reports, and administrative records.
5) Identify the major requirements for planning, designing, constructing, and equipping sports facilities.
6) Apply appropriate safety, accessibility, maintenance, environmental, and sustainability principles to sports facilities.
7) Develop a basic administrative and facility-management plan for a school, community, club, or institutional sports programme.

COURSE CONTENT

- Introduction to Sports Organisation and Administration
- Organisational Structure in Sport
- Leadership and Management in Sport
- Functions of Sports Administration
- Sports Programme Planning and Organisation
- Sports Personnel Management
- Financial Administration in Sport
- Sports Marketing
- Communication and Public Relations
- Introduction to Sports Facility Planning
- Sports Facility Design and Site Selection
- Construction of Sports Facilities
- Types and Specifications of Sports Facilities
- Sports Facility Equipment and Maintenance
- Safety
- Accessibility and Sustainable Facility Management
- Facility Management and Evaluation

CATEGORY	DETAILS
Core Competencies	• Administrative • Leadership • Event-management • Financial • Communication • Facility-planning • Facility-management
Core Values	• Accountability • Transparency • Integrity • Discipline • Responsibility • S
Pedagogical Approaches	• Interactive lectures • Case studies • Group discussions • Problem-based learning • Budget preparation exercises
Learning Resources	• Physical Resources • Sports fields • Athletics tracks • Sports halls • Gymnasiums • Swimming pools where available • Instructional Resources • Sports administration textbooks

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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Hoye, R., Smith, A., Nicholson, M., Stewart, B., & Westerbeek, H. (2018). *Sport management: Principles and applications* (5th ed.). Routledge.

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World Athletics. (2026). *Track and field facilities and competition rules*. World Athletics.

HKE 213 Coaching and Officiating of Sports

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 30

COURSE OVERVIEW

Coaching and Officiating of Sports is a practical and professional course designed to equip students with the knowledge, skills, attitudes, and competencies required to coach athletes and teams and officiate sporting activities effectively. The course introduces students to the principles of sports coaching, training, skill development, communication, motivation, team management, sports ethics, and performance evaluation, alongside the principles and practical procedures of officiating.

The course covers coaching principles, training methods, technical and tactical instruction, session planning, athlete assessment, competition management, rules and regulations, officiating signals, positioning, decision-making, scoring, conflict management, safety, and fair play. Students gain practical experience through demonstrations, simulations, peer coaching, officiating exercises, and participation in organised competitions.

RELEVANCE STATEMENT

Effective coaching and competent officiating are essential for the development, organisation, safety, and integrity of sport. Coaches are responsible for developing athletes' physical, technical, tactical, psychological, and social capabilities, while officials ensure that competitions are conducted fairly, safely, and according to established rules.

The course is therefore highly relevant to students of Physical and Health Education, Sports Science, and Sports Management because it prepares them for professional roles as coaches, instructors, referees, umpires, judges, technical officials, and sports administrators. It also develops leadership, communication, decision-making, teamwork, discipline, ethical conduct, and problem-solving skills that are valuable in school, community, recreational, and competitive sport.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the principles, roles, responsibilities, and ethics of sports coaching and officiating.
2) Describe the rules, regulations, procedures, and technical requirements governing selected sports.

3) Apply appropriate coaching methods and training principles in developing athletes' physical, technical, tactical, and psychological abilities.
4) Demonstrate effective skills in planning, conducting, supervising, and evaluating coaching sessions.
5) Demonstrate appropriate officiating techniques, including positioning, signalling, decision-making, scoring, and application of rules.
6) Apply appropriate strategies for managing athletes, teams, competitions, safety, conflicts, and sporting equipment.
7) Evaluate athlete and team performance and demonstrate professional, ethical, fair, and inclusive coaching and officiating practices.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Explain the principles, functions, and responsibilities of coaches and sports officials.
2) Interpret and apply the rules and regulations of selected sports during training and competition.
3) Develop appropriate training programmes and coaching session plans based on athletes' needs and levels of development.
4) Demonstrate appropriate coaching techniques for teaching and correcting sports skills.
5) Demonstrate basic officiating skills, including positioning, signalling, scoring, and decision-making.
6) Manage sporting competitions effectively while maintaining safety, discipline, fairness, and sportsmanship.
7) Assess athlete and team performance and provide constructive feedback for continuous improvement.

COURSE CONTENT

- Introduction to Sports Coaching and Officiating
- Principles of Sports Coaching
- Sports Training Principles and Methods
- Coaching Session Planning
- Technical Skill Development
- Tactical Coaching and Team Management
- Psychological Aspects of Coaching

- Principles and Philosophy of Officiating
- Rules and Regulations of Sports
- Officiating Techniques and Mechanics
- Officiating Selected Sports
- Competition Management
- Safety
- Injury Prevention and Emergency Management
- Ethics
- Fair Play and Athlete Welfare

CATEGORY	DETAILS
Core Competencies	• Coaching • Technical • Tactical • Officiating • Communication • Leadership • Assessment • Decision-making • Safety
Core Values	• Fair play • Integrity • Discipline • Respect • Teamwork • Responsibility • Leadership • Honesty • Accountability

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Demonstrations • Practical coaching • Peer coaching • Peer officiating • Micro-coaching • Cooperative learning
Learning Resources	• Physical Resources • Sports fields • Courts • Athletics facilities • Gymnasium • Swimming pool where available • Sports balls • Cones and markers • Whistles • Stopwatches • Scoreboards • Score sheets • Referee/official equipment
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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Weinberg, R. S., & Gould, D. (2019). *Foundations of sport and exercise psychology* (7th ed.). Human Kinetics.

Haff, G. G., & Triplett, N. T. (Eds.). (2016). *Essentials of strength training and conditioning* (4th ed.). Human Kinetics.

Siedentop, D., Hastie, P. A., & van der Mars, H. (2020). *Complete guide to sport education* (3rd ed.). Human Kinetics.

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Relevant International Federation rules and regulations for sports such as athletics, football, basketball, volleyball, tennis, handball, swimming, and other sports should be consulted for current officiating requirements.

National sporting bodies and federations in Nigeria should also be consulted for national competition rules, officiating procedures, coaching standards, and certification requirements.

HKE 214 Recreation and Tourism Education

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Recreation and Tourism Education is a multidisciplinary course that introduces students to the concepts, principles, practices, and educational significance of recreation and tourism. The course examines recreation as a means of promoting physical, mental, social, and emotional wellbeing, while tourism is explored as an important avenue for leisure, cultural exchange, economic development, environmental awareness, and community development.

The course covers the nature and types of recreation and tourism, leisure education, recreational activities, tourism resources, tourism planning and management, ecotourism, cultural tourism, hospitality, safety, sustainability, community participation, and the educational and economic importance of tourism. Emphasis is placed on practical participation, programme planning, responsible tourism, environmental conservation, and the development of lifelong leisure skills.

RELEVANCE STATEMENT

Recreation and tourism contribute significantly to health, wellbeing, education, employment, cultural preservation, social integration, and economic development. Properly planned recreational activities provide opportunities for relaxation, physical

fitness, creativity, social interaction, and stress management, while responsible tourism can promote cultural understanding, environmental conservation, and local economic development.

The course is relevant to students of Physical and Health Education, Recreation, Tourism, Sports Management, and related disciplines because it equips them with competencies for planning, organising, managing, and evaluating recreational and tourism programmes. It also prepares students to utilise Nigeria's rich natural, historical, cultural, and recreational resources for educational, social, health, and sustainable economic purposes.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, nature, and importance of recreation, leisure, and tourism.
2) Identify different types of recreational activities and tourism resources and explain their educational, health, social, cultural, and economic significance.
3) Apply appropriate principles and methods in planning, organising, and managing recreational and tourism programmes.
4) Demonstrate practical skills in designing and conducting recreational activities suitable for individuals and groups of different ages and abilities.
5) Examine the relationship between tourism, recreation, environmental conservation, cultural heritage, and community development.
6) Apply appropriate safety, risk-management, ethical, inclusive, and sustainable practices in recreational and tourism activities.
7) Develop basic recreational and tourism programmes that promote lifelong leisure participation, wellbeing, cultural appreciation, and sustainable development.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define recreation, leisure, tourism, and related concepts and explain their relationship.
2) Identify and classify various recreational activities and tourism resources.
3) Explain the physical, psychological, social, educational, cultural, and economic benefits of recreation and tourism.
4) Plan, organise, implement, and evaluate recreational and tourism programmes.

5) Identify and utilise natural, cultural, historical, and community tourism resources responsibly.
6) Apply appropriate safety, environmental, ethical, inclusive, and sustainable practices in recreation and tourism.
7) Develop a basic recreation or tourism project that demonstrates effective planning, resource management, community participation, and sustainability.

COURSE CONTENT

- Introduction to Recreation
- Leisure and Tourism
- Theories and Principles of Recreation and Leisure
- Types and Forms of Recreation
- Recreational Activities and Programme Planning
- Recreation for Different Population Groups
- Introduction to Tourism
- Tourism Resources and Attractions
- Tourism Planning and Management
- Ecotourism and Sustainable Tourism
- Cultural and Heritage Tourism
- Recreation and Tourism in Nigeria
- Recreation
- Tourism and Economic Development
- Safety
- Risk Management and Ethics
- Recreation
- Tourism and Environmental Education
- Tourism and Recreation Marketing

CATEGORY	DETAILS
Core Competencies	• Programme-planning • Activity-management • Tourism-resource • Communication • Leadership • Safety • Digital
Core Values	• Respect for nature • Environmental stewardship • Cultural appreciation • Tolerance • Hospitality • Respect for diversity • Entrepreneurship • Community participation • Social responsibility
Pedagogical Approaches	• Recommended approaches include: • Interactive lectures • Field trips • Educational tours • Demonstrations • Outdoor practical activities • Project-based learning
Learning Resources	• Physical Resources • Recreational facilities • Sports fields and courts • Parks and gardens • Swimming facilities where available • Camping equipment • Outdoor recreation equipment

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests

REFERENCES AND FURTHER READING

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Fennell, D. A. (2021). *Ecotourism* (5th ed.). Routledge.

United Nations World Tourism Organization. (2018). *Sustainable tourism development resources*. UNWTO.

HKE 202 Introduction to Biomechanics and Kinesiology

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introduction to Biomechanics and Kinesiology is a foundational course that introduces students to the scientific principles governing human movement and their application to physical activity, exercise, sport, health, and rehabilitation. The course examines the structure and function of the musculoskeletal system, the mechanical principles of motion,

and the analysis of movement using the concepts of biomechanics and kinesiology. Students explore the anatomical and physiological basis of movement, including body planes and axes, joint structure and function, muscle actions, posture, balance, locomotion, and the laws of mechanics that influence human performance. The course also covers force, motion, leverage, equilibrium, work, energy, power, and the biomechanical analysis of fundamental and sport-specific skills.

RELEVANCE STATEMENT

The course provides a scientific understanding of how the human body moves and how movement can be optimised for health, learning, and athletic performance. It equips future teachers, coaches, fitness professionals, and sports scientists with the knowledge and practical skills required to analyse movement, improve sports techniques, prevent injuries, and enhance physical performance.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts, scope, and importance of biomechanics and kinesiology.
2. Describe the anatomical and physiological foundations of human movement.
3. Identify body planes, axes, and types of human movement.
4. Explain the mechanical principles governing motion and human performance.
5. Analyse joint structure, muscle function, and movement patterns.
6. Apply biomechanical principles to sports skills, exercise, and daily activities.
7. Evaluate movement efficiency and identify factors contributing to performance and injury.
8. Demonstrate basic movement analysis using biomechanical concepts.
9. Apply principles of posture, balance, stability, and coordination to physical activity.
10. Utilise biomechanical knowledge to improve coaching, teaching, rehabilitation, and sports performance.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the basic concepts of the kinematics, dynamics of human motion and the architectural features and mechanical properties;
2. Describe the tissue and function in the context of normal and pathological movement;
3. Explain the motion of a rigid body, measurement and processing of kinematic data;

4. Describe the body anthropometry, forces and moments, work, energy, and power;
5. Explain the biomechanical adaptations to training, knee osteoarthritis;
6. Demonstrate the knowledge of tissue biomechanics, orthopaedic and biomechanics of gait across the lifespan;
7. Describe the factors, and principles involved in human development;
8. Explain the effects of physical activity on health and performance;
9. State the evolution of physical activity and sport;
10. List and analyse the physiological, psychological, and social factors that influence an individual's participation in physical activity and sport; and '

COURSE CONTENT

- Basic concepts of the kinematics
- Dynamics of human motion and the architectural features and mechanical properties of musculoskeletal tissue
- Tissue function n the context of normal and pathological movement
- Motion of a rigid body, measurement and processing of kinematic data, body anthropometry, forces and moments, work, energy, and power
- Tissue biomechanics, orthopaedic biomechanics, biomechanics of gait across the lifespan, biomechanical adaptations to training, knee osteoarthritis
- Human movement and of systems, factors, and principles involved in human development, effects of physical activity on health and performance, the evolution of physical activity and sport, and the physiological, psychological, and social factors that influence an individual's participation in physical activity and sport
- Fitness technology, rhythm and dance aquatics individual and dual activities human movement based on anatomical and mechanical principles
- Emphasis on application of these principles to fundamental movement and physical education activity
- Human performance and motor development

CATEGORY	DETAILS
Core Competencies	• Knowledge of biomechanics and kinesiology principles • Human movement analysis • Application of mechanical principles to movement • Musculoskeletal system assessment • Motor skill and performance analysis • Posture, balance, and coordination assessment • Exercise and sports technique evaluation • Injury prevention and movement correction
Core Values	• Scientific integrity • Professionalism • Precision and accuracy • Critical thinking • Ethical practice • Safety consciousness • Commitment to excellence • Innovation and creativity • Analytical and evidence-based decision-making • Teamwork and collaboration • Responsibility and accountability
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (pbl) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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World Health Organization (WHO). (2020). *Guidelines on Physical Activity and Sedentary Behaviour*.

HKE 204 First Aids and Accident Prevention in Sports

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

First Aid and Accident Prevention in Sports is a practical and professionally oriented course that equips students with the knowledge, skills, and competencies required to prevent, recognise, assess, and manage sports-related injuries and medical emergencies. The course emphasises the principles of first aid, emergency care, injury prevention, risk management, and safety practices in physical education, sports, exercise, and recreational activities. Students are introduced to the causes and types of sports injuries, emergency response procedures, basic life support (BLS), cardiopulmonary resuscitation (CPR), wound management, fracture and dislocation care, bleeding control, shock management, burns, heat- and cold-related illnesses, and transportation of injured athletes. The course also examines accident prevention strategies, safety regulations, emergency action plans, facility inspection, and the roles and responsibilities of teachers, coaches, officials, and sports administrators in maintaining safe sporting environments.

RELEVANCE STATEMENT

The course provides essential practical skills for protecting the health and safety of learners, athletes, and participants in physical activity. It prepares future teachers, coaches, fitness instructors, sports administrators, and recreation managers to recognise emergencies, provide immediate first aid, reduce injury risks, and ensure safe learning and sporting environments.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts, principles, and importance of first aid and accident prevention in sports.
2. Identify common sports injuries, their causes, signs, symptoms, and preventive measures.
3. Demonstrate appropriate first aid procedures for sports-related injuries and emergencies.
4. Apply basic life support (BLS) and cardiopulmonary resuscitation (CPR) techniques in emergency situations.
5. Assess injury severity and determine appropriate emergency responses.
6. Demonstrate safe methods of handling, immobilising, and transporting injured athletes.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the theory and principles of first aids and accident prevention;
2. Describe the soft tissue injury;
3. Explain the transverse fracture compound fracture, oblique, fracture, spiral fracture, comminute fracture and impact fracture;
4. Describe the joint dislocation in the body;
5. Explain the various content in a first aid box; and
6. Demonstrate the knowledge of sport injuries prevention and safety precautions.

COURSE CONTENT

The theory and principles of first aids and accident prevention. Soft tissue injury (Contusion, abrasion, laceration, incision, strain and sprain) Bone (Transverse Fracture Compound fracture, Oblique Fracture, Spiral Fracture, Comminute Fracture and Impact Fracture) Joint dislocation and first aid box content (Bandages, Antiseptics, Cotton balls and swabs, Saline, Hydrogen peroxide, Iodine, Dressings, Eye wash, Disposable gloves, Scissors Adhesive Bandages and Thermometer).Prevention of sport injuries and Safety precautions.

CATEGORY	DETAILS
Core Competencies	• Emergency first aid knowledge and skills • Basic life support (bls) and cardiopulmonary resuscitation (cpr) competence • Sports injury recognition and management • Accident prevention and risk management • Emergency response and decision-making • Injury assessment and patient care
Core Values	• Scientific integrity • Professionalism • Precision and accuracy • Critical thinking • Ethical practice • Safety consciousness • Commitment to excellence • Innovation and creativity • Analytical and evidence-based decision-making • Teamwork and collaboration • Responsibility and accountability
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (pbl) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American Academy of Orthopaedic Surgeons (AAOS). (2021). *First Aid, CPR, and AED (8th ed.)*. Jones & Bartlett Learning.

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HKE 223 Citizenship and Leadership Training

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 120

COURSE OVERVIEW

Citizenship and Leadership Training is a value-oriented course designed to develop responsible, ethical, and patriotic citizens who can contribute meaningfully to national development and community well-being. The course introduces students to the principles of citizenship, leadership, governance, civic responsibility, national values, and democratic participation. It emphasises the development of leadership competencies, social responsibility, integrity, teamwork, and active community engagement. The course examines the rights and responsibilities of citizens, the Constitution of the Federal Republic of Nigeria, democratic institutions, the rule of law, human rights, national unity, peacebuilding, conflict resolution, and sustainable development. Students explore different theories and styles of leadership, leadership ethics, decision-making, emotional intelligence, communication, and organisational behaviour in educational, community, and professional settings.

RELEVANCE STATEMENT

The course provides essential leadership and civic competencies needed to manage teams, organise sports programmes, lead community health initiatives, and promote ethical behaviour in sports and education. It prepares future teachers, coaches, sports administrators, and health educators to serve as role models who uphold integrity, fairness, inclusiveness, and national values.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts of citizenship, leadership, governance, and civic responsibility.

2. Describe the rights, duties, and responsibilities of citizens in a democratic society.
3. Demonstrate knowledge of the Constitution of the Federal Republic of Nigeria and the principles of the rule of law.
4. Analyse different leadership theories, styles, and approaches and their applications.
5. Develop effective leadership, communication, and interpersonal skills.
6. Demonstrate ethical behaviour, integrity, accountability, and professionalism in leadership roles.
7. Promote national unity, peace, tolerance, and respect for diversity.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Demonstrate responsible citizenship and civic engagement.
2. Apply leadership principles to personal, academic, and professional situations.
3. Promote ethical decision-making, accountability, and good governance.
4. Resolve conflicts using negotiation and peacebuilding strategies.
5. Communicate effectively and work collaboratively in diverse teams.
6. Initiate and participate in community development and volunteer programmes.
7. Contribute positively to national development and sustainable development goals.

COURSE CONTENT

- The concepts, philosophy, and importance of citizenship and leadership in promoting responsible governance and national development
- The evolution of citizenship, democratic values, constitutional governance, civic rights, duties, and responsibilities, with emphasis on the Nigerian context and global best practices
- The Constitution of the Federal Republic of Nigeria, the structure and functions of government, democratic institutions, electoral processes, human rights, rule of law, accountability, transparency, and public participation in governance
- National symbols, values, identity, patriotism, and strategies for promoting national integration and peaceful coexistence
- Characteristics of effective leaders, leadership theories and styles, ethical leadership, servant leadership, transformational leadership, decision-making, communication, emotional intelligence, teamwork, motivation, conflict management, and organisational leadership

- Students learn practical leadership skills for educational institutions, workplaces, sports organisations, and community settings
- Contemporary issues such as corruption, insecurity, social justice, environmental sustainability, gender equality, youth empowerment, entrepreneurship, digital citizenship, media literacy, and community development
- Leadership workshops, debates, simulations, community service projects, volunteer activities, group discussions, civic education campaigns, and reflective exercises

CATEGORY	DETAILS
Core Competencies	• Citizenship and civic responsibility • Leadership and team management • Ethical decision-making and integrity • Knowledge of democratic governance and the rule of law • Communication and public speaking skills • Critical thinking and problem-solving • Conflict prevention, resolution, and peacebuilding • Emotional intelligence and self-leadership • Community engagement and volunteerism
Core Values	• Sportsmanship and fair play • Discipline and self-control • Professionalism • Integrity and ethical conduct • Teamwork and cooperation • Leadership and responsibility • Respect for rules and officials • Commitment to excellence • Perseverance and resilience

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning • Independent study and reflective learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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National Commission for Colleges of Education (NCCE). Minimum Standards for Nigeria Certificate in Education (NCE) Programmes.

National Orientation Agency (NOA). Publications on national values, civic responsibilities, patriotism, and nation-building.

National Universities Commission (NUC). Core Curriculum and Minimum Academic Standards (CCMAS).

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United Nations Educational, Scientific and Cultural Organization (UNESCO). (2024). *Global Citizenship Education: Topics and Learning Objectives*.

United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.

HKE 224 Test and Measurement in Physical and Health Education

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Test and Measurement in Physical and Health Education is a foundational course that introduces students to the principles, concepts, techniques, and practical applications of testing and measurement in physical education, health education, fitness, and sport. The

course examines the processes involved in selecting, administering, scoring, interpreting, and evaluating physical, physiological, motor, skill, health-related, and educational tests.

Students are introduced to concepts such as validity, reliability, objectivity, norms, standardisation, measurement error, test construction, and evaluation. Practical emphasis is placed on measuring body composition, health-related fitness, motor fitness, physical skills, physiological parameters, and selected health indicators. Students also learn how to organise test batteries, collect and analyse data, interpret results, and use findings for instructional planning, fitness programming, health promotion, and performance improvement.

RELEVANCE STATEMENT

Accurate testing and measurement are essential for determining learners' physical fitness, health status, motor abilities, skill development, and progress in physical and health education. Teachers, coaches, and health professionals require reliable information to identify individual differences, establish baseline performance, monitor improvement, prescribe appropriate activities, and evaluate the effectiveness of programmes.

This course is therefore highly relevant to students of Physical and Health Education because it develops their competence in using scientific procedures to assess learners and athletes. It also promotes evidence-based decision-making, individualised instruction, appropriate fitness programming, health promotion, and objective evaluation of physical education and health education programmes.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, purposes, and scope of testing, measurement, and evaluation in physical and health education.
2) Differentiate among tests, measurement, assessment, and evaluation and explain their applications in physical and health education.
3) Describe and apply the principles of validity, reliability, objectivity, standardisation, and norms in test selection and administration.
4) Select and administer appropriate tests for assessing physical fitness, motor ability, health-related fitness, and sports skills.
5) Apply appropriate procedures for collecting, recording, scoring, and interpreting test and measurement data.
6) Analyse test results using appropriate descriptive and basic statistical techniques.

7) Use test and measurement findings to make appropriate decisions concerning teaching, fitness programming, health promotion, talent identification, and performance improvement.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and explain the concepts of test, measurement, assessment, and evaluation.
2) Explain the characteristics of a good test, including validity, reliability, objectivity, usability, and standardisation.
3) Select appropriate tests according to the purpose, age, sex, ability, and characteristics of the participants.
4) Demonstrate correct procedures for administering selected physical, health, fitness, motor, and skill tests.
5) Record, score, organise, and analyse test data using appropriate procedures.
6) Interpret test results and compare performance with appropriate standards, norms, or criteria.
7) Prepare and use test reports to support instructional planning, fitness development, health promotion, and evaluation of physical and health education programmes.

COURSE CONTENT

- Introduction to Test
- Measurement and Evaluation
- Principles of Test Construction and Selection
- Types and Classification of Tests
- Test Administration and Safety
- Anthropometric Measurements
- Body Composition Assessment
- Health-Related Fitness Assessment
- Skill-Related Fitness Assessment
- Motor Ability and Motor Skill Testing
- Physiological Measurements
- Health and Wellness Assessment
- Sports Skill Testing
- Cognitive and Affective Assessment in Physical and Health Education

- Statistical Treatment of Test Data
- Norms
- Standards and Interpretation of Test Results
- Test Batteries and Practical Application

CATEGORY	DETAILS
Core Competencies	• Testing • Measurement • Assessment • Data-management • Statistical • Interpretation • Equipment • Safety
Core Values	• Accuracy • Objectivity • Honesty • Integrity • Responsibility • Confidentiality • Fairness • Professionalism
Pedagogical Approaches	• Interactive lectures • Demonstrations • Practical testing sessions • Laboratory exercises • Peer testing • Small-group activities • Problem-based learning

CATEGORY	DETAILS
Learning Resources	• Physical and Testing Equipment • Weighing scales • Stadiometers/height measures • Measuring tapes • Skinfold calipers • Stopwatches • Heart-rate monitors • Blood-pressure monitors • Measuring scales
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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HKE 321 Introduction to Psychology and Sociology of Sport and Exercise

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introduction to Psychology and Sociology of Sport and Exercise is an interdisciplinary course that examines the psychological and sociological factors that influence participation, performance, and behaviour in sport, exercise, and physical activity. The course explores how individual thoughts, emotions, motivation, personality, and mental processes interact with social institutions, culture, gender, media, family, and community to shape experiences in sport and exercise. The course introduces students to the fundamental theories and principles of sport psychology and sport sociology, emphasising their application in enhancing athletic performance, promoting lifelong physical activity, improving mental well-being, fostering social inclusion, and understanding the broader role of sport in society.

RELEVANCE STATEMENT

For students of Physical Education, Exercise Science, and Sport Development, this course provides an understanding of the behavioural and social factors that affect learning, participation, coaching, and performance. It equips future educators, coaches, fitness professionals, and sports administrators with the knowledge and skills to motivate participants, build cohesive teams, manage diverse groups, promote inclusion, and enhance both performance and well-being. The course also highlights the transformative role of sport in education, public health, youth development, community engagement, and national integration.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts of psychology, sociology, sport, exercise, and physical activity.
2. Describe the relationship between psychological and sociological principles in sport and exercise.

3. Explain the influence of motivation, personality, emotion, and self-confidence on sports performance.
4. Examine the role of socialisation agents such as family, schools, peers, and the media in sport participation.
5. Discuss the effects of culture, gender, ethnicity, and social class on participation in sport and exercise.
6. Identify psychological techniques used to improve performance and mental well-being.
7. Analyse the social values and functions of sport in national development and community cohesion.
8. Apply psychological and sociological concepts to coaching, teaching, leadership, and sports management.
9. Recognise ethical issues and challenges affecting sport and exercise participation.
10. Promote positive attitudes toward healthy lifestyles and lifelong physical activity.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the concept of sport and exercise psychology;
2. Describe the behavioural responses and adaptations to sport and exercise;
3. Explain the various theories used to describe behaviour in sport and exercise psychology;
4. Discuss factors causing stress and anxiety in sport skill learning and performance;
5. Demonstrate the knowledge of group and individual behaviour in sport and exercise environment;.
6. Define the concept of sociology;
7. Describe the basic sociological theories;
8. Explain the concept of sociology of sports and goals of sociology of sport;
9. Describe the social values and sports, socialisation agents in sport;
10. Explain the common social problems in sports, drugs use and violence in sports;
11. Demonstrate the knowledge of stratification and social mobility, sports, race and ethnicity.

COURSE CONTENT

- Concept of sport and exercise psychology

- Behavioural responses and adaptations to sport and exercise
- (Personality-psychological core, typical responses and role-related)
- **Theories:** Trait, situational and interactional approach, psycho-dynamic, social learning
- Performance and exercise adherence to promote health, motivation (intrinsic and extrinsic), self-confidence, achievement-motivation
- Arousal-theories drive, inverted-U hypothesis, the catastrophe theory, individual zone of optimal functioning)
- Stress and causes of stress and anxiety learning and performance process, feedback techniques, attention and concentration, aggression and violence in sport
- Social facilitation, cohesion and factors affecting cohesion and audience effects
- Definition of sociology, application of basic sociological theories (functionalist theory, conflict theory, interactionist theory and feminist theory) concept of sociology of sports, goals of sociology of sport, social values and sports, socialisation agents and sport
- Social problems and sports, drugs use and violence in sports
- Stratification and social mobility, sports, race and ethnicity
- Sports and Gender, Future of Sports and Leisure participation

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking

CATEGORY	DETAILS
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility • Commitment to Health and Wellness
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL) • Project-Based Learning • Seminars and Student Presentations • Field Visits and Experiential Learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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Jarvis, M. (2023). *Sport Psychology: A Student's Handbook (3rd ed.)*. Routledge.

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Wann, D. L., Melnick, M. J., Russell, G. W., & Pease, D. G. (2001). *Sport Fans: The Psychology and Social Impact of Spectators*. Routledge.

Weinberg, R. S., & Gould, D. (2023). *Foundations of Sport and Exercise Psychology (8th ed.)*. Human Kinetics.

HKE 322 Exercise Physiology

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Exercise Physiology is the scientific study of how the human body responds and adapts to physical activity and exercise. The course examines the acute and chronic physiological responses of the cardiovascular, respiratory, muscular, nervous, endocrine, metabolic, and thermoregulatory systems to exercise.

Students are introduced to the physiological basis of physical fitness, exercise performance, training adaptation, fatigue, recovery, energy metabolism, and exercise prescription. The course also examines the effects of exercise on health and disease prevention, with practical emphasis on monitoring physiological responses such as heart rate, blood pressure, oxygen consumption, respiratory responses, and body composition.

The course provides a scientific foundation for physical education teaching, sports coaching, fitness programming, exercise prescription, health promotion, and sports performance.

RELEVANCE STATEMENT

Understanding exercise physiology is essential for professionals involved in physical education, sports, fitness, and health promotion. Knowledge of how the body responds and adapts to exercise enables teachers and coaches to design safe, effective, progressive, and scientifically appropriate physical activity programmes.

The course is particularly relevant to students of Physical and Health Education, Exercise Science, Sports Science, and related disciplines, as it helps them understand the physiological basis of physical fitness and athletic performance. It also equips them to monitor exercise responses, prevent overtraining and exercise-related injuries, promote healthy lifestyles, and adapt exercise programmes to different populations and environmental conditions.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the basic concepts, principles, and scope of exercise physiology and its application to physical activity, fitness, health, and sport.
2) Describe the acute physiological responses of major body systems to different forms and intensities of exercise.
3) Explain the mechanisms of energy production and utilisation during rest, exercise, and recovery.
4) Analyse the physiological adaptations that occur as a result of regular aerobic, anaerobic, strength, and flexibility training.
5) Demonstrate appropriate procedures for monitoring selected physiological responses to exercise.
6) Examine the effects of environmental conditions, nutrition, hydration, fatigue, and recovery on exercise performance and health.

7) Apply principles of exercise physiology in designing safe and effective exercise and fitness programmes for different populations.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define exercise physiology and explain its importance to physical education, health, fitness, and sports performance.
2) Explain the physiological functions of the cardiovascular, respiratory, muscular, nervous, endocrine, and metabolic systems during exercise.
3) Describe the different energy systems and explain their contribution to various types and intensities of physical activity.
4) Demonstrate basic procedures for measuring physiological responses such as heart rate, blood pressure, respiratory rate, and exercise intensity.
5) Explain the physiological adaptations resulting from regular endurance, strength, speed, and flexibility training.
6) Analyse the effects of fatigue, recovery, nutrition, hydration, and environmental conditions on exercise performance.
7) Apply exercise physiology principles to develop safe, appropriate, and individualised physical activity and exercise programmes.

COURSE CONTENT

- Introduction to Exercise Physiology
- The Muscular System and Exercise
- Cardiovascular Responses to Exercise
- Respiratory Responses to Exercise
- Energy Systems and Exercise Metabolism
- Exercise Intensity and Oxygen Consumption
- Neuromuscular and Neurological Responses
- Endocrine Responses to Exercise
- Thermoregulation and Exercise
- Exercise
- Nutrition and Hydration
- Exercise
- Fatigue and Recovery

- Physiological Adaptations to Training
- Exercise Prescription and Training Principles
- Exercise and Health
- Exercise Physiology for Special Populations

CATEGORY	DETAILS
Core Competencies	• Physiological knowledge • Exercise-monitoring • Fitness-assessment • Exercise-prescription • Training-programming • Research • Communication • Technology
Core Values	• Scientific curiosity • Accuracy • Objectivity • Discipline • Responsibility • Respect for individual differences • Evidence-based practice
Pedagogical Approaches	• Interactive lectures • Laboratory practicals • Demonstrations • Exercise-testing sessions • Field-based activities • Small-group experiments • Case studies • Problem-based learning • Data-analysis workshops

CATEGORY	DETAILS
Learning Resources	• Treadmills • Stationary bicycles • Step benches • Heart-rate monitors • Weighing scales • Stadiometers • Skinfold calipers • Measuring tapes • Exercise mats
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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Powers, S. K., & Howley, E. T. (2021). *Exercise physiology: Theory and application to fitness and performance* (11th ed.). McGraw-Hill.

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HKE 323 Combat Sport, Traditional Sport and Dance Education

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Combat Sport, Traditional Sport and Dance Education is a practical and culturally oriented course that introduces students to selected combat sports, indigenous/traditional sports, and dance forms as components of physical and health education. The course examines the historical development, principles, techniques, skills, rules, safety measures, educational values, and cultural significance of these activities.

The combat-sport component introduces students to activities such as judo, karate, taekwondo, wrestling, boxing, and related self-defence practices, with emphasis on discipline, controlled movement, fitness, safety, and sportsmanship. The traditional-sport component explores indigenous Nigerian games and sporting practices, their cultural meanings, organisation, skills, and relevance to contemporary physical education. The dance component focuses on traditional, recreational, creative, and educational dance, including rhythm, movement, choreography, cultural expression, and performance.

RELEVANCE STATEMENT

Combat sports, traditional sports, and dance provide important opportunities for physical fitness, motor-skill development, discipline, cultural education, social interaction, creativity, and personal development. Traditional sports and dances are also valuable tools for preserving indigenous knowledge, cultural identity, community values, and national heritage.

The course is particularly relevant to students of Physical and Health Education, Sports Science, Recreation, and related disciplines because it prepares them to teach and organise culturally relevant physical activities in schools and communities. It also equips prospective teachers with the ability to adapt traditional games, combat activities, and dances for educational purposes while promoting safety, inclusion, cultural respect, and healthy lifestyles.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, historical development, principles, and educational significance of combat sports, traditional sports, and dance.

2) Identify and describe selected combat sports, indigenous sports, traditional games, and dance forms practised in Nigeria and other cultures.
3) Demonstrate basic technical and movement skills in selected combat sports, traditional sports, and dance activities.
4) Apply appropriate rules, techniques, teaching methods, and safety procedures in the instruction and organisation of these activities.
5) Examine the physical, psychological, social, educational, and cultural benefits of combat sports, traditional sports, and dance.
6) Develop appropriate programmes that integrate combat sports, traditional sports, and dance into school and community physical education.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Explain the nature, history, principles, and educational value of combat sports, traditional sports, and dance.
2) Identify and classify selected Nigerian traditional sports, games, dances, and internationally recognised combat sports.
3) Demonstrate basic skills, movements, techniques, rhythms, and sequences in selected activities.
4) Apply appropriate rules, safety procedures, teaching methods, and organisational techniques.
5) Explain the physical, psychological, social, cultural, and educational benefits of participation.
6) Plan and conduct appropriate practical sessions involving combat sports, traditional sports, and dance.

COURSE CONTENT

- Introduction to Combat
- Traditional Sports and Dance
- Principles and Classification of Combat Sports
- Basic Combat Skills and Techniques
- Selected Combat Sports
- Traditional Sports and Games in Nigeria
- Skills and Organization of Traditional Sports

- Educational and Cultural Significance of Traditional Sports
- Introduction to Dance Education
- Elements and Principles of Dance
- Traditional and Cultural Dance
- Creative and Educational Dance
- Teaching Combat Sports
- Traditional Sports and Dance
- Safety
- Health and Risk Management
- Inclusion and Gender Responsiveness
- Organisation and Management of Events

CATEGORY	DETAILS
Core Competencies	• Technical • Teaching • Cultural • Safety • Choreographic • Organisational • Communication • Leadership • Inclusive-practice
Core Values	• Discipline • Respect • Self-control • Fair play • Sportsmanship • Teamwork • Courage • Confidence • Perseverance

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Demonstrations • Practical sessions • Skill drills • Peer teaching • Micro- • Dance composition • Video analysis • Cultural fieldwork
Learning Resources	• Wrestling mats • Boxing gloves and protective equipment • S • Skipping ropes • Balls • Ropes for tug-of-war • Musical instruments
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Green, T. A. (Ed.). (2010). *Martial arts of the world: An encyclopedia of history and innovation*. ABC-CLIO.

Fraleigh, S. H. (1996). *Dance and the lived body: A descriptive aesthetics*. University of Pittsburgh Press.

Adshead-Lansdale, J., & Layson, J. (Eds.). (1994). *Dance history: An introduction*. Routledge.

Hanna, J. L. (1987). *To dance is human: A theory of nonverbal communication*. University of Chicago Press.

Kraus, R., Hilsendager, S., & Dixon, B. (1991). *History of the dance in art and education* (4th ed.). Prentice Hall.

Wuest, D. A., & Bucher, C. A. (2009). *Foundations of physical education, exercise science, and sport* (16th ed.). McGraw-Hill.

Kirk, D. (2010). *Physical education futures*. Routledge.

Relevant Nigerian studies and publications on indigenous games, traditional sports, traditional dances, wrestling, and cultural heritage should be incorporated to ensure that students understand the indigenous context of the course.

Current rules and instructional materials from relevant international and national sport federations should be consulted for combat sports such as wrestling, boxing, judo, karate, and taekwondo.

Degree Course Descriptions (400–500 Level)

SED 411 Methods of Teaching Physical & Health Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Methods of Teaching Physical and Health Education is a professional education course designed to equip students with the knowledge, skills, and competencies required for effective teaching of Physical and Health Education (PHE) at the primary, secondary, and tertiary levels. The course emphasises modern teaching methodologies, lesson planning, instructional strategies, classroom and field management, assessment techniques, and the effective use of instructional resources in delivering Physical and Health Education. The course integrates educational theories with practical teaching experiences, enabling prospective teachers to design, implement, and evaluate learner-centred instructional programmes that promote physical fitness, health literacy, motor skill development, lifelong participation in physical activity, and healthy living.

RELEVANCE STATEMENT

For students of Physical Education, Exercise Science, and Sport Development, this course provides the pedagogical foundation required for effective teaching, coaching, and sports instruction. It equips future educators with the skills to design age-appropriate learning experiences, foster motor skill development, promote healthy lifestyles, and encourage lifelong participation in physical activity.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the philosophy, aims, and objectives of Physical and Health Education.
2. Describe the principles and methods of teaching Physical and Health Education.
3. Prepare effective schemes of work, lesson plans, and instructional materials.
4. Apply learner-centred teaching strategies appropriate to Physical and Health Education.
5. Demonstrate effective classroom, gymnasium, and field management techniques.

6. Apply inclusive teaching strategies that accommodate learners with diverse needs and abilities.
7. Demonstrate professional ethics and effective communication in Physical and Health Education teaching.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Design effective schemes of work and lesson plans for Physical and Health Education.
2. Apply a variety of learner-centred teaching methods.
3. Demonstrate competence in teaching practical and theoretical aspects of Physical and Health Education.
4. Manage classes, sports facilities, and practical activities safely and efficiently.
5. Use appropriate instructional materials and digital technologies to enhance learning.
6. Assess and evaluate learners' knowledge, skills, and attitudes using valid and reliable methods.
7. Demonstrate professionalism, ethical conduct, and effective communication in teaching.

COURSE CONTENT

- **Aims and objectives of Teaching Physical education in Primary and Secondary Schools:** Basic 1–9
- Methods of Teaching Physical Education: Demonstration, manual guidance, Lecture, Fieldwork, verbalisation, field trip etc. Materials for teaching Physical Education (Computer-based Training (CBT) and Improvisation.
- Minor Games and Sports: Perceptual skills refined motor skills and gross foot work
- **Content of the Physical Education syllabus in primary and secondary schools:** Basic 1–9
- Preparation of lesson notes in Physical Education: tabular and essay format with emphasis on preparation, organisation, lesson presentation and evaluation
- **Aims and objectives of teaching Health Education in Primary and Secondary Schools:** Basic 1–9
- Methods of teaching Health Education: Incidental, discussion projects, field trip, audio Visual, demonstration, lecture, micro-teaching: use of filmstrips
- **Improvisation of materials, Evaluation in Health Education and preparation of lesson notes:** as above

CATEGORY	DETAILS
Core Competencies	• Knowledge • Practical • Research • Professional • Digital • Health • Civic • Teamwork • Analytical and Critical Thinking
Core Values	• Professionalism • Integrity and Fair Play • Discipline and Self-Control • Respect for Diversity and Inclusion • Teamwork and Cooperation • Leadership and Responsibility
Pedagogical Approaches	• Interactive Lectures • Group Discussions and Collaborative Learning • Practical Demonstrations • Case Studies • Problem-Based Learning (PBL)
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.

Bucher, C. A., & Krotee, M. L. (2002). Management of Physical Education and Sport (13th ed.). McGraw-Hill.

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Hardman, K., & Green, K. (Eds.). (2011). Contemporary Issues in Physical Education: International Perspectives. Meyer & Meyer Sport.

Lumpkin, A. (2017). Introduction to Physical Education, Exercise Science, and Sport Studies (10th ed.). McGraw-Hill Education.

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McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise Physiology: Nutrition, Energy, and Human Performance. Lippincott Williams & Wilkins.

Nixon, H. L., & Jewett, A. E. (1980). An Introduction to Physical Education. Saunders College Publishing.

Sharkey, B. J., & Gaskill, S. E. (2013). Fitness and Health. Human Kinetics.

Wuest, D. A., & Bucher, C. A. (2019). Foundations of Physical Education, Exercise Science, and Sport (20th ed.). McGraw-Hill Education.

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National Policy on Education (Federal Republic of Nigeria).

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HKE 403 Business of Sport Management and Communication, Community Recreation, Leisure and Tourism

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Business of Sport Management and Communication, Community Recreation, Leisure and Tourism is a multidisciplinary course that introduces students to the principles and practices of managing sport as a business and using sport, recreation, leisure, and tourism as instruments for individual and community development. The course examines the organisation, administration, marketing, financing, communication, entrepreneurship, and management of sport and recreation programmes.

It further explores community recreation, leisure services, tourism development, event management, hospitality, destination promotion, community participation, and sustainable tourism. Particular attention is given to the economic and social potential of sport and recreation enterprises, communication strategies, customer relations, sponsorship, branding, digital media, and the development of sustainable community-based recreation and tourism initiatives.

RELEVANCE STATEMENT

Sport, recreation, leisure, and tourism are increasingly important components of the global and Nigerian economy, providing opportunities for employment, entrepreneurship, community development, social integration, health promotion, cultural exchange, and destination development. Effective management and communication are essential for transforming sport and recreational activities into sustainable enterprises and community services.

The course is particularly relevant to students of Physical and Health Education, Sport Management, Recreation, Tourism, and related disciplines because it develops business, managerial, communication, entrepreneurial, and community-development competencies. It prepares graduates to identify opportunities within the sport and recreation industry, mobilise resources, manage events, attract sponsorship, communicate with stakeholders, develop community programmes, and promote tourism and leisure opportunities responsibly.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, and importance of sport management, sport business, communication, community recreation, leisure, and tourism.
2) Examine the organisational, administrative, financial, entrepreneurial, and marketing functions involved in managing sport and recreation enterprises.
3) Apply appropriate communication, public relations, digital-media, branding, and customer-service strategies in sport, recreation, leisure, and tourism.
4) Develop basic business and entrepreneurial plans for sport, recreation, leisure, and tourism enterprises.
5) Plan, organise, and manage sport, recreation, leisure, and tourism events and programmes for diverse communities.
6) Evaluate the social, economic, cultural, environmental, and health contributions of community recreation, leisure, and tourism.
7) Design sustainable and inclusive sport, recreation, leisure, and tourism initiatives that promote community development and employment.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and explain the principles and practices of sport management, communication, community recreation, leisure, and tourism.
2) Identify business and entrepreneurial opportunities within the sport, recreation, leisure, and tourism industries.
3) Demonstrate basic skills in sport marketing, sponsorship, public relations, branding, and communication.
4) Prepare a basic business plan for a sport, recreation, leisure, or tourism enterprise.
5) Plan and organise sport, recreation, leisure, and tourism events and community programmes.
6) Apply ethical, inclusive, environmentally responsible, and culturally sensitive practices in managing recreation and tourism activities.
7) Evaluate and communicate the outcomes and impacts of sport, recreation, leisure, and tourism programmes on individuals and communities.

COURSE CONTENT

- Introduction to Sport Business and Management
- Principles of Sport Management
- Sport Entrepreneurship and Business Development

- Sport Marketing and Promotion
- Sport Communication
- Sport Media and Digital Communication
- Introduction to Community Recreation
- Community Recreation Planning and Programming
- Recreation Facilities and Resource Management
- Leisure Studies
- Introduction to Tourism
- Tourism Resources and Destination Management
- Community-Based Tourism
- Tourism
- Hospitality and Customer Service
- Event Management
- Finance
- Sponsorship and Resource Mobilisation
- Sustainable Recreation
- Leisure and Tourism

CATEGORY	DETAILS
Core Competencies	• Sport-management • Business • Entrepreneurial • Marketing • Communication • Digital-media • Financial-management • Leadership • Negotiation • Research • Sustainability

CATEGORY	DETAILS
Core Values	• Entrepreneurship • Innovation • Professionalism • Integrity • Accountability • Transparency • Leadership • Teamwork • Community service
Pedagogical Approaches	• Interactive lectures • Case studies • Business simulations • Group discussions • Role-play • Entrepreneurship projects • Event-management simulations • Community needs assessment • Field visits • Tourism-resource mapping
Learning Resources	• Sports facilities • Recreation centres • Community parks • Tourism sites • Event venues • Sports equipment • Public-address systems

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Masteralexis, L. P., Barr, C. A., & Hums, M. A. (2021). *Principles and practice of sport management* (6th ed.). Jones & Bartlett Learning.

Mullin, B. J., Hardy, S., & Sutton, W. A. (2014). *Sport marketing* (4th ed.). Human Kinetics.

Shank, M. D., & Lyberger, M. R. (2015). *Sports marketing: A strategic perspective* (5th ed.). Routledge.

Parks, J. B., Quarterman, J., & Thibault, L. (Eds.). (2011). *Contemporary sport management* (4th ed.). Human Kinetics.

Cooper, C., Fletcher, J., Fyall, A., Gilbert, D., & Wanhill, S. (2018). *Tourism: Principles and practice* (6th ed.). Pearson.

Page, S. J. (2019). *Tourism management* (6th ed.). Routledge.

Torkildsen, G. (2005). *Leisure and recreation management* (5th ed.). Routledge.

McLean, D. D., Hurd, A. R., & Rogers, N. B. (2008). *Kraus' recreation and leisure in modern society* (8th ed.). Jones & Bartlett Learning.

Fennell, D. A. (2021). *Ecotourism* (5th ed.). Routledge.

Weaver, D. (2006). *Sustainable tourism: Theory and practice*. Elsevier.

HKE 412 Communicable and Non-Communicable Diseases

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Communicable and Non-Communicable Diseases is a health education course that introduces students to the nature, causes, transmission, prevention, control, and management of major diseases affecting individuals and communities. The course

provides a comparative understanding of communicable diseases, which can be transmitted between people, animals, or through environmental and other routes, and non-communicable diseases (NCDs), which are generally chronic conditions influenced by genetic, physiological, environmental, and behavioural factors.

The course examines major diseases such as malaria, tuberculosis, HIV/AIDS, hepatitis, cholera, typhoid, respiratory infections, diarrhoeal diseases, hypertension, diabetes, cardiovascular diseases, cancers, obesity, and other lifestyle-related conditions. Emphasis is placed on disease causation, risk factors, signs and symptoms, modes of transmission, prevention, screening, early detection, health education, treatment adherence, rehabilitation, and community-based disease control.

RELEVANCE STATEMENT

Communicable and non-communicable diseases constitute major public-health challenges and affect educational participation, productivity, family wellbeing, and community development. Understanding their causes, risk factors, modes of transmission, prevention, and control is essential for developing effective health education and disease-prevention programmes.

The course is particularly relevant to students of Health Education, Physical and Health Education, Nursing, Public Health, Education, and related disciplines because it prepares them to provide accurate health information, promote healthy behaviours, identify disease risks, support preventive practices, and participate in community health-promotion activities. It also strengthens students' capacity to address emerging health challenges through evidence-based education and community intervention.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, characteristics, classifications, causes, and public-health significance of communicable and non-communicable diseases.
2) Identify major communicable and non-communicable diseases and describe their risk factors, signs, symptoms, and complications.
3) Explain the various modes and mechanisms of transmission of communicable diseases and the factors influencing disease spread.
4) Apply appropriate principles of prevention, control, screening, early detection, treatment adherence, and rehabilitation.

5) Examine the behavioural, environmental, social, genetic, and socioeconomic factors associated with disease occurrence.
6) Demonstrate appropriate health communication and education strategies for promoting disease prevention and healthy lifestyles.
7) Develop appropriate individual and community-based disease-prevention and health-promotion programmes.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and differentiate between communicable and non-communicable diseases.
2) Identify major diseases and explain their causes, risk factors, modes of transmission, signs, symptoms, and complications.
3) Explain the chain of infection and the factors that influence the transmission and spread of communicable diseases.
4) Demonstrate knowledge of appropriate preventive measures, including immunisation, personal hygiene, sanitation, environmental management, screening, and healthy lifestyle practices.
5) Explain the major modifiable and non-modifiable risk factors associated with non-communicable diseases.
6) Design and communicate appropriate health-education messages and disease-prevention interventions for individuals and communities.
7) Evaluate disease-prevention practices and develop appropriate health-promotion programmes for schools and communities.

COURSE CONTENT

- Introduction to Communicable and Non-Communicable Diseases
- Concepts of Disease Causation and Epidemiology
- Chain and Modes of Disease Transmission
- Bacterial and Water/Food-Borne Diseases
- Viral Diseases
- Malaria and Other Vector-Borne Diseases
- Sexually Transmitted and Reproductive Infections
- Respiratory and Other Communicable Diseases
- Prevention and Control of Communicable Diseases

- Introduction to Non-Communicable Diseases
- Cardiovascular Diseases
- Diabetes Mellitus and Metabolic Disorders
- Cancer
- Chronic Respiratory and Other NCDs
- Lifestyle and Behavioural Risk Factors
- Disease Prevention
- Health Promotion and Community Intervention
- Emerging and Re-Emerging Health Threats
- Disease Surveillance and Health Education Practice

CATEGORY	DETAILS
Core Competencies	• Disease identification • Risk-assessment • Health-education • Prevention • Communication • Screening awareness • Community-mobilisation • Health-promotion • Data-management • Critical-thinking • Programme-planning • Research • Advocacy • Ethical
Core Values	• Responsibility • Compassion • Empathy • Integrity • Respect for human dignity • Confidentiality • Non-discrimination • Healthy living

CATEGORY	DETAILS
	• Self-discipline • Accountability • Community responsibility • Environmental responsibility • Cooperation • Tolerance • Scientific thinking
Pedagogical Approaches	• Case studies • Group discussions • Problem-based learning • Disease-outbreak simulations • Demonstrations • Health-education campaigns • Community surveys • Field visits • Role-play • Health-risk assessment exercises • Video presentations
Learning Resources	• Health-education charts • Anatomical models • Posters • Hand-washing demonstration materials • Personal protective equipment • First-aid kits • Thermometers • Blood-pressure monitors • Weighing scales • Height measures • Measuring tapes

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

World Health Organization. (2022). *Noncommunicable diseases*. World Health Organization.

World Health Organization. (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization.

World Health Organization. (2023). *Global report on hypertension: The race against a silent killer*. World Health Organization.

Centers for Disease Control and Prevention. *Principles of epidemiology in public health practice: An introduction to applied epidemiology and biostatistics*. CDC.

Gordis, L. (2014). *Epidemiology* (5th ed.). Elsevier.

Stanhope, M., & Lancaster, J. (2016). *Public health nursing: Population-centered health care in the community* (9th ed.). Elsevier.

McKenzie, J. F., Neiger, B. L., & Thackeray, R. (2017). *Planning, implementing, and evaluating health promotion programs: A primer* (7th ed.). Pearson.

Green, L. W., & Kreuter, M. W. (2005). *Health program planning: An educational and ecological approach* (4th ed.). McGraw-Hill.

Park, K. (2021). *Park's textbook of preventive and social medicine* (26th ed.). Banarsidas Bhanot.

HKE 402 Life Skills & Skill-Based Health Education

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Life Skills & Skill-Based Health Education is a practical and learner-centred course designed to equip students with the knowledge, attitudes, values, and practical skills

required to make informed and responsible decisions about their health and wellbeing. The course moves beyond the transmission of health information by emphasising the development of competencies that enable learners to apply health knowledge to real-life situations.

The course explores major life skills such as self-awareness, self-esteem, empathy, effective communication, interpersonal relationships, critical thinking, creative thinking, decision-making, problem-solving, coping with stress and emotions, conflict resolution, negotiation, refusal skills, and responsible decision-making. It also examines the application of these skills to health-related issues, including personal hygiene, nutrition, physical activity, mental health, substance-use prevention, sexual and reproductive health, disease prevention, safety, and healthy lifestyles.

RELEVANCE STATEMENT

Traditional health education that focuses primarily on providing information may not always result in sustained healthy behaviour. Individuals require practical skills that enable them to interpret health information, resist negative influences, solve problems, communicate effectively, manage emotions, cope with stress, and make healthy choices.

Life skills and skill-based health education are therefore essential components of effective health promotion, particularly among children, adolescents, and young adults. The course is relevant to students preparing for careers in health education, physical and health education, teaching, counselling, community health, public health, youth development, and health promotion.

It enables learners to become effective health educators who can facilitate participatory learning, strengthen protective factors, promote resilience, and help individuals and communities translate health knowledge into appropriate behaviour.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1) Define life skills and skill-based health education.
2) Explain the importance of life skills to individual and community health.
3) Identify major life skills required for healthy living.
4) Explain the relationship between knowledge, attitudes, skills, and health behaviour.
5) Develop self-awareness and positive self-esteem.
6) Demonstrate effective communication and interpersonal skills.

7) Apply appropriate techniques for managing stress and emotions.
8) Explain the role of life skills in preventing substance use and other risky behaviours.
9) Apply life skills to sexual and reproductive health and responsible relationships.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and explain the concept of life skills.
2) Identify core life skills relevant to health and wellbeing.
3) Explain how life skills influence health behaviour.
4) Demonstrate self-awareness and positive self-concept.
5) Communicate health information effectively.
6) Demonstrate active listening and interpersonal communication.
7) Apply critical-thinking and creative-thinking skills to health problems.
8) Apply problem-solving strategies to everyday health challenges.
9) Demonstrate appropriate stress and emotion-management skills.

COURSE CONTENT

- Concept and Principles of Life Skills
- Self-Awareness and Self-Concept
- Effective Communication Skills
- Interpersonal Relationships
- Critical and Creative Thinking
- Decision-Making Skills
- Problem-Solving Skills
- Coping with Stress and Emotions
- Assertiveness
- Negotiation and Refusal Skills
- Conflict Resolution
- Meaning and causes of conflict
- Life Skills and Mental Health
- Life Skills and Substance-Use Prevention
- Life Skills and Sexual and Reproductive Health

- Life Skills
- Nutrition and Physical Activity
- Skill-Based Health Education
- Planning and Implementing Life-Skills Programmes
- Assessment and Evaluation of Life Skills

CATEGORY	DETAILS
Core Competencies	• Self-Management Competency • Communication Competency • Critical-Thinking Competency • Creative-Thinking Competency • Decision-Making Competency • Problem-Solving Competency
Core Values	• Self-respect • Respect for others • Responsibility • Empathy • Integrity • Honesty • Tolerance • Cooperation • Self-discipline
Pedagogical Approaches	• Interactive discussions • Role-play • Simulation • Case-study analysis • Group discussions • Brainstorming • Problem-based learning
Learning Resources	• Life-skills education textbooks • Health education textbooks • WHO and UNICEF life-skills and health-education resources • Lesson plans and facilitator guides

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

World Health Organization. *Life Skills Education for Children and Adolescents in Schools*. WHO.

World Health Organization. Relevant resources on health-promoting schools, adolescent health, mental health, life skills, and health education.

UNICEF. Relevant publications on life skills, adolescent development, education, resilience, and social-emotional learning.

UNESCO. Relevant publications on skills-based health education, sexuality education, adolescent wellbeing, and education for health and wellbeing.

United Nations Office on Drugs and Crime. Relevant resources on life-skills education and substance-use prevention among young people.

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.

Bandura, A. Relevant works on social cognitive theory, self-efficacy, and human behaviour.

Relevant current Nigerian publications and policy documents on health education, adolescent health, school health, life-skills education, and health promotion.

HKE 405 Research Methods and Statistics in Sports, Exercise and Physical Activity

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Research Methods and Statistics in Sports, Exercise and Physical Activity is designed to introduce students to the principles, processes, and practical applications of scientific

research in sport, exercise, physical education, and physical activity. The course develops students' ability to identify research problems, formulate research questions and hypotheses, review relevant literature, select appropriate research designs, collect and analyse data, interpret findings, and communicate research outcomes.

The course covers quantitative, qualitative, and mixed-methods research approaches, with particular emphasis on research designs commonly used in sports and exercise science. Students are introduced to descriptive and inferential statistics, including measures of central tendency and dispersion, correlation, regression, t-tests, analysis of variance, chi-square, and other appropriate statistical procedures. Practical use of statistical software and ethical research practices is emphasised.

RELEVANCE STATEMENT

Research and statistical skills are essential for evidence-based decision-making in sports, exercise, physical education, health, and physical activity. Coaches, teachers, fitness professionals, sport managers, and researchers need to understand how to generate, analyse, and interpret evidence relating to performance, fitness, participation, health, and programme effectiveness.

The course is therefore relevant because it enables students to evaluate existing evidence, conduct basic research, make informed professional decisions, and communicate research findings effectively. It also prepares students for undergraduate projects, postgraduate research, professional practice, programme evaluation, and evidence-based intervention in sports and physical activity settings.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, purposes, and processes of scientific research in sports, exercise, physical education, and physical activity.
2) Identify and formulate research problems, objectives, questions, hypotheses, and variables relevant to sports and physical activity.
3) Examine different research designs, sampling techniques, data-collection methods, and measurement procedures.
4) Apply appropriate statistical techniques to organise, analyse, summarise, and interpret sports, exercise, and physical-activity data.
5) Use appropriate statistical software and digital tools for data entry, analysis, presentation, and interpretation.

6) Demonstrate ethical and professional standards in research, including informed consent, confidentiality, integrity, and responsible data management.
7) Develop and communicate a research report based on empirical data and draw appropriate conclusions and recommendations.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Explain the nature, purposes, characteristics, and stages of research in sports, exercise, and physical activity.
2) Formulate appropriate research problems, objectives, research questions, hypotheses, and operational definitions of variables.
3) Select suitable research designs, populations, samples, sampling techniques, and data-collection instruments.
4) Organise and analyse quantitative and qualitative data using appropriate methods.
5) Calculate and interpret major descriptive and inferential statistics used in sports and exercise research.
6) Use statistical software to analyse, present, and interpret research data accurately.
7) Prepare and present a coherent research report containing findings, conclusions, recommendations, references, and appropriate statistical evidence.

COURSE CONTENT

- Introduction to Research in Sports and Physical Activity
- Research Problems
- Objectives
- Questions and Hypotheses
- Literature Review and Theoretical Framework
- Research Approaches and Designs
- Experimental Research in Exercise and Sport
- Population
- Sampling and Sample Size
- Data-Collection Methods and Instruments
- Measurement
- Reliability and Validity
- Data Organization and Presentation

- Descriptive Statistics
- Probability and Statistical Inference
- Correlation and Regression
- Tests of Differences
- Non-Parametric Statistics
- Multivariate and Advanced Statistical Concepts
- Statistical Software and Data Analysis
- Research Ethics
- Research Proposal and Report Writing

Structure of a research proposal.

CATEGORY	DETAILS
Core Competencies	• Research-problem identification • Research-design • Sampling • Measurement • Research-writing • Presentation • Ethical • Problem-solving • Evidence-based practice
Core Values	• Research integrity • Honesty • Objectivity • Accuracy • Accountability • Confidentiality • Respect for participants • Academic integrity • Fairness

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Research-method demonstrations • Statistical problem-solving • Research article appraisal • Group discussions
Learning Resources	• Computers • Projector • Whiteboard • Calculators • Fitness-testing equipment • Stopwatches • Weighing scales • Stadiometers • Measuring tapes • Heart-rate monitors • Blood-pressure monitors
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2015). *Research methods in physical activity* (7th ed.). Human Kinetics.

Gratton, C., & Jones, I. (2010). *Research methods for sports studies* (2nd ed.). Routledge.

Vincent, W. J., & Weir, J. P. (2012). *Statistics in kinesiology* (4th ed.). Human Kinetics.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE.

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill Education.

Portney, L. G. (2020). *Foundations of clinical research: Applications to evidence-based practice* (4th ed.). F. A. Davis.

Hopkins, W. G. (2000). *A new view of statistics*. Sport science.

American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.

World Health Organization. (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization.

HKE 423 Substance Use and Abuse Prevention

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Substance Use and Abuse Prevention is a core course designed to provide students with comprehensive knowledge of the causes, patterns, consequences, prevention, and control of substance use and abuse among individuals and communities. The course examines the biological, psychological, social, cultural, economic, and environmental factors that contribute to the initiation, continuation, and prevention of substance use. It emphasises evidence-based approaches to health promotion, behavioural change, and community interventions aimed at reducing the burden of substance abuse and addiction. The course introduces students to the concepts of drug use, misuse, abuse, dependence, addiction, and recovery. Students study the classification of psychoactive substances, including alcohol, tobacco, prescription medicines, inhalants, cannabis, opioids, stimulants, sedatives, and other emerging substances of abuse. The course explores the effects of these substances on physical health, mental health, academic performance, family life, workplace productivity, and community safety.

RELEVANCE STATEMENT

The course is highly relevant to Health Education, Physical and Health Education, Human Kinetics, Public Health, Psychology, Social Work, Nursing, and Community Health. It prepares graduates to address one of the major public health challenges affecting young people and communities by promoting prevention, education, and early intervention.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the concepts and principles of substance use and abuse prevention.
2. Differentiate between substance use, misuse, abuse, dependence, and addiction.
3. Identify the major classes of psychoactive substances and their effects on the human body.
4. Explain the biological, psychological, social, and environmental determinants of substance use.
5. Identify risk and protective factors associated with substance abuse.
6. Demonstrate knowledge of counselling, referral, rehabilitation, and relapse prevention.
7. Develop school and community-based substance abuse prevention programmes.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the concepts and theories of substance use and abuse prevention.
2. Identify common psychoactive substances and describe their effects.
3. Assess factors that contribute to substance use and addiction.
4. Develop evidence-based prevention and health promotion programmes.
5. Apply basic counselling and referral principles in substance abuse prevention.
6. Advocate for healthy lifestyles and drug-free communities.
7. Demonstrate ethical and professional conduct in prevention practice.

COURSE CONTENT

- The basic and detailed concepts of drug, substance use and abuse, drug misuse
- Rehabilitation techniques employed on victims of drug abuse and the effect of drug abuse on the body
- Introducing social, psychological, pharmaceutical and cultural aspects of drug use, misuse and abuse
- The methods, materials and theories of drug abuse prevention in the school and community will be introduced
- Illicit (e. g. Opiates, marijuana, methamphetamines) and licit (such as alcohol, tobacco, caffeine) substances.
- Drug addiction and drug dependency
- Harmful effects of alcohol and tobacco and other narcotic, sedatives, depressants and stimulant drugs will be explored

- Critical examination of the factors associated with the use of these substances and methods of prevention
- Skills for avoiding destructive behaviours, including substance control and cessation need to be developed
- The chemical pharmacologic, physiological, and socio-economic use, misuse and abuse of alcohol and such psychoactive substances as opiates and opium, such as: synthetic narcotics, barbiturates, tranquillisers marijuana lysergic and diethylamide (LSD) and tranquillisers/stimulant (cocaine, amphetamine and caffeine)

CATEGORY	DETAILS
Core Competencies	• Understanding of substance use and abuse concepts • Knowledge of psychoactive substances and their effects • Identification of risk and protective factors • Substance abuse prevention and health promotion skills • Behaviour change communication and health education • Screening, early identification, and referral skills • Basic counselling and psychosocial support competence
Core Values	• Sportsmanship and fair play • Discipline and self-control • Professionalism • Integrity and ethical conduct • Teamwork and cooperation • Leadership and responsibility • Respect for rules and officials • Commitment to excellence • Perseverance and resilience

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning • Independent study and reflective learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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Levinthal, C. F. (2021). *Drugs, Behavior, and Modern Society (9th ed.)*. Pearson.

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National Institute on Drug Abuse (NIDA). (2020). *Drugs, Brains, and Behavior: The Science of Addiction (Latest Edition)*.

United Nations Office on Drugs and Crime (UNODC). (2018). *International Standards on Drug Use Prevention (2nd ed.)*.

WHO. (2023). *Mental Health, Brain Health and Substance Use: Global Perspectives and Public Health Approaches*.

HKE 424 Recreational Management

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 20 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Recreational Management is a course designed to equip students with the knowledge, skills, and competencies required to plan, organise, implement, supervise, and evaluate recreational programmes and services for individuals, groups, and communities. The course examines the principles of recreation, leisure behaviour, programme development, facility and equipment management, leadership, staffing, budgeting, marketing, safety, risk management, and evaluation.

The course exposes students to different forms of indoor and outdoor recreation, community recreation, school recreation, therapeutic recreation, sports recreation, cultural recreation, and leisure services. Emphasis is placed on effective utilisation of human, material, financial, and environmental resources to provide accessible, inclusive, safe, and sustainable recreational opportunities.

RELEVANCE STATEMENT

Recreation contributes significantly to physical and mental wellbeing, social development, community integration, productivity, creativity, and quality of life. Effective recreational management is necessary to ensure that recreational facilities, programmes, personnel, and resources are used efficiently and that activities meet the needs of diverse populations.

The course is particularly relevant to students of Physical and Health Education, Sport Management, Recreation, Tourism, and related disciplines because it prepares them for professional roles in schools, recreation centres, sports organisations, community development agencies, fitness facilities, hotels, resorts, parks, and local government recreation services. It also develops entrepreneurial skills that can support employment and self-employment in the growing recreation and leisure industry.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, functions, and significance of recreation and recreational management.
2) Identify and classify different types of recreational activities, programmes, facilities, and services for diverse populations.
3) Apply principles of planning, organising, staffing, directing, coordinating, and controlling recreational programmes.
4) Develop appropriate recreational programmes based on the needs, interests, abilities, ages, and resources of target populations.
5) Demonstrate effective leadership, communication, supervision, budgeting, marketing, and resource-management skills in recreation.
6) Apply appropriate safety, risk-management, accessibility, inclusion, and environmental sustainability principles in recreational activities.
7) Evaluate recreational programmes, facilities, and services and recommend strategies for improving their effectiveness and sustainability.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define recreation and explain its importance to individuals, groups, and communities.
2) Identify and differentiate various types of recreational activities, programmes, facilities, and services.

3) Apply management principles in planning, organising, implementing, supervising, and evaluating recreational programmes.
4) Design recreational programmes appropriate for different age groups, abilities, interests, and community needs.
5) Demonstrate effective leadership, communication, teamwork, budgeting, marketing, and resource-management skills.
6) Apply appropriate safety, risk-management, inclusive-practice, and environmental-management procedures.
7) Evaluate recreational programmes and facilities and develop recommendations for improvement and sustainable management.

COURSE CONTENT

- Introduction to Recreation
- Principles and Philosophy of Recreation
- Types and Forms of Recreation
- Recreation and Different Population Groups
- Recreation Needs Assessment and Programme Planning
- Organisation and Administration of Recreation
- Leadership and Supervision in Recreation
- Recreation Facilities and Equipment Management
- Financial Management and Resource Mobilisation
- Marketing and Promotion of Recreation
- Safety and Risk Management
- Inclusive and Accessible Recreation
- Recreation
- Health and Wellbeing
- Outdoor Recreation and Environmental Management
- Community Recreation
- Recreation Event Management
- Entrepreneurship and Career Opportunities in Recreation
- Monitoring and Evaluation of Recreation Programmes

CATEGORY	DETAILS
Core Competencies	• Management • Leadership • Facility-management • Financial • Marketing • Safety • Inclusive-practice • Environmental- • Event-management
Core Values	• Responsibility • Leadership • Teamwork • Cooperation • Discipline • Integrity • Accountability • Environmental responsibility • Safety consciousness • Professionalism • Cultural sensitivity
Pedagogical Approaches	• Interactive lectures • Practical demonstrations • Group discussions • Facility-management exercises • Event-management simulations
Learning Resources	• Recreation centres • Community parks • Playgrounds • Sports fields • Swimming pools • Indoor game facilities • Fitness equipment

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Torkildsen, G. (2005). *Leisure and recreation management* (5th ed.). Routledge.

McLean, D. D., Hurd, A. R., & Rogers, N. B. (2008). *Kraus' recreation and leisure in modern society* (8th ed.). Jones & Bartlett Learning.

Rossman, J. R., & Schlatter, B. E. (2015). *Recreational programming: Designing leisure experiences* (7th ed.). Sagamore Publishing.

Edginton, C. R., Hudson, S. D., Dieser, R. B., & Edginton, S. R. (2014). *Leisure programming: A service-centered and benefits approach* (6th ed.). Sagamore Publishing.

Masteralexis, L. P., Barr, C. A., & Hums, M. A. (2021). *Principles and practice of sport management* (6th ed.). Jones & Bartlett Learning.

Hurd, A. R., Barcelona, R. J., & Meldrum, J. T. (2018). *Leisure services management*. Human Kinetics.

Human Kinetics. Relevant texts on recreation programming, facility management, sport management, and leisure studies.

World Health Organization. (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization.

Relevant Nigerian National Commission for Colleges of Education (NCCE) curriculum documents, community recreation policies, sports-development documents, and local-government recreation guidelines should be consulted for contextual alignment.

HKE 402 Health Practice and School Child

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Health Practice and School Child is a course designed to provide learners with knowledge and practical skills for promoting, maintaining, and improving the health and wellbeing of school-age children. The course examines the physical, mental, emotional, social, and environmental health needs of children in school settings and explores the role of teachers, health educators, parents, school administrators, health professionals, and communities in meeting these needs.

The course covers principles of child health, personal hygiene, nutrition, physical activity, common childhood illnesses, communicable and non-communicable diseases, school health services, environmental sanitation, mental health, safety, first aid, immunisation, health screening, child protection, and health education. Emphasis is placed on preventive health practices and the creation of a safe, healthy, inclusive, and supportive school environment.

RELEVANCE STATEMENT

Children spend a significant proportion of their formative years in school, making the school an important setting for health promotion, disease prevention, health education, and healthy behaviour development. Poor hygiene, malnutrition, unsafe environments, infectious diseases, mental health challenges, injuries, substance use, and inadequate access to health services can adversely affect children’s attendance, learning, development, and academic achievement.

This course is therefore particularly relevant to students preparing for careers in health education, physical and health education, teaching, school health services, community health, counselling, and related professions. It equips learners with competencies for identifying children’s health needs, promoting healthy practices, preventing common health problems, responding appropriately to health emergencies, and supporting effective school health programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1. Explain the concepts of child health, school health, and health practice.

2. Describe the physical, mental, emotional, and social health needs of school-age children.
3. Identify factors influencing the health and development of school children.
4. Explain principles of personal hygiene and healthy living among school children.
5. Discuss the nutritional requirements of school-age children.
6. Identify common diseases and health problems affecting school children.
7. Explain methods of preventing communicable and non-communicable diseases among children.
8. Explain the components and functions of school health services.
9. Explain the importance of environmental sanitation and safety in schools.
10. Describe the roles of teachers, parents, health professionals, and communities in promoting school-child health.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1. Define child health and school health.
2. Explain the dimensions of health and their relevance to children.
3. Identify factors affecting children's growth, development, and wellbeing.
4. Explain appropriate nutritional practices for school children.
5. Identify common childhood diseases and their preventive measures.
6. Explain the importance of physical activity, adequate rest, and sleep.
7. Identify potential health and safety hazards within school environments.
8. Explain basic principles of school health screening and referral.
9. Explain appropriate approaches to child safeguarding and protection.
10. Participate in planning and implementing school health programmes.

COURSE CONTENT

- Concepts of Child and School Health
- Meaning of health
- Meaning of child health
- Meaning of school health
- Dimensions of child health
- Importance of health during childhood

- Relationship between health and learning
- Determinants of child health
- Child health indicators. Growth and Development of School Children
- Personal Hygiene Practices
- Nutrition and School Children
- Communicable Diseases
- Non-Communicable Diseases and Other Health Conditions
- Physical Activity
- Exercise
- Rest and Sleep
- Mental
- Emotional and Social Health
- School Health Services
- Environmental Health and Safety in Schools
- First Aid and Management of Common School Emergencies
- Child Protection and Safeguarding
- Health Education for School Children
- School Health Programme

CATEGORY	DETAILS
Core Competencies	• Health Promotion Competency • Child Health Assessment Competency • Health Education Competency • First-Aid Competency • Communication Competency • Disease Prevention Competency • Environmental Health Competency • Inclusive Practice Competency

CATEGORY	DETAILS
Core Values	• Respect for children and their dignity • Compassion and empathy • Responsibility • Self-discipline • Cleanliness and personal responsibility • Respect for human rights • Equity and inclusion • Confidentiality • Non-discrimination
Pedagogical Approaches	• Interactive lectures • Guided discussions • Demonstrations • Practical first-aid sessions • Role-play and simulation • Case-study analysis • Problem-based learning • Group projects • Health education campaigns • School/environmental health surveys
Learning Resources	• Course textbooks and lecture notes • School health manuals • Child health and development textbooks • Health education materials • WHO and UNICEF child-health resources • School health programme guidelines
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

World Health Organization. *WHO Guideline on School Health Services*. WHO.

World Health Organization. *Global Standards for Health-Promoting Schools*. WHO.

World Health Organization & United Nations Educational, Scientific and Cultural Organization. *Making Every School a Health-Promoting School: Global Standards and Indicators*. WHO/UNESCO.

UNICEF. Relevant publications on child health, nutrition, child protection, water, sanitation and hygiene, and school health.

Park, K. *Park's Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). *Health Behavior: Theory, Research, and Practice*. Jossey-Bass.

McKenzie, J. F., Neiger, B. L., & Thackeray, R. *Planning, Implementing, and Evaluating Health Promotion Programs*. Jones & Bartlett Learning.

HKE 404 Skill Development and Techniques in Selected Racquet and Stick Games

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Skill Development and Techniques in Selected Racquet and Stick Games is a practical and skill-based course designed to develop students' knowledge, technical abilities, tactical understanding, and instructional competence in selected racquet and stick games. The course introduces students to the fundamental principles, skills, rules, strategies, and performance techniques associated with games such as tennis, badminton, table tennis, squash, hockey, cricket, and other stick-based sports. The course focuses on the progressive development of motor skills, coordination, agility, speed, accuracy, and strategic thinking required for effective participation and performance in racquet and stick games. Students are exposed to techniques such as grip, stance, footwork, ball/shuttle control, serving, receiving, striking, passing, shooting, defending, attacking, and tactical play.

RELEVANCE STATEMENT

The course provides essential practical and pedagogical skills required for effective teaching, coaching, and administration of racquet and stick games. It broadens students' sporting knowledge beyond traditional team sports and develops competencies in individual and team-based activities.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the history, nature, and educational importance of selected racquet and stick games.
2. Demonstrate fundamental and advanced technical skills in selected racquet and stick games.
3. Apply appropriate methods for teaching and developing racquet and stick game skills.
4. Explain and apply rules, regulations, and officiating procedures.
5. Demonstrate tactical awareness and decision-making during game situations.
6. Develop training activities for improving player performance.
7. Apply safety principles and injury prevention measures during participation.
8. Organise and manage racquet and stick game competitions.
9. Evaluate individual and team performance using appropriate assessment techniques.
10. Promote teamwork, discipline, sportsmanship, and lifelong participation in physical activity.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Demonstrate the skills and techniques of service, (forehand- racquet angle, shot height, body positioning) and backhand (drive- Serve, lob Serve, Z Serve), rally, drop, clear, volley, single and double offensive and smashing in tennis;
2. Demonstrate the skills and techniques of service, (forehand- racquet angle, shot height, body positioning) and backhand (drive- Serve, lob Serve, Z Serve), rally, drop, clear, volley, single and double offensive and smashing in table-tennis;
3. Demonstrate the skills and techniques of service (forehand- racquet angle, shot height, body positioning) and backhand (drive- Serve, lob Serve, Z Serve), rally, drop, clear, volley, single and double offensive and smashing in badminton;

4. Demonstrate the skills and techniques of service, (forehand- racquet angle, shot height, body positioning) and backhand (drive- Serve, lob Serve, Z Serve), rally, drop, clear, volley, single and double offensive and smashing in squash;
5. Use the facilities and implements for participation;
6. Utilise and apply the knowledge of racquet sport rules, terminology, and scoring procedures;
7. Demonstrate proper court etiquette and good sportsmanship;
8. Demonstrate the skills and techniques of (First touch, leading, passing, hit, and flat stick tackle) in hockey;
9. Demonstrate the skills and techniques of (Hand-eye coordination, and batting, hand-eye coordination with throwing and catching, bowling, fielding and wicket-keeping) in cricket;
10. Demonstrate a good knowledge of the history of hockey and cricket, there rules and regulations;

COURSE CONTENT

- Basic skills and knowledge associated with playing a variety of racquet sports such as tennis, badminton, table tennis and squash
- The service
- (Forehand- racquet angle, shot height, body positioning) and backhand (drive- Serve, lob Serve, Z Serve)
- Rally, drop, clear, volley, single and double offensive and smashing
- The rules and regulations in racquet sport, terminology, and scoring procedures
- **Skills in Hockey:** First touch, leading, passing, hit, and flat stick tackle
- **Cricket skills:** Hand-eye coordination, and batting, hand-eye coordination with throwing and catching, bowling, fielding and wicket-keeping
- The history of the games, rules and regulations for each sports, officiating, equipment and facilities used in each sport

CATEGORY	DETAILS
Core Competencies	• Sport management and administration skills • Sport business and entrepreneurship competence • Leadership and organisational management • Sport marketing, branding, and sponsorship management • Sport communication and public relations skills • Event planning and management • Community recreation programme development
Core Values	• Sportsmanship and fair play • Discipline and self-control • Professionalism • Integrity and ethical conduct • Teamwork and cooperation • Leadership and responsibility • Respect for rules and officials • Commitment to excellence • Perseverance and resilience
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Badminton World Federation (BWF). Laws of Badminton and Coaching Manuals (Latest Edition).

Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and Methodology of Training (6th ed.)*. Human Kinetics.

Bompa, T. O., & Carrera, M. C. (2015). *Conditioning Young Athletes*. Human Kinetics.

Briggs, J. (2019). *Squash: Skills, Techniques and Strategies*. Bloomsbury Publishing.

Brown, J. (2018). *Tennis: Steps to Success (4th ed.)*. Human Kinetics.

Grice, T. (2016). *Badminton: Steps to Success (3rd ed.)*. Human Kinetics.

Griffin, L. L., Mitchell, S. A., & Oslin, J. L. (2021). *Teaching Sport Concepts and Skills: A Tactical Games Approach (4th ed.)*. Human Kinetics.

Hay, J. G. (2018). *The Biomechanics of Sports Techniques (4th ed.)*. Prentice Hall.

Hodges, L. (2017). *Table Tennis: Steps to Success (2nd ed.)*. Human Kinetics.

Human Kinetics. (2021). *Successful Coaching (5th ed.)*. Human Kinetics.

International Hockey Federation (FIH). Rules of Hockey and Coaching Resources (Latest Edition).

International Table Tennis Federation (ITTF). Handbook and Rules of Table Tennis (Latest Edition).

International Tennis Federation (ITF). Tennis Rules and Coaching Resources (Latest Edition).

Kenney, W. L., Wilmore, J. H., & Costill, D. L. (2023). *Physiology of Sport and Exercise (8th ed.)*. Human Kinetics.

Launder, A. G. (2020). *Play Practice: Engaging and Developing Skilled Players from Beginner to Elite*. Human Kinetics.

Magill, R. A., & Anderson, D. I. (2022). *Motor Learning and Control: Concepts and Applications (13th ed.)*. McGraw-Hill Education.

McGinnis, P. M. (2021). *Biomechanics of Sport and Exercise (4th ed.)*. Human Kinetics.

Reilly, T., & Williams, A. M. (2020). *Science and Soccer (3rd ed.)*. Routledge.

Rink, J. E. (2022). *Teaching Physical Education for Learning (9th ed.)*. McGraw-Hill Education.

HKE 420 First Aid, Accident Prevention and Safety Education

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 20 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

First Aid, Accident Prevention and Safety Education is a practical and skill-oriented course designed to equip learners with the knowledge, attitudes, and competencies required to prevent accidents, respond appropriately to injuries and emergencies, and promote safety in schools, homes, workplaces, sports environments, and communities. The course introduces the principles of first aid, emergency response, accident prevention, risk assessment, personal and environmental safety, and health and safety education.

The course covers the recognition and management of common injuries and emergencies such as bleeding, wounds, burns, fractures, sprains, choking, fainting, seizures, poisoning, drowning, heat-related emergencies, and sports injuries. It also emphasises accident investigation, emergency preparedness, safety rules, safe school environments, road safety, fire safety, and the role of health educators in developing safety-conscious individuals and communities.

RELEVANCE STATEMENT

Accidents and emergencies can occur at any time in schools, homes, sports facilities, workplaces, roads, and communities. Prompt and appropriate first aid can reduce the severity of injuries, prevent complications, and potentially save lives before professional medical assistance becomes available. At the same time, many accidents are preventable through effective safety education, environmental modification, risk assessment, and responsible behaviour.

The course is therefore particularly relevant to students preparing for careers in health education, physical and health education, teaching, sports, community health, public health, and related professions. It prepares learners to respond effectively to common emergencies and to design and implement accident-prevention and safety-education programmes.

COURSE OBJECTIVES

At the end of the course, learners should be able to:

1. Explain the concepts of first aid, accidents, safety, hazards, and risk.
2. Discuss the principles and objectives of first aid.
3. Identify common causes and types of accidents in schools, homes, workplaces, sports, and communities.
4. Explain the principles of accident prevention and risk reduction.
5. Identify and assess common safety hazards.
6. Explain the contents and appropriate use of a first-aid kit.
7. Explain road, fire, electrical, water, and environmental safety.
8. Explain the importance of emergency preparedness and response planning.

LEARNING OUTCOMES

Upon successful completion of the course, learners should be able to:

1. Define first aid, accident, safety, hazard, risk, and emergency.
2. Explain the objectives and principles of first aid.
3. Identify common hazards and accident risks.
4. Demonstrate basic principles of CPR and choking response in accordance with current recognised first-aid guidance.
5. Explain methods of preventing accidents in schools, homes, sports environments, workplaces, and communities.

6. Identify appropriate safety measures for fire, electricity, water, roads, and recreational activities.
7. Develop simple emergency-response procedures.

COURSE CONTENT

- The basic and detailed concepts of health and safety
- Meaning and principles of first aid and first aid management of selected emergency situations
- Accidents, accident prevention and management techniques
- Safety tasks of teachers, accident reporting, safety measures
- Concepts of safety education and related terminologies
- Principles and practice of safety in the homes, schools, industries, hospitals, sports/ homes and other settings
- Safety skills and programmes in schools and general safety skills and techniques in schools and environment
- Analysis of the importance and relevance of safety programmes in schools
- Safety approaches to environmental hazards
- The critical need for safety and what the school can do to improve safety conditions
- Community and industrial safety will be briefly analysed
- Practical situated sessions are provided to promote efficiency in management situations

CATEGORY	DETAILS
Core Competencies	• First-Aid Competency • Emergency-Response Competency • Accident-Prevention Competency • Risk-Assessment Competency • Safety-Education Competency • Communication Competency • Problem-Solving Competency • Leadership Competency • Teamwork Competency

CATEGORY	DETAILS
Core Values	• Responsibility • Alertness • Compassion • Self-discipline • Courage • Respect for human life • Teamwork
Pedagogical Approaches	• Interactive lectures • Demonstrations • Hands-on practical sessions • First-aid simulations • Role-play • Emergency-response drills • Case-study analysis • Problem-based learning • Group discussions • Safety inspections
Learning Resources	• First-aid kits • CPR manikins • Bandages and dressings • Splints and immobilisation materials • Gloves and personal protective equipment • Training AEDs where available • Fire-safety demonstration equipment
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American Heart Association. *Guidelines for CPR and Emergency Cardiovascular Care*. American Heart Association.

International Federation of Red Cross and Red Crescent Societies. *International First Aid, Resuscitation and Education Guidelines*. IFRC.

American Red Cross. *First Aid/CPR/AED Participant's Manual*. American Red Cross.

World Health Organization. Relevant publications on injury prevention, road safety, emergency care, drowning prevention, and community safety.

World Health Organization. *Global Status Report on Road Safety*. WHO.

World Health Organization. Relevant resources on drowning prevention and injury prevention.

National Highway Traffic Safety Administration. Relevant resources on road safety and injury prevention.

Relevant current Nigerian guidelines and publications on road safety, emergency response, school safety, occupational safety, disaster preparedness, and injury prevention.

Current textbooks on first aid, emergency care, accident prevention, sports injuries, school health, and safety education.

Current peer-reviewed journal articles on first aid education, injury prevention, emergency response, school safety, sports injuries, road safety, and community-based safety promotion.

HKE 413 Application of Computer Skills and Informatics in Physical & Health Education

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Application of Computer Skills & Health Informatics is a practical course designed to equip students with essential computer literacy and health informatics competencies required for effective learning, teaching, health education practice, research, administration, and health promotion. The course introduces students to the use of computers, digital technologies, information systems, electronic health records, health databases, digital communication tools, and data-management applications in health-related settings.

The course combines fundamental computer skills with the principles and applications of health informatics. Students learn how to use word-processing, spreadsheet, presentation, internet, database, and communication applications while developing competencies in health data collection, storage, retrieval, analysis, interpretation, security, and dissemination. Attention is also given to digital health, telehealth, electronic health records, health information systems, data privacy, cybersecurity, and the ethical use of health information.

RELEVANCE STATEMENT

The increasing digitisation of health and education services has made computer literacy and health informatics essential competencies for health educators and other health professionals. Computers and digital information systems support health education, research, record keeping, programme planning, disease surveillance, health communication, monitoring and evaluation, and evidence-based decision-making.

This course is therefore relevant to students preparing for careers in health education, physical and health education, public health, community health, teaching, health promotion, research, and health administration. It enables learners to use digital tools effectively, manage health information responsibly, analyse health data, communicate health messages through digital platforms, and participate meaningfully in modern health information systems.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain the concepts of computer applications, information technology, and health informatics.
2. Identify major components of computer hardware and software.
3. Demonstrate basic computer operating skills.
4. Use word-processing applications to prepare professional health and academic documents.
5. Prepare effective presentations using presentation software.
6. Explain the principles and applications of health informatics.
7. Identify major types of health information systems.
8. Explain the uses of electronic health records and electronic medical records.
9. Collect, manage, store, retrieve, and communicate health information appropriately.
10. Apply basic database concepts to health information management.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Define computer literacy, information technology, and health informatics.
2. Identify and explain the functions of basic computer hardware and software.
3. Conduct reliable online searches for health and academic information.
4. Communicate professionally using email and other digital platforms.
5. Explain the structure and functions of health information systems.
6. Describe the role of electronic health records in health services.
7. Use digital technologies in health education and health promotion.
8. Explain basic concepts of telehealth and digital health.
9. Apply principles of data privacy, confidentiality, and cybersecurity.
10. Use digital information to support evidence-based health education practice.

COURSE CONTENT

- The basic and detailed concepts of computer application and breaking edge
- Application of computer in health diagnostics and treatment of complicated ailments
- Usage of data to improve human health and health care services
- Concept of health informatics
- Application of medical concepts in conjunction with health information technology is explored
- Roles and goals of health informatics
- Consumer, clinical, nursing and public health informatics
- Applicable decision analysis techniques and decision support systems
- Trends in health informatics
- Health informatics technology in population
- Human computer interaction
- Information system in health care
- IT and cyber security
- Web technologies and cloud computing
- Geographic Information System (GIS)
- Modern information technology
- Health service statistics

- The internet
- **Modern methods for data collection, analysis and data transmission:** Google survey form
- Resource management within the health care field

CATEGORY	DETAILS
Core Competencies	• Computer Literacy Competency • Digital Productivity Competency • Data Management Competency • Health Informatics Competency • Data Analysis Competency • Digital Communication Competency • Information Literacy Competency
Core Values	• Accuracy • Confidentiality • Integrity • Accountability • Professionalism • Respect for privacy • Responsible use of technology
Pedagogical Approaches	• Demonstrations • Hands-on computer practicals • Guided tutorials • Interactive lectures • Problem-based learning • Individual practical exercises • Group projects • Case studies • Data-management exercises

CATEGORY	DETAILS
Learning Resources	• Desktop and laptop computers • Computer laboratory • Internet connectivity • Projectors and interactive displays • Microsoft Windows or equivalent operating systems • Microsoft Word or equivalent word-processing software • Microsoft Excel or equivalent spreadsheet software
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Shortliffe, E. H., & Cimino, J. J. (Eds.). *Biomedical Informatics: Computer Applications in Health Care and Biomedicine*. Springer.

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Wager, K. A., Lee, F. W., & Glaser, J. P. *Health Care Information Systems: A Practical Approach for Health Care Management*. Jossey-Bass.

Nelson, R., & Staggers, N. *Health Informatics: An Interprofessional Approach*. Elsevier.

World Health Organization. *Global Strategy on Digital Health*. WHO.

World Health Organization. Relevant publications on digital health, health information systems, data governance, and health information management.

World Health Organization. Relevant resources on digital health interventions and health-system strengthening.

Centers for Disease Control and Prevention. Relevant resources on public health informatics, health information systems, and digital data management.

Relevant current Nigerian policies and guidelines on digital health, health information management, data protection, electronic health records, and health information systems.

Current peer-reviewed journal articles on health informatics, digital health, electronic health records, mHealth, telehealth, public health informatics, and health education technology.

SED 511 Science, Technology and Society

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Science, Technology and Society (STS) is an interdisciplinary course that examines the relationships among scientific knowledge, technological development, and human society. It explores how science and technology influence social, economic, political, cultural, environmental, and health-related development, while also examining how society shapes scientific research and technological innovation.

The course introduces students to the nature, meaning, history, philosophy, methods, and development of science and technology. It examines major scientific discoveries and technological innovations, their applications, benefits, limitations, risks, ethical implications, and consequences for individuals and society. Particular attention is given to contemporary issues such as information and communication technology, artificial intelligence, biotechnology, energy, environmental sustainability, health technology, digital transformation, innovation, globalisation, and responsible use of science and technology.

RELEVANCE STATEMENT

Science and technology have become central to contemporary life and national development. Advances in areas such as digital technology, artificial intelligence, communication, transportation, medicine, agriculture, energy, industry, education, and environmental management continue to transform the way people live, work, learn, and interact.

However, scientific and technological development also presents challenges, including environmental degradation, digital inequality, misinformation, unemployment resulting from automation, cyber risks, privacy concerns, ethical controversies, and inappropriate use of technology.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain the concepts, nature, scope, development, and interrelationships of science, technology, and society.

2. Examine the historical development and contributions of science and technology to human civilisation and societal development.
3. Analyse the influence of social, cultural, economic, political, and environmental factors on scientific and technological development.
4. Evaluate the benefits, limitations, risks, and consequences of scientific discoveries and technological innovations on society.
5. Apply scientific and technological knowledge to identify and propose solutions to contemporary social, health, environmental, and developmental problems.
6. Demonstrate critical thinking, scientific literacy, technological literacy, innovation, and responsible decision-making in relation to science and technology.
7. Assess ethical, social, environmental, and sustainability issues associated with scientific research and technological development.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1. Define science, technology, and society and explain the relationship among them.
2. Describe major stages in the historical development of science and technology and their contributions to human development.
3. Analyse how social, cultural, political, economic, and environmental conditions influence scientific and technological advancement.
4. Evaluate the positive and negative effects of scientific discoveries and technological innovations on individuals and society.
5. Apply scientific and technological principles to address selected real-life and community problems.
6. Demonstrate critical thinking, scientific inquiry, technological awareness, creativity, and innovation in responding to contemporary challenges.
7. Evaluate ethical and sustainability implications of scientific and technological developments and advocate responsible use.

COURSE CONTENT

- Definition of science, ethics and science process skills as ways of finding but about the environment and attempt to put structure on it
- Assumptions of Science concerning nature and the processes and products of scientific investigations

- Ethics of science and scientific attitudes Knowing the ethics of science and developing scientific attitudes know the assumptions of science concerning nature and the processes and products of scientific investigations/implication
- Science process skills Application of science process skills to emphasis on communicating, interpreting data, designing experiments, reporting completely, and accurately, formulating hypotheses, generalising, predicting and others

CATEGORY	DETAILS
Core Competencies	• Scientific literacy • Technological literacy • Critical-thinking • Problem-solving • Research and inquiry • Innovation • Digital literacy • Information literacy • Ethical reasoning • Decision-making • Communication • Environmental • Entrepreneurial • Collaboration • Policy-awareness • Technology-assessment

CATEGORY	DETAILS
Core Values	• Professionalism • Creativity • Innovation • Accountability • Integrity • Equity • Inclusiveness • Respect for diversity • Learner-centredness • Collaboration • Critical thinking • Evidence-based practice • Lifelong learning • Adaptability
Pedagogical Approaches	• Interactive lectures • Group discussions • Curriculum case studies • Problem-based learning • Project-based learning • Curriculum-design workshops • Brainstorming • Role-play • Microteaching • Peer review • Curriculum critique • Concept mapping • Simulation • Field visits

CATEGORY	DETAILS
Learning Resources	• Curriculum Documents • National curriculum frameworks • Health education curriculum documents • Teacher education curriculum guidelines • Institutional curriculum templates • Course outlines • Curriculum evaluation reports • Education policies
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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HKE 501 Alcohol, Drugs and Doping in Sports

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Alcohol, Drugs and Doping in Sports is a course designed to provide students with knowledge and practical understanding of the use, misuse, effects, prevention, detection, and control of alcohol, psychoactive substances, performance-enhancing substances, and prohibited methods in sport. The course examines how substance use can affect physical performance, health, psychological wellbeing, sportsmanship, athlete development, and the integrity of sport.

The course introduces students to major categories of substances, including alcohol, stimulants, narcotics, cannabinoids, anabolic agents, peptide hormones, hormone and metabolic modulators, diuretics and masking agents, and other prohibited substances and methods. It also addresses anti-doping education, therapeutic use exemptions, testing procedures, doping control, athlete rights and responsibilities, ethical issues, social influences, prevention strategies, and the role of coaches, teachers, health professionals, sport administrators, and families.

RELEVANCE STATEMENT

Alcohol and drug misuse, together with doping, can undermine athlete health, fair competition, sportsmanship, and public confidence in sport. Athletes may be exposed to substances through peer pressure, competitive expectations, misinformation, body-image concerns, commercial influences, or the desire for improved performance.

Understanding these issues is therefore essential for students preparing for careers in Physical and Health Education, Sport Science, Coaching, Sport Management, Exercise Science, and related disciplines. The course equips students to identify risk factors, educate athletes, promote healthy alternatives, understand anti-doping requirements, recognise the consequences of prohibited substance use, and support ethical and safe sporting environments.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts of alcohol use, drug use, substance misuse, performance enhancement, and doping in sports.

2) Identify major categories of alcohol, psychoactive substances, performance-enhancing substances, and prohibited methods used in or associated with sport.
3) Examine the physiological, psychological, social, ethical, and performance-related effects of alcohol, drugs, and doping.
4) Explain the principles, rules, procedures, and responsibilities associated with anti-doping in sport.
5) Apply appropriate prevention, health-education, counselling, and risk-reduction strategies for alcohol, drug misuse, and doping.
6) Develop critical-thinking and ethical decision-making skills for addressing substance-use and doping-related situations in sport.
7) Design appropriate clean-sport and substance-abuse prevention programmes for athletes, schools, sports clubs, and communities.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and differentiate alcohol use, drug use, substance misuse, substance dependence, performance enhancement, and doping.
2) Identify major categories of substances and methods that may affect athletic performance and explain their potential risks.
3) Describe the physiological and psychological effects of alcohol, drugs, and performance-enhancing substances on athletes.
4) Explain the basic principles of anti-doping regulations, testing, prohibited substances and methods, and athlete responsibilities.
5) Analyse social, psychological, environmental, and sporting factors that may encourage substance use or doping.
6) Demonstrate appropriate health-education, prevention, communication, and ethical decision-making skills related to substance use in sport.
7) Develop and evaluate a practical clean-sport and substance-abuse prevention programme for athletes or sporting communities.

COURSE CONTENT

- Introduction to Alcohol
- Drugs and Doping in Sports
- Classification of Drugs and Psychoactive Substances
- Alcohol and Sports Performance

- Stimulants and Sports
- Narcotics
- Opioids and Pain-Relieving Drugs
- Meaning of narcotics and opioids
- Cannabis and Other Psychoactive Substances
- Anabolic Agents and Steroids
- Hormones
- Peptide Hormones and Growth Factors
- Beta-2 Agonists
- Diuretics and Masking Agents
- Blood Doping and Other Prohibited Methods
- Anti-Doping in Sport
- Doping Control and Testing

Purpose of doping control, Supplements, Medications and Doping Risk, Physiological Effects of Doping, Psychological and Social Dimensions, Ethics and Integrity in Sport, Prevention, Health Education and Intervention, Developing a Clean-Sport Programme.

CATEGORY	DETAILS
Core Competencies	• Knowledge • Substance-identification • Risk-assessment • Health-promotion • Anti-doping • Ethical decision-making • Communication
Core Values	• Integrity • Fair play • Honesty • Responsibility • Self-discipline • Respect • Accountability • Sportsmanship

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Practical demonstrations • Laboratory sessions • Fitness-testing practicals • Exercise demonstrations • Circuit-training sessions • Group discussions
Learning Resources	• Exercise mats • Dumbbells • Resistance bands • Barbells and weights
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

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HKE 512 Introductory Sports Biomechanics

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 60 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introductory Sports Biomechanics is a foundational course that introduces students to the application of mechanical and anatomical principles to human movement and sports performance. The course examines how forces, motion, balance, stability, leverage, momentum, energy, and mechanical principles influence movement in sporting and physical-activity contexts.

Students are introduced to the basic concepts of biomechanics, kinematics, kinetics, Newton's laws of motion, centre of gravity, equilibrium, friction, projectile motion, work, power, energy, torque, levers, and angular motion. Practical applications include analysis of fundamental movements and sport skills such as running, jumping, throwing, kicking, lifting, striking, and rotational movements.

RELEVANCE STATEMENT

Biomechanics provides a scientific foundation for understanding how and why the human body moves. Knowledge of biomechanics enables physical educators, coaches, athletes, exercise professionals, and sport scientists to analyse movement, improve technique, select appropriate equipment, enhance performance, and promote safe participation.

The course is particularly relevant to students of Physical and Health Education, Sport Science, Exercise Science, Coaching, and related disciplines because it provides essential knowledge for teaching movement skills and analysing sporting techniques. It also develops foundational skills that can be applied to sports performance, physical conditioning, rehabilitation, equipment design, and injury prevention.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the meaning, scope, principles, and applications of biomechanics in sports and physical activity.
2) Describe the fundamental concepts of motion, force, equilibrium, balance, stability, and mechanical advantage.

3) Apply Newton's laws of motion and other mechanical principles to human movement and sporting skills.
4) Analyse linear and angular motion in selected sports and physical activities.
5) Explain the mechanical principles underlying common sporting techniques such as running, jumping, throwing, kicking, and striking.
6) Use basic observational and technological methods to analyse movement and identify technical strengths and weaknesses.
7) Apply biomechanical principles to improve sports performance, teaching effectiveness, equipment use, and injury prevention.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define biomechanics and explain its relevance to sport, exercise, physical education, and human movement.
2) Identify and explain basic biomechanical concepts, terminology, and principles.
3) Distinguish between kinematic and kinetic variables in human movement.
4) Apply Newton's laws, principles of force, leverage, balance, stability, and momentum to sporting movements.
5) Analyse basic linear and angular movements involved in selected sports skills.
6) Conduct a simple observational biomechanical analysis of a sporting movement and communicate the findings.

COURSE CONTENT

- Introduction to Biomechanics
- Basic Anatomical and Mechanical Concepts
- Linear Motion
- Angular Motion
- Force and Its Application in Sport
- Newton's Laws of Motion
- Work
- Power and Energy
- Equilibrium
- Balance and Stability
- Centre of Gravity and Human Movement

- Levers in the Human Body
- Torque and Angular Momentum
- Projectile Motion

Meaning of projectile motion, Fluid Mechanics in Sport, Biomechanics of Locomotor Activities, Biomechanics of Throwing and Striking, Biomechanics of Selected Sports Skills, Biomechanics and Sports Performance, Biomechanics and Injury Prevention, Methods and Technology for Movement Analysis.

CATEGORY	DETAILS
Core Competencies	• Biomechanical knowledge • Movement-analysis • Kinematic • Kinetic • Problem-solving • Technical-analysis • Mathematical • Technology • Performance-enhancement • Injury-prevention
Core Values	• Accuracy • Scientific thinking • Objectivity • Discipline • Safety consciousness • Critical thinking • Problem-solving • Creativity • Innovation • Teamwork • Cooperation • Professionalism

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Practical demonstrations • Movement demonstrations • Laboratory activities • Video analysis • Group discussions • Problem-solving exercises
Learning Resources	• Biomechanics laboratory • Force plates, where available • Stopwatches • Measuring tapes • Metre rules • Weighing scales • Video cameras • Tripods • Motion-analysis equipment • Goniometers
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

McGinnis, P. M. (2021). *Biomechanics of sport and exercise* (4th ed.). Human Kinetics.

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Hamill, J., Knutzen, K. M., & Derrick, T. R. (2022). *Biochemical basis of human movement* (5th ed.). Wolters Kluwer.

Robertson, D. G. E., Caldwell, G. E., Hamill, J., Kamen, G., & Whittlesey, S. N. (2014). *Research methods in biomechanics* (2nd ed.). Human Kinetics.

Knudson, D. (2021). *Fundamentals of biomechanics* (3rd ed.). Springer.

Bartlett, R. (2007). *Introduction to sports biomechanics: Analysing human movement patterns* (2nd ed.). Routledge.

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HKE 513 Physiology of Exercise

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 60 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Physiology of Exercise is a foundational course that examines the acute responses and chronic adaptations of the human body to physical activity and exercise. It provides students with an understanding of how the cardiovascular, respiratory, muscular, nervous, endocrine, metabolic, and thermoregulatory systems function during exercise and adapt to different forms and intensities of training.

The course covers energy metabolism, oxygen consumption, cardiovascular and respiratory responses, muscular function, fatigue, recovery, environmental influences, training adaptations, exercise testing, and exercise prescription. It also explores the application of exercise physiology to physical fitness, sports performance, health promotion, disease prevention, physical conditioning, and lifelong wellness.

RELEVANCE STATEMENT

Knowledge of exercise physiology is essential for understanding the scientific basis of physical activity, exercise training, fitness development, sports performance, and health promotion. It enables practitioners to understand how the body responds to exercise and how appropriate training can produce beneficial physiological adaptations.

The course is particularly relevant to students of Physical and Health Education, Exercise Science, Sport Science, Coaching, Recreation, and related disciplines. It equips future teachers, coaches, fitness professionals, and exercise practitioners with the knowledge necessary to design safe and effective exercise programmes, monitor physiological responses, improve physical performance, and promote healthy lifestyles.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, and significance of exercise physiology.
2) Describe the physiological functions of major body systems during rest and different forms of exercise.
3) Explain the energy systems involved in physical activity and their contribution to different exercise intensities and durations.
4) Analyse acute physiological responses and chronic adaptations to aerobic, anaerobic, resistance, flexibility, and combined training.
5) Explain the physiological mechanisms underlying fatigue, recovery, overtraining, and exercise performance.
6) Apply exercise physiology principles to fitness assessment, exercise prescription, physical conditioning, and sports performance.
7) Evaluate the influence of nutrition, hydration, environmental conditions, age, sex, training status, and individual differences on exercise responses.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define exercise physiology and explain its relevance to health, fitness, physical education, and sports performance.
2) Describe the acute responses of the cardiovascular, respiratory, muscular, nervous, endocrine, and metabolic systems to exercise.
3) Explain the major energy systems and their contribution to different types of physical activity.
4) Analyse the physiological adaptations resulting from regular aerobic, anaerobic, and resistance training.
5) Demonstrate basic methods for assessing and monitoring physiological responses to exercise.
6) Explain the physiological causes of fatigue and the processes involved in exercise recovery and adaptation.
7) Apply exercise physiology principles to develop safe, effective, and individualised exercise and conditioning programmes.

COURSE CONTENT

Introduction to Exercise Physiology, Skeletal Muscle and Exercise, Energy for Physical Activity, Carbohydrate, Fat and Protein Metabolism, Cardiovascular Responses to Exercise

- Structure and function of the heart
- Respiratory Responses to Exercise
- Oxygen Consumption and Aerobic Capacity
- Nervous System and Exercise
- Endocrine Responses to Exercise
- Thermoregulation and Exercise
- Physiological Adaptations to Aerobic Training
- Anaerobic Exercise Physiology
- Resistance Exercise Physiology
- Flexibility
- Mobility and Functional Exercise
- Exercise Fatigue
- Recovery and Adaptation
- Exercise Testing and Physiological Assessment
- Exercise Prescription
- Exercise Physiology and Special Populations
- Environmental and Occupational Exercise Physiology
- Exercise
- Nutrition and Wellness

CATEGORY	DETAILS
Core Competencies	• Exercise physiology knowledge • Fitness-assessment • Exercise-prescription • Training • Monitoring • Data-interpretation • Problem-solving • Safety • Communication • Health-promotion • Research • Professional
Core Values	• Scientific inquiry • Accuracy • Objectivity • Discipline • Self-management • Responsibility • Safety consciousness • Professionalism • Integrity • Commitment • Perseverance • Teamwork • Respect

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Laboratory practicals • Demonstrations • Exercise testing • Field-based fitness assessments • Group discussions • Case studies • Problem-based learning • Project-based learning • Video demonstrations
Learning Resources	• Treadmills • Exercise bicycles • Step benches • Heart-rate monitors • Blood-pressure monitors • Stopwatches • Weighing scales • Stadiometers • Measuring tapes • Skinfold calipers where available
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

Kenney, W. L., Wilmore, J. H., & Costill, D. L. (2022). *Physiology of sport and exercise* (8th ed.). Human Kinetics.

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HKE 521 Organisation and Administration of Physical Education and Sports

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Organisation and Administration of Physical Education and Sports is a course designed to provide students with the knowledge, skills, and competencies required to effectively plan, organise, administer, coordinate, supervise, and evaluate physical education and sports programmes. The course examines the principles of management and administration as they apply to schools, sports clubs, institutions, communities, and other sporting organisations.

The course covers organisational structures, administrative principles, leadership, planning, staffing, budgeting, communication, decision-making, facilities and equipment management, sports scheduling, event management, record keeping, safety, supervision, public relations, conflict management, and programme evaluation. Emphasis is placed on efficient utilisation of human, financial, material, and physical resources for achieving educational and sporting objectives.

RELEVANCE STATEMENT

Effective organisation and administration are essential for the successful delivery of physical education, sports, recreation, and fitness programmes. Well-organised programmes promote participation, improve performance, ensure safety, enhance accountability, and maximise available resources.

The course is particularly relevant to students of Physical and Health Education, Sports Science, Coaching, Recreation, and Sport Management because it prepares them for administrative and leadership responsibilities in schools, colleges, universities, sports clubs, government sports agencies, community organisations, fitness centres, and sporting events. It also develops competencies needed for managing contemporary sports organisations in an increasingly professional and commercially oriented sports environment.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, scope, and functions of organisation and administration in physical education and sports.
2) Examine different organisational structures and administrative systems used in physical education and sports institutions.
3) Apply principles of planning, organising, staffing, directing, coordinating, and controlling physical education and sports programmes.
4) Demonstrate effective leadership, communication, decision-making, delegation, and supervision skills in sports administration.
5) Develop appropriate strategies for managing sports facilities, equipment, finances, personnel, and other resources.
6) Apply appropriate procedures for organising sports competitions, events, tournaments, and physical education programmes safely and efficiently.
7) Evaluate physical education and sports programmes and recommend strategies for improving their effectiveness, accountability, sustainability, and participation.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define organisation and administration and explain their importance to physical education and sports.
2) Identify and describe appropriate organisational structures and administrative functions in sports institutions.

3) Apply management principles to the planning and implementation of physical education and sports programmes.
4) Demonstrate effective leadership, communication, delegation, supervision, and decision-making skills.
5) Prepare basic budgets and manage sports facilities, equipment, personnel, and other resources responsibly.
6) Organise and supervise sporting events and competitions using appropriate administrative and safety procedures.
7) Evaluate sports and physical education programmes and develop practical recommendations for improvement.

COURSE CONTENT

- Introduction to Organisation and Administration
- Principles and Theories of Administration
- Organization of Physical Education and Sports
- Planning in Physical Education and Sports
- Organisation and Management of Physical Education Programmes
- Sports Programme Administration
- Leadership in Physical Education and Sports
- Staffing and Personnel Management
- Communication and Decision-Making
- Financial Management
- Facilities and Equipment Management
- Sports Personnel and Volunteer Management
- Organization of Sports Competitions
- Sports Event Management
- Safety
- Risk and Emergency Management
- Sports Governance and Policy
- Public Relations and Sports Communication
- Record Keeping and Office Administration
- Legal and Ethical Issues in Sports Administration
- Technology in Sports Administration

CATEGORY	DETAILS
Core Competencies	• Administrative • Organisational • Planning • Leadership • Communication • Decision-making • Financial-management • Facility-management
Core Values	• Leadership • Discipline • Responsibility • Accountability • Integrity • Transparency • Fairness • Teamwork • Cooperation • Equity
Pedagogical Approaches	• Interactive lectures • Group discussions • Case studies • Role-play • Sports-management simulations • Event-planning exercises • Budget preparation exercises

CATEGORY	DETAILS
Learning Resources	• Sports facilities • Sports fields • Gymnasiums • Recreation centres • Equipment stores • Offices • Meeting rooms • Sports equipment • First-aid kits • Public-address systems
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

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HKE 511 Skill Development and Techniques in Selected Ball Games

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Skill Development and Techniques in Selected Ball Games is a practical and skills-oriented course designed to develop students' technical, tactical, and instructional competencies in selected ball games commonly taught in schools and played competitively. The course provides a comprehensive understanding of the fundamental and advanced skills, rules, strategies, officiating, coaching methods, and safety principles associated with various ball games. The course typically covers selected games such as football (soccer), basketball, volleyball, handball, hockey, cricket, table tennis, badminton, lawn tennis, and other ball games relevant to the curriculum and available facilities. Students learn the techniques of ball control, passing, receiving, dribbling, serving, shooting, striking, tackling, blocking, attacking, defending, and team play, depending on the selected sport.

RELEVANCE STATEMENT

The course provides essential practical and pedagogical skills for teaching, coaching, officiating, and managing ball games in schools, sports clubs, and community settings. It equips future educators and sports professionals with the competencies needed to develop athletic talent, improve technical performance, encourage lifelong participation in sports, and contribute to national sports development.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the history, nature, and significance of selected ball games.
2. Demonstrate fundamental and advanced skills in selected ball games.
3. Apply the rules, regulations, and officiating procedures governing selected ball games.
4. Analyse and apply offensive and defensive strategies during game situations.
5. Demonstrate effective coaching methods and instructional techniques for teaching ball games.
6. Apply principles of physical conditioning, injury prevention, and safety during training and competition.
7. Promote lifelong participation in ball games for health, recreation, and competitive sport.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Demonstrate the skills and techniques of passing, throwing, catching, volley, shooting and dribbling, defending, ball control, and goalkeeping in soccer;
2. Demonstrate the skills and techniques of passing, throwing, catching, volley, shooting and dribbling, defending, ball control, and goalkeeping in volleyball;
3. Demonstrate the skills and techniques in high jump. passing, throwing, catching, volley, shooting and dribbling, defending, ball control, and goalkeeping in handball;
4. Demonstrate the skills and techniques in triple jump passing, throwing, catching, volley, shooting and dribbling, defending, ball control, and goalkeeping in basketball;
5. Discuss the history of soccer, volleyball, basketball and handball;
6. Explain the rules and regulations of for each of the ball games and be able to officiate the games; and
7. Use the facilities and implements for participation.

COURSE CONTENT

- Practical skills of (Passing, throwing, catching, volley, shooting and dribbling, defending, ball control, and goalkeeping.) and techniques in soccer, volleyball, basketball and handball
- The history of the games
- Rules and regulations for each sport, officiating and equipment and facilities used in each sport

CATEGORY	DETAILS
Core Competencies	• Technical skill proficiency in selected ball games • Game tactics and strategic decision-making • Coaching and instructional competence • Officiating and rule interpretation • Skill analysis and performance evaluation • Physical fitness and motor performance • Training programme planning and implementation

CATEGORY	DETAILS
Core Values	• Sportsmanship and fair play • Discipline and self-control • Professionalism • Integrity and ethical conduct • Teamwork and cooperation • Leadership and responsibility • Respect for rules and officials • Commitment to excellence • Perseverance and resilience
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning • Technology-enhanced learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

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Weinberg, R. S., & Gould, D. (2023). *Foundations of Sport and Exercise Psychology (8th ed.)*. Human Kinetics.

World Health Organization (WHO). (2020). *Guidelines on Physical Activity and Sedentary Behaviour*.

HKE 502 Nutrition in Sport and Exercise

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Nutrition in Sport and Exercise is a specialised course that examines the principles of nutrition and their application to physical activity, exercise, sports performance, health promotion, and recovery. The course provides students with a scientific understanding of the role of nutrients in energy production, growth, tissue repair, hydration, recovery, body composition, and optimal athletic performance. The course explores the functions of carbohydrates, proteins, fats, vitamins, minerals, water, and dietary fibre in supporting exercise and sports participation. Students also examine energy metabolism, nutrient timing, hydration strategies, weight management, nutritional assessment, dietary planning, sports supplements, ergogenic aids, and the nutritional needs of different populations, including children, adolescents, adults, older adults, athletes, and individuals with special health conditions.

RELEVANCE STATEMENT

The course provides essential knowledge for integrating sound nutritional practices into teaching, coaching, fitness training, and athlete development. It equips future educators, coaches, fitness instructors, and health professionals with the competencies required to guide individuals and athletes in making informed dietary choices that support training, competition, recovery, and long-term health.

COURSE OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Explain the principles of nutrition and their relationship to exercise, health, and sports performance.

2. Describe the functions of macro- and micronutrients in energy production, growth, recovery, and body maintenance.
3. Explain energy metabolism during rest, exercise, and recovery.
4. Evaluate the role of sports supplements and ergogenic aids using scientific evidence.
5. Explain the relationship between nutrition, body composition, physical fitness, and disease prevention.
6. Apply food safety and ethical principles in nutrition planning and sports performance.

LEARNING OUTCOMES

At the end of the course, the students should be able to:

1. Explain the role of nutrition in exercise performance and recovery.
2. Assess nutritional status and dietary needs of individuals and athletes.
3. Develop appropriate meal plans and hydration strategies.
4. Evaluate the use of dietary supplements and ergogenic aids critically.
5. Promote healthy nutrition practices using evidence-based approaches.
6. Apply nutritional principles to improve physical fitness, health, and sports performance.

COURSE CONTENT

- The nutritional parameters of athletic performance
- Nutritional intervention planning
- Energy production and the energy nutrients
- Vitamins and minerals
- Principles of balanced diets, timing and composition of intakes
- Hydration, weight management strategies, and nutritional needs for special situations
- Protein requirements for athletes and Nutritional Ergogenic Aids

CATEGORY	DETAILS
Core Competencies	• Knowledge of sports and exercise nutrition • Nutritional assessment and dietary evaluation • Meal planning and nutrition programme design • Energy metabolism and exercise physiology • Hydration and fluid management • Weight management and body composition assessment

CATEGORY	DETAILS
Core Values	• Sportsmanship and fair play • Discipline and self-control • Professionalism • Integrity and ethical conduct • Teamwork and cooperation • Leadership and responsibility • Respect for rules and officials • Commitment to excellence • Perseverance and resilience
Pedagogical Approaches	• Interactive lectures • Group discussions and collaborative learning • Practical demonstrations • Case studies • Problem-based learning (PBL) • Project-based learning • Seminars and student presentations • Field visits and experiential learning
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical Resources • ICT Resources • Field-Based Learning Resources • Resource Persons

CATEGORY	DETAILS
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American College of Sports Medicine (ACSM). (2016). *Nutrition and Athletic Performance: Position Stand*.

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Maughan, R. J., Burke, L. M., & Dvorak, J. (2018). *IOC Handbook on Sports Nutrition*.

McArdle, W. D., Katch, F. I., & Katch, V. L. (2022). *Exercise Physiology: Nutrition, Energy, and Human Performance (10th ed.)*. Wolters Kluwer.

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HKE 504 Test, Monitoring and Evaluation in Sport and Physical Education

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Test, Monitoring and Evaluation in Sport and Physical Education is a course designed to develop students' knowledge and practical competencies in the systematic assessment of physical fitness, motor abilities, sports performance, physical education programmes, and participants' progress. The course examines the principles and procedures for test construction, administration, scoring, interpretation, monitoring, and evaluation in sport and physical education.

Students are introduced to concepts such as measurement, assessment, testing, evaluation, validity, reliability, objectivity, norms, standards, fitness assessment, performance monitoring, programme evaluation, data analysis, and reporting. Practical emphasis is placed on the selection and administration of appropriate tests for physical fitness, motor skills, health-related fitness, skill performance, and sport-specific abilities. The course also develops students' capacity to use assessment information for planning instruction, monitoring progress, identifying strengths and weaknesses, improving performance, and evaluating programme effectiveness.

RELEVANCE STATEMENT

Effective testing, monitoring, and evaluation are essential for making evidence-based decisions in physical education and sports. Teachers and coaches need accurate assessment information to determine students' fitness levels, monitor athletes' progress, identify areas requiring improvement, design appropriate training programmes, and evaluate the effectiveness of instruction and sports programmes.

The course is particularly relevant to students of Physical and Health Education, Sports Science, Exercise Science, Coaching, and related disciplines. It provides practical competencies for conducting fitness and performance assessments, interpreting results, maintaining progress records, evaluating programmes, and using assessment evidence to improve teaching, coaching, training, and sports administration.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, purposes, and processes of testing, measurement, monitoring, assessment, and evaluation in sport and physical education.
2) Identify and select appropriate tests and assessment procedures for measuring physical fitness, motor abilities, health-related fitness, and sports performance.
3) Apply principles of test construction, administration, scoring, validity, reliability, objectivity, and standardisation.
4) Demonstrate competence in administering selected physical fitness, motor skill, and sports performance tests safely and accurately.
5) Monitor students' and athletes' performance and progress using appropriate assessment tools, records, and technological resources.
6) Analyse and interpret test results using appropriate descriptive and basic statistical techniques.
7) Evaluate physical education, exercise, training, and sports programmes and use assessment evidence to recommend improvements.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define and distinguish between testing, measurement, assessment, monitoring, and evaluation.
2) Explain the principles of validity, reliability, objectivity, standardisation, and norms in physical education and sport assessment.
3) Select appropriate tests for assessing health-related fitness, skill-related fitness, motor abilities, and sports performance.
4) Administer selected fitness and sports performance tests accurately, safely, and ethically.
5) Record, score, analyse, and interpret test results using appropriate procedures.
6) Monitor individual and group progress and provide appropriate feedback based on assessment evidence.
7) Evaluate physical education and sports programmes and make evidence-based recommendations for improvement.

COURSE CONTENT

Introduction to Testing, Measurement and Evaluation, Principles of Test Administration

- Characteristics of a good test
- Test Construction and Selection
- Health-Related Physical Fitness Testing
- Skill-Related Fitness Testing
- Motor Ability and Fundamental Movement Assessment
- Sports-Specific Testing
- Exercise and Physiological Monitoring
- Principles and Processes of Monitoring
- Athlete and Student Progress Monitoring
- Technology in Testing and Monitoring
- Evaluation of Physical Education Programmes
- Evaluation of Sports Programmes
- Data Management and Statistical Analysis
- Norms
- Standards and Interpretation of Scores
- Practical Administration of Fitness Tests

CATEGORY	DETAILS
Core Competencies	• Psychological knowledge • Motivational • Communication • Leadership • Mental skills • Goal-setting • Concentration • Assessment • Programme-design

CATEGORY	DETAILS
Core Values	• Respect • Empathy • Integrity • Fairness • Discipline • Responsibility • Patience • Self-confidence
Pedagogical Approaches	• Sports facilities • Training fields • Gymnasium • Exercise mats • Stopwatch/timer • Whiteboards • Flip charts • Performance-recording materials
Learning Resources	• Goal-setting templates • Performance diaries • Athlete profiling forms • Mental-skills training manuals • Case studies • Coaching videos • Digital Resources
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

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HKE 526 Sports Officiating

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 60

COURSE OVERVIEW

Sports Officiating is a practical and theoretical course designed to equip students with the knowledge, skills, attitudes, and professional competencies required to officiate sporting activities effectively, fairly, safely, and confidently. The course introduces students to the principles, rules, techniques, procedures, ethics, and responsibilities of sports officials across selected individual and team sports.

The course covers the roles and duties of referees, umpires, judges, timekeepers, scorers, starters, and other officials; interpretation and application of rules; positioning and movement; signalling; decision-making; communication; conflict management; safety; officiating technology; and preparation for competitions. Practical sessions provide

opportunities for students to officiate actual or simulated sporting events and receive feedback on their performance.

RELEVANCE STATEMENT

Competent officials are essential to the successful organisation and conduct of sporting competitions. Effective officiating ensures that rules are properly interpreted and enforced, participants are treated fairly, competitions are safe, and the integrity of sport is maintained.

The course is relevant to students of Physical and Health Education, Sports Science, Coaching, Exercise Science, Recreation, and Sport Management because it prepares them for officiating responsibilities in schools, colleges, universities, clubs, communities, and competitive sporting organisations. It also provides a foundation for professional certification and further development as referees, umpires, judges, technical officials, and sports administrators.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the meaning, principles, importance, roles, and responsibilities of sports officiating.
2) Identify and interpret the rules, regulations, equipment, playing areas, and procedures of selected sports.
3) Demonstrate appropriate officiating techniques, positioning, movement, signals, and mechanics in selected sports.
4) Apply effective decision-making, communication, and conflict-management skills during sporting competitions.
5) Demonstrate appropriate procedures for preparing, conducting, and concluding sporting events as an official.
6) Apply safety, ethical, professional, and inclusive principles in sports officiating.
7) Evaluate personal officiating performance and develop strategies for continuous improvement and professional development.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define sports officiating and explain the functions and responsibilities of different categories of sports officials.

2) Interpret and apply the rules and regulations of selected sports accurately.
3) Demonstrate correct positioning, movement, signalling, timing, scoring, and officiating mechanics.
4) Make timely, fair, and evidence-based decisions during sporting situations.
5) Communicate effectively with athletes, coaches, fellow officials, and spectators.
6) Conduct sporting events safely and professionally while maintaining discipline and fairness.
7) Assess their own officiating performance and demonstrate a commitment to continuous professional development.

COURSE CONTENT

- Introduction to Sports Officiating
- Principles of Effective Officiating
- Rules and Regulations of Sport
- Positioning and Movement
- Signals and Communication
- Decision-Making in Officiating
- Athletics Officiating
- Football Officiating
- Basketball Officiating
- Volleyball Officiating
- Handball Officiating
- Other Selected Sports
- Preparation for Sporting Events
- Conduct of Sporting Competitions
- Scoring
- Timing and Record Keeping

Scoring systems, Ethics and Professional Conduct, Conflict and Disciplinary Management

Sources of conflict, Safety and Risk Management, Technology in Sports Officiating, Physical and Mental Preparation of Officials.

CATEGORY	DETAILS
Core Competencies	• Rule

CATEGORY	DETAILS
	• Technical officiating • Decision-making • Positioning • Communication • Signalling • Scoring and timing • Conflict-management • Safety • Leadership • Teamwork • Fitness • Technology • Ethical • Reflective
Core Values	• Integrity • Fairness • Impartiality • Honesty • Respect • Discipline • Accountability • Responsibility • Professionalism • Teamwork • Commitment • Courage • Confidence • Patience • Objectivity • Transparency • Fair play • Inclusiveness • Safety consciousness • Excellence

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Rule-book analysis • Demonstrations • Practical officiating • Role-play • Video analysis • Case studies • Officiating simulations • Peer teaching • Peer assessment • Field practice • Competition observation
Learning Resources	• Sports fields • Courts • Tracks • Swimming pools where available • Whistles • Stopwatches • Scoreboards • Score sheets • Flags • Cones • Measuring equipment • Official sports equipment • Referee/official uniforms • Communication devices
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

American Sport Education Program. (2007). *Officiating fundamentals*. Human Kinetics.

Andrews, D. L., & Jackson, S. J. (Eds.). Relevant literature on sport, officiating, and professional practice.

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EMT 521 Environmental Education and Awareness

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Environmental Education and Awareness is a course designed to develop students' knowledge, attitudes, values, skills, and commitment towards understanding and addressing environmental issues. The course examines the relationship between humans and their environment and promotes responsible behaviour for the protection, conservation, sustainable use, and restoration of environmental resources.

The course introduces students to major environmental concepts and issues, including ecosystems, biodiversity, natural resources, pollution, waste management, climate change, environmental health, sanitation, population growth, urbanisation, environmental degradation, conservation, environmental laws, and sustainable development. Emphasis is placed on environmental awareness, behavioural change, community participation, environmental responsibility, and practical approaches to solving environmental problems.

RELEVANCE STATEMENT

Environmental challenges such as climate change, pollution, deforestation, biodiversity loss, poor waste management, flooding, land degradation, water scarcity, and unsustainable resource exploitation increasingly affect human health, livelihoods, education, and quality of life. Environmental education is therefore essential for developing environmentally responsible individuals and communities.

The course is particularly relevant to students of Environmental Health, Health Education, Physical and Health Education, Integrated Science, Biology, Geography, Agriculture, Education, and related disciplines. It equips future teachers and environmental profes-

sionals with the capacity to promote environmental awareness, sustainable practices, community participation, and environmentally responsible behaviour in schools and communities.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1) Explain the concepts, principles, objectives, scope, and importance of environmental education and awareness.
2) Examine the relationships among humans, ecosystems, natural resources, environmental quality, and sustainable development.
3) Identify and analyse major local, national, and global environmental problems and their causes, effects, and possible solutions.
4) Demonstrate appropriate knowledge and skills for environmental conservation, pollution prevention, waste management, and sustainable resource utilisation.
5) Apply participatory approaches and communication strategies to promote environmentally responsible attitudes and behaviours.
6) Evaluate environmental education initiatives and advocate sustainable practices, environmental responsibility, and community action.

LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

1) Define environmental education and awareness and explain their importance to individuals, communities, and society.
2) Describe the components and functions of ecosystems and explain human-environment relationships.
3) Identify major environmental problems and assess their effects on human health, society, and ecological systems.
4) Demonstrate practical strategies for environmental conservation, pollution control, sanitation, and waste management.
5) Develop and implement basic environmental education and awareness programmes.
6) Evaluate environmental awareness activities and propose practical solutions to environmental challenges.

COURSE CONTENT

- Introduction to Environmental Education

- Historical Development of Environmental Education
- Environment and Ecosystems
- Natural Resources and Conservation
- Biodiversity and Conservation
- Environmental Pollution
- Waste Management and Environmental Sanitation
- Climate Change and Global Environmental Change
- Environmental Health
- Population
- Urbanisation and the Environment
- Sustainable Development
- Environmental Awareness
- Environmental Education in Schools
- Community Environmental Education
- Methods of Environmental Education
- Environmental Communication and Advocacy
- Environmental Impact and Risk
- Environmental Laws
- Policies and Institutions
- Environmental Ethics and Values
- Environmental Education Programme Development
- Contemporary Environmental Issues
- Climate change

CATEGORY	DETAILS
Core Competencies	• Environmental literacy • Environmental-awareness • Critical-thinking • Problem-solving • Conservation • Waste-management • Communication

CATEGORY	DETAILS
Core Values	• Environmental responsibility • Stewardship • Sustainability • Respect for nature • Accountability • Integrity • Conservation • Responsibility
Pedagogical Approaches	• Interactive lectures • Group discussions • Environmental case studies • Field trips • Nature walks • Environmental surveys • Demonstrations • Project-based learning
Learning Resources	• Community service learning • Environmental campaigns • School environmental clubs • Digital learning • Guest lectures • Community-based projects • Improve
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

REFERENCES AND FURTHER READING

UNESCO. (1978). *Intergovernmental Conference on Environmental Education: Final report*. UNESCO.

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PROGRAMME 5 OF 6

Integrated Science Education

Introduction

The Integrated Science curriculum is a comprehensive educational framework that combines concepts, principles, and skills from the major branches of science – Biology, Chemistry, Physics, Earth and Space, and Environmental Science – into a unified course of study. Rather than teaching these disciplines as separate subjects, the curriculum emphasises the interconnectedness of scientific knowledge and its application to solving real-life problems. This interdisciplinary approach helps learners develop a holistic understanding of the natural world and the relationships between science, technology, society, and the environment.

Integrated Science is designed to foster scientific literacy by equipping learners with the knowledge, skills, attitudes, and values necessary for informed decision-making and lifelong learning. The curriculum encourages inquiry-based learning, critical thinking, creativity, collaboration, and problem-solving through practical activities, investigations, experiments, fieldwork, and project-based learning. Learners are encouraged to ask questions, formulate hypotheses, collect and analyse data, and communicate scientific findings effectively. The curriculum also addresses contemporary global and national challenges such as climate change, environmental conservation, health education, sustainable development, renewable energy, biodiversity conservation, and the responsible use of technology. Through these themes, students appreciate the relevance of science in improving the quality of life and promoting sustainable development.

At the tertiary level, particularly in Colleges of Education, the Integrated Science curriculum prepares pre-service teachers with strong scientific content knowledge, pedagogical competence, and professional ethics required for effective science teaching. It emphasises learner-centred instructional strategies, integration of information and communication technology (ICT), laboratory competence, assessment techniques, and research skills needed for continuous professional development. Overall, the Integrated Science curriculum serves as a foundation for scientific inquiry, technological innovation, environmental stewardship, and national development by producing scientifically literate citizens who can apply scientific knowledge responsibly in everyday life.

Philosophy of Integrated Science

The philosophy of the Nigeria Certificate in Education (NCE) Integrated Science is anchored on the following areas:

a. Fundamental unity of science
b. The use of scientific method as a common approach in problem solving
c. The role and function of science and technology in everyday life
d. To prepare students for further studies in integrated science

Integrated science is an approach to the study of science in such a way as to show the fundamental unity of science. It is an approach to the study of the environment, free of the limitation imposed by the separate subject's disciplines. This is not to decry the value of a subject discipline approach; it clearly has its uses. However, at the level of readiness for learning of secondary schools students, the boundaries between the disciplines can only appear as artificial, man-made constructs which interfere with unified views of nature, which children bring to the classroom with them.

Integrated science emphasises those concepts which are common to all sciences, the process of science and the skills associated with them. The great themes of science such as energy, field and particles theories, conservation, balance and cycles in nature are also emphasises and their relevance to everyday life. Integrated science also emphasised inquiry into nature of the environment. The scientific method of inquiry can be learned by everyone, and a prime aim of the programme is to provide students with an introduction to this method and allow them to follow their own inquiries. The method of inquiry has cognitive and practical aspects.

These cognitive aspects include the ability to formulate questions, to identify variables and design experiments, to interpret results, recognise patterns, generate hypotheses, draw conclusions and develop theoretical models. The practical skills required include general skills such as ability to observe and to measure, and more specialised skills in the handling and use of laboratory apparatus, living material, and chemicals.

Objectives of Integrated Science

The objectives of teaching integrated science are aim at:

1. Enabling students gain the concept of the fundamental unity of science;

2. Instilling in students a commonality of approach to problems of scientific nature ie the scientific method;
3. Increasing students understanding of the role and functions of science and technology in everyday life;
4. Making students well informed scientifically and technologically;
5. Enabling students acquire and demonstrate the intellectual competence and professional skills necessary for the teaching of basic science and technology in primary and junior secondary schools, as an inquiry based subject;
6. Developing in students the ability to impart and encourage in their pupils the spirit of inquiry into living and nonliving things in the environment;
7. Developing the ability and motivation in students to work and think in an independent manner;
8. Enabling students carry out scientific investigations, emphasising co-operation, development of appropriate scientific processes and skills and improving their written and oral communications skills
9. Developing in students the interest to pursue higher studies in integrated science.

Regulation (Programme Structure)

Admission Requirements and Graduation

Admission Requirements

NCE Programme

a) A Senior Secondary School Certificate (SSCE/WAEC/NECO/NABTEB or any other equivalent Certificate from recognised examination bodies with credit in five (5) subjects (English, Mathematics, physics, biology and chemistry) in not more than two sittings.

NCE-Degree Programme

i. Candidates must satisfy the UTME and O' Level admission requirements for Degree Education programme in Integrated Science.
ii. Candidates with NCE cumulative grade point average (2.40-5.00) equivalent to Merit and above shall continue into the 2-year Bachelor of Education degree programme.

iii. NCE candidates with cumulative grade point average (1.50-2.39) equivalent to Pass and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme.

Graduation Requirements

NCE Programme: NCE Programme: Candidates for the award of NCE certificates are required, among others, to earn at least 59 credit in Integrated Science, 22 credits in General Education courses, 6 credits in Teaching Practice and 12 credits in General Studies Education (totalling credits in the Integrated Science component of the NCE programme) to qualify for graduation, viz:

S/N	Component	Weight/credit load
	General Education	22
	Teaching Practice (TP)	06
	General Studies (GSE)	12
	Integrated science	40
Total Units:		**80**

Total Minimum Credit Units Required for NCE graduation: 80 **credit units**

Degree Programme: Candidates for the award of Bachelor Degree in Education certificates are required among others, to earn at least 54 credits in Integrated Science, 12 credits in General Education and 4 credits in General Studies (totalling credits in the Integrated Science Education component of the B. Ed programme) to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	Integrated science	54
2	General Education	12
3	General studies (GSE)	04
Total	**Units**	**70**

Total Minimum Credit Units Required for NCE-Degree graduation: **70 credit units**

National Goals of Education Nigeria

General Goals of Education

i. Development of the individual into a morally sound, patriotic and effective citizen

ii. Total integration of the individual into the immediate community, the Nigerian society and the world

iii. Provision of equal access to qualitative educational opportunities for all citizens at all levels of education within and outside the formal school system iv Incubation of national consciousness, values and national unity; and

iv. Development of appropriate skills, mental, physical and social abilities and competencies to empower the individual to live in and contribute positively to the society.

Specific Goals of Education

a) Ensure and sustain unfettered access and equity to education for the total development of the individual

b) Ensure the quality of education delivery at all levels

c) Promote functional education for skill acquisition, job creation and poverty reduction

d) Ensure periodic review, effectiveness and relevance of the curriculum at all levels to meet the needs of society and the world of work;

e) Collaborate with development partners, the private sector, non-governmental organisations and local communities to support and fund education; and

f) Promote information technology capability at all levels

Objectives of Integrated Science Education Programme

The objectives of this course are to:

- To produce competent and professionally qualified teachers capable of effectively delivering the integrated Basic Science Curriculum at primary and junior secondary school levels, fostering scientific literacy and inquiry-based learning among young learners.
- To equip pre-service teachers with a unified, interdisciplinary understanding of core sciences (biology, chemistry, physics, and environmental/earth sciences), emphasising the interconnections between disciplines to address real-world challenges such as sustainability and technological advancement.

- To develop pedagogical skills, including inclusive strategies informed by Universal Design for Learning (UDL) and competency-based approaches, enabling teachers to accommodate diverse learner needs and promote equitable science education across Nigeria's cultural and regional contexts.
- To instil practical laboratory and fieldwork competencies, along with the ability to integrate hands-on experiments, improvisation, and digital tools, preparing teachers to conduct effective inquiry-oriented practicals in resource-constrained environments.
- To cultivate positive attitudes toward science, critical thinking, problem-solving, and lifelong learning in teachers, enabling them to inspire curiosity, collaboration, and innovation in students while contributing to national development goals like STEM empowerment and global competitiveness.
- To prepare reflective practitioners who can adapt teaching methods to evolving educational needs, including technology integration and environmental awareness, in line with Sustainable Development Goals (SDG 4) and international standards for quality science education.

Learning Outcomes of Integrated Science Education Programme

By the end of the course, students should be able to:

1. Demonstrate a comprehensive, interconnected knowledge of core scientific disciplines (mathematics, biology, chemistry, physics, and earth/environmental sciences), applying scientific concepts and processes to explain natural phenomena and solve real-world problems.
2. Plan, deliver, and assess effective integrated science lessons for primary and junior secondary levels, using inquiry-based, learner-centred pedagogical strategies to promote scientific literacy and critical thinking among diverse students.
3. Design and conduct safe, hands-on practical experiments and fieldwork, including improvisation of materials in resource-limited settings, while integrating digital tools and technology to enhance teaching and learning.
4. Apply principles of Universal Design for Learning (UDL) and inclusive practices to adapt instruction for diverse learner needs, ensuring equitable access and fostering positive attitudes toward science across cultural and regional contexts.

5. Exhibit professional competencies, including reflective practice, ethical conduct, and collaboration, to contribute to curriculum development, environmental awareness, and national STEM goals as competent basic education science teachers.
6. Engage in competency-based assessments and continuous self-evaluation, mastering skills in content integration, classroom management, and problem-solving to support lifelong professional development and adaptable teaching in dynamic educational environments.

Relevance Statement for Integrated Science Education

The programme is highly relevant in Nigeria, as it directly addresses the critical need for quality foundational STEM education at the basic education level (primary and junior secondary schools). Training competent teachers can help deliver the programme builds scientific literacy from an early age, fostering inquiry-based learning, problem-solving, and an interconnected understanding of biology, chemistry, physics, and environmental sciences. On a societal level, the programme satisfies pressing national needs by producing teachers who promote sustainable development, environmental awareness, and equitable education in diverse contexts, including resource-constrained and underserved areas. It aligns with Nigeria's aspirations for rapid industrialisation, job creation, and poverty reduction through STEM empowerment, as evidenced by initiatives from bodies like NASENI and the Federal Ministry of Education emphasising STEM for infrastructural and economic advancement.

NCE-MAS (Minimum Academic Standards) for NCE Programme

Staffing Requirements (Personnel)

Institutions offering this programme shall employ **adequate, qualified, and competent personnel** to ensure effective programme delivery and administration. Such personnel shall include:

1. Course Lecturer
2. Laboratory Technologist,
3. Laboratory Technicians
4. Laboratory Attendants
5. Workshop Attendant.
6. Computer Technicians

7. Store Officer

Other supporting Staff

a. Administrative Staff for Department Coordination
b. Librarian/Resource Centre Staff with Science Education focus.
c. Clerk

Academic Staff

For an Integrated Science Education Department/Programme in a Nigerian College of Education, academic staff should possess qualifications that align with the multidisciplinary nature of Integrated Science, including:

- Ed/BSc.(Ed) Integrated Science Education
- Ed/BSc. (Ed) Physics, Chemistry, Biology, Mathematics, Geography and other relevant science disciplines.
- BSc Physics, Chemistry, Biology, Mathematics and Geography plus PGDE/PDE, with a minimum of 2:2 with a relevant master's degree or a PhD for senior roles (at least 40–60% of staff should hold PhDs to align with global research-oriented standards).

A minimum of 8–12 full-time academic staff dedicated to the Integrated Science Department, depending on student enrolment (recommended student-lecturer ratio of 15:1 to 20:1 for effective supervision of practicals, micro-teaching, and research projects). In view of the fact that all students in the College offer the programme (NCCE Guidelines). For the degree programme, at least 4 core staff with a Ph.D. degree in relevant teaching qualification among which there must be at least one full time professor is required. The programme must be administered by a staff not lower than a Senior Lecturer cadre.

The NUC guidelines on staff/student ratio of 1:30 for core subjects (Integrated Science) shall apply. It is expected that all academic staff should possess PhD degree. However, the proportion of academic staff with PhD degree should not be less than 70%. With a minimum load of 18 Units per semester for students and a minimum of six full-time equivalent of staff in each programme. Staff should have a maximum of 15 contact hours per week for lectures, tutorials, practical, and supervision of projects.

Administrative Support Staff (Non- Academic)

The services of the administrative support staff are indispensable in the proper administration of the departments and school offices. It is important to recruit very competent

senior staff that are computer literate. At the least, a secretary, a clerical officer and a messenger/cleaner are the minimum administrative staff expected for the programme.

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories and workshop/studios, are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

Library

Colleges should leverage on available technology to put in place rich databases and other electronic/digital library and information resources. In addition, well stock and current hardcopies of reference and other textual materials on Integrated Science should be provided centrally at the level of school. A well network digital library should serve the college community. Availability of wireless facilities (Wi-Fi) with adequate bandwidth should enhance access to these electronic resources.

Equipment Required for the Teaching of Integrated Science

Description Quantity

S/N	Description	Quantity Required
1	Skeletal system	3
2	Muscular system	3
3	Brain and Nervous system	3
4	Circulatory system	3
5	Digestive system	3
6	Eye and Vision	3
7	Skin and Excretory Organ	1
8	Microscope	1
9	Incubator/Steriliser	1

S/N	Description	Quantity Required
10	Autoclave (portable)	3
11	Top loading Balances	4
12	Hot plates	1
13	Refrigerator	1
14	Water filter	1
15	Hygrometer	1
16	Drying oven	1
17	Microtome	1
18	Automatic tissue processor	3
19	Centrifuge	1
20	Herbarium cabinet	9
21	Herbarium Index Boxes	3
22	Air pump	1
23	Photometer	1
24	Kymograph	1
25	Insect light traps	3
26	Dissecting microscope	3
27	Insect Box (large) many	
28	Slide projector	1
29	Overhead projector	2
30	Steel frame Aquarium	1
31	Oxygen meter	3
32	Binocular microscope	10
33	Embedding Bath	1
34	Water bath	1

S/N	Description	Quantity Required
35	PH meter	1
36	Tissue Grinder	1
37	Calorimeter	1
38	Auxanometer (Electric)	1
39	Soil Auger	4
40	Plant press	2
41	Soil testing kit	2
42	Wooden Quadrat	1
43	Measuring tape	10
44	Biological tape	1
45	Bunsen Burner	18
46	Gas cylinder	2
47	Meter balance	5
48	Cone balance	5
49	Thermostat	5
50	Steam Bath	5
51	Magnetic stirrer	3
52	Suction pump	3
53	Circulating water pump	3
54	Extractor	2
55	Rotary Evaporator	1
56	Water tank	1
57	First Aid Box	2
58	Conductivity meter	1
59	Water Distiller	5

S/N	Description	Quantity Required
60	Spectro photometer	5
61	Ammeter	10
62	Volt meter	10
63	Rheostat	5
64	Pendulum equipment	10
65	Triangular prism	10
66	Rectangular prism	10
67	Stop clock	5
68	Convex and concave mirror 10 each	
69	Telescope	5
70	Vernier calipers	5
71	Micrometer screw Guage	3
72	Thermometer	5
73	Bar Magnet	5
74	Electro magnet	5
75	Colour Disc	3
76	Colour filter	3
77	Ray box	10
78	Ripple tank	1
79	Meter Box	2
80	Resonance table	1
81	Dry cell	5
82	Glass string (100ml)	3
83	Plug key	5
84	Simple Electric meter generator	5

S/N	Description	Quantity Required
85	Zinc rod	5
86	Copper rod	5
87	Capillary tubes	2
88	Glass tubes	2
89	Stop watch	10
90	Hand lens	10
91	Bean balance	3
92	Spring balance	2
93	Dissecting Kit.	3
94	Computer	3
95	Work bench with all accessories	
96	Tool box with all essentials	
97	chemicals	
98	Glass ware (Pipette, Burette, Conical flask, Beaker, etc.)	10
99	Retort stand	20
100	Tripod stand	20
101	Litmus papers 2 Packs	
102	Spatula	10
103	Mortar and pestle	2
104	Ray boxes	5
105	Safety goggle	10
106	Hand lens	20
107	Mobile Laboratory for Physics and Chemistry	2

Reagent Needed

1. Hydrochloric Acid (HCL)
2. Tetraoxosulphate (iv) Acid (Sulphuric Acid); H_2SO_4
3. Trioxonitrate (III) Acid; HNO_3
4. Sodium Hydroxide; NaOH
5. Ethanoic Acid; CH_3COOH
6. Acetic Acid
7. Sodium Trioxonitrate (iii); Na_2Co_3
8. Different Salts (Acidic Salts, Alkaline Salts & Neutral Salts)

Science Laboratories

Dedicated standard laboratory for Integrated science should be provided for integrated science practicals, equipped with basic apparatus (microscopes, Bunsen burners, glassware, balances, dissection kits, electrical circuits, models of human anatomy, geological samples) to support hands-on inquiry, experimentation, and interdisciplinary activities. Labs should include preparation/storage rooms, safety equipment (fume hoods, eye wash stations, fire extinguishers, first aid kits), and ventilation compliant with OSHA/ NFPA standards.

a. **Classrooms and Lecture Halls**: A minimum of 3 spacious, well-ventilated rooms with flexible seating for group discussions, seminars, and collaborative learning; equipped with projectors, whiteboards/smartboards, and audio-visual aids to facilitate varied teaching methods aligned with Universal Design for Learning (UDL).

b. **ICT and Digital Resources**: Computer laboratory or multimedia centre with reliable internet access, computers/devices (student-computer ratio ideally 1:5 or better), projectors, interactive software, simulation tools (e.g. PhET for physics/chemistry), data loggers, and educational platforms to support UNESCO ICT Competency Framework integration, digital pedagogy, and virtual experiments.

c. **Library and Resource Centre**: Well-stocked physical and digital library with textbooks, journals, reference materials on integrated science, pedagogy, and STEM education; access to online databases and open educational resources (OER) for research and lesson planning.

d. **Micro-Teaching and Demonstration Facilities**: Dedicated spaces or rooms equipped with video recording equipment for micro-teaching practice, peer observation, and reflective teaching sessions essential for competency-based teacher training.

e. **Outdoor Learning Areas**: Access to school gardens, weather stations, ponds, or environmental plots for earth/environmental science fieldwork, ecology studies, and real-world applications promoting inquiry-based learning.

f. **Safety and Support Infrastructure**: Reliable electricity (with backup power), potable water, waste disposal systems (especially for chemicals), and accessible facilities to ensure inclusive education; storage for consumables and hazardous materials.

g. **Personnel:** According to global standards (including NSTA guidelines for science teacher preparation, UNESCO recommendations for quality STEM education, and alignments with NCCE benchmarks for NCE programmes in Nigeria), the following outline the quantity and quality of personnel required for effective delivery of the NCE Integrated Science Education programme. These ensure hands-on practical training, interdisciplinary integration, inclusive pedagogy, and competency-based assessment.

Pedagogical Approaches, Modes of Assessment and Instructional Materials for Integrated Science Education

Integrated Science Education delivery relies on student-centred instruction, continuous skill-based evaluation, and multi-format learning resources to engage large, diverse student cohorts effectively.

Pedagogical Approaches

Modern Integrated Science Education shifts away from passive rote learning toward interactive frameworks that build critical thinking and collaborative problem-solving skills.

- **Inquiry-Based Learning**: Learners investigate scientific questions, formulate hypotheses, collect evidence, analyse results and draw conclusions. It develops curiosity, critical thinking and scientific reasoning.
- **Problem-Based Learning (PBL)**: Students are presented with authentic problems such as water pollution, energy shortages, waste management or climate change and work collaboratively to develop solutions.
- **Project-Based Learning**: Learners undertake practical projects that integrate concepts from different science disciplines. Examples include constructing a simple solar cooker, investigating local water quality or developing a waste-recycling project.

- **Discovery Learning**: Students are guided to discover scientific principles through observation, experimentation and manipulation of materials rather than receiving all information directly from the teacher.
- **Cooperative Learning**: Students work in small, heterogeneous groups to perform experiments, discuss scientific concepts, solve problems and present findings. It promotes communication, teamwork and peer learning.

Modes of Assessment for NCE

Assessment in Integrated Science should measure not only students' knowledge but also their practical skills, scientific reasoning, attitudes, creativity and ability to apply science to real-life problems. The following modes are appropriate:

Assessment Type	Weight / Format	Objective & Methods
Continuous Assessment (CA)	**40%** *(Formative)*	Evaluates ongoing progress via online quizzes, mid-semester tests, short essays, practical group projects, and class attendance.
Practical & Venture Projects	*Integrated into CA*	Applied evaluation for science practicals or skill-based modules (e.g. producing a projects, exhibition displays).
Semester Final Examination	**60%** *(Summative)*	Primarily administered via using Multiple Choice Questions (MCQs) and Fill-in-the-Blank items for rapid, objective & Essay.
Assessment Type	**Weight / Format**	**Objective & Methods**

Modes of Assessment for Degree

Assessment in Integrated Science should measure not only students' knowledge but also their practical skills, scientific reasoning, attitudes, creativity and ability to apply science to real-life problems. The following modes are appropriate:

Assessment Type	Weight / Format	Objective & Methods
Continuous Assessment (CA)	**30%** *(Formative)*	Evaluates ongoing progress via online quizzes, mid-semester tests, short essays, practical group projects, and class attendance.

Assessment Type	Weight / Format	Objective & Methods
Practical & Venture Projects	*Integrated into CA*	Applied evaluation for science practicals or skill-based modules (e.g. producing a projects, exhibition displays).
Semester Final Examination	**70%** *(Summative)*	Primarily administered via using Multiple Choice Questions (MCQs) and Fill-in-the-Blank items for rapid, objective & Essay.
Assessment Type	**Weight / Format**	**Objective & Methods**

Instructional Materials

Instructional materials are resources used by teachers to make the teaching and learning of Integrated Science more concrete, interesting, interactive, and effective. They help learners understand scientific concepts through observation, experimentation, demonstration, and practical activities.

1. Print Materials: Integrated Science textbooks and reference books, Teacher's guides and manuals, Lecture notes and handouts, Worksheets and activity sheets, Workbooks, Science journals and magazines, Charts, posters, diagrams and illustrations
2. Real Objects and Specimens: Plants, leaves, flowers, fruits and seeds, Rocks, minerals and soil samples, Bones and preserved biological specimens, Laboratory chemicals and materials, Everyday objects illustrating scientific principles, Samples of metals and non-metals.
3. Laboratory Materials and Equipment; Test tubes, beakers, flasks and measuring cylinders Thermometers and balances, Microscopes and hand lenses, Bunsen burners/ spirit lamps, Magnets and electrical circuits, Models and apparatus for mechanics, heat, light and sound Specimen bottles and preservation materials

Dual Mandate Curriculum Course Distribution Structure for Integrated Science (100–500) Levels)

Curriculum Design Framework

A curriculum design framework provides a systematic structure for planning, developing, implementing, and evaluating an Integrated Science curriculum. It ensures that the curriculum responds to learners' needs, national educational goals, scientific developments, and societal challenges. Courses for the NCE programme were also properly

aligned with the Bachelor of Integrated Science Education degree, component to ensure that there are no repetitions on the one hand and systematic progression is guaranteed during implementation. The courses for the NCE programmes, therefore, naturally dovetail into the degree ones. The NCE Integrated Science education curriculum component is as shown in the table below and the subsequent description of the courses:

NCE Course Distribution (100–300 Level)

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30	30
EDU 112	Educational Psychology	2	C	30	30
GSE 111	General English 1	1	C	15	15
GSE 112	Introduction to Library Studies	1	C	15	15
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15	15
BIO 101	General Biology I	2	C	30	-
CHE 111	General Chemistry 1	2	C	30	
MAT 111	General Mathematics I (Number Theory)	2	C	30	
PHY 111	General Physics I	2	C	30	
ISC 111	Introduction to Science Education and Integrated Science	1	C	15	35
ISC 112	Component of Life	2	C	30	35
ISC 113	Nature of Matter	2	C	30	
ISC 114	Mechanics	2	C	30	
Total		**22**			

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30	30
GSE 121	English Proficiency for Teachers	1	C	15	15
GSE 122	Digital Literacy & AI for Educators	1	C	15	15

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 123	Media and Information Literacy I	1	C	15	15
BIO 121	General Biology II	1	C	30	-
CHE 121	General Chemistry II	1	C		
MAT 102	General Mathematics II (Algebra and Trigonometry)	2	C		
PHY 102	General Physics II	1	C		
ISC 121	Introduction to Scientific Methods	2	C	30	45
ISC 123	Integrated Science Practical	1	C	15	45
Total		**15**			

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 211	Classroom Management	1	C	15	15
EDU 212	Curriculum and Curriculum Delivery	2	C	30	30
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30	30
GSE 211	General English II	1	C	15	15
GSE 212	Introduction to Foundational Literacy	1	C	15	15
GSE 213	Media and Information Literacy II	1	C	15	15
CSE 211	Introduction to Computer	3	C	30	
ISC 211	Dynamics	1	C	30	
BIO 212	Genetics	1	C	30	
ISC 212	Methods of Teaching Integrated Science I	2	C	15	45
ISC 213	Metals and Non-Metals	2	C	30	
ISC 214	Global Ecology	2	C	30	
Total		**19**			

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	30
EDU 222	Educational Administration, Planning and Supervision	1	C	15	15
EDU 223	Introduction to Educational Technology	1	C	15	15
EDU 224	Micro Teaching: II (Practicum)	2	C	30	30
GSE 221	Introduction to Foundational Numeracy	1	C	15	15
GSE 222	Entrepreneurship and Green Skills	1	C	15	15
ISC 221	Nature of Matter II	1	C	30	
ISC 223	Man and His Environment	2	C	30	
Total		**11**			

NCE 300 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours	Source
EDU 311	Teaching Practice	6	C	45	270	NCEMAS

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	15
GSE 321	Global Citizenship Education and Political Economy	1	C	15	15
ISC 321	Carbon Compounds	2	C	30	
ISC 322	Seminar in Integrated Science	1	C	30	
Total		**7**			

The following are the core courses for integrated science education as stipulated in the NUC Benchmark Minimum Academic Standards. These courses must be taught

in Years 4 and 5 of all bachelor's degree programmes in Integrated Science Education under the Dual Mandate Minimum Academic Standards.

Degree Course Distribution (400–500 Level)

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	LP
GST 411	Peace and Conflict Resolution	2	C	30	
SED 401	Special Methods in Teaching Integrated Science II	3	C	15	45
ENT 401	Entrepreneurship in Integrated Science	3	C	15	45
BIO 401	Genetics II	2	C	15	45
BIO 402	Population Biology and Evolution	2	C	30	-
GLY 401	Introduction to Geology	2	C	30	
Total		**14**			

Degree 400 Level

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	LP
EDU 402	Educational Measurement, Test, Research Methods and Statistics	3	C	45	
ENT 412	Venture Creation	2	C	30	
BIO 403	Biogeography and Soil Biology	3	C	30	
EIS 402	Industrial Raw Materials Resource Inventory	2	C	15	-
CHM 402	Environmental Chemistry I	2	C	30	
BIO 404	General Physiology	2	C	30	
BIO 405	Hydrobiology	3	C	30	
Total		**17**			

Degree 500 Level

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	LP
EDU 501	Teaching Practice	6	C		135
SED 501	Science, Technology and Society	3	C	45	
CHE 501	Analytical Chemistry	2	C	30	
BCH 501	General Biochemistry	3	C	30	
MCB 501	General Microbiology	3	C	30	45
Total		**17**			

Degree 500 Level

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	LP
EDU 500	Project	3	C		135
CHE 502	Environmental Chemistry II	3	C	45	45
PHY 502	General Physics III (Behaviours of Matter)	3	C	45	45
Total		**9**			

NCE Course Descriptions (100–300 Level)

Course Contents (100 Level)

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biology I introduces students to the fundamental principles of biology that underpin the study of living organisms. The course examines the structure and organisation of cells, the functions of cellular organelles, and the characteristics and classification of living things. It also explores the concepts of chromosomes, genes, heredity, reproduction, evolution, ecological principles, and interactions among organisms. Students will gain a solid foundation in biological concepts necessary for advanced studies in biology and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide students with a fundamental understanding of the structure, organisation, and functions of cells and their organelles.
2. Introduce the characteristics, classification, and modes of reproduction of living organisms.
3. Explain the ecological relationships and interactions among organisms and their environment.
4. Familiarise students with the basic principles of heredity and evolution.
5. Expose students to the different habitat types and their distinguishing characteristics.
6. Develop students' understanding of the fundamental concepts and principles of general biology.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

1. Explain cells structures and organisations;
2. Summarise functions of cellular organelles;

3. Characterise living organisms and state their general reproduction;
4. Describe the interrelationship that exists between organisms;
5. Discuss the concept of heredity and evolution; and
6. Enumerate habitat types and their characteristics

CATEGORY	DETAILS
Core Competencies	1 Scientific inquiry 2 Observation 3 Classification of living things 4 Evaluation 5 Application
Core Values	• 1 Curiosity • 2 Integrity • 3 Diligence • 4 Responsibility • 5 Conservation • 6 Team work
Pedagogical Approaches	• 1 Inquiry-based learning • 2 Demonstration • 3Group discussion 4 Group work • Case study • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Biology text book, charts, model • 2 Specimens • 3 Multimedia facilities • 4 Microscope, prepared slides • 5 Laboratory manual • National Curriculum for Basic Education
Assessment Methods	• 1 Lab and field report • Class • 2 presentation of findings

Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

PHY 111 General Physics I Mechanics

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces 100- level student to the basics principles of classical mechanics which is the branch of Physics that deals with motion of objects and the forces that cause them. The course emphasises both theoretical and practical understanding and problem – solving skills, application to real life situations

Course-Relevant Statement

Mechanics is a core foundational course designed to introduce students to the fundamental principles governing the motion of bodies and the forces that cause such motion. The course is relevant because it provides the essential theoretical background and analytical skills required for further studies in Physics, Engineering, and other applied sciences. Topics such as kinematics, dynamics, work, energy, momentum, gravitation, and rotational motion form the basis upon which advanced courses in electricity, waves, Thermodynamics, and Quantum physics are built. Mastery of mechanics is therefore critical for academic progression in science and technology programmes.

Beyond academics, the course is professionally relevant because the laws of mechanics are applied in solving real-world problems in engineering, industry, agriculture, transportation, and energy. In the Nigerian context, understanding mechanics is vital for the design and maintenance of machines, buildings, vehicles, irrigation systems, and renewable energy devices. The course also develops students' problem-solving, critical thinking, and quantitative reasoning abilities which are important for national development, research, and teaching. Thus, PHY 111 equips students with both the conceptual foundation and practical skills needed to contribute meaningfully to technological growth and self-reliance in Nigeria.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain Fundamental and derived quantities
2. State the importance of dimensional analysis,

3. Define vector and scalar quantities,
4. Derive equations of motion,
5. State momentum, conservation principle, system of particles.
6. Describe planetary motion, and space travel.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Differentiate between fundamental and derived quantities and their units
2. Solve problems involving dimensional analysis
3. Differentiate between vector and scalar quantities with examples.
4. Explain the application of Newtonian mechanics; equation of motion, momentum conservation etc.
5. Explain system of particles and applying them in problem solving.
6. Explain the planetary motion and space travel

COURSE CONTENT

- Space and time
- Units and dimension
- Vectors and Scalars
- Differentiation of vectors
- Displacement
- Velocity and acceleration
- Kinematics
- **Newton laws of motion:** Inertial frames, Impulse, force and action at a distance, momentum conservation
- Relative motion
- Application of Newtonian mechanics
- Equations of motion
- Conservation principles in physics
- Conservative forces
- Conservation of linear momentum
- Kinetic energy and work
- Potential energy

- System of particles
- Centre of mass
- Rotational motion
- Torque
- Vector product
- Moment
- Rotation of coordinate axes and angular momentum
- Polar coordinates
- Conservation of angular momentum
- Circular motion
- Moments of inertia
- Gyroscopes and precession
- Gravitation
- Newton’s Law of Gravitation
- Kepler’s Laws of Planetary Motion
- Gravitational Potential Energy
- Escape velocity
- Satellites motion and orbits

CATEGORY	DETAILS
Core Competencies	• Relate (Application) • Problem-solving competence • Mathematical competence • Experimental competence • Measurement competence • Construct (Skill) Critical-thinking • Competence

CATEGORY	DETAILS
Core Values	• Accuracy and precision • Honesty and integrity • Curiosity • Creativity and innovation • Teamwork and cooperation • 6, Respect for safety rules • Responsibility and accountability • Critical and independent thinking
Pedagogical Approaches	• Interactive lectures • Problem-based learning (PBL) • Inquiry-based learning • Practical/laboratory learning • Demonstration method • Collaborative learning • Project-based learning • Simulation-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Laboratory equipment • Metre rules and measuring tapes • Stopwatches • Masses and balances • Spring balances • Trolleys and dynamics tracks • Pulley systems • Inclined-plane apparatus • Simple pendulum apparatus • Projectile-motion apparatus • 10 Elastic springs • National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Short quizzes and classroom exercises. • Numerical and conceptual problem-solving tests • Graph construction and interpretation. • Mid-semester examinations. • End-of-semester written examinations.

Halliday, D., Resnick, R., & Walker, J. (2021). *Fundamentals of Physics* (12th ed.). Wiley.

Serway, R. A., & Jewett, J. W. (2018). *Physics for Scientists and Engineers with Modern Physics* (10th ed.). Cengage Learning.

CHE 111 General Chemistry I (Inorganic)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Chemistry I (Inorganic) is an introductory course designed to provide students with fundamental knowledge and understanding of the principles, concepts and applications of inorganic chemistry. The course introduces students to the nature and behaviour of matter, atomic structure, chemical bonding, periodicity, chemical formulae and equations, stoichiometry, chemical reactions, states of matter, solutions, acids and bases, oxidation – reduction reactions and basic thermochemistry. Attention is given to the periodic classification of elements and the relationship between electronic structure and the physical and chemical properties of elements and their compounds. The course also develops students' practical skills in chemical measurements, laboratory techniques, observation, experimentation, data analysis and safe handling of chemicals. Emphasis is placed on connecting fundamental chemical principles with applications in industry, agriculture, environmental management, health, education and everyday life.

COURSE-RELEVANT STATEMENT

General Chemistry I (Inorganic) provides the foundational knowledge required for understanding more advanced areas of chemistry and other science-related disciplines. A sound understanding of atomic structure, periodicity, chemical bonding, reactions and stoichiometry enables students to explain the properties and transformations of inorganic substances. The course is particularly relevant to students of chemistry, integrated science, biology, physics, environmental science, agriculture, medicine, engineering and science

education. It equips learners with the conceptual, mathematical, practical and analytical skills necessary for solving chemical problems and understanding the role of chemistry in scientific and technological development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the basic concepts and principles of chemistry and relate them to observable phenomena.
2. Describe the structure of atoms in terms of protons, neutrons and electrons.
3. Explain atomic orbitals, electronic configuration and their relationship to the properties of elements.
4. Describe the development and organisation of the periodic table.
5. Explain periodic trends such as atomic radius, ionisation energy, electron affinity and electronegativity.
6. Distinguish between ionic, covalent and metallic bonding and explain their characteristics.

LEARNING OBJECTIVES

By the end of this course, students should be able to:

1. Define and correctly use fundamental terms and concepts in inorganic chemistry.
2. Describe atomic structure and determine the electronic configuration of elements.
3. Use the periodic table to predict and explain the properties and behaviour of elements.
4. Explain periodic trends and relate them to atomic structure.
5. Differentiate between major types of chemical bonding and predict basic molecular properties.
6. Write chemical formulae and correctly balance chemical equations.

COURSE CONTENT

- Atoms, molecules, elements and compounds
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table
- Hybridisation and shapes of simple molecules
- Valence Forces
- Structure of solids

- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter
- Elementary thermochemistry
- Rates of reaction, equilibrium and thermodynamics
- Acids, bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry

CATEGORY	DETAILS
Core Competencies	• Scientific reasoning competence • Chemical problem-solving competence • Numeracy competence • Laboratory competence • Observation competence • Data-analysis competence • Critical-thinking
Core Values	• Accuracy and precision • Honesty and integrity • Safety consciousness • Curiosity • Creativity and innovation • Teamwork and cooperation • Responsibility and accountability • Environmental responsibility • Respect for evidence

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive Lecture Method • Inquiry-Based Learning • Problem-Based Learning • Demonstration Method • Collaborative Learning • Project-Based Learning • Simulation and Digital Learning • Flipped Classroom • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Laboratory Resources • Test tubes and test-tube racks • Beakers and conical flasks • Measuring cylinders • Burettes and pipettes • Volumetric flasks • Balance • Thermometers • Bunsen burners or appropriate heating equipment • National Curriculum for Basic Education
Assessment Methods	• Classroom quizzes • Assignments • Laboratory assessment • Laboratory reports • Mid-semester test • Project assessment • Practical examination • End-of-semester examination

REFERENCES AND FURTHER READING

Chang, R., & Goldsby, K. A. (2022). *Chemistry* (13th ed.). McGraw-Hill Education.

Tro, N. J. (2023). *Chemistry: An molecular approach* (6th ed.). Pearson.

Atkins, P., Jones, L., & Laverman, L. (2023). *Chemical principles: The quest for insight* (8th ed.). W. H. Freeman/Macmillan Learning.

OpenStax. (2019). *Chemistry 2e*. Rice University. This is an open-access general chemistry textbook covering the scope and sequence of a two-semester general chemistry course

MAT 111 General Mathematics I (Number Theory)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of number theory and mathematical structures. It focuses on the properties and operations of numbers, including integers, primes, divisibility, congruences, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real-life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem-solving.

COURSE OBJECTIVES

The objectives of this course are to:

1. Demonstrate a proper understanding of the number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility, and congruence.
3. Appreciate and utilise the applications of numbers in real-life situations.
4. Solve problems using principle of mathematical induction Define and analyse congruences, including reflexive, symmetric, and transitive properties.
5. Define and analyse congruence, including reflexive, symmetric, and transitive properties

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and apply the process of counting and the use of ordered pairs (Peano's Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.
3. Explore further properties of integers, including well-ordering principle and divisibility.
4. Apply mathematical induction in proving theorems and laws.
5. Understand primes, relatively prime integers, and unique factorisation.
6. State and prove the fundamental theorem of arithmetic.
7. Define and analyse congruences, including reflexive, symmetric, and transitive properties.

CATEGORY	DETAILS
Core Competencies	• Creativity • Innovation • Reflective thinking • Critical thinking • Communication • Collaboration
Core Values	• Integrity • Respect • Team spirit • Perseverance • Transparency • Tolerance • Honesty
Pedagogical Approaches	• Learner-Centred Approach • Collaborative and Cooperative Learning • Blended Learning • Discussion and dialogue • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms • National Curriculum for Basic Education
Assessment Methods	• Continuous Assessment • Formative Assessment • Digital assessment • Summative assessment • Readings • Class work

REFERENCES AND FURTHER READING

Current textbook on An Introduction to the Theory of Numbers.
Use of online Resources

ISC 111 Introduction to Science Education and Integrated Science

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 35

COURSE OVERVIEW

This course examines the nature, purpose, and scope of science as a field of knowledge and its role in education. It introduces student-teachers to key ideas underlying the teaching and learning of science, including inclusive access to science learning, the significance of science in human development, and the philosophical foundations that guide scientific inquiry. The course also explores integrated science as a unifying approach to understanding scientific concepts and discusses the interactions among science, technology, and society within contemporary contexts.

RELEVANCE STATEMENT

The course is relevant to the professional preparation of education college students as it provides the conceptual and philosophical foundation necessary for effective science teaching at basic and post-basic levels. By addressing inclusive science education, national development, and the link between science, technology, and society, the course equips student-teachers with the knowledge required to promote scientific literacy, critical thinking, and responsible citizenship in line with national educational goals.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define the meaning and scope of science and science education.
2. Explain the concept of science education for all and its implications for inclusive education.
3. Describe the importance of science education to individuals and society.
4. Analyse the role of science education in national development.
5. Examine the philosophical foundations of science and scientific knowledge.
6. Evaluate integrated science as a foundation for the achievement and understanding of science, and the relationship between science, technology, and society.

LEARNING OUTCOMES

By the end of this course students should be able to:

1. Accurately identify and articulate the key features, scope, and aims of scientific knowledge
2. Demonstrate understanding of inclusive science learning by proposing strategies that promote equal participation of all learners.
3. Illustrate the contributions of science learning to cognitive development, problem-solving, and informed decision-making through relevant examples.
4. Critically assess the influence of science learning on national progress.
5. Apply philosophical reasoning to explain how scientific knowledge is generated, validated, and guided by underlying values and assumptions.
6. Integrate scientific ideas across disciplines to show how a unified science approach supports technological advancement and addresses societal needs.

COURSE CONTENT

- The meaning of Science and Science Education
- The concept of Science Education for all
- Science Education for National Development
- The importance of Science Education
- Philosophy of Science
- The scientific methods and science ethics
- Science and Superstition

- Students' performance in Integrated Science and technology and its implication for achieving success in science

CATEGORY	DETAILS
Core Competencies	• 1 Observing • 2 measuring • 3 experimenting, 4 problem solving, ICT & teamwork
Core Values	• Curiosity • Honesty • Objectivity • Cooperation • Responsibility, and
Pedagogical Approaches	• Inquiry-based and hands-on learning • Demonstrations and models • Contextual and problem-based • Active and constructivist and Concept mapping • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Human resources such as science teacher, Lab • Technician. • Print resources journals and STAN Magazines. • Practical laboratory resources. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	1 Formative, Practical assessments & Summative

REFERENCES AND FURTHER READING

Arokoyu, a. A. (2012). Elements of contemporary integrated science curriculum: impacts on science education. *Global Journal of Educational Research, 1*(11), 49–55.

Maryann C. O. & Onyekwena M. C (2019).Science education: A tool for sustainability in Nigeria's development. *Multidisciplinary Journal of Education, Research and Development 3*(1).

ISC 112 Component of Life I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 35

COURSE OVERVIEW

This course introduces student-teachers to fundamental component of life concepts that explain the structure, functioning, and continuity of life. It covers the organisation of cells and the roles of their components, the distinguishing features and grouping of living organisms, and the relationship between chromosomes and genes in the transmission of traits. The course also examines interactions among organisms, principles of heredity and evolutionary change, and basic ecological concepts, including habitats and their types.

RELEVANCE STATEMENT

The course provides the foundation required for effective teaching of life sciences at the basic and post-basic levels. Understanding cellular organisation, inheritance, biodiversity, and ecological relationships, enables student-teachers to explain component of concepts clearly, relate them to everyday life, and promote scientific thinking among learners, in line with national educational goals.

COURSE OBJECTIVES

The objectives of this course are to:

1. Describe the structure, organisation, and basic components of the cell as the fundamental unit of life.
2. Explain the functions of major cellular components and their roles in sustaining life processes.
3. Identify and classify living organisms based on their shared characteristics and observable features.
4. Explain the roles of chromosomes and genes in the transmission of traits from parents to offspring.
5. Analyse the interactions among living organisms and between organisms and their environment.
6. Discuss the principles of heredity, evolutionary change, and basic ecological concepts, including habitats and their types.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Correctly label and describe the structural components of plant and animal cells and explain their organisation.
2. Relate the functions of cellular components to the life processes they perform in living organisms.
3. Differentiate and group living organisms based on observable characteristics using accepted biological classification systems.
4. Explain the connection between chromosomes and genes in the inheritance of traits from one generation to another.
5. Illustrate interrelationships among organisms using food chains, food webs, and other ecological models.
6. Demonstrate understanding of heredity, evolution, and ecology by explaining adaptation, variation, habitats, and ecosystem components.

COURSE CONTENT

Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes their relationships and importance, general reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism); heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitats

CATEGORY	DETAILS
Core Competencies	• 1Cognitive/intellectual competencies • 2 Process skills. • 3Practical/manipulative
Core Values	• 1 Scientific values • 2 objectivity, accuracy and patience. • 3 Personal & social values.

CATEGORY	DETAILS
Pedagogical Approaches	• 1 Inquiry-based and hands-on learning. • 2Demonstrations and models. • 3 Collaborative strategies. • 4 Contextual and problem-based. • 5 Peer teaching. 5 Role-playing predator-prey dynamics • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Visual resources; charts/posters, models, specimens, flash cards. • 2 Practical laboratory; microscope, slides, materials for slide prep, hand lens. • 3 Print resources; textbooks: new concept integrated science, teacher's guide: NERDC basic science teacher's guide. • National Curriculum for Basic Education
Assessment Methods	• 1 Formative: Quizzes on definitions/habitat 2 classification • 3 observation checklists during field/lab • 4 practicals • 5 Practical assessments. • 6 Summative.

REFERENCES AND FURTHER READING

Crow D (2024) *Components of Biological Systems: Building Blocks of Life*. Bio Eng Bio Electron. 6:16.

Akdemir, Ö. (2006). *Competency of Secondary School Science Teachers in Laboratory Practices and the Problems they face with Applications*. Master of science thesis, Fırat University Social Sciences Institute Elazığ.

ISC 113 Nature of Matter I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an introduction to the fundamental principles of chemistry, including the structure of atoms, molecules, elements and compounds, electronic configuration, periodicity, and molecular shapes. It also covers chemical bonding, stoichiometry, and the structure of solids to explain the properties and behaviour of matter.

Students will explore thermochemistry, reaction rates, chemical equilibrium, acids, bases, salts, gases, redox reactions, and basic electrochemistry. The course equips students with essential knowledge and problem-solving skills for further studies in chemistry and related scientific fields.

RELEVANCE STATEMENT

This course equips students with essential chemical knowledge and problem-solving skills, preparing them for careers in science, medicine, engineering, and technology. It addresses societal needs by promoting scientific literacy, enabling solutions to challenges in health, environment, industry, and everyday life. Nationally, it supports the development of a skilled workforce, fostering research, innovation, and technological advancement for economic growth and sustainable development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the basic structure of matter.
2. Describe chemical bonding and molecular structure of solids.
3. Apply quantitative chemical principles to solve basic chemical problems.
4. Explain energy changes, reaction processes by discussing thermochemistry and basic thermodynamic concepts.
5. Demonstrate understanding of fundamental chemical reactions in relation to everyday and laboratory applications.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Demonstrate understanding of the structure of matter and periodic trends.

2. Analyse chemical bonding, molecular structure and properties of solids.
3. Solve quantitative and qualitative chemical problems involving chemical equations, stoichiometry, gas laws, kinetic theory of matter, and properties of gases.
4. Explain chemical energetics and reaction dynamics in relation to chemical systems.
5. Apply knowledge of chemical reactions to practical contexts.

COURSE CONTENT

- Atoms, molecules, elements and compounds, Modern electronic theory of atoms, physical and Chemical Changes, Separation Techniques, Electronic configuration, periodicity and building up of the periodic table, hybridisation and shapes of simple molecules, Valence Forces
- Structure of solids
- Properties of gases, chemical bonding and intermolecular forces, kinetic theory of matter

CATEGORY	DETAILS
Core Competencies	• Analytical, problem-solving, scientific • Reasoning skills • Critical thinking, practical • Laboratory competence
Core Values	• Accuracy • Ethical scientific practice • Curiosity, environmental • Responsibility, and teamwork
Pedagogical Approaches	• Student-centred approach. • Guided discussions, and visual models • Problem-solving, inquiry-based learning • Laboratory activities, critical thinking. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks, Journals & Online • Resources, charts visual and audio visual resources. • National curriculum for Basic Education (Integrated Science)

CATEGORY	DETAILS
Assessment Methods	• Quizzes • Assignments and class participation. • Multiple-choice • Short-answer and structured problem-solving questions.

REFERENCES AND FURTHER READING

West African Examinations Council (WAEC). (2023). *Chemistry Syllabus for Senior Secondary Schools*. Lagos (WAEC).

ISC 114A Laboratory Management and Safety

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces student-teachers to essential practical skills and safety practices required for effective work in the integrated science laboratory. It covers common laboratory hazards, preventive measures, and basic first-aid procedures, as well as fundamental techniques for integrated science measurement. The course also focuses on the correct use and care of microscopes, including compound and dissection microscopes, laboratory drawing and illustration with emphasis on accuracy, scaling, and proportion, and the proper handling of common laboratory apparatus.

RELEVANCE STATEMENT

The course is relevant to the professional preparation of integrated science NCE student-teachers as it equips them with the practical knowledge and safety awareness necessary for teaching integrated science at basic and post-basic levels. By emphasising laboratory safety, correct use of equipment, and accurate observation skills, the course supports effective science instruction and promotes safe learning environment.

COURSE OBJECTIVES

The objectives of this course are to:

1. Discuss common hazards encountered in the integrated science laboratory and apply appropriate preventive measures and basic first-aid procedures.

2. Explain basic integrated science measurements using standard units and simple measuring instruments.
3. Describe proper use and maintenance of the microscope for effective integrated science observation.
4. Differentiate and operate compound and dissection microscopes for various laboratory activities.
5. Produce accurate laboratory drawings and illustrations, observing correct scaling, proportion, and labelling conventions.
6. Select and use common integrated science laboratory apparatus correctly and safely during practical activities.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Identify common integrated science laboratory hazards and apply appropriate preventive measures and basic first-aid procedures during practical activities.
2. Carry out basic integrated science measurements accurately, using standard units and simple measuring instruments.
3. Demonstrate correct use and routine care of the microscope for effective observation of integrated science specimens.
4. Expanciate between compound and dissection microscopes and use each appropriately for relevant laboratory investigations.
5. Draw neat and accurate laboratory drawings and illustrations, observing correct scaling, proportion, and proper labelling.
6. Describe how to use common integrated science laboratory apparatus safely and effectively during experiments and practical sessions.

COURSE CONTENT

- Laboratory management
- Laboratory rules and regulation
- Laboratory equipment and apparatus
- Storage and management procedure
- Common laboratory hazards
- Prevention and first aid
- Measurements in integrated science laboratory. Uses and care of microscope

- Compound and dissecting microscope
- Integrated science drawings and illustration
- Scaling
- Accuracy and proportion
- Use of common laboratory apparatus and laboratory experiments designed in Integrated Science

CATEGORY	DETAILS
Core Competencies	1 Managerial/administrative competencies. • Technical/practical competencies. • Safety competencies; hazard identification, first aid, use of safety equipment • Emergency procedures and risk • Assessment competences
Core Values	• Attitude and ethics. • Safety values. • Social & • Ethical • Values; respect for life.
Pedagogical Approaches	• Inquiry-based and hands-on learning • Demonstrations • Collaborative strategies • Participatory learning and discovery learning strategy. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Human resources; science teacher/lecturer • 2 Print resources textbook –laboratory management and safety in school by STAN. • 3Safety Equipment/ practical resources; personal protective • Equipment (PPE), fire safety Aid, emergency • Equipment, hazard sign, water disposal. • Laboratory apparatus and management tools. • National curriculum for Basic Education (Integrated Science)

CATEGORY	DETAILS
Assessment Methods	• Lab reports/portfolios of fieldwork • Practical assessments • Micro-teaching sessions on ecology topics, pre/post-concept tests.

REFERENCES AND FURTHER READING

Ekpo, J. (1988). Safety tips: The design and development of chemistry laboratory safety modules for secondary schools. *The Journal of Chemical Education*, *65*(12), 1088.

ISC 114B Transport Control and Development in Living Things

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an integrated study of the processes and mechanisms involved in transportation, coordination and control, growth, reproduction, and development in living organisms. It examines how substances such as water, mineral salts, gases, nutrients, hormones, and waste products are transported within plants and animals. The course also explores the structures and functions of the circulatory, respiratory, excretory, nervous, and endocrine systems**,** with emphasis on how these systems maintain coordination and internal balance in living organisms.

The course further introduces the principles of growth and development, including cell division, differentiation, tissue formation, reproductive processes, embryonic development, and factors affecting growth and development. Through the study of both plant and animal systems, learners develop an understanding of the similarities, differences, and interrelationships among life processes. Practical activities and observation of biological specimens are used to strengthen learners' understanding of physiological processes and their applications to health, agriculture, environmental management, and everyday life.

COURSE RELEVANT STATEMENT

The study of Transport, Control and Development in Living Things is relevant because it enables students to understand the essential biological processes that sustain life. Knowledge of transport systems explains how materials are distributed within organisms, while the study of control and coordination helps students understand how organisms

respond to internal and external stimuli and maintain stable internal conditions. Understanding growth and development provides insight into the life cycles of organisms, human development, reproduction, and the factors that influence healthy growth.

The course is also important in health education, medicine, agriculture, biotechnology, environmental science, and science education. It equips students with the knowledge and skills needed to explain common biological and health-related conditions, appreciate the complexity of living systems, and apply scientific knowledge to problems relating to human health, crop production, animal development, and environmental sustainability. Through this course, students develop scientific thinking, observation, investigation, problem-solving, and critical-thinking skills essential for further study and professional practice in the biological and health sciences.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concept and importance of transport in living organisms.
2. Describe the mechanisms of movement of water, mineral salts, gases, nutrients, and waste products in plants and animals.
3. Explain the structure and functions of the transport systems in plants, including the roles of xylem and phloem.
4. Describe the structure and functions of the major components of the circulatory system in animals.
5. Explain the processes involved in gaseous exchange and the transport of respiratory gases.
6. Discuss the mechanisms of excretion and the removal of metabolic waste products from living organisms.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Demonstrate a clear understanding of the principles of transport in plants and animals.
2. Explain how materials are transported and distributed within living organisms.
3. Identify and describe the functions of major transport structures and systems.
4. Explain the processes of coordination, control, and homeostasis in living organisms.
5. Distinguish between nervous and hormonal control mechanisms.
6. Explain how organisms respond to environmental stimuli.

7. Compare developmental processes in plants and animals.

COURSE CONTENT

Root, leave and stem system of plant, Structure and arrangement of xylem and phloem tissues, Transportation system in plant, and Distribution system in plants, Fertilisation and development of fetus, Blood test and practical application of blood group, Consequences of excessive reproduction.

CATEGORY	DETAILS
Core Competencies	• Scientific and Biological • Literacy understanding. • Critical Thinking and Problem-Solving. • Observation and Investigation Skills. • Communication Skills. • Collaboration and Teamwork
Core Values	• Respect for Life and Living Organisms. • Scientific Integrity. • Responsibility taking. • Curiosity and Creativity. • Critical and Independent Thinking. • Respect and Tolerance
Pedagogical Approaches	• Interactive Lectures. • Inquiry-Based Learning. • Practical and Laboratory Activities. • Demonstration Method. • Collaborative Learning. • Problem-Based Learning. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Textbooks and Reference Materials • General Biology textbooks, Plant • Physiology textbooks, Human • Physiology textbooks • Laboratory Resources • Microscopes and prepared slides, Fresh plant specimens, Animal specimens or models • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Class quizzes and short tests • Oral questioning and classroom participation • Individual and group assignments • Concept maps and biological diagrams • Homework and reflective learning activities

REFERENCES AND FURTHER READING

Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). *Molecular Biology of the Cell* (7th ed.). W. W. Norton & Company.

Campbell, N. A., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). *Campbell Biology* (12th ed.). Pearson

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Biology II provides students with a broad understanding of the diversity of living organisms through a comparative study of the Plant and Animal Kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plants and animals. The course equips students with the foundational knowledge needed to appreciate the relationship between the structure, function, and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animals. It enables prospective biology teachers to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge gained is fundamental for advanced studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific observation, analytical thinking, and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course are to:

1. Describe the general characteristics of the Plant and Animal Kingdoms.
2. Compare the similarities and differences between plants and animals based on their external features.
3. Explain the ecological adaptations of plants and animals to different habitats.
4. Describe the basic physiological processes in living organisms, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development.
5. Explain how structure and function are related in plants and animals.
6. Discuss the importance of physiological processes in the survival of living organisms.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. State the unique characteristics of plant and animal kingdoms;
3. Describe ecological adaptations in the plant and animal kingdoms;
4. Explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. Describe growth and development in plants and animals.
6. Appreciate the diversity and ecological significance of plants and animals.

COURSE CONTENT

A generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological princi**ple** • Hygiene • Classification
Core Values	• Curiosity • Thinking • Integrity • Teamwork • Self-discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical-based instruction • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Biology textbooks • Charts • Models • Videos • National Curriculum for Basic Education
Assessment Methods	• Practical report

Raven, P. H., Johnson, G. B., Mason, K. A., Losos, J. B., & Singer, S. R. (2022). Biology (13th ed.). McGraw-Hill

PHY 102 General Physics II (Electricity & Magnetism)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the fundamental principles of electricity and magnetism. It covers electrostatics, electric circuits, magnetism and electromagnetic induction. PHY 122 provides the theoretical foundation for advanced courses in electromagnetism, electronics and communications. Emphasis is placed on laws, concepts and applications to real -life electrical and magnetic systems.

Course-Relevant Statement

Electricity and Magnetism form the basis of modern technology. The course provides students with the core knowledge required to understand and development electrical, electronic, and communication systems. It connects mechanics to field theory and prepares students for Advanced physics and Engineering courses. It is also a pre- requisite to many physics' courses in higher levels

Students develop competence in circuit analysis using ohm's and Kirchoff's laws, solving problems involving electric and magnetic fields, applying Faraday's and Lenz's laws to induction problems, mathematical modelling of Electrical systems, critical thinking and quantitative problem solving. Reliable power and communication are critical to National development. Graduate of PHY 102 can contribute to rural electrification, renewable energy, telecommunications and industrial automation in Nigeria. In summary the course trains students to understand, design, and troubleshoot the electrical systems that power modern society.

COURSE OBJECTIVES

The objectives of this course are to:

1. State the law of electrostatics, compare electrostatics with gravitational field,
2. State Coulomb's law, Ohm's law, ampere's law, Biot-savart law and
3. Show their applications,
4. Explain the concept of dipole moment, electromagnetic induction;
5. Discuss self and mutual inductance,
6. Cover Faraday's laws, Lenz's law and Maxwell's equation

LEARNING OBJECTIVES

By the end of this course, Student should be able to;

1. State the laws of electrostatics and compare electrostatic field with gravitational field.
2. State Coulomb's law, Ohm's law, Ampere law, Biot-Savart law and their applications.
3. Explain the concept of dipole moment
4. Explain the concept of electromagnetic induction; self and mutual inductance
5. State Faraday's law, Lenz's law, and Maxwell's equation
6. Calculate electric field, electric potential, and capacitance for simple geometries.
7. Demonstrate safety consciousness when handling electrical apparatus.

COURSE CONTENTS

Forces in nature; Electrostatics; electric charge and its properties, methods of charging; Coulomb's law and superposition; electric field and potential; Gauss's law; Capacitance; Electric dipoles; Energy in electric fields; Conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits; Magnetic fields; Lorentz force; Biot-Savart and Ampère's laws; magnetic dipoles; Dielectrics; Energy in magnetic fields; Electromotive force; Electromagnetic induction; Self and mutual inductances; Faraday and Lenz's laws; Step up and step down transformers: Maxwell's equations; Electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

CATEGORY	DETAILS
Core Competencies	• Conceptual competence • Problem-solving competence • Experimental competence • Measurement competence • Circuit-analysis competence
Core Values	• Scientific curiosity • Accuracy and precision • Critical thinking • Creativity and innovation • Teamwork and cooperation • Responsibility

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Demonstration method • Collaborative learning • Project-based learning • Discussion method • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Laboratory resources • Instructional materials • Digital resources • NERDC e-Curriculum and learner resources • National Curriculum for Basic Education
Assessment Methods	• Class tests • Assignments • Laboratory work • Practical reports • Quizzes • 6 Group projects • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

Nigerian Educational Research and Development Council (NERDC). (2025). *New Revised Senior Secondary Education Curriculum*. Abuja: NERDC.

National Commission for Colleges of Education (NCCE). (2024). *Minimum Standards for Nigeria Certificate in Education: Science Education – Physics*. Abuja: NCCE. The curriculum specifically includes electrostatics, magnetostatics, current electricity, electrolysis and capacitance.

CHE 121 General Chemistry II (Organic)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Chemistry II (Organic Chemistry) is an introductory undergraduate course that builds students' understanding of the chemistry of carbon-containing compounds. The course examines the relationship between molecular structure, bonding, physical properties, reactivity, and mechanisms of organic compounds. Major areas include nomenclature, isomerism and stereochemistry, hydrocarbons, haloalkanes, alcohols, ethers, phenols, aldehydes, ketones, carboxylic acids and their derivatives, amines, aromatic compounds, and selected biologically important organic molecules. Students are introduced to major organic reaction types, including substitution, addition, elimination, oxidation – reduction, condensation, and polymerisation reactions. Emphasis is placed on reaction mechanisms, functional-group transformations, synthesis, and the interpretation of basic spectroscopic information such as IR, NMR and mass spectra. These are consistent with contemporary undergraduate organic chemistry curricula, which emphasise functional groups, mechanisms, synthesis, stereochemistry and structure elucidation. The course also develops students' ability to relate organic chemistry to everyday life and professional fields such as medicine, pharmacy, agriculture, food science, environmental science, biotechnology and materials science.

COURSE RELEVANT STATEMENT

Organic chemistry provides an essential foundation for understanding the composition, properties and transformations of carbon-based substances found in living organisms and in numerous industrial and technological products. Knowledge of organic chemistry is therefore important for students of Integrated Science, Chemistry, Biology, Biochemistry, Medicine, Pharmacy, Agriculture and related disciplines. The course enables students to understand how molecular structure determines the physical and chemical behaviour of organic substances and how organic reactions can be controlled to produce useful compounds. It also provides foundational knowledge for understanding biomolecules such as carbohydrates, lipids, amino acids and proteins, as well as pharmaceuticals, polymers, fuels, solvents and other industrial materials. Contemporary university curricula similarly emphasise the application of organic chemistry to biological and technological contexts.

COURSE OBJECTIVES

The objectives of this course are to:

- Explain the fundamental principles of organic chemistry, including carbon bonding, hybridisation, molecular geometry, resonance and electronic effects.
- Identify, classify and name common organic compounds using appropriate IUPAC nomenclature.
- Describe the structures, properties and reactions of major classes of organic compounds.
- Explain the concepts of structural isomerism, stereoisomerism, chirality, optical activity and geometric isomerism.
- Distinguish between nucleophiles, electrophiles, free radicals and other important reactive species.
- Explain and predict common organic reaction mechanisms, including substitution, addition, elimination and condensation reactions.

LEARNING OBJECTIVES

By the end of this course, students should be able to:

1) Explain the fundamental principles governing the structure and bonding of organic molecules.
2) Identify and correctly name common organic compounds and functional groups.
3) Classify organic compounds according to their functional groups and structural characteristics.
4) Explain structural, geometrical and optical isomerism and determine basic stereo-chemical configurations.
5) Describe the physical and chemical properties of major classes of organic compounds.
6) Write and balance simple organic chemical equations and predict major reaction products.

COURSE CONTENT

- Historical survey of the development and importance of Organic Chemistry
- Fullerenes as fourth allotrope of carbon
- Uses as nanotubules
- Nanostructures
- Nanochemistry
- Electronic theory in organic chemistry
- Isolation and purification of organic compounds

- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry
- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics
- Stereochemistry
- The chemistry of alkanes
- Alkenes
- Alkynes
- Alcohols
- Ethers
- Amines
- Alkyl halides
- Nitriles
- Aldehydes
- Ketones
- Carboxylic acids and derivatives
- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA
- IIA and IVA elements
- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• Chemical knowledge and understanding • Organic nomenclature competence • Problem-solving competence • Structural interpretation competence • Reaction prediction competence • Laboratory competence

CATEGORY	DETAILS
Core Values	• Scientific integrity • Accuracy and precision • Safety consciousness • Curiosity and inquiry • Critical thinking • Creativity and innovation
Pedagogical Approaches	• Interactive Lectures • Problem-Based Learning • Inquiry-Based Learning • Collaborative Learning • Flipped Classroom • Case-Based Learning • Molecular Modelling and Simulation • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks and Reference Materials • Laboratory Resources • Digital Resources • Visual and Instructional Materials • National Curriculum for Basic Education
Assessment Methods	• Short quizzes • Assignments • Tutorial exercises • Laboratory reports • Practical examinations • Mid-semester examination • End-of-semester examination • Oral presentations/seminars

REFERENCES AND FURTHER READING

Clayden, J., Greeves, N., & Warren, S. (2012). *Organic Chemistry* (2nd ed.). Oxford University Press.

McMurry, J. (2023). *Organic Chemistry* (10th ed.). Cengage Learning.

Wade, L. G., & Simek, J. W. (2017). *Organic Chemistry* (9th ed.). Pearson.

MTH 121 Elementary Mathematics I (Algebra & Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops students' ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomials, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series, The trigonometry component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and application of science, technology, engineering, social sciences, economics, and other disciplines. A strong understanding of elementary algebra and trigonometry enables students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher-level mathematics and discipline-specific courses that require mathematical reasoning and computation. Knowledge of algebra supports the study of functions, calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer science, and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real-life and professional situations.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain and apply the basic concepts and properties of the real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials, and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.
4. Solve linear, quadratic, simultaneous, and selected higher-order equations.
5. Solve linear and quadratic inequalities and represent their solutions appropriately.
6. Represent and interpret simple algebraic relationships using tables, graphs, and equations.
7. Define and apply the basic trigonometric ratios: sine, cosine, and tangent.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE CONTENT

- Elementary set theory
- Subsets
- Union
- Intersection
- Complements and Venn diagrams
- Real numbers
- Integers
- Rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem

- Complex numbers
- Algebra of complex numbers
- The Argand diagram
- De-Moivre's theorem
- Nth roots of unity
- Circular measure
- Trigonometric functions of angles of any magnitude
- Addition and factor formulae

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Creativity • Innovation • Reflective thinking • Collaboration • Self-development.
Core Values	• Integrity • Team spirit • Perseverance • Transparency • Tolerance • Honesty
Pedagogical Approaches	• Learner-Centred Approach • Collaborative & • Cooperative • Learning • Blended Learning • Discussion and Dialogue • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Core Textbooks and Reference materials 2 Digital and online Learning Platforms 3 National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Continuous • Assessment • Formative Assessment • Summative assessment • Readings • Class work • Assignment • Group assignment • Presentations • Written Quiz

REFERENCES AND FURTHER READING

College Algebra – algebraic techniques, equations, functions, and graphs.

Elementary Trigonometry – trigonometric ratios, identities, equations, and applications.

Schaum's Outline of Elementary Algebra – particularly good for worked examples and practice problems.

Schaum's Outline of Trigonometry – useful for additional exercises and step-by-step solutions.

OpenStax, Algebra and Trigonometry

ISC 121 Introduction to Scientific Methods

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

The course introduces scientific inquiry through human senses and tools (microscope, hand lens, telescope), accurate measurement of physical quantities, classification of objects and living things (plants/animals, vertebrates/invertebrates), science process skills, ethical principles, scientific attitudes, and the products/implications of scientific investigations.

RELEVANCE STATEMENT

The course is highly relevant because it equips future primary and junior secondary teachers with foundational skills in scientific inquiry and observation. Mastering the

use of senses, optical instruments (microscope, hand lens, telescope), basic measurement techniques, classification of objects and living things, science process skills, and ethical principles, trainees gain the competence needed to deliver accurate, hands-on science lessons effectively. This directly addresses the national priority of improving science teaching quality and learner outcomes in basic education across Nigeria.

The course serves critical individual, societal, and national needs by building teachers' capacity to foster curiosity, critical thinking, and scientific attitudes in young learners. Individually, it enhances trainees' confidence and employability as competent educators. Societally, it promotes scientific literacy, evidence-based reasoning, and responsible attitudes toward health, environment, and technology among school-children. Nationally, it supports Nigeria's goals of human capital development, STEM education advancement, sustainable development awareness, and reduction of educational inequalities through well-prepared science teachers who can inspire the next generation.

COURSE OBJECTIVES

The objectives of this course are to:

1. Correctly use a hand lens, microscope, and simple measuring instruments (e.g. ruler, measuring cylinder, thermometer) to observe and record details of at least five different objects or specimens during practical sessions.
2. After studying measurement techniques, students will accurately measure and record length, area, volume, mass, temperature, and time for given objects or events, expressing results in appropriate SI units with no more than 10% error in laboratory exercises.
3. Upon learning classification criteria, students will classify a set of 10–15 objects or organisms based on observable characteristics such as colour, shape, size, behaviour, and structure, justifying their groupings in written or oral reports.
4. In sessions on classification of living things, students will identify and categorise at least eight (8) organisms into major groups (e.g. vertebrates vs. invertebrates, flowering vs. non-flowering plants, and subgroups of vertebrates) using dichotomous keys or charts during practical identification activities.
5. Following discussions on science process skills, students will demonstrate basic process skills (e.g. observation, inference, prediction, classification) and integrated skills (e.g. hypothesising, experimenting, communicating) by designing and

conducting a simple investigation (e.g. testing factors affecting plant growth or object sinking/floating) and presenting findings.

6. After covering ethics of science and scientific attitudes, students will exhibit scientific attitudes (e.g. curiosity, objectivity, honesty, open-mindedness, perseverance) in group activities by accurately recording data without fabrication, questioning assumptions, and respecting differing viewpoints in discussions.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the role of human senses and assistive tools (e.g. microscope, hand lens, telescope, glasses, and hearing aids) in scientific observation and explain how they extend human capabilities for data collection.
2. Demonstrate competence in fundamental measurement techniques for physical quantities (length, area, volume, mass, temperature, time) and apply appropriate units and instruments in scientific contexts.
3. Explain the importance of systematic classification of objects and living things using observable criteria and apply it to differentiate plants (flowering/non-flowering) and animals (vertebrates/invertebrates and major vertebrate groups).
4. Describe the key steps and characteristics of scientific methods, including problem identification, observation, hypothesis formulation, experimentation, data analysis, and conclusion drawing.
5. Identify and apply basic and integrated science process skills in investigating natural phenomena, fostering inquiry-based learning suitable for teaching primary/junior secondary pupils.

COURSE CONTENT

- Senses and related organs
- Observations
- Microscope, Hand lens, Telescope, Glasses, Hearing Aids
- Measurement of length, area, volume, mass, temperature, and time
- **Classification of objects:** colour, shape, behaviour and other observed criteria
- **Classification of living things:** plants and animals; vertebrates and invertebrates; groups of vertebrates, flowering and non-flowering plants
- Ethics of science and developing scientific attitudes
- Products of scientific investigations/implications

- Science process skill

CATEGORY	DETAILS
Core Competencies	• Science process skills mastery • Classification and categorisation skills • Inquiry and investigative competencies • Instrument handling and practical skills • Pedagogical competencies
Core Values	• Scientific attitudes: • Ethics and integrity in science: • Responsibility and environmental awareness. • Lifelong learning and professionalism.
Pedagogical Approaches	• Emphasise student-centred • Hands-on and inquiry-based learning: • Demonstrations and tool use: • Collaborative and active strategies. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks and modules • NOUN/NTI STAN (Science Teachers Association of Nigeria). • Visual/digital aids. • Practical tools. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Practical assessments: • Performance tasks (e.g. measuring accurately, classifying specimens, microscope focusing), lab reports/portfolios of observations

REFERENCES AND FURTHER READING

Aktamis, H. & Ergin. (2008). The effect of scientific process skills education on students' scientific creativity, science attitudes and academic achievements. *Asia-Pacific Forum on Science Learning and Teaching*, *9*(1), article 4

ISC 122 Integrated Science Practical I

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to essential scientific laboratory techniques and analytical skills used in biological and chemical investigations. It covers microscopy and microtomy, spectroscopic and separation techniques, herbarium and museum practices, as well as experimental design, scientific report writing, and presentation skills. Emphasis is placed on hands-on practice, accuracy, and proper documentation of scientific work.

RELEVANCE STATEMENT

The course equips individuals with practical laboratory and analytical skills needed for scientific study and employment, supports society through improved scientific literacy, research accuracy, and conservation practices, and contributes nationally by developing skilled manpower for education, research, healthcare, agriculture, and environmental management.

COURSE OBJECTIVES

The objectives of this course are to:

1. Apply basic microscopy and slide preparation techniques.
2. Use instruments for qualitative and quantitative analysis.
3. Prepare biological drawings, herbarium specimens, and museum samples correctly.
4. Carry out simple experiments and present scientific findings clearly.
5. Develop accurate observation, measurement, and documentation skills.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Operate microscopes, hand lenses, and analytical instruments safely and effectively.
2. Prepare and examine microscope slides and integrated science specimens accurately.
3. Apply techniques such as spectrophotometry, chromatography, and refractometry.
4. Design experiments, analyse data, and write standard scientific reports.
5. Demonstrate an experimental result using appropriate scientific formats.

COURSE CONTENT

- Microscopy: handling of microscopes, preparation of microscope slides (Microtomy) for microscopic examinations, use of hand lens, biological drawings and diagrams
- Spectrophotometry, colorimetry, photometry, polarimetry, chromatography, reflection, refractometry, melting points and colligative properties Herbarium and Museum Techniques
- Experimental designs, report writing and presentations

CATEGORY	DETAILS
Core Competencies	• Practical laboratory and analytical skills • Observation, measurement, and data interpretation • Scientific drawing and specimen preservation • Experimental design and report writing • Communication and presentation skills
Core Values	• Accuracy and precision • Integrity and honesty in data handling • Safety consciousness • Organisation and responsibility • Teamwork and professionalism
Pedagogical Approaches	• Teaching will adopt hands-on laboratory instruction. • Demonstrations, Guided Experiments • Specimen preparation • Scientific drawing. • Inquiry-based learning. • Scientific thinking • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Laboratory manuals. • Textbooks on experimental method. • Herbarium and museum • Technique guides, and online resources. • Instructional videos. • National curriculum for Basic Education (Integrated Science)

CATEGORY	DETAILS
Assessment Methods	• Practical tests, laboratory reports • Drawings, specimen preparation) • Project work and presentations

REFERENCES AND FURTHER READING

Nzewi, U. M. (2008). *Practical Approach to the Effective Teaching of Ecological Concepts for Sustainable Development*. Science Teachers' Association of Nigeria (STAN) Biology Panel Series 2008. 1–6.

ISC 123 Carbon Compound I

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

Carbon Compounds I is a foundational course in Organic Chemistry that introduces students to the chemistry of carbon and its compounds. The course explores the unique properties of carbon that enable it to form a vast number of stable compounds through catenation and covalent bonding. Students are introduced to the classification, nomenclature, structure, physical and chemical properties, preparation, and reactions of major classes of organic compounds. The course emphasises the relationship between molecular structure and chemical behaviour, providing students with a solid understanding of the principles that govern organic reactions. Laboratory activities reinforce theoretical concepts by developing practical skills in the preparation, purification, identification, and characterisation of organic compounds.

RELEVANCE STATEMENT

The course highlights the significance of carbon compounds in everyday life and their applications. It also examines the environmental impact of organic compounds and promotes the responsible use of chemical resources to support sustainable development. Overall, Carbon Compounds I equip students with the foundational knowledge, practical skills, and scientific competencies required to understand the chemistry of carbon compounds and their essential roles in industrial processes, technological innovation, and environmental sustainability. This foundation prepares students for advanced courses in chemistry and related scientific fields while fostering critical thinking, problem-solving, and ethical scientific practice.

COURSE OBJECTIVES

The objectives of this course are to:

1. Give the unique properties of carbon that account for the diversity of organic compounds.
2. Discuss the classification and nomenclature of organic compounds according to IUPAC rules.
3. Explain the structure, bonding, and hybridisation of carbon atoms.
4. Identify and classify hydrocarbons and their derivatives.
5. Describe the physical and chemical properties of major classes of carbon compounds.
6. Explain the mechanisms of basic organic reactions.
7. Apply laboratory techniques in the preparation, purification, and identification of organic compounds.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the unique properties of carbon that enable it to form a wide variety of organic compounds.
2. Describe the structure, bonding, hybridisation, and catenation of carbon atoms.
3. Classify organic compounds based on their functional groups and structural characteristics.
4. Apply the International Union of Pure and Applied Chemistry (IUPAC) rules to correctly name and write the structures of organic compounds.
5. Differentiate between saturated, unsaturated, aliphatic, aromatic, cyclic, and acyclic carbon compounds.
6. Explain the concept of isomerism and distinguish between structural and stereoisomerism.

COURSE CONTENT

- Introduction to Organic Chemistry, Structure and Bonding of Carbon, Hybridisation and Molecular Geometry, Classification of Organic Compounds, IUPAC Nomenclature, Isomerism (Structural and Stereoisomerism)
- Hydrocarbons: Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons

- Functional Groups and Their Properties: Introduction to Organic Reaction Mechanisms, Organic Reactions, Substitution, Addition, Elimination, Oxidation and Reduction

CATEGORY	DETAILS
Core Competencies	• 1 Chemical Knowledge and Understanding • 2 Analytical and Critical Thinking. • 3 Problem-Solving Skills • 4 Scientific Investigation
Core Values	1 Integrity • Safety Consciousness • Prioritise safe handling, storage, and disposal of chemicals • Respect for • Ethical Scientific Practice. • Collaboration and Respect
Pedagogical Approaches	• Modelling and Worked. • Project-Based Learning (PBL). • 3Collaborative Pair Programming. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Books • Online resources • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Self-assessment • Pair assessment, group assessment

REFERENCES AND FURTHER READING

Bilgin, I., & Geban, O. (2006). The effect of cooperative learning approach based on conceptual change condition on students' understanding of chemical concepts. *Journal of Science Education and Technology, 15*(1), 31–46.

ISC 124A Man and Energy

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course provides a foundational introduction to the principles of transfer of energy. Temperature Celsius and Kelvin temperature scales- and the concept of absolute zero of temperature. Heat and heat transfer by conduction, convection and radiation. Light (propagation, shadows and eclipse. Laws of reflection. Image formed by a plane mirror. Uses of convex and concave mirrors. Sound waves longitudinal waves. Velocity of sound in air. Factors which cause changes in the frequency of sounds pitch of a sound, equipping future teachers with essential knowledge of energy, light and sound phenomena relevant to everyday applications and basic science teaching.

RELEVANCE STATEMENT

The course is highly relevant because it equips future primary and junior secondary school teachers with core scientific knowledge of energy concepts, one of the fundamental forces shaping modern life. As trainee teachers responsible for delivering integrated science curricula, understanding concepts like heat transfer, light, sound and energy applications enables them to teach these topics effectively and accurately. This foundational grasp helps address common student misconceptions, facilitates simple classroom demonstrations and promotes inquiry-based learning, which aligns with Nigeria's emphasis on science process skills and practical teaching in basic education. Mastering these principles will help graduates become confident educators who can inspire young learners, improve science performance in schools, and contribute to reducing persistent challenges like poor achievement in physics-related topics at secondary levels.

COURSE OBJECTIVES

The objectives of this course are to:

1. Demonstrate methods of charging objects (e.g. friction, induction, conduction) through hands-on experiments and correctly identify the properties of electric charges
2. Calculate the electrostatic force between multiple point charges using vector addition and solve related problems with accuracy in numerical computations.
3. Sketch electric field lines for various charge configurations and compute the electric potential at a point due to a system of charges, applying Gauss's law to symmetric charge distributions.

4. Derive the capacitance of parallel-plate capacitors with dielectrics and analyse the torque and potential energy of electric dipoles in uniform electric fields through problem-solving exercises.
5. Measure current, voltage, and resistance in simple circuits using Ohm's law and analyse series-parallel combinations by constructing and testing circuits in a laboratory setting.
6. Apply the Lorentz force to determine the trajectory of charged particles in magnetic fields and use Biot-Savart and Ampère's laws to calculate magnetic fields produced by current-carrying wires.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the fundamental concept of forces in nature, particularly electromagnetic forces, and explain how they unify electrostatic and magnetic phenomena.
2. Describe the properties of electric charges, methods of charging, and apply Coulomb's law to predict interactions between charged particles, including the concept of superposition.
3. Describe electric fields, potentials, and Gauss's law, enabling them to evaluate energy storage in electric fields and the behaviour of capacitors in circuits.
4. Differentiate between conductors and insulators, apply Ohm's law to DC circuits, and analyse current flow, voltage drops, and resistance in practical electrical systems.
5. Describe magnetic fields, the Lorentz force, and laws like Biot-Savart and Ampère's, allowing them to assess magnetic dipoles and energy in magnetic fields.
6. Explain electromotive force, electromagnetic induction, self and mutual inductances, and apply Faraday's and Lenz's laws to devices like transformers.

COURSE CONTENT

- Transfer of energy
- Renewable and non-renewable energy, Conservation of Energy, Temperature Celsius and Kelvin temperature scales- and the concept of absolute zero of temperature, Heat, Heat transfer by conduction, convection and radiation, Light (propagation, shadows and eclipse, Laws of reflection
- Image formed by a plane mirror
- Uses of convex and concave mirrors, Sound waves longitudinal waves

- Velocity of sound in air, Factors which cause changes in the frequency of sounds Pitch of a sound

CATEGORY	DETAILS
Core Competencies	• Laboratory and practical competencies. • Pedagogical competencies. • Analytical skills
Core Values	• Curiosity • Perseverance, and lifelong learning • Fostering attitudes of inquiry • Open mindedness. • Ethical and societal responsibility
Pedagogical Approaches	• Inquiry-based and hands-on learning • Guided experiments • Constructivist and collaborative methods: • Group activities, problem-based learning. • Active learning techniques: Flipped classroom elements. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks and course materials • Practical apparatus • Digital and visual aids, Free PhET • Interactive Simulations • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Quizzes, concept • Maps, worksheets on key laws

REFERENCES AND FURTHER READING

Serway, R. A., & Jewett, J. W. (2019). *Physics for Scientists and Engineers* (10th ed.). Cengage Learning.

Boyle, G. (Ed.). (2012). *Renewable Energy: Power for a Sustainable Future* (3rd ed.). Oxford University Press.

ISC 124B Earth and the Planetary System

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Earth and the Planetary System is an introductory course that explores the origin, structure, composition, and dynamic processes of the Earth within the context of the Solar System and the wider universe. The course provides students with a scientific understanding of Earth's internal and external systems, its relationship with the Sun, Moon, and other planets, and the natural processes that shape the planet over time. It also examines the formation and characteristics of the Solar System, planetary motions, Earth's place in the universe, and the interactions among the atmosphere, hydrosphere, lithosphere, and biosphere.

The course emphasises the fundamental principles of Earth and planetary sciences, including geology, meteorology, oceanography, astronomy, and environmental science. Students will gain knowledge of Earth's structure, geological history, plate tectonics, rocks and minerals, weather and climate, natural hazards, and the role of Earth's systems in sustaining life. In addition, the course introduces modern methods of studying Earth and other planetary bodies through satellite technology, remote sensing, and space exploration.

RELEVANCE STATEMENT

This course introduces students to the scientific study of the Earth and its place within the planetary system. It emphasises the physical structure and dynamic processes of the Earth, the formation and characteristics of the Solar System, Earth–Sun–Moon relationships, geological and atmospheric processes, and the significance of Earth science in understanding environmental change, natural hazards, and sustainable development. The course integrates theoretical knowledge with practical applications to prepare students for further studies and professional practice in Earth science, environmental science, geography, geology, and science education.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify and label major physiographic features (e.g. mountains, plateaus, plains, valleys) on maps or diagrams of Nigeria and the world, and describe at least five features associated with plate tectonics during class discussions or practical sessions.

2. Construct simple models or diagrams of the solar system showing the relative positions, sizes, and movements of planets, the Sun, and other bodies, and explain the origin of the solar system using accepted theories in a short presentation or written report.
3. Demonstrate the characteristics and layers of the atmosphere and hydrosphere by sketching vertical profiles and explaining their roles in weather, climate, and life support through group activities or laboratory observations.
4. Describe at least 8–10 common rock-forming minerals and three major rock types (igneous, sedimentary, metamorphic) based on properties (e.g. colour, texture, hardness, cleavage) using hand specimens or charts, and identify examples of economic minerals occurring in Nigeria (e.g. tin, coal, petroleum) with 80% accuracy in identification exercises.
5. Outline the geologic time scale and key events in Earth's history (e.g. formation, major extinctions, evolution of life) on a timeline diagram and relate them to the broader history of the Universe (e.g. Big Bang) in explanatory essays or oral defences.
6. Apply the theory of plate tectonics to explain the occurrence of earthquakes, volcanoes, and major landforms by analysing maps of plate boundaries and seismic data, predicting potential hazard zones (including in Nigeria/West Africa) in problem-solving tasks.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the basic elements of physical geology, including Earth's physiographic features and internal structure (core, mantle, crust), and relate them to surface processes and landform development.
2. Describe the composition, origin, and key characteristics of the solar system, including planetary movements and their influence on Earth phenomena.
3. Describe the origin, structure, and functions of Earth's atmosphere (layers, composition) and hydrosphere (oceans, water cycle), and discuss their interactions with other Earth systems.
4. Classify major minerals and rock types based on physical properties and formation processes, and identify economically important minerals and rocks relevant to Nigeria's geology and resources.
5. Outline the history of the Earth (geologic time scale, major events) and Universe (cosmological origins), appreciating the vast timescales involved in planetary and cosmic evolution.

6. Describe the Earth's internal structure and the theory of plate tectonics, including mechanisms of plate movement, and explain associated phenomena such as earthquakes, volcanic activity, mountain building, and continental drift.

COURSE CONTENT

- Introduction to Earth and Planetary Science
- Origin of the Universe and the Solar System
- Earth's Structure and Composition
- Minerals
- Rocks
- The Rock Cycle
- Plate Tectonics and Continental Drift
- Geological Time Scale
- Earth's Atmosphere and Weather Systems
- Climate and Climate Change
- The Moon and Earth–Moon Relationship
- Solar and Lunar Eclipses
- The Planets of the Solar System
- Asteroids
- Comets
- Meteoroids
- Space Exploration and Satellite Technology
- Natural Hazards and Disaster Management

CATEGORY	DETAILS
Core Competencies	• 1 Geological observation and classification. • Conceptual understanding of Earth systems. • Historical and temporal reasoning.
Core Values	• Scientific curiosity. • Ethical awareness. • Perseverance and open-mindedness. • Scientific curiosity and evidence-based inquiry

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-based and hands-on. • Demonstrations and models. • Collaborative learning. • Visual and constructivist. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks/modules: NCCE/NTI. • Visual/digital: Diagrams/time scales, free YouTube. • Field trip notes (local quarries/landforms). • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Quizzes on rock/mineral. • Practical.

REFERENCES AND FURTHER READING

Condie, K. C. (2021). *Earth as an Evolving Planetary System* (4th ed.). Elsevier. A comprehensive text on the evolution of Earth's crust, mantle, core, atmosphere, hydrosphere, and biosphere, emphasizing Earth as an integrated planetary system.

Kump, L. R., Kasting, J. F., & Crane, R. G. (2010). *The Earth System* (3rd ed.). Pearson Education

ISC 211 Dynamics

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The examined the principles governing the motion of particles and rigid bodies under the influence of forces. Building on the foundations of mechanics and kinematics, the course introduces Speed, Speed/Time Graph for Linear Motion. Relative motion. Application of Newtonian mechanics. Equations of motion. Kinematics; Newton's laws of motion (Inertial frames, Impulse, force and action at a distance,). Linear Momentum. Conservation of Linear Momentum. Gravitation Force: Newton's Law of Gravitation, Kepler's Laws of Planetary Motion, Gravitational Potential Energy, Escape velocity. The course

emphasises the application of mathematical and physical principles to solve real-world problems involving moving bodies.

Students develop analytical and problem-solving skills through lectures, tutorials, laboratory experiments, and computational exercises. The course also demonstrates the relevance of dynamics to engineering, astronomy, transportation, sports, robotics, environmental science, and other scientific disciplines. Upon completion, students will possess the knowledge and practical skills required for more advanced studies in physics and related fields

RELEVANCE STATEMENT

The course provides Integrated Science students with a comprehensive understanding of the physical laws governing motion and the interaction of forces in nature. The course equips students with scientific reasoning, quantitative analysis, and practical problem-solving skills necessary for investigating mechanical systems and explaining natural phenomena. Knowledge gained from this course forms the basis for advanced studies in mechanics, engineering physics, geophysics, astronomy, environmental science, and technology.

The course also develops students' ability to apply Newtonian mechanics, conservation principles, and mathematical models to solve scientific and technological problems encountered in research, industry, education, and everyday life. It encourages logical thinking, precision in measurement, and experimental competence while fostering innovation and the effective application of physics in national development. These outcomes are consistent with standard university dynamics curricula, which emphasise particle and rigid-body motion, work-energy methods, and impulse-momentum analysis.

COURSE OBJECTIVES

The objectives of this course are to:

1. Understand the principles governing motion and forces.
2. Apply Newton's laws of motion to solve physical problems.
3. Analyse motion using energy and momentum methods.
4. Explain rotational motion and dynamics of rigid bodies.
5. Apply dynamics concepts to practical and real-world situations.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Describe different types of motion and the forces responsible for them.
2. Solve numerical problems involving linear and rotational motion.
3. Apply the laws of conservation of energy and momentum.
4. Analyse systems involving friction, circular motion, and oscillations.
5. Interpret physical situations using mathematical and graphical methods.

COURSE CONTENT

- Displacement, velocity and acceleration
- Speed, Speed/Time Graph for Linear Motion
- Relative motion
- Application of Newtonian mechanics
- Equations of motion
- Kinematics
- **Newton's laws of motion:** Inertial frames, Impulse, force and action at a distance,
- Linear Momentum
- Conservation of Linear Momentum
- Gravitation Force: Newton's Law of Gravitation, Kepler's Laws of Planetary Motion, Gravitational Potential Energy, Escape velocity, Satellites motion and orbits
- Concept and Purpose of Space Travels
- Satellite and Its uses in the Society

CATEGORY	DETAILS
Core Competencies	• Analytical and critical thinking skills • Quantitative and mathematical reasoning • Problem-solving competence • Scientific inquiry and logical reasoning
Core Values	• Accuracy • Discipline, and intellectual honesty

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive Lecture Method • Demonstration Method • Laboratory/Experimental Method. • Problem-Solving Approach • Inquiry-Based Learning • Project-Based Learning (PBL). • Collaborative Learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks, Halliday, D., Resnick, R., & Walker, J. • Fundamentals of Physics • Young, H. D., & Freedman, R. A. Physics • 3National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Continuous Assessment (30–40%) • Quizzes, Assignments and problem sets • Class Mid-Semester Test (optional, if applicable) • Final Examination

REFERENCES AND FURTHER READING

Halliday, D., Resnick, R., & Walker, J. (2021). *Fundamentals of Physics* (12th ed.). John Wiley & Sons.

Serway, R. A., & Jewett, J. W. (2019). *Physics for Scientists and Engineers* (10th ed.). Cengage Learning.

Young, H. D., & Freedman, R. A. (2020). *University Physics with Modern Physics* (15th ed.). Pearson.

BIO 212 Genetics I

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Genetics in Biology is a foundational course that examines the principles of heredity and variation in living organisms. The course explores the structure and function of genetic

material, patterns of inheritance, gene expression, mutation, and the molecular basis of heredity. Emphasis is placed on classical (Mendelian) genetics, molecular genetics, population genetics, and modern applications such as biotechnology and genetic engineering. The course integrates theory with practical examples to help students understand how genetic principles explain biological diversity and continuity of life.

RELEVANCE STATEMENT

Genetics is central to modern biology and underpins advances in medicine, agriculture, biotechnology, and environmental science. Understanding genetics equips students with the knowledge needed to interpret biological processes, address challenges such as genetic diseases and food security, and appreciate ethical issues related to genetic technologies. This course provides a strong scientific foundation for careers in biological sciences, health sciences, agriculture, and related fields.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain fundamental genetic concepts and terminology.
2. Describe the structure and function of DNA, RNA, and genes.
3. Apply Mendelian and non-Mendelian principles to solve genetic problems.
4. Explain mechanisms of gene expression, regulation, and mutation.
5. Analyse patterns of inheritance in individuals and populations.
6. Relate genetic principles to real-life applications in medicine, agriculture, and biotechnology.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Define and correctly use key genetic terms and concepts.
2. Illustrate and explain Mendel’s laws of inheritance.
3. Solve basic genetic crosses using Punnett squares and probability.
4. Describe DNA replication, transcription, and translation.
5. Explain chromosomal behaviour during meiosis and its genetic consequences.
6. Discuss the causes and effects of genetic mutations.
7. Demonstrate understanding of modern genetic techniques and their applications.

COURSE CONTENT

- Definition of key genetic terms
- Concepts and terminology
- The structure and function of DNA
- RNA
- Genes
- Apply Mendelian and non-Mendelian principles to solve genetic problems
- Chromosomal behaviour during meiosis and its genetic consequences
- Mechanisms of gene expression
- Regulation
- Mutation
- Patterns of inheritance in individuals and populations
- Genetic principles to real-life applications in medicine
- Agriculture
- Biotechnology

CATEGORY	DETAILS
Core Competencies	• Scientific literacy. • Critical thinking. • Problem-solving.
Core Values	• Ethical awareness. • Teamwork and collaboration. • Integrity and responsibility
Pedagogical Approaches	• Learner-centred methods. • Hands-on activities, improvisation. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Textbooks such as Teaching • Integrated Science in Secondary Schools. • NCCE and NERDC curriculum guides. • Online platforms like Khan Academy, Google Scholar, Zoom. • 5 Practical teaching guides. • 6 National curriculum for Basic Education (Integrated Science)
Assessment Methods	1 Quizzes • Assignments, and participation • Role play, case studies and • Problem-based activities) • 5 practical/laboratory work (activity-based lessons, use of local materials, process skills, and lab safety)

REFERENCES AND FURTHER READING

Pierce, B. A. (2023). *Genetics: A Conceptual Approach* (8th ed.). W. H. Freeman.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to Genetic Analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M. A., & Killian, D. J. (2019). *Concepts of Genetics* (12th ed.). Pearson.

ISC 212 Methods of Teaching Integrated Science

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course focuses on understanding and effectively teaching the Integrated Science curriculum by addressing difficult concepts, misconceptions, and learner needs. It emphasises learner-centred strategies such as problem-based learning, role play, improvisation with local materials, and activity-based science to promote process skills and meaningful learning.

The course also covers lesson and unit planning, continuous assessment, record keeping, laboratory organisation and safety, use of eLearning tools, and integration of indigenous

knowledge through the Culturo-Techno-Contextual Approach (CTCA), preparing students for effective and innovative science teaching.

RELEVANCE STATEMENT

The course addresses individual needs by developing teachers' pedagogical competence, critical thinking, digital literacy, and practical skills for effective Integrated Science teaching; meets societal needs by promoting scientific literacy, correcting misconceptions, encouraging learner-centred and culturally relevant instruction, and supporting community-based and sustainable science education; and serves national needs by strengthening the quality of science education through a well-trained teaching workforce capable of implementing the Integrated Science curriculum, integrating indigenous knowledge and technology, and contributing to national development, innovation, and human capital growth.

COURSE OBJECTIVES

The objectives of this course are to:

1. State the nature and goals of the Integrated Science curriculum and identify difficult concepts and misconceptions.
2. Apply learner-centred teaching strategies, including role play, problem-based learning, vignettes, and case studies, to teach challenging concepts.
3. Utilise improvisation and locally available materials to conduct practical, activity based science lessons that develop process skills and support continuous assessment.
4. Plan and implement effective unit and lesson plans while organising, stocking, and maintaining a safe science laboratory.
5. Integrate indigenous knowledge and modern digital tools, including eLearning platforms, Zoom, WhatsApp and Google Scholar to enhance teaching and learning in Integrated Science.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Demonstrate understanding of the Integrated Science curriculum, including its structure, goals, and the identification of difficult concepts and common misconceptions.
2. Design and implement learner-centred instructional strategies such as role play, vignettes, problem-based learning and case studies to effectively teach challenging scientific concepts.

3. Apply practical teaching skills using improvisation, locally available materials, and activity-based approaches to develop students' science process skills and facilitate continuous assessment.
4. Prepare and execute effective lesson and unit plans while maintaining safe, organised and well-stocked science laboratories for teaching and experimentation.
5. Integrate technology and indigenous knowledge through eLearning platforms, digital tools (Zoom, WhatsApp, Google Scholar) and the Culturo-Techno-Contextual Approach (CTCA) to enhance teaching, learning and relevance of science concepts.

COURSE CONTENT

- Understanding the nature of the Integrated Science Curriculum, effective methods and strategies for teaching difficult concepts in integrated science, the use of role play, vignettes, problem-based approach and case studies to teach the difficult concepts, improvisation and use of local materials in teaching Integrated Science, teaching science as activities and process skills acquisition, report keeping and continuous assessment and keeping inventory in integrated science laboratory
- Use of eLearning platforms, zoom, WhatsApp, Google Scholar
- Indigenous science knowledge and the integrated science core curriculum, culturo-techno-contextual approach (CTCA)
- Misconceptions in Science, Unit plan, lesson plan and lesson planning

CATEGORY	DETAILS
Core Competencies	• Learner-centred teaching • Practical resourcefulness • Lesson planning, laboratory management and the integration of • Technology and Indigenous knowledge.
Core Values	• Accuracy • Integrity • Creativity • Collaboration and lifelong.

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-centred methods. • Role play • Vignettes and case studies. • Laboratory safety • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks such as Teaching Integrated Science • 2 NCCE and NERDC curriculum. • 3 Google Scholar, Zoom and WhatsApp. • Laboratory safety manuals. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Quizzes • Assignments • Participation • Role play • Case studies

REFERENCES AND FURTHER READING

Akinbobola, A. O., & Afolabi, F. (2010). *Teaching Methods in Science Education*. Lagos: National Open University of Nigeria.

Abimbola, I. O. (2015). *Issues and Innovations in Science Education*. Ilorin: University of Ilorin Press.

Ezeliora, B. (2018). *Methods of Teaching Integrated Science*. Onitsha: West and Solomon Publishing Company.

ISC 213A Health Problem

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Health Problems is course that provides students with a comprehensive understanding of the major health challenges affecting individuals, families, and communities. It examines the causes, patterns, prevention, control, and management of communicable and non-

communicable diseases, nutritional disorders, environmental health issues, and emerging public health concerns. The course emphasises the relationship between health, lifestyle, environment, and socioeconomic factors, while promoting health education, disease prevention, and healthy living practices.

RELEVANCE STATEMENT

Health is a fundamental human right and an essential component of sustainable national development. The increasing burden of communicable diseases, non-communicable diseases, environmental pollution, malnutrition, and emerging global health threats requires scientifically informed citizens who can contribute to disease prevention and health promotion.

This course equips students with the knowledge, attitudes, and practical skills needed to recognise common health problems, understand their causes and consequences, and implement appropriate preventive and control strategies. It also develops learners' capacity to make informed health decisions, promote healthy lifestyles, participate in community health programmes, and advocate for environmental sanitation and public health policies. The course is particularly relevant for students of Integrated Science Education, as it prepares them to teach health-related concepts effectively, promote health awareness in schools and communities, and contribute to achieving national and global health goals,

COURSE OBJECTIVES

The objectives of this course are to:

- 1 Identify common health problems in society.
- 2 Explain causes, symptoms, and prevention of diseases.
- 3 Promote personal and community health practices.
- 4 Understand the role of health education in disease prevention.
- 5 Apply health knowledge in teaching and daily life.

LEARNING OUTCOMES

At the end of this course, students should be able to:

- 1 Define health and health problems.
- 2 Classify communicable and non-communicable diseases.
- 3 Explain methods of disease prevention and control.
- 4 Demonstrate basic health-promoting behaviours.
- 5 Discuss the role of schools and teachers in health promotion.

COURSE CONTENT

- Microorganisms' importance in food
- Source of contamination, Application of standard food hygiene
- Cleaning and sterilising methods to traditional foods
- Food preservation and fermentation
- Food spoilage, food poisoning and infection
- Sanitation and sanitary practice as related to everyday living where contaminant of soil, water and air may result in the deterioration of the environment and methods of water and sewage treatment

CATEGORY	DETAILS
Core Competencies	• Health Literacy. • Disease • Prevention and health Promotion. • Research Skills. • Scientific Inquiry.
Core Values	• Respect for Human Life. • Empathy and Compassion. • Discipline. • Environmental Stewardship.
Pedagogical Approaches	• Interactive lectures • Group discussion and role-play • Case studies and demonstrations • Health talks and project work • Inquiry-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Health Education and Integrated Science Textbooks • WHO and Ministry of Health publications • Charts, posters, and health documentaries • National curriculum for Basic Education (Integrated Science)

CATEGORY	DETAILS
Assessment Methods	• Continuous Assessment • Tests • Assignments, presentations) • End of Semester Examination

REFERENCES AND FURTHER READING

Park, K. (2023). *Park's Textbook of Preventive and Social Medicine* (27th ed.). Banarsidas Bhanot Publishers.

World Health Organization (WHO). (2024). *World Health Statistics 2024*. Geneva: WHO.

Centers for Disease Control and Prevention (CDC). (2024). *Principles of Epidemiology in Public Health Practice* (4th ed.)

ISC 213B Thermodynamics and Property of Matter

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Elective | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Thermodynamics and Properties of Matter is a foundational physics course that examines the principles governing heat, energy, work, and the physical properties of matter. The course introduces the laws of thermodynamics and explores how matter responds to changes in temperature, pressure, and external forces. Topics include temperature and heat, thermal expansion, kinetic theory of gases, real and ideal gases, phase transitions, elasticity, surface tension, viscosity, and transport phenomena. Emphasis is placed on both theoretical understanding and practical applications in science, engineering, and technology.

RELEVANCE STATEMENT

This course provides essential knowledge for understanding natural and engineered systems involving energy transfer and material behaviour. It is relevant to physics, engineering, chemistry, materials science, environmental science, and applied sciences. The principles learned are fundamental to technologies such as engines, refrigeration, power generation, material design, and climate studies, making the course vital for scientific literacy and technological advancement.

COURSE OBJECTIVES

The objectives of this course are to:

1. Introduce the fundamental concepts and laws of thermodynamics.
2. Explain the thermal and mechanical properties of solids, liquids, and gases.
3. Develop analytical skills for solving thermodynamic and material-related problems.
4. Relate theoretical principles to real-life and industrial applications.
5. Prepare students for advanced studies in physics and related disciplines.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain and apply the laws of thermodynamics to physical systems.
2. Analyse heat transfer processes and energy transformations.
3. Describe and evaluate the properties of matter such as elasticity, viscosity, and surface tension.
4. Apply kinetic theory to explain the behaviour of gases.
5. Solve quantitative problems involving thermodynamic processes and material properties.

COURSE CONTENT

- Kinetic theory of gases
- Molecular collisions and mean free path
- Gas laws
- General gas equation
- Thermal conductivity
- First Law of thermodynamics
- Heat, work and internal energy, reversibility
- Thermodynamic processes
- Adiabatic, isothermal, isobaric
- Second law of thermodynamics
- Heat engines and entropy, Zero’s law of thermodynamics
- Elasticity
- Hooke’s law, Young’s, shear and bulk moduli
- Hydrostatics

- Pressure, buoyancy, Archimedes' principles
- Bernoulli's equation and incompressible fluid flow
- Surface tension
- Adhesion, cohesion, viscosity, and capillarity

CATEGORY	DETAILS
Core Competencies	• Scientific Knowledge and Understanding. • Practical and Laboratory Skills. • Critical Thinking and Problem-Solving.
Core Values	• Scientific Integrity. • Excellence. • Responsibility. • Innovation.
Pedagogical Approaches	• Interactive Lecture Method. • Inquiry-Based Learning. • Laboratory/ • Experimental Method. • Problem-Based Learning (PBL). • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Physics textbooks on thermodynamics. • Lecture notes and course handouts • Laboratory manuals and practical guides • Scientific journals and reference materials • Online learning platforms • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Continuous assessment (quizzes, assignments, and homework) • Laboratory experiments and reports • Mid-semester tests • End-of-semester written examination

REFERENCES AND FURTHER READING

Çengel, Y. A., & Boles, M. A. (2024). *Thermodynamics: An Engineering Approach* (10th ed.). McGraw-Hill Education.

Halliday, D., Resnick, R., & Walker, J. (2022). *Fundamentals of Physics* (12th ed.). John Wiley & Sons.

Serway, R. A., & Jewett, J. W. (2023). *Physics for Scientists and Engineers* (11th ed.). Cengage Learning.

ISC 221 Integrated Science Practical II

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Integrated Science Practical II is a laboratory- and field-based course designed to strengthen students' practical skills and scientific inquiry through hands-on activities in integrated science. The course emphasises the integration of scientific concepts, experimental techniques, observation, measurement, data collection, analysis, and interpretation to solve real-life scientific problems. The primary goal is to transform students-teachers beyond basic sciences knowledge to applicable thinking. Graduates must not only understand but also to effectively conduct practical at basic education levels (primary and junior secondary school students).

RELEVANCE STATEMENT

Integrated Science Practical II is a core professional course that provides students with the opportunity to apply theoretical scientific knowledge through practical laboratory experiments, field investigations, and scientific inquiry. The course integrates concepts from biology, chemistry, physics, earth science, and environmental science, enabling students to develop a holistic understanding of natural phenomena and their applications in everyday life.

The course is designed to strengthen students' scientific process skills, including observation, measurement, experimentation, data collection, analysis, interpretation, and communication of scientific findings. It emphasises the importance of laboratory safety, ethical scientific practices, and the proper use of scientific equipment and materials. Through carefully planned practical activities, students gain firsthand experience in conducting investigations, testing hypotheses, solving scientific problems, and making evidence-based conclusions.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the Anatomy of flowering plant.
2. Primary vegetative body: stem, leaf and root to show the mature tissues namely parenchyma, collenchyma, xylem and phloem.
3. Care and use of dissecting Kits and other biological wares.
4. Conduct experimental designed practical aspect of topics in ISC 121.
5. Dissection and general histology of animal tissues based on vertebrate forms.
6. List types of fruits and seed.
7. Identification of various groups of organisms in animal kingdom

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Examine various groups of lower invertebrates under microscopes.
2. Dissect animal tissues based on vertebrate forms.
3. State the types of fruits and seed.
4. Identified the various group of organisms in animal kingdom.
5. Explain flowering plant.

COURSE CONTENT

- Anatomy of flowering plants, primary vegetative body: Stem, leaf and root to show the mature tissues namely parenchyma, collenchyma, sclerenchyma, xylem and phloem
- Types of fruits and seeds
- Care and use of dissecting kits and other biological wares
- Dissection and general histology of animal tissues based on vertebrate forms
- Morphology and functions of epithelial, muscular, nervous and connective tissues
- Examination of various groups of lower invertebrates under microscopes, identification of various groups of organisms in Animal Kingdom

CATEGORY	DETAILS
Core Competencies	• Practical aspect • Creativity • Critical thinking, skills • Intelligence, pedagogic knowledge • Reflective thinking • Self-development. • Social emotional learning, time management, **etc.**
Core Values	• Scientific Integrity. • Critical Thinking • Problem-Solving. • Safety Consciousness.
Pedagogical Approaches	• Practical methods • Modelling and Worked Project-3. Based Learning (PBL, and collaborative pair Programming). • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Books and • Online resources • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Self-assessment • Pair assessment, group assessment

REFERENCES AND FURTHER READING

Ackerman, P., Ellis, D., & Glover, P. (2021). *Advanced Practical Skills in Science*. Oxford University Press.

UNESCO. (2021). *A Guide to Inquiry-Based Science Education*. UNESCO Publishing. American Association for the Advancement of Science (AAAS). (2020). *Science for All Americans*. Oxford University Press.

ISC 222 Man and His Environment

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Man and His Environment is a course that examines the dynamic relationship between humans and the physical, biological, and socio-cultural environment. The course explores how natural and human-made environments influence human life and how human activities, in turn, affect environmental quality and sustainability. It integrates concepts from biology, chemistry, geography, ecology, and environmental science to provide students with a holistic understanding of environmental systems and the need for sustainable resource management.

The course introduces students to the components of the environment, including ecosystem structure and function, biodiversity, natural resources, environmental pollution, climate change, population conservation practices. Students also study the causes and consequences of environmental degradation and the roles of individuals, communities, industries, and governments in environmental protection.

RELEVANCE STATEMENT

Man and His Environment course is fundamental to the study of Integrated Science because it provides students with an understanding of the interactions between humans and their natural and built environments. As environmental challenges such as climate change, pollution, biodiversity loss, deforestation, desertification, flooding, continue to affect communities world-wide, there is an increasing need for scientifically informed citizens and educators who can promote environmental sustainability.

This course equips students with the knowledge, practical skills, and attitudes required to identify, analyse, and address environmental problems using scientific principles. It emphasises environmental conservation, sustainable use of natural resources, ecosystem protection, and responsible human activities that support sustainable development. Through theoretical and practical learning experiences, students develop critical thinking, problem-solving, and decision-making skills that enable them to contribute effectively to environmental management and community development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concept of environment and its components.
2. Describe the interactions between humans and the environment.
3. Identify major environmental problems and their causes.
4. Explain strategies for environmental conservation and sustainability.
5. Apply environmental concepts in basic science teaching.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Define and classify components of the environment.
2. Explain human impacts on land, water, and air.
3. Discuss environmental pollution and climate change.
4. Identify conservation practices and sustainable resource use.
5. Demonstrate responsible environmental attitudes.

COURSE CONTENT

- Human Beings as Higher Animals
- Characteristics of primates
- Introductory Ecology
- Ecosystem ecological classification of habitat types, terrestrial and aquatic biomass, specific features of each, biotic components of habitat
- Water cycle, Carbon and Nitrogen cycles
- Traditional and modem methods of food preservation
- **Associations:** parasitism, symbiosis and commensalisms
- **Resources exploitation by man:** deforestation, desertification and mining etc
- **Environmental pollution:** causes, consequences and control
- Climatic change, Ozone layer
- Conservation and recycling of natural resources
- Field trip

CATEGORY	DETAILS
Core Competencies	• Environmental Literacy. • Critical Thinking and • Problem-Solving. • Observation and Investigation Skills.
Core Values	• Environmental • Stewardship. • Responsibility. • Sustainability. • Respect for Nature. • Integrity.
Pedagogical Approaches	• Lecture and guided discussion • Case studies on local environmental issues • Field observation and community studies • Group work and project-based learning • Problem-solving and inquiry methods • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Integrated Science and -Environmental Studies Textbooks • Government and NGO environmental publications • Charts, documentaries, and online open resources. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Continuous Assessment (tests, assignments, projects). • End of Semester Examination

REFERENCES AND FURTHER READING

Cunningham, W. P., & Cunningham, M. A. (2021). *Principles of Environmental Science: Inquiry and Applications* (10th ed.). McGraw-Hill.

Enger, E. D., & Smith, B. F. (2022). *Environmental Science: A Study of Interrelationships* (16th ed.). McGraw-Hill.

Raven, P. H., Berg, L. R., & Hassenzahl, D. M. (2021). *Environment* (10th ed.). Wiley.

ISC 223 Research Method in Integrated Science

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Research Methods is a foundational course designed to equip students with the knowledge and skills required to conduct systematic, ethical, and scientific research. The course introduces students to the principles of research design, qualitative and quantitative approaches, data collection techniques, sampling methods, data analysis, and research reporting. Emphasis is placed on critical thinking, problem identification, and the application of appropriate methodologies across disciplines.

RELEVANCE STATEMENT

Research Methods is essential for academic success and professional development, as it provides students with the tools needed to generate reliable knowledge, solve real-world problems, and contribute meaningfully to their fields of study. The course prepares students for final-year projects, postgraduate research, evidence-based decision-making, and professional practice in research-oriented environments.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify research problems and formulate research questions and hypotheses.
2. Differentiate between qualitative, quantitative, and mixed research approaches.
3. Apply appropriate research designs and data collection methods.
4. Analyse and interpret research data accurately.
5. Present research findings in a clear, logical, and academic manner.
6. Demonstrate ethical considerations in conducting research.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain key research terminologies and concepts.
2. Develop a well-structured research proposal.
3. Select suitable research designs and methodologies for specific studies.
4. Collect, analyse, and interpret data using basic statistical and qualitative techniques.
5. Evaluate research reports and scholarly articles.

6. Apply ethical standards in research practice**.**

COURSE CONTENT

- Research method
- Types of research method
- And Importance of research method
- Identification of research topics
- Topic selection
- Literature Review
- Construction of instruments
- Validation of instruments
- **Data Analysis:** Descriptive and Inferential Statistics
- Project reports

CATEGORY	DETAILS
Core Competencies	• Research Literacy. • Problem Identification. • Research Design. • Data Collection and Management.
Core Values	• Integrity. • Excellence. • Objectivity. • Curiosity.
Pedagogical Approaches	• Interactive Lecture Method. • Inquiry-Based Learning. • Project-Based Learning. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Research methodology • Academic journals and peer-reviewed articles • Online databases (e.g. Google Scholar, institutional repositories) • Lecture notes and handouts • Statistical and data analysis software (e.g. SPSS, Excel) • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Continuous Assessment (quizzes, assignments, class participation) • Research proposal or mini-project • Practical data analysis exercises.

REFERENCES AND FURTHER READING

Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). Sage Publications.

Creswell, J. W., & Guetterman, T. C. (2021). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (6th ed.). Pearson.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research Methods in Education* (8th ed.). Routledg

ISC 321 Carbon Compound II

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Carbon Compounds II is a course that builds on the fundamental concepts introduced in Carbon Compounds I. The course focuses on the chemistry, structure, properties, reactions, synthesis, and applications of important classes of organic compounds. It examines the relationships between molecular structure and chemical behaviour while emphasising the role of organic compounds in biological systems, industrial processes, agriculture, pharmaceuticals, and environmental sustainability. The course covers the chemistry of aromatic compounds, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, acid derivatives, amines, amino acids, carbohydrates, lipids, proteins, polymers, and selected synthetic organic materials. Students also study reaction

mechanisms, functional group transformations, stereochemistry, and introductory spectroscopic techniques used in the identification of organic compounds.

RELEVANCE STATEMENT

Carbon Compounds II is a core course in Integrated Science that provides students with advanced knowledge of the chemistry of carbon-containing compounds and their significance in biological, industrial, agricultural, pharmaceutical, and environmental systems. The course enables students to understand the structure, properties, reactions, synthesis, and applications of major classes of organic compounds. It emphasises the relationship between molecular structure and chemical reactivity, fostering analytical thinking and problem-solving skills. The course also develops practical laboratory competencies in the preparation, purification, identification, and characterisation of organic compounds while promoting safe laboratory practices and environmental responsibility. Knowledge gained from this course equips students with the scientific foundation needed for further studies in chemistry, biochemistry, medicine, environmental science, agriculture, and science education. Furthermore, it prepares prospective Integrated Science teachers to effectively teach organic chemistry concepts and relate them to real-life applications and sustainable development.

COURSE OBJECTIVES

The objectives of this course are to:

- Describe various component of carbon compound,
- Identify the branches of organic compound,
- Classify the state the relationship between amino acids,
- Haloalkanes, alkanols, carboxylic acids and derivatives,
- Explain the basic structural synthetic macro-molecules peptides and proteins
- Relate properties of amino acids to their functional groups

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Describe various component of carbon compound,
2. Identify the branches of organic compound like Haloalkanes, alkanols, carboxylic acids and derivatives,
3. Identify the different classes of organic molecules relevant to life (Carbohydrates, Protein, fats, nucleic)

4. Draw the structure of each of the molecules
5. Describe their chemical functions

COURSE CONTENT

- The chemistry of Haloalkanes, Alkanols (Alcohols), Alkanoic Acids (carboxylic acids and derivatives), Nitriles, Aldehydes, Ketones, Synthetic Macro-Molecules Polymerisation, Amines and Amino Acids, proteins
- Basic principles of tests for proteins
- Introductory chemistry of carbohydrates, lipids and nucleic acids
- Nomenclature of nucleosides, and nucleotides
- Effects of acid and alkali on hydrolysis of nucleic acids

CATEGORY	DETAILS
Core Competencies	• Scientific Knowledge and Understanding: • Analytical and Critical Thinking: • Laboratory and Practical Skills: • Problem-Solving Skills. • Communication Skills:
Core Values	• Scientific Integrity. • Safety Consciousness • Critical Thinking • Teamwork and Collaboration • Environmental Responsibility
Pedagogical Approaches	• The pedagogical approaches will include • Lectures • Tutorials • Laboratory Practicals • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• General Biology textbooks (Print, offline soft copies and online resources) • Organic Chemistry textbooks (Print, offline soft copies and online resources) • Introductory Biochemistry Textbooks • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Assignments • Class presentations • Continuous assessment (CA) • Tests • Semester Examinations

REFERENCES AND FURTHER READING

Clayden, J., Greeves, N., & Warren, S. (2021). *Organic Chemistry* (3rd ed.). Oxford University Press.

Solomons, T. W. G., Fryhle, C. B., & Snyder, S. A. (2022). *Organic Chemistry* (13th ed.). John Wiley & Sons.

McMurry, J. (2021). *Organic Chemistry* (10th ed.). Cengage Learning.

Carey, F. A., & Giuliano, R. M. (2022). *Organic Chemistry* (11th ed.). McGraw-Hill Education.

National Research Council. (2019). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. National Academies Press.

EDU 322 Seminar in Integrated Science

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 15

COURSE OVERVIEW

Seminar in Integrated Science is an advanced course designed to provide students with opportunities to explore, analyse, discuss and communicate contemporary issues, emerging trends and current developments in Integrated Science and Science Education. The course exposes students to selected scientific, technological, environmental, health and educational issues that cut across different branches of science.

The seminar emphasises independent study, literature review, critical thinking, scientific inquiry, oral presentation and scholarly communication. Students are expected to identify relevant topics, formulate appropriate questions or problems, review current literature, organise scientific information, present their findings and participate effectively in academic discussions. The course also develops students' ability to relate scientific knowledge to societal problems and national development, particularly within the Nigerian context.

RELEVANCE STATEMENT

The Seminar in Integrated Science is relevant because modern scientific and technological challenges are multidisciplinary and require the integration of knowledge from biology, chemistry, physics, earth science, environmental science and related fields. The course equips prospective Integrated Science teachers and science professionals with the skills required to investigate contemporary scientific issues, evaluate evidence and communicate scientific knowledge effectively.

The course is particularly important in Nigeria where challenges such as climate change, environmental degradation, public health concerns, energy security, food security, emerging technologies and sustainable development require scientifically informed responses. Through seminars, students develop confidence in discussing scientific issues, evaluating research findings and connecting scientific knowledge with classroom teaching, community needs and national development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the meaning, nature and scope of seminar studies in Integrated Science.
2. Identify contemporary issues and emerging trends relevant to Integrated Science.
3. Select and formulate appropriate seminar topics and researchable scientific problems.
4. Conduct systematic searches for relevant scientific and educational literature.
5. Review and synthesise information from books, journals, reports and credible electronic sources.
6. Apply scientific reasoning and critical-thinking skills in analysing scientific issues.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Describe the purpose, principles and processes involved in conducting seminars in Integrated Science.
2. Identify relevant contemporary scientific, technological, environmental and societal issues for seminar presentation.
3. Formulate clear and relevant seminar topics, objectives and guiding questions.
4. Locate and evaluate credible scientific information from textbooks, scholarly journals, databases and other reliable sources.
5. Analyse and synthesise information from different scientific disciplines to explain complex issues

COURSE CONTENT

This course is designed to expose students to presentation skills on contemporary issues as they affect teaching and learning Integrated science.

CATEGORY	DETAILS
Core Competencies	• Problem-solving and analytical skills. • Laboratory and practical competencies. • Pedagogical competencies. • Integrating inquiry-based methods
Core Values	• Honesty • Integrity • Inclusion • Respect • Team spirit • Perseverance
Pedagogical Approaches	• Learner-centred Approach • Collaborative /Cooperative Learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Textbooks and course materials • Practical apparatus • Kits, Digital and visual aids • Free PhET Interactive • Simulations for virtual labs on circuits, charges, fields. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Formative assessments: • Quizzes, concept maps, worksheets. • Practical/laboratory assessments: • Performance-based tasks. • Summative assessments: • End-of-course examination. • Diagnostic tools: Pre/post-tests or conceptual survey

REFERENCES AND FURTHER READING

Bybee, R. W. (2020). *STEM Education Now More Than Ever.* NSTA Press.

Lederman, N. G., & Abell, S. K. (Eds.). (2019). *Handbook of Research on Science Education, Volume III.* Routledge.

National Research Council. (2012). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* National Academies Press.

Degree Course Descriptions (400–500 Level)

GSE 412 Peace and Conflict Resolution

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts, theories and practices of peace, conflict, security and conflict resolution, with particular attention to Nigeria and the wider African context. It examines the nature, types, dynamics and root causes of conflicts, including ethnic, religious, economic, political, boundary, land and resource-related conflicts, as well as insurgency and terrorism. The course explores major theories of conflict and their application to selected Nigerian conflict situations. It further examines approaches to peacebuilding, conflict management and security, including mediation, negotiation, arbitration, dialogue, collaboration, community policing and other forms of Alternative Dispute Resolution (ADR). Attention is also given to social justice and the Nigerian legal framework, peacekeeping, post-conflict management, refugees and internally displaced persons (IDPs), and the roles of government, communities, religious and traditional institutions, the media, NGOs and international organisations such as the United Nations (UN), African Union (AU) and Economic Community of West African States (ECOWAS) in promoting sustainable peace and security.

RELEVANCE STATEMENT

Peace and Conflict Resolution is particularly relevant in preparing graduates to understand and respond constructively to the complex social, ethnic, religious, political, economic and security challenges affecting Nigeria, Africa and the wider world. The course develops students' capacity for critical analysis, tolerance, dialogue, peaceful coexistence and non-violent management of disagreements, while equipping them with practical skills in mediation, negotiation, conflict prevention and peacebuilding. For prospective educators and other professionals, these competencies are important for creating safe and inclusive environments, managing interpersonal and community conflicts, promoting social justice and responsible citizenship, and contributing to national integration, sustainable development and a culture of peace.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concepts and principles of peace, conflict, conflict resolution, conflict transformation and security.
2. Examine the nature, characteristics, forms and types of conflict and violence at individual, interpersonal, community, national and international levels.
3. Identify and analyse the major root causes and consequences of conflict and violence.
4. Explain the relationship between conflict, violence, insecurity, terrorism and development.
5. Differentiate between conflict and terrorism and examine their implications for individuals, communities and national security.
6. Discuss the concepts of conflict prevention, conflict management, conflict resolution, conflict transformation and peace building.
7. Examine various strategies and mechanisms for preventing and resolving conflicts, including negotiation, mediation, arbitration, dialogue and reconciliation.
8. Develop appropriate skills for peaceful communication, negotiation, problem-solving, tolerance and constructive management of disagreements.
9. Examine the roles of government, international organisations, and civil society organisations, the media and traditional institutions in conflict prevention and peace building.
10. Analyse the importance of human rights, social justice, good governance, equity and inclusive participation in promoting sustainable peace.
11. Apply appropriate peace building and conflict-resolution strategies to selected conflict situations in Nigeria and other societies.
12. Demonstrate attitudes and behaviours that promote peaceful coexistence, mutual respect, tolerance, cooperation and responsible citizenship.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Define and explain the concepts and principles of peace, conflict, conflict resolution, conflict transformation, peacebuilding and security, and distinguish their major features and applications.
2. Identify and classify the nature, characteristics, forms and types of conflict and violence at individual, interpersonal, community, national and international levels.
3. Identify, explain and analyse the major causes, dynamics and consequences of conflict and violence in different societies.

4. Explain and analyse the relationships among conflict, violence, insecurity, terrorism and socio-economic development.
5. Differentiate conflict from terrorism and **assess** their implications for individuals, communities, national security and socio-economic development.
6. Describe and distinguish the processes of conflict prevention, conflict management, conflict resolution, conflict transformation and peacebuilding.
7. Demonstrate the ability to apply appropriate conflict prevention and resolution strategies, including negotiation, mediation, arbitration, dialogue and reconciliation, to selected conflict situations.
8. Demonstrate effective skills in peaceful communication, negotiation, problem-solving, tolerance and constructive management of interpersonal and group disagreements.
9. Analyse and evaluate the roles of government, international organisations, civil society organisations, the media and traditional institutions in conflict prevention, management and peacebuilding.
10. Explain and evaluate the contributions of human rights, social justice, good governance, equity, inclusion and participatory decision-making to sustainable peace and security.
11. Apply appropriate peacebuilding and conflict-resolution strategies to selected conflict situations in Nigeria and other societies, taking into consideration their specific social, cultural, political and economic contexts.
12. Demonstrate attitudes and behaviours that promote peaceful coexistence, mutual respect, tolerance, cooperation, non-violence and responsible citizenship.

COURSE CONTENT

- Concepts of Peace, Conflict and Security in a multi-ethnic nation
- Types and Theories of Conflicts: Ethnic, Religious, Economic, Geo-political Conflicts
- Structural Conflict Theory, Realist Theory of Conflict, Frustration-Aggression Conflict Theory
- Root causes of Conflict and Violence in Africa: Indigene and settlers Phenomenon
- Boundaries/boarder disputes
- Political disputes
- Ethnic disputes and rivalries
- Economic Inequalities

- Social disputes
- Nationalist Movements and Agitations
- **Selected Conflict Case Studies:** Tiv-Junkun
- Zango Kartaf, Chieftaincy and Land disputes
- Peace Building, Management of Conflicts and Security: Peace & Human Development
- **Approaches to Peace & Conflict Management:** Religious, Government, Community Leaders and others
- Elements of Peace Studies and Conflict Resolution: Conflict dynamics assessment Scales: Constructive & Destructive
- Justice and Legal framework: Concepts of Social Justice
- The Nigeria Legal System
- Insurgency and Terrorism
- Peace Mediation and Peace Keeping
- Peace & Security Council (International, National and Local levels) Agents of Conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives
- Alternative Dispute Resolution, ADR.
- Dialogue b)
- Arbitration, c)
- Negotiation d)
- Collaboration
- Roles of International Organisations in Conflict Resolution
- The United Nations, UN and its Conflict Resolution Organs
- The African Union & Peace Security Council (c)
- ECOWAS in Peace Keeping
- Media and Traditional Institutions in Peace Building
- Managing Post-Conflict Situations/Crisis: Refugees
- Internally Displaced Persons, IDPs
- The role of NGOs in Post-Conflict Situations/Crisis

CATEGORY	DETAILS
Core Competencies	Critical thinking, conflict analysis, problem-solving, communication, negotiation, mediation, collaboration, decision-making, information and media literacy
Core Values	Peace, tolerance, empathy, respect, justice, equity, fairness, responsibility, integrity, cooperation, respect for diversity, non-violence
Pedagogical Approaches	• Interactive lecture, case study, problem-based learning, group discussion, role-play, simulation, debate, collaborative learning, inquiry-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	Course texts, Nigerian Constitution, case studies, maps, newspapers, documentaries, multimedia resources, UN/AU/ECOWAS resources, conflict scenarios, relevant legal and policy documents, National Curriculum for Basic Education
Assessment Methods	Self-assessment, peer assessment, group assessment, quizzes, case-study analysis, presentations, role-play/performance tasks, assignments, continuous assessment

READINGS/REFERENCES:

1. Albert, I.O (2014) Research Methods in Peace and Conflict Studies.
2. Sylvester, V (2023). Readings in Peace and Conflict Resolution (Shimtex Press).
3. Best, S. G (2006) Introduction to Peace and Conflict Studies in West Africa (Spectrum Books).
4. Contemporary Security and Peace building in Africa (2021) Edited by Reuben Lewis and Kwesi Aning.
5. UN Peace maker Resource Library materials.
6. Conflict Resolution Trainers' Manual (Open Educational Resource).

EDU 402 Educational Measurements, Tests, Research Methods and Statistics

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

EDU 402 introduces students to the fundamental concepts, principles and applications of educational measurement, testing, research methods and statistics. The course focuses on the measurement and assessment of learning outcomes, identification of the domains of learning, and development and use of appropriate assessment instruments. It also introduces students to the nature, purposes, types, processes and applications of educational research. The course examines different types of educational data and the statistical techniques appropriate for analysing them. Students are introduced to hypothesis testing, critical values, errors of inference and interpretation of statistical results. Practical application of statistical packages, particularly IBM-SPSS, is emphasised to develop students' competence in data analysis and interpretation. The course also develops students' communication, research reporting and ethical decision-making skills necessary for conducting and presenting educational research.

RELEVANCE STATEMENT

This course is relevant to teacher education because effective teaching, learning and educational decision-making depend on accurate assessment, systematic research and appropriate interpretation of data. It equips students with the knowledge and practical skills required to measure learning outcomes, construct and use appropriate assessment instruments, analyse educational data and make evidence-based decisions. The research component prepares students to identify educational problems, conduct systematic investigations, communicate research findings and apply appropriate ethical standards. Competence in statistical analysis and the use of IBM-SPSS further enhances students' ability to conduct quantitative educational research and interpret research findings accurately. The course therefore provides an essential foundation for evidence-based teaching, educational evaluation, research and professional practice.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concepts, principles and purposes of educational measurement, testing, assessment and evaluation.

2. Apply appropriate techniques for measuring and assessing students' learning outcomes.
3. Identify the major domains of learning and select or develop appropriate instruments for assessing each domain.
4. Demonstrate skills in constructing, administering, scoring and interpreting appropriate educational assessment instruments.
5. Identify different types and sources of educational data and determine the appropriate statistical techniques for analysing them.
6. Explain the meaning, purpose, characteristics, types and processes of educational research.
7. Apply appropriate research methods and procedures to investigate educational problems.
8. Formulate research questions, objectives and hypotheses appropriate to educational research problems.
9. Apply descriptive and inferential statistical techniques to analyse and interpret educational data.
10. Conduct hypothesis testing using appropriate procedures and interpret results based on critical values, levels of significance and possible errors.
11. Use IBM-SPSS and other relevant statistical software packages to enter, organise, analyse and interpret educational data.
12. Demonstrate effective communication and research-reporting skills in presenting educational research findings.
13. Apply appropriate procedures for drawing conclusions, making inferences and taking evidence-based decisions from research and assessment results.
14. Identify and critically evaluate ethical issues associated with educational research and demonstrate responsible and ethical research practices.
15. Demonstrate competence in integrating measurement, research and statistical knowledge in solving educational problems and improving professional practice.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and distinguish the concepts, principles, purposes and applications of educational measurement, testing, assessment and evaluation.

2. Apply appropriate measurement and assessment techniques to determine and evaluate students' learning outcomes.
3. Identify and differentiate the major domains of learning and select or develop suitable assessment instruments for measuring learning in each domain.
4. Construct, administer, score and interpret appropriate educational assessment instruments using established principles and procedures.
5. Identify and classify different types and sources of educational data and select appropriate statistical techniques for analysing them.
6. Explain the meaning, purpose, characteristics, types and processes of educational research and distinguish among major research approaches and designs.
7. Apply appropriate research methods and procedures to investigate and provide evidence-based solutions to identified educational problems.
8. Formulate clear and appropriate research questions, objectives and hypotheses based on identified educational research problems.
9. Apply descriptive and inferential statistical techniques to analyse, summarise and interpret educational research data appropriately.
10. Conduct and interpret hypothesis **tests** using appropriate statistical procedures, levels of significance and critical values, while identifying possible Type I and Type II errors.
11. Use IBM-SPSS and other relevant statistical software packages to enter, organise, process, analyse and interpret educational data.
12. Communicate and report educational research findings effectively using appropriate academic, statistical and research-reporting conventions.
13. Draw valid conclusions, make appropriate inferences and take evidence-based decisions from educational research, measurement and assessment results.
14. Identify and critically evaluate ethical issues in educational research and demonstrate responsible, professional and ethical research practices.
15. Integrate knowledge and skills in measurement, assessment, research and statistics to identify, investigate and solve educational problems and improve professional practice.

COURSE CONTENT

- Types of educational measurements
- Types of tests, development of tests, test blueprint, item analysis, reliability and validity of instruments

- Domains of learning and taxonomy of cognitive outcomes
- Meaning of research, types of research with focus on descriptive and experimental research
- The research process
- Writing a research proposal
- Research designs
- Theoretical/conceptual framework and review of literature
- Sample and sampling techniques
- Types of data, data gathering, data processing, data analysis and interpretation
- Probability, critical values and error and their place in inferences
- Ethical considerations (political, economic religious and cultural) in research
- Data analysis using IBM-SPSS in educational data analysis
- Reporting educational research

CATEGORY	DETAILS
Core Competencies	• Critical thinking and analytical skills • Digital literacy and data literacy • Reflective thinking and self-development • Collaboration and innovation
Core Values	• Integrity and honesty • Responsibility and perseverance • Team spirit and service • Humility and transparency
Pedagogical Approaches	• Lecture-Based Approach • Collaborative /Cooperative Learning • Inquiry-Based Learning • Experiential Learning, Flipped Classroom • Case-Based Learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Online Courses and Tutorials • Software Tools • Practical Guides/Handbooks • Supplementary Learning Materials • National Curriculum for Basic Education
Assessment Methods	• Continuous Assessment • Formative Assessment • Practical/Performance-Based Assessment • Project-Based Assessment

REFERENCES AND FURTHER READING

1. Ihedioha, C. E. (2025). *Fundamental Principles of Research Methods*.
2. Ogunboyede, M. (2024). *Tests, Measurement, Assessment, Evaluation and Research in Education*.
3. Creswell, J. W. (2022). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*.
4. Omachi, D. (2019). *Fundamental of Educational Measurement and Evaluation*.
5. Educational Measurement (5th Edition/ NCME Open Access).
6. Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research (Open Educational Resources Collection).

ENT 412 Venture Creation

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory Core Course | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides students with the knowledge, practical skills and entrepreneurial competencies required to identify viable business opportunities, develop innovative business ideas, create new ventures and manage micro and small enterprises successfully. It covers opportunity identification, environmental scanning, market research, business planning, entrepreneurial finance, marketing, e-commerce, small and family business management, negotiation and business communication. Through practical activities such as brainstorming, business idea generation, pitching and business plan development,

students are exposed to the processes involved in transforming problems and unmet needs into viable entrepreneurial opportunities. The course also introduces emerging technologies, including Artificial Intelligence (AI), Virtual and Mixed Reality, Internet of Things (IoT), blockchain, cloud computing and renewable energy, and explores their applications in creating innovative products, services and digital businesses.

RELEVANCE STATEMENT

Venture Creation is relevant to preparing graduates to become entrepreneurial, innovative and self-reliant in response to changing labour-market conditions and socio-economic challenges in Nigeria. The course enables students to recognise opportunities within local and wider markets, transform innovative ideas into viable enterprises, mobilise resources, use digital technologies and e-commerce, and develop the financial, marketing, communication and management competencies required for business sustainability. By combining entrepreneurial knowledge with practical venture-development experiences, the course promotes creativity, problem-solving, responsible risk-taking and job creation, thereby preparing graduates not only to seek employment but also to create enterprises, generate employment and contribute to sustainable economic and community development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the concepts, principles and processes of venture creation and entrepreneurship.
2. Identify and evaluate entrepreneurial opportunities arising from problems, emerging trends, market gaps and high-potential sectors.
3. Generate original business ideas, products, services and concepts through creativity and innovation.
4. Examine the processes involved in transforming entrepreneurial ideas into viable business concepts.
5. Conduct basic market, customer and competitor analysis for prospective ventures.
6. Develop a preliminary business concept suitable for incubation, presentation or pitching to potential investors and funding institutions.
7. Identify and evaluate various sources of entrepreneurial finance available to micro and small enterprises.
8. Explain the requirements and procedures for establishing and managing micro and small enterprises.

9. Apply appropriate entrepreneurial marketing principles and strategies in promoting products and services.
10. Demonstrate the use of e-commerce and digital platforms for entrepreneurial activities and business development.
11. Apply emerging technologies and digital solutions to improve entrepreneurial processes, products, services and business performance.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Explain and distinguish the concepts, principles and processes of venture creation and entrepreneurship.
2. Identify, assess and evaluate entrepreneurial opportunities arising from problems, emerging trends, market gaps and high-potential sectors.
3. Generate and develop original business ideas, products, services and concepts using creativity, innovation and problem-solving skills.
4. Explain and apply the processes involved in transforming entrepreneurial ideas into feasible and viable business concepts.
5. Conduct and interpret basic market, customer and competitor analyses to determine the feasibility and potential of prospective ventures.
6. Develop and present a preliminary business concept suitable for incubation, business pitching and consideration by potential investors or funding institutions.
7. Identify, compare and evaluate various sources of entrepreneurial finance available to micro and small enterprises and determine their suitability for different business needs.
8. Explain and apply the basic requirements and procedures for establishing, operating and managing micro and small enterprises.
9. Apply appropriate entrepreneurial marketing principles and strategies to promote products and services and reach target customers effectively.
10. Demonstrate the use of e-commerce platforms and digital technologies to support entrepreneurial activities, customer engagement and business development.
11. Apply emerging technologies and digital solutions to improve entrepreneurial.

COURSE CONTENT

- **Opportunity Identification:**
    - Sources of business opportunities in Nigeria

  - Environmental scanning
  - Demand and supply gap/unmet needs/market gaps/Market Research
  - Unutilized resources
  - Social and climate conditions and Technology adoption gap
- **New business development:** business planning, market research
- **Entrepreneurial Finance:** Venture capital, Equity finance, Micro finance, Personal savings, Small business investment organisations and Business plan competition
- **Entrepreneurial marketing and e-commerce:**
  - Principles of marketing
  - Customer Acquisition & Retention
  - B2B
  - C2C and B2C models of e-commerce
  - First Mover Advantage
  - E-commerce business models and Successful E-Commerce Companies
- Small Business Management/Family Business: Leadership & Management, Basic book keeping, Nature of family business and Family Business Growth Model
- **Negotiation and Business communication:** Strategy and tactics of negotiation/ bargaining, Traditional and modern business communication methods
- **Opportunity Discovery Demonstrations:** Business idea generation presentations, Business idea Contest, brainstorming sessions, Idea pitching
- **Technological Solutions:**
  - The Concept of Market/Customer Solution
  - Customer Solution and Emerging Technologies
  - Business Applications of New Technologies – Artificial Intelligence (AI)
  - Virtual/Mixed Reality (VR)
  - Internet of Things (IoTs)
  - Blockchain
  - Cloud Computing
  - Renewable Energy and others. Digital Business and E-Commerce Strategies

CATEGORY	DETAILS
Core Competencies	Opportunity identification, creativity and innovation, critical thinking, problem-solving, entrepreneurial thinking, financial literacy, digital literacy, market research, business planning, communication, negotiation, marketing, teamwork, decision-making, technological competence
Core Values	Creativity, innovation, integrity, accountability, resilience, self-reliance, responsibility, perseverance, adaptability, customer orientation, ethical entrepreneurship
Pedagogical Approaches	Case study, practical demonstration, experiential learning, project-based learning, problem-based learning, brainstorming, group work, market research, business simulation, idea pitching, digital pedagogy, Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	Business Model Canvas, sample business plans, market research tools, financial records/templates, case studies, digital devices, internet resources, e-commerce platforms, multimedia resources, AI and other emerging technology tools, National Curriculum for Basic Education.
Assessment Methods	Self-assessment, peer assessment, group assessment, business idea presentation, pitching, market research project, business plan/project, practical tasks, quizzes, assignments, continuous assessment

REFERENCES AND FURTHER READING

1. Udukeke, F.O (2023). *Venture Creation: Entrepreneurship Guide*.
2. Entrepreneurship and Venture Creation: Theory and Practice by Association of Business Specialists and Entrepreneurs of Nigeria. (ABSEN)
3. Olannye, P.O et al. (2018) *Basic Entrepreneurship: Small Business Management & Venture Creation*.
4. MIT Open Course ware: New Enterprises.
5. The Startup Owner's Manual Resource Repository.

EDU 501 Teaching Practice

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 6 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Teaching Practice is an advanced practical professional course designed to provide student teachers with extended opportunities to apply and consolidate their subject-matter knowledge, pedagogical skills and professional competencies in authentic classroom settings. The course builds on the experiences acquired during Teaching Practice I and focuses on more independent and effective teaching practice. Students are expected to plan and deliver lessons, employ appropriate teaching methods and strategies, use instructional facilities effectively, assess learners' progress and manage classroom activities efficiently. The course also emphasises the application of child psychology and knowledge of individual differences to address learners' diverse academic, social, emotional and developmental needs. Through supervised teaching, observation, feedback, reflective practice and professional engagement, students develop greater confidence, competence, responsibility and positive attitudes required for effective teaching.

RELEVANCE STATEMENT

Teaching Practice is relevant because it provides student teachers with an opportunity to consolidate and demonstrate the professional knowledge, skills and attitudes required for effective classroom practice. It bridges the gap between educational theory and professional teaching by enabling students to independently apply subject knowledge, pedagogical principles, child psychology and classroom management techniques. The course prepares prospective teachers to respond effectively to individual differences and diverse learning needs, select and use appropriate instructional facilities, and create conducive learning environments. It also promotes professional responsibility, reflective practice, effective communication and continuous improvement. Successful completion of the course equips student teachers with practical competencies necessary for effective and responsible teaching in schools.

COURSE OBJECTIVES

The objectives of this course are to:

1. Apply comprehensive subject-matter knowledge accurately and effectively in classroom teaching.

2. Plan, organise and deliver well-structured lessons using appropriate pedagogical approaches and teaching strategies.
3. Demonstrate effective classroom communication and interaction skills during teaching and learning activities.
4. Apply principles of child psychology in understanding learners' behaviour, development and learning needs.
5. Recognise and respond appropriately to individual differences among learners in actual classroom situations.
6. Adapt teaching methods, learning activities and instructional materials to accommodate learners with diverse abilities, interests and learning needs.
7. Select, prepare and effectively use appropriate instructional facilities, materials and educational technologies to facilitate learning.
8. Demonstrate positive professional attitudes, values, commitment and ethical conduct towards teaching and learners.
9. Apply effective classroom management strategies to establish and maintain a safe, orderly and conducive learning environment.
10. Demonstrate appropriate strategies for managing learners' behaviour and promoting positive classroom participation.
11. Apply suitable assessment techniques to monitor learners' understanding, progress and achievement.
12. Use feedback from learners, supervising teachers and other professional sources to improve teaching performance.
13. Demonstrate reflective practice by evaluating teaching experiences and identifying areas for professional improvement.
14. Demonstrate confidence, initiative, responsibility and professional competence in performing teaching duties.
15. Integrate subject knowledge, pedagogical skills, child psychology, instructional resources and classroom management in effective classroom practice.

LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Demonstrate accurate and effective application of subject-matter knowledge in planning and delivering classroom lessons.

2. Plan, organise and deliver well-structured lessons using appropriate pedagogical approaches, teaching methods and instructional strategies.
3. Demonstrate effective verbal and non-verbal communication and interaction skills that promote meaningful teaching and learning in the classroom.
4. Apply principles of child psychology to explain and respond appropriately to learners' behaviour, developmental characteristics and learning needs.
5. Identify and respond appropriately to individual differences in learners' abilities, interests, backgrounds and learning needs in classroom situations.
6. Adapt teaching methods, learning activities and instructional materials to accommodate learners with diverse abilities, interests, learning styles and educational needs.
7. Select, prepare and effectively utilise appropriate instructional facilities, materials and educational technologies to enhance learners' understanding and participation.
8. Demonstrate positive professional attitudes, values, commitment and ethical conduct in interactions with learners, colleagues, supervisors and other stakeholders.
9. Apply effective classroom management strategies to establish and maintain a safe, orderly, inclusive and conducive learning environment.
10. Apply appropriate strategies for managing learners' behaviour and promoting positive participation, engagement and cooperation in classroom activities.
11. Select and apply appropriate assessment techniques to monitor learners' understanding, progress and achievement and to inform teaching decisions.
12. Use constructive feedback from learners, supervising teachers and other professional sources to identify weaknesses and improve teaching performance.
13. Engage in reflective teaching practice by evaluating teaching experiences, identifying strengths and weaknesses, and developing strategies for professional improvement.
14. Demonstrate confidence, initiative, responsibility and professional competence in planning and performing teaching duties and other professional responsibilities.
15. Integrate subject-matter knowledge, pedagogical skills, knowledge of child psychology, instructional resources, assessment and classroom management skills to demonstrate effective classroom practice.

COURSE CONTENT

- Effective and responsive teaching practices and interactions are key for all learning in professional teacher preparation

- The importance of teaching practice is to provide the students with an opportunity to apply their pedagogical knowledge and skills in practice
- Therefore, the practical implementation of teaching and learning strategies in the classroom, as applied to the subject, area should be taught through micro-teaching before students embark on the exercise

CATEGORY	DETAILS
Core Competencies	• Critical thinking and reflective thinking • Creativity, innovation, and instructional planning • Collaboration, communication, and leadership
Core Values	• Integrity and honesty • Responsibility and perseverance • Respect, inclusion, and team spirit • Humility and service
Pedagogical Approaches	• Learner-Centred Approach, Collaborative /Cooperative Learning • Problem-Based Learning, Blended Approach, Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Digital Resources • Audio-visual Resources • Feedback Tools • National Curriculum for Basic Education
Assessment Methods	• **D**irect Observation • Student Feedback • Portfolio Assessment • Performance-Based Assessment • Supervisor or Mentor Evaluation

REFERENCES AND FURTHER READING

1. Cirocki, A.; Farrelly, R.& Sapp, T. (2024). *Developing Materials for Innovative Teaching and Sustainable Learning*.
2. Spiro, J., & Paran, A. (2023). *Becoming a Reading Teacher: Connecting Research and Practise*.
3. Robinson, A. (2022). *Principles and Practice of Teaching*.
4. Iwu, A. O. (n.d). Teaching Practice: An Integrated Approach.
5. Teaching Practice Manuals for Nigerian Universities.
6. OER Commons: Teacher Education and Practicum Hub.
7. UNESCO Open Resources for Teacher Education

EDU 500 Research Project

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory Core Course | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Research Project is a practical and independent research course designed to develop students' competence in identifying, investigating and reporting educational problems within their areas of specialisation. The course provides students with opportunities to apply knowledge and skills acquired from research methods, educational measurement and statistics to the systematic investigation of contemporary educational issues. Students are guided through the processes of identifying researchable problems, reviewing relevant literature, formulating research questions and objectives, designing appropriate research studies, selecting samples, developing and validating research instruments, collecting and analysing data, and interpreting findings. Emphasis is placed on independent inquiry, academic writing, appropriate citation and referencing, research ethics and effective communication of research findings. Students undertake individual research projects under the guidance of research supervisors and produce coherent research reports based on their investigations.

RELEVANCE STATEMENT

The Research Project is relevant because it provides students with practical experience in applying research knowledge and skills to real educational problems. It develops students' capacity to investigate contemporary issues systematically and generate evidence that can contribute to improve teaching, learning, educational planning and professional practice.

The course strengthens students' skills in literature review, research design, sampling, instrument development, data analysis, interpretation and academic reporting. It also promotes independent learning, critical thinking, problem-solving, academic integrity and ethical research practices. By completing an independent research project under supervision, students develop the confidence and competence required for evidence-based decision-making and further academic or professional work in education.

COURSE OBJECTIVES

The objectives of this course are to:

1. Identify and formulate researchable topics relating to contemporary educational problems within their areas of subject specialisation.
2. Examine and clearly state educational research problems, including their context, significance and implications.
3. Search for, select and critically review relevant literature related to identify research problems.
4. Develop appropriate research questions, objectives and hypotheses where applicable.
5. Conceptualise and design appropriate research studies for investigating identified educational problems.
6. Select appropriate research methodologies, designs, populations and sampling techniques for educational research.
7. Develop, adapt and establish the validity and reliability of questionnaires, tests, interview schedules, observation schedules and other relevant research instruments.
8. Plan and implement appropriate procedures for selecting research samples and collecting relevant data.
9. Identify and apply appropriate statistical techniques for analysing data in accordance with research objectives and questions.
10. Analyse, interpret and present research findings accurately and logically.
11. Write a coherent and well-structured research report in accordance with accepted academic and institutional standards.
12. Apply appropriate citation and referencing techniques in acknowledging sources of information used in the research project.
13. Demonstrate understanding of ethical principles and responsible practices in conducting educational research.

14. Demonstrate effective academic communication skills in presenting and defending research findings.
15. Work independently and responsibly in planning, conducting and completing a research project under the guidance and supervision of a research supervisor.

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Identify and formulate appropriate researchable topics addressing contemporary educational problems within their areas of subject specialisation.
2. Clearly state and explain educational research problems, including their context, significance, scope and implications for educational theory and practice.
3. Search for, select, synthesise and critically evaluate relevant literature related to identified educational research problems using appropriate academic sources.
4. Formulate clear and researchable research questions, objectives and hypotheses, where applicable, based on identified research problems.
5. Conceptualise and design appropriate research studies for systematically investigating identified educational problems.
6. Select and justify appropriate research methodologies, designs, target populations and sampling techniques in relation to specific educational research problems.
7. Develop or adapt appropriate research instruments and establish evidence of their validity and reliability for collecting relevant educational data.
8. Plan and implement appropriate sampling and data-collection procedures in accordance with the requirements of the selected research design.
9. Select and apply appropriate statistical techniques for analysing research data in accordance with the research questions, objectives and hypotheses.
10. Analyse, interpret and present research findings accurately, logically and coherently using appropriate tables, figures and statistical procedures where necessary.
11. Write and organise a coherent research report that conforms to accepted academic, institutional and disciplinary standards.
12. Apply appropriate citation and referencing conventions to acknowledge sources of information and maintain academic integrity in research writing.
13. Identify and apply ethical principles and responsible research practices in the planning, conduct, analysis and reporting of educational research.

14. Demonstrate effective academic communication and presentation skills in presenting, explaining and defending research findings before supervisors, assessors and other academic audiences.
15. Demonstrate independence, responsibility and effective research-management skills in planning, conducting, documenting and completing a research project under appropriate supervision.

COURSE CONTENT

- Application of knowledge and skills acquired in research methods, statistics and evaluation in identifying and proffering solutions to educational problems
- Working independently under the guidance of a Project Supervisor
- Planning and execution of a well-conceptualised research and presenting a written report on the study conducted

CATEGORY	DETAILS
Core Competencies	• Critical thinking and analytical skills • Digital literacy and information literacy • Reflective thinking and self-development • Collaboration and communication skills
Core Values	• Integrity and honesty • Responsibility and perseverance • Humility and team spirit • Service and transparency
Pedagogical Approaches	• Collaborative /Cooperative Learning • Inquiry-Based Learning • Project-Based Learning • Problem-Based Learning. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Digital and online Resources • Audio-visual Resources • Experiential and Hands-on-Resources. • National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Formative Assessment • Summative Assessment • Alternative Assessment

1. Ighomereho, S. (2024). Fundamentals of Research Project Writing in Management and Social Sciences.
2. Kwakye, D. O. & Kayii, E. (2024). Research Methods for University Scholars.
3. Isaac, M. & Ogbonna, K (2023). Research Writing and Technique.
4. Okechukwu, O. (2017). Introduction to Research Methodology and Report Writing.
5. Sage Research Methods Community & Open Guides.
6. Networked Digital Library of Theses & Dissertations.

Teaching Practice

Undergoing teaching practice is an indispensable aspect of preservice teacher preparation and teachers' professional development. It affords trainee teachers' maximum opportunity for experiencing teaching, teachers' roles and school administration real time. Given its important place in teacher preparation, the exercise, under the Dual Mandate programme is allotted 6 credit units and designed to be undertaken by all undergraduate as preservice teachers which should last for a full semester duration which should run at a stretch from the beginning of year 500 1st Semester to the end (For a duration of Twelve weeks) and for the NCE students, it should run at a stretch from the beginning of NCE III 1st semester to the end. Also, teaching practice is compulsory for all NCE students. It has to be done in the candidate's teaching subject (s) and has to be passed for the candidate to earn the 6 credits required for graduation in this course area. It must be coordinated by School of Education, specifically the coordination to be housed in the Department of Curriculum and Instructions, under the supervision of a committee with the Dean of Education as Chairman. The duration should commence with teaching practice orientation. During this period, trainee teachers are assigned supervisors from colleges, mentors from their associate schools of teaching practice. Also, college monitoring teams, mainly from the Quality assurance Unit are also assigned responsibilities to follow up on the trainee teachers, the school-based mentors and teaching practice supervisors with a view to ensuring that trainee teachers are afforded maximum opportunity for acquiring and practising skill of teaching and school management. During Teaching practice a minimum of **ten supervision** should be made on a student before the final computations of such

students' TP score is made. As for the NCE students only students who pass EDU 213 – Micro teaching theory would qualify to offer EDU 224-Micro teaching practicum and only students who pass EDU 224 would qualify to go on Teaching Practice. Find attached in A and B below teaching practice assessment instrument and supervisors' monitoring instrument respectively.

SED 401 Special Method of Teaching Integrated Science II

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Special Methods in Teaching Integrated Science II is a professional course designed to equip prospective Integrated Science teachers with advanced knowledge, skills and competencies required for effective teaching of Integrated Science at the secondary school level. The course builds on the principles and practices introduced in Special Methods in Teaching Integrated Science I, with emphasis on practical application, lesson planning, instructional strategies, classroom management, assessment and the integration of appropriate teaching and learning resources. The course exposes students to various learner-centred methods suitable for teaching scientific concepts, processes and skills. It also develops teachers' ability to select appropriate methods according to the nature of the topic, learners' abilities, available resources and instructional objectives. Attention is given to laboratory and field activities, problem-solving, inquiry, project-based learning, cooperative learning, demonstration, discussion and the effective use of information and communication technology (ICT). Students are also trained to evaluate teaching effectiveness through appropriate assessment techniques and to identify and address learning difficulties encountered by Integrated Science students.

Course-Relevant Statement

The course is relevant because effective teaching of Integrated Science requires teachers who possess both sound scientific knowledge and appropriate pedagogical skills. Integrated Science involves concepts from different areas of science and therefore requires teaching approaches that promote integration, experimentation, critical thinking, creativity, problem-solving and scientific inquiry. Special Methods in Teaching Integrated Science II prepares prospective teachers to translate scientific knowledge into meaningful classroom experiences. It enables them to use appropriate instructional strategies and resources, manage practical activities safely, assess learners effectively and adapt instruction to

different learning needs. The course therefore contributes to the preparation of competent, innovative and reflective Integrated Science teachers who can promote scientific literacy and meaningful learning among secondary school students.

COURSE OBJECTIVES

The objectives of this course are to:

- Explain the principles and purposes of teaching Integrated Science at the secondary school level.
- Identify and describe different methods and strategies for teaching Integrated Science.
- Select appropriate teaching methods based on instructional objectives, content and learners' characteristics.
- Prepare effective lesson plans and lesson notes for Integrated Science topics.
- Demonstrate the use of inquiry, discovery, problem-solving and project-based approaches in teaching science.
- Organise and conduct meaningful laboratory, field and practical activities.

LEARNING OUTCOMES

At the end of the course, learners should be able to:

1. Demonstrate competence in planning and presenting Integrated Science lessons.
2. Apply appropriate learner-centred instructional methods in teaching different science concepts.
3. Prepare and use relevant instructional materials and ICT tools effectively.
4. Conduct laboratory, demonstration and field activities safely and effectively.
5. Apply inquiry, discovery, cooperative learning and problem-solving approaches in science teaching.
6. Formulate appropriate instructional objectives using measurable learning outcomes.
7. Develop valid and reliable assessment tasks for evaluating students' knowledge, skills and attitudes.

COURSE CONTENT

- Science teaching resource kits making
- Influence of examination and test on students' performance
- Language in science and science nomenclature
- Development of science modules for teaching the gifted

- Visually handicap (blind)
- Hearing impaired and other teaching science to exceptional children
- Teaching science as activities and process skills acquisition
- Further treatment of some difficult concepts in Basic Science and Technology
- General principles and philosophy of improvisation in science teaching
- Sourcing for and producing a catalogue of science teaching materials in the immediate and distant environment
- Further treatment of Laboratory design
- Organisation and management and Safety in the Laboratory

CATEGORY	DETAILS
Core Competencies	• Lesson-planning competency: • Pedagogical competency • Scientific inquiry competency • Practical laboratory competency • Instructional-resource competency • ICT and digital competency • Classroom-management competency • Assessment competency • Communication competency
Core Values	• Curiosity • Creativity • Critical thinking • Collaboration • Responsibility • Safety consciousness • Integrity • Respect • Inclusiveness • Environmental responsibility

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-Based Learning • Constructivist Approach • Problem- Based Learning • Project-Based Learning • Cooperative and Collaborative Learning • Discussion Method • Field-Based Learning • 8 Concept Mapping • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Integrated science text book • Laboratory resources • Locally available materials • ICT resources • Digital resources • National Curriculum for Basic Education
Assessment Methods	• Formative Assessment • Summative Assessment • Performance-Based Assessment

REFERENCES/MATERIALS

National Commission for Colleges of Education (NCCE). (2024). *Trends and New Trends in Teacher Education* (Vol. 21).

University of Nigeria, Nsukka, Department of Science Education. (n.d.). *Course Modules: Integrated Science Education Special Methods*.

Seland Strata, T. T., Henriksen, E. K., & Jegstad, K. M. (2023). Inquiry-based science education in science teacher education: A systematic review. *International Journal of Science Education, 45*(3), 191–249.

ENT 401 Entreprenueship in Teaching Integrated Science

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Entrepreneurship in Teaching Integrated Science is a course designed to equip prospective Integrated Science teachers with the knowledge, skills, attitudes and competencies required to identify opportunities, develop innovative ideas and transform scientific knowledge into useful products, services and solutions. The course links Integrated Science with entrepreneurship by exposing learners to practical ways of applying scientific principles to real-life economic, environmental and community problems.

The course focuses on entrepreneurial thinking, creativity, innovation, opportunity identification, problem-solving, product development, project management, resource mobilisation, marketing and basic financial management. It also introduces learners to the development of small-scale science-related enterprises based on areas such as environmental management, agricultural science, renewable energy, water purification, waste recycling, science equipment production and educational technology.

COURSE-RELEVANT STATEMENT

Entrepreneurship in Teaching Integrated Science is relevant because science education should not only provide learners with theoretical knowledge but should also enable them to apply scientific knowledge to solve practical problems and create opportunities for self-employment and community development. Integrated Science provides numerous opportunities for entrepreneurial activities because its concepts can be applied to agriculture, health, environmental protection, energy, water resources, recycling, food processing, technology and the production of simple scientific equipment. Through entrepreneurial approaches, prospective teachers can learn how to identify local problems and guide students in developing scientifically based solutions.

The course also supports the Nigerian emphasis on practical and innovation-driven entrepreneurship education. In 2026, the National Universities Commission specifically called for entrepreneurship education to move beyond theoretical teaching towards practical, action-oriented approaches that develop creativity, resilience, innovation and job-creation capacity. Furthermore, evidence from Nigerian education research indicates that effective entrepreneurship education requires competent teachers, appropriate instructional methods and adequate instructional resources.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define and explain the concepts of entrepreneurship, entrepreneurial education, innovation and enterprise.
2. Explain the relationship between Integrated Science education and entrepreneurship.
3. Identify entrepreneurial opportunities that can arise from scientific knowledge and skills.
4. Develop entrepreneurial mindsets involving creativity, initiative, resilience, risk awareness and problem-solving.
5. Identify community and environmental problems that can be addressed through scientific and technological solutions.
6. Generate and evaluate innovative ideas for science-related products and services.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Explain the meaning, characteristics and importance of entrepreneurship in science education.
2. Demonstrate an entrepreneurial mindset when addressing scientific and community problems.
3. Identify viable entrepreneurial opportunities from Integrated Science concepts.
4. Generate creative and innovative ideas for science-related products and services.
5. Develop simple prototypes and useful products from locally available materials.
6. Apply scientific knowledge to solve practical environmental, health, energy and technological problems.

COURSE CONTENT

- Understanding of the issues and strategies involved in starting and managing a small business, The student will go through the steps required to develop a business plan including marketing, Organising, financing, controlling, and managing risk, the role of small business, definition of Small, business, strengths and weaknesses of small business, trends expected for small businesses, Entrepreneurship and ownership – definition of entrepreneur, Traits of successful entrepreneurs, Rewards and hazards of being an entrepreneur, Ethics and social responsibility- The role that values play in ethical behaviour, the importance of ethics, and ethics versus social responsibility, The

business plan-the need for a business plan, the steps in the preparation of a business plan, operating plans and financial plans

- **Location:** importance of site selection for a business, processes for selecting the right site for a business
- Financing -estimating the money needed to launch a new business, ways to raise money for a new business, Organisational planning- staffing and training, organisational charts
- Planning and controlling- stages of growth for a business and the problems encountered at each, the interconnectedness of planning and controlling, Setting realistic goals

CATEGORY	DETAILS
Core Competencies	• 1 Entrepreneurial mindset: • Opportunity-recognition competency • Creativity and innovation • Scientific problem-solving competency • Product-development competency • Business-planning competency • Financial competency • Digital competency • Teamwork and leadership
Core Values	• Creativity • Innovation • Integrity • Responsibility • Self-reliance • Hard work • Resilience • Teamwork • Respect

CATEGORY	DETAILS
Pedagogical Approaches	• Experiential Learning • Project-Based Learning • Students should undertake projects such as: • Production of simple science equipment • Recycling of waste materials • Production of organic manure • Simple water-treatment projects • Solar-energy projects • Production of teaching aids • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks • Laboratory equipment • Locally available materials • ICT resources • Business resources • Marketing resources • National Curriculum for Basic Education
Assessment Methods	• Oral questioning • Classroom discussion • Short quizzes • Individual assignments • Group assignments • Practical exercises • Peer assessment • Self-assessment • Teacher observation

REFERENCES AND FURTHER READING

UNESCO-IBE. (2023). *Values of entrepreneurship: Equipping learners with the skills and mindset for entrepreneurial success.*

Somià, T., Lechner, C., & Pittaway, L. (2024). Assessment and development of coachability in entrepreneurship education. *International Journal of Management Education*, *22*(1), 100921.

Mack, A., Carter-Rogers, K., Bahaw, P., et al. (2024). Entrepreneurial knowledge and skill exposure in vocational education: Development of a new assessment scale. *Discover Education*, *3*, 237.

Ojo, M. B., & Okwilagwe, E. A. (2024). Assessment of entrepreneurship education knowledge acquisition, change of attitude to entrepreneurship and skills acquisition among university undergraduates in South-Western Nigeria. *European Journal of Theoretical and Applied Sciences*, *2*(1), 713–723.

ESI 401 Nature of Matter II

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an introduction to the stoichiometry, elementary thermochemistry. Rates of reaction. Chemical equilibrium and thermodynamics, it also covers acids, bases and salts. Redox reactions and introduction to electrochemistry. Students will explore thermochemistry, reaction rates, chemical equilibrium, acids, bases, salts, redox reactions, and basic electrochemistry. The course equips students with essential knowledge and problem-solving skills for further studies in chemistry and related scientific fields.

RELEVANCE STATEMENT

This course equips students with essential chemical knowledge and problem-solving skills, preparing them for careers in science, medicine, engineering, and technology. It addresses societal needs by promoting scientific literacy, enabling solutions to challenges in health, environment, industry, and everyday life. Nationally, it supports the development of a skilled workforce, fostering research, innovation, and technological advancement for economic growth and sustainable development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the rates of reaction.

2. Describe chemical equilibrium and thermodynamics.
3. Apply quantitative chemical principles to solve basic chemical problems.
4. Explain energy changes, reaction processes by discussing electrochemistry and basic electrochemistry concepts.
5. Demonstrate understanding of fundamental redox reactions in relation to everyday and laboratory applications.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Demonstrate understanding of the chemical equation.
2. Discuss the rates of chemical reaction.
3. Solve quantitative and qualitative chemical problems involving chemical equations, and stoichiometry.
4. Describe chemical equilibrium and thermodynamics.
5. Apply knowledge of chemical reactions to practical contexts

COURSE CONTENT

- Chemical equations
- Stoichiometry
- Elementary thermochemistry
- Rates of reaction
- Chemical equilibrium and thermodynamics
- Acids, bases and salts
- Redox reactions and introduction to electrochemistry
- Volumetric Analysis, Qualitative Analysis

CATEGORY	DETAILS
Core Competencies	• 1 Apply chemical principles • 2 perform accurate calculations • 3 conduct experiments safely. • 4 critical thinking.

CATEGORY	DETAILS
Core Values	• Accuracy • Ethical scientific practice • Curiosity • Environmental responsibility, and • Teamwork, promoting lifelong learning.
Pedagogical Approaches	• 1 student-centred approach • Interactive lectures • Guided discussions, and • Visual models. • Problem-solving, inquiry-based learning • Laboratory activities. • Encourages critical thinking. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Learning resources such as Textbooks, Journals & • 2 Online Resources and Practical & Interactive Tools • 3 National curriculum for Basic Education (Integrated Science)
Assessment Methods	• 1 Quizzes, assignments and class participation, alongside • Laboratory practicals and reports to assess practical skills. • A mid-semester test and a final written examination. • Semester examination consisting of multiple-choice, short-answer

REFERENCES AND FURTHER READING

Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2024). *Chemistry: The Central Science* (16th ed.). Pearson.

Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2023). *General Chemistry: Principles and Modern Applications* (12th ed.). Pearson.

BIO 401 Genetics II

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Genetics II is an advanced course that builds on the fundamental principles of heredity, Mendelian genetics and chromosome biology introduced in Genetics I. The course provides students with a deeper understanding of the mechanisms responsible for genetic variation, inheritance patterns and the transmission and expression of genetic information. Major areas include population genetics, cytogenetics, microbial genetics, plant and animal genetics, biochemical and molecular genetics, human genetics, gene interactions, pedigree analysis, mutation and chromosomal variation. The course also examines deviations from simple Mendelian inheritance, gene frequencies and the Hardy-Weinberg principle, sex determination, mutations, chromosomal abnormalities and applications of genetics in medicine, agriculture and biotechnology. The broader Nigerian teacher-education curriculum similarly emphasises DNA, genetic codes, sex-linked inheritance, mutations, human heredity, genetic counselling and applications of genetics.

COURSE-RELEVANT STATEMENT

Genetics II is relevant because an understanding of genetics is essential for explaining heredity, biological variation, evolution, human health, agricultural improvement and biotechnology**.** Knowledge of genetic mechanisms enables students to understand how characteristics are transmitted from parents to offspring and how genetic variation arises within populations. The course is particularly important in contemporary science education because developments in molecular genetics, genomics, genetic engineering and genome editing have expanded the applications of genetics in medicine, agriculture, environmental management and biotechnology. Current genetics curricula increasingly include topics such as mutation and DNA repair, chromosome abnormalities, linkage and recombination, population genetics and genome-editing technologies. For Integrated Science teachers, Genetics II provides the scientific foundation necessary to explain genetic phenomena accurately and to relate genetics to everyday issues such as inherited disorders, blood groups, sex-linked characteristics, selective breeding, biodiversity and conservation.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain advanced concepts and terminology used in genetics.
2. Explain the molecular and chromosomal basis of heredity.
3. Describe different patterns of inheritance beyond simple Mendelian inheritance.
4. Explain gene interactions and their effects on phenotypic expression.
5. Analyse pedigree diagrams and determine possible inheritance patterns.
6. Explain the principles of population genetics.
7. Apply the Hardy-Weinberg principle to genetic problems.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Define and explain major concepts and terminology in advanced genetics.
2. Analyse different patterns of inheritance and gene interaction.
3. Construct and interpret genetic crosses and pedigree charts.
4. Calculate and interpret gene and genotype frequencies in populations.
5. Apply the Hardy-Weinberg principle to appropriate population-genetics problems.
6. Explain the causes and significance of genetic variation.
7. Identify and describe structural and numerical chromosome abnormalities.

COURSE CONTENT

- Aspects of human genetics, pedigree analysis, further consideration of various deviations from basic principles
- Gene interactions, including biochemical mutants, nucleic acids and nucleotides, DNA replication, mutation of DNA, proteins and regulation of gene expression
- DNA technology and genetic engineering
- Pre- requisite -ISC 212

CATEGORY	DETAILS
Core Competencies	• Genetic reasoning and conceptual competence • Problem-solving competence • Practical and laboratory competence • Data analysis competence • Scientific inquiry competence • Digital and technological competence • Critical-thinking competence
Core Values	• Scientific integrity • Accuracy and objectivity • Respect for life • Ethical responsibility • Curiosity and innovation • Teamwork and cooperation • Respect for diverse opinions
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Cooperative learning • Project-based learning • Concept mapping • Case-study approach • Simulation and modelling • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Print resources • Genetics textbooks and reference books • Biology textbooks • Laboratory manuals • Journals and current scientific articles • Course • Genetics problem sets and worksheets • Pedigree-analysis exercises • Onion root-tip • National Curriculum for Basic Education
Assessment Methods	• Pre-test • Concept maps • Diagnostic questions • Short quizzes • Oral questioning • Formative assessment • Conduct continuously during instruction. • Class exercises

REFERENCES AND FURTHER READING

Ojo, A. T. (2024). Examination of secondary school students' conceptual understanding, perceptions, and misconceptions about genetics concepts. *Pedagogical Research*, *9*(1), em0185.

Silaban, O. R., Resti, N., Koerniadi, D., Kusnadi, & Rahman, T. (2024). TPACK and learning strategies in genetics: A pedagogical study. *EduMatSains*, *9*(1), 175–186.

Audu, A. O. P., & Agba, A. A. (2024). Effects of inquiry strategy on senior secondary school students' achievement in reformulation of knowledge in biology concepts. *International Journal of Arts, Communication and Pedagogy*, *3*(2).

Walck-Shannon, E. M., et al. (2025). Students don't learn the way they think they do in a large, active-learning genetics course. *CBE – Life Science Education*.

BIO 402 Population B Iology and Evolution

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Population Biology and Evolution is a course that introduces students to the principles governing biological populations and the evolutionary processes responsible for changes in organisms over time. The course examines population structure, population growth, population density, population distribution, demographic processes, carrying capacity, competition, predation, migration and population regulation. The course also explores the mechanisms of biological evolution, including genetic variation, mutation, natural selection, genetic drift, gene flow, recombination, sexual selection and reproductive isolation. Students are introduced to concepts such as adaptation, speciation, evolutionary relationships, molecular evolution, coevolution and the evidence supporting evolutionary theory.

Emphasis is placed on the relationship between population biology, genetics, ecology and evolution**,** enabling students to understand how environmental conditions and genetic processes interact to influence population change. The course also considers contemporary applications of population biology and evolution to biodiversity conservation, climate change, agriculture, disease ecology and sustainable management of natural resources.

COURSE RELEVANT STATEMENT

Population Biology and Evolution is relevant to the preparation of students in Biology and Integrated Science because it provides an understanding of how populations change, survive, adapt and evolve in response to genetic and environmental factors. Knowledge of population processes is essential for understanding biodiversity, ecosystem stability, species distribution and conservation. The course is particularly relevant to contemporary challenges such as biodiversity loss, habitat destruction, climate change, invasive species and sustainable management of biological resources**.** Understanding evolutionary processes also helps students appreciate how organisms adapt to changing environments and how populations may respond to environmental pressures. The course develops students' abilities to interpret biological data, investigate population changes, explain evolutionary relationships and apply scientific principles to real-world biological and environmental problems. It therefore contributes to the development of scientific reasoning, environmental responsibility, problem-solving skills and evidence-based decision-making.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define and explain the basic concepts and principles of population biology and evolution.
2. Describe the characteristics of biological populations, including population size, density, distribution, age structure and sex ratio.
3. Explain population growth patterns, including exponential and logistic growth.
4. Analyse the factors that regulate population size and distribution.
5. Explain the roles of birth rate, death rate, immigration and emigration in determining population dynamics.
6. Describe ecological interactions such as competition, predation, parasitism, mutualism and their effects on populations.
7. Explain the sources of genetic variation within populations.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Explain major concepts and principles of population biology.
2. Describe the structure and dynamics of biological populations.
3. Explain population growth and regulation.
4. Discuss factors affecting population distribution and abundance.
5. Explain genetic variation and its importance to evolutionary change.
6. Describe the major mechanisms of evolution.
7. Explain natural selection and adaptation.

COURSE CONTENT

Biological properties of species; Natural selection, variations, isolation mechanisms (including their breakdown resulting in hybridisation, adaptation, origin of life, origin of species and adaptive radiation, Evolution of selected groups of plants and animals, including humans), Population dynamics and factors affecting population growth.

CATEGORY	DETAILS
Core Competencies	• Scientific knowledge competence • Population analysis competence • Quantitative and mathematical competence • Data interpretation competence • Evolutionary reasoning competence • Problem-solving competence • Field-research competence • Critical-thinking competence
Core Values	• Respect for life and biodiversity • Environmental responsibility • Scientific honesty • Objectivity • Curiosity • Teamwork • Respect for alternative viewpoints • Ethical responsibility
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Field-based learning • Cooperative learning • Project-based learning • Discovery learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	Textual resources • Recommended biology textbooks. • Population ecology and evolutionary biology reference books. • Scientific journals and research articles. • Course handouts and lecture notes. • Field guides for local plants and animals. Laboratory resources • Microscopes. • Specimen bottles and collection equipment. • National Curriculum for Basic Education
Assessment Methods	• Diagnostic assessment Formative assessment • Short quizzes. • Oral questioning. • Classroom discussions. • Concept maps. • Practical exercises. • Group assignments.

REFERENCES AND FURTHER READING

Clark, M. A., Douglas, M., & Choi, J. (2018). *Biology 2e*. OpenStax. The resource remains actively maintained, with its PDF version updated in July 2025.

OpenStax. (2025). *Population demography*. In *Biology 2e*.

OpenStax. (2025). *Population evolution and population genetics*. In *Biology 2e*.

OpenStax. (2025). Adaptive evolution. In Biology

GLY 401 Introduction to Geology

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Introduction to Geology is a foundational course that introduces students to the Earth, its materials, structure, history and the geological processes that shape its surface and interior.

The course examines the origin and evolution of the Earth, the rock cycle, minerals, rocks, plate tectonics, geological structures, weathering, erosion, earthquakes, volcanoes and other internal and external geological processes. It also introduces students to geological time, fossils, natural resources, groundwater, environmental geology and the relationship between geological processes and human activities. Practical activities focus on the observation and identification of common minerals and rocks, interpretation of geological maps, and basic field investigation techniques.

COURSE RELEVANT STATEMENT

Geology is relevant to understanding the physical foundation of the Earth and the natural processes that influence human life and the environment. Knowledge of geology enables students to understand the formation and distribution of rocks, minerals, soils, groundwater and other natural resources. It also provides a scientific basis for understanding and managing geological hazards such as earthquakes, landslides, erosion and volcanic activity. In Nigeria, introductory geological knowledge is particularly relevant to mineral exploration, groundwater development, construction, agriculture, environmental management and the sustainable utilisation of natural resources. The course therefore provides an essential foundation for further studies in earth science, environmental science, geography, mining, engineering and integrated science.

COURSE OBJECTIVES

The objectives of this course are to:

- Define geology and explain its scope, branches and importance to society.
- Describe the origin, age and general evolution of the Earth and its position within the solar system.
- Explain the internal structure of the Earth**,** including the crust, mantle and core.
- Identify common minerals based on their physical and chemical properties.
- Describe the major types of rocks**,** including igneous, sedimentary and metamorphic rocks.
- Explain the rock cycle and the processes responsible for the formation and transformation of rocks.

LEARNING OBJECTIVES

At the end of the course students should be able to:

i. Describe the structure and composition of the earth;

ii. Identify the major minerals and rocks; and

iii. Recognise and explain driving forces within the earth and the manifestations.

iv. List common minerals based on their physical and chemical properties.

v. Discuss the major types of Rocks.

vi. Explain the rock cycle and the processes responsible for the formation and transformation of rocks

COURSE CONTENTS

Elements of Physical geology and physiographic features of the Earth, The solar system, Origin and characteristics of the atmosphere and hydrosphere, Classification, properties and description of major minerals, rock types and occurrence of economic minerals, History of the Earth and Universe, Earth Internal Structure, Plate Tectonics and Earthquakes.

CATEGORY	DETAILS
Core Competencies	• Geological knowledge and understanding • Mineral and rock identification • Earth-system thinking • Geological observation and field skills • Map and spatial interpretation • Scientific inquiry and problem-solving • Geological-process reasoning
Core Values	• Scientific integrity and honesty • Environmental responsibility • Respect for nature and Earth resources • Sustainability • Critical thinking • Curiosity and scientific inquiry • Accuracy and careful observation • Safety consciousness

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Inquiry-based learning • Field-based learning • Laboratory practicals • Problem-based learning • Project-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Hand specimens of common rocks and minerals • Hand lenses • Streak plates • Hardness-testing materials • Magnets • Microscopes • Rock and mineral identification keys • National Curriculum for Basic Education
Assessment Methods	• Short quizzes • Class exercises • Oral questioning • Mineral and rock identification exercises • Map-reading exercises • Group discussions • Concept maps • Practical worksheets

REFERENCES AND FURTHER READING

American Geosciences Institute (AGI). (2020). *A Call for Action: The Future of Undergraduate Geoscience Education.* AGI. This resource provides guidance on geoscience concepts, skills, competencies, curriculum development and assessment.

BIO 403 Biogeography and Soil Biology

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Biogeography and Soil Biology is a course that introduces students to the distribution of organisms across the Earth and the biological processes occurring within soil ecosystems. The course examines the relationship between organisms and their physical environment, including climate, topography, geological factors, vegetation, and soil characteristics. It also explores soil as a living ecosystem, focusing on microorganisms, soil fauna, decomposition, nutrient cycling, soil fertility, and interactions among soil organisms. Students are introduced to major biogeographical regions, patterns of species distribution, biodiversity, ecological succession, adaptation, and the effects of human activities on ecosystems and soil resources.

RELEVANCE STATEMENT

The study of Biogeography and Soil Biology is relevant to understanding how environmental factors influence the distribution, abundance, diversity, and adaptation of organisms. Knowledge of soil organisms and their activities is essential for understanding decomposition, nutrient cycling, soil fertility, agricultural productivity, biodiversity conservation, and environmental sustainability. The course equips students with knowledge and practical skills needed to appreciate ecosystem processes and address environmental challenges such as soil degradation, habitat destruction, biodiversity loss, and climate change.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define and explain the concepts of biogeography, soil biology, biodiversity, habitat, ecosystem, and biogeographical region.
2. Explain the major factors that influence the geographical distribution of organisms.
3. Describe major terrestrial and aquatic biogeographical regions and their characteristic organisms.
4. Explain the effects of climate, soil, topography, geological history, and human activities on species distribution.
5. Describe patterns of biodiversity and species distribution at local, regional, and global levels.

6. Explain ecological adaptation, dispersal, migration, isolation, speciation, and extinction.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Explain fundamental concepts and principles of biogeography and soil biology.
2. Identify and classify major biogeographical regions and representative organisms.
3. Analyse the environmental factors responsible for the distribution of organisms.
4. Describe the characteristics and functions of soil as a biological ecosystem.
5. Identify common groups of soil microorganisms and soil fauna and explain their ecological roles.
6. Explain and demonstrate the processes of decomposition and nutrient cycling in soil.

COURSE CONTENT

- Gondwanaland and theory of continental drift
- Theory of land bridges
- Distribution of world key floral and faunal groups including factors affecting distribution
- Phyto- and zoo geographical regions of the world, Relationships between plants and animal distributions (emphasising local examples), Concept of succession, colonisation and dispersal in terrestrial plants and animals, Concept of endemicity and refugia, Island biogeography, Physical and chemical nature of soil, Detritus organisms, Cycling of minerals and nutrient pools, Plant and animal soil water relationship, soil sampling techniques, Causes of soil erosion and alleviation methods/ techniques

CATEGORY	DETAILS
Core Competencies	• Scientific knowledge competence • Observation and identification competence • Ecological analysis competence • Soil investigation competence • Data-handling competence • Problem-solving competence • Research competence

CATEGORY	DETAILS
Core Values	• Respect for nature and biodiversity • Scientific curiosity and inquiry • Integrity and honesty in scientific investigation • Teamwork and cooperation • Critical and creative thinking • Sustainability consciousness • Respect for evidence and scientific reasoning • Resource conservation
Pedagogical Approaches	• Inquiry-based learning • Field-based learning • Problem-based learning • Project-based learning • Cooperative learning • Discovery learning • Discussion method • Demonstration method • ICT-supported learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Soil samples from different locations • Soil augers or sampling tools • Hand lenses and microscopes • Petri dishes and specimen containers • Thermometers • Soil pH kits/meters • Soil moisture meters • Computers and tablets • Projectors and interactive displays • National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Oral questioning • Classroom discussions • Short quizzes • Concept maps • Observation of practical activities • Fieldwork exercises • Group presentations • Mid-semester tests • End-of-semester examinations

REFERENCES AND FURTHER READING

Harrison, P. A., McElwee, P. D., & van Huysen, T. L. (Eds.). (2024). *Thematic Assessment Report on the Interlinkages among Biodiversity, Water, Food and Health.* IPBES Secretariat, Bonn.

O'Brien, K., Garibaldi, L., & Agrawal, A. (Eds.). (2024). *Thematic Assessment Report on the Underlying Causes of Biodiversity Loss and the Determinants of Transformative Change and Options for Achieving the 2050 Vision for Biodiversity.* IPBES Secretariat.

EIS 402 Industrial Raw Materials Resource Inventory

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Industrial Raw Materials Resource Inventory is a course designed to introduce students to the identification, classification, distribution, assessment, documentation and sustainable management of natural resources that serve as raw materials for industrial production. The course examines metallic and non-metallic minerals, rocks, fossil fuels, agricultural products, forest resources, water resources and other materials used in various industries. Students will explore the geographical distribution and characteristics of industrial raw materials, methods of resource exploration and inventory, sampling and field identification techniques, resource mapping, quality assessment, processing and utilisation. The course also considers the economic importance of raw materials, value-chain development, environmental impacts of resource extraction and strategies for sustainable resource

management. Emphasis is placed on Nigeria's industrial raw-material resources and their potential contribution to economic diversification and sustainable development.

COURSE RELEVANT STATEMENT

The study of Industrial Raw Materials Resource Inventory is relevant because industrial development depends heavily on the availability, quality, accessibility and sustainable management of raw materials. Nigeria possesses substantial mineral, agricultural, forest and other natural resources that can support manufacturing, construction, energy production and other economic activities. However, inadequate resource information, limited exploration, inefficient utilisation, environmental degradation and dependence on imported industrial inputs can constrain industrial development. The course therefore equips students with the knowledge and practical skills required to identify, inventory, evaluate, map and manage industrial raw-material resources**.** It also develops awareness of responsible resource exploitation, environmental protection, local processing and value addition.

COURSE OBJECTIVES

The objectives of this course are to:

- Define and explain the concepts of industrial raw materials, natural resources, resource inventory and resource assessment**.**
- Classify industrial raw materials into major categories such as metallic minerals, non-metallic minerals, energy resources, agricultural resources and forest resources.
- Identify major industrial raw materials and describe their physical, chemical and economic characteristics.
- Explain the geological, geographical and environmental factors controlling the occurrence and distribution of raw materials.
- Identify major sources of industrial raw materials in Nigeria and other parts of the world.
- Explain the principles and methods of conducting a resource inventory.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

- Define and distinguish key concepts related to industrial raw materials and resource inventories.
- Classify and identify major industrial raw materials based on their characteristics and uses.

- Locate and describe the geographical distribution of selected industrial raw materials.
- Collect, identify and document representative raw-material samples using appropriate field techniques.
- Conduct basic resource inventories involving field observation, sampling, classification and documentation.
- Interpret maps and spatial information relating to the distribution of industrial resources.

COURSE CONTENT

Survey of Nigeria's industries and their raw material requirements, Mineral chemistry, Fossils and their uses, Plant and animal products, Nuclear, solar, aerodynamic/wind and hydrodynamic sources of energy, Potentials and applications of locally available raw materials as industrial feed stocks.

CATEGORY	DETAILS
Core Competencies	• Resource identification competence • Resource inventory competence • Field investigation competence • Geospatial competence • Analytical competence • Problem-solving competence
Core Values	• Sustainability • Scientific integrity • Resource conservation • Teamwork and cooperation • Innovation and creativity • Respect for indigenous and local knowledge
Pedagogical Approaches	• Field-based learning • Inquiry-based learning • Project-based learning • Problem-based learning • Cooperative learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Mineral and rock specimens • Soil and agricultural raw-material samples • Hand lenses • Microscopes • Sample bags and containers • GPS devices or GPS-enabled mobile phones • Compass • National Curriculum for Basic Education
Assessment Methods	• Oral questioning • Class discussions • Short quizzes • Assignments • Concept maps • Sample-identification exercises • Group activities • Fieldwork exercises

REFERENCES AND FURTHER READING

U.S. Geological Survey (USGS). (2026). *Mineral Commodity Summaries 2026*. U.S. Geological

U.S. Geological Survey, National Minerals Information Center. (2026). *Mineral Commodity Summaries 2026 Data Release*. USGS.

Ministry of Solid Minerals Development (MSMD). (2026). *Roadmap for the Growth and Development of the Nigerian Mining Industry*. Federal Government of Nigeria.

ESI 403 Mechanics

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the fundamental principles of classical mechanics, including space, time, vectors, kinematics and Newton’s laws of motion. It covers motion, momentum, energy, systems of particles and rotational dynamics, including torque, angular momentum

and circular motion. The course also explores gravitation, planetary motion, gravitational potential energy, and escape velocity and satellite orbits, providing students with the knowledge and problem-solving skills to analyse and predict physical phenomena.

RELEVANCE STATEMENT

This course is highly relevant as it provides students with a solid foundation in classical mechanics, essential for understanding the physical world and solving real-life problems in physics, engineering and technology. Concepts such as motion, forces, energy, momentum and gravitation are fundamental for applications in mechanics, aerospace, robotics and satellite technology. It also develops critical thinking, analytical and problem-solving skills, enabling students to model and predict physical phenomena, design experiments, and apply Newtonian principles in academic, research and professional contexts. The knowledge gained supports further studies in physics, engineering, space science and related scientific disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Describe the concepts of force, work done and energy 9forms of energy)
2. Explain the fundamental concepts of space and time.
3. Describe and analyse motion in one and two dimensions.
4. State and apply Newton’s laws of motion.
5. Discuss conservation principles in mechanics and Analyse rotational and angular motion of solid bodies.
6. Explain gravitational phenomena by applying Newton’s law of gravitation and Kepler’s laws.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the fundamental principles of force, power, work done and energy (forms of energy)
2. Demonstrate understanding of fundamental physical quantities.
3. Analyse kinematics of particles and systems and relative motion in one and two dimensions.
4. Apply Newton’s laws of motion to explain inertial frames, impulse, forces, momentum conservation and solve practical problems.

5. Apply conservation principles in mechanics and Analyse rotational and angular motion.
6. Describe gravitational principles of Newton's law of gravitation and Kepler's laws.

COURSE CONTENT

- **Force, Work done Energy:** Forms of Energy
- Vectors and Scalars, Differentiation of vectors
- Conservation principles in physics, Conservative forces, System of particles, Centre of mass
- Rotational motion
- Torque, vector product, moment, rotation of coordinate axes and angular momentum
- Polar coordinates
- Conservation of angular momentum
- Circular motion
- Gyroscopes and precession
- Motion in a Circle Simple Harmonic Motion

CATEGORY	DETAILS
Core Competencies	• Conceptual/theoretical competencies. • Mathematical/ • Computational competencies • Practical/experimental competencies • Application/problem-solving competencies
Core Values	• 1 Accuracy • Integrity • Curiosity, 4.Perseverance and teamwork in all scientific and • Practical activities.

CATEGORY	DETAILS
Pedagogical Approaches	• Student-centred and Interactive teaching methods. • Demonstrations Methods. • Problem-solving and Inquiry-based learning. • 4 Laboratory experiments and simulations. • 5Critical thinking, Experimentation and real-world application of concepts. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Textbooks include Fundamentals of Physics by Halliday et al. • 2 Physics for Scientists and • 3 Physics Classroom Tutorials. • 4 National curriculum for Basic Education (Integrated Science)
Assessment Methods	• 1 Continuous assessment (quizzes. participation) • Laboratory experiments and reports on motion. • A mid-semester test and a final examination

REFERENCES AND FURTHER READING

Dugas, R. (1988) *A History of Classical Mechanics*. New York, NY: Dover Publications Inc,

CHM 402 Environmental Chemistry I

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Environmental Chemistry is the study of the chemical processes occurring in the environment and the interactions between chemical substances and the atmosphere, hydrosphere, lithosphere and biosphere. The course examines the sources, transport, transformation, fate and effects of natural and anthropogenic chemicals in the environment. The course covers atmospheric chemistry, water chemistry, soil chemistry, chemical cycles, environmental pollutants, toxic substances, heavy metals, pesticides, petroleum hydrocarbons, plastics and other emerging contaminants. It also examines acid rain, eutrophication, ozone depletion, climate change, air and water pollution, waste

management, environmental monitoring and chemical remediation. Particular attention is given to the application of chemistry in solving environmental problems and protecting human and ecosystem health. Contemporary environmental policy increasingly recognises pollution, climate change and biodiversity loss as interconnected environmental challenges.

COURSE RELEVANT STATEMENT

Environmental Chemistry is relevant because human activities continuously introduce chemicals and other pollutants into air, water and soil. Industrial activities, agriculture, transportation, mining, petroleum activities, waste disposal and combustion can release substances that affect environmental quality and human health. Chemical pollutants can contaminate environmental media, accumulate in food chains and adversely affect organisms and ecosystem functions.

The course therefore provides students with the scientific knowledge and practical skills required to identify environmental chemical pollutants, understand their sources and transformations, assess their effects, monitor environmental quality and recommend appropriate pollution-prevention and remediation strategies. This is particularly important in developing sustainable approaches to environmental protection, public health and natural-resource management.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define and explain the concepts and principles of environmental chemistry.
2. Describe the chemical composition and properties of the atmosphere, hydrosphere, lithosphere and biosphere.
3. Explain major chemical cycles operating in the environment, including carbon, nitrogen, sulphur and phosphorus cycles.
4. Explain the sources, transport, transformation and fate of chemical substances in the environment.
5. Identify major environmental pollutants and their sources.
6. Explain the chemistry of air pollution and major atmospheric pollutants.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Explain fundamental concepts and principles of environmental chemistry.
2. Describe chemical processes occurring in air, water, soil and living systems.

3. Identify and classify major environmental pollutants and their sources.
4. Explain the chemical transformations and movement of pollutants through environmental systems.
5. Analyse basic physical and chemical parameters used in assessing environmental quality.
6. Conduct simple laboratory investigations involving air, water and soil chemistry.

COURSE CONTENT

- Concepts of elementary cycles
- Characteristics of the atmosphere
- Sources
- Types and effects of environmental pollution
- Wastewater treatment
- Composition of domestic/industrial wastes and waste management
- Water chemistry and analysis
- Chemical and physical instrumentation in environmental sciences
- Introduction to Environmental Impact Assessment
- Twelve principles of green chemistry

CATEGORY	DETAILS
Core Competencies	• Scientific Literacy Competence • Critical Thinking Competence • Problem-Solving Competence • Laboratory and Practical Competence • Data Analysis and Interpretation Competence • Research Competence • Green Chemistry Competence
Core Values	• Safety consciousness • Integrity and honesty • Ethical responsibility • Teamwork and cooperation • Innovation and creativity • Resource conservation

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-based learning: • Problem-based learning: • Project-based learning: • Cooperative learning: • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks and reference books. • Chemistry and environmental science journals. • Periodicals and scientific articles. • Laboratory equipment and glassware. • pH meters and pH indicators. • Conductivity meters. • Dissolved oxygen meters. • Turbidity meters. • National Curriculum for Basic Education
Assessment Methods	• Continuous assessment tests • Assignments • Fieldwork/project • Environmental case study • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

United Nations Environment Programme (UNEP). (2024). *Specialized Manual on Green and Sustainable Chemistry Education and Learning*. Nairobi: UNEP.

United Nations Environment Programme (UNEP). (2021). *Green and Sustainable Chemistry: Framework Manual*. Nairobi: UNEP.

International Union of Pure and Applied Chemistry (IUPAC). (2025). *Guiding Principles of Responsible Chemistry*. IUPAC. The principles emphasise responsible innovation, safety, sustainability, ethical behaviour, communication, collaboration, integrity and interdisciplinary convergence.

BIO 404 General Physiology

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Physiology is an introductory course that examines the normal functions and activities of living organisms, with particular emphasis on the human body. The course explores how cells, tissues, organs, and organ systems function individually and interact to maintain life. It introduces students to fundamental physiological concepts including homeostasis, cellular communication, membrane transport, body fluid balance, nerve and muscle function, blood circulation, respiration, digestion, excretion, and endocrine regulation. The course provides a foundation for understanding more advanced courses in human physiology, anatomy, health sciences, biology, and integrated science.

COURSE RELEVANT STATEMENT

The study of General Physiology is relevant to students because an understanding of normal body functions is essential for explaining how living organisms survive, grow, reproduce, respond to their environment, and maintain internal stability. Knowledge of physiological processes enables students to relate biological principles to everyday health, nutrition, physical activity, environmental conditions, disease prevention, and human well-being. The course also develops scientific reasoning and practical skills needed for teaching, research, health education, and further study in biological and health-related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define physiology and explain its relationship with anatomy and other biological sciences.
2. Explain the concept of homeostasis and its importance in maintaining normal body functions.
3. Describe the structural and functional organisation of the human body from cells to organ systems.
4. Explain the physiological properties of cell membranes and mechanisms of membrane transport.
5. Describe the composition and functions of body fluids and their role in maintaining internal balance.

6. Explain the basic physiology of excitable tissues, including nerve and muscle cells.

LEARNING OBJECTIVES

At the end of this course, students should be able to:

1. Explain the chemistry of organic compounds and their biological importance;
2. State the general characteristics of enzymes;
3. Describe nutrition, digestion and absorption in plants and animals;
4. Discuss the cell membrane structure and list its functions;
5. Summarise osmoregulation, excretion and transport in animals;
6. Enumerate growth hormones in plants and their functions;

COURSE CONTENTS

Chemicals of life: The chemistry of Carbohydrates, lipids, proteins and nucleic acids and their biological importance, General characteristics of enzymes; nutrition, digestion, and absorption in plants and animals. Biosynthesis: Photosynthesis and protein synthesis, Cell membrane structure and function, A general study of osmoregulation, excretion, transport, growth hormones and enzymology, homeostasis and their co-ordination in animals, Plant water relation, growth and growth regulation.

CATEGORY	DETAILS
Core Competencies	• Physiological knowledge and understanding • Homeostatic reasoning • Structure – function competence • Systems integration • Scientific inquiry and problem-solving • Practical and laboratory competence
Core Values	• Scientific integrity and honesty • Respect for human life and dignity • Safety consciousness • Teamwork and cooperation • Respect for diversity and inclusion • Curiosity and lifelong learning • Critical thinking and intellectual independence

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lecture • Active learning • Group discussion • Problem-based learning • Inquiry-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Recommended physiology textbooks • Laboratory manuals • Lecture notes and handouts • Scientific journals and review articles • Laboratory resources • Digital resources • National Curriculum for Basic Education
Assessment Methods	• Short quizzes • Oral questioning • Class exercises • Concept maps • Group presentations • Case-study discussions • Practical exercises

REFERENCES AND FURTHER READING

Alogbonsi, A., Silverthorn, D. U., et al. (2025). *PhysioCAFUN: A competency-based curriculum development guideline to strengthen physiology education in Africa*. Advances in Physiology Education, 49, 53–62. The framework adapts HAPS physiology learning outcomes for African physiology education.

Silverthorn, D. U., Cafferty, P., Casagrand, J., et al. (2023). Creating the HAPS Physiology Learning Outcomes: Terminology, eponyms, inclusive language, core concepts, and skills. *Advances in Physiology Education*, *47*.

BIO 405 Hydrobiology

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Hydrobiology is the study of life in aquatic environments, including freshwater, marine and transitional ecosystems. The course examines the physical, chemical and biological characteristics of aquatic habitats and the interactions among aquatic organisms and their environment. It covers the diversity, adaptation, distribution, productivity and ecological relationships of microorganisms, plants and animals inhabiting water bodies. Students are introduced to aquatic food chains and webs, nutrient cycling, water quality, pollution, eutrophication, conservation and sustainable management of aquatic resources. Practical activities emphasise sampling and identification of aquatic organisms, measurement of selected water-quality parameters, and interpretation of ecological data from rivers, streams, lakes, wetlands and other aquatic environments.

RELEVANCE STATEMENT

Hydrobiology is relevant to understanding the ecological, economic and public-health importance of aquatic environments. The course equips students with knowledge and practical skills for assessing aquatic ecosystems, monitoring water quality, understanding the effects of pollution and climate change on aquatic biodiversity, and promoting the conservation and sustainable use of water resources. It is particularly important in Nigeria because freshwater systems, wetlands, rivers, lakes and coastal environments support fisheries, agriculture, domestic water supply, biodiversity and livelihoods. The knowledge gained provides a foundation for environmental management, fisheries, conservation biology, public health, water-resource management and science teaching.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define hydrobiology and explain its scope, importance and relationship with other biological and environmental sciences.
2. Describe the major types of aquatic ecosystems, including freshwater, marine, estuarine, riverine, lacustrine and wetland ecosystems.
3. Explain the physical and chemical properties of water and their influence on aquatic organisms and ecosystem processes.

4. Identify major groups of aquatic organisms, including plankton, nekton, benthos, aquatic plants, microorganisms and aquatic vertebrates.
5. Explain adaptations of aquatic organisms to different environmental conditions.
6. Describe aquatic food chains, food webs and energy flow within aquatic ecosystems.

LEARNING OBJECTIVES

At the end of this course, students should be able to:

1. Discuss the physical properties of water;
2. Explain the thermal stratification of lakes;
3. Summarise the importance and interplay of oxygen, carbon-dioxide and pH in water;
4. Describe fresh water communities;
5. List factors influencing the distribution and productivity of aquatic macrophytes; phytoplanktons, benthic algae and zooplanktons;
6. Discuss the importance and adaptive features of Estuarine communities.

COURSE CONTENT

- Principles of aquatic biology with particular reference to limnology
- The physical properties of water and their biological significance
- Thermal stratification of lakes
- Waves and currents and their effects on substratum
- Dissolved oxygen, carbon-dioxide and inorganic ions in freshwater
- The carbonate-bicarbonate system and pH
- Oligotrophic and Eutrophic lakes
- The chemical composition of African lake waters
- Freshwater communities, factors influencing the distribution and productivity of aquatic macrophytes, phytoplanktons, benthic algae
- Zooplanktons in freshwater
- Marine brackish water/estuarine communities and their chemical factors
- Colonisation and succession in aquatic ecosystems, adaptations and interrelationships

CATEGORY	DETAILS
Core Competencies	• Knowledge of aquatic ecosystems • Aquatic biodiversity competence • Ecological analysis • Water-quality assessment competence • Field and laboratory skills • Scientific inquiry and problem-solving • Conservation competence
Core Values	• Respect for biodiversity • Scientific honesty and integrity • Responsibility and accountability • Respect for aquatic life • Safety consciousness • Teamwork and cooperation • Critical thinking • Curiosity and innovation • Sustainability consciousness
Pedagogical Approaches	• Interactive lectures • Field-based learning • Laboratory practicals • Inquiry-based learning • Problem-based learning • Project-based learning. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Compound and dissecting microscopes • Hand lenses • Plankton nets • Water-sampling bottles • Secchi discs • Thermometers • pH meters • Dissolved oxygen meters/kits • Conductivity meters • National Curriculum for Basic Education
Assessment Methods	• Short quizzes • Class exercises • Oral questioning • Practical demonstrations • Field observations • Group discussions • Mid-semester test • Fieldwork report • Individual assignment

REFERENCES AND FURTHER READING

Food and Agriculture Organization (FAO). (2024). *The State of World Fisheries and Aquaculture 2024: Blue Transformation in Action.* FAO. The report provides current evidence on aquatic food systems, sustainability, scientific research, capacity building and community participation.

United Nations Environment Programme (UNEP). (2024). *Mid-term Status on SDG 6 Indicators: 6.3.2, 6.5.1 & 6.6.1.* UNEP. Useful for teaching water quality, integrated water-resource management and water-related ecosystems and biodiversity.

BIO 406 Biological Techniques

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Biological Techniques is a fundamental course designed to introduce students to the principles, methods, instruments, and practical skills used in the study of living organisms and biological processes. The course provides students with theoretical knowledge and practical experience in biological investigations, laboratory procedures, field studies, specimen collection, preservation, preparation, observation, measurement, and analysis.

The course covers the use of biological laboratory equipment, microscopy, biological staining, dissection, preparation of temporary and permanent slides, biological drawing, measurement of biological materials, and the identification and classification of organisms. It also introduces students to basic microbiological techniques, tissue preparation, centrifugation, chromatography, electrophoresis, and elementary molecular biology techniques, depending on available facilities and programme requirements. Emphasis is placed on laboratory safety, ethical treatment of organisms, accurate data collection, proper record-keeping, scientific reasoning, and the responsible disposal of biological waste. Students are expected to develop practical competencies that will support further studies in biology, microbiology, biochemistry, physiology, ecology, biotechnology, and Integrated Science education.

Course-Relevant Statement

Biological Techniques is relevant to the training of science students because practical skills are essential for understanding biological concepts and conducting scientific investigations. The course bridges the gap between theoretical knowledge and practical application by equipping students with the techniques required to observe, investigate, measure, identify, and analyse biological materials. The course supports the development of scientific literacy, critical thinking, problem-solving, laboratory management, and research skills. It also prepares students to use appropriate instructional materials and practical methods in teaching biological concepts in secondary schools and other educational settings. Furthermore, the course promotes safe laboratory practices, environmental responsibility, ethical scientific conduct, and evidence-based decision-making. These competencies are important for biological research, science education, public health, agriculture, environmental conservation, and biotechnology.

COURSE OBJECTIVES

The objectives of this course are to:

1. Understand the principles and applications of basic biological techniques.
2. Identify and use common biological laboratory equipment and instruments.
3. Develop practical skills in microscopy, specimen preparation, staining, and biological observation.
4. Acquire techniques for collecting, handling, identifying, and preserving biological specimens.
5. Understand basic laboratory procedures used in microbiology, physiology, biochemistry, and molecular biology.
6. Develop competence in biological measurement, data collection, analysis, interpretation, and presentation.
7. Apply appropriate safety procedures and ethical principles during laboratory and field investigations.
8. Develop the ability to design and conduct simple biological experiments.
9. Understand the importance of quality control, accuracy, and reliability in biological investigations.
10. Apply biological techniques in research, science teaching, agriculture, health, and environmental management.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Describe the principles and applications of commonly used biological techniques.
2. Identify and explain the functions of biological laboratory equipment.
3. Demonstrate the correct use of light microscopes and other basic laboratory instruments.
4. Prepare temporary slides and carry out simple biological staining procedures.
5. Collect, label, handle, and preserve biological specimens appropriately.
6. Demonstrate basic dissection techniques and identify selected biological structures.
7. Explain the principles of centrifugation, chromatography, electrophoresis, and spectrophotometry.
8. Perform simple microbiological procedures under appropriate laboratory supervision.

9. Record experimental observations accurately using tables, diagrams, and laboratory reports.
10. Analyse and interpret basic biological data using appropriate methods.

COURSE CONTENT

- Microscopy: handling of microscopes, preparation of microscope slides (Microtomy) for microscopic examinations, use of hand lens, biological drawings and diagrams
- Spectrophotometry, colorimetry, photometry, polarimetry, chromatography, refractometry, melting points and colligative properties Herbarium and Museum Techniques
- Experimental designs, report writing and presentations

CATEGORY	DETAILS
Core Competencies	• Practical Laboratory Skills • Scientific Investigation • Observation and Measurement • Critical Thinking and Problem-Solving • Communication Skills • Teamwork and Collaboration • Research and Innovation
Core Values	• Accuracy • Honesty and integrity • Safety consciousness • Responsibility • Respect for life • Teamwork • Professionalism
Pedagogical Approaches	• Practical Laboratory Demonstrations • Hands-on Laboratory Activities • Inquiry-Based Learning • Problem-Based Learning • Project-Based Learning • Field-Based Learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Light microscopes • Dissecting kits • Prepared microscope slides • Glass slides and cover slips • Biological specimens • Petri dishes and culture media • Pipettes and micropipettes • Centrifuge
Assessment Methods	• Formative Assessment • Summative Assessment • Practical Assessment

REFERENCES AND FURTHER READING

1. American Society for Microbiology. (n.d.). *Guidelines for biosafety in teaching laboratories*. American Society for Microbiology. Consult the society's official resources for current laboratory safety guidance: American Society for Microbiology.
2. Brown, A. E. (2012). *Benson's microbiological applications: Laboratory manual in general microbiology* (13th ed.). McGraw-Hill. This is a useful reference for basic microbiological procedures; lecturers should check for newer editions.
3. Cappuccino, J. G., & Welsh, C. T. (2017). *Microbiology: A laboratory manual* (11th ed.). Pearson.

SED 501 Science, Society and Technology

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

This course addresses key issues such as ethical considerations in science, responsible use of technology, scientific literacy, environmental stewardship, and the role of science in addressing contemporary societal challenges. It also highlights the contribution of science education to national development, citizenship, and sustainable development goals, particularly within the Nigerian context.

Students are encouraged to develop critical thinking, scientific literacy, ethical reasoning, and problem-solving skills to evaluate the benefits, risks, and challenges associated with emerging technologies. The course prepares learners to make informed decisions,

participate actively in societal discourse on science and technology, and apply scientific knowledge responsibly in addressing local and global challenges. For prospective Integrated Science teachers, the course provides the knowledge and pedagogical foundation needed to relate scientific concepts to everyday life and societal needs.

COURSE OBJECTIVES

The objectives of this course are to:

- Examine the relationship between science, technology, and society
- Promote ethical awareness in scientific practices
- Emphasise the role of science in national development.
- Discuss Contemporary issues such as Artificial Intelligence, biotechnology etc.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the impact of science and technology on society.
2. Discuss ethical issues related to scientific advancement.
3. Relate science education to social and economic development in Nigeria.
4. Demonstrate responsible scientific attitudes and citizenship.

COURSE CONTENT

- Meaning and nature of science
- Meaning and nature of technology
- Meaning and characteristics of society
- Relationship between science
- Society and technology
- Historical development of science and technology
- Traditional and indigenous science and technology
- Contributions of African societies to science and technology
- Major scientific and technological revolutions
- Industrial Revolution
- Development of modern science and technology
- Food and agriculture
- Health and medicine

- Housing and construction
- Transportation
- Communication
- Energy production and utilisation
- Water supply and sanitation
- Development of science and technology in Nigeria and Indigenous technologies in Nigeria

CATEGORY	DETAILS
Core Competencies	• Scientific Literacy. • Critical Thinking and Problem-Solving • Critically evaluate scientific and technological issues • Digital and Technological Competence • Utilise information and communication technologies (ICT) • Analytical Skills, Analyse the social, economic, ethical, cultural.
Core Values	• Scientific • Integrity • Upholding honesty, objectivity • Critical Thinking • Applying logical reasoning • Innovation and Creativity • Encouraging curiosity, creativity
Pedagogical Approaches	• Interactive • Lecture Method • Discussion and Debate Method • Case Study Approach • Inquiry-Based Learning • Project-Based Learning (preferably group-based) • Use of ICT and Media Analysis • Role Play and Simulation. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Textbooks like Ogunniyi, M. B. (2011). Science Education in Nigeria: • Historical and Contemporary Issues, and Miller, J. D. (2012). Civic Scientific Literacy. • Springer can be used. • Reference Materials such as 4. UNESCO publications on Science, Technology, and Society, Federal Ministry of Education (Nigeria) policy documents. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• End-of-Semester Examination. • Short quizzes and class tests, written • Assignments and reflective essays • Class participation and attendance • Project and practical assessment, individual • Group projects on science – society topics

Cutcliffe, S. H. (2020). *Ideas, Machines, and Values: An Introduction to Science, Technology, and Society Studies* (2nd ed.). Rowman & Littlefield.

National Research Council. (2019). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. National Academies Press.

CHE 501 Analytical Chemistry II

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Analytical Chemistry is a fundamental branch of chemistry concerned with the identification, separation, determination and quantification of chemical substances in various samples. The course introduces students to the principles and applications of qualitative and quantitative chemical analysis, sampling, preparation of samples, measurement techniques, accuracy, precision, errors and statistical treatment of analytical data. It covers classical analytical methods such as gravimetric and volumetric analysis, as well as instrumental techniques including spectroscopy, chromatography, electroanalytical methods and selected modern analytical techniques. Emphasis is placed on laboratory practice, safe handling of chemicals, quality assurance, interpretation of analytical results

and application of analytical chemistry to environmental, biological, industrial, agricultural and educational problems.

RELEVANCE STATEMENT

Analytical Chemistry is relevant because reliable chemical analysis is essential for identifying substances, determining their concentrations and assessing the quality and safety of materials and the environment**.** The course equips students with practical and analytical skills needed to investigate chemical composition in water, soil, food, medicines, biological materials and industrial products. It is particularly relevant to environmental monitoring, public health, agriculture, mineral exploration, food quality control, industrial production and scientific research in Nigeria. The knowledge and skills acquired provide an important foundation for further studies and professional practice in chemistry, integrated science, environmental science, laboratory technology and related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define analytical chemistry and explain its scope, branches and applications.
2. Distinguish between qualitative and quantitative chemical analysis**.**
3. Explain the principles of sampling, sample preparation, separation and measurement in chemical analysis.
4. Explain the concepts of accuracy, precision, sensitivity, selectivity and detection limits**.**
5. Identify major sources of systematic and random errors in chemical measurements.
6. Apply appropriate methods for expressing and calculating concentrations of chemical substances.

LEARNING OBJECTIVES

At the end of this course, the students should be able to:

1. Explain analytical processes which include description of chemist as a problem solver;
2. Describe and differentiate forms of error;
3. Explain its implication on laboratory analysis;
4. State different statistical tool use in treatment of data;
5. Solve practical problems using the statistical tools;

6. Define sampling and give reasons for sampling in field work;

COURSE CONTENTS

Meaning, scope and importance of analytical chemistry, Branches of analytical chemistry: qualitative and quantitative analysis, Classical and instrumental methods of analysis, Theory of errors; and statistical treatment of data. theory of sampling. Chemical methods of analysis including volumetric, gravimetric, data analysis and presentation. Physico-chemical methods, Optical methods of analysis; separation methods.

CATEGORY	DETAILS
Core Competencies	• Explain fundamental concepts and principles of analytical chemistry. • Distinguish between qualitative and quantitative analytical methods. • Select appropriate analytical techniques for particular samples and problems. • Collect and prepare representative samples.
Core Values	• Accuracy and precision • Scientific honesty and integrity • Safety consciousness • Responsibility and accountability • Critical thinking • Objectivity and evidence-based reasoning • Attention to detail
Pedagogical Approaches	• Interactive lectures • Laboratory-based learning • Inquiry-based learning • Problem-based learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)

CATEGORY	DETAILS
Learning Resources	• Analytical balances • Burettes, pipettes • And measuring cylinders • Volumetric flasks • Beakers and conical flasks • pH meters • Conductivity meters • Colorimeters/ • Spectrophotometers • Centrifuges • Heating equipment • National Curriculum for Basic Education
Assessment Methods	• Short quizzes • Class exercises • Problem-solving activities • Laboratory worksheets • Practical demonstrations • Oral questioning • Group discussions • Sample-analysis exercises • Data interpretation exercises

REFERENCES AND FURTHER READING

International Union of Pure and Applied Chemistry (IUPAC). (2025). *Compendium of Chemical Terminology (IUPAC Gold Book), 5th ed.* IUPAC. https://doi.org/10.1351/goldbook.

Hibbert, D. B. (2025). Glossary of terms for mass and volume in analytical chemistry. *Pure and Applied Chemistry, 97*(2), 137–147. https://doi.org/10.1515/pac-2023-0903.

Hibbert, D. B. (2021). Metrological and quality concepts in analytical chemistry: IUPAC recommendations 2021. *Pure and Applied Chemistry, 93*(9), 997–1048.

EIS 501 Global Ecology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course examines global ecological issues with emphasis on the impact of science and technological development on population, health, culture, and society.

It addresses contemporary issues such as gender roles, diseases, drug abuse, disease transmission, blood transfusion, preventive medicine, and immunisation within a global and Nigerian ecological context.

RELEVANCE STATEMENT

This course supports teacher preparedness in health and environmental education as well as addressing national and global health challenges.

It also promotes values-based, preventive, and community-oriented education which emphasises societal relevance and sustainability.

COURSE OBJECTIVES

The objectives of this course are to:

1. Expose students to the impact of science and technological development on global population dynamics and ecological balance.
2. Examine the influence of ecology on gender roles, culture, and social organisation in different societies.
3. Create awareness of common diseases, their causes, effects, and methods of treatment and control.
4. Develop understanding of disease transmission, prevention, and control strategies at local and global levels.
5. Educate students on drug abuse, its causes, consequences, and preventive measures.
6. Introduce concepts of blood transfusion, preventive medicine, and immunisation in public health management.
7. Equip future teachers with relevant knowledge and skills for teaching health-related and ecological topics in schools.
8. Promote responsible attitudes towards health, environmental sustainability, and global citizenship.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain the effects of science and technological development on population growth, migration, and global ecology.
2. Analyse the relationship between ecology, gender roles, culture, and societal development.
3. Identify common diseases and explain their causes, effects, and methods of treatment.
4. Describe various methods of disease transmission and appropriate prevention and control measures.
5. Explain communicable (contacted) diseases, their modes of spread, prevention, and control strategies.
6. Discuss the causes, effects, and prevention of drug abuse in society.
7. Explain the concept, importance, and procedures involved in blood transfusion.
8. Describe the roles of preventive medicines and immunisation in disease control and public health.

COURSE CONTENT

- Science and Technological Development on Population
- **Gender Roles in Society and Culture Diseases:** Causes, Effects, Treatments
- Drug Abuse
- Methods of Diseases Transmission
- **Contacted Disease:** Spread, Prevention and Control
- Blood Transfusion
- Preventive Medicines
- Immunisation

CATEGORY	DETAILS
Core Competencies	• **Critical thinking.** • **Computational thinking and problem-solving.** • **Digital literacy and information management.** • **Creativity and innovation** • **Effective communication and collaboration**

CATEGORY	DETAILS
Core Values	• 1 Ethical responsibility. • 2 Lifelong learning. • 3 Teamwork and leadership. • 4 Responsible use of information and communication technologies. • Respect
Pedagogical Approaches	• Demonstration Method. • Hands-on Practical/Laboratory Method. • Project-Based Learning (PBL). • Problem-Based Learning. • Inquiry-Based Learning. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• 1 Foundations of Computer Science • 2 Online learning platforms. • 3 Open-source software and programming tools • 4 National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Class tests • Assignments • Quizzes • Mid-Semester Test (where applicable) • Final Examination • Written examination covering theoretical and practical aspects

REFERENCES AND FURTHER READING

Long, L., & Long, N. (2017). *Computers: Information Technology in Perspective*. Pearson.

Morley, D., & Parker, C. S. (2019). *Understanding Computers: Today and Tomorrow* (16th ed.). Cengage Learning.

BCH 501 General Biochemistry

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Biochemistry is an introductory course that examines the chemical principles underlying life processes in living organisms. The course introduces students to the molecular composition of living cells and the structures, properties and functions of major biological molecules, including carbohydrates, lipids, proteins, nucleic acids, vitamins, minerals and water. It also examines enzymes, bioenergetics, metabolism and the biochemical transformations that sustain life. Emphasis is placed on the relationship between molecular structure and biological function, enzyme activity, energy production, metabolic pathways and the regulation of biochemical processes. The course also provides students with basic laboratory and analytical skills for investigating biochemical substances and reactions. It serves as a foundation for advanced studies in biology, microbiology, physiology, genetics, biotechnology, medicine, nutrition and related life sciences.

COURSE RELEVANT STATEMENT

General Biochemistry is relevant because an understanding of the chemical basis of life enables students to explain how living organisms obtain, transform and utilise nutrients and energy. Knowledge of biochemical principles is essential for understanding normal physiological processes, growth, reproduction, disease conditions, nutrition, environmental interactions and biotechnology. The course equips students with the scientific knowledge and practical skills required to interpret biochemical processes at the cellular and molecular levels. It also promotes problem-solving, laboratory competence, critical thinking and appreciation of the applications of biochemistry in health, agriculture, food science, environmental management and industrial biotechnology.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the basic principles and scope of biochemistry and its relationship with other biological and chemical sciences.
2. Describe the chemical composition of living organisms and explain the biological importance of water, acids, bases, buffers and minerals.

3. Identify and classify major biomolecules, including carbohydrates, lipids, proteins and nucleic acids.
4. Explain the structural characteristics and biological functions of carbohydrates, lipids, proteins and nucleic acids.
5. Describe the different levels of protein structure and relate protein structure to biological function.
6. Explain the nature, classification, mechanism and biological importance of enzymes.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Understand the structure of different macromolecules in biological system;
2. Identify types of chemical reactions involving these macromolecules;
3. Explain the various methods of isolation of these macromolecules;
4. Estimate the effects of acids and alkalis on the macromolecules;
5. Know how to purify the macromolecules; and 6. learn how to quantify the various macromolecules.

COURSE CONTENT

- Introductory chemistry of amino acids
- Their properties, reactions and biological functions, Classification of amino acids: neutral, basic and acidic
- Polar and non-polar
- Essential and nonessential amino acids, Peptides, Introductory chemistry and classification of proteins, Biological functions of proteins, Methods of their isolation, purification and identification, Primary, secondary, tertiary and quaternary structures of proteins, Basic principles of tests for proteins and amino acids, Introductory chemistry of carbohydrates, lipids and nucleic acids, Nomenclature of nucleosides, and nucleotides
- Effects of acid and alkali on hydrolysis of nucleic acids

CATEGORY	DETAILS
Core Competencies	• Biochemical knowledge competence • Biomolecular analysis competence • Enzyme and metabolic competence • Laboratory competence • Scientific inquiry competence • Problem-solving competence
Core Values	• Scientific integrity • Critical thinking • Accuracy and precision • Responsibility • Teamwork and cooperation • Respect for life • Ethical conduct
Pedagogical Approaches	• Interactive lectures • Problem-based learning (PBL) • Inquiry-based learning • Practical laboratory work • Small-group discussions • Case-based learning • Flipped classroom • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Print Resources • Laboratory Resources • Digital • Resources • Human Resources 9 National curriculum for basic Education

CATEGORY	DETAILS
Assessment Methods	• Class tests/quizzes • Assignments • Laboratory reports • Practical examinations • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

Nelson, D. L., Cox, M. M., & Hoskins, A. A. (2021). *Lehninger Principles of Biochemistry* (8th ed.). W. H. Freeman/Macmillan Learning. The 8th edition includes updated content, revised problems and digital learning resources.

Berg, J. M., Tymoczko, J. L., Gatto, G. J., Jr., & Stryer, L. (2023). *Biochemistry* (10th ed.). W. H. Freeman/Macmillan Learning.

Hines, J. K. (2025). *Biochemistry: A Short Course* (5th ed.). W. H. Freeman/Macmillan Learning.

MCB 501 General Microbiology

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Microbiology is an introductory course that provides students with fundamental knowledge of microorganisms and their roles in nature, human health, agriculture, industry and the environment. The course introduces students to the major groups of microorganisms, including bacteria, archaea, fungi, protozoa, algae and viruses, with emphasis on their structure, classification, physiology, nutrition, growth, reproduction and genetics. The course also examines microbial interactions with humans, animals, plants and the environment. Students are introduced to principles of microbial cultivation, microscopy, sterilisation, disinfection, aseptic techniques, microbial identification, antimicrobial agents and basic immunological concepts**.** Practical activities develop students' ability to observe, culture and identify microorganisms while maintaining appropriate laboratory safety and biosafety practices.

COURSE RELEVANT STATEMENT

General Microbiology is relevant because microorganisms are fundamental components of virtually all ecosystems and have significant effects on human health, agriculture, food production, biotechnology and environmental processes. An understanding of microorganisms enables students to appreciate their beneficial roles in nutrient cycling, decomposition, fermentation, biotechnology and sustainable agriculture, as well as their harmful roles in infectious diseases, food spoilage and environmental contamination. The course provides a foundation for advanced studies in medical microbiology, environmental microbiology, industrial microbiology, food microbiology, immunology, biotechnology, molecular biology and public health**.** It also develops scientific inquiry, laboratory competence, critical thinking and responsible practices in handling microorganisms.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define microbiology and explain its scope, major branches and importance to biological and environmental sciences.
2. Describe the historical development of microbiology and discuss major contributions to the development of microbial science.
3. Identify and differentiate the major groups of microorganisms, including bacteria, archaea, fungi, protozoa, algae and viruses.
4. Describe the structural characteristics of prokaryotic and eukaryotic microorganisms and explain their biological functions.
5. Explain the principles of microbial classification, taxonomy and identification.
6. Describe microbial nutrition and explain the nutritional requirements of microorganisms.

LEARNING OBJECTIVES

At the end of the course students should be to

1. Students will be introduced to basic concepts and scope of microbiology;
2. Layout of a microbiology laboratory;
3. Equipment and reagents in a microbiology laboratory; and
4. The theory behind basic protocols in a microbiology laboratory.
5. Explain the principles of microbial classification, taxonomy and identification
6. Describe the microbial nutrition and explain the nutritional requirement of microorganism.

COURSE CONTENTS

History of the Science of Microbiology, Classification of organisms into prokaryotes and eukaryotes; Classification of prokaryotes into archaea and eubacteria Anatomy and cytochemistry of bacteria and fungi, Shapes, groupings and colonial morphology of bacteria and fungi, Structure of viruses, Sterilisation and disinfection; Structure, ecology and reproduction of representative microbial genera, Culture of micro-organisms, Isolation of micro-organisms; isolation of bacteria, viruses, fungi (yeasts and moulds, Nutrition and biochemical activities of micro-organisms, Antigens and antibodies, Identification and economic importance of selected microbial groups, Microbial variation and heredity, Study of laboratory Equipment, Introduction to microbiology of air food, milk, dairy products, water and soil, Staining techniques, antibiotic sensitivity tests, serological tests, antimicrobial agents.

CATEGORY	DETAILS
Core Competencies	• Microbial literacy competence • Microbial identification competence • Microscopy competence • Laboratory competence • Scientific inquiry competence • Data analysis competence • Biosafety competence • Problem-solving competence
Core Values	• Scientific integrity • Accuracy and precision • Responsibility • Safety consciousness • Teamwork and cooperation • Critical thinking • Ethical conduct • Respect for life

CATEGORY	DETAILS
Pedagogical Approaches	• Interactive lectures • Practical laboratory teaching • Inquiry-based learning • Problem-based learning • Case-based learning • Collaborative learning • Demonstration method. • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Light and compound microscopes • Slides and cover slips • Culture media and culture plates • Test tubes, test-tube racks and inoculating loops • Incubators • Autoclaves • Water baths • Centrifuges 10 pH meters 11 National curriculum for basic Education
Assessment Methods	• Class tests and quizzes • Assignments • Laboratory reports • Practical tests

REFERENCES AND FURTHER READING

Boury, N., Siegesmund, A., Kushner, D. B., Smyth, D. S., Allen, M. E., Frazier, A., et al. (2024). Updated ASM Curriculum Guidelines describe core microbiology content to modernize the framework for microbiology education. *Journal of Microbiology & Biology Education, 25*(3),

EIS 502 Component of Life II

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

A component of Life II is an advanced course in Integrated Science that builds upon the concepts introduced in Components of Life I**.** The course focuses on the structure, functions, interactions, and continuity of living organisms, emphasising the biological systems that sustain life. It integrates concepts from cell biology, genetics, physiology, ecology, microbiology, and evolution to provide students with a comprehensive understanding of life processes. The course also highlights the application of biological knowledge to health, agriculture, environmental conservation, and biotechnology.

RELEVANCE STATEMENT

A component of Life II is a core course in the integrated sciences that examines the fundamental structures, processes, and interactions that characterise living organisms. It builds on the foundational knowledge acquired in Components of Life I by exploring advanced concepts in cell biology, genetics, physiology, ecology, microbiology, evolution, and biotechnology. The course emphasises the organisation of living systems from the molecular and cellular levels to organisms and ecosystems, enabling students to understand how life is sustained, reproduced, and adapted to changing environments.

The course is designed to provide students with both theoretical knowledge and practical laboratory skills necessary for understanding basic science phenomena. It also highlights the application of biological principles in medicine, agriculture, environmental conservation, public health, and modern biotechnology. Through lectures, laboratory experiments, fieldwork, and scientific investigations, students develop critical thinking, analytical skills, and scientific inquiry that prepare them for professional careers in science education. Overall, Components of Life II equips students with a comprehensive understanding of life’s complexity and the scientific principles governing living organisms, while fostering appreciation for biodiversity, environmental sustainability.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the organisation and characteristics of living organisms.
2. Describe the structure and functions of cells and tissues.

3. Discuss the anatomy and physiology of major organ systems.
4. Explain the principles of heredity and genetics.
5. Describe the processes of growth, development, and reproduction in living organisms.
6. Explain the interactions between organisms and their environment.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Describe the chemical composition of living organisms, including the roles of carbohydrates, proteins, lipids, and enzyme and their functions.
2. Discuss the structure and functions of major human organ systems, including the digestive, respiratory, circulatory, excretory.
3. Explain the structure and physiological processes of plants, including photosynthesis, respiration, transpiration, mineral nutrition
4. Identify major groups of microorganisms and evaluate their beneficial and harmful roles in health, agriculture, industry, and the environment.
5. Analyse ecological relationships among organisms, including energy flow, food chains, food webs, nutrient cycling, population dynamics

COURSE CONTENT

- Biological Molecules
- Carbohydrates, Proteins, Lipids, Enzymes and their functions
- Human Anatomy and Physiology
- Digestive system, Respiratory system, Circulatory system, and Excretory system
- Plant Structure and Physiology
- Plant tissues, Photosynthesis, Transpiration, Mineral nutrition
- Microbiology
- Bacteria, Viruses, Fungi, Importance of microorganisms
- Ecology
- Ecosystems, Food chains and food webs, Energy flow, Nutrient cycles and Population dynamics

CATEGORY	DETAILS
Core Competencies	• Critical Thinking and Problem-Solving. • Scientific Knowledge. • Digital and Information Literacy
Core Values	• Objectivity – Base conclusions on scientific evidence • Innovation – Encourage creativity. • Curiosity and Lifelong Learning • Develop a passion for scientific inquiry.
Pedagogical Approaches	• Modelling and Worked • Project-Based Learning (PBL collaborative Pair Programming four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	8 Books 9 Online resources 10 National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Self-assessment • Pair assessment • Group assessment

REFERENCES AND FURTHER READING

Adeniyi, E.O. (2007). *9-Year Basic Science and Technology Curriculum*. Curriculum Development Centre, NERDC, Abuja.

EIS 503 Metals and Non-Metals

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an introduction to the chemistry of selected metals and non-metals, including the comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry, it also covers general properties of metals and non-metal, reactivity of metals and the Chemistry of selected non-metals.

Students will explore chemistry of selected metals, transition metal chemistry, properties of metals, and importance of metals, common ores and extraction of metals, and the chemistry of selected non-metals. The course equips students with essential knowledge and problem-solving skills for further studies in chemistry and related scientific fields.

RELEVANCE STATEMENT

This course equips students with essential knowledge and problem-solving skills, preparing them for careers in science, medicine, engineering, and technology. It addresses societal needs by promoting scientific literacy, enabling solutions to challenges in health, environment, industry, and everyday life. Nationally, it supports the development of a skilled workforce, fostering research, innovation, and technological advancement for economic growth and sustainable development.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the chemistry of selected metals and non-metals.
2. Describe the chemistry of group IA, IIA and IVA elements.
3. Explain the properties of metals and non-metals.
4. Clarify common ores and extraction of metals.
5. Show purification of ores elastic properties of solids.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Demonstrate understanding of the properties of metals and non-metals.
2. Analyse chemistry of group IA, IIA and IVA elements.
3. Identify common ores and extraction of metals.
4. Explain the uses of metals and non-metals.
5. Apply knowledge of metals and non-metals to practical contexts.

COURSE CONTENT

- The Chemistry of selected metals and non-metals
- Comparative chemistry of group IA, IIA and IVA elements
- Introduction to transition metal chemistry
- General Properties of Metals
- Reactivity of Metals

- Importance of Metals and non-metals
- Common Ores and Extraction of Metals
- **Electrolysis Corrosion:** Factors which affect the Corrosion of Iron and Steel
- Mining and Purification of Ores Elastic Properties of Solids
- The Chemistry of selected non-metals
- Uses of metals and non-metals

CATEGORY	DETAILS
Core Competencies	• Scientific Inquiry Skills. • Critical • Thinking and problem-Solving • Analytical and quantitative Skills. • Practical Laboratory Competence.
Core Values	• Integrity. • Safety • Consciousness • Environmental • Stewardship. • Teamwork. • Curiosity.
Pedagogical Approaches	• 1 Student-centred approach. • 2 Guided discussions. • 3 Problem-solving, inquiry-based learning • 4 Laboratory activities, and • ICT-supported tools. • 6 Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Textbooks, Journals & Online Resources. • National curriculum for Basic Education (Integrated Science)
Assessment Methods	• Quizzes • Assignments and class participation • Laboratory 5. practicals skills. • A mid-semester test and a final written examination

REFERENCES AND FURTHER READING

Brown, T. L., LeMay, H. E., Bursten, B. E., Murphy, C. J., Woodward, P. M., & Stoltzfus, M. W. (2024). *Chemistry: The Central Science* (16th ed.). Pearson.

Petrucci, R. H., Herring, F. G., Madura, J. D., & Bissonnette, C. (2023). *General Chemistry: Principles and Modern Applications* (12th ed.). Pearson.

Housecroft, C. E., & Sharpe, A. G. (2022). *Inorganic Chemistry* (6th ed.). Pearson.

CHE 502 Environmental Chemistry II

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Environmental Chemistry is the study of the chemical processes occurring in the environment and the interactions between chemical substances and the atmosphere, hydrosphere, lithosphere and biosphere. The course examines the sources, transport, transformation, fate and effects of natural and anthropogenic chemicals in the environment. The course covers atmospheric chemistry, water chemistry, soil chemistry, chemical cycles, environmental pollutants, toxic substances, heavy metals, pesticides, petroleum hydrocarbons, plastics and other emerging contaminants. It also examines acid rain, eutrophication, ozone depletion, climate change, air and water pollution, waste management, environmental monitoring and chemical remediation. Particular attention is given to the application of chemistry in solving environmental problems and protecting human and ecosystem health. Contemporary environmental policy increasingly recognises pollution, climate change and biodiversity loss as interconnected environmental challenges.

COURSE RELEVANT STATEMENT

Environmental Chemistry is relevant because human activities continuously introduce chemicals and other pollutants into air, water and soil. Industrial activities, agriculture, transportation, mining, petroleum activities, waste disposal and combustion can release substances that affect environmental quality and human health. Chemical pollutants can contaminate environmental media, accumulate in food chains and adversely affect organisms and ecosystem functions. The course therefore provides students with the scientific knowledge and practical skills required to identify environmental chemical pollutants, understand their sources and transformations, assess their effects, monitor environmental quality and recommend appropriate pollution-prevention and remediation

strategies. This is particularly important in developing sustainable approaches to environmental protection, public health and natural-resource management.

COURSE OBJECTIVES

The objectives of this course are to:

1. Define and explain the concepts and principles of environmental chemistry.
2. Describe the chemical composition and properties of the atmosphere, hydrosphere, lithosphere and biosphere.
3. Explain major chemical cycles operating in the environment, including carbon, nitrogen, sulphur and phosphorus cycles.
4. Explain the sources, transport, transformation and fate of chemical substances in the environment.
5. Identify major environmental pollutants and their sources.
6. Explain the chemistry of air pollution and major atmospheric pollutants.
7. Examine the chemistry of water and factors affecting water quality.

LEARNING OBJECTIVES

At the end of the course, students should be able to:

1. Explain fundamental concepts and principles of environmental chemistry.
2. Describe chemical processes occurring in air, water, soil and living systems.
3. Identify and classify major environmental pollutants and their sources.
4. Explain the chemical transformations and movement of pollutants through environmental systems.
5. Analyse basic physical and chemical parameters used in assessing environmental quality.
6. Conduct simple laboratory investigations involving air, water and soil chemistry.

COURSE CONTENT

- Greenhouse gases
- Chemistry of the greenhouse effect
- Carbon dioxide
- Methane
- Nitrous oxide and other greenhouse gases
- Global warming and climate change

- Sources and sinks of carbon
- Chemical approaches to climate-change mitigation
- Structure and importance of the ozone layer
- Formation and destruction of stratospheric ozone
- Ozone-depleting substances
- Chlorofluorocarbons and halons
- Ozone depletion and environmental consequences
- Ozone protection and the Montreal Protocol
- Composition and properties of soil
- Soil pH and buffering capacity
- Soil organic matter
- Nutrient availability
- Soil salinity and sodicity
- Sources of heavy metals
- Lead
- Mercury
- Cadmium
- Chromium and arsenic
- Chemical forms and mobility
- Environmental persistence
- Toxicological effects and Remediation and control

CATEGORY	DETAILS
Core Competencies	• Scientific Literacy Competence • Critical Thinking Competence • Problem-Solving Competence • Laboratory and Practical Competence

CATEGORY	DETAILS
Core Values	• Safety consciousness • Integrity and honesty • Ethical responsibility • Teamwork and cooperation • Innovation and creativity • Resource conservation
Pedagogical Approaches	• Inquiry-based learning: • Problem-based learning: • Project-based learning: • Cooperative learning: • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Chemistry textbooks and reference books. • Chemistry and environmental science journals. • Periodicals and scientific articles. • Laboratory equipment and glassware. • pH meters and pH indicators. • Conductivity meters. • National Curriculum for Basic Education
Assessment Methods	• Continuous assessment tests • Assignments • Fieldwork • Environmental case study • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

United Nations Environment Programme (UNEP). (2024). *Specialized Manual on Green and Sustainable Chemistry Education and Learning*. Nairobi: UNEP.

United Nations Environment Programme (UNEP). (2021). *Green and Sustainable Chemistry: Framework Manual*. Nairobi: UNEP.

International Union of Pure and Applied Chemistry (IUPAC). (2025). *Guiding Principles of Responsible Chemistry*. IUPAC. The principles emphasise responsible innovation, safety, sustainability, ethical behaviour, communication, collaboration, integrity and interdisciplinary convergence.

PHY 502 General Physics III (Behaviour of Matter)

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CORE COURSE) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

General Physics III: Behaviours of Matter introduces students to the fundamental physical principles that explain how matter responds to external forces and changes in temperature, pressure, volume, and other physical conditions. The course examines the mechanical, thermal, and fluid properties of solids, liquids, and gases, with emphasis on elasticity, viscosity, surface tension, pressure, buoyancy, fluid flow, thermal expansion, heat transfer, and the kinetic theory of matter. Students are introduced to relevant laws and mathematical relationships and are provided with opportunities to apply theoretical principles through practical activities, demonstrations, experiments, and problem-solving exercises.

Course-Relevant Statement

Understanding the behaviour of matter is essential for explaining physical phenomena and solving practical problems in science, engineering, agriculture, environmental studies, medicine, and everyday life. Knowledge of the physical properties of solids, liquids, and gases enables students to understand how materials respond to forces, temperature and pressure and how these principles are applied in areas such as construction, hydraulics, refrigeration, weather systems, material selection, and industrial processes. The course therefore provides a foundation for advanced studies in physics and other science and technology-related disciplines.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain the basic physical properties and states of matter.
2. Describe the molecular and kinetic behaviour of solids, liquids, and gases.
3. Explain the concepts of density, relative density, pressure, and specific gravity.
4. Apply the principles of elasticity and Hooke's law to physical problems.
5. Determine elastic constants such as Young's modulus, bulk modulus, and shear modulus.
6. Explain the concepts of stress, strain, elastic limit, and plastic deformation.
7. Describe pressure variations in liquids and gases.

LEARNING OBJECTIVES

By the end of this course, the student should be able to;

1. Explain the concepts of heat and temperature and relate the temperature scales;
2. Define, derive, and apply the fundamental thermodynamic relations to thermal systems;
3. Describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. State the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. Deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. Describe and determine the effect of forces and deformation of materials and surfaces

COURSE CONTENTS

Heat and Temperature, Temperature scales, Gas laws; General gas equation, Thermal conductivity, First Law of thermodynamics, Heat, work and internal energy, reversibility, Thermodynamic processes, Adiabatic, isothermal, isobaric; Second law of thermodynamics, Heat engines and entropy, Zero's law of thermodynamics, Kinetic theory of gases; Molecular collisions and mean free path; Elasticity, Hooke's law, Young's, shear and bulk moduli, Hydrostatics, Pressure, buoyancy, Archimedes' principles; Bernoulli's equation and incompressible fluid flow, Surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

CATEGORY	DETAILS
Core Competencies	• Conceptual competence • Problem-solving competence • Experimental competence • Measurement competence • Data-analysis competence • Scientific inquiry competence • Application competence • Laboratory safety competence • Technology competence
Core Values	• Accuracy and precision • Scientific integrity • Critical thinking • Creativity and innovation • Curiosity about the behaviour • Teamwork and cooperation • Responsibility • Safety consciousness • Perseverance
Pedagogical Approaches	• Inquiry-based learning • Problem-based learning • Demonstration method • Collaborative learning • Project-based learning • Discussion method • Simulation-based learning • Blended learning • Four-in-One Model (TPACK, Jigsaw, Problem-based Learning and Micro-teaching)
Learning Resources	• Laboratory Resources • Instructional Resources • Digital Resources • National Curriculum for Basic Education

CATEGORY	DETAILS
Assessment Methods	• Class tests • Assignments • Quizzes • Laboratory exercises • Practical reports • Presentations • Problem-solving exercises • Mid-semester examination • Final examination

REFERENCES AND FURTHER READING

National Commission for Colleges of Education (NCCE). (2025). *Nigeria Certificate in Education: Minimum Standards – Science Education/Physics*. Abuja: NCCE. The standards include mechanics and properties of matter, elastic moduli and practical physics.

Moebs, W., Ling, S. J., & Sanny, J. (2016). *University Physics Volume 1*. OpenStax, Rice University. Relevant chapters include elasticity, fluids, density, pressure, fluid dynamics and viscosity.

OpenStax. (2016). *University Physics Volume 1: Stress, Strain, and Elastic Modulus*. Rice University. The text provides treatment of stress, strain, Young's modulus, bulk modulus and shear modulus.

PROGRAMME 6 OF 6

Physics Education

Introduction

Education is the foundation of personal growth, social development, and national progress. It shapes individuals, communities and nations. General course in education introduces prospective teachers to the basics of teaching and learning. It introduces students to the principles, purpose, and practices of education, helping them understand how teaching and learning occur in different settings in today's diverse and changing world. These courses expose students to key educational principles, theories and practices required for teacher effective teaching and learning. The Physics education programme provides teachers with a broad understanding of the essential knowledge, skills and core values that every teacher needs, to fit into the society. The programme also emphasises practical application, critical thinking, and ethical awareness, preparing students to engage effectively with learners in diverse and inclusive settings.

Philosophy

The programme's philosophy is to teach physics contextually, promote students' interactions with nature, and relate physics concepts to the daily life activities of students and natural occurrences. It is grounded in the belief that every teacher should be a well-rounded, socially responsible, and ethically aware.

Regulation (Programme Structure)

Admission and Graduation Requirements

Admission Requirements

i. Candidates with NCE cumulative grade point average (2.40-5.00) equivalent to Merit and above, shall continue into the 2-year Bachelor of Science Education degree programme.

ii. NCE candidates with cumulative grade point average (1.50-2.39) equivalent to Pass and below will be required to acquire 2-year post qualification teaching experience to qualify for admission into the 2-year degree programme.

Graduation Requirements

NCE Programme: Candidates for the award of NCE certificates are required, among others, to earn at least 22 credits in General Education courses, 6 credits in Teaching Practice, 12 credits in General Studies Education (totalling credits in the Education component of the NCE programme) and 103 credits in Physics to qualify for graduation, viz:

S/N	Component	Weight/credit load
	General Education	22
	Teaching Practice (TP)	06
	General Studies (GSE)	12
	Physics	40
Total Units:		**80**

Total Minimum Credit Units Required for NCE graduation: **80 credit units**

Degree Programme: Candidates for the award of Bachelor Degree in Human Kinetic Education/Physical Education certificates are required among others, to earn at least 12 credits in General Education 4 credits in General Studies Education (totalling credits in the Education component of the B. Sc. Ed programme) and 102 credits in Health Education courses to qualify for graduation, viz:

S/N	Component	Weight/credit load
1	General Education	12
2	General Studies (GSE)	04
3	Physics	54
Total Units:		**70**

Facilities

a) Classroom Facilities

b) Teaching and Learning Technology

c) Instructional Materials

d) Library and Resource Centre

e) ICT Laboratory

f) Workshops

g) Physics Laboratory

h) Teaching Practice Laboratory/ Micro teaching Studio

Personnel

a) Course Lecturers

There should be a minimum of 8 (Eight) Academic staff

a) Teaching Practice Supervisors: all Academic Staff

b) Instructional/Lab Assistants: 3 Laboratory Assistants, and 1 Laboratory Supervisor

c) Laboratory Technicians: 3 Technicians

d) Laboratory Technologist: 2 Laboratory Technologists

e) Librarians/Resource Centre Managers: 2 Librarians and 2 Resource Centre managers

f) Administrative Support Staff: Secretary, 2 Clerical Assistants,

National Goals of Education Nigeria:

vii. Total integration of the individual into the immediate community, the Nigerian society and the world

viii. Provision of equal access to qualitative educational opportunities for all citizens at all levels of education within and outside the formal school system

ix. Incubation of national consciousness, values and national unity; and

x. Development of appropriate skills, mental, physical and social abilities and competencies to empower the individual to live in and contribute positively to the society.

h) Ensure the quality of education delivery at all levels

i) Promote functional education for skill acquisition, job creation and poverty reduction

j) Ensure periodic review, effectiveness and relevance of the curriculum at all levels to meet the needs of society and the world of work;

k) Collaborate with development partners, the private sector, non-governmental organisations and local communities to support and fund education; and Promote information technology capability at all levels

Objectives of the Programme:

The objectives of the Physics Education programme are to:

1. Provide students with a broad and balanced foundation of Physics knowledge and practical skills;
2. Instil in students a sense of enthusiasm for Physics and appreciation of its applications in different contexts;
3. Instil in students a culture of creativity and critical thinking that will enable them to seek solutions to problems;
4. Develop in students the ability to apply their knowledge and skills in Physics to solve theoretical and practical problems;
5. Develop in students through an education in Physics a range of transferable skills of value in physics and other areas;
6. And provide students with a knowledge and skills base for further studies in Physics or multidisciplinary areas involving physics.
7. Instil the basic knowledge of the organisational concepts and techniques in practical laboratory management.
8. Instil ethical behaviour, social responsibility, and respect for diversity.

Learning Outcomes for the Programme:

By the end of the programme graduates should be able to:

a) Analyse problems, evaluate information, and propose appropriate solutions in educational contexts.
b) Demonstrate effective written and oral communication by presenting ideas clearly and responding appropriately in discussions.
c) Demonstrate respect for others, act ethically in educational situations, and appreciate cultural and individual differences.
d) Practice new ideas, apply knowledge in changing educational environments.
e) Design and participate in learning activities that accommodates diverse learners and promote participation for all.
f) Generate innovative ideas, and reflect on their learning experiences to improve practice
g) Engage in activities that address community needs and demonstrate responsible citizenship in educational and social settings.

Relevance Statement

The Physics Education course is important because it helps students become well-rounded teachers who can think clearly, communicate effectively and act responsibly. It equips prospective teachers with professional knowledge, skills and values needed to teach confidently, effectively, and ethically in today's diverse classrooms. These courses also prepare teachers to understand, support all learners, harness their abilities, and shape their future by using modern methods, understanding human development, and responding to the real needs of individuals, schools and society. By learning these courses, students are better prepared to make a positive difference in their classrooms, schools, communities, nation and globally.

General Learning Outcomes for the Programme:

By the end of the programme, students should be able to:

a) Explain key concepts in teaching and learning and show this understanding through class discussions, tests and practical activities.

b) Plan and deliver simple, clear, well-structured, and engaging lessons that support different types of learners.

c) Communicate well with learners, parents, and colleagues using respectful and understandable language.

d) Use teaching materials and basic digital technology to make learning easier and more interesting.

e) Create a friendly and inclusive classroom by applying contextual strategies that supports learners with different abilities, where every learner feels respected, safe, and able to participate.

f) Collaborate with others in teams, showing cooperation, patience, and respect.

g) Analyse their own teaching, identify what went well and what needs to be improved.

h) Demonstrate good behaviour and professional ethics, acting responsibly as a role model.

g) Support the emotional and social needs of learners, helping them feel confident and motivated.

h) Engage in lifelong learning by seeking new knowledge and adapting to changes in education and society.

CATEGORY	DETAILS
Core Competencies	• Creativity • Communication • Critical thinking • Collaboration • Innovation • Reflective thinking • Self-development • Leadership • Digital literacy learning • Lifelong learning • Time Management • Self-awareness • Sacrifice
Core Values	• Honesty • Integrity • Inclusion • Respect • Team spirit • Perseverance • Service • Flexibility • Tolerance • Transparency • Humility • Honour

CATEGORY	DETAILS
Pedagogical Approaches	• Learner-Centred Approach • Collaborative /Cooperative Learning • Inquiry-Based Learning • Experiential Learning • Blended Learning • Discussion and Dialogue • Project-based Learning • UDL & SEL Based Teaching • Edutainment
Learning Resources	• Core Textbooks • Recommended Supplementary Texts • National and International Policy Documents • Academic Journals • Electronic Learning Resources • Professional Organisations • Audio-Visual and Practical
Assessment Methods	• Class participation and attendance • Assignments and quizzes • Group projects and presentations • Practical demonstrations • Reflective journals or portfolios • Mid-semester tests • Final written examination

NCE Course Distribution (100–300 Level)

NCE 100 Level

NCE 100 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 111	Introduction to Teaching and Historical Foundations of Education	2	C	30	30
EDU 112	Educational Psychology	2	C	30	30
GSE 111	General English 1	1	C	15	15
GSE 112	Introduction to Library Studies	1	C	15	15
GSE 113	Family Life, Human Trafficking & Emerging Issues	1	C	15	15
BIO 101	General Biology I	2	C	30	-
CHE 111	General Chemistry 1	2	C	30	
MAT 111	General Mathematics I (Number Theory)	2	C	30	
PHY 111	General Physics I	2	C	30	
PHY 103	General Physics II (Behaviour of Matter)	2	C	30	
PHY 113	Introduction to Space Science	2	C	30	
PHY 107	General Physics Practical I	1	C	15	45
Total		**20**			

NCE 100 Level

NCE 100 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 121	Principles and Methods of Teaching in Basic Education	2	C	30	30
EDU 122	Sociological and Philosophical Foundations of Education	2	C	30	30

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 121	English Proficiency for Teachers	1	C	15	15
GSE 122	Digital Literacy & AI for Educators	1	C	15	15
GSE 123	Media and Information Literacy I	1	C	15	15
BIO 121	General Biology II	1	C	30	-
CHE 121	General Chemistry II	1	C		
MAT 102	General Mathematics II (Algebra and Trigonometry)	2	C		
PHY 102	General Physics II	1	C		
PHY 104	General Physics IV (Vibration, Waves and Optics)	2	C	30	
PHY 105	General Physics Practical II	1	C	15	45
PHY 124	Introduction to Astronomy & Environmental Physics	2	C	30	
Total		**17**			

NCE 200 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 211	Classroom Management	1	C	15	15
EDU 212	Curriculum and Curriculum Delivery	2	C	30	30
EDU 213	Micro Teaching I: (Theory and Practice)	2	C	30	30
GSE 211	General English II	1	C	15	15
GSE 212	Introduction to Foundational Literacy	1	C	15	15
GSE 213	Media and Information Literacy II	1	C	15	15
CSE 211	Introduction to Computer	3	C	30	
PHY 206	Thermal Physics	2	C	45	
PHY 207	General Physics Practical III	2	C	-	45
Total		**15**			

NCE 200 Level

NCE 200 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 221	Research Methods, Measurement and Evaluation	2	C	30	30
EDU 222	Educational Administration, Planning and Supervision	1	C	15	15
EDU 223	Introduction to Educational Technology	1	C	15	15
EDU 224	Micro Teaching: II (Practicum)	2	C	30	30
GSE 221	Introduction to Foundational Numeracy	1	C	15	15
GSE 222	Entrepreneurship and Green Skills	1	C	15	15
PHY 221	Workshop Practice	2	C		45
PHY 204	General Physics VI (Waves and Optics)	2	C	30	
PHY 206	General Physics VII (Energy and Environment)	1	C	30	
PHY 208	General Physics Practical IV	1	C		45
Total		**14**			

NCE 300 Level

First Semester

Course Code	Course Title	Status	Credit Units	Lecture Hours	Practical Hours	SOURCE
EDU 311	Teaching Practice (TPD)	C	6	30	45	CCMAS
Total			**6**			

NCE 300 Level: Second Semester

Course Code	Course Title	Credit Units	Status (C, E)	Lecture Hours	Practical Hours
EDU 321	Research Project	2	C	30	30
EDU 322	Theory and Practice of Guidance and Counselling	1	C	15	15

Course Code	Course Title	Credit Units	Status (C, E)	Lecture Hours	Practical Hours
GSE 321	Global Citizenship Education and Political Economy	1	C	15	15
PHY 302	Introduction to Electric Circuits and Electronics	2	2	15	
PHY 301	General Physics V(Modern Physics)	2	2	30	
Total		**8**			

Degree Course Distribution (400–500 Level)

Degree 400 Level

Degree 400 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
GSE 412	Peace and Conflict Resolution	2	C	30	30
PHY 401	Analytical Mechanics I	3	C	45	
PHY 403	Electromagnetism	3	C	45	
PHY 405	Quantum Physics	3	C	45	
CSC 413	Artificial Intelligence	2	C	30	
SED 402	Methods of Teaching Physics	2	C	30	
Total		**15**			

Degree 400 Level

Degree 400 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 402	Educational Measurements, Tests, Research Methods and Statistics	3	C	45	45
ENT 412	Venture Creation	3	C	30	30
PHY 404	Electromagnetic Waves and Optics	3	C	45	
PHY 406	Statistical and Thermal Physics	3	C	45	
PHY 423	Methods in Teaching Physics II	3	C	30	
PHY 402	Ordinary Differential Equation	2	C	30	
Total		**17**			

Degree 500 Level

Degree 500 Level: First Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 501	Teaching Practice	6	C	90	90
PHY 501	Quantum Mechanics I	3	C	45	
PHY 503	Mathematical Method in Physics	3	C	45	
PHY 513	Complex Variables and Vector Space	3	C	30	
SED 502	Science Technology and Society	2	C	30	
Total		**17**			

Degree 500 Level

Degree 500 Level: Second Semester

Course Code	Course Title	Credit Units	Status	Lecture Hours	Practical Hours
EDU 500	Research Project	3	C	45	45
PHY 521	Biophysics	2	C	30	
PHY 501	Quantum Mechanics II	3	C	45	
PHY 504	Mathematical Methods in Physics II	3	C	45	
PHY 505	Physics Entrepreneurship	2	C	45	
PHY 525	Nuclear and Particle Physics	2	C	30	
PHY 526	Semiconductor Devices	3	C	45	
PHY 527	Physics of Solar Systems	2	C	30	
Total		**20**			

COURSE DESCRIPTION

NCE Course Descriptions (100–300 Level)

PHY 101 General Physics I (Mechanics)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core course) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces 100- level student to the basics principles of classical mechanics which is the branch of Physics that deals with motion of objects and the forces that cause them. The course emphasises both theoretical and practical understanding and problem – solving skills, application to real life situations

RELEVANCE STATEMENT

Mechanics is a core foundational course designed to introduce students to the fundamental principles governing the motion of bodies and the forces that cause such motion. The course is relevant because it provides the essential theoretical background and analytical skills required for further studies in Physics, Engineering, and other applied sciences. Topics such as kinematics, dynamics, work, energy, momentum, gravitation, and rotational motion form the basis upon which advanced courses in electricity, waves, Thermodynamics, and Quantum physics are built. Mastery of mechanics is therefore critical for academic progression in science and technology programmes.

Beyond academics, the course is professionally relevant because the laws of mechanics are applied in solving real-world problems in engineering, industry, agriculture, transportation, and energy. In the Nigerian context, understanding mechanics is vital for the design and maintenance of machines, buildings, vehicles, irrigation systems, and renewable energy devices. The course also develops students' problem-solving, critical thinking, and quantitative reasoning abilities which are important for national development, research, and teaching. Thus, PHY 111 equips students with both the conceptual foundation and practical skills needed to contribute meaningfully to technological growth and self-reliance in Nigeria.

COURSE OBJECTIVES

The objectives of this course are to:

1. Explain Fundamental and derived quantities
2. State the importance of dimensional analysis,

3. Define vector and scalar quantities,
4. Derive equations of motion,
5. Momentum, conservation principle, system of particles.
6. Planetary motion, and space travel.

LEARNING OUTCOMES

By the end of the course, the students should be able:

a) Differentiate between fundamental and derived quantities and their units
b) Solve problems involving dimensional analysis
c) Differentiate between vector and scalar quantities with examples.
d) Explain the application of Newtonian mechanics; equation of motion, momentum conservation etc.
e) Explain system of particles and applying them in problem solving.
f) Explain the planetary motion and space travel

COURSE CONTENT

- Space and time
- Units and dimension, vectors and scalars
- Differentiation of vectors: displacement, velocity, and acceleration. kinematics
- **Newton laws of motion:** Inertial frames, Impulse, force and action at a distance, momentum conservation
- Relative motion
- Application of Newtonian mechanics, Equations of motion, Conservation principles in physics, Conservative forces, conservation of linear momentum, Kinetic energy, work and Potential energy
- System of particles
- Centre of mass
- Rotational motion
- Torque, vector product, moment, rotation of coordinate axes and angular momentum
- Polar coordinates, conservation of angular momentum, circular motion, moments of inertia, gyroscopes, and precession
- Gravitation: Newton’s law of gravitation, Kepler’s laws of planetary motion, gravitational potential energy, escape velocity, satellites motion, and orbits

CATEGORY	DETAILS
Core Competencies	• Relate (Application) • Construct (Skill) • (Knowledge) State and explain • Critical thinking
Core Values	• Team work • Self confidence • Responsibility • Commitment
Pedagogical Approaches	• Project, essay • Lab Reports, practical test • Examination • Assignment • Learner-Centred Approach
Learning Resources	• Textbooks, online books, digital ticker – timer • Graphs • Graphs • Core textbooks, on-line books
Assessment Methods	• Project, essay, class discussion • Oral questions • Written test • Performance-Based Assessment

Reference: University Physics by Hugh D. Young and Roger Freedman (2026)

Journal of National Institute of Physics (2020)

PHY 103 General Physics III (Behaviour of Matter)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Behaviour of Matter is a foundational course that introduces students to the structure, properties, and physical behaviour of solids, liquids, and gases. The course bridges the gap

between classical mechanics in PHY 111 and more advanced courses in Thermal Physics, Electricity, and Materials Science. It provides students with the conceptual framework and quantitative tools to understand how matter responds to external forces, heat, and pressure. The course is academically relevant because it lays the groundwork for understanding elasticity, fluid mechanics, surface phenomena, thermal expansion, and kinetic theory. These are core to engineering, geophysics, and applied physics. Professionally, the principles are applied in construction, material design, oil and gas, manufacturing, agriculture, and renewable energy systems. In the Nigerian context, knowledge of the behaviour of matter is critical for road construction, building materials, water supply systems, drilling, and storage. The course also develops experimental skills and data analysis abilities through laboratory work. Thus, PHY 112 equips students to explain and predict the physical behaviour of materials used in industry and everyday life.

RELEVANCE STATEMENT

Behaviour of Matter is directly relevant to the training of physicists, engineers, and applied scientists because it explains how materials respond to force, heat, and pressure in real-world situations. The course provides the foundational knowledge required for advanced courses such as Thermal Physics, Materials Science, Geophysics, and Engineering Physics. The course builds on PHY 111 Mechanics and introduces students to elasticity, fluid mechanics, surface phenomena, and kinetic theory. These concepts are essential for understanding the physical properties of materials and for further study in condensed matter physics and applied physics. In Nigeria and globally, the principles taught in PHY 112 are applied in Construction & Civil Engineering. Selection of building materials, understanding stress-strain behaviour, and prevention of structural failure and fluid flow in pipelines, viscosity of crude oil, pressure management, and drilling operations. Design of machines, springs, cables, and tools based on elastic properties. Irrigation systems, water pumps, and storage tanks that rely on fluid statics and surface tension. Renewable Energy: Solar thermal systems and heat transfer applications. Knowledge of the behaviour of matter helps in solving everyday Nigerian problems such as burst water pipes, road deformation, building collapse, and efficient storage and transportation of liquids and gases. It also promotes safety, accuracy, and innovation in material usage. The course develops students' experimental, analytical, and problem-solving skills through laboratory work. Students learn to measure, record, analyse data, and communicate results – competencies required for research, industry, and entrepreneurship.

COURSE OBJECTIVES

The objectives of this course are to:

a) Differentiate between the concepts of heat and temperature

b) Identify the types of thermometer and thermometric properties

c) State gas laws, thermodynamic laws, and how to apply them in solving problems

d) State Hooke's law and its applications

e) Define Young's shear and Bulk modulus as well as Poisson ratio of materials

f) Explain and apply the concept of fluid motion in everyday life.

LEARNING OUTCOMES

At the end of this course, students should be able to:

a) Explain the molecular structure and physical properties of solids, liquids and gases.

b) State and describe the laws of elasticity and their limitations.

c) Describe the principles governing fluid statics, fluid dynamics, and kinetic theory of gases.

d) Explain surface phenomena and thermal properties of matter.

e) Apply the concepts of stress, strain, Young's modulus and Poisson's ratio to solve numerical problems.

f) Solve problems involving pressure, buoyancy, viscosity, streamline flow, and Bernoulli's principle.

COURSE CONTENT

- Heat and Temperature and Temperature scales
- Gas laws
- General gas equation
- Thermal conductivity
- First Law of thermodynamics
- Heat, work, and internal energy and reversibility
- Thermodynamic processes
- Adiabatic, isothermal and isobaric
- Second law of thermodynamics
- Heat engines and entropy, Zero's law of thermodynamics
- Kinetic theory of gases

- Molecular collisions and mean free path
- Elasticity
- Hooke's law, Young's, shear and bulk moduli
- Hydrostatics
- Pressure, buoyancy, Archimedes' principles
- Bernoulli's equation and incompressible fluid flow
- Surface tension
- Adhesion, cohesion, viscosity, capillarity, drops and bubbles

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Collaboration • Innovation • Leadership • Time Management
Core Values	• Creativity and Innovation • Commitment • Confidence • Resilience • Excellence
Pedagogical Approaches	• Discussion & Dialogue • Contextual teaching Learning • Learner-Centred Approach • Inquiry-Based Learning • UDL & SEL Based Teaching
Learning Resources	• Analogy instructional strategy • Digital and Online Platforms • Core Textbooks & Reference Materials • **Contextual approach**

CATEGORY	DETAILS
Assessment Methods	• Performance-Based Assessment • **Formative assessment** • Continuous Assessment • **Continuous assessment**

Reference: University Physics by Hugh D. Young and Roger Freedman (2026)

Journal of National Institute of Physics (2020)

PHY 113 Introduction to Space Science

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the study of the universe beyond the Earth's atmosphere. It provides a foundation in astronomy and space physics. The course cover solar system, stars galaxies, and cosmology. Structure and evolution of celestial bodies, Earth's atmosphere, ionosphere, magnetosphere and radiation belts, solar physics, solar wind, space weather and interactions of solar radiation with earth, satellites, rockets, spacecraft, remote sensing, and space missions, Telescope, detectors, and data analysis in astronomy, GPS, satellite communication, weather forecasting, climate monitoring, and disaster management, role of NASRDA, satellite programmes and space policy. Emphasis is placed on understanding space as an environment and its relevance to life on earth.

RELEVANCE STATEMENT

Space science is critical for technology, security and sustainable development. This course provides the foundation for understanding space systems and their applications. PHY 113 is a pre- requisite for space physics, remote sensing and satellite communication. It connects physics principles to astronomy and space technology. Skills from this course are applied in space agencies, satellite TV, internet, GPS, navigation systems, metrological satellites, climate monitoring, early warning systems, surveillance, remote sensing reconnaissance, precision farming, land use mapping, drought monitoring, pipeline monitoring, exploration using remote sensing, astrophysics, solar- terrestrial physics, planetary science, understanding celestial mechanics and space environment, interpreting satellite data and images, basic knowledge of spacecraft and satellite systems, applications of space technology to solve earth problems, data analysis in astronomy and space

weather, and awareness of space policy and international cooperation, space technology drives national development in communication, security, agriculture and disaster management, Graduates of this course contribute to Nigeria's space programme, climate adaptation, and the use of satellite data for socio- economic growth. In summary this course trains students to understand the space environment and apply space science and technology to address national challenges in communication, environment and development.

COURSE OBJECTIVES

The objectives of this course are to:

a) Define basic concepts of Space Science, astronomy and astrophysics.
b) Describe the structure and components of Solar system, Milky way, Galaxy and the universe.
c) Explain the origin, structure and evolution of stars, planets, comets, asteroid and galaxies.
d) Interpret astronomical data such as light curves, spectra, and Hertzsprung – Russell diagrams.
e) Analyse space weather, solar activity, and their effects on Earth's environment and Technology
f) Apply basic laws of motion and gravitation to solve problems in planetary and satellite motion.

LEARNING OUTCOMES

By end of this course, students should be able to:

a) Explain the concept of space science, solar system, galaxies and large-scale structure of the universe.
b) Comprehend Space exploration and space technology,
c) Make use of computer simulation to explain space weather and its impact on earth

COURSE CONTENT

Introduction to space, The solar system, The Sun; Our closest star, The Earth-moon system,

- Stars and stellar evolution
- Galaxies and the large-scale structure of the universe
- The expanding universe and cosmology

- Space exploration: History and technology
- Spacecraft and space technology
- The search for extraterrestrial life
- Human spaceflight and colonisation
- Space weather and its impact on Earth
- Space science and society

CATEGORY	DETAILS
Core Competencies	• Self-Development • Time Management • Innovation & Critical Thinking • Pedagogic Knowledge • Innovation
Core Values	• Respect • Perseverance • Resilience • Self- confidence • Self-Direction & Service
Pedagogical Approaches	• Learner-Centred Approach • Inquiry-Based Learning • Collaborative /Cooperative Learning • Experiential Learning • Blended Learning
Learning Resources	• Core textbooks • Digital & Online • Learning • Learning Platforms • Instructional materials. • Journals

CATEGORY	DETAILS
Assessment Methods	• Continuous Assessment • Continuous Assessment • Formative Assessment • Formative Assessment • Performance-Based Assessment

Reference/Reading: Reference: University Physics by Hugh D. Young and Roger Freedman (2026)

Journal of National Institute of Physics (2020)

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Material

PHY 107 General Physics Practical I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (Core course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course provides hands – on laboratory experience to complement PHY 101 and PHY102, PHY 103 and PHY 104. Students will perform experiments in Mechanics and properties of matter. Emphasis is placed on developing skills in accurate measurement, data collection, analysis, graphing, error estimation, and scientific report. This course also trains students Insafe handling and proper use of Laboratory instruments.

RELEVANCE STATEMENT

The course bridges the gap between theory and practice and develops the experimental skills required for all advanced physics and engineering courses. The course reinforces concepts in Mechanics and Behaviour of Matter through direct experimentation. Skills acquired in measurement, data analysis, graph plotting, and error estimation are prerequisites for PHY 214, PHY 224, and all research-based courses in the physics programme. In industry and research, accurate measurement and experimental validation are critical. The competencies developed in PHY 107 are applied in: Calibration of instruments, quality control, and materials testing. Measurement of fluid properties like viscosity and density in pipelines and drilling. Testing of elastic properties of building materials to ensure structural integrity. Design of experiments, data collection, and scientific reporting. Training of future science teachers with practical demonstration skills.

Practical skills in measurement and experimentation help address local challenges such as accurate water flow measurement, testing of building materials, and maintenance of equipment. The course promotes a culture of evidence-based problem solving and innovation in Nigeria. PHY 107 develops core competencies including: precision in measurement, safe handling of instruments, data recording, error analysis, teamwork, and technical report writing. These are essential skills for employability in labs, industries, and postgraduate research. In summary, It produces graduates who can not only understand physics principles but also verify, apply, and communicate them through practical work.

COURSE OBJECTIVES

The objectives of this course are to:

a) State the principles, laws and formulas related to experiments in Mechanics and properties of Matter

b) Describe the function and proper use of common laboratory instruments and apparatus

c) Apply appropriate formulas to analyse experimental data and solve physics problems.

d) Plot and interpret graphs from experimental data including determination of slope, intercept, and error analysis.

e) Calculate uncertainties, errors, and present results with correct units and significant figures.

f) Demonstrate correct handling and use of laboratory equipment for experiments in mechanics, elasticity and fluid mechanics.

g) Exhibit ability to manage the laboratory.

LEARNING OUTCOMES

By the end of the course students should be able to:

a) Acquire basic knowledge,

b) Acquire competency and skills of organisational concepts

c) Explain techniques in practical physics and laboratory management

COURSE CONTENT

- These introductory courses emphasise quantitative measurements, the treatment of measurement errors, and graphical analysis
- A variety of experimental techniques should be employed
- The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat and viscosity

- These are covered in

PHY 111, 112, and 113. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

CATEGORY	DETAILS
Core Competencies	• **Creativity** • **Critical thinking** • **Problem Solving** • **Entrepreneurial Skill** • **Time Management**
Core Values	• Flexibility • Integrity & • Versatility • Confidence • Self – Direction • Resilience
Pedagogical Approaches	• Collaborative /Cooperative Learning • Discovery Learning • Analogy instructional • Approach • Experiential learning • Discussion and Dialogue
Learning Resources	• Physics Practical Manual, Practical physics text books • Physics Practical Manual, Practical physics text books • Physics Practical Manual, Practical physics text books • Physics Practical Manual, Practical physics text books • Physics Practical Manual, Practical physics text books
Assessment Methods	• Continuous assessment • Formative assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials**,** Digital and online Learning Platforms, Instructional Materials, etc.

Physics Practical Manual KIS (2024)

BIO 111 General Biology I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (Core course) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course introduces student to the fundamental principles of biology that underpin the study of living organisms. The course examines the structure and organisation of cells, the functions of cellular organelles, and the characteristics and classifications of living things. It also explores the concepts of chromosomes, genes, heredity reproduction, evolution, ecological principles, and interactions among organisms. Students will ga in a solid foundation in biological concepts necessary for advanced studies in biology and related disciplines.

RELEVANCE STATEMENT

This course provides students with the foundational knowledge required for understanding biological systems and life processes. It equips prospective biology teachers with essential concepts in cell biology, genetics, ecology, evolution, and taxonomy, enabling them to explain biological phenomena scientifically. The knowledge acquired will support further studies in biological sciences and enhance students' ability to apply biological principles to environmental conservation, health, agriculture, and science Education.

COURSE OBJECTIVES

The objectives of this course is to:

1. Provide students with a fundamental understanding of the structure, organisation, and functions of cells and their organelles.
2. Introduce the characteristics, classification, and modes of reproduction of living organisms.
3. Explain the ecological relationships and interactions among organisms and their environment
4. Familiarise students with the basic principles of heredity and evolution.

5. Expose students to the different habitat types and the distinguishing characteristics-
6. Develop students" understanding of the fundamental concepts and principles of general biology.

LEARNING OUTCOMES

At the end of lectures, students should be able to:

Explain cells structures and organisations;

1.

1. Summarise functions of cellular organelles;

Characterise living organisms and state their general reproduction;

3.

1. Describe the interrelationship that exists between organisms;
2. Discuss the concept of heredity and evolution; and enumerate habitat types and their characteristics

6.

COURSE CONTENT

Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes their relationships and importance, general mode of reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism); heredity and e volution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitats

CATEGORY	DETAILS
Core Competencies	• Scientific Inquiry • Observation • Classification of Living things • Evaluation • Application

CATEGORY	DETAILS
Core Values	• Curiosity • Diligence • Integrity • Responsibility • Conservation and team work
Pedagogical Approaches	• Inquiry based learning • Demonstration • Group Discussion • Group work • Case studies
Learning Resources	• Biology text books, Chart, models • Specimens • Multimedia facilities, prepared slides • Laboratory Manual, cultures • Herbarium
Assessment Methods	• Lab and field report • Class presentation of findings

REFERENCES AND FURTHER READING

1. **Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., & Orr, R.B. (2021)Campbell Biology (12th ed) Pearson**

CHE 111 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (CCMAS) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides a foundational understanding of the fundamental principles and concepts of Chemistry. It examines atoms, molecules elements, compounds and chemical reactions, with emphasis on modern electronic theory, electronic configuration, periodicity and the development of the periodic table. Th course also covers chemical bonding, hybridisation, molecular shapes, intermolecular forces, valence forces and the structure of

solids. Students are introduced to chemical equations, stoichiometry, kinetic theory of matter, properties of gases, elementary thermochemistry, reaction rates, chemical equilibrium and basic thermodynamics. Further topics include acids, bases, and salts, redox reactions, introductory electrochemistry and radioactivity. The course combines conceptual understanding with appropriate calculations and applications to develop a strong foundation for further study of chemistry.

RELEVANCE STATEMENT

A sound knowledge of General chemistry is essential for understanding more advanced areas of chemistry and its application in science, technology, health, agriculture and industry. The course equips students with the fundamental concepts, principles and problems- solving skills required to interpret chemical phenomena, perform quantities chemical calculations and relate microscopic properties of matter to observable behaviour. It also provides the necessary foundation for subsequent courses in organic, inorganic, physical, analytical and environmental chemistry.

COURSE OBJECTIVES

The objectives of this course are to;

1. Explain the fundamental concepts of atoms, molecules, element, compounds and chemical reactions;
2. Describe the modern electronic structure configurations and periodic trends;
3. Explain chemical bonding, hybridisation, molecular shapes, intermolecular forces and structure of solids;
4. Write and balance chemical equations and solve quantitative problems involving stoichiometry;
5. Explain the basic principles of kinetic theory, gases, thermochemistry, reaction rates, equilibrium and thermodynamics;
6. Explain the concepts of acids, bases, salts, redox, reactions, electrochemistry and radioactivity and relate them to practical applications.

LEARNING OUTCOMES

At the end of this course, the students should be able to;

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;

4. Justify the trends of atomic radii, ionisation energies, electronegativity of elements based on their position on the periodic table;
5. Identify and balance oxidation – reduction equation and solve redox titration problems;
6. Illustrate shapes of simple molecules and hybridised orbitals;
7. Identify the characteristics of acids, bases, and salts, and solve problems based on their quantitative relationship;
8. Apply the principles of equilibrium to aqueous systems using Le chatelier's principle to predict the effect of concentrations, pressure and temperatures changes on equilibrium mixtures;
9. Analyse and perform calculations with the thermodynamics functions, enthalpy, entropy and free energy;
10. Determine rates of reactions and its dependence on concentration, time and temperature.

COURSE CONTENT

- Atoms, molecules, elements and compounds and chemical reactions
- Modern electronic theory of atoms
- Electronic configuration, periodicity and building up of the periodic table
- Hybridisation and shapes of simple molecules
- Valence forces
- Structure of solids
- Chemical equations and stoichiometry
- Chemical bonding and intermolecular forces, kinetic theory of matter
- Elementary thermochemistry
- Rates of reaction, equilibrium and thermodynamics
- Acids bases and salts
- Properties of gases
- Redox reactions and introduction to electrochemistry
- Radioactivity

CATEGORY	DETAILS
Core Competencies	• 1.knowledge • 2.analysis • 3.application
Core Values	• Objectivity and scientific inquiry • Innovation • Scientific curiosity • Integrity and discipline
Pedagogical Approaches	• Interactive lectures • Guided discussion • Demonstrations • Problem – solving sessions • Use of simulations and charts
Learning Resources	
Assessment Methods	• 1.class tests • 2.quizzes • 3.assignment • Oral • Questioning • Continuous assessment

REFERENCES AND FURTHER READING

1. Brown, T.L., LeMay, H.E., Bursten, B. E., Murphy, C. J., Woodward, P.M., & Stoltzfus, 2.M.W. (2018). *Chemistry; The Central SCIENCE (14TH ed) Pearson*.
2. Ebbibing, D. D., & Gammon, S.D. (2017) *General chemistry (11th ed.) Cengage Learning*

MAT 111 General Mathematics I (Number Theory)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of Number Theory and Mathematical structures. It focuses on the properties and operations of numbers, including integers, primes, divisibility, congruences, and groups. Emphasis is placed on mathematical reasoning, proofs, and applications of numbers in real – life situations. Students will explore theorems, mathematical induction, linear congruences, and the use of number systems in problem solving.

RELEVANCE STATEMENT

Number Theory enables pre – service teachers to explain number concept clearly, systematically and confidently to learners.

COURSE OBJECTIVES

By the end of this course, students should be able to;

1. Demonstrate a proper understanding of number system, including direction and magnitude of numbers.
2. Apply and manipulate different mathematical ideas involving numbers, such as ordering, induction, divisibility and congruence.
3. Appreciate and utilise the applications of numbers in real -life situations.
4. Solve problems using principle of mathematical induction define and analyse congruences, including reflexive, symmetric and transitive properties.
5. Define and analyse congruence, reflexive, symmetric and transitive properties.

LEARNING OUTCOMES

By the end of this course, students should be able to;

1. Explain and apply the process of counting and the use of ordered pairs (Peano’s Axioms).
2. Perform fundamental operations in mathematical structures and analyse group properties.
3. Explore further properties of integers, including well- ordering principle and divisibility.

4. Apply mathematical induction in proving theorems and laws.
5. Understand primes, relatively prime integers and unique factorisation.
6. State and prove the fundamental theorem of arithmetic.
7. Define and analyse congruences, including reflexive, symmetric, and transitive properties
8. Wofk with residue classes and solve linear congruences using basic theorems.
9. Apply Fermat's theorem, Euler's functions and related concepts to problems in number theory.
10. Demonstrate an understanding of the use of numbers in solving practical and theoretical problems.

COURSE CONTENT

- Process of counting, Peano's Axioms using ordered pairs, Fundamental operations in mathematical structures, groups – group properties, further properties of Integers, well ordering principle, mathematical induction to Laws of trichotomy, divisibility (basic definitions, divisions, primes, gcd)
- **Basic theorems on gcd:** proofs may be required
- **Relatively prime integers:** unique factorisation
- **The fundamental theorem of arithmetic:** proof may be required
- **Congruences, basic definitions and examples, properties of congruences:** reflexive symmetric and transitive; the equivalence relation
- Residue classes, linear congruences, basic theorems and solutions of linear congruences, proofs of the main theorem may be required, Fermat's theorem and applications, the proof of Fermat's theorem may be required, Euler function and number (proof not required)
- Application to linear congruences, fundamental operation in mathematical structures, group properties

CATEGORY	DETAILS
Core Competencies	• 1.creativity • 2.innovation • Reflective thinking • Critical thinking • Communication • Collaboration • Self – development
Core Values	• 1.integrity • 2.respect • Team spirit • Perseverance • Transparency • Tolerance • 7.honesty
Pedagogical Approaches	• Learner- centred approach • Collaboration & cooperative learning • Blending learning • Discussion and Dialogue
Learning Resources	• Core text books and reference materials • Digital and Online learning platforms
Assessment Methods	• Continuous assessment • 2 formative assessments • Digital assessment • Summative assessment • Readings • 6.class work • Assignment • Group assignment • Presentations • Written

Suggested;

1. **Current textbook on an introduction to the theory of Numbers**
2. **Use of online resources.**

CSC 111 Introduction to Computer Science

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This foundational course introduces NCE students to the basic concepts, history, and societal relevance of Computer Science. It provides learners with an understanding of how computers evolved from the first generation to modern-day systems, their classifications, and their transformative impact on education, industry, governance, and everyday life.

The course exposes students to the fundamental components of computer hardware and software, basic computer data processing systems, and emerging issues related to computer ethics and human values. It also introduces Information and Communication Technology (ICT) as a critical tool for teaching, learning, communication, and national development in the digital age.

Through a blend of theory and practical exposure, the course promotes responsible use of technology, digital citizenship, and ethical awareness. It supports inclusive learning through Universal Design for Learning (UDL) principles and nurtures Social Emotional Learning (SEL) competencies such as responsible decision-making, self-management, and collaboration. By the end of the course, students will appreciate computer science as a problem-solving discipline and a vital tool for effective teaching and lifelong learning.

RELEVANCE STATEMENT

This course provides foundational knowledge of computer science concepts, history, and applications. It equips students with an understanding of computing systems, problem-solving approaches, and the role of computers in modern society, forming the intellectual basis for further studies in programming, software development, and information technology.

COURSE OBJECTIVES

The objectives are to:

- Explain the meaning, scope, and importance of Computer Science in modern society.

- Trace the historical development of computers from the first generation to contemporary systems.
- Classify computers based on size, purpose, and functionality.
- Identify and describe the basic components of computer hardware and software.
- Explain the concept and stages of computer data processing systems.
- Discuss the impact of computers on education, communication, and national development.
- Explain basic principles of computer ethics and human issues related to technology use.
- Demonstrate responsible and ethical behaviour in the use of ICT tools.

Apply basic ICT knowledge to support learning and teaching activities

CATEGORY	DETAILS
Core Competencies	• 1.creativity • 2.innovation • Reflective thinking • Critical thinking • Communication • Collaboration • Self – development
Core Values	• 1.integrity • 2.respect • Team spirit • Perseverance • Transparency • Tolerance • 7.honesty
Pedagogical Approaches	• Learner- centred approach • Collaboration & cooperative learning • Blending learning • Discussion and Dialogue
Learning Resources	• Core text books and reference materials • Digital and Online learning platforms

CATEGORY	DETAILS
Assessment Methods	• Continuous assessment • 2 formative assessments • Digital assessment • Summative assessment • Readings • 6.class work • Assignment • Group assignment • Presentations • Written

Elementary Mathematics I (Algebra and Trigonometry)

PHY 102 Elementary Mathematics I (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the essential mathematical techniques required to solve problems in general Physics. It provides the mathematical foundation needed for PHY 111, PHY 112 and all subsequent physics courses. Emphasis is placed on understanding concepts and applying them to physical problems rather than pure mathematical proofs.

RELEVANCE STATEMENT

Physics is expressed in the language of mathematics, and this course equips students with the essential tools needed to formulate and solve physical problem. The course provides the foundation for all core physics courses. Concepts from PHY 115 are used directly in PHY 111 Mechanics, PHY 112 Properties of Matter, PHY 214 Electromagnetic Theory, and PHY 224 Mathematical Methods. Without mastery of calculus, vectors, and differential equations taught here, students cannot progress in the degree.

The mathematical skills from PHY 115 are critical in: Engineering, Modelling motion, forces, circuits, and systems using differential equations and vectors. Data analysis, signal processing, and modelling using calculus and coordinate systems, Data Science & Computing: Series expansions, functions, and numerical methods for simulation,

Research: Formulating physical laws mathematically, analysing data, and making predictions, Aerospace & Telecommunications: Vector analysis for fields, waves, and navigation.

Students develop core competencies in: Mathematical modelling of physical systems, Problem-solving using calculus, vectors, and ODEs, Approximation techniques using series expansions, Logical reasoning and quantitative analysis and translating real-world problems into mathematical form. National development in technology, energy, and infrastructure depends on people who can model and solve problems mathematically. Graduates with PHY 115 skills can contribute to innovations in renewable energy, communication systems, structural design, and scientific research in Nigeria. In summary, PHY 115 transforms students from “users of formulas” to “problem solvers”. It ensures physics graduates have the quantitative and analytical competence demanded by academia, industry, and research worldwide.

COURSE OBJECTIVES

The course objectives are to:

a) Introduce Subsets, union, intersection, compliments,
b) Cover Venn diagrams, real number, integers,
c) Explain rational and irrational numbers, sequences and series,
d) Discuss complex number, Argand diagram and
e) Introduce Binomial theorem, De-Moivre’s theorem, and trigonometrical functions of angle

LEARNING OUTCOMES

By the end of the course, the students should be able to; -

a) Differentiate between subsets, union, intersections and complements.
b) Draw Venn Diagrams.
c) Distinguish between real number, integers, rational and irrational numbers
d) Explain sequences and series
e) Explain Binomial theorem, complex numbers.
f) Solve problems on complex numbers, Argand diagram
g) Explain De-Moivre’s theorem, trigonometric functions of angles and of any magnitude

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements
- Venn diagrams
- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers

algebra of complex numbers; the Argand diagram. De-Moivre's theorem, nth roots of unity.

Circular measure, trigonometric functions of angles of any magnitude. Addition and factor formulae.

CATEGORY	DETAILS
Core Competencies	• Creativity • Pedagogic Knowledge • Reflective Thinking • Critical thinking • Self-Development
Core Values	• Inclusion • Self –Confidence, Ee, Humility, Honesty • Fairness • Excellence • Humility
Pedagogical Approaches	• Learner-Centred Approach • Collaborative /Cooperative Learning • Blended Learning • Inquiry-Based Learning

CATEGORY	DETAILS
Learning Resources	• Digital and online Learning Platforms • Digital and online Learning Platforms • Classroom & Instructional Materials, e • **Journals** • Core Textbooks and Reference materials
Assessment Methods	• Continuous Assessment • Formative Assessment • Performance-Based Assessment • Performance-Based Assessment • Formative Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 121/MTH 121 Elementary Mathematics I (Calculus)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides the fundamental concepts of differential and integral calculus required for Physics and Engineering students. The course focuses on limits, differentiation, integration and their applications to problems. It serves as the foundation for PHY 115, PHY 215 and other courses that require mathematical modelling.

RELEVANCE STATEMENT

Calculus is the language of change in Physics. This course equips students with the tools to describe motion, forces, energy and fields mathematically. It is also a pre- requisite for all 300 level and 400level theoretical physics courses. This course provides the basis for understanding mechanics, electromagnetism, quantum mechanics, and mathematical methods.

COURSE OBJECTIVES

The course Objectives are to:

a) Introduce Real variable

b) Discuss function of function,

c) Explain techniques of differentiation and integration,

d) Show application of differentiations and integration in Physics

LEARNING OUTCOMES

By the end of the course, students should be able to:

a) Explain function of a real variable and function of function

b) Differentiate between techniques of differentiation and integration

c) Explain the application of differentiation and integration in Physics

d) Apply integration to calculate area, volume, work and other physical quantities.

e) Define and evaluate limits and test for continuity of function

COURSE CONTENT

- Function of a real variable, graphs, limits and idea of continuity
- The derivative, as limit of rate of change
- Techniques of differentiation
- Extreme curve sketching
- Integration as an inverse of differentiation
- Methods of integration
- Definite integrals
- Application to areas, volumes

CATEGORY	DETAILS
Core Competencies	• **Self-development** • **Self -Efficacy** • **Collaboration** • **Critical thinking** • **Problem -solving**
Core Values	• Tolerance • Patriotism • Perseverance • Team Spirit

CATEGORY	DETAILS
Pedagogical Approaches	• Project work • Inquiry-based learning • Contextual learning • Blended learning
Learning Resources	• Core text books • Interactive boards • Instruction Materials • Reference materials • Online- Learning platform
Assessment Methods	• Home work • Test + • Assignment • Test • Exams + project questions • Tutorial

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Online Learning Platforms, Classroom & Instructional Materials, etc.

A – level Engineering mathematics by K. A. Shroud uploaded 2014

PHY 121 General Physics II (Electricity & Magnetism)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces the fundamental principles of electricity and magnetism. It covers electrostatics, electric circuits, magnetism and electromagnetic induction. PHY 121 provides the theoretical foundation for advanced courses in electromagnetism, electronics and communications. Emphasis is placed on laws, concepts and applications to real -life electrical and magnetic systems.

RELEVANCE STATEMENT

Electricity and Magnetism form the basis of modern technology. The course provides students with the core knowledge required to understand and development electrical, electronic, and communication systems. It connects mechanics to field theory and prepares students for Advanced physics and Engineering courses. It is also a pre- requisite to many physics' courses in higher levels

Students develop competence in circuit analysis using ohm's and Kirchoff's laws, solving problems involving electric and magnetic fields, applying Faraday's and Lenz's laws to induction problems, mathematical modelling of Electrical systems, critical thinking and quantitative problem solving.

Reliable power and communication are critical to National development. Graduate of PHY 122 can contribute to rural electrification, renewable energy, telecommunications and industrial automation in Nigeria. In summary the course trains students to understand, design, and troubleshoot the electrical systems that power modern society.

COURSE OBJECTIVES

The course objectives are to:

a) State the law of electrostatics, compare electrostatics with gravitational field,
b) State Coulomb's law, Ohm's law, ampere's law, Biot-savart law and
c) Show their applications,
d) Explain the concept of dipole moment, electromagnetic induction;
e) Discuss self and mutual inductance,
f) Cover Faraday's laws, Lenz's law and Maxwell's equation

LEARNING OUTCOMES

By the end of the course, the students should be able to:

1. State the laws of electrostatics and compare electrostatic field with gravitational field.
2. State Coulomb's law, Ohm's law, Ampere law, Biot-Savart law and their applications.
3. Explain the concept of dipole moment
4. Explain the concept of electromagnetic induction; self and mutual inductance
5. State Faraday's law, Lenz's law, and Maxwell's equation
6. Calculate electric field, electric potential, and capacitance for simple geometries.
7. Demonstrate safety consciousness when handling electrical apparatus.

COURSE CONTENT

- Forces in nature. Electrostatics; electric charge and its properties, methods of charging,
- Coulomb's law and superposition, electric field and potential and Gauss's law. Capacitance;
- Electric dipoles; energy in electric fields; conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits. Magnetic fields; Lorentz force; Biot-Savart
- And Ampère's laws; magnetic dipoles; dielectrics and energy in magnetic fields.
- Electromotive force; Electromagnetic induction; Self and mutual inductances; Faraday and
- Lenz's laws; Step up and stepdown transformers: Maxwell's equations; Electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

CATEGORY	DETAILS
Core Competencies	• **Leadership** • **Entrepreneurial skill** • **Social Emotional learning** • **Innovation** • **Reflection** • **Critical thinking**
Core Values	• Tolerance • Humility • Honesty • Freedom • Respect • Peace
Pedagogical Approaches	• Cooperative Learning • Inquiry-Based Learning • Blended learning • Discovery learning • Learner-Centred Approach • Project based learning

CATEGORY	DETAILS
Learning Resources	• Classroom & Instructional Materials • Digital and online Learning Platforms • Reference Materials • Instructional Materials • Interactive board • Core textbooks
Assessment Methods	• Assignments + test • Project • Test / exam • Formative Assessments • Continuous assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 104 General Physics IV (Vibration Waves and Optics)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 123 introduces students to the fundamental principles of oscillatory motion, wave phenomena, and optics, vibration: Simple harmonic motion, energy in SHM, damped and forced oscillations, resonance, Wave Motion, Types of waves, wave equation, wave speed, superposition, standing waves, beats, Doppler effect, Geometrical Optics: Reflection, refraction, lenses, mirrors, and optical instruments, Physical Optics: Interference – Young's double slit, thin films. Diffraction – single slit and diffraction grating. Polarisation of light. Emphasis is placed on both the mathematical treatment of wave phenomena and practical applications in physics, engineering, and technology.

RELEVANCE STATEMENT

Vibration, waves and optics form the backbone of many modern technologies. PHY 123 equips students with the foundational knowledge to understand and apply wave and optical principles. It provides the bridge between classical mechanics and electromagnetic

theory, and introduces concepts essential for advanced physics. Knowledge from this course is applied in Fibre optics, signal transmission, antenna and wave propagation Ultrasound imaging, lasers in surgery, optical diagnostics, Seismic wave analysis, acoustic well logging, Manufacturing: Laser cutting, interferometry for precision measurement, ICT & Consumer Electronics: Cameras, microscopes, telescopes, displays, holography. Students develop competence in Mathematical modelling and analysis of oscillatory and wave systems Solving problems in interference, diffraction, and polarisation, Using and calibrating optical instruments like lenses and mirrors, Experimental data collection, analysis and interpretation, Critical thinking and problem-solving in wave-related phenomena, Understanding waves and light is critical for national development, Graduates contribute to improved healthcare through medical imaging, expanded broadband/ communication networks, security systems, remote sensing, and renewable energy technologies. In summary, PHY 123 trains students to understand, analyse, and apply the principles of vibration, waves and optics to solve real-world scientific and technological problems

COURSE OBJECTIVES

The course objectives are to:

a) Define SHM,

b) Explain energy in vibrating system, damped simple harmonic and Q values,

c) Show waves, types of waves, properties and applications, wave equations (1D, 2D and 3D), d) Explain wave energy, power, phase and group velocities,

d) Describe Doppler effect,

e) Explain propagation of sound in gases, liquid and solid and their properties,

f) Explain wave nature of light and Huygen’s principle**.**

LEARNING OUTCOMES

By the end of the course, the students should be able to;

a) Explain SHM, energy in a vibrating system, damped simple harmonics and Q values

b) Define waves, mention its types, properties and applications

c) Differentiate between 1D, 2D and 3D wave equations, wave energy, power, phase and group velocities.

d) Explain doppler effect, propagation of sound in gases, solid and liquids, and their properties

e) Explain wave nature of light, Huygens’s Principle

COURSE CONTENT

- Simple Harmonic Motion (SHM), Energy in a vibrating system, Damped SHM, Q values, and power response curves, Forced SHM, resonance and transients and coupled SHM.
- Normal modes
- Waves
- Types and properties of waves as applied to sound, transverse and longitudinal waves
- Superposition, interference, diffraction, dispersion, polarisation
- Waves at interfaces
- Energy and power of waves
- The 1-D wave equation, 2-D and 3-D wave equations, wave energy and power, phase and group velocities, echo, beats, The doppler effect, propagation of sound in gases, solids and liquids, and their properties
- Optics
- Nature and propagation of light
- Reflection, refraction, internal reflection, dispersion, scattering of light, reflection and refraction at plane and spherical surfaces, thin lenses and optical instruments
- Wave nature of light
- Huygens's principle, interference and diffraction

CATEGORY	DETAILS
Core Competencies	• Communication • Collaboration • Productivity • Creativity • Critical thinking
Core Values	• Honour • Team Spirit. • Professional ethics & Responsibility • Creativity & innovation • Integrity

CATEGORY	DETAILS
Pedagogical Approaches	• Discussion &Dialogue • Collaborative /Cooperative Learning • Blended Learning • Learner-Centred Approach • Inquiry-Based Learning
Learning Resources	• Digital and online Learning Platforms • Core Textbooks and Reference materials • Digital and online Learning Platforms • Core Textbooks and Reference materials • Classroom & Instructional Materials.
Assessment Methods	• Performance-Based Assessment • Performance-Based Assessment • Continuous Assessment • Formative Assessment • Continuous Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 124 Introduction to Astronomy and Environmental Physics

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course provides an introductory survey of the universe and the physical principles governing the Earth's environment. Solar system, stars, galaxies, cosmology. Celestial mechanics, Kepler's laws, gravitation. Telescopes and observational techniques. Origin and evolution of stars and the universe, Earth's atmosphere and climate, energy flow and balance. Renewable and non-renewable energy sources. Atmospheric physics, pollution – air, water, noise and radiation. Greenhouse effect, ozone depletion, and global warming. Basic principles of meteorology and environmental monitoring. The course emphasises the

connection between physics principles and understanding both space and the Earth's environment.

RELEVANCE STATEMENT

Astronomy and environmental physics are critical for understanding our place in the universe and sustaining life on Earth. PHY 124 gives students a broad perspective on cosmic phenomena and environmental challenges. This course introduces students to astrophysics, space science, and environmental physics. It serves as foundation for PHY 224 Astrophysics, PHY 324 Atmospheric Physics, and PHY 424 Renewable Energy. It connects physics to geography, geology, and climate science.

Knowledge from this course is applied in Space Science & Technology: Satellite technology, remote sensing, astronomy research, Solar, wind, hydro, and other renewable energy development, Environment & Climate: Environmental impact assessment, climate modelling, pollution control, Meteorology: Weather forecasting, climate change studies, Environmental monitoring, gas flaring, and remediation, NGOs & Government Agencies: NESREA, NIMET, NASRDA for policy and data. Students develop competence in Understanding celestial motions and astronomical observations, Analysing energy flow and environmental systems. Evaluating sources of pollution and their physical effects, Data interpretation in climate and atmospheric studies, applying physics to solve environmental and sustainability problems, Scientific reporting and public awareness on environmental issues. Nigeria faces challenges of energy access, climate change, flooding, desertification, and pollution. Graduates of PHY 124 can contribute to renewable energy projects, environmental protection, disaster management, and space research that support national development and the SDGs. In summary, PHY 124 trains students to understand astronomical phenomena and apply physics to address environmental problems facing society.

COURSE OBJECTIVES

The course objectives are to:

a) Explain Concept of astronomy, solar system, cosmology, night sky,

b) Explain Big-bang theory,

c) State Hubble's law,

d) Define earthquake, eclipse, climate change, ozone layer depletion, and environmental pollution.

LEARNING OUTCOMES

By the end of the course, students should be able to:

a) Explain the concepts of astronomy, solar system, cosmology, Night sky, big-bang theory etc.

b) State the basic cosmological principle and Hubble's law

c) Explain scientifically the following natural phenomena among others, earthquake, eclipse, climate change, ozone layer depletion, environmental pollution, etc.

COURSE CONTENT

- Solar System-History and early view, origin (nebular, collision and recent theory), brief explanation to planetary system (terrestrial, gaseous and dwarf planet) using size, density, rotation and revolution and chemical composition.

Other solar system bodies (comets, meteors, asteroids and planetoids), the sun

(Interior and atmosphere) and sun-earth distances (perihelion and aphelion, winter and solar solstice, vernal and autumnal equinox)

- Night sky, stars and constellations (grouping, evolution and death), the big-bang theory and Hubble's law, properties of large-scale universe and origin of the universe
- The composition of earth atmosphere, greenhouse effects and greenhouse gases, climate change and global warming and their consequences, renewable and nonre-newable energy resources and utilisation, ozone layer and ozone layer depletion, earthquakes.

CATEGORY	DETAILS
Core Competencies	• Problem Solving • Lifelong Learning • **Innovation** • Time Management • Social Emotional Learning
Core Values	• Empathy • Commitment • Self –confidence • Equality • Tolerance.

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-Based Learning • Collaborative /Cooperative Learning • Learner-Centred Approach • Analogy • Experiential Learning
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms • Digital and online Learning Platforms • Digital and online Learning Platforms • Core Textbooks and Reference materials
Assessment Methods	• Continuous Assessment • Formative Assessment • Performance-Based Assessment • Continuous Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 108 General Practical Physics II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 125 is a laboratory course designed to reinforce the theoretical concepts taught in PHY 121, PHY 122, and PHY 123 through hands-on experiments. The course covers practical work in Mechanics and Properties of Matter: Determination of g, Young's modulus, viscosity, surface tension, Electricity and Magnetism: Ohm's law, Kirchhoff's laws, Wheatstone bridge, potentiometer, e/m ratio, magnetic field measurements, Waves and Optics: Simple harmonic motion, resonance, speed of sound, refractive index, focal length of lenses and mirrors, interference and diffraction experiments, Measurement and Data Analysis: Use of instruments, error analysis, graph plotting, and scientific report

writing, Emphasis is placed on experimental technique, accuracy, data analysis, and interpretation of results.

RELEVANCE STATEMENT

Practical physics is the foundation of scientific training. PHY 125 develops the experimental skills needed to test theories, validate concepts, and apply physics to real-world problems, this course provides the experimental basis for all theory courses in 100 evel. It is a prerequisite for PHY 225 Advanced Physics Laboratory and all subsequent lab courses. It trains students in the scientific method and laboratory safety. Skills from this are applied in Experimental design, instrumentation, data acquisition, Testing of materials, calibration of instruments, quality control, Measurement of electrical, mechanical and optical properties, Well logging, fluid property measurement, sensor calibration, Teaching laboratory skills and demonstration techniques. Students develop competence in Handling and using physics laboratory apparatus safely and correctly, taking accurate measurements and recording data, performing error analysis and uncertainty calculations, Plotting and interpreting graphs, writing scientific reports and drawing valid conclusions from experiment Teamwork, patience, and attention to detail in the lab. Technology depends on experimental verification. Graduates trained through PHY 125 contribute to standards organisations, testing laboratories, and industries that require accurate measurement and quality assurance for national development. In summary, this course trains students to think and work like experimental physicists by bridging theory with practice through laboratory investigation.

COURSE OBJECTIVES

The course objectives are to:

a) Explain the Basic knowledge, competency, and skill of organisational concepts and
b) Show techniques in Practical Physics laboratory **General Practical Physics II** management, and continuation of PHY 114.

LEARNING OUTCOMES

By the end of this course, students should be able to:

a) Perform the prescribed experiments
b) Analyse the resulting data and state the appropriate scientific inferences.

COURSE CONTENT

This practical course is a continuation of PHY 114 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses

that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

CATEGORY	DETAILS
Core Competencies	• Entrepreneurial skill • Collaboration • Reflective • Time Management • Productivity & Innovation
Core Values	• Self- confidence • Adaptability • Honesty • Respect & Selflessness • Harmony
Pedagogical Approaches	• Inquiry-Based Learning • . • Collaborative /Cooperative Learning • Experiential Learning • Discussion & Dialogue • Blended Learning
Learning Resources	• Practical Manual • Core Textbooks & Reference Materials • Instructional Materials • Instructional Materials • Practical Manual
Assessment Methods	• Continuous Assessment • Formative Assessment • Performance-Based Assessment • Performance-Based Assessment • & Project work

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Practical Instructional Materials, etc.

BIO 121 General Biology II

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 15 | **PRACTICAL HOURS** -

COURSE OVERVIEW

General Biology II students with a broad understanding of diversity of living organism through a comparative study of Plant and Animal kingdoms. The course examines the similarities and differences in the external features, classification, and ecological adaptations of plants and animals. It also introduces students to fundamental physiological processes, including nutrition, respiration, transport (circulation), excretion, reproduction, growth, and development in both plant and animals. The course equips students with the foundational knowledge needed to appreciate the relationship between the structure, function and adaptation of living organisms in different environments.

RELEVANCE STATEMENT

This course provides students with a solid foundation in organismal biology by highlighting the diversity, organisation, adaptation, and physiological processes of plants and animal. It enables prospective biology teacher to understand how organisms survive, interact with their environments, and perform essential life processes. The knowledge gained is fundamental for advance studies in botany, zoology, ecology, physiology, agriculture, environmental science, and biology education. It also develops scientific observation, analytical thinking and appreciation of biodiversity and environmental conservation.

COURSE OBJECTIVES

The objectives of this course is to;

1. Describe the general characteristics of the plant and Animal kingdoms
2. Compare the similarities and differences between plants and animals based on their external features.
3. Explain the ecological adaptations of plants and animals to different habitats.
4. Describe the basic physiological processes in living organisms, including nutrition, respiration, transport (circulation), excretion, reproduction, growth and development.

5. Explain how structure and function are related in plants and animals.
6. Discuss the importance of physiological processes in the survival of living organisms.
7. Explain the diversity and ecological significance of plants and animals.

LEARNING OUTCOMES

At the end of the course, students should be able to;

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. State the unique characteristics of plants and animal kingdoms;
3. Desribe ecological adaptations in the plant and animal kingdoms;
4. Explain nutrition, respiration, excretion and reproduction in plants and animals and
5. Describe growth and development in plants and animals.
6. Appreciate the diversity and ecological significance of plants and animals'

COURSE CONTENT

A generalised survey of plant and animal kingdoms based mainly on the study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

CATEGORY	DETAILS
Core Competencies	• Scientific inquiry • Biological principle • Hygiene • Classification
Core Values	• Curiosity • 2.thinking • Integrity • Teamwork • Self discipline
Pedagogical Approaches	• Demonstration • Jigsaw method learning • Practical – based instruction

CATEGORY	DETAILS
Learning Resources	• Biology text books • Charts • Models • Videos
Assessment Methods	• Practical report

REFERENCES AND FURTHER READING

1. Urry, L.A., Cain, M.L., Wasserman, Minorsky, P.V., & Orr, R.B.(2021)Campbell Biology (12th ed) Pearson
2. Raven, P. H., Johnson, G.B., Mason, K.A., Losos, J.B., &Singer, S.R. (2022). *Biology (13th ed.)*. McGraw – Hill

CHE 121 General Chemistry I

LEVEL 100 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental principles and application of organic chemistry, beginning with its historical development, electronic theory, nomenclature functional groups, structural determination, purification techniques, reaction mechanisms, kinetic and stereochemistry. It covers the chemistry of major classes of organic compounds and introduces carbon nanostructures, fullerenes, nanotubes, and nano chemistry. The course also examines selected metals and non metals, comparative chemistry, of Groups IA, IIA and IVA elements and introductory transition metal chemistry.

RELEVANCE STATEMENT

The course provides a strong foundation for understanding the structures, properties, reactions, and applications of organic and selected inorganic compounds. It develops the chemical knowledge and skills required for further study in chemistry, biochemistry, pharmacy, environmental science, materials science, and related disciplines.

COURSE OBJECTIVES

The objectives of the course are to;

1. Explain the historical development and importance of organic chemistry.
2. Describe the electronic structure, bonding, nomenclature, and functional groups of organic compounds
3. Apply appropriate methods for the isolation, purification, identification and structural determination of organic compounds.
4. Explain basic organic reaction mechanisms, kinetics and stereochemical principles.
5. Describe the properties and reactions of major classes of organic compounds.
6. Explain the chemistry and applications of fullerenes, nanotubes, nanostructures, and nanochemistry.
7. Compare the chemistry of selected metals and non metals, including Groups IA, IIA, and IVA elements
8. Describe the fundamental properties and chemistry of transition metals

LEARNING OUTCOMES

At the end of this course, students should be able to;

1. State the importance and development of organic chemistry
2. Define the fullerenes and its applications
3. Discuss electronic theory
4. Determine the qualitative and quantitative structures in organic chemistry.
5. Describe rules guiding nomenclature and functional group classes of organic compounds.
6. Determine rate of reaction to predict mechanisms of reactions.
7. Identify classes of organic functional group with brief description of their chemistry.
8. Describe basic properties of transition metals.

COURSE CONTENT

- Historical survey of development and importance of organic chemistry, Fullerenes as fourth allotrope of carbon, uses as nanotubes, nanostructures, nano chemistry
- Electronic theory in organic chemistry
- Isolation and purification of organic compounds
- Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry
- Nomenclature and functional group classes of organic compounds
- Introductory reaction mechanism and kinetics

- Stereochemistry
- The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives
- The chemistry of selected metals and non- metals
- Comparative chemistry of Group IA, IIA, and IVA elements
- Introduction to transition metal chemistry

CATEGORY	DETAILS
Core Competencies	• 1.nomenclature • Identification • Classification • Structure • Purification • 6.analysis • Stereochemistry • Mechanism • Reactivity
Core Values	• Accuracy • 2.integrity • 3.safety • Responsibility • Curiosity • Creativity • Discipline • Objectivity
Pedagogical Approaches	• Demonstration • Lecture method • Inquiry based learning • Problem- based leaning • Collaborative learning • Guided discovery • Discussion method

CATEGORY	DETAILS
Learning Resources	• Periodic table • Molecular charts • Laboratory equipments • Reaction mechanism charts
Assessment Methods	• 1.assignments • 2.classtest • 3.quizzes • Continuous assessment • End – of -semester examination

REFERENCES AND FURTHER READING

1. Brown, T.L., LeMay, H.E., Bursten, B. E., Murphy, C. J., Woodward, P.M., & Stoltzfus, 2.M.W. (2018). *Chemistry; The Central SCIENCE (14TH ed) Pearson*.
2. Ebbibing, D. D., & Gammon, S.D. (2017) *General chemistry (11th ed.) Cengage Learning*

MTH 121 Elementary Mathematics (Algebra and Trigonometry)

LEVEL 100 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an introductory mathematics course designed to provide students with a sound foundation in fundamental algebraic and trigonometric concepts. The course develops student's ability to understand mathematical relationships, manipulate algebraic expressions, solve equations and inequalities, and apply mathematical principles to practical and scientific problems. The algebra component covers the real number system, algebraic expressions, indices, surds, polynomial, factorisation, algebraic fractions, linear and quadratic equations, simultaneous equations, inequalities, variation, sequences and series. The trigonometric component introduces angles and their measurement, trigonometric ratios, the unit circle, trigonometric identities, equations, graphs, and applications of trigonometry to triangles and other practical problems.

RELEVANCE STATEMENT

This course provides the fundamental language and analytical tools required for the study and applications of science, technology, engineering, social sciences, economics and other disciplines. A strong understanding of elementary algebra and trigonometry enables students to formulate and solve quantitative problems, interpret mathematical relationships, and develop logical and analytical thinking skills. The course serves as a foundation for higher – level mathematics and discipline – specific courses that requires mathematical reasoning and computation. Knowledge of algebra supports the study of function, calculus, statistics, and mathematical modelling, while trigonometry provides essential concepts for geometry, calculus, physics, engineering, surveying, architecture, computer, science and related fields. By completing this course, students are expected to develop the mathematical competence and confidence necessary for further academic study and for solving quantitative problems in real – life and professional situations

Learning Outcome;

At the end of the course students should be able to:

1. Define Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using Binomial theorem.

COURSE OBJECTIVES

At the end of the course, students should be able to:

1. Explain and apply the basic concepts and properties of real number system.
2. Simplify and manipulate algebraic expressions involving indices, surds, polynomials and algebraic fractions.
3. Factorise algebraic expressions using appropriate methods.
4. Solve linear, quadratic simultaneous and selected higher -order equations.
5. Solve linear and quadratic inequalities and represent teir solutions appropriately.
6. Represent and interpret simple algebraic relationships using tables, graphs and equations
7. Define and apply the basic trigonometric ratios; sine, cosine, and tangent.
8. Use trigonometric identities to simplify expressions and solve mathematical problems.

9. Apply algebraic and trigonometric methods to practical problems in science, technology, engineering and everyday situations

COURSE CONTENT

- Elementary set theory, subsets, union, intersection, complements
- Venn diagrams
- Real numbers
- Integers, rational and irrational numbers
- Mathematical induction
- Real sequences and series
- Theory of quadratic equations
- Binomial theorem
- Complex numbers
- Algebra of complex numbers
- The Argand diagram
- De-Moivre's theorem, nth roots of unity
- Circular measure, trigonometric functions of angles of any magnitude
- Addition and factor formulae

CATEGORY	DETAILS
Core Competencies	• 1.honesty • 2.creativity • Critical thinking • Innovation • Collaboration • Reflective thinking • Self – development • Problem solving

CATEGORY	DETAILS
Core Values	• Integrity • Perseverance • 2.team spirit • 3.tolerance • Responsibility • Curiosity • Creativity • Discipline • Objectivity
Pedagogical Approaches	• Learner centred approach • Collaborative cooperative learning • Problem- based leaning • Collaborative learning • Blended learning • Discussion dialogue
Learning Resources	• Core text books • Reference materials • Digital and online learning platforms
Assessment Methods	• Continuous assessment • Class test • Summative • End – of -semester examination

REFERENCES AND FURTHER READING

College Algebra Elementary trigonometry Schaum's Outline of Elementary Algebra Schaum's Outline of Trigonometry Openstax, Algebra and Trigonometry

NCE 200 Level: First Semester

CSE 211 Introduction to Computing

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the fundamental concepts of computing and its application to physics and science. The course covers Computer History, components, hardware, software, operating systems, Algorithms, flowcharts, problem-solving techniques, Programming Language: Introduction to a high-level language such as Python, C, or FORTRAN. Variables, data types, control structures, functions, arrays, Numerical Methods: Introduction to computational techniques for solving physics problems – root finding, interpolation, numerical integration and differentiation, use of spreadsheets and software for data processing, plotting, and scientific computing, Applications in Physics: Computer simulations and modelling of physical systems. Emphasis is placed on developing computational thinking and basic coding skills for scientific problem solving.

RELEVANCE STATEMENT

Computing is now an essential tool in modern physics and scientific research. This course provides students with the digital skills needed to analyse data, simulate systems, and solve complex physics problems. This is a foundation course for PHY 311 Computational Physics, PHY 312 Data Analysis, and PHY 414 Modelling and Simulation. It equips students with programming and numerical skills required for advanced physics and research projects. Skills from this course are applied in data analysis, simulations, computational modelling, Reservoir modelling, seismic data processing, process simulation, Numerical analysis, data visualisation, algorithm development, Scientific programming, automation, app development, CAD, finite element analysis, control systems

Students develop competence in writing, testing, and debugging computer programs, Applying numerical methods to solve physics problems, Using computers for data acquisition, processing and visualisation, Computational problem-solving and logical thinking, using scientific software and programming for modelling physical phenomena. The digital economy depends on computational skills. Graduates of PHY 211 can contribute to e-governance, smart systems, tech startups, research institutions, and industries driving Nigeria’s digital transformation and innovation agenda. In summary, this

course trains students to use computers as a tool for solving scientific problems, analysing data, and modelling physical systems.

COURSE OBJECTIVES

The objectives of the course are to:

a) Explain Historical perspective of computing sciences,

b) Describe the characteristics of programmes in computing sciences, hardware, software, integration and application in business and other segment of society,

c) Illustrate information processing and its roles in society,

d) Give assignment using PC's, OS, and several commonly used applications, internet and online resources, browsers, search engines for studies**.**

LEARNING OUTCOMES

By the end of the course, the students should be able to:

a) Narrate the historical perspective of computing sciences

b) Explain the characteristics of programmes in computing sciences

c) Explain hardware, software, integration and applications in business and other segments of the society.

d) Use information processing and its role in society.

e) Perform assignment using the PC's OS and several commonly used applications

f) Use internet and online resources, browsers and search engines for studies.

COURSE CONTENT

- This course introduces a historical perspective of computing sciences that gave birth to the different programmes
- Characteristics of each programme in computing sciences
- Hardware,
- Software
- And human resources
- Integration and application in business and other segments of society
- Information processing and its roles in society
- Students will be required to complete lab assignments using the PC's operating system, and several commonly used applications, such as word processors, spread-sheets, presentations, graphics and other applications

- Internet and on-line resources, browsers, and search engines

CATEGORY	DETAILS
Core Competencies	• Pedagogic Knowledge • Problem-Solving • Democratic Values • Self-Development • Creativity
Core Values	• Professional ethics &Responsibility • Self- Perseverance • Peace • Resilience • Confidence, &Respect
Pedagogical Approaches	• Learner-Centred Approach • Collaborative /Cooperative Learning • Inquiry-Based Learning • Blended Learning • Discussion &Dialogue
Learning Resources	• Core Textbooks and Reference materials • Online resources • Digital and online Learning Platforms • Classroom & Instructional Materials • Digital and online Learning Platforms
Assessment Methods	• Continuous Assessment • Formative Assessment • Performance-Based Assessment • Continuous Assessment & • Project work

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Online resources, Digital and online Learning Platforms, Classroom & Practical Instructional Materials, etc.

Introduction to Computing Sciences by Jessie Huynh online (November,2024)

PHY 212 Mathematics for Physics II

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces advanced mathematical techniques required for solving problems in physics and engineering, The course covers Vector Calculus: Gradient, divergence, curl. Gauss's, Green's and Stokes' theorems, Analytic functions, Cauchy-Riemann equations, complex integration, residue theorem, Separation of variables. Heat, wave and Laplace equations with applications, Legendre polynomials, Bessel functions, Hermite and Laguerre polynomials, Fourier Series and Fourier Transforms: Expansion of functions, applications to physics problems, Matrices and Linear Algebra: Eigenvalues and eigen-vectors, diagonalization. Applications to quantum mechanics. Emphasis is on mathem-atical formulation and solution of physical problems

RELEVANCE STATEMENT

Mathematics is the language of physics. PHY 212 provides students with the advanced mathematical tools needed to model and solve problems in electromagnetism, quantum mechanics, and engineering physics. It bridges calculus from 100L to the mathematical physics of 300L and 400L. Skills from this course are applied in Signal processing, control systems, structural analysis, Fourier analysis, wave propagation, antenna design, Fluid flow modelling, heat transfer, reservoir simulation, Matrix methods, transforms, numerical solution, Solving PDEs for physical systems, quantum and statistical physic. Students develop competence in Applying vector calculus to fields in E&M and fluid dynamics, Solving PDEs with boundary and initial conditions, using special functions to solve physics problems, working with complex variables and contour integration, Matrix methods for coupled systems, Mathematical modelling and analytical problem solving. Advanced modelling is key to technology and infrastructure development. Graduates of this course con tribute to telecommunications, power systems, weather/climate modelling, medical imaging, and R&D where mathematical physics drives innovation. In summary, this course equips students with the essential mathematical methods to formulate, analyse, and solve the complex problems encountered in modern physics and technology.

COURSE OBJECTIVES

The course objectives are:

a) Explain Vector differentiation, D-Grad and D-vector, divergence and curl

b) Show application of vector algebra, Gauss and Stoke's theorem,

c) Describe dipole and energy relation, introduction to analytical geometry and introduction to complex number.

LEARNING OUTCOMES

By the end of the course, students should be able to:

a) Discuss the basic Mathematical concepts which will enable them to solve problems in relevant areas in Physics.

COURSE CONTENT

Vector differentiation, D-Grad and D-Vector, Divergence and Curl, Application of vector Algebra

Divergence (Gauss and Stokes theorem, dipole, energy relation), Introduction to Analytical Geometry, and Introduction to complex number.

CATEGORY	DETAILS
Core Competencies	• Entrepreneurship • Productivity • Reflective Thinking • Self-Efficacy • Creativity, Innovation
Core Values	• Honesty • Honour • Humility • Harmony • Flexibility
Pedagogical Approaches	• Learner-Centred Approach • Inquiry-Based Learning • Collaborative /Cooperative Learning • Blended Learning • Discussion & Dialogue

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Digital and online Learning Platforms • Classroom & Instructional Materials • Core Textbooks and Reference materials • Digital and online Learning Platforms
Assessment Methods	• Formative Assessment • Continuous Assessment • Performance-Based Assessment • Continuous Assessment • Formative Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials.

PHY 205 Thermal Physics

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the concepts of heat, temperature, and the laws governing thermal systems. The course covers thermometry, thermal expansion, ideal gas law, Internal energy, work, heat. Applications to cyclic and non-cyclic processes, Entropy, reversible and irreversible processes, Carnot cycle, heat engines and refrigerators, Maxwell-Boltzmann distribution, mean free path, transport phenomena, Statistical Microstates, macrostates, Boltzmann factor, partition function. Introduction to classical and quantum statistics, Enthalpy, Helmholtz and Gibbs free energies. Phase transitions and chemical potential, Applications: Heat transfer – conduction, convection, radiation. Emphasis is placed on both macroscopic and microscopic descriptions of thermal systems

RELEVANCE STATEMENT

Thermal physics explains how energy moves and transforms in matter. PHY 213 is central to understanding engines, materials, and environmental systems. This course provides the foundation for connecting mechanics to statistical and quantum physics. Skills from are

applied in design of engines, turbines, refrigerators, HVAC systems, Reservoir thermodynamics, gas processing, heat exchangers, Phase transitions, heat treatment, thermal properties of materials, Atmospheric physics, climate modelling, renewable energy systems, Drying, refrigeration, process heat management. Students develop competence in applying the laws of thermodynamics to physical systems, calculating work, heat, entropy and efficiency of thermal processes, using kinetic theory to explain macroscopic properties of gases, understanding statistical distributions and partition functions, Analysing heat transfer problems, Problem-solving in energy conversion and thermal systems. Energy is critical to national development. Graduates of this course contribute to power generation, energy efficiency, climate mitigation, refrigeration in agriculture/health, and sustainable energy technologies that address Nigeria's energy and climate challenges. In summary, this course trains students to understand, analyse, and apply the principles of heat and thermodynamics to solve energy and industrial problems.

COURSE OBJECTIVES

a) Define Second law of thermodynamics,

b) Explain Carnot cycles,

c) Describe second law of entropy, thermodynamic potentials and Maxwell relations,

d) Explain gas equation, phase transitions, Gibbs Free energy, Clausius- Clapeyron equation, e) kinetic theory, mean free path, Equi-partition of energy and heat transfer.

LEARNING OUTCOMES

By the end of this course, the students should be able to:

a) State the 2^{nd} law of thermodynamics, Carnot cycles, the second law of entropy, thermodynamic potentials and Maxwell relations.

b) Explain ideal gas equation, phase transitions, Gibbs Free energy, Clausius-Clapeyron equation.

c) Explain the concept of kinetic theory, Mean free path, Equi-partition of energy and heat transfer

COURSE CONTENT

- The Foundations of classical thermodynamics including the zeroth and definition of temperature
- The first law, work heat and internal energy
- Carnot cycles and the second law
- Entropy and irreversibility, thermodynamic potentials, and the Maxwell relations

- Ideal gas equation and internal energy, including internal molecular modes
- Qualitative discussion of phase transitions: Gibbs Free energy
- Clausius-Clapeyron equation, examples of phase transitions including Van der Waals gas
- Kinetic theory
- Mean free path
- Equi-partition of energy
- Heat transfer
- Diffusion rate

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Entrepreneurial skill • Productivity • Reflective Thinking • Self-Efficacy &Creativity
Core Values	• Creativity and innovation • Honesty • Self –confidence • &Responsibility • Professional ethics
Pedagogical Approaches	• Learner-Centred Approach • Contextual teaching • Inquiry-Based Learning • Blended Learning • Discussion & Dialogue
Learning Resources	• Core Textbooks Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Classroom & Instructional Materials • Core Textbooks Reference materials

CATEGORY	DETAILS
Assessment Methods	• Performance-Based Assessment • Continuous Assessment • Performance-Based Assessment • Continuous Assessment • Project work

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 207 General Practical Physics III

LEVEL 200 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This is a foundational laboratory course designed to develop basic experimental skills and reinforce concepts taught in 200L theory courses. The course covers practical work in Measurement of length, mass, time. Simple pendulum, spring constant, viscosity, surface tension, and moment of inertia, Specific heat capacity, thermal conductivity, coefficient of linear expansion, and gas laws, Ohm's law, Wheatstone bridge, potentiometer, resistivity, e/m of an electron, and magnetic field measurements, Focal length of lenses and mirrors, refractive index, interference, diffraction, and speed of sound, Use of Vernier calipers, micrometer screw gauge, CRO, multimeter, and other basic lab instruments, Measurement errors, error propagation, graphing, and scientific report writing. Emphasis is placed on accuracy in measurement, proper use of laboratory equipment, and standard scientific reporting.

RELEVANCE STATEMENT

This course builds the experimental foundation for all subsequent physics courses and for careers requiring measurement and testing skills. It provides hands-on validation of theories in mechanics, heat, electricity, and optics. Skills from this course are applied in Calibration, testing, and quality control, Measurement, instrumentation, and prototyping, Demonstration of physics principles, Basic experimental design and data collection, Metrology, materials testing, equipment maintenance. Students develop competence in

Accurate measurement using standard instruments, Designing and conducting simple experiments, performing error analysis and uncertainty estimation, Plotting and interpreting graphs, writing formal laboratory reports, Working safely and ethically in the laboratory. Accurate measurement is the basis of science and technology. Graduates with skills from this course contribute to quality assurance, technical education, and industrial development in Nigeria. In summary, this course trains students in fundamental laboratory techniques, data handling, and scientific communication needed for advanced physics and technology practic

COURSE OBJECTIVES

The course objectives are:

Show Basic knowledge, competency, and skill of organisational concepts and techniques in Practical.

Perform Physics and laboratory management and continuation of PHY 125.

LEARNING OUTCOMES

By the end of this course, students should be able to carry out the prescribed experiments, analyse the resulting data and state the appropriate scientific inference (s).

COURSE CONTENT

The laboratory course consists of a group of experiments drawn from diverse areas of

Physics (Optics, Electrical, and Electronics, Electromagnetism, Mechanics, Modern Physics and others). It is accompanied by seminar studies of standard experimental techniques and the analysis of famous and challenging experiments.

CATEGORY	DETAILS
Core Competencies	• Entrepreneurial skill • Productivity • Self-Efficacy • Entrepreneurial skill • Productivity

CATEGORY	DETAILS
Core Values	• **Integrity** • Ethics &Responsibility • **Resilience** • Ethics &Responsibility • Resilience
Pedagogical Approaches	• Project-based Learning • Collaborative /Cooperative Learning • Inquiry-Based Learning • Collaborative /Cooperative Learning • Project-based Learning
Learning Resources	• Classroom & Practical Instructional Materials • Digital and online Learning Platforms • Practical Manual • Digital and online Learning Platforms • Core Textbooks & Reference materials
Assessment Methods	• Performance-Based Assessment • Performance-Based Assessment • Formative Assessment • Performance-Based Assessment • Continuous Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Practical Instructional Materials, etc.

PHY 221 Workshop Practice

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

The course is a hands-on technical course designed to introduce students to basic workshop tools, fabrication techniques, and safety practices used in physics and engineering laboratories.

The course covers Safety rules, use of PPE, fire prevention, and first aid. Measurement tools vernier calipers, micrometer screw gauge. Fitting tools – files, hammers, screw-drivers, pliers.

Marking out, cutting, drilling, filing, threading, soldering and brazing, Types of wood, wood joints, sawing, planning, and finishing, Basic operation of lathe, drilling machine, grinding machine, and bench grinder, Wiring, soldering, circuit assembly, and use of electrical test tools, Basic glass working techniques for scientific apparatus, Reading and interpreting workshop drawings and sketches. Care and maintenance of tools and equipment.

Emphasis is on skill acquisition, precision, and safe work habits.

RELEVANCE STATEMENT

Workshop skills are essential for physicists, engineers, and technologists to build, repair, and maintain equipment. Students learn to fabricate experimental setups.

Skills from the course are applied in Fabrication and modification of experimental apparatus

Maintenance, prototyping, fitting, machining, and quality control, PCB soldering, wiring, and assembly of circuits Building demonstration kits for teaching, Fabrication, repair, and small-scale manufacturing, Students develop competence in Safe handling of workshop tools and machines, Accurate measurement and fabrication of components, Soldering, wiring, and assembly of electronic/physics equipment Reading technical drawings and working to specification, Troubleshooting and maintenance of lab equipment.

Local capacity in fabrication reduces dependence on imported equipment. Graduates of PHY 221 contribute to Nigeria’s industrialisation through technical skills in manufacturing, repair, and maintenance. In summary, PHY 221 equips students with practical workshop skills to design, build, and maintain physics and engineering systems.

COURSE OBJECTIVES

The course objectives are to:

- Design Workshop layout and safety, sheet metal operations (casting, cutting, drilling, turning, milling),
- Describe soldering techniques and wrap joint, plain and cylindrical generation of smooth surface using power operated machines,
- **State the** Criteria for selection of materials used for construction (metallic and non-metallic), instrumentation and measuring techniques.

LEARNING OUTCOMES

By the end of this course, the students should be able to construct basic Physics teaching aids using locally available materials.

COURSE CONTENT

- Workshop layout and safety
- Basic hand tools and bench work practices
- Measurement and gauging
- Sheet metal operations
- Casting
- Cutting, drilling, turning, and milling
- Metal joining devices and adhesives in common use
- Soldering techniques and wrap joints
- Plain and cylindrical generation of smooth surface using power operated machines
- **Criteria for selection of materials used for construction:** metallic and non-metallic
- Instrumentation and measuring techniques
- Multi-meters and oscilloscopes
- Extension of instrument range
- **A survey of the use of electronic circuit devices:** e.g. diodes, transistors including FET, integrated circuits
- Photocells
- Basic circuit development and analysis
- Wood logging
- Wood types and processing

- Plastic types and working
- Plastic moulding, bending, and encapsulation

Emotional Intelligence	**Equality**	**Inquiry-Based Learning**	**Core Textbooks and Reference materials,**	**Formative assessment**
Reflective Thinking	Discipline	&Project-based Learning	Classroom & Instructional Materials	Continuous assessment
Productivity	Commitment	Blended Learning,	Digital and online Learning Platforms	Performance-Based Assessment
Collaboration	Equality	Experiential Learning	Platforms, Classroom & Instructional Materials	Performance-Based Assessment
Creativity,	Freedom	Project-based Learning	Core Textbooks and Reference materials,	Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 204 General Physics VI (Waves and Optics)

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course introduces students to energy resources, energy conversion, and the interaction between energy use and the environment. The course links physics principles to sustainable development. The course covers Forms of energy, work, power, energy conversion and efficiency, Fossil fuels – coal, oil, natural gas. Energy content and environmental impact. Solar, wind, hydro, geothermal, biomass, and tidal energy. Principles and applications, Nuclear Energy: Fission, fusion, reactors, and safety, Batteries, fuel cells, grid systems, and transmission losses, Greenhouse effect, global warming, ozone depletion, acid rain, and pollution, Energy demand, energy audit, conservation, and policy, clean technologies and Nigeria's energy mix. Emphasis is placed on quantitative analysis and real-world energy problems.

RELEVANCE STATEMENT

Energy is central to economic growth and environmental sustainability. The course equips students to address Nigeria's energy challenges. It connects physics to energy policy and climate science. Skills from PHY 222 are applied in Power generation, renewable energy projects, grid management, Environmental impact assessment, climate monitoring, pollution control, Energy policy, rural electrification, sustainability programmes, Energy audit, efficiency improvement, green technology, Solar PV, wind turbines, bioenergy, and energy store.

Students develop competence in Calculating energy demand, efficiency, and payback period, evaluating renewable energy technologies, analysing environmental impact of energy systems, performing energy audits and conservation studies, understanding climate physics and policy, Nigeria faces energy poverty and climate challenges. Graduates of PHY 222 contribute to energy access, clean energy deployment, and environmental protection for sustainable national development. In summary, the course trains students to understand energy systems and their environmental impact, and to develop solutions for sustainable energy use.

COURSE OBJECTIVES

The course objectives are to:

- Explain Basic concepts, types and properties of wave,
- Define SHM, harmonic oscillator, group and phase velocity,
- Show the Doppler effect, interference, superposition,
- Perform the Young's slits Michelson interferometer experiment,

Describe the diffraction, single and double slits, explain the concept of echo, beat, sound in gases, liquid and solids, show different types of lenses, optical lenses, prism, optical instruments and their applications, Describe the concept of polarisation.

LEARNING OUTCOMES

By the end of this course, the students should be able to:

a) Explain the basic concepts, types and properties of wave,

b) Explain SHM, harmonic oscillator, group and phase velocity, doppler effect.

c) Explain interference, superposition, Young's slits, Michelson interferometer, diffraction, single and double slits

d) Explain the concept of echo, beats, sound in gases, liquids and solids

e) Explain optical lenses, prisms, optical instruments and their applications

f) Explain the concept of polarisation

COURSE CONTENT

- Wave phenomena: Types and properties of waves, SHM, harmonic oscillator, waves on a string, energy in wave motion, acoustical waves, longitudinal waves, standing waves
- Group and phase velocity, doppler effect
- Physical Optics
- Spherical waves
- Interference, superposition, Young's slits, multiple slits, the Michelson interferometer
- Diffraction
- Single and double slits
- The diffraction grating and spectrometers
- Thin films
- Dispersion and scattering
- Echo, Beats, Doppler effects, sound in gases, liquids, and solids
- Geometrical
- Optics, Waves and rays
- Reflection at plane and spherical surfaces, refraction, thin lenses, prism, optical lenses, and optical instruments, such as microscopes, telescopes and other lens maker's formula
- Polarisation: Polarisation states
- Unpolarised and partially polarised light

Brewster's angle; Polarising beam splitters; Photometry and light spectrum analysis

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity

CATEGORY	DETAILS
Core Values	• Equality • Discipline • Commitment • Equality • Freedom
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 206 General Physics VII (Energy and Environment)

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course studies the physics of wave motion and the behaviour of light. It covers both mechanical waves and electromagnetic waves with applications in communication and instrumentation.

The course covers Types of waves, wave equation, superposition, standing waves, and resonance, Sound waves, intensity, Doppler effect, and applications, Maxwell's equations, EM spectrum, polarisation, and propagation, Reflection, refraction, lenses, mirrors, optical instruments. Interference, diffraction, polarisation, and coherence, Principles, types, and applications, Total internal reflection, optical fibres, and communication, Experiments on sound, interference, diffraction, and optical instruments. Emphasis is on both mathematical treatment and practical applications.

RELEVANCE STATEMENT

Waves and optics are fundamental to communication, medicine, and technology. PHY 223 provides core skills for modern photonics and acoustic. It bridges mechanics to EM theory.

Skills from PHY 223 are applied in Telecommunications: Fibre optics, laser communication, signal processing, Ultrasound imaging, endoscopy, laser surgery, diagnostic optics, Radar, lidar, night vision, remote sensing, Laser cutting, holography, optical metrology, Acoustics, audio engineering, display technology.

Students develop competence in Solving wave equations and analysing wave phenomena Designing optical systems with lenses and mirrors, performing interference and diffraction experiments, understanding laser operation and fibre optic systems, Using optical instruments and measurement techniques. Optical and wave technologies drive internet, healthcare, and security. Graduates of PHY 223 contribute to innovation in communication networks, medical devices, and sensor systems for national development.In summary, the course trains students in wave physics and optics for applications in communication, health, and advanced technology.

L Earning Objectives

The course objectives are to:

Explain Sources of energy, climate impact, energy requirement and consumption,

Describe energy processing and conversion, greenhouse effect, biological forms of energy, Construct structure of atoms,

Mention radioactivity, decay laws, interaction of radiation with matters, nuclear fission and energetics,

Show how chain reaction affects human, reactor types and control, thermonuclear fusion and nuclear fuel, ignition and Lawson criterion, solar power technologies, and thermal pollution

LEARNING OUTCOMES

By the end of this course, students should be able to:

a) State the sources of energy
b) Enumerate climate impact, energy requirements and consumption, energy processing and conversion
c) Explain the greenhouse effect and biological forms of energy
d) Explain the structure of atom, radioactivity and decay laws.
e) Explain the interaction of radiation with matter, nuclear fission and energetics
f) Discuss how chain reaction affects human
g) Explain reactor types and control
h) Explain thermonuclear fusion and nuclear fuels, ignition and Lawson Criterion
i) Mention five (5) Solar power technologies
j) Explain Tidal stream power and tidal range power, energy transportation and storage.
k) Explain thermal pollution

COURSE CONTENT

- Energy sources and climate impacts
- Energy requirements and consumption
- Energy processing and conversion
- Energy units and pricing
- The greenhouse effects
- **Biological forms of energy:** fossil fuels and biofuels
- Basic nuclear physics
- The atom, radioactivity and decay laws
- Interaction of radiation with matter

- Nuclear fission principles and energetics
- Chain reaction and dynamics. Reactor types and control. Current status of nuclear fission as a power source. Nuclear fusion principles and energetics. (Examples in stars and on earth).
- Thermonuclear fusion. Nuclear fuels. Ignition and the Lawson criterion. Magnetic and inertial confinement. Current status of nuclear fusion as a power source. Stellar fusion.
- Proton-proton chain and CNO cycle. Solar power technologies. Solar thermal. Solar photovoltaic. Wind energy. Nature of wind. Wind power and wind turbines. Betz criterion.
- Energy from waves and tides
- Principles of water waves, energy, and power
- Wave power extraction
- Origin and properties of tides
- Tidal stream power and tidal range power
- Power from fluids
- Hydro power
- Energy transportation and storage
- Thermal pollution
- Energy costs, capacity, reserves, and efficiency
- Emerging environmental effects of energy processing

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity
Core Values	• Equality • Discipline • Commitment • Equality • Freedom

CATEGORY	DETAILS
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 224 Physics Methodology

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course introduces students to the scientific methods, tools, and professional practices used in physics research and teaching. The course covers Scope of physics, branches, and contributions to science and technology,

Problem identification, hypothesis, experiment, data analysis, and conclusion, Units, dimensions, significant figures, types of errors, propagation of errors, Tables, graphs, curve fitting, and statistical analysis, Lab safety, record keeping, and equipment handling, technical report writing, literature search, referencing, and presentation skills.

Academic integrity, plagiarism, and professional ethics.

Research, teaching, industry, and entrepreneurship opportunities. Emphasis is on developing good scientific habits and research skills.

RELEVANCE STATEMENT

The course lays the foundation for scientific inquiry and professional practice in physics.

It teaches the methodology needed for PHY 225, PHY 323.

Skills from the course are applied in Designing experiments, data analysis, and scientific reporting, Lesson planning, demonstration, and evaluation methods, Quality control, R&D, documentation, and problem-solving, Proposal writing and literature review

Students develop competence in Scientific thinking and problem-solving, Error analysis and data presentation, technical writing and oral presentation, use of scientific literature and referencing, Laboratory safety and ethical conduct. A strong methodology base produces credible scientists and teachers. Graduates of P contribute to quality research, innovation, and evidence-based solutions for national development. In summary, the course trains students in the methods, ethics, and communication skills required to practice physics professionally.

COURSE OBJECTIVES

Th course objectives are to

Explain the Basic knowledge, show competency, and skill of organisational concepts and Perform techniques in Practical Physics and laboratory management and continuation of PHY 125.

LEARNING OUTCOMES

By the end of this course, students should be able to carry out the prescribed experiments, analyse the resulting data and state the appropriate scientific inference (s).

COURSE CONTENT

The laboratory course consists of a group of experiments drawn from diverse areas of

Physics (Optics, Electrical, and Electronics, Electromagnetism, Mechanics, Modern Physics and others). It is accompanied by seminar studies of standard experimental techniques and the analysis of famous and challenging experiments.

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity
Core Values	• Equality • Discipline • Commitment • Equality • Freedom
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 208 General Physics Practical

LEVEL 200 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 1 | **STATUS** Compulsory (core course) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 45

COURSE OVERVIEW

The course is an intermediate laboratory course designed to reinforce concepts from 200L theory courses through hands-on experiments. The course covers practical work in Determination of g, Young's modulus, viscosity, and surface tension, Specific heat capacity, thermal conductivity, and coefficient of linear expansion, Wheatstone bridge, potentiometer, RC and RL circuits, e/m of electron Refractive index, focal length of lenses and mirrors, interference and diffraction, Photoelectric effect, Franck-Hertz experiment, Error analysis, graph plotting, and technical report writing. Emphasis is on accuracy of measurement, use of instruments, and interpretation of results.

RELEVANCE STATEMENT

The course develops practical and analytical skills that link theory to experiment.

It builds foundation for final year project work. Skills from PHY 225 are applied in Experimental design, measurement, and calibration, Science teaching with demonstrations, Testing, quality control, and instrumentation, Material testing and characterisation

Students develop competence in Operating physics laboratory equipment, Taking precise measurements and estimating uncertainties, Analysing data and plotting graphs, Writing scientific lab reports, Teamwork and adherence to lab safety. Practical skills in physics support manufacturing, education, and research. Graduates of PHY 225 contribute to technological development through accurate measurement and problem-solving. In summary, trains students to conduct physics experiments, analyse data, and communicate results scientifically.

COURSE OBJECTIVES

The course objectives are to:

Explain Basic knowledge, show competency, and skill of organisational concepts and techniques in Practical Physics and laboratory management and continuation of PHY 214.

LEARNING OUTCOMES

By the end of this course, students should be able to carry out the prescribed experiments, analyse the resulting data and state the appropriate scientific inference (s).

COURSE CONTENT

The laboratory course consists of a group of experiments drawn from diverse areas of

Physics (optics, electromagnetism, mechanics, Modern Physics, etc.). It is accompanied by seminar studies of standard experimental techniques and the analyses of famous and challenging experiments.

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity
Core Values	• Equality • Discipline • Commitment • Equality • Freedom
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

NCE 300 Level: Second Semester

PHY 321 Introduction to Nuclear Physics

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the structure of the atomic nucleus, nuclear forces, radioactivity, and nuclear reactions. The course combines theoretical principles with applications in energy, medicine, and industry. The course covers Nuclear size, mass, charge, spin, magnetic moment, binding energy, and stability, Liquid drop model, shell model, and collective model, Characteristics of nuclear force and the deuteron problem, Laws of radioactive decay, half-life, decay chains, alpha, beta and gamma decay, Reaction kinematics, Q-value, cross-section, fission, fusion, and chain reactions, GM counter, scintillation detectors, semiconductor detectors, and radiation safety, Nuclear energy, nuclear medicine, radiotracers, agriculture, industry, and dating techniques, Classification of elementary particles and conservation laws. Emphasis is placed on both quantitative analysis and practical applications of nuclear science.

RELEVANCE STATEMENT

Nuclear physics is critical to energy, health, agriculture, and national security. PHY 321 provides the scientific foundation for peaceful applications of nuclear technology. It connects quantum mechanics to nuclear phenomena.

Skills from PHY 321 are applied in nuclear power generation, reactor physics, waste management, nuclear medicine, radiotherapy, diagnostic imaging, radiopharmaceuticals Non-destructive testing, radiography, thickness gauging, sterilisation Mutation breeding, pest control, food preservation, Radioisotope dating, tracer studies, pollution monitoring Radiation detection, nuclear safeguards, forensics.

Students develop competence in Calculating binding energy, Q-values, and reaction rates, understanding decay processes and radiation interactions with matter, Operating radiation

detectors and following safety protocols, applying nuclear techniques in medicine and industry, Evaluating benefits and risks of nuclear technology.

Nuclear science supports energy security, healthcare delivery, and food security. Graduates of this course contribute to Nigeria's development through safe and responsible use of nuclear technology for power, cancer treatment, and industrial applications. In summary, this course trains students to understand nuclear structure and reactions and to apply nuclear science safely for national development**.**

COURSE OBJECTIVES

The course objectives are to

1. Understand the structure, properties, and stability of the atomic nucleus.
2. Explain the nature of nuclear forces and different nuclear models.
3. Describe the mechanisms of alpha, beta, and gamma decay and laws of radioactivity.
4. Analyse nuclear reactions in terms of Q-value, cross-section, fission and fusion.
5. Explain the principles of operation of nuclear radiation detectors.
6. Apply nuclear physics concepts to energy, medicine, agriculture, and industry.
7. Demonstrate knowledge of radiation safety and protection principles.
8. Appreciate the role of nuclear science in sustainable development.

LEARNING OUTCOMES

On successful completion of this course, students should be able to:

1 State nuclear properties such as binding energy, spin, and magnetic moment.

1. Explain liquid drop and shell models of the nucleus.
2. Describe types of radioactive decay and derive the decay law.
3. Calculate binding energy, half-life, and Q-values for nuclear reactions.
4. Analyse fission and fusion processes and explain chain reactions.
5. Use GM counters and scintillation detectors to measure radiation.
6. Apply nuclear techniques to solve problems in medicine, industry, and agriculture.
7. Follow radiation safety procedures and handle radioactive sources responsibly.
8. Evaluate the social, economic, and environmental impact of nuclear technology.
9. Communicate nuclear physics concepts and experimental results clearly in report

LEARNING OUTCOMES

By the end of this course, the students should be able to:

a) Discuss concept of radioactivity and its application

b) Detection of radiation using Geiger Muller counter, Geiger-Nuttal law, gamma decay, nuclear energy levels, internal conversion and mass absorption coefficient

c) Mention the evidence for magic numbers and shell model

d) Explain liquid drop model and Weizsacker's semi empirical mass formula

e) Explain Tile Tokamak fusion system

COURSE CONTENT

Constituents of Nuclei: isotopes, isobars and isotones.

- Nuclear properties: Charge, size, angular momentum, magnetic dipole moments, electric quadrupole moment
- Atomic masses: mass spectrograph and mass spectrometer, packing fraction, binding energy
- Radioactivity Decay: Radioactive equilibrium, the natural radioactive series
- Applications of radioactive decay
- Artificial Radioactivity: Electron and position emission, orbital electron capture, transuranic elements
- Beta decay, energy spectrum of beta rays, neutrino and its detection
- Alpha decay, Geiger-Nuttall law
- Gamma decay, nuclear energy levels, internal conversion, passage of gamma rays through matter, mass absorption coefficients
- Nuclear Forces: Short range forces, charge symmetry, charge independence, non-central forces, saturation on, exchange forces
- Nuclear Models: Evidences for magic numbers and shell model
- Liquid drop model and Weizsacker's semi-empirical mass formula, energy neutrons, energy fission neutrons, energy release in fission, theory of fission process
- Nuclear fission: Energy production in stars
- Tile Tokamak fusion system, relative abundance of elements
- Cosmic

Rays: Components, intensity variations, origin, cosmic ray showers, particles and antiparticles, mesic atoms.

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity
Core Values	• Equality • Discipline • Commitment • Equality • Freedom
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials, etc.

PHY 322 Introduction to Electromagnetism

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an introductory one that lays the foundation for the study of electromagnetic theory. The course introduces students to the fundamental laws of electricity and magnetism, and how they are unified into a single theory of electromagnetism. It emphasises both conceptual understanding and problem- solving with direct applications to circuits, antennas and wave propagation.

RELEVANCE STATEMENT

Introduction to Electromagnetism is a core foundational course for all physics and engineering students. It prepares students for electromagnetic theory, where Maxwell's equation sare treated in differential form.

LEARNING OUTCOMES

On completion, the student should be able to;

1. Derive Maxwell's equation set from the empirical laws of electromagnetism.
2. Use the fundamental laws of electromagnetism to solve simple problems of electro-statics, magnetostatics, and electromagnetic induction in a vacuum;
3. Modify Maxwell's laws to apply in the presence of materials and solve problems involving them;
4. Derive the electromagnetic boundary conditions that apply at the interface between two simple media and use them to solve problems involving two or more materials.
5. Explain the properties of plane electromagnetic waves in a vacuum and in simple media and to be able to derive these properties from Maxwell's equations apply the special theory of relativity to problems in electromagnetism

COURSE CONTENT

- Review of vector calculus
- Electrostatics and magnetostatics, Magnetisation and magnetic susceptibility
- Laplace's equation and boundary value problems
- Multipole expansions, EM waves in dielectric and magnetic materials
- Polarisation of EM waves

- Electromagnetic induction
- Faraday's and Lenz's laws
- A.C. Circuits.
- Maxwell's equations
- Lorentz covariance and special relativity
- Gauss theorem in dielectrics
- Poisson's equations
- Uniqueness theorem
- Magnetron
- Magnetic properties
- Motors
- Generators and Poynting vectors

CATEGORY	DETAILS
Core Competencies	• **Reflective thinking** • **Innovation** • **Communication** • **Collaboration** • **Self-development, &** • **Self-awareness**
Core Values	• Flexibility • Team spirit • Integrity • Transparency • Humility, & • Honour
Pedagogical Approaches	• UDL & SEL Based Teaching • Collaborative learning • Learner-Centred Approach • /Cooperative Learning • Learner-Centred Approach

CATEGORY	DETAILS
Learning Resources	• Digital and online Learning Platforms • Digital and online Learning Platforms • Classroom & Instructional Materials • Reference materials • Core Textbooks
Assessment Methods	• Continuous Assessment • Formative Assessment • Formative assessment • Continuous assessment • Project work

Reference/Reading: Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Instructional Materials,

PHY 323 General Physics Practical VI

LEVEL 300 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 323 is an advanced laboratory course designed to reinforce concepts from 300L first semester theory courses through experiments and instrumentation.

The course covers practical work in Radioactive decay measurements, use of GM counter and scintillation detector, half-life determination, absorption of alpha, beta and gamma rays, Verification of network theorems, diode and transistor characteristics, design and testing of rectifier, amplifier and OP-amp circuits, Use of CRO, signal generator, digital multimeter, and function generator for circuit testing, Computer-based data logging, curve fitting, error analysis and graphical presentation of results, Scientific report writing, result interpretation and uncertainty analysis. Emphasis is placed on precision measurement, instrumentation skills, and linking theory to experimental practice.

RELEVANCE STATEMENT

This course builds hands-on competence in nuclear physics and electronics, preparing students for research, industry, and project work. It develops experimental skills needed for nuclear physics, electronics, and instrumentation research. Skills from this course are

applied in radiation monitoring, detector operation, nuclear instrumentation, Circuit design, testing, troubleshooting, signal analysis, Operation and calibration of medical diagnostic equipment, testing of electronic components, calibration, NDT, Data acquisition, experimental setup, instrumentation, Prototyping and hardware develop, Students develop competence in Operating nuclear detectors and radiation safety equipment, Constructing and analysing electronic circuits Using advanced laboratory instruments and measurement techniques, Performing statistical and error analysis on experimental data, Writing technical reports and presenting experimental results, Adherence to laboratory safety and professional ethics, Practical skills in nuclear and electronic instrumentation are critical for healthcare, energy, security and manufacturing. Graduates of this course contribute to technological self-reliance, equipment maintenance, and quality assurance for national development. In summary, this course trains students to carry out independent experiments in nuclear physics and electronics, analyse data accurately, and apply physics principles to real-world instrumentation problems.

COURSE OBJECTIVES

The objectives are to

1. Show Basic knowledge,
2. Show competency, and skill of organisational concepts and techniques.
3. Perform Practical Physics and laboratory management and continuation of PHY 225.

Learning Outcomes

On completion, the student should be able to

Verify some equations, physical laws, and theorems;

Identify apparatus and set up experiments; and

Investigate relationships between physical quantities numerically and graphically.

COURSE CONTENT

- Wave phenomena: Types and properties of waves, SHM, harmonic oscillator, waves on a string, energy in wave motion, acoustical waves, longitudinal waves, standing waves
- Group and phase velocity, doppler effect
- Physical Optics
- Spherical waves
- Interference, superposition, Young’s slits, multiple slits, the Michelson interferometer

- Diffraction
- Single and double slits
- The diffraction grating and spectrometers
- Thin films
- Dispersion and scattering
- Echo, Beats, Doppler effects, sound in gases, liquids, and solids
- Geometrical
- Optics, Waves and rays
- Reflection at plane and spherical surfaces, refraction, thin lenses, prism, optical lenses, and optical instruments, such as microscopes, telescopes and other lens maker's formula
- Polarisation: Polarisation states
- Unpolarized and partially polarised light

Brewster's angle; Polarising beam splitters; Photometry and light spectrum analysis.

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Self- Development • Entrepreneurial skill • Time Management • Creativity
Core Values	• Love • Responsibility • Confidence • Honest • Perseverance
Pedagogical Approaches	• Experiential Learning • Blended Learning • Collaborative /Cooperative Learning • Project-based Learning • Learner-Centred Approach

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Practical Instructional Materials • Classroom Instructional Materials • Reference materials • Practical manual based
Assessment Methods	• Continuous Assessment, & • Formative Assessment • Performance-Based Assessment • Project work. • Project work.

REFERENCES AND FURTHER READING

Core Textbooks and Reference materials, Digital and online Learning Platforms, Classroom & Practical Instructional Materials, etc.

Degree Course Descriptions (400–500 Level)

PHY 401 Analytical Mechanics I

LEVEL 400 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

PHY 401 Analytical Mechanics I

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

The course is the advanced mathematical treatment of classical mechanics. Instead of using forces like in PHY 101, students will use energy and mathematical principles to solve complex motion problems. The goal is to give tools to handle systems with particles, constraints, and complicated forces- i. e the foundation for Quantum Mechanics and statistical mechanics.

RELEVANCE STATEMENT

This Course is a bridge course that connects introductory mechanics to advanced theoretical courses. The course also develops skills in differential equations, calculus of variations and tensor methods needed for research. It meets the minimum standard for core theoretical physics courses and its essential for further studies

COURSE OBJECTIVES

By the end of the course students to;

1. Formulate mechanics problems using Lagraangian and Hamiltonian methods
2. Solve constrained motion problem more easily than Newton’s laws
3. Understand the connection between symmetry and conservation laws- Noether’s theorem
4. Prepare for Quantum Mechanics and classical Field theory

LEARNING OUTCOMES

By the end of the course students should be able to:

1. Explain the limitations of Newtonian mechanics and why analytical methods are needed.
2. Define concepts ad generalised coordinates, holonomic constraints, Lagrangian Hamiltonian, phase space and action.
3. Describe the physical meaning of variational principles and symmetry in mechanics.
4. Formulate the Lagrangian L= T – V for a given mechanical system using generalised coordinates.
5. Derive equations of motion using Lagrange's Equations and Hamiltonian's Equations.
6. Solve problems of central force motion, Kepler's orbits and scattering.
7. Analyse system of coupled oscillators to find normal modes and frequencies.
8. Apply Euler's equations to describe rigid body rotation.

COURSE CONTENT

- Review of Newtonian mechanics
- Motion of a particle in one, two and three dimensions
- Internal forces, external forces, forces of constraint
- Systems of particles and collision theory
- Newtonian gravitation
- Conservative forces and potentials
- Oscillations, central force problems
- Accelerated frames of reference
- Rigid body dynamics
- Rotational problems and polar coordinates
- Mechanics of continuous media
- Galilean relativity
- Relativistic kinematics and dynamics, Applications of relativistic kinematics

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Self- Development • Entrepreneurial skill • Time Management • Creativity

CATEGORY	DETAILS
Core Values	• Love • Responsibility • Confidence • Honest • Perseverance
Pedagogical Approaches	• Experiential Learning • Blended Learning • Collaborative /Cooperative Learning • Project-based Learning • Learner-Centred Approach
Learning Resources	• Core Textbooks and Reference materials • Practical Instructional Materials • Classroom Instructional Materials • Reference materials • Practical manual based
Assessment Methods	• Continuous Assessment, & • Formative Assessment • Performance-Based Assessment • Project work. • Project work.

Key Textbooks / References

1. Goldstein, H., Poole, C, &Safko, J. Classical Mechanics 3rd Edition, Addison – Wesley, 2002.
2. Taylor, J.R Classical Mechanics, University Science Books, 2

PHY 403 Electromagnetism

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course builds on PHY 102 General Physics II and introduces the fundamental laws governing electric and magnetic fields, and how they combine to form electromagnetic waves.

RELEVANCE STATEMENT

COURSE OBJECTIVES

At the end of the course, students should be able to;

understand both static and dynamic electric and magnetic fields, and the unification of both through Maxwell's equations.

LEARNING OUTCOMES

On completion of PHY 403, students should be able to:

1. Describe the electric field and potential, and related concepts, for stationary charges
2. Calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential
3. Describe and determine the magnetic field for steady and moving charges
4. Determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law
5. Describe electromagnetic induction and make calculations using Faraday and Lenz's laws
6. Explain the basic physical meaning of Maxwell's equations in integral form
7. Evaluate DC circuits to determine electrical parameters
8. Determine the characteristics of AC voltages and currents in resistors, capacitors, and inductors 3769

COURSE CONTENT

- Review of vector calculus
- Electrostatics and magnetostatics, Magnetisation and magnetic susceptibility
- Laplace's equation and boundary value problems

- Multipole expansions, EM waves in dielectric and magnetic materials
- Polarisation of EM waves
- Electromagnetic induction
- Faraday's and Lenz's laws
- A.C. Circuits.
- Maxwell's equations
- Lorentz covariance and special relativity
- Gauss theorem in dielectrics
- Poisson's equations
- Uniquenes's theorem
- Magnetron
- Magnetic properties
- Motors
- Generators and Poynting vectors

CATEGORY	DETAILS
Core Competencies	• Emotional Intelligence • Reflective Thinking • Productivity • Collaboration • Creativity
Core Values	• Equality • Discipline • Commitment • Equality • Freedom
Pedagogical Approaches	• Inquiry-Based Learning • &Project-based Learning • Blended Learning • Experiential Learning • Project-based Learning

CATEGORY	DETAILS
Learning Resources	• Core Textbooks and Reference materials • Classroom & Instructional Materials • Digital and online Learning Platforms • Platforms, Classroom & Instructional Materials • Core Textbooks and Reference materials
Assessment Methods	• Formative assessment • Continuous assessment • Performance-Based Assessment • Performance-Based Assessment • Performance-Based Assessment

Key Textbooks / References

Grant, I.S. and Philips, W.A. Electromagnetism ELBS Manchester 1974

Feynman, R.P., Leighton, R.B. and Sands, M. The Feynman Lectures on Physics

Sadiku, M.N.O. Elements of Electromagnetics 88af89bd

PHY 405 Quantum Physics

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course introduces students to the principles of quantum physics which describe the behaviour of matter and energy at atomic and sub atomic levels.

RELEVANCE STATEMENT

This course is a core theoretical course designed to provide students with the fundamental principles that govern microscopic systems. The course is relevant and is the basis for understanding atomic, nuclear, solid state and particles physics. Quantum principles are the foundation of modern technologies including lasers, semiconductors, transistors, MRI, quantum computing, nanotechnology and solar cells.it equips students with mathematical and conceptual tools needed for research in physics, material science, and Engineering at postgraduate level.it also shows where classical fails and introduces a new frame work for describing nature at atomic scales. Knowledge of quantum physics is essential for careers

in research institutes, telecommunication, energy, defence and academia. It also prepares students postgraduate studies.

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Understand the failure of Classical physics and the need for quantum theory
2. Apply the postulates and mathematical formalism of quantum mechanics
3. Solve the Schrodinger equation for simple systems
4. Understand the atomic structure, angular momentum, spin and approximation methods

LEARNING OUTCOMES

On completion, the student should be able to

1. State the postulates of quantum mechanics

2 explain the basics of vectors and tensor operators

1. Solve a variety of physical problems using the Schrodinger equation.
2. Work with angular momentum operators and their eigenvalues both qualitatively and quantitatively.
3. Explain electron spin and the Pauli principle
4. Apply perturbation theory and other methods to find approximate solutions to problems in quantum mechanics, including the fine-structure of energy levels of hydrogen.

COURSE CONTENT

- The formulation of quantum mechanics in terms of state vectors and linear operators
- Time evolution of the Schrodinger equation
- The theory of angular momentum and spin
- Electron spin and the Stern-Gerlach experiment
- Identical particles and the Pauli exclusion principle, multi-electron atoms
- Approximation methods
- Variational methods and WKB approximation for bound states and tunnelling
- Time-independent Perturbation theory
- The fine structure of hydrogen
- Harmonic oscillator

- Creation and annihilation operators
- External fields: Zeeman and Stark effects in hydrogen

CATEGORY	DETAILS
Core Competencies	• Research and competence • Application • Analytical • Mathematical • Conceptual
Core Values	• **Precision and rigour** • **Scientific inquiry** • **Critical thinking** • **Integrity** • **Collaboration**
Pedagogical Approaches	• **Lecture method** • **Problem solving** • **Visualisation** • **Discussion** • **Flipped Classroom**
Learning Resources	• **Core textbooks** • **Visual Aids** • **Software/ simulations** • **Past questions & problem sets** • **Laboratory**
Assessment Methods	• **Tests** • **Assignments** • **Class participation** • **Problem solving** • **Projects**

Reference;

Griffiths, D.J, introduction to Quantum mechanics 2th ed

Zettill, N., Quantum Mechanics; Concepts and Applications.

CSC 413 Artificial Intelligence

LEVEL 300 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Artificial intelligence introduces students to the fundamental concepts, principles, and techniques of artificial intelligence. The course covers the history of AI, Intelligent agents, problem solving by search, knowledge representation, reasoning, machine learning basics and applications of AI. Students will learn both theoretical foundations and practical approaches to building intelligent systems that can perceive, reason and make decisions

RELEVANCE STATEMENT

Artificial intelligence is a core course designed to equip students with knowledge and skills to develop intelligent systems for the 21st century. AI is driving innovations in healthcare, finance, agriculture, education, security and technology. Graduate must understand AI to remain competitive in the job market. It prepares students for post graduate courses in machine learning, Data mining and robotics. Ai techniques provide new ways to solve complex real – world problems that are difficult with traditional algorithms. Ai is key to Nigeria's digital economy, smart agriculture, fintech and e-governance initiatives**.**

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Define AI and explain the different approaches to building intelligent systems
2. Design and implement intelligent agents and search algorithms to solve problems
3. Apply knowledge representation techniques using logic and rules.
4. Understand basic principle of machine learning and expert systems
5. Evaluate ethical and social implications of AI technologies.

LEARNING OUTCOMES

At the end of this course, students should be able to:

1. Explain AI fundamentals, concepts, goals, types, techniques, branches, applications, AI technology and tools; 44 Computing New

2. Discuss intelligent agents, their performance, examples, faculties, environment and architectures, and determine the characteristics of a given problem that an intelligent system must solve;
3. Describe the Turing test and the "Chinese Room" thought experiment, and differentiate between the concepts of optimal reasoning/behaviour and human-like reasoning/behaviour;
4. Describe the role of heuristics and the trade-offs among completeness, optimality, time complexity, and space complexity;
5. Analyse the types of search and their applications in AI and describe the problem of combinatorial explosion of search space and its consequences;
6. Demonstrate knowledge representation, semantic network and frames along with their applicable uses;
7. Practice Natural Language Processing, translate a natural language (e.g. English) sentence into a predicate logic statement, convert a logic statement into clause form, apply resolution to a set of logic statements to answer a query; and
8. Analyse programming languages for AI and expert systems technology, and employ application domains of AI.

COURSE CONTENT

- Overview of Artificial Intelligence
- History of AI.
- Goals of AI.
- AI Technique
- Types of AI.
- Branches and applications of AI.
- Advantages and Disadvantages
- Introduction to Intelligent Agents
- Agent Performance, Examples of Agents, Agent Faculties, Rationality, Agent Environment
- Agent Architectures
- Search
- General Classes of AI Search Algorithm Problems
- Problem Solving by Search
- Types of AI Search Techniques and Strategies

- Introduction to the types of problems and techniques in AI.
- Problem-Solving methods
- Major structures used in AI programmes
- Knowledge Representation
- KR and Reasoning Challenges
- KR Languages
- Knowledge representation techniques such as predicate logic, non-monotonic logic, and probabilistic reasoning
- **Semantic Network:** types of relationships, semantic network inheritance, types and components
- Introduction to Frames
- Natural Language Processing (NLP)
- Introduction to natural language understanding and various syntactic and semantic structures
- **Introduction to Expert Systems:** characteristics, components, types, requirements, technology, development
- Programming Languages for AI.
- Introduction to computer image recognition
- Lab work: Group practical in (i) Turing test practical – Students can act out their own version of the Turing test (ii) Facial recognition practical to aid in teaching students how machine learning works with students simulating a facial recognition algorithm
- **Practical applications of NLP in groups:**
    - Question Answering focuses on building systems that automatically answer the questions asked by humans in a natural language
    - Spam detection application for detecting unwanted e-mails getting to a user's inbox
    - Sentiment analysis/opinion mining should be used on the web to analyse the attitude, behaviour, and emotional state of the sender, implemented through a combination of NLP and statistics
    - Practical exercise of machine translation used to translate text or speech from one natural language to another natural language such as the Google Translator
    - Developing a model to provide word processor software for the spelling correction

  - Developing a model for speech recognition for converting spoken words into text
  - Implementing a Chatbot to provide the staff/student's chat services
- OR Group Practical exercise on agents and its environment using simulation of a colony of ants foraging for food
- Model simulating a message between agents
- Model simulating the flocking behaviour of birds
- Model to apply standard search algorithm to the classic search problem of missionaries and cannibals, and how to use communicating agents for searching networks
- 45 Computing New Some computer AI animation exercises for any branch of AI.
- Practical exercise on simple robots coupling and programming
- Group project of building a lawn robot for trimming grasses, or any simple design and implementation of robotics

CATEGORY	DETAILS
Core Competencies	• Algorithm • Modelling • System design • Data • Communication
Core Values	• **Innovation** • **Ethical Responsibility** • **Lifelong learning** • **Integrity** • **Collaboration**
Pedagogical Approaches	• **Lecture + demonstration** • **Group project** • **Problem based learning** • **Hands- on lab** • **Guest lectures**

CATEGORY	DETAILS
Learning Resources	• Core text books • Supporting texts • Software/ tools • Datasets • Online Resources
Assessment Methods	• Tests • Assignment • Project • Attendance • Exams

Degree 400 Level: Second Semester

PHY 404 Electromagnetic Waves Optics

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 404 electromagnetic, waves and optics is a core course that develops the theory of electromagnetic waves from Maxwell's equation and applies it to optical phenomena. Students will understand how light and radio waves propagate, interact with matter, and are applied in communication and optical technologies.

RELEVANCE STATEMENT

EM Waves are the basis of radio, TV, mobile communication, radar, satellite, and microwaves system. Optics drives cameras, microscopes, telescope, lasers and fibre optic internet. It is a bridge that prepares students for further courses in physics and post graduate courses Photonics and Telecommunications. Graduates are needed in telecommunication companies, broadcasting, medical imaging, defence, and renewable energy sectors. Understanding wave propagation is essential for research in antennas, photonics nanophtonics, and remote sensing, and it supports Nigeria's ICT, broadband and space technology goals.

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Derive electromagnetic wave equations from Maxwell's equations
2. Analyse propagation, reflection, refraction, and polarisation of EM WAVES
3. Understand principles of waveguides, transmission lines and antennas.
4. Explain optical phenomena using geometrical and physical optics
5. Describe operations of lasers, fibre, optics and optical instruments

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Pre explain plane electromagnetic waves and waves propagation;
2. Derive the wave equation;
3. Describe the transport of electromagnetic energy;
4. Explain scattering, interference, diffraction, reflection, polarisation, and refraction of electromagnetic waves;
5. Use complex notation competently for wave phenomena;
6. Solve problems which require the use of wave representations of electric and magnetic fields in propagating electromagnetic waves;
7. Analyse simple examples of interference and diffraction phenomena;
8. Explain the principles of operation of a range of equipment used in modern optics, notably the Michelson interferometer and Fabry-Perot etalon;
9. Explain the physics of the laser and processes involved in producing laser radiation to solve simple problems;

COURSE CONTENT

- Review of Maxwell's equations and wave equations in a dielectric
- Electromagnetic potentials
- Propagation of plane and spherical waves
- Huygen's wavelets and Fermat's principle
- Recap of polarisation states
- Interference
- Michelson interferometer and Fabry-Perot etalon
- Fourier transform spectroscopy

- Young's slits
- Lloyd's mirror
- Fraunhofer diffraction
- Resolution of optical instruments
- Reflection and refraction
- Transmission lines
- **Wave guides and optical cavities Lasers:** rate equation, Steady state operation; threshold and efficiency

CATEGORY	DETAILS
Core Competencies	• Theoretical • Computational • Experimental • Design • Analytical
Core Values	• **Precision** • **Innovation** • **Scientific integrity** • **Safety** • **Collaboration**
Pedagogical Approaches	• **Lecture** • **Laboratory practical** • **Demonstration** • **Simulation** • **Discussion**
Learning Resources	• **Core text books** • **Laboratory Equipment** • **Visual Aids** • **Software** • **Charts and models**

CATEGORY	DETAILS
Assessment Methods	• Test • Assignment • Group work • Practical • Exams

Degree 400 Level: Second Semester

PHY 406 Statistical and Thermal Physics

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course connects microscopic mechanics to microscopic thermodynamics properties of matter. The course develops statistical methods to explain thermal phenomena and applies them to ideal gases, solids and radiation. Student will understand how macroscopic properties like temperature, pressure, entropy and heat capacity arise from the statistical behaviour of large numbers of particles.

RELEVANCE STATEMENT

This course is a core theoretical one that provides the bridge between mechanics and thermodynamics. It also explains electrical, thermal, and magnetic properties of solids, liquids and gases. The course also is used in design of engines refrigerators, powerplants, semiconductor devices, lasers and cryogenics. Statistical methods are used in astrophysics, plasma physics, nuclear physics and biophysics. Also, understanding BE and FD statistics is critical lasers, superconductors, semiconductors and nanotechnology. The course prepares students for careers in energy, material science, chemical Engineering, and post graduate studies.

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Apply the laws of thermodynamics and thermodynamics potential to physical systems
2. Use statistical methods to derive macroscopic properties from microscopic properties from microscopic behaviour

3. Distinguish between MB, BE, and FD statistics and their applications
4. Calculate partition functions and thermodynamic quantities for ideal systems
5. Explain thermal properties of solids, gases, and radiation using statistical physics

LEARNING OUTCOMES

On completion, the student should be able to

1. Describe an ideal gas on the basis of classical statistics
2. Explain the basic concepts of statistical mechanics, including entropy, its statistical interpretation and relation to disorder, and the statistical origin of the second law of thermodynamics;
3. Illustrate the canonical and grand-canonical partition functions for systems in thermal equilibrium, and use them to obtain thermodynamic quantities of interest.
4. Describe the implications of the indistinguishability of particles for systems of noninteracting quantum particles.
5. Deduce the Bose-Einstein and Fermi-Dirac distribution functions, and apply them to calculate the properties of Bose and Fermi gases, for example in the context of White Dwarf stars and black-body radiation.
6. Explain the physical origin of Bose-Einstein condensation, to characterise it quantitatively, and to explain the experiments confirming Bose-Einstein condensation

COURSE CONTENT

- Basic theory of thermodynamics
- Basic of probability theory
- Microstates and macrostates
- The concept of ensembles
- Statistical interpretation of entropy and temperature
- Isolated systems and the microcanonical ensemble
- Statistical physics of non-isolated systems
- Derivation of the Boltzmann distribution and canonical ensemble
- The partition function in thermodynamics
- Non-interacting systems
- Equipartition theorem
- Density of states
- Grand canonical ensemble

- Fermi-Dirac and Bose-Einstein distributions
- The ideal Fermi gas
- Fermi energy
- Electronic heat capacity, The ideal Bose gas, Black body radiation, Bose-Einstein condensation

CATEGORY	DETAILS
Core Competencies	• Theoretical • Computational • Problem solving • Analytical • Mathematical
Core Values	• **Innovation** • **Collaboration** • **Scientific curiosity** • **Logical resoning** • **Precision**
Pedagogical Approaches	• **Lecture method** • **Demonstration** • **Simulation** • **Case studies** • **Mathematical workshops**
Learning Resources	• **Reference text** • **Visual aids** • **Software** • **Laboratory** • **Past questions and problem sets**
Assessment Methods	• **Assignments** • **Tests** • **Attendance and participation** • **Exams** • **Projects**

Degree 400 Level: Second Semester

PHY 423 Methods in Teaching Physics II

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This is a professional course designed to equip prospective Physics Teachers with advance methods, strategies, and skills for effective teaching of physics at senior secondary school level. This course builds on other professional courses by focusing on modern teaching approaches, curriculum implementation, assessment, and use of technology in Physics teaching. Emphasis is placed on inquiry-based learning, problem solving and practical work.

RELEVANCE STATEMENT

PHY/SED 423 is a professional core course for Physics Education students. This course is relevant because it bridges the subject matter knowledge and pedagogy, enabling students to translate physics concepts into classroom practice. It also prepares teachers to implement the Nigerian Senior Secondary School Physics curriculum effectively. The course provides strategies for teaching abstract and difficult topics like Quantum Physics, EM Waves, and Nuclear Physics. It equips teachers with skills to use ICT, simulations, and inquiry methods to make interesting and relevant. Furthermore, it develops reflective, competent, and innovative Physics teachers needed for national development in STEM.

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Interpret and implement the SS1 – SS3 Physics curriculum
2. Apply appropriate methods and strategies to teach specific Physics topics
3. Design and conduct Physics practical and demonstrations safely
4. Use ICT and instructional materials to enhance Physics teaching
5. Construct valid test items and evaluate students' performance in Physics

LEARNING OUTCOMES

By the end of SED/PHY 423, students should be able to;

1. Analyse the SSCE/NECO/WAEC Physics syllabus and scheme of work

2. Develop lesson plans and lesson notes using different teaching models
3. Demonstrate skills in inquiry, problem- solving and project- based methods
4. Desihn and improvise instructional materials for teaching physics concepts
5. Manage a Physics laboratory effectively and ensure safety
6. Construct and administer valid physics test items and interpret results
7. Apply ict tools, simulations, videos and software in teaching Physics.
8. Teach difficult physics topics using analogies and models.

COURSE CONTENT

- SSCE physics syllabus
- Scheme of work
- Lesson plan
- Lesson note
- Taxonomy of objectives
- Inquiry method
- Problem -solving
- Project method
- Concept mapping
- 5E’S model
- Teaching difficult topics. Organisation and management of the physics laboratory
- Safety and rules
- Improvisation
- Conducting and supervising practical of simulations
- Videos and software
- Virtual labs advantages and challenges
- Test construction
- Types of test items
- Marking schemes
- Recording and reporting
- Remediation
- Peer teaching of selected SS1 -SS3 topics
- Feedback and reflection

CATEGORY	DETAILS
Core Competencies	• Classroom • Curriculum • Assessment • Pedagogy • ICT
Core Values	• **Creativity** • **Patience & empathy** • **Safety consciousness** • **Professionalism** • **Collaboration**
Pedagogical Approaches	• **Microteaching** • **Peer teaching &reflection** • **Workshop/practical** • **ICT – integrated** • **Demonstration**
Learning Resources	• **Core textbooks** • **Curriculum documents** • **Laboratory equipment** • **ICT resources** • **Instructional Aids**
Assessment Methods	• **Test** • **Microteaching** • **Assignment** • **Attendance & participation** • **Practical**

REFERENCES AND FURTHER READING

1. okebukola, P.A. Teaching Strategies; A blue print for effective teaching
2. Nzewi, U.M. Teaching of physics in Schools.

Degree 400 Level

B.Sc. Ed

Second Semester

PHY 402 Ordinary Differential Equation

LEVEL 400 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This an advanced course that extends the study of ordinary differential Equations to systems of ODE's, nonlinear equations and methods of solution using series and transforms. The course focuses on both analytical and qualitative technique for solving ODEs that model real world problems in physics engineering and biology.

RELEVANCE STATEMENT

This course is a core mathematics course that provides tools for modelling and solving dynamic systems. ODEs are used to model motion, circuits, population growth, chemical reactions and control systems. The course prepares students for MTH 403 PDE, MTH 404 Numerical analysis, MTH 405 Mathematical modelling and MTH 407 Dynamics systems. The course also is essential for engineers, physicists, economists, and data scientist who model time – dependent system. Develops analytical thinking and ability to translate real problems into mathematical form. It is also used in modelling in agriculture, health, energy systems and telecommunications.

LEARNING OUTCOMES

At the end of the course students should be able to:

1. Define existence and uniqueness theorems;
2. Describe Volterra and Fredholm types; and
3. Solve some problems of reduction of ordinary Differential equations to Integral equations.
4. Define first and second order linear equations;
5. Describe Cauchy problems; and
6. Solve some problems in Parabolic, Hyperbolic and Elliptic equations.

COURSE CONTENT

- Existence and uniqueness theorems, dependence of solutions on initial data and parameters
- Properties of solutions
- Sturm comparison and Sonin-Polya theorems
- Linear and non-linear systems
- Floquet's theory and stability theory
- Integral equations: classification, Volterra and Fredholm types Neumann series
- **Fredholm alternative for degenerate Hilbert:** Schmidt kernels
- Reduction of ordinary differential equations to integral equations
- Symmetric kernels, eigenfunction expansion with application
- Theory and solutions of first-order and second order linear equations
- Classification, characteristics and canonical forms
- Cauchy problems
- Elliptic equations: Laplace's and Poisson's formulas, properties of harmonic functions
- Hyperbolic equations
- Wave equations, retarded potential: transmission line equation, Riemann method
- Parabolic equation: Diffusion equation, singularity function, boundary and initial – value problems

CATEGORY	DETAILS
Core Competencies	• Critical thinking • Numerical competence • Qualitative competence • Modelling competence • Analytical competence
Core Values	• **Persistence** • **Logical reasoning** • **Creativity** • **Integrity** • **Collaboration**

CATEGORY	DETAILS
Pedagogical Approaches	• Flipped classroom • Lecture method • Discussion • Project based learning • Problem solving tutorial
Learning Resources	• Software • Visual aids • Reference materials • Online resources • Text books
Assessment Methods	• Project • Attendance and participation • Tests • Assignments • Exams

REFERENCE;

Boyce, W.E.& DiPrima, R.C. Elementary Differentials Equations and Boundary value Problems

Zill, D. G. A First Course in Differential Equations with Modelling Applications

Degree 500 Level

B.Sc. Ed

First Semester

PHY 511 Teaching Practice II

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** *not stated* | **PRACTICAL HOURS** 135

COURSE OVERVIEW

This course is a field – based professional course where students are posted to approved secondary schools to practice teaching under supervision. It is the capstone of the teacher education programme. students will independently plan, teach, assess, and manage, classrooms in real school's settings. The course integrates teory from all education and methods courses into practice.

RELEVANCE STATEMENT

Teaching practice II is a mandatory professional course that bridges theory and practice in teacher education. This course is relevant because it is required for graduation and NCE / B.Sc. Ed certification. It provides opportunity to apply pedagogical knowledge in actual classrooms before NYSC and employment. It also develops competence in lesson delivery, classroom management, and school administration. The course exposes students to realities of the teaching profession and helps them decide on specialisation. The course produces competent teachers needed to improve learning outcomes in Nigerian Schools.

COURSE OBJECTIVES

At end of the course, students should be able to;

1. Apply curriculum and teaching methods in real classroom situations.
2. Plan and deliver effective lessons using appropriate strategies and materials
3. Manage a classroom and maintain discipline professionally
4. Assess students and keep accurate records
5. Participate in other school activities and demonstrate professional conduct.

LEARNING OUTCOMES

At the end of the course, the students should be able to demonstrate:

1. Knowledge of the subject matter;
2. The necessary pedagogical skills; acquired understanding of child psychology;
3. The needed attitude towards Teaching; proper use of instructional facilities; knowledge of individual differences in actual classroom situations and how to use this knowledge to assist children in real-time;

and effective classroom management skills.

COURSE CONTENT

- Effective and responsive teaching practices and interactions are key for all learning in professional teacher preparation
- Teaching practice is important to provide the students with an opportunity to apply their pedagogical knowledge and skills in practice
- Therefore, the practical implementation of teaching and learning strategies in the classroom, as applied to the subject area, should be taught through micro-teaching before students embark on the exercise

CATEGORY	DETAILS
Core Competencies	• **Pedagogical** • **Curriculum** • **Classroom management** • **Assessment competence** • **Communication**
Core Values	• Professionalism • Dedication • Reflective practice • Respect • Creativity
Pedagogical Approaches	• School -Based • Practice • Micro teaching • Observation • Mentoring • Reflective Journal

CATEGORY	DETAILS
Learning Resources	• Documents • Curriculum materials • Teaching aids • Assessment tools • Supervision forms
Assessment Methods	• Viva/oral interview • Portfolio • General conduct • Teaching practice • Lesson and records

Degree 500 Level: First Semester

PHY 501 Quantum Mechanics I

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** 45

COURSE OVERVIEW

This course PHY 501 is an advanced theoretical course that introduces the fundamental principles and mathematical formalism of non- relativistic quantum mechanics. The course develops quantum theory fro experimental foundations and builds the operator formalism to describe physical systems. Emphasis is on solving the Schrodinger equation for key systems and interpreting quantum phenomena

RELEVANCE STATEMENT

This course is a core that forms the foundation for all modern physics. The course is relevant because, QM explains lasers, semiconductors, transistors, MRI, Quantum Computing and nanotechnology.it also prepares students for Quantum Mechanics II, Quantum field theory, Solid state Physics and Nuclear / Particle physic. It is also essential for research in materials science, photonics, atomic physics and quantum information. The course provides the language to describe atoms, molecules, and subatomic particles where classical physics fails.it is key to Nigeria’s goals in ICT, renewable energy, medical physics and space science.

COURSE OBJECTIVES

At the end of the course, students should be able to

1. State the postulates of quantum mechanics and their physical significance
2. Formulate and solve the time – independent Schrodinger equation for standard potentials
3. Use operator methods and Dirac notation to describe quantum systems
4. Understand angular momentum and the hydrogen atom solution
5. Apply approximation methods to problems without exact solutions

LEARNING OUTCOMES

Learning Outcomes On completion, the student should be able to

1. State the postulates of quantum mechanics
2. Explain the basics of vectors and tensor operators
3. Solve a variety of physical problems using the Schrodinger equation.
4. Work with angular momentum operators and their eigenvalues both qualitatively and quantitatively.
5. Explain electron spin and the Pauli principle
6. Apply perturbation theory and other methods to find approximate solutions to problems in quantum mechanics, including the fine-structure of energy levels of hydrogen.

COURSE CONTENT

- The formulation of quantum mechanics in terms of state vectors and linear operators
- Time evolution of the Schrodinger equation
- The theory of angular momentum and spin
- Electron spin and the Stern-Gerlach experiment
- Identical particles and the Pauli exclusion principle, multi-electron atoms
- Approximation methods
- Variational methods and WKB approximation 906 Education New 3. for bound states and tunnelling.
- Time-independent Perturbation theory
- The fine structure of hydrogen
- Harmonic oscillator

- Creation and annihilation operators
- External fields: Zeeman and Stark effects in hydrogen

CATEGORY	DETAILS
Core Competencies	• Physical interpretation • Computational approximation • Mathematical • Problem solving • Collaboration
Core Values	• **Abstract thinking** • **Curiosity** • **Integrity** • **Rigour** • **Innovation**
Pedagogical Approaches	• **Discussion** • **Seminar presentation** • **Mathematical workshops** • **ICT Integration** • **Lecture method**
Learning Resources	• **Mathematical reference** • **Visual Aids** • **Software** • **Core textbooks** • **Past questions**
Assessment Methods	• **Exams** • **Tests** • **Seminar/ presentation** • **Project** • **Experiment**

REFERENCES AND FURTHER READING

Griffiths, D.J Introduction to Quantum Mechanics 3rd Edition

Sakurai, J.J. Modern Quantum Mechanics

Degree 500 Level: First Semester

PHY 503 Mathematical Methods in Physics I

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This is a core course that equips physics students with advanced mathematical tools needed to solve problems in theoretical and applied physics. The course focuses on methods rather pure proofs, with direct application to mechanics, electromagnetism, quantum mechanics and thermal physics.

RELEVANCE STATEMENT

Mathematical Methods in Physics is a core foundation course for all theoretical and research physics. A student cannot do Quantum Mechanics, EM Theory, or solid state without these methods. PDEs, Fourier, and special functions appear everywhere. The course provides techniques to solve real physics problems that cannot be solved by elementary calculus. It is essential for modelling, simulation, and data analysis in physics research. This course prepares students for MSc/PhD Level Courses in Theoretical Physics and Engineering. The application of this course is used in signal processing, optics, control systems and computational physics.

COURSE OBJECTIVES

At the end of the course, students should be able to;

1. Apply complex analysis to evaluate integrals and solve physics problems.
2. Solve PDEs using separation of variables and transform methods.
3. Use special functions and orthogonal polynomials in physical systems.
4. Apply Fourier and Laplace transforms time – dependent systems.
5. Use tensor and group theory methods in mechanics and quantum.

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Explain the concepts of scalar and vector fields;
2. Describe the properties of div, grad and curl and be able to calculate the divergence and curl of vector fields in various coordinate systems;

3. Calculate surface and volume integrals in various coordinate systems;
4. Calculate flux integrals and relate them to the divergence and the divergence theorem;
5. Calculate line integrals and relate them to the curl and to Stokes' Theorem;
6. Apply the methods of vector calculus to physical problems;
7. Calculate the Fourier series associated with simple functions and apply them to selected physical problems.

COURSE CONTENT

- Vector and scalar fields
- Vector operators
- Div, grad, and curl
- Divergence theorem
- Stoke's theorem
- Linear Algebra and functional Analysis
- Transformations in linear vector spaces and matrix theory
- Hilbert space and complete sets of orthogonal functions
- Special functions of 907 Education New mathematical physics (The gamma function
- Hypergeometric functions
- Legendre functions
- Bessel functions
- Hermite and Laguerre functions
- The Dirac – Delta function
- Integral transforms and Fourier series
- Fourier series and Fourier transforms
- The Dirichlet conditions. orthogonality of functions.
- Fourier coefficients
- Complex representation of Fourier series
- Laplace transform
- Applications of transform methods to the solution of elementary differential equations of interest in physics and engineering

CATEGORY	DETAILS
Core Competencies	• Mathematical • Competences • Computational • Competence • Modelling competence • Analytical competence • Theoretical competence
Core Values	• **Rigorous** • **Persistence** • **Abstraction** • **Integrity** • **Curiosity**
Pedagogical Approaches	• **Lecture** • **Problem- solving** • **Computational** • **Demonstration** • **Discussion**
Learning Resources	• **Software** • **Visual aids** • **Reference** • **Past questions** • **Core text books**
Assessment Methods	• **Assignment** • **Attendance &participation** • **Examination** • **Tests** • **Project**

REFERENCES AND FURTHER READING

Boas, M.L. Mathematical Methods in the Physics Sciences.

Arfken, G.B. & Weber, H.J. Mathematical Methods for Physicists.

Degree 500 Level: First Semester

PHY 513 Complex Variables and Vector Space

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 513 is a core mathematical physics course that introduces students to two fundamental tools used throughout theoretical physics: complex analysis and vector Spaces. The course covers function of a complex variable, integration in the complex plane, and the algebraic/ geometric structure of vector spaces with direct applications to Quantum Mechanics, Electromagnetism, and Signal Processing.

RELEVANCE STATEMENT

Complex Variable and Vector Space is a foundational mathematics course for modern physics. Wavefunctions are complex – valued. QM is formulated entirely in Hilbert vector using Dirac notation. Complex analysis is used to solve boundary value problems, evaluate integrals, and analyse waves. Fourier transforms, Laplace transforms, and impedance all use complex variables. The course provides the language for advanced courses like Quantum Mechanics, mathematical methods and solid state. The course can be applied in optics, control systems, fluid dynamics and quantum computing.

Learning Objectives;

At the of this course, students should be able to;

1. Manipulate complex numbers and functions and test for analycity using Cauchy – Riemann equations
2. Evaluate real and complex integrals using Cauchy's theorem and the Residue theorem
3. Understand the structure of vector spaces, subspaces, basis, and dimension
4. Apply linear operators, eigenvalues and eigenvectors to physical systems.
5. Work with inner product spaces, orthonormal bases, and Dirac bra- ket notation
6. Use these mathematical tools to solve problems in Quantum Mechanics and EM Theory.

LEARNING OUTCOMES

By the end of PHY 513, students should be able to;

1. Perform operations on complex numbers and represent them on the Argand plane
2. Determine if a function is analytic and find its derivative
3. Evaluate contour integrals and real integrals using residue theory
4. Define vector spaces and prove linear independence, basis and dimension
5. Find eigenvalues/ eigenvectors and diagonalize matrices and operators
6. Apply Gram- Schmidt orthogonalization and work with Hermitian/unitary operators
7. Use Dirac notation to represent quantum states and observables
8. Model physical problems in terms of complex functions and vector spaces

COURSE CONTENT

- Complex numbers, Argand diagram, de Moivre's theorem
- Functions of a complex variable
- Limits, Continuity, differentiability
- Cauchy – Riemann equations
- Harmonic Functions, Elementary Functions
- Exponential logarithmic, trigonometric, conformal mapping
- Contour integral
- Cauchy 's integral theorem and formula
- Taylor and Laurent series
- Singularities
- Residue theorem, Evaluation of real integrals. inverse Laplace transforms. applications to physics.
- Inner products, norm, orthogonality
- Eigen values/ eigenvectors
- Hermitian, unitary operators
- Introduction to Hilbert spaces and Dirac notation
- Applications to Quantum Mechanics

CATEGORY	DETAILS
Core Competencies	• **Algebraic** • Competences • **Modelling competence** • **Computational** • Competence • Analytical competence • Problem – solving • Competence
Core Values	• **Rigorous** • **Persistence** • **Abstraction** • **Integrity** • **Curiosity**
Pedagogical Approaches	• **Lecture** • **Problem- solving** • **Computational** • **Demonstration** • **Discussion**
Learning Resources	• **Software** • **Visual aids** • **Reference** • **Past questions** • **Core text books**
Assessment Methods	• **Assignment** • **Attendance &participation** • **Examination** • **Tests** • **Project**

REFERENCES AND FURTHER READING

Complex plane and vector space (the math behind quantum states and waves).

SED 502 Science, Technology and Society (STS)

LEVEL 500 Level | **SEMESTER** First Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

SED 502is a core professional course for science education that examines the inter - relationship between Science, Technology and Society. The course traces the historical development of science and technology, analyses how science influences societal development and vice versa, and discusses issues of scientific literacy, ethics, environment, population, energy, and sustainable development. It equips future science teachers to teach science not just as facts, but as a social enterprise relevant to everyday life in Nigeria and the world.

RELEVANCE STATEMENT

Science, Technology and Society is a core teacher education course for national development. This course is relevant because it moves teachers from teaching science asit affects food health, transportation, communication and jobs – making science teachable and interesting. It also helps learners understand fake news vs science, climate change, GMOs, vaccines, 5G, AI, -- critical for scientific citizenship. Nigeria's development depends on scientific literacy and appropriate use of technology. STS explains why societies develop or remain underdeveloped. STS is a theme in NERDC Basic Science and Technology curriculum – JSS and SSS. Every science teacher must be competent to teach it. STS addresses SDG issues – climate, energy crisis, environmental pollution, ICT revolution, bioethics.

COURSE OBJECTIVES

At end of this course students should be able to;

1. Explain the nature of science, technology, and society and their interactions
2. Trace historical development of science and technology and their impact on society
3. Analyse contemporary STS issues in Nigeria; energy, environment, health, population, ICT.
4. Apply STS concepts to science curriculum and classroom teaching
5. Evaluate ethical, cultural, and environmental implications of scientific and technological development
6. Promote scientific literacy citizenship among learners

LEARNING OUTCOMES

By the end of SED 502, students should be able to;

1. Define Science, Technology, Society and describe models of sts interaction
2. Explain major scientific revolutions and how technology transformed societies
3. Analyse at least 5 contemporary STS issues in Nigeria – e.g. fuel subsidy removal and renewable energy, deforestation, fake drugs, internet fraud, AI
4. Design a lesson plan integrating STS issues into physic/ chemistry/ biology topic
5. Debate ethical issues; GMOs, cloning, nuclear energy, AI, social media
6. Assess impact of Science and Technology on culture, economy, and environment in Nigeria
7. Propose solutions for sustainable development using STS frame work

COURSE CONTENT

- Definition of Science, Technology, Society, Nature of Science – NOS.
- Models of STS relationship
- Linear, interactive
- STS as a discipline
- Scientific literacy
- History of science and technology
- From ancient Egypt, Africa to modern era
- Scientific revolutions
- Copernican, Darwinian, Industrial, ICT revolution, indigenous Science and Technology in Nigeria, indicators of development, Role of science and technology in development, technology transfer, appropriate technology, and innovation
- Nigeria’s science and technology policy
- Environment
- Pollution, climate change, deforestation, oil spillage in Niger Delta
- Energy
- Fossil fuel vs renewable
- Health
- Vaccines, Drug abuse, Traditional vs Orthodox medicine, Population and food security
- ICT and Society

- Internet, AL, Social media, Cybersecurity, Biotechnology
- GMOs, cloning, Gene Editing, Ethics of science, Superstition, pseudoscience vs science
- STS approach to science teaching
- STS curriculum – NERDC.
- How to teach STS issues
- **Discussion, debate, role:** play, field trips, assessment of STS attitudes and values

CATEGORY	DETAILS
Core Competencies	• **Pedagogical** • Competences • **Critical thinking** • Competence • **Citizenship** • Competence • Communication • Competence • **Values** • Competence • **Research**
Core Values	• **Scientific literacy** • **Environmental stewardship** • **Social Responsibility** • **Integrity& ethics** • **Open mindedness** • **Critical mindedness**
Pedagogical Approaches	• **Lecture -discussion** • **Issue – based learning** • **Debate &Role play** • **Case study** • **Field visit** • **Media analysis**

CATEGORY	DETAILS
Learning Resources	• Software • Visual aids • Newspaper& social media • On -line resources • Core text books • Community resources
Assessment Methods	• Assignment • Attendance &participation • Examination • Tests • Project

Degree 500 Level: Second Semester

PHY 521 Biophysics

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

This course is an interdisciplinary course that applies the principles and methods of physics to understand biological systems. The course bridges physics and biology by treating living organisms as physical system governed by laws of mechanics, thermodynamics, electricity and quantum mechanics. Key topics are molecular structure, membrane physics, Bioelectricity, Radiation biophysics, medical physics and Physical techniques in biology. Emphasis is placed on quantitative modelling of biological processes from the molecular to the organism level.

RELEVANCE STATEMENT

Biophysics is a core applied physics course that addresses the intersection of physics, Biology and medicine, this is relevant because it forms the foundation for medical physics, biomedical engineering, radiology, and physiotherapy. It explains how X-rays, MRI, ultrasound, and lasers work in diagnosis and treatment. Biophysics provide stools for studying DNA, proteins, cell membranes, and neural signals using physical methods. It

drives the design of prosthetics, pacemakers, biosensors, and drug delivery system. Relevant for solving problems in diseases diagnosis, radiation safety, and public health in Nigeria. Opens careers in hospital, research institutes, pharmaceuticals, and biomedical industries.

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. Explain biological structures and processes using physical laws and model.
2. Apply concepts of mechanics, thermodynamics and fluid dynamics to biological systems
3. Understand the electrical properties of cells, membranes, and nerves
4. Describe the interaction of radiation with biological matter
5. Use physical instrumentations and techniques in biological research and medicine
6. Analyse biomechanical problems in human movement and physiology.

LEARNING OUTCOMES

By the end of the course, students should be able to;

1. Apply Newton's laws and elasticity to muscles, bones, and blood flow
2. Explain membrane transport using diffusion, osmosis, and Nernst equation
3. Model action potentials and nerve conduction using circuit and cable
4. Calculate energy in biological systems using the thermodynamics and bioenergetics
5. Describe the physical basis of microscopy, spectroscopy, and imaging techniques
6. Assess the effects of ionising and non- ionising radiation on living tissue
7. Use basic biophysical instruments and interpret biomedical data

COURSE CONTENT

- Scope of biophysics, structure of biomedical
- Proteins, DNA, lipids, intermolecular forces, Hydrophobic effect, stress, strain, elasticity, of tissues, Blood flow
- Poiseuille's law, Respiratory mechanics, locomotion and human movement
- Structure of cell membranes, diffusion, osmosis, active transport, Electrochemistry, Nernst and Goldman equations, resting potential, action potential, Hodgkin – Huxley model

- ECG, EEG, bioelectric instrumentation, Energy in biological systems, ATP, metabolism, Entropy and order in living systems, irreversible thermodynamics, interaction of radiation with matter, Dosimetry, X-ray, MRI, ultrasound, Nuclear medicine, Radiation protection and safety

CATEGORY	DETAILS
Core Competencies	• Modelling • Instrumentation • Analytical • Interdisciplinary • Research • Safety
Core Values	• Precision and accuracy • Interdisciplinarity • Ethic &safety • Innovation • Human – centred focus • Evidence – based
Pedagogical Approaches	• Case -based • Lecture • Laboratory/hands on • Field/ clinical visit • Group project • Demonstrations
Learning Resources	• Core -text books • Reference books • Equipment • Multimedia • On line resources • Field trip

CATEGORY	DETAILS
Assessment Methods	• **Assignment** • **Attendance &participation** • **Examination** • **Tests** • **Project** • **Test**

REFERENCES AND FURTHER READING

1. Cotterill, R. Biophysics: An introduction, Wiley, 2002.
2. Nelson, P. Biological Physics; Energy information, life 2nd edition W.H Freeman, 2014.

PHY 501 Quantum Mechanics II

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

Brief description of the course; scope, level, and major areas covered. States what the course is about, why it's taught, and how it fits into the programme.

RELEVANCE STATEMENT

Why this course matters to;

1. The student will have knowledge and gained skills.
2. How will the department supports other courses
3. The profession will benefit from research from the industry and career application
4. Contribution to development and problem solving in the nation

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. State and explain key concepts and theories
2. Apply principles to solve problems
3. Analyse and evaluate real – world situations
4. Use tools, instruments, or software relevant to the course

5. Communicate ideas clearly in written and oral form

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Apply the mathematical tools of quantum mechanics
2. Understand approximation methods in quantum mechanics;
3. Explain the scattering theory;
4. Find the unitary transformations linked to symmetry operations;
5. Apply time-dependent perturbation theory to variety of problems;
6. Derive a mathematical description of quantum motion in electromagnetic fields;
7. Apply the relativistic wave equations to simple single-particle problems;
8. Use Dirac notation to represent quantum-mechanical states and manipulate operators in terms of their matrix elements.

COURSE CONTENT

- Time-independent and time-dependent perturbation theory
- Scattering theory
- Elastic potential scattering
- Green’s function and partial wave methods
- Symmetries in quantum mechanics
- Rotations, space-time reflections and parity
- Selection rules for atomic transitions
- Emission and absorption of radiation
- Selection rules for hydrogen
- Description and interpretation of selected phenomena from each of atomic physics, molecular physics, solid state physics, and nuclear physics using quantum mechanical models
- Relativistic wave equation
- The Klein-Gordon equation
- The Dirac equation
- Chirality
- Lorentz invariance and non-relativistic limit

CATEGORY	DETAILS
Core Competencies	• Technical • Practical • Analytical • Interdisciplinary • Communication • Safety
Core Values	• Precision and accuracy • Interdisciplinarity • Ethic &safety • Innovation • Human – centred focus • Evidence – based
Pedagogical Approaches	• Case -based • Lecture • Laboratory/hands on • Field/ clinical visit • Tutorials • ICT /Simulation
Learning Resources	• Core -text books • Reference books • Equipment • Multimedia • On line resources • Field trip
Assessment Methods	• Assignment • Attendance &participation • Examination • Tests • Project • Test

PHY 504 Mathematical Methods in Physics I

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 504 is an advanced mathematical physics course designed to equip students with specialised techniques for solving problems in the theoretical and applied physics. The course extends PHY 503 by focusing on advanced topics; partial differential equations, Green's Functions, integral equations, tensor analysis, Group theory, and variational principles. Emphasis is on applying these methods directly to problems in Quantum Mechanics, Electromagnetism, Fluid Dynamics and statistical physics.

RELEVANCE STATEMENT

Mathematical Methods in physics is a core requirement for theoretical and research – oriented physics students.it provides the mathematical tools for Quantum Mechanics, Biophysics, plasma physics and post graduate research. The course enables students to solve complex physics problems involving fields, waves, and many -body systems that cannot be handled by elementary methods.it is essential for theoretical research, computational physics, and mathematical modelling in engineering and industry. methods are used in signal processing, optics, control system, and data science.it is a pre-requisite for M.SC./PhD work in theoretical paticle and condensed matter physics.

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. Solve linear and nonlinear partial differential equation using separation of variable and transform methods
2. Construct and apply Green's functions to inhomogeneous boundary value problems
3. Use tensor analysis to formulate analysis physical laws in different coordinate systems
4. Apply group theory to classify states and selection rules in physics
5. Use calculus of variations and Lagrangian/ Hamiltonian methods in mechanics and field theory
6. Solve integral equations and apply them to scattering and potential problems

LEARNING OUTCOMES

At the end of the course, students should be able to:

1. Describe the properties of different types of functions and be able to sketch them in both 2D Cartesian and polar coordinates;
2. Integrate and differentiate functions of one variable using a range of techniques and be able to apply integration and differentiation to a range of physical problems;
3. Show how smooth functions can be expressed in terms of power series;
4. Explain the properties of complex numbers and construct some basic complex functions; employ matrix notation, carry out matrix algebra and use matrices to solve systems of linear equations;
5. Compute the properties of determinants, be able to evaluate them, and
6. Use them to test for unique solutions of linear equations; solve first and second order ordinary differential equations using a range of techniques.

New Course Contents

Partial differential equations. Solution of boundary value problems of partial differential equations by various methods which include separation of variables, the method of integral transforms. Sturm-Liouville theory; uniqueness of solutions. Calculus of residues and applications to evaluation of integrals and summation of series. Applications to various physical situations, which may include, electromagnetic theory, quantum theory, diffusion phenomena; complex variable theory and their relation to selected physical problems. Complex differentiation and integration. Cauchy's theorem. Taylor's and Laurent's series. Ordinary differential equations of first and second order and their physical applications. Homogeneous partial differential equations.

CATEGORY	DETAILS
Core Competencies	• **Technical** • **Abstract** • **Analytical** • **Computational** • **Research** • **Problem- solving**

CATEGORY	DETAILS
Core Values	• Rigour &logical thinking • Elegance • Integrity • Innovation • Excellence • Persistence
Pedagogical Approaches	• Seminar presentation • Lecture • Laboratory/hands on • Visualisation • Tutorials • ICT /Simulation
Learning Resources	• Core -text books • Reference books • Equipment • Multimedia • On line resources • Field trip
Assessment Methods	• Assignment • Attendance &participation • Examination • Tests • Project • Test

Reference1.Arfken, G.B., Weber. J., & Harris, F.E., Mathematical Methods for Physicist, 7th ed. Academic Press, 2013.2. Hasani, S. Mathematical Physics: A Modern Introduction, Springer, 2013.

PHY 505 Physics Entrepreneurship

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 505 is a professional and innovation – oriented course that bridges physics knowledge with Entrepreneurship and Business development. It trains physics students to identify, develop, and commercialise physics – based ideas into viable products and services. It covers fundamentals of physics – based businesses, innovation and product design, Business plan for physics ventures, intellectual property, start -up funding, and Marketing of Physics products. Renewable Energy solutions, electronic device fabrication, instrumentation, software/Apps for physics, scientific consultancy, and solar inverter installation services.

RELEVANCE STATEMENT

Physics Entrepreneurship is a critical employability and self – reliance course. This course is relevant because, it moves physics graduates from waiting for scarce jobs to creating physics – based businesses and jobs for others. Teaches how to monetise physics knowledge e.g. Solar installation, electronics repair, coding, data analysis, instrumentation. Nigeria needs tech – preneurs in renewable energy, telecoms, and fabrication – all physics driven fields. Entrepreneurship is now a compulsory requirement for all Nigerian graduates to promote self – reliance. Physicists worldwide are founders of tech companies e.g. Elon Musk, physics background in SpaceX/ Tesla.

COURSE OBJECTIVES

At the end of this course, students should be able to:

1. Identify business opportunities in physics and applied physics
2. Transform a physics concept into a product or service idea
3. Develop a business plan for a physics – based enterprise
4. Understand intellectual property rights, patents and commercialisation
5. Apply basic financial, marketing, and management skills to a physics venture
6. Demonstrate creativity, innovation, and risk management in tech entrepreneurship

LEARNING OUTCOMES

On completion, the student should be able to;

1. Develop creative ability to apply physics knowledge to real-world settings;
2. Generate ideas of innovation and entrepreneurship; and
3. Apply entrepreneurial skills and mindset in approaching societal problems.

COURSE CONTENT

- Creativity: Developing questioning attitude, concept development, reconstructionism, critical thinking and brainstorming, use of practical and creative techniques in concept development
- Identifying underlining physics principles in real life situations and physics principles driving equipment
- Product development and requirements: Team building, product and service design concepts, consumer driven design, business planning, marketing and market research
- Intellectual property, pricing and financial strategies, finding sources of funding

CATEGORY	DETAILS
Core Competencies	• **Technical** • **Financial** • **Innovation** • **Business plan** • **Marketing & sales** • **Pitching & communication**
Core Values	• **Creativity &innovation** • **Problem solving** • **Integrity** • **Self – reliance** • **Excellence** • **Resilience**
Pedagogical Approaches	• **Experiential learning** • **Lecture & discussion** • **Case study method** • **Visualisation** • **Business simulation** • **Guest lecture**

CATEGORY	DETAILS
Learning Resources	• Core -text books • Technical tools • Equipment • Business tools • On line resources &media • Software
Assessment Methods	• Business idea & pitch • Group business plan &prototype • Examination • Business plan defence • Project • Test

REFERENCES AND FURTHER READING

1. **Drucker, P., Innovation and Entrepreneurship, Harper, 2006**
2. **Ozigbo, N.C. Entrepreurship for physicists and Scientists, 2018**

PHY 525 Nuclear and Particle Physics

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 525is a core advanced physics course that studies the structure, properties, and interactions of atomic nuclei and fundamental particles. The course covers; properties of nuclei, nuclear models, Radioactivity, nuclear reactions, Fission and Fusion, particle accelerators and detectors, Classification of elementary particles. The standard model, conservation laws, Quarks and leptons, and fundamental interactions. It connects the microscopic world of nucleus to energy Production, medical applications and the origin of the universe.

RELEVANCE STATEMENT

Nuclear and particle physics is a strategic core course for national development and global science. The course is relevant because foundation for nuclear power generation, Nigeria's

future energy mix, and radiation energy research. Critical for understanding fission and fusion reactors. The course explain radiotherapy, nuclear medicine, PET scans, industrial gauging, and radiation Sterilisation. Relevant for radiation protection, nuclear safety regulation – NNRA and non – proliferation. Studies the smallest building blocks of matter – quarks, leptons, bosons – and the big bang. Essential for M.Sc. / PhD in High – energy physics. Basis for work in accelerators, detectors, material analysis, and nuclear research centres – CERT Zaria, etc.

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. Describe nuclear properties like size, mass, binding energy, spin, parity and magnetic moment
2. Explain radioactive decay laws, decay series, and the physics of alpha, beta, and gamma decay
3. Compare and contrast nuclear models – liquid drop, shell, collective models
4. Analyse nuclear reactions, Q- value, cross – section and reaction mechanisms
5. Describe fission and fusion processes and their energy applications
6. Classify elementary particles, conservation laws and the standard Model.
7. Understand the principle of accelerators and detectors.

LEARNING OUTCOMES

By the end of PHY 525, students should be able to;

1. Calculate nuclear binding energy, Q- value, and decay constants using semi – empirical mass formula.
2. Apply conservation laws to determine allowed nuclear reactions and particle decays.
3. Distinguish between different nuclear models and explain nuclear magic numbers
4. Analyse fission and fusion energy yield and conditions for chain reactions
5. Classify particles into hadrons, lepton, quarks and explain their quantum numbers
6. Interpret decay schemes, Feynman diagrams, and particles interaction data
7. Evaluate radiation hazards and apply radiation safety measures in line with NNRA standards

COURSE CONTENT

- **Nuclei size, mass, charge, binding energy, semi:** empirical mass formula, spin, parity, magnetic dipole, electric quadrupole moments

- Decay law, half- life, alpha, beta, Gamma decay theories
- Selection rules, Natural decay series Applications
- **Liquid drop model, shell model, collective model, nuclear reactions:** types, Q-valuE, cross -section, compound nucleus, direct reactions
- **Spontaneous and induced fission, chain reactions, reactors:** criticality
- Fusion like
- D-D, D-T, reactions, Lawson criterion, Stellar energy production
- Van de Graff, cyclotron, synchrotron, Detectors
- GM counter, scintillation, Semiconductor, bubble chamber, principles of detection
- Classification
- Leptons, hadrons, mesons, baryons, fundamental interactions
- Strong, weak, EM, Gravitational
- Conservation laws baryon, lepton, strangeness, quark model, Eightfold way, Standard model, Feynman diagrams

CATEGORY	DETAILS
Core Competencies	• Analytical • Modelling • Classification • Safety • Research • Energy
Core Values	• **Precision & Accuracy** • **Safety** • **Scientific** • **Integrity** • **Innovation** • **Global Awareness**

CATEGORY	DETAILS
Pedagogical Approaches	• Lecture • Problem – based • Visualisation • Demonstration • Seminar / presentation • Field/virtual tour
Learning Resources	• Equipment • Software • On- line resources • Reference books • Core text books • Real objects
Assessment Methods	• Tests • Assignment • Attendance & participation

REFERENCES AND FURTHER READING

1. **Krane, K. S. Introductory Nuclear Physics 3rd Ed. 1988**
2. **Perkins, D.H. Introduction to High Energy Physics, 4th Ed. Cambridge 2000**

PHY 526 Semiconductor Devices

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 3 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 45 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 526 is a core applied physics course that studies the physics and operation of semiconductor devices that drive modern electronics. The course covers; review of semiconductor physics – band structure, intrinsic/extrinsic semiconductors, Fermi level. Carrier transport – drift, diffusion, generation -recombination, p-n junction theory, metal – semiconductor junctions, BJT, FET, MOSFET, CMOS, optoelectronic devices -LED, Photodiode, Solar cell, Laser diode, and Power and specials devices – Thyristor, TRIAC,

UJT. Emphasis is on device physics, I -V characteristics, fabrications concepts, and renewable energy sector.

RELEVANCE STATEMENT

This course semiconductor Devices is a strategic core course for technology and industrialisation. The course is relevant because; all phones, computer, inverters, solar systems, TVs, and medical equipment are built on semiconductor devices. Nigeria imports billions in electronics and solar products. Understanding device physics enables local assembly, repair, fabrication and innovation. Solar cells, charge controllers, and inverters are semiconductor devices – critical for solving Nigeria's power crisis. Graduates can work in telecoms- MTN, Airtel, NCC, electronics design, solar companies, NIGCOMSAT, and semiconductor repair/ maintenance. This course is a Pre requisite for MSc in electronics, condensed matter physics, Nanotechnology, and materials science

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. Explain energy bands, doping, and carrier transport in semiconductors
2. Analyse p-n junction formation, band bending, and I – V characteristics.
3. Describe the operation and modelling of BJT, JFET, MOSFET devices
4. Understand optoelectronic and power semiconductor devices.
5. Relate device physics to fabrication processes – diffusion, ion implantation, oxidation
6. Apply semiconductor devices to power, switching, and solar energy applications

LEARNING OUTCOMES

By the end of PHY 526, students should be able to;

1. Calculate carrier concentration, Fermi level, drift and diffusion currents
2. Sketch and interpret energy band diagrams for p- n junction, metal – semiconductor, and MOS structures
3. Derive and plot I – V and C -V characteristics of diodes and transistors
4. Distinguish between BJT, JFET, MOSFET operation modes and biasing
5. Explain working principle of LED photodiode, solar cell, and laser dioxide
6. Design simple circuits using diodes and transistors – rectifier, amplifier switch
7. Evaluate efficiency, losses and thermal effects in power devices and solar cells

COURSE CONTENT

- **Energy bands, intrinsic and extrinsic semiconductors, effective mass, Fermi:**
  - Dirac statistics
  - Fermi level
  - Carrier concentration
  - Hall effect
  - Drift current
  - Mobility
  - Conductivity
  - Diffusion current
  - Einstein relation
  - Generation – recombination
  - Continuity equation
  - Minority carrier lifetime
- P -n junction at equilibrium and bias, depletion region, band diagram, I -V characteristics, breakdown
- Schottky barrier, ohmic contact, C -V characteristics
- BJT
- **Structure, operation, Ebers:** Moll Model, characteristics, JFET, MESFET, MOSFET
- Structure, threshold voltage, MOS Capacitor, C-V, MOSFET I -V, CMOS concept, Scaling
- Light interaction with semiconductors, LED, Photodiode, PIN, Avalanche, Solar cell – operation, efficiency, equivalent circuit, Laser Diode principle
- Power diode, SCR, TRIAC, DIAC, UJT.
- Basic fabrication steps
- Oxidation, lithography, diffusion, ion implantation, introduction to nanodevices

CATEGORY	DETAILS
Core Competencies	• Device analysis • Circuit • Diagnostic • Energy • Fabrication Awareness • Research
Core Values	• **Precision & Accuracy** • **Innovation** • **Safety** • **Integrity** • **Problem solving** • **Sustainability**
Pedagogical Approaches	• **Lecture** • **Problem – based** • **Laboratory/ practical** • **Simulation** • **Demonstration** • **Case ctudy**
Learning Resources	• **Equipment** • **Software** • **On- line resources** • **Equipment** • **Software** • **Real objects**
Assessment Methods	• **Tests** • **Assignment** • **Attendance & participation** • **LAb reports & simulation**

REFERENCES AND FURTHER READING

1. Streetman, B.G.& Banerjee, S.K. Solid state Electronic Devices, 7th Ed. Pearson, 2015
2. Sze, S.M.& Ng, K.K. Physics of Semiconductor Devices, 3rd ed. Wiley, 2007.

PHY 527 Physics of Solar SYSTEMS

LEVEL 500 Level | **SEMESTER** Second Semester | **CREDIT UNITS** 2 | **STATUS** Compulsory (core course) | **LECTURE HOURS** 30 | **PRACTICAL HOURS** *not stated*

COURSE OVERVIEW

PHY 527 is a specialised and astrophysics course that studies the origin, structure, dynamics and physics of the solar system and other planetary systems. The course covers; Formation theories of solar systems- Nebular hypothesis, physical properties of the Sun, orbital mechanics and Kepler's laws, Planetary interiors and atmosphere, Moons, asteroids, comets and Kuiper Belt, Magnetospheres, Exoplanetary system and detection methods, and habitability. It combines classical mechanics, thermodynamics, and electro-magnetism to understand planets as physics laboratories.

RELEVANCE STATEMENT

Physics of solar systems is a strategic space science course. This course is relevant because; Nigeria has space agency – NASRDA, and satellites – NigComsat, Nigeria Sat. Understanding solar systems is foundation for space science career. Studying planetary atmosphere helps understand Earth's climate change, greenhouse effect, weather – by comparing with Venus, Mars. This course investigates conditions for habitability, where life can exist- connecting physics to biology and philosophy. The basis for satellite orbits, planetary missions, asteroid mining – future economy. Over 5000 exoplanets discovered. This is fastest growing field in physics with Nobel prizes in 2019. The curriculum and inspiration makes physics exciting – planets, moons, aliens – and inspires secondary school teaching.

COURSE OBJECTIVES

At the end of this course, students should be able to;

1. Explain theories of solar system formation and evolution
2. Apply Kepler's laws and Newtonian mechanics to planetary orbits
3. Describe physical properties, interiors, and atmosphere of planets orbits

4. Understand physics of Sun; structure, energy generation, solar wind
5. Classify small solar system bodies; asteroids, comets, meteorites
6. Explain detection methods and properties of exoplanetary systems.
7. Evaluate conditions for habitability and habitable zones.

LEARNING OUTCOMES

By the end of PHY 527, students should be able to;

1. Calculate orbital period, escape velocity, surface gravity, and equilibrium temperature of planets
2. Sktech and explain structure of sun and planetary interiors using physics principles
3. Apply Kepler's and Newton's law to solve orbital transfer and eclipse problems
4. Distinguish between types of small bodies and their orbits- Asteroid belt, Kuiper belt, Oort cloud
5. Compare atmosphere of Earth, Venus, Mars and explain greenhouse effects
6. Interpret exoplanet detection data; radial velocity, transit light curves
7. Assess habitability of a planet based on mass, distance from star, and atmosphere

COURSE CONTENT

- Nebular hypothesis, condensation sequence, age dating
- Overview of solar system
- Planets, dwarf planets, small bodies
- Layout and scale
- Solar structure
- Core, radiative, convective zones
- Solar energy – pp -chain
- Solar atmosphere
- Photosphere, chromosphere
- Corona
- Solar wind, sunspots, solar cycle space weather effects on Earth
- Kepler's law, Newton law of gravitation
- Orbital elements
- Escape velocity, synchronous orbits
- Tides, Roche limit,

- Lagrange points, eclipse
- Terrestrial vs Jovian planets
- Interiors
- Differentiation, plate tectonics
- Atmosphere origin, structure, greenhouse effect
- Moons
- Formation, Galilean moons, Titans, Enceladus, Asteroids, Comets, Meteorites, Kuiper belt objects
- Methods of exoplanet detection
- Radial velocity, transit, microlensing
- Hot Jupiter, Super – earth
- Habitable zone, conditions for life, Drake equation
- Current missions Kepler, TESS, JWST

CATEGORY	DETAILS
Core Competencies	• Orbital competence • Planetary physics competence • Data interpretation • Comparative competence • Space awareness competence • Science communication
Core Values	• **Curiosity& wonder** • **System thinking** • **Precision** • **Sustainability** • **Imagination** • **Scientific Integrity**
Pedagogical Approaches	• **Lecture with visuals** • **Mathematical derivation** • **Laboratory/ practical** • **Simulation & modelling** • **Data analysis lab** • **Project- based learning**

CATEGORY	DETAILS
Learning Resources	• Equipment • Software • On- line resources • Equipment • Software • Real objects
Assessment Methods	• Tests • Assignment • Attendance & participation • Lab. reports & simulation

PART II

Curriculum Implementation Framework

Institutional structure, Teacher Educator Standards, mentoring, course credit system and assessment, quality assurance, Teaching Practice, official instruments and the Graduate Employability Tracking Framework

Introduction

The National Commission for Colleges of Education (NCCE) is guided in all its activities by its vision to produce "well-motivated teachers with high personal and professional discipline, integrity and competence."

The National Policy on Dual Mandate in Colleges of Education and Implementation Guidelines establishes the framework for Colleges of Education in Nigeria to concurrently offer Nigeria Certificate in Education (NCE), Diplomas, Professional Certificates, Post-Graduate Diploma in Education, and Degree programmes, including seamless progression from NCE to degree programmes without mandatory university affiliation. Anchored on the Federal Colleges of Education Act No. 43 of 2023, the policy seeks to expand access to quality tertiary education, improve teacher quality and professionalism, optimise existing human and physical resources, reduce duplication between NCE and degree curricula, and strengthen the relevance and competitiveness of Colleges of Education. It assigns complementary regulatory responsibilities to the NCCE and National Universities Commission (NUC), requires Colleges to meet prescribed staffing, infrastructure, financial and curriculum standards before commencing degree programmes, and provides for phased, readiness-based accreditation, continuous professional development, ICT and AI integration, inclusive education, sustainable funding, monitoring through National Education Management Information System (NEMIS) and Teacher Management Information System (TMIS), risk management, and a 2026–2028 implementation work plan to guide nationwide implementation while preserving the core mandate of Colleges of Education to produce qualified teachers for Nigeria's basic education system.

In line with this vision and in pursuance of its mandate to maintain standards for Teacher Education at the sub-degree level, the NCCE has revised the existing NCE Teacher Education Programmes. In the revision, NCCE is guided by the need to provide effective teachers for all areas represented in Basic Education. Consequently, the following set of Teacher Education Programmes is for:

1. Basic,
2. Post-basic,
3. Tertiary, and
4. Skill certification.

In view of the fundamental transformation in Teacher Education introduced by the Dual Mandate, the NCCE, in collaboration with the NUC, reviewed the Implementation

Framework to guide Colleges of Education in effectively mounting and delivering NCE-Degree programmes, while ensuring harmonised curricula, prescribed standards, accreditation requirements, and quality assurance. The necessity of the reviewed Implementation Framework is predicated on:

i. The 'gap' between prescribed curriculum content and good curriculum practice. This is so because when the curriculum content is without an implementation guide, different lecturers and different NCE-Degree-awarding institutions may adopt different approaches, and this might be detrimental to the intended purpose and best practice in Teacher Education. Such a situation might crystallise into undesired outcomes.

ii. The need to prescribe standards and practical guidelines on what is expected to be done by administrators, teachers and students in the process of implementing the curriculum. It is believed that this will ensure that there is uniformity in practice across all the NCE-Degree-awarding institutions.

iii. The need for the National Commission for Colleges of Education to ensure that NCE-Degree-awarding institutions implement Standards for curriculum practice in the same way. It is expected that institutions adhere strictly to this Implementation Framework so that best practice in Teacher Education can be realised.

iv. The guidelines in the Framework can serve as standards for NCE-Degree-awarding Institutions to produce specific and measurable curriculum outputs. The attainment of these standards will form part of the normal Quality Assurance System the NCCE applies. First, NCE-Degree-awarding Institutions can use the Framework to evaluate themselves by assessing all the inputs, processes and outputs involved in their implementation of the curriculum. Second, the NCCE will also use this Framework to determine how well an NCE-Degree-awarding Institution is performing.

v. The Dual Mandate Teacher Education Programmes incorporate 'Teacher Standards'. These Standards have been developed through several Federal and State processes and represent a clear description of the knowledge, skills and attitudes a professional teacher should exemplify. As the Teacher Standards are an approved part of all Teacher Education programmes, it is necessary for NCE-Degree-awarding Institutions to comply with these new Standards and the assessment of student teachers should be guided by the Standards. Henceforth, assessment will not only look at the student teacher's mastery of the curriculum content but also look at whether he or she has imbibed the right knowledge, skills and attitudes that will make him or her the type of teacher the nation requires.

vi. The Implementation Framework is focused on institutional structure, Resource Development and Admission Procedure and Guidelines for Establishing New Academic Programmes and Institutions, Skill-gap Management and Institutional Linkages, Standards for Teacher Education and Professionalism, Course Credit System and Students' Assessment, Learning Opportunities and Mentoring, Quality Assurance and Teaching Practice.

Institutional Structure, Resource Development and Admission

Teaching is a dynamic profession that requires continuous review to address contemporary issues and challenges. The public is of the view that there is a mismatch between the quality of education offered at the basic level and its role in the country. The reason for the mismatch may be accounted for in part by the fact that the existing NCE programmes are not tailored towards the production of teachers for the Basic Education levels and programmes such as Early Childhood Care Development and Education (ECCDE), Primary Education Studies, Adult & Non-Formal and Special Needs & Inclusive Education.

1. To produce effective career-focused teachers for these levels of education (Basic, Post-basic, Tertiary, and Skill certification), the NCCE has restructured its existing programmes to pay attention to producing teachers for Early Childhood Care Development and Education (ECCDE), Primary Education Studies, Adult & Non-Formal and Special Needs & Inclusive Education.

The new Teacher Education programmes in the 2026 Edition of the Dual Mandate (NCE-Degree-Awarding) Minimum Academic Standards will require a merger (where necessary) and unbundling of Schools and Departments that will accommodate the identified specialised teaching areas and programmes.

A new institutional structure of Schools and Departments has been designed for the NCE-Degree-awarding Institutions. The purpose of the restructuring is to enable the institutions to implement the new programmes. This would also promote the production of professional teachers for each of the different levels of Education.

The NCE-Degree-awarding institutions shall have one or more of the following Schools and Departments. Each NCE-Degree-awarding institution is expected to identify and establish the Schools in line with the Dual Mandate requirements.

The established structure in Colleges of Education and other NCE-Degree-awarding institutions shall be:

1) School of Arts and Languages Education
2) School of Business Management Education
3) School of Foundation and Lifelong Education
4) School of Computing Education

5) School of General Education and General Studies Education
6) School of Science Education
7) School of Social Sciences
8) School of Special Needs and Inclusive Education
9) School of Technology Education
10) School of Vocational Education

Note: *Additional schools and programmes, apart from those above, shall be approved by the NCCE in line with the Dual Mandate requirements as the need arises.*

Schools and Departments in Conventional Colleges of Education

1. School of Arts and Languages Education

a. Arabic Studies
b. English and Literary Studies
c. French
d. Hausa
e. Igbo
f. Yoruba
g. History and International Studies
h. Music
i. Theatre and Creative Arts
j. Other Nigerian Languages

2. School of Business Management Education

a. Accounting Education
b. Business Administration
c. Entrepreneurship Studies
d. Marketing
e. Office Technology and Management

3. School of Foundation and Lifelong Education

a. Adult and Non-Formal Education
b. Early Childhood Care Development and Education
c. Primary Education

4. School of Computing Education

a. Computer Science
b. Artificial Intelligence and Robotics
c. Data Science and Analytics
d. Networking and Cybersecurity
e. Software and Web Development

5. School of Education and General Studies Education

a. Curriculum and Instruction
b. Educational Foundations
c. Educational Psychology and Counselling
d. Educational Technology
e. Centre of Educational Technology (CET)
f. Teaching Practice Unit

6. School of Science Education

a. Integrated Science
b. Biology
c. Chemistry
d. Environmental Studies
e. Health Education Studies
f. Human Kinetics
g. Mathematics
h. Physics

7. School of Social Sciences Education

a. Christian Religious Studies
b. Economics and Public Finance

c. Geography and Environmental Sustainability
d. Islamic Studies
e. Library and Information Science
f. Political Science and Diplomacy
g. Social Studies and Civic Education

8. School of Special Needs and Inclusive Education

a. Education for Gifted and Talented Learners
b. Education for Learners with Communication and Behaviour Disorders
c. Education for Learners with Hearing Impairment
d. Education for Learners with Intellectual Disabilities
e. Education for Learners with Learning Disabilities
f. Education for Learners with Physical and Health Impairment
g. Education for Learners with Visual Impairment
h. Rehabilitation Education
i. Special Needs Education

9. School of Technology Education

a. Automobile Technology
b. Building Technology
c. Electrical and Electronic Technology
d. Mechanical Technology
e. Wood Technology

10. School of Vocational Education

a. Agribusiness
b. Animal Production
c. Crop Production
d. Fine and Applied Arts (Graphics, Ceramics, Sculpture and Painting & Artistry)
e. Clothing and Textile
f. Food and Nutrition
g. Home Management

h. Family and Child Development

i. Hospitality Management

Note

i. All the programmes are double-major programmes, except Adult Education and Special Needs Education, which are single-major programmes because they are combined with a teaching subject.

ii. Adult Education Courses are to be combined with teaching subjects. To achieve this, students are to take 20 units for NCE and 27 units for Degree from the core courses.

iii. Staff who are to teach courses in the Department of GSE should be domiciled in their various departments of speciality and shall only be required to handle courses as lecturers in GSE.

iv. Each School is to be headed by a Dean and deputised by a Deputy/Sub Dean

v. Each department is to be headed by a Head of the Department

vi. Colleges using **Arabic** as the language of instruction **(Arabic Medium)** for Islamic Studies are to use the Arabic version of the relevant curriculum.

vii. Proprietors are at liberty to choose their programmes of interest. Details of academic offerings and other programmes are available at the National Commission for Colleges of Education.

Approved General Studies Courses

a) General English I

b) Introduction to Library Studies

c) Family Life, Human Trafficking & Emerging Issues

d) English Proficiency for Teachers

e) Digital Literacy & AI for Educators

f) Media and Information Literacy I

g) General English II

h) Introduction to Foundational Literacy

i) Media and Information Literacy II

j) Introduction to Foundational Numeracy

k) Entrepreneurship and Green Skills

l) Global Citizenship Education and Political Economy

m) Peace and Conflict Resolution

n) Venture Creation

Directorates

NCE-Degree-awarding institutions should have the following **Academic** Directorates, among others:

a) Directorate of Teaching Professionalism and Mentoring

b) Directorate of Career Services Centre

c) Directorate of Academic Planning

d) Directorate of Quality Assurance.

e) Directorate of Consultancy Services

f) Directorate of Education Support Services

g) Directorate of Information and Communication Technology (ICT)

h) Directorate of Skills Development and Linkages

i) Directorate of Continuing Education

j) Directorate of Research and Innovations

k) Directorate of Grants, Partnerships and Resource Mobilisation

***Note**:*

1. Colleges using Arabic as a Medium of Instruction shall use Arabic as a language of curriculum and instructional delivery only in that programme.
2. All Directorates shall be headed by a Director who shall be a Chief Lecturer/ Professor.
3. The Director shall be appointed by the Provost.
4. There shall be Deputy Director (s) for each Directorate.
5. Deputy Director (s) shall **not** be below the rank of a Senior Lecturer

Colleges of Education (Technical)

1. School of Education

Departments as in a conventional College

2. Directorates

As in a conventional College

3. School of Vocational Education

As in a conventional College

4. School of Business Management

As in a conventional College

5. School of Technology Education

As in a conventional College

6. School of Science Education

As in a conventional College

7. School of Childhood, Primary and Adult Education

As in a conventional College

8. School of Special Needs and Inclusive Education

As in a conventional College

Colleges of Education (Special)

1. School of Arts and Language

Departments and subject combinations as in a Conventional College

2. School of Education

Departments as in Conventional Colleges of Education

3. Directorates

As in a Conventional College

4. School of Language Education

Departments and subject combinations as in Conventional Colleges of Education

5. School of Science Education

Departments and subject combinations as in Conventional Colleges

6. School of Technical and Vocational Education

Departments and subject combinations as in Conventional Colleges of Education

7. School of Special Needs Education

Departments of:

i. Education for Gifted and Talented Learners
ii. Education for Learners with Communication and Behaviour Disorders
iii. Education for Learners with Hearing Impairment
iv. Education for Learners with Intellectual Disabilities
v. Education for Learners with Learning Disabilities
vi. Education for Learners with Physical and Health Impairment
vii. Education for Learners with Visual Impairment
viii. Rehabilitation Education

8. School of Childhood, Primary and Adult Education

a. Adult and Non-Formal Education
b. Early Childhood Care Development and Education
c. Primary Education

Approved Subject Combinations for School of Special Education

Special Needs and Adult Education Courses are to be combined with teaching subjects. To achieve this, students are to take 20 units for NCE and 27 units for Degree from the core courses/subjects as in conventional Colleges.

Structure and Functions of the Directorates

1. Directorate for Continuing Education

Structure

i. Director
ii. Deputy Director (s)
iii. Administrative and Clerical Officers

Functions

Director

i. Shall be responsible to the Provost
ii. Shall be the head of the Directorate
iii. Shall supervise all staff of the Directorate
iv. Shall be a member of the Academic Board

Deputy Directors

The Deputy Directors shall assist the Director in his/her responsibilities

Examination Officers in Directorate of Continuing Education

There shall be an Examination Officer for each course being run under the Continuing Education Directorate.

2. Directorate of Information and Communication Technology (ICT)

i. Director
ii. Deputy Director
iii. Head of units as may be required

Functions

(a) Director

i. Shall be responsible to the Provost
ii. Shall be the head of the Directorate
iii. Shall supervise all staff of the Directorate

iv. Shall oversee all ICT-related activities

v. Shall be a member of the Academic Board and Admission Committee

(b) Deputy Director

Shall assist the Director in his/her responsibilities

3. Directorate of Entrepreneurship, Skills Development and Linkages

i. Director

ii. Deputy Director

iii. Units as may be required

(a) Director

i. Shall be responsible to the Provost

ii. Shall be the administrative head of the Directorate

iii. Shall establish skill gap needs for programmes offered by the college

iv. Shall perform any ancillary function related to the mandate of the directorate.

v. Shall be a member of the Academic Board

(b) Deputy Director

Shall assist the Director in discharging the functions of the office

4. Directorate of Quality Assurance

i. Director

ii. Deputy Director

iii. A Committee which shall comprise the Director, Deputy Director and Representatives of the Registry, Bursary, Works and Services, Student Affairs, Student Union, Staff Unions, Schools.

Functions

i. Shall maintain an internal quality self-assessment process for submission to management and NCCE.

ii. Shall monitor the process of NCCE/NUC accreditation exercise

iii. Shall ensure quality and excellence in all activities of the college

iv. Shall develop, apply and review quality benchmarks/parameters for various academic programmes and administrative activities of the College

v. Shall facilitate the creation of a learner-centred environment, conducive to quality education and academic staff professional growth

vi. Shall provide a feedback mechanism for students, parents and other stakeholders on quality-related issues.

vii. Shall disseminate information on various quality parameters of teacher education

viii. Shall organise inter- and intra-institutional workshops and seminars on quality-related issues

ix. Shall document all activities/programmes that lead to quality improvements

x. Shall serve on the Academic Board, monitor teaching practice/SIWES, monitor MIS directorate, monitor examination, monitor result collation, Continuous Assessments and coordinate work ethics.

5. Directorate of SIWES

i. Director

ii. Representatives of participating schools

iii. Administrative Staff

a) Director

i. Shall be responsible to the Provost

ii. Shall oversee monitoring of SIWES selection processes, postings, monitoring of students on SIWES, supervisors, and final reports/results of SIWES

6. Coordinator of Acculturation

i. Shall be appointed by the Provost

ii. Shall mobilise students for acculturation

iii. Shall organise all acculturation activities

7. Directorate of Academic Planning

i. Director

ii. Deputy Director

a) Director

i. Shall be responsible to the Provost
ii. Shall be the Administrative Head of the Directorate
iii. Shall guide the development of academic programmes of the college
iv. Shall coordinate the NCCE/NUC accreditation exercise
v. Shall superintend the conception of the school calendar and secure relevant approvals before making it public
vi. Shall advise on needed infrastructural development that can support academic programmes of the college
vii. Perform any other academic assignment given by the Provost as might be determined from time to time

b) Deputy Director

Shall assist the Director in all his responsibilities.

8. Directorate of Consultancy Services

i. Director
ii. Deputy Director
iii. Head of Revenue
iv. Head of Administration
v. Head of Marketing
vi. Head of Production
vii. Head of Training

a) Director

i. Shall be responsible to the Provost
ii. Shall be the Administrative head of the Directorate
iii. Shall figure out areas of comparative advantage that the College can provide consultancy services in
iv. Shall conduct feasibility studies for purposes of rendering services
v. Shall perform any other function ancillary to his duties as might be determined from time to time

b) Deputy Director

Shall assist the Director in all his responsibilities

c) Head of Revenue

i. Shall oversee IGR of the Directorate
ii. Shall be responsible for accounting records of the Directorate
iii. Shall advise the Director on financial matters

d) Head of Administration

i. Shall be responsible for advising the Director on administrative matters
ii. Shall be responsible for all administrative activities of the Directorate

e) Head of Marketing

i. Shall be responsible for marketing the products of the Directorate
ii. Shall liaise with potential IGR sources

f) Head of Production

Shall be responsible for the production work of the Consultancy Services

g) Head of Training

Shall be responsible for trainings, consultations with UBEC and other relevant agencies.

9. Directorate of Teacher Professionalisation and Mentoring

i. Director
ii. Deputy Director
iii. Head of Teacher Professionalisation
iv. Head of Mentoring

a) Director

i. Shall be responsible to the Provost
ii. Shall be the Administrative head of the directorate
iii. Shall be a member of the Academic Board

b) Deputy Director

Shall assist the Director in all his/her responsibilities

c) Head of Teacher Professionalisation

Shall be responsible for all matters relating to teacher professionalisation

d) Head of Mentoring

Shall be responsible for all matters relating to staff and student mentoring

10. Directorate of Career Service

a. Director
b. Deputy Director
c. Head of Units
i. Shall be responsible for coordinating Career Guidance for students
ii. Shall coordinate students' employability and skills development activities
iii. Shall organise Internship/Placement and industry linkages for students
iv. Shall ensure open linkages to student exchanges.

11. Directorate of Research and Innovation

The Directorate of Research and Innovation serves as the central coordinating body responsible for:

i. Promoting a vibrant research culture
ii. Driving innovation and commercialisation
iii. Ensuring research quality and ethics
iv. Mobilising research funding
v. Journal and book publications
vi. Linking research to societal and industry needs

Director

i. Reports to the Provost, through the Deputy Provost Academics
ii. Implements and enforces the College's research policies
iii. Provides leadership and supervision to team members
iv. Oversees research fund utilisation

v. Champions commercialisation of research findings

Deputy Director

Shall assist the Director in his/her responsibilities

12. Directorate of Grants, Partnerships and Resource Mobilisation

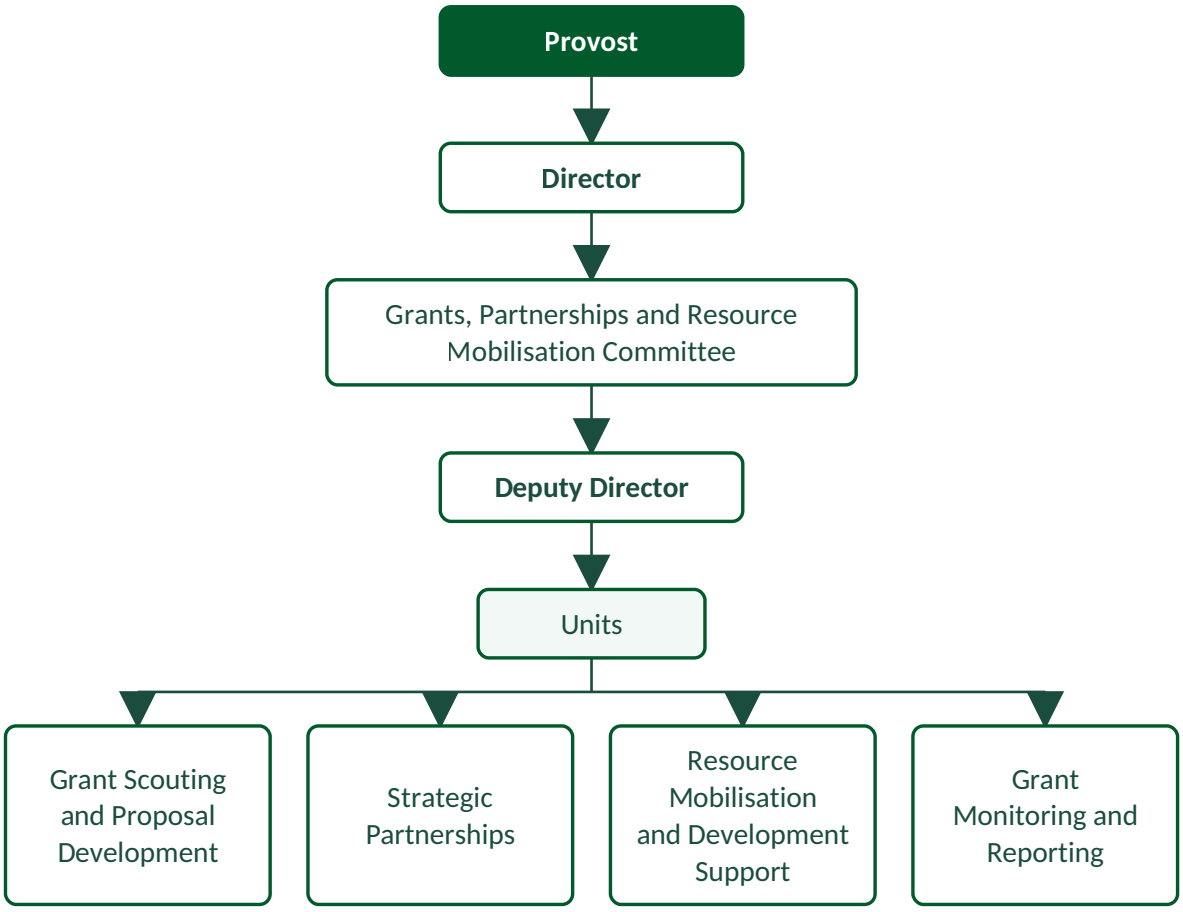
Mandate of the Directorate

The Directorate of Grants, Partnerships and Resource Mobilisation shall coordinate the identification, development, acquisition and management of external funding opportunities and strategic partnerships to support the College's academic, research, infrastructural and community development objectives.

There shall be a committee, comprising Academic Planning, Quality Assurance, Research and Innovation, Academic Departments, Bursary, Works, Registry, Purchasing and Physical Planning units, to collaborate, align and prioritise funding needs and identify funding agencies relevant to each unit.

The directorate shall serve as the institutional coordinating unit for grant scouting, donor engagement, proposal development, partnership development, resource mobilisation and monitoring of externally supported initiatives, in collaboration with relevant academic departments, directorates and administrative units.

Organogram



Organogram of the Directorate of Grants, Partnerships and Resource Mobilisation

Director

A Chief Lecturer/Professor with strong professional standing and integrity.

The Director should possess strong strategic, analytical, communication and relationship-management skills, as well as the ability to coordinate multidisciplinary teams.

Functions of the Directorate

1. Grant Scouting and Opportunity Identification

Systematically identify, monitor and publicise available funding opportunities from Government Agencies, Non-Governmental Organisations (NGOs), International Development Partners, Foundations, Corporate Bodies and other legitimate funding sources.

2. Funding Opportunity Analysis

Screen available opportunities and assess their relevance to the College's strategic priorities, eligibility requirements, funding limits, institutional capacity and anticipated benefits.

3. Grant Proposal Development and Coordination

Coordinate the preparation of competitive grant applications in collaboration with departments, researchers, project teams and relevant administrative units, without prejudice to their statutory functions.

4. Strategic Partnership Development

Establish and maintain productive relationships with funding agencies, government institutions, industries, NGOs, foundations, research institutions and development partners.

The objective should be to develop long-term collaborations that produce funding, technical assistance, research opportunities, training, equipment and other institutional benefits.

5. Donor Identification and Engagement

Develop a structured approach to identifying potential donors and maintaining relationships with them. This should include donor mapping, stakeholder engagement, institutional capability statements, project concept notes, follow-up correspondence and regular communication concerning the College's priorities and achievements.

6. Partnership Agreements and Memoranda of Understanding

Coordinate the development, documentation and monitoring of institutional partnerships and memoranda of understanding, in collaboration with the Legal Unit and other relevant units.

7. International Collaboration and Development Partnerships

Identify opportunities for international collaboration in teacher education, research, digital learning, technical and vocational education and institutional capacity development.

8. Industry, Alumni and Private-Sector Engagement

Develop relationships with industries, alumni, entrepreneurs and private-sector organisations to mobilise resources and create opportunities for students and staff. Activities may include industry-sponsored laboratories, equipment donations, scholarships, practical training and staff development.

9. Grant Compliance and Institutional Coordination

Coordinate with the Bursary, Procurement, Internal Audit, relevant project managers and other authorised units to ensure that successful grants are administered in accordance with their conditions. The Directorate should maintain a record of grant agreements, approved budgets, milestones, reporting deadlines and required deliverables. It should not independently assume financial custody or override the statutory responsibilities of the Bursary, Procurement or Internal Audit.

10. Monitoring, Evaluation and Reporting

Monitor the progress and performance of externally supported projects in collaboration with the implementing units. Periodic reports should be submitted to Management and other appropriate institutional authorities.

11. Advisory Services to College Management

Advise Management on emerging funding opportunities, donor priorities, partnership risks, institutional readiness and resource mobilisation strategies.

NOTE: There shall be an adequate complement of non-teaching staff for all Directorates.

Teaching and Non-Teaching Staff Ratio

The approved Teaching to Non-Teaching staff ratio is 70% teaching staff to 30% non-teaching staff

Certification

At the end of the training, all NCE-Degree-awarding institutions shall award Certificates in the following specialised focal areas:

(i) Nigeria Certificate in Education in Approved programmes

(ii) Bachelor's Degree in Approved programmes

(iii) Post-Graduate Diploma in Education

(iv) National Skills Qualification (NSQ)

Procedure and Guidelines for Establishing New Academic Programmes

Procedure for Obtaining Approval to Establish NCE-Awarding Institutions

Approval to establish an NCE-awarding institution shall be granted only when there is evidence that there is a library, administrative facilities and adequate resources on the ground to teach all the courses in the discipline of specialisation and General Studies. The procedure for obtaining approval to establish an NCE institution shall consist of the following:

i. Submission of Application Form

ii. An application form shall be submitted to the Executive Secretary, National Commission for Colleges of Education (NCCE) with the following documents:

iii. A properly laid out Academic brief describing the business concept, vision, mission, profiles and experience of promoters and management teams, target market, financial structure including evidence of start-up capital, operational plan, key risks and mitigants, preferred location and any other information that will be useful in assessing the viability of the proposed institution.

iv. In addition, the following documents shall be included in the proposal:

   a. Curriculum (if different from NCE Minimum Standards) demonstrating creativity, innovation and link with market economy.

   b. Information on school leadership with a proven track record.

   c. Number and list of full-time and part-time qualified instructors/lecturers.

   d. Information on learning environment, resources, facilities and equipment to be made available.

   e. Systems and structures for measuring impact.

   f. Evidence that more institutions of the type and level are required in the economy.

   g. Evidence of human resources available to the proprietor for the past three years.

   h. A tax clearance certificate for the past three years.

   i. An audited financial statement and/or bank statement.

   j. Evidence of registration of the Institution with Corporate Affairs Commission (CAC).

Analysis of Application and Inspection Visit

The Academic brief and the attached documents shall be analysed by NCCE. A team of specialist staff of NCCE and Resource Persons shall visit the site of the proposed institution to confirm the correctness of the submissions made by the prospective proprietor, after paying the prescribed amount to NCCE's Account. The team shall pay attention to the following:

i. the proposed curriculum of the institution;
ii. the physical facilities: offices, classrooms, workshops, farm laboratories, studios and library (as appropriate) for the proposed programmes to be offered by the institution, their adequacy, size of classes proposed, environment, and the complement of equipment required;
iii. adequacy of financial resources to support capital and recurrent expenditure;
iv. availability of human resources: administrative, teaching and support staff in quality, number and mix for the programme to be mounted in the first and second years of existence of the institution.
v. the institution's library shall be well-furnished and stocked with relevant books and non-book items, for the proposed programmes and adequate space to accommodate its readership; and
vi. availability of regular water and power supplies.

Recommendations to the Governing Board of NCCE/HME

The report of the inspection shall be considered by NCCE along with the Academic Brief in relation to meeting the provisions of the Education (National Minimum Standards and Establishment of Institutions) Act 30 of 2022. The recommendation of NCCE shall then be submitted to the Honourable Minister of Education for licensing the institution to operate.

Governing Board of NCCE/HME's Decision

If the application to establish the institution receives the approval of the Governing Board of NCCE/Honourable Minister of Education (HME), the institution shall be listed as licensed to operate in Nigeria. The Federal Ministry of Education/ Governing Board of NCCE shall inform the proprietor of the outcome of his application through NCCE.

Re-Submission of Application

Where the application is unsuccessful, the letter to the proprietor shall state reasons for denying the approval. The proprietor shall re-apply for approval to run or establish the institution after remedying all the deficiencies highlighted in the earlier report.

Academic Brief

A properly laid out academic brief should contain business concept, vision, mission, profiles and experience of promoters and management team, target market, financial structure including evidence of start-up capital, operational plan, key risks and mitigants, preferred location and any other information that will be useful in assessing the viability of the institution.

The academic brief shall contain the following:

a. A well-articulated academic brief showing the programmes to be offered and student enrolment by each year in the next 5–10 years;
b. A well-articulated Master Plan showing a clear description of the physical structure of the campus and relative to the academic development plans of the institution;
c. Audited financial report or a certified bank statement of account showing the financial position and capability of the prospective proprietor;
d. Tax clearance certificate of the proprietor for the past three (3) years;
e. Evidence of human resources available to the proprietor;
f. Information on school leadership with proven track record of experience;
g. System and structure for measuring impact of academic, administrative and financial activities;
h. Evidence that more institutions and programmes of such type and level are required in the economy;
i. Evidence of registration with CAC or Enabling Act, Edict or Bye-Law;
j. Evidence of ownership of at least twenty-five (25) hectares of land or evidence of long lease agreement of at least 5–10 years.

Procedure and Guidelines for Commencing Degree Programmes

Prior to the commencement of degree programmes in any COE, without prejudice to the maturity period, a COE shall make a formal application with specific education

programmes to NCCE. NCCE shall determine the prima facie qualification and readiness of the COE and make appropriate recommendations to NUC for further processes. This is to eliminate the possible practice of obtaining approval for non-education programmes in the COEs.

Only institutions meeting the prescribed human, infrastructural, and financial thresholds shall be granted operational approval. The NCCE shall specifically verify:

i. Adequacy of academic staff strength and qualification mix against the staffing thresholds set out by NUC;
ii. Availability and condition of laboratories, libraries, ICT facilities, and lecture-hall capacity relative to projected degree enrolment;
iii. Existence of an approved, harmonised curriculum for each proposed degree programme; and
iv. Institutional financial capacity to sustain the programme without compromising core NCE delivery.

Organisation, Management and Governance

A Constitution or Bye-law or some equivalent instrument or means shall exist to spell out the authority and responsibilities of each organisational component of the institution – Governing Council, College Management, Academic Board, Works and Services, etc. together with the process by which they function and interrelate. Provisions for the delineation of roles, authority and responsibilities to the staff shall be depicted in a table or organisational chart which represents the actual working order of the proposed institution. The administrative structure of the institution shall be like what is obtainable at government-owned institutions. Rules and regulations shall not conflict with the conventional responsibilities in academia.

Governing Council

The proprietor shall appoint a Governing Council which shall be the overall policy-making body of the institution. The composition of the council shall include representatives of the proprietor, Ministry of Education (State or Federal), National Commission for Colleges of Education, Employers and professional registration council/association related to the disciplines offered, the Provost, one (1) Deputy Provost, two (2) representatives of the Academic Board, four (4) representatives from the College Congregation (2 academic

and 2 non-teaching staff). One (1) representative of alumni, with the Registrar as Secretary.

***Note**: There can be variations in membership depending on the proprietorship of the institution.*

Academic Board

There shall be an Academic Board whose main function shall be taking decisions on academic matters. The composition shall include the Provost as Chairman, the Deputy Provosts, Dean of Students' Affairs, Dean of the Schools, Academic Directors, Heads of Academic Departments, Chief lecturers/Professors, two (2) representatives of the Academic Staff Union and the College Librarian and Registrar as Secretary.

Administration of the Institution

There shall be appointed to run the institution a Provost (or its equivalent) and other principal officers such as, the Registrar, Bursar, and the Librarian. The Provost of an institution shall hold a Ph.D. degree and professional qualification in one of the disciplines offered in the institution; shall be a Chief Lecturer/Professor of at least five (5) years and shall have cognate industrial work/teaching/administrative experience. The candidate shall show evidence of scholarship such as publications and research activities in both his/her discipline and higher education. The Provost shall have a teaching qualification and be registered with the Teachers Registration Council of Nigeria.

Teaching Staff

There shall be available to the proposed programmes a full complement of teaching staff number and mix required to teach all the courses listed in the curriculum. The number and mix of teaching staff shall be in line with the NCCE/NUC criteria. On average, a minimum of six core and permanent staff. The number excludes teaching staff for General Studies and other service courses taught by other departments. Generally, teaching staff is expected to teach for a minimum of 8 contact hours per week. Where necessary, part-time or adjunct lecturers shall be engaged to cover some of the periods. The minimum qualification for any lecturer in an NCE-degree-awarding institution shall be a master's degree. However, a holder of a first degree not below Second Class (Lower Division) can be employed in training positions as an assistant lecturer. In all cases, before they get their

first promotion, they must have full membership of a professional body in the discipline they teach, acquire a teaching qualification and must be registered with the Teachers' Registration Council of Nigeria (TRCN). All academic staff must have evidence of digital literacy from a recognised institution.

Non-Teaching Staff

There shall be a full complement of Administrative, Professional and Technical staff. For science and other programmes, each of the laboratories, workshops and ancillary facilities shall be fully staffed with at least a Secretary, Technologist, Technician, Office Assistants, Laboratory Attendant and Cleaners.

Physical Facilities

a. Laboratories

There shall be adequate number and types of laboratories available for the programme (s) to be offered. Where the department is to share existing laboratories with other departments, adequate arrangements shall be made to accommodate all the courses to be taught. The tools, instruments and equipment listed for each laboratory in the NCE-Degree Minimum Academic Standards shall be provided, installed and commissioned before the approval inspection takes place and before the first set of students are admitted. In all cases, care shall be taken to ensure that the programmes do not over-stretch the available facilities.

b. Workshops/Studios

An adequate number and size of workshops/studios to sustain an initial intake of 30 students in each of the three years of the programme shall be available. The hand and machine tools and equipment required for the programme shall be available, installed and commissioned before the approval inspection visit. The list of workshops, studios and minimum equipment required for each programme is contained in the NCE-Degree Minimum Standards Curriculum released by NCCE.

c. Classrooms/Lecture Theatres

Adequate number of classrooms/lecture theatres shall be available for the programme. Ideally, at least five classrooms, each fully equipped to seat not less than thirty (30) Students at a time, shall be available to each programme. Where classrooms are centrally

allocated to the various courses, care shall be taken to ensure that all courses are included in the schedule for the number of contact hours specified.

d. Library

The library of the institution shall have a seating capacity for at least one quarter of the readership at a time and shall be able to provide all the basic services that institutional and departmental libraries require with a minimum student-to-book ratio of 1:10. Text and reference books, journals, reading and non-book materials in the disciplines to be offered shall be provided in quantity and mix that will provide adequately for all students to be enrolled.

Virtual Library

A virtual library is also necessary. The college and department should leverage available technology to put in place rich databases and other electronic/digital library and information resources covering all programmes. A well-networked digital library should serve the entire college community. Availability of wireless facilities (Wi-Fi) with adequate bandwidth should enhance access to these electronic resources. In any case, there should be internet-ready workstations in the library for at least 25% of students enrolled in each academic programme. The funding of the library should be in line with the NCCE/ NUC guidelines.

e. Staff Offices

Offices shall be available for all teaching staff of the programme. Each department shall have well-furnished offices for the Head of Department and other officers (Administrative and Clerical officers) in the department. Senior Lecturers and above shall have well-furnished individual offices with computers, printers, air conditioners, file cabinets, bookshelves, refrigerators, toilet facilities, etc. The non-teaching staff should also be adequately accommodated. All staff offices shall be interconnected.

f. Welfare Facilities

Colleges shall provide adequate welfare facilities for both staff and students. For students, these shall include cafeteria, health and recreational facilities, and hostel. For all Teaching and Non-Teaching staff, these include staff housing, health and recreational facilities, and provisions for pensions and gratuities.

g. Municipal Facilities

Regular power or solar energy, gas and water supplies shall be available for the laboratories, workshops, studios, resource rooms, fire safety and emergency services, recreational facilities, toilets and sanitation facilities, waste collection and disposal services, road network and other facilities for the college.

h. Finance

Colleges shall be adequately funded to meet capital and recurrent expenditure needs of the college. Adequate consumables shall be on the ground for students' practical. There should be adequate funding for science and technology-based programmes. In both cases, colleges shall make provision for maintaining small tools/equipment in the workshops, laboratories and classrooms. Major repairs shall be funded from capital/recurrent grant as appropriate.

Admissions

Introduction

Each programme has its own unique features and demands. These unique features and demands are properly articulated in the introductory pages to each programme in the relevant booklets. Requirements that are common to all the subjects are set out below:

General Admission Requirements

a. A senior secondary school certificate (SSC) WAEC, NECO or GCE 'O' Level, NABTEB, and equivalent certificates with four (4) Credits at not more than two sittings. Two of the credits must be relevant to the course the candidates wish to offer. Credits in English and/or Mathematics may be required in some courses to meet departmental requirements. NBAIS for those doing Arabic and Islamic studies only.

b. A Grade II Teacher's Certificate (TC II) with credit or merit in five subjects, two of which must be relevant to the course that the candidate wishes to offer. Credit/merit in English Language and/or Mathematics may be a requirement in some courses.

c. Successful candidates in the Pre-NCE final examinations who, in addition to fulfilling the 'O' Level requirements of 4 credit passes as stated in (a) above, have satisfied the JAMB requirement for admission.

d. In addition to other requirements, all candidates shall fulfil admission requirements in line with JAMB guidelines.

Course Requirements

a. The Education and General Studies Courses are compulsory for all registered students in the NCE-Degree programmes.

b. All registered students must submit a supervised project before graduation. The project may be written in Education or any of the student's special areas. (This is without prejudice to long essays or seminar papers that may be required by some departments.) Three copies of projects, typed, double-spaced and bound (hard cover) together with soft copy of each completed project, shall be submitted by each student before graduation. The credits earned shall be recorded under EDU 321 and EDU 500 for the NCE and Degree programmes respectively.

c. Classroom observation should be carried out in the Demonstration School of the College. Teaching Practice is compulsory for both NCE and Degree students, and it shall last for one semester (NCE) and 12 weeks for Degree, with each carrying 6 credit units. Colleges are free to make their own arrangements for Teaching Practice. The credits earned shall be recorded under EDU 311 and EDU 501 as the case may be.

d. A supervised mentoring programme is compulsory for all students registered for NCE-Degree programmes in any Dual Mandate institution.

e. Industrial Attachment or SIWES is compulsory for all students registered for courses in Vocational, Technology, Theatre Arts, Music, Computing courses, Adult & Non-Formal Education and other courses approved by the NCCE. This is for a minimum of 16 weeks with 2 credit units.

f. Acculturation/Language Immersion Programmes are compulsory for all students offering Arabic, French and Nigerian Languages at the officially designated centres for a period of twelve (12) weeks or any other acceptable institution within or outside the country.

Guidelines for the Appointment of Deans and Heads of Departments

a) Deans of Schools

i) Eligibility

The Dean of a School shall be elected. To be eligible for this election, the officer shall not be below the rank of Chief Lecturer/Professor.

***Note**: In the absence of a Chief Lecturer/Professor, the Provost can appoint the most senior Lecturer in the school in an acting capacity for a duration of one year and renewable for another one year.*

ii) Tenure

The Dean shall hold office for 2 years from the date of his/her election unless the person resigns, but shall be eligible for re-election for a second and final term. He/she should leave office for at least two years before re-contesting for the position.

b) Head of Department

i) Eligibility

The HOD shall be elected. To be eligible for election, the officer shall not be below the rank of Principal Lecturer. Where there is no qualified staff for this position, the most senior academic staff can be appointed in an Acting capacity until a qualified person is available.

ii) Tenure

The HOD shall hold office for 2 years from the date of his/her appointment or until the person resigns, but shall be eligible for re-appointment for a second and final term. However, if there is no eligible officer, the most senior lecturer in the department shall be appointed as an acting HOD by the Provost for a tenure of one year, which is renewable for another one year.

Skill-Gap Management and Institutional Linkages

The National Commission for Colleges of Education advocates a collaborative approach to curriculum development that brings together all stakeholders in the curriculum implementation and utilisation chain for purposes of curriculum evaluation and review. This approach requires that adequate feedback comes from stakeholders such that the outcome of any curriculum review process meets the market and individual needs of the clientele as well as national aspirations. This approach to curriculum development requires that NCE-Degree awarding institutions obtain requisite information on how well their graduates are doing on the job and what is required to improve their job performance. However, over the years, it has been observed that NCE-Degree-awarding institutions do not do enough to follow up with their graduates so that they can contribute to the curriculum review process based on empirical data.

As part of the implementation of the 2026 edition of the Dual Mandate curriculum, NCCE shall monitor institutional linkages with a view to utilising the data on how well graduates of institutions are doing in their chosen areas of human endeavour for accreditation status. To ensure that decisions about programmes' relevance to society have an empirical basis, NCE-awarding institutions are directed to conduct regular labour market information surveys covering all disciplines studied in their respective institutions. In addition, quality tracer study reports shall be required and would significantly account for the scores each NCE-awarding institution shall receive during external quality assurance processes.

To ensure that relevant data informs upcoming curriculum reviews by the NCCE, all NCE-Degree awarding institutions are directed to establish a directorate of skill development and linkages that shall provide required direction for Dual Mandate Curriculum. The directorate shall be responsible for establishing skill requirements in programmes offered by the institution. Detailed functions of the directorate follow.

Functions of Skill-Gap Management and Institutional Linkage Directorate

The functions of the Directorate are to:

a. Identify and document the skills required for competent and employable teachers;
b. Compile and update the database of all NCE graduates regarding their career progression;

c. Conduct a survey of market needs of NCE graduates from time to time;
d. Organise advocacy, sensitisation and mobilisation programmes for the inculcation of appropriate skills in NCE-Degree Graduates;
e. Establish and maintain a linkage with employers of labour for exchange of ideas to determine the needs and the relevance of the skills acquired by NCE-Degree Graduates;
f. Involve employers of labour for the purpose of determining the demands of the labour market as well as national aspiration;
g. Collaborate with internal and external support agencies and institutions; and
h. Conduct follow-up or tracer studies to determine observed skill-gap issues among the institution's graduates.

Tracer or Follow-up Studies shall report on

a. Resource management skills of the NCE-Degree Graduates;
b. Evaluation/Assessment skills of the NCE-Degree Graduates;
c. Workplace partnership and/or team spirit of the NCE-Degree Graduates;
d. NCE-Degree Graduates' industrial skills;
e. NCE-Degree Graduates' entrepreneurship skills;
f. NCE-Degree Graduates' social skills;
g. NCE-Degree Graduates' Computer /ICT skills;
h. NCE-Degree Graduates' Team-teaching skills;
i. NCE-Degree Graduates' Oral and written communication skills;
j. NCE-Degree Graduates' Listening skills;
k. NCE-Degree Graduates' Project management skills;
l. NCE-Degree Graduates' problem-solving skills;
m. NCE-Degree Graduates' adaptation to work environment and dress code;
n. NCE-Degree Graduates' assimilation of work-based experience;
o. NCE-Degree Graduates' awareness of local and global issues, particularly in their subject areas;
p. NCE-Degree Graduates' leadership skills;
q. NCE-Degree Graduates' ability to take corrections;
r. NCE-Degree Graduates' ability to perform assigned tasks correctly;
s. NCE-Degree Graduates' soft/interpersonal skills;

t. NCE-Degree Graduates' competency in the delivery of subject matter (theory and practice) skills;

u. NCE-Degree Graduates' reading skills;

v. NCE-Degree Graduates' cognitive skills;

w. NCE-Degree Graduates' subject-specific skills as needed in various school subjects; and

x. Any other information relevant to determining suitability of NCE-Degree Graduates in the world of work.

Structure of the Directorate of Skill Development and Linkages

There shall be a Director and four Deputy Directors in the directorate. The Deputy Directors shall be:

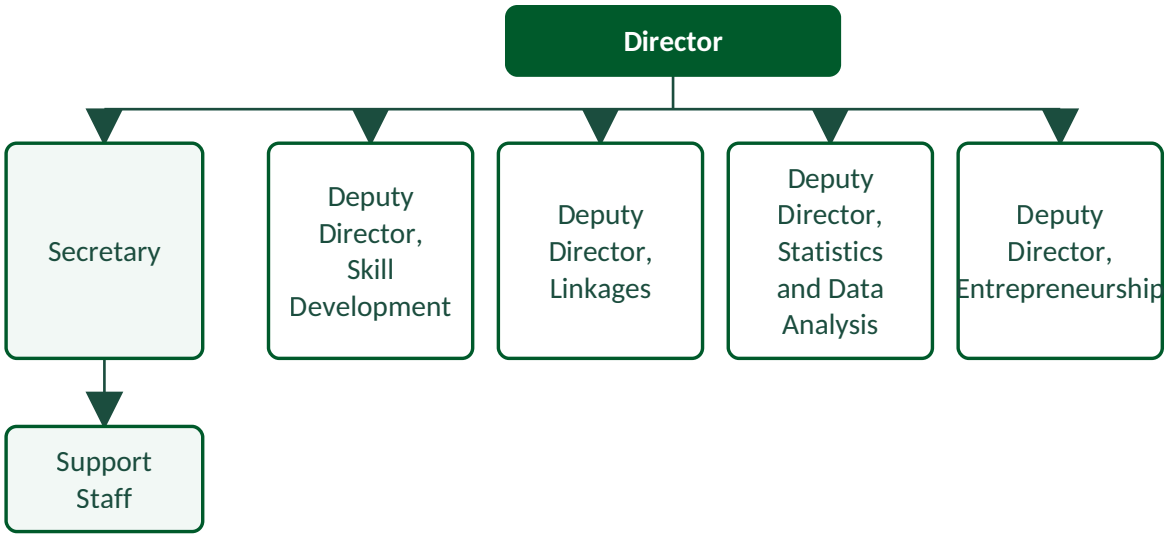
a. Deputy Director, Skill Development;

b. Deputy Director, Entrepreneurship;

c. Deputy Director, Linkages; and

d. Deputy Director, Statistics and Data Analysis

Note: *The directorate shall be serviced by Support Staff as laid out for all directorates in NCE-Degree awarding institutions.*



Organogram of the Directorate of Skill Development and Linkages

Functions of the skill development unit

a. To identify and document the skills required for competent and employable NCE teachers;

b. To conduct survey on labour market needs of college academic programmes from time to time;

c. To liaise with other unit heads on issues related to skill development.

d. To prepare a report on the activities of the unit for onward submission to the Director;

e. To keep relevant records of the unit; and

f. To carry out any other functions that may be assigned by the Director from time to time.

Functions of Linkages Unit

The unit is to:

a. Establish and maintain cordial relationships with the labour market, especially State Universal Basic Education Boards and other employment agencies for the purpose of determining the direction of the institution's educational programmes and course offering in the college of education;

b. Obtain regular information on job opportunities and societal expectations of NCE-Degree Graduates;

c. Sensitise the students and other stakeholders on relevant information on the job market available to NCE-Degree Graduates;

d. Liaise with institutions and establishments on proper training (SIWES, workshops on proper excursions) for students in Technical and Vocational Education; and

e. Carry out any other functions that may be assigned by the Director from time to time.

Functions of Statistics and Data Analysis Unit

The unit shall:

a. Generate, analyse and maintain statistical database on graduates, employers and international development partners;

b. Analyse collected data on NCE-Degree Graduates for decision-making and policy change;

c. Carry out periodic surveys of NCE-Degree Graduates' on-the-job performance;

d. Carry out periodic needs assessment of employers of NCE-Degree Graduates;

e. Develop, use and document test instruments for the directorate; and

f. Carry out any other functions that may be assigned by the Director from time to time.

Functions of the Entrepreneurship Unit

The unit shall:

a. Establish and coordinate the exploration of entrepreneurship opportunities in existing disciplines of the College;
b. initiate and sustain cordial relationships with employers of labour for the purpose of obtaining useful information on areas of entrepreneurial development;
c. develop and implement innovative strategies for bridging of skill gaps of NCE-Degree Graduates;
d. encourage productive institutional labour market relationships with employers of labour;
e. develop entrepreneurial skill potentials of both students and staff for deployment to relevant labour market;
f. promote linkage between the labour market and the NCE-awarding institution for acceptability and marketability of NCE-Degree Graduates;
g. explore possible sources of funding to support entrepreneurial development activities in the College; and
h. carry out any other functions that may be assigned by the Director from time to time.

Indicators for appropriate skill gaps, structures and procedures in NCE-Degree awarding institutions.

As part of external quality assurance measures, the National Commission for Colleges of Education shall examine the extent to which each NCE-degree-awarding institution is developing and applying relevant skills in workplaces. Where skill gaps are seen, institutions shall be held accountable for any remedial efforts that might be required for compliance in skill gap management. Consequently, it shall be the responsibility of each NCE-degree-awarding institution, through the Directorate, to determine the:

a) Adequacy and functionality of available infrastructure in NCE-degree-awarding institutions;
b) Adequacy of available manpower with respect to required skills in programmes run by the institution;
c) Quality of skill acquisition by NCE-Degree Graduates in programmes offered by the institution;
d) Literacy and communication skills competencies (reading, writing, listening and speaking) of NCE-Degree Graduates;

e) Disposition of pre-service NCE teachers to the teaching profession;

f) Level of motivation and incentives of NCE-Degree Graduates;

g) Quality of education and the required skill standards for employability.

Indicators for appropriate skill gaps management procedures

The following data shall assist NCCE in determining the appropriateness of skill gaps management in the NCE-awarding institution:

a) Frequency of visits and collaboration between Colleges and employers of labour;

b) Existence of employment procedures and level of compliance with laid down processes;

c) Quality of manpower and succession planning in the school; and

d) Evidence of required skills and job specification for employed staff of the institution.

Specific Guidelines on Labour Market Information Determination in NCE-Degree-Awarding Institutions

The National Commission for Colleges of Education expects all Colleges of Education in Nigeria to implement the guidelines stipulated below for Internal and External Quality Assurance processes. NCE-Degree-Awarding institutions shall be required to demonstrate compliance in:

a. Identifying and establishing relationships with stakeholders such as Institutional stakeholders (private and public primary and secondary schools and universities), SUBEB and other Employers of labour, College alumni, and host communities;

b. Obtaining information on the aspirations and expectations of the stakeholders and the general public through needs assessment;

c. Conducting periodic market surveys using appropriate instruments (questionnaire, checklist, etc.);

d. Providing periodic labour market information to students that can guide their career decisions; and

e. Providing an enabling environment for counselling students on employment matters.

Guidelines on NCE-Degree Graduates' Tracer Studies/Follow up

The following are guidelines for NCE-Degree Graduates' tracer/follow up studies:

a) Develop a database for NCE-Degree Graduates;

b) Generate a photo album for every graduating set with contact details;

c) Develop social media platforms for every graduating set for easy follow-up;

d) Follow up NCE-Degree Graduates (through social networks, Alumni Associations, SUBEB, Ministry of Education, Local Government Education Authority, Post Primary Schools Board and Private Institutions etc.);

e) Develop instruments such as questionnaires, interview blanks, focus group discussion blanks, etc. to determine the level of performance of NCE-Degree Graduates;

f) Calculate acceptance work skill indices for all NCE programmes offered by the institution;

g) Publish the outcome of the studies;

h) Conduct sensitisation programmes with different stakeholders like the NCE-Degree Graduates, employers, community leaders etc. to fill the skill gaps in programmes of the institution.

Standards for Teacher Education and Professionalism

Teacher Standards

The Teacher Standards represent a measurable and public statement of the quality and professionalism regarding the required knowledge, skills, and attitudes of teachers. The Teacher Standards should be the foundation and goal of the curriculum of an NCE-Degree-Awarding Institution.

The NCCE has developed Teacher Standards to ensure that, amongst others:

a) Teachers exhibit professional knowledge and competency regarding how learners learn and how to teach effectively;

b) Teachers have professional skills to plan for and assess effective learning;

c) Teachers ensure and maintain conducive learning environments.

By formulating explicit and observable learning outcomes, Teacher Standards assist lecturers in their planning. Teacher Standards provide guidance for the formulation of output-focused learning opportunities that develop the knowledge, skills and attitudes required in an effective teacher.

The NCE-Degree-Awarding Institutions and the NCCE should therefore ensure that:

1) Curriculum implementation of all NCE courses should focus on student teachers achieving all the Teacher Standards successfully;

2) The new NCE certificate will demand measurable evidence that a student teacher has achieved all Teacher Standards to an acceptable level. Evidence should be gathered through varied assessments, Teaching Practice reports, etc.

The NCCE expects that the products of NCE-Degree-Awarding institutions should be able to exhibit professional knowledge and professional practice in their professional engagement as outlined in the Teacher Standards below.

Framework for Programme Teacher Educator Standards

The Need for Teaching Standards

To compete in a global economy requires that public education produce graduates with the knowledge and skills that can contribute positively to the country's overall economic

growth. While there may be many factors that enhance economic growth, the quality of public education is certainly a major factor. However, the quality of teachers in public schools is directly tied to the quality of education and training they receive in the teacher preparation programmes. As a result, the need to ensure that all teachers receive quality instruction in the programme areas of their teacher preparation necessitated that Teaching Standards for teacher educators be developed. These Standards, when applied to all Colleges of Education, provide a systematic way to evaluate the quality of teachers at each college, as well as provide a basis for comparison across colleges.

These Teaching Standards for Teacher Educators define the performance expectations of lecturers in all Colleges of Education in Nigeria. The Standards not only provide a basis for retention and promotion but also for hiring. It is therefore the purpose of this section to:

a. set the framework for teacher education,
b. describe the Standards, and
c. delineate the implementation process for using the Standards for the assessment of all lecturers in Colleges of Education.

Framework for Teacher Education

A simple definition of a programme teacher educator is anyone who prepares teacher-trainees in any programme offered by a college of education. But that general definition is not specific enough to describe who is included in these Standards. The framework of the re-organised teacher preparation programmes in the Colleges of Education calls for education programmes to be developed in Early Childhood Education, Primary Education Studies, Secondary Education, Adult Education, and Special Education. The Programme courses taught in those programmes should be congruent with the Programmes required for teachers to teach at the selected levels of education. For example, the curricula of many of the Nigeria Certificate in Education (NCE) courses are developed around Integrated Programmes, as defined by the five categories of programmes rather than subject specialisation, such as Early Childhood Care and Education, Primary Education Studies, Special Needs Education, Adult and Non-Formal Education, Secondary Education, as it was before the reformed Dual Mandate Minimum Academic Standards. This also applies to technology teacher educators.

Teaching today is no longer a craft passed on without change from one generation to the next. Teaching as one has seen teaching done, or teaching as one has been taught, is as outmoded now as is practising engineering with a slide rule or accounting with an adding

machine. Recent research in cognitive psychology, for example, provides concepts and principles that challenge traditional thinking about learning. Programme teacher education, then, begins when the prospective teacher enters a teacher preparation programme. General education courses, courses in a major area, and teacher education courses all contribute to learning to teach. Although a teacher education programme should provide a good foundation for beginning teachers, it is expected that there should be growth in knowledge and skills throughout a teacher's career.

It is likewise expected that teacher educators continue to grow throughout their careers. Therefore, the Standards for Teacher Educator Programmes that have been developed reflect the expectation that teacher educators will continue to grow in their professions as they strive to meet the Standards at higher levels of performance.

Framework for the Teaching Standards

The Implementation guide for the Standards describes the twelve Standards or Attributes that Teacher Educators in Colleges of Education in Nigeria should possess. They also articulate the knowledge, values and practices of ideal Programme teacher educators. Standards are not only about what teacher educators should know but also about what they should be able to do, as well as their dispositions towards their work.

The Standards are divided into three sections: **Programme Content Standards, Professional Development Standards,** and **ICT Standards for Instruction.**

a. The Programme Content Standards stipulate that teacher educators of Programmes should have in-depth and current knowledge of their area of specialisation, use methodologies that reflect best practices, create learning environments that respect all students, and develop appropriate assessments to measure student progress.
b. The Professional Development Standards map out the career path on which teacher educators can work towards and assess their progression toward promotion. The Attribute Standards centre on the teacher educator as a model for professional values and practices, and as a collaborator at both the institutional and community levels.
c. The ICT Standards for Instruction describe the level of ICT that Programmes teacher educators should possess and incorporate into their instruction.

To facilitate implementation at the college level, Attribute Indicators are provided for each Standard to help teacher educators and their evaluators clarify job expectations. Through a piloted process with Programme teacher educators, the Attribute Indicators have been allocated to levels of expected performance: Basic, Proficient, and Accomplished. The teacher educator who aspires to a position at the basic level will be assessed on the Basic

performance indicators, from which she/he will then begin to work toward achieving the indicators for the Proficient level. To achieve recognition at the Accomplished level, a teacher educator would have to possess the Basic level indicators plus all additional indicators assigned to the Proficient level, and at least 70% of Accomplished level indicators.

The teacher standards stipulate Attribute Assessment Evidence, which are best defined as artefacts (documents, objects, examples) that are used to demonstrate that the teacher educator has met the Attribute Standard described by the Attribute Indicators. Many of the artefacts can serve multiple purposes. It is the responsibility of the teacher educator to describe in a reflective analysis how the selected artefacts show performance of specific Attribute Indicators for a Standard.

Teaching Standards and examples of evidence for each of the levels and each of the indicators are presented on the following pages.

Programme Content Standards

Standard 1: Teacher educators of Programmes have an in-depth and current knowledge of their areas of specialisation.		
Basic	***Proficient***	***Accomplished***
• Exhibit knowledge of the subject of specialisation as defined in the curriculum at the level the teacher is teaching	• Choose appropriate problem-solving activities based on set objectives and demonstrate effective imple-mentation	• Display sound scientific literacy and numeracy by being well-grounded in fundamental concepts, laws, principles and theories in the chosen area of special-isation • Exhibit positive scientific attitudes, interest, skills and show an ability to motivate and arouse Programme interests.
Standard 2: Teacher educators of Programmes understand the nature of the programmes and society and the connections among them.		
Basic	***Proficient***	***Accomplished***

• Exhibit knowledge of the nature of the programme as an enquiry into the natural world • Demonstrate understanding of the programmes and how to use them in solving life problems	• Demonstrate an understanding of the historical and socio-cultural milieu in which the programme flourishes • Explore with students the history and importance of Programmes • Guide students to understand how progresses in Programmes have made useful contributions in alleviating human suffering.	• Assist students to develop the ability for critical evaluation and to understand that Programmes operate through curiosity and the accumulation of knowledge, values and skills • Help students to develop skills to evaluate critically the impact of Programmes, especially on the environment • Encourage students to interpret Phenomenon, based on knowledge obtained from diverse disciplines and to see the connection among them
Standard 3: Programmes teacher educators foster scientific enquiry within the instructional process.		
Basic	***Proficient***	***Accomplished***
• Demonstrate the process of scientific investigation • Build on students' prior knowledge on the programme • Provide students with opportunities to take part in hands-on, minds-on and eyes-on science activities	• Encourage students to acquire the fundamentals of Programmes with a view to solving Programmes-related problems • Demonstrate how scientists question, think and reason	• Facilitate participatory class activities, involving generation of investigable and researchable questions, and hands-on activities using scientific methods • Expand students' understanding and develop their capacity to recognise problems and the skills to ask relevant questions and proffer solutions • Provide activities that promote creativity, open-mindedness, critical thinking and team-work among the students.
Standard 4: Programmes teacher educators create enabling learning environments.		

Basic	*Proficient*	*Accomplished*
• Familiarise her (him) self with the laboratory and workshop safety requirements • Make Programmes education accessible to all students irrespective of state of origin, religion and background, gender and other cultural factors • Demonstrate effective classroom management skills • Provide opportunities for students to acquire laboratory skills.	• Involve the students effectively and actively in the learning process	• Create democratic and interactive learning environment • Encourage students with special learning needs to participate actively in Programmes' education
Standard 5: Teacher educators of Programmes employ diverse instructional resources in their classrooms.		
Basic	*Proficient*	*Accomplished*
• Use local materials and examples for effective teaching	• Use local resource persons and centres for effective teaching • Improvise instructional materials from local sources • Use ICT to harness the wealth of instructional resources • Aware of current trends in the development of instructional resources	• Expose students to effective use of library and Internet resources for independent research and problem solving.
Standard 6: Teacher educators of Programmes use formal and informal assessment strategies to evaluate students' progress.		
Basic	Proficient	Accomplished

• Use assessment strategies that reflect and are congruent with instructional goals • Use continuous assessment to support instruction and enhance learning • Provide timely feedback to students about their achievement on assessment tasks • Use assessment to provide feedback in the instructional process.	• Employ multiple methods of assessment that are fair and accurate to analyse the progress of students • Value students' self-assessment as an important component of the Programme's programme	

Professional Development Standards

Standard 7: Programmes teacher educators demonstrate the professional values and practices that support a teacher education programme.		
Basic	***Proficient***	***Accomplished***

• Treat students consistently with respect and consideration, and are concerned for their development as learners • Work within the statutory frameworks relating to teachers' responsibilities	• Demonstrate high expectations of all students: respect their social, cultural, linguistic, religious and ethnic background and are committed to raising their educational achievement • Model and promote positive values, attitudes and behaviour that they expect from their students • Appreciate the contributions that support staff and other professionals make to teaching and learning • Promote active and independent learning that enable students to think for themselves • Demonstrate enthusiasm and passion for Programmes as instructional disciplines • Support cross-disciplinary instruction in the school as a learning community	• Demonstrate professional self-esteem as a teacher of Programmes • Contribute to and share responsibility in the corporate life of the school • Contribute to and share responsibility in the life of the community.
Standard 8: Programmes teacher educators model teaching that demonstrates content and professional knowledge, skills, and dispositions, reflecting accepted best practices.		
Basic	***Proficient***	***Accomplished***

• Model professional demeanour, punctuality and effective record keeping: • Demonstrate mastery of subject matter • Demonstrate professional ethics in the teaching of Programmes	• Model effective instruction to meet the needs of diverse learners	• Demonstrate critical thinking and problem-solving and promote them among teacher educators, teachers, and/or prospective teachers • Raise awareness, alternative conceptions and world views to traditions in Programmes classrooms • Revise courses to incorporate current research and/or best practices • Mentor new entrants into the teaching profession and/or teacher educators • Facilitate peers' professional development experiences related to effective teaching practices • Anchor practice on current policy and research related to Programmes teacher education.
Standard 9: Programmes teacher educators enquire systematically into, reflect on, and improve their own practice and demonstrate commitment to continuous professional development.		
Basic	***Proficient***	***Accomplished***
• Engage actively in life-long learning	• Reflect systematically on own practice and learning • Engage in professional development focused on career progression • Participate actively in and reflect on learning activities in professional associations, examination bodies and learned societies • Apply life experiences to teaching and learning • Submit self willingly to peer group assessment.	

Standard 10: Teacher educators collaborate with relevant stakeholders to improve teaching, research and student learning.		
Basic	Proficient	Accomplished
• Participate in joint decision making about teacher education • Engage in advocacy for Programmes education	• Participate in collaborative projects that contribute to improved teacher education	• Engage in cross-cultural and cross-institutional partnerships • Support teacher education • Foster cross-disciplinary endeavours • Foster school-community relations • Seek financial support for innovation in Programmes education.

ICT Standards for Instruction

Standard 11: Programmes teacher educators can make use of the basic ICT available in their colleges.		
Basic	***Proficient***	***Accomplished***
• Use the basic operations of available ICT applications, i.e. e-mail, word processing, database management programmes, presentation models and graphics • Perform Internet searches to develop materials for classroom instruction	• Evaluate quality of Internet-based materials • Develop Programmes activities that use available ICT • Use teacher online communities for collaboration and sharing • Use ICT for communication with stakeholders.	• Integrate and adapt curriculum content in ICT environment
Standard 12: Programmes teacher educators use their knowledge of subject matter, teaching and learning and ICT to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.		
Basic	***Proficient***	***Accomplished***

• Access relevant content from virtual libraries	• Engage in competitions to showcase the integration of ICT in education • Demonstrate skills of a facilitator rather than an instructor using ICT • Create e-learning materials.	• Promote, support, and model creative and innovative thinking about using ICT for teaching and learning Programmes • Engage students in exploring real-world issues and solving authentic problems using digital tools and resources • Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes • Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments • Promote project-based learning in a One-on-One ICT environment • Use virtual laboratories for experiments and projects

Programme Content Standards – Basic level examples of evidence

Standards	Examples of evidence for assessment
Standard 1: Teacher educators of Programmes have an in-depth and current knowledge of their area of specialisation.	• Observations from supervisors, colleagues, students, or other recognised professional bodies • Course outline • Student assignments • Student work samples • Videos, audiotapes, pictures and/or diagrams of teaching and resources • Develop instructional materials, • Relevant credentials (e.g. certificates, licenses) • Examples of student assessment • Interview performance • Performance in assessment tests • Performance test of basic laboratory safety measures • Quality of questions and marking schemes • Safety charts and manuals • Documents requesting for basic safety tools, equipment, and facilities • External examiners' reports • Accreditation reports • Students' Industrial Work Experience Scheme (SIWES) Reports • Annual Performance Evaluation Reports (APER)
Exhibit knowledge of the subject of specialisation as defined in the curriculum at the level the teacher is teaching	
Standard 2: Teacher educators of Programmes understand the nature of science, technology and society and the connections among them.	
Exhibit knowledge of the nature of science, science education, and science as an enquiry into the natural world	
Demonstrate understanding of the difference between science (as a body of knowledge and a process of acquiring and refining the knowledge) and technology (as an application of scientific principles and knowledge to solve human problems)	
Standard 3: Programmes teacher educators foster scientific enquiry within the instructional process.	
Demonstrate the process of scientific investigation	
Build on students' prior Programmes knowledge	
Provide students with opportunities to take part in hands-on, minds-on and eyes-on science activities	
Standard 4: Programmes teacher educators create enabling learning environments.	
Familiarise with the laboratory and workshop safety requirements	
Make Programmes education accessible to all students irrespective of state of origin, religion and background, gender and other cultural factors	
Demonstrate effective classroom management skills	
Provide opportunities for students to acquire laboratory skills.	
Standard 5: Teacher educators of Programmes employ diverse instructional resources in their classrooms.	

Standards	Examples of evidence for assessment
Use local materials and examples for effective teaching	
Standard 6: Teacher educators of Programmes use formal and informal assessment strategies to evaluate students' progress.	
Use assessment strategies that reflect and are congruent with instructional goals	
Use continuous assessment to support instruction and enhance learning	
Provide timely feedback to students about their achievement on assessment tasks	
Use assessment to provide feedback in the instructional process.	

Programme Content Standards – Proficient level examples of evidence (over and above Basic level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 1: Teacher educators of Programmes have an in-depth and current knowledge of their area of specialisation.	• Letters of commendation/ testimonials • Teaching awards and/or other forms of recognition • Examples of ICT-based teaching and learning • Output of problem solving activities (e.g. models, projects, reports from field work, excursions and exhibitions)
Choose appropriate problem-solving activities based on set objectives and demonstrate effective implementation	
Standard 2: Teacher educators of Programmes understand the nature of science, technology and society and the connections among them.	
Demonstrate an understanding of the historical and socio-cultural milieu in which the scientific and technological enterprise flourishes	
Explore with students the history and importance of Programmes	
Guide students to understand how progresses in Programmes have made useful contributions in alleviating human suffering.	
Standard 3: Programmes teacher educators foster scientific enquiry within the instructional process.	

Standards	Examples of evidence for assessment
Encourage students to acquire the fundamentals of Programmes with a view to solving Programmes -related problems	
Demonstrate how scientists question, think and reason	
Standard 4: Programmes teacher educators create enabling learning environments.	
Involve the students effectively and actively in the learning process	
Standard 5: Teacher educators of Programmes employ diverse instructional resources in their classrooms.	
Use local resource persons and centres for effective teaching	
Improvise instructional materials from local sources	
Use ICT to harness the wealth of instructional resources	
Aware of current trends in the development of instructional resources	
Standard 6: Teacher educators of Programmes use formal and informal assessment strategies to evaluate students' progress.	
Employ multiple methods of assessment that are fair and accurate to analyse the progress of students	
Value students' self-assessment as an important component of the Programmes	

Programme Content Standards – Accomplished level examples of evidence (over and above Basic and Proficient level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 1: Teacher educators of Programmes have an in-depth and current knowledge of their area of specialisation.	• Philosophical statement that reflects underlying knowledge and values of teacher education
Display a sound scientific literacy and numeracy by being well-grounded in fundamental concepts, laws, principles and theories in the chosen area of specialisation	

Standards	Examples of evidence for assessment
Exhibit positive scientific attitudes, interest, skills and show an ability to motivate and arouse Programmes interests.	
Standard 2: Teacher educators of Programmes understand the nature of science, technology and society and the connections among them.	
Assist students to develop the ability for critical evaluation and to understand that Programmes operate through curiosity and the accumulation of knowledge, values and skills	
Help students to develop skills to evaluate critically the impact of Programmes, especially on the environment	
Encourage students to interpret Programmes, based on knowledge obtained from diverse disciplines and to see the connection among them	
Standard 3: Programmes teacher educators foster scientific enquiry within the instructional process.	
Facilitate participatory class activities, involving generation of investigable and researchable questions, and hands-on activities using scientific methods	
Expand students' understanding and develop their capacity to recognise problems and the skills to ask relevant questions and proffer solutions	
Provide activities that promote creativity, open-mindedness, critical thinking and team-work among the students.	
Standard 4: Programmes teacher educators create enabling learning environments.	
Create democratic and interactive learning environment	
Encourage students with special learning needs to participate actively in Programmes education	
Standard 5: Teacher educators of Programmes employ diverse instructional resources in their classrooms.	
Expose students to effective use of library and Internet resources for independent research and problem-solving.	

Standards	Examples of evidence for assessment
Standard 6: Teacher educators of Programmes use formal and informal assessment strategies to evaluate students' progress.	

Professional Development Standards – Basic level examples of evidence

Standards	Examples of evidence for assessment
Standard 7: Programmes teacher educators demonstrate the professional values and practices that support a teacher education programme.	• Observations from supervisors, peers, students and other recognised professional bodies • Course outline • Videos, audiotapes, pictures and/or diagrams of teaching and resources • Develop instructional materials. • Relevant credentials (e.g. certificates, licenses) • Referee report • Annual performance report • Annual institutional report • Institutional Quality Assurance Report
Treat students consistently with respect and consideration, and are concerned for their development as learners	
Work within the statutory frameworks relating to teachers' responsibilities	
Standard 8: Programmes teacher educators model teaching that demonstrates content and professional knowledge, skills, and dispositions, reflecting accepted best practices.	
Model professional demeanour, punctuality and effective record keeping:	
Demonstrate mastery of subject matter	
Demonstrate professional ethics in the teaching of Programmes	
Standard 9: Programmes teacher educators enquire systematically into, reflect on, and improve their own practice and demonstrate commitment to continuous professional development.	
Engage actively in life-long learning	
Standard 10: Teacher educators collaborate with relevant stakeholders to improve teaching, research and student learning.	
Participate in joint decision-making about teacher education	
Engage in advocacy for Programmes education	

Professional Development Standards – Proficient level examples of evidence (over and above Basic level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 7: Programmes teacher educators demonstrate the professional values and practices that support a teacher education programme.	• Teaching awards and/or other forms of recognition • Individual and joint publications resulting from collaboration • Joint publications with students • Teachers' journals • Active membership of relevant professional associations • Examples of ICT-based teaching and learning
Demonstrate high expectations of all students	
Model and promote positive values, attitudes and behaviours that they expect from their students	
Appreciate the contributions that support staff and other professionals make to teaching and learning	
Promote active and independent learning that enables students to think for themselves	
Demonstrate enthusiasm and passion for Programmes as instructional disciplines	
Support cross-disciplinary instruction in the school as a learning community	
Standard 8: Programmes teacher educators model teaching that demonstrates content and professional knowledge, skills, and dispositions, reflecting accepted best practices.	
Model effective instruction to meet the needs of diverse learners	
Standard 9: Programmes teacher educators enquire systematically into, reflect on, and improve their own practice and demonstrate commitment to continuous professional development.	
Reflect systematically on own practice and learning	
Engage in professional development focused on career progression	
Participate actively in and reflect on learning activities in professional associations, examination bodies and learned societies	
Apply life experiences to teaching and learning	
Submit self willingly to peer group assessment.	

Standards	Examples of evidence for assessment
Engage actively in life-long learning	
Standard 10: Teacher educators collaborate with relevant stake-holders to improve teaching, research and student learning.	
Participate in collaborative projects that contribute to improved teacher education	

Professional Development Standards – Accomplished level examples of evidence (over and above Basic and Proficient level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 7: Programmes teacher educators demonstrate the professional values and practices that support a teacher education programme.	• Evidence of collaborative activities (e.g. minutes and agenda of meetings) • Letters of commendation/ testimonials • Records of awards, recognition, and financial support for research resulting from collaboration • Philosophical statement that reflects underlying knowledge and values of teacher education • Statement of philosophy of teaching and learning • Evidence of career and professional development goals and activities • Evidence of active participation in professional development experiences • Evidence of community outreach activities • Output of problem-solving activities (e.g. models, projects, reports from field work, excursions and exhibitions)
Demonstrate professional self-esteem as a teacher of Programmes	
Contribute to and share responsibility in the corporate life of the school	
Contribute to and share responsibility in the life of the community.	
Standard 8: Programmes teacher educators model teaching that demonstrates content and professional knowledge, skills, and dispositions, reflecting accepted best practices.	
Demonstrate critical thinking and problem-solving and promote them among teacher educators, teachers, and/or prospective teachers	
Raise awareness of alternative conceptions and world views to traditions in classrooms	
Revise courses to incorporate current research and/or best practices	
Mentor novice teachers and/or teacher educators	
Facilitate peers' professional development experiences related to effective teaching practices	
Anchor practice on current policy and research related to education, in particular Programmes on teacher education.	
Standard 9: Programmes teacher educators enquire systematically into, reflect on, and improve their own practice and demonstrate commitment to continuous professional development.	
Standard 10: Teacher educators collaborate with relevant stakeholders to improve teaching, research and student learning.	
Engage in cross-cultural and cross-institutional partnerships.	

Standards	Examples of evidence for assessment
Support teacher education for the Basic Education level	
Foster cross-disciplinary endeavours	
Foster school-community relations	
Seek financial support for innovation in Programmes education.	

ICT Standards for Instruction – Basic level examples of evidence

Standards	Examples of evidence for assessment
Standard 11: Programme teacher educators can make use of the basic ICT available in their colleges.	• Chats • SMS • e-mail address • Observations from supervisors, peers, students and/or other recognised professional bodies • Course outline • Videos, audiotapes, pictures and/or diagrams of teaching and resources • Develop instructional materials. • Annual performance report • Annual institutional report • Institutional Quality Assurance Report
Use the basic operations of available ICT applications, i.e. e-mail, word processing, database management programmes, present-ation models and graphics.	
Perform Internet searches to develop materials for classroom instruction	
Standard 12: Programmes teacher educators use their knowledge of subject matter, teaching and learning and ICT to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.	
Access relevant content from virtual libraries	

ICT Standards for Instruction – Proficient-level examples of evidence (over and above Basic-level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 11: Programme teacher educators can make use of the basic ICT available in their colleges.	• Blog • Video and teleconferencing • Evidence of career and professional development goals and activities • Evidence of active participation in professional development experiences
Evaluate quality of Internet-based materials.	
Develop programmes and activities that use available ICT.	
Use teacher online communities for collaboration and sharing.	
Use ICT for communication with stakeholders.	
Standard 12: Programme teacher educators use their knowledge of subject matter, teaching and learning, and ICT to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.	
Engage in competitions to showcase the integration of ICT in education.	
Demonstrate skills of a facilitator rather than an instructor using ICT.	
Create e-learning materials.	

ICT Standards for Instruction – Accomplished level examples of evidence (over and above Basic and Proficient level examples of evidence already cited)

Standards	Examples of evidence for assessment
Standard 11: Programme teacher educators can make use of the basic ICT available in their colleges.	• Webpage • Evidence of collaborative activities (e.g. minutes and agenda of meetings) • Letter of commendation/testimonials • Records of awards, recognition, and financial support for research resulting from collaboration • Philosophical statement that reflects underlying knowledge and values of teacher education • Evidence of community outreach activities • Output of problem-solving activities (e.g. models, projects, reports from field work, excursions and exhibitions) • Patents/copyrights
Integrate and adapt curriculum content in ICT environment	
Standard 12: Programmes teacher educators use their knowledge of subject matter, teaching and learning and ICT to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.	
Promote, support, and model creative and innovative thinking about using ICT for teaching and learning Programmes	
Engage students in exploring real-world issues and solving authentic problems using digital tools and resources	
Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes	
Model collaborative knowledge construction by engaging in learning with students	
Promote project-based learning in a One-on-One ICT environment	
Use virtual laboratories for experiments and projects	

Demonstrating Compliance

Implementation of the Standards

Implementation of these Standards will be a phased-in process that will begin sensitising teacher educators at each NCE-Degree-Awarding institution to the nature of the Teaching Standards. NCE-Degree-Awarding institutions will be required to have their lecturers complete a self-assessment based on the Attribute Standards and the Attribute Indicators and provide appropriate available Attribute Evidence. From that self-assessment, the teacher educator will set goals and indicate what steps are needed to meet them. For example, what professional development experiences would assist in meeting these goals, or what changes in instructional approaches are needed. This self-assessment process will also encourage in-depth knowledge of the Attribute Standards, the Indicators, and the

types of Evidence that can be used as support. Activity 1 (Appendix A) and Activity 2 (Appendix B) are examples of how such a self-assessment should be implemented.

To assist teacher educators in meeting the standards, the Quality Assurance Unit and teacher educators in each College of Education will be trained to support the implementation of the Standards for providing appropriate feedback to teacher educators, college management and the National Commission for Colleges of Education (NCCE). The feedback received by the NCCE will be used to provide a database on the current level of performance of each Programme, teacher educators on the Standards, and the type of capacity-building programme needed to meet the identified gaps. In addition, the Standards will be part of the policy for the recruitment and career progression of Programme teacher educators.

To develop efficient and effective professional teacher educators for the 21st century, the following categorisation will become operational. This categorisation shall be based on the exhibition of evidence of the features enumerated by the teacher under each categorisation.

Assistant Lecturer to Lecturer III

Before employment, teacher educators shall be required to register with the Teachers Registration Council of Nigeria (TRCN), be conversant with the Code of Ethics of the teaching profession and undergo an internship of one academic year after employment under an Accomplished teacher, as part of School Based Teacher Development (SBTD).

SBTD is an approach to mentor teachers through sharing of classroom experiences of activities that worked and on challenges that were faced during instruction. These experiences must be part of documented records of teachers' reflective journals.

The focus is on developing teachers' competence under the watchful eyes of an Accomplished mentor.

Lecturer II to Senior Lecturer

In addition to meeting the requirements for Lecturer III and meeting the promotion requirements stated in the Conditions and Schemes of Service, the teacher educator should have cognate experience of at least three years.

Principal Lecturer/Associate Professor to Chief Lecturer/Professor

Lecturers going to the rank of principal and chief lecturer/Professor must meet the promotion requirements as stated in the Conditions and Schemes of Service.

Providing Evidence of Meeting the Teacher Educator Standards

The Quality Assurance Unit in each College of Education is charged with leading Teacher Educators through the initial self-assessment process, i.e. studying the Standards and Attribute Indicators and pulling together available Attribute Evidence (see Appendix A and Appendix B for activities to assist this process). From the self-assessment, Teacher Educators should identify what steps they need to take to meet the Standards (at least at the Basic Level), and what professional development, if any, will be needed to assist them in meeting the Standards. The Quality Assurance Unit will also assess the quality of the documentation in the Professional Portfolios.

Programmes teacher educators must examine their practice through the creation of a ***Professional Portfolio*** based on these Standards. Such a portfolio will serve to portray and articulate aspects of their practice that might inform others of their standing and progress. The process of creating a Professional Portfolio serves to provide a link between reflection and practice that has for some time been essential to viewing evaluation as professional development. Thus, the Professional Portfolio that is developed by each Programme teacher educator provides evidence of how (s)he is meeting the standards.

Selecting Artefacts that Demonstrate Teaching Effectiveness

One of the tasks in the process of creating a Professional Portfolio that demonstrates teaching effectiveness is to study the Standards and the Attribute Indicators delineated at the level of performance on which the teacher educator will be evaluated, i.e. Basic, Proficient, or Accomplished. Using, among others, the list of possible artefacts in the Standards as illustrated in this document, teacher educators will select the evidence that best shows the quality of their work in terms of the required specific indicators.

Reflective Analysis for the Portfolio

Selecting artefacts (evidence) is only the first step in presenting evidence of how the Standards for teacher educators have been met. In order to better communicate how those artefacts illustrate effective practice, accompanying written commentaries must be included to provide insight into the rationale for choosing each piece of evidence that has been provided.

In the written commentaries, the teacher educator must describe, analyse, and reflect on how his/her work relates to the Standards. The reflective written commentary is the identifying difference between a portfolio developed around the Standards for Programmes teacher educators and a simple collection of pedagogical specimens. The

description, analysis, and evaluation inherent in the reflective process form the basis for professional understanding and improvement. Reflection is important in sustaining one's professional competence and informing professional judgement.

Description is the first step in a reflective process. It must be used for the development of a portfolio of evidence to show that a Teacher Educator has met the required Standards. It provides the relevant context for the teacher educator's practice and the basis for analysis and reflective commentary and highlights the relevant features of the teacher educator's professional context that influenced the selection of artefact (s).

Analysis must provide explanations of how the evidence included meets the selected Attribute Indicator for each Standard. The teacher educator must provide a list of the documents in the portfolio with the explanation for each, for example in a table. However, there are several ways for presentation of this analysis that are acceptable, as long as clear explanations are provided for how each artefact meets the requirements of a specific Attribute Indicator.

Reflective commentary on the aspects of the teacher educator's practice represented in the portfolio involves a synthesis of the findings. This reflective commentary shall highlight the impact of the educator's practice and justify why a certain artefact provides evidence of such practice. Reflection is a process that facilitates the development of future action from the contemplation of past and/or current behaviour.

In summary, finding artefacts to meet indicators within a standard is crucial for providing evidence. A portfolio is more than just individual pieces put together under a standard. A rationale, reflection, or some other media must provide "the glue" to bind the pieces into one cohesive product.

Uses of the Standards

The Standards for Programmes Teacher Educators in the Colleges of Education in Nigeria will be used as one of the bases for determining expectations and assessing the performance of teacher educators. Those who employ teacher educators, universities, schools, and others, will benefit from having an external set of Teaching Standards defining the quality level of teacher education that applies to all Colleges of Education in Nigeria.

Examples of uses for the standards

1. Guide to the search process for hiring individuals who will have a primary role as teacher educators.

2. Guide to the design of a staff development programme for teacher educators.
3. Guide to the annual evaluation of an individual who is a teacher educator.
4. Promoting dialogue among their members about the issues of teacher education.
5. Guide to the development of portfolios for teacher educators.
6. Guide to the construction of curriculum vitae.
7. Guide to the development of programmes that are designed to prepare teacher educators.
8. Guide to offering professional development on the standards.
9. Workshops or clinics at professional meetings to instruct about the standards.
10. Basis for research on teacher education.
11. Disseminate the standards to other working groups.
12. Promote reference to the standards in discussions about teacher education.
13. Catalyse debate and discussion about the definition, role, and expectations of teacher educators.
14. Use as a reference to collect data on the performance, expectations, and working conditions of teacher educators.

In summary, the implementation of the Teaching Standards for teacher educators in the Colleges of Education will provide a basis for quality assurance and enhance the quality of graduates.

Mentoring and Learning Opportunities

It is observed that the classic approach of teacher preparation, whereby teacher trainees are given a large body of curriculum content with the hope that it can support them in their teaching roles on graduation, has failed the Nigerian education system. This position is predicated on the large public outcry about the poor quality of basic education in the country. To completely reverse the trend, NCCE is introducing mentoring in the 2026 edition of the NCE-Degree Minimum Standards as a vital approach to improving the quality of the available teaching force. Under the mentoring approach introduced, each teacher education institution would have to introduce a School-based Teacher Development Programme (SBTD) that would be closely monitored and supervised by the NCCE.

SBTD is an approach to mentor teachers through the sharing of classroom experiences, activities that worked and challenges that were faced during instruction. These experiences must be part of documented records of the teacher's reflective journal. SBTD recognises the need for a teacher to keep written records of his plans, his observations and his thoughts in the journal. The focus is on developing teachers' competence under the watchful eyes of an accomplished mentor.

Keeping a journal by a teacher is an important aspect of a reflective teaching process. The journal (diary) helps him to keep track of events and to compose his thoughts and plans more efficiently. SBTD also involves seeking assistance and collaborating with other teachers and mentors. Mentors and mentees meet once or twice a month to review what happened in the classroom since the last meeting. Colleagues, mentors and mentees compare notes and learn from one another. The whole process of SBTD involves self-criticism, self-evaluation and feedback on the teaching process. It leads to the improvement of the teacher's function.

The SBTD envisaged shall use a ***co-operative*** learning strategy that focuses on *team-based activities* in which mentors and mentees work together to solve problems. It should be emphasised that the approach should ensure that teachers really understand the key roles being covered. Team learning should ensure that younger teachers learn from their mentors and experienced teachers reinforce their knowledge by explaining the desirable approaches to others.

It is important that teachers learn to interact effectively. Teachers should face situations in which all three interactive patterns (competition, collaboration, leadership) are operating

and will need to be effective in each. There is considerable evidence that working together to achieve a common goal produces higher achievement and greater productivity than working alone. Cooperative SBTD improves mastery and retention in the learning of difficult tasks, problem solving, creativity, and sharing of experiences, among others.

The introduction of mentoring and SBTD has become imperative because we employ a lot of novice teacher educators in our teacher education programmes. The characteristics of SBTD are that it is a self-learning, school-based mentoring and supervision support that encourages group collaboration that results in whole-school development. As an essential component of Continuous Professional Development, SBTD is cost-effective. Its emphasis is on active learning and reflective teaching, not passive exposition of students to tested content. Under the programme, teachers are facilitators who observe and do. The teacher learns to dialogue with self-reflection on the lesson topic, thinking about appropriate materials and employs the help of others who listen and support his career development **(**see sample classroom observation Instrument in the appendices at the back of this framework**)**. He reflects on his actions during lesson delivery, keeps a record of teaching activities, evaluates actions and reactions, uses evidence to reflect change in behaviour, caters for individual differences, and improves professional practice continuously.

As a mentor, he/she offers student-teachers positive support in their journey to be qualified teachers by:

a) being clear about expectations of the student-teacher in terms of professional behaviour and the type of teaching he/she wants to see;
b) being calm and gentle, accepting mistakes and helping them to learn from them;
c) being approachable, accessible and available when really needed;
d) asking reflective and open questions to encourage depth of thought;
e) listening to students, allowing them to express themselves and trying not to interrupt them
f) guiding them to find their own solutions to any difficulties they are facing and supporting them when those difficulties need further discussion to find a solution;
g) using creative and problem-solving approaches to learning that stimulate the teacher and the student;
h) being honest about things that they did well, areas they could improve and explaining how to improve them. Giving examples of where he/she observed the behaviour, so they know what is expected of them;

i) keeping track of the student's progress and knowing the areas where they need support

j) encouraging the student to make decisions and to exercise an appropriate degree of autonomy so that they can develop their own approach to teaching;

k) identifying, acknowledging and appreciating what the student teacher brings to the school;

l) being a passionate, positive role model, expecting, setting and demonstrating high examples of professionalism;

m) fostering positive, productive relationships with all members of staff, students, their families and the wider community, demonstrating respect for culture and diversity;

n) being respectful of the student-teacher and understanding them, taking into account what they already know and can do;

o) being knowledgeable and understanding of how adults learn;

p) Observing and assessing student-teachers objectively, using agreed criteria

Guidelines for mentorship

To be an effective mentor**,**

a. It is important that the mentor builds a trusting relationship with the mentee;

b. Spend time with the mentee outside the classroom or the meeting room to get to know the mentee; what he/she is interested in, what he/she thinks about teaching, etc.;

c. Listen to the mentee and try not to interrupt when he/she is speaking;

d. Ask open questions to make him/her think;

e. Be calm and gentle; accept his/her mistakes and help him/her to learn.

f. Be honest about things which the mentee did well and things which he/she did not do well;

g. When giving feedback, the mentor should not just say 'good' or 'unsatisfactory'; he/she should give examples of things that they did well or could do better and explain why.

Leading the periodic meetings with the mentees

Mentors in an NCE-degree-awarding institution should note that:

a. The purpose of the meeting is to give the mentees a chance to talk about their day;

b. The mentees should do most of the talking;

c. The mentor needs to guide the discussion by asking questions, then adding any observations and suggestions.

Steps in mentorship

1. Reflection

Read the mentee's reflective journal with them and use the questions to guide their thinking. What was their biggest success today?

a. What challenges did they face?
b. Why do they think the challenges arose?
c. What did they do to help them overcome the challenges?
d. Did they feel they were well-prepared?
e. What will they do differently tomorrow?
f. Have they asked anyone for help today?
g. How would they like you to help them tomorrow?

2. Planning

The guidelines that follow can help with planning and will be beneficial to the mentee.

a. Routinely discuss the daily plan for the next lesson;
b. Talk about the content the mentor will be teaching the mentee;
c. Check the activities the mentee must do;
d. Discuss ideas on how to improve the mentee's practice in the next lesson;
e. Guide mentees to recognise learning experiences that shall be beneficial to learners in the lesson to be taught;
f. Find out how they are going to support learners who find learning difficult;
g. Help the mentees prepare teaching aids, lesson plans, etc.

How to lead a periodic meeting with mentees

The purpose of this meeting is to look at what mentees have learnt during the week and to discuss plans for the next week.

What are the steps?

1. Before each meeting, the mentor will ask the mentees to bring along exercise books of three learners:

a. One who has struggled to learn
b. One who learnt at a steady pace
c. One who found learning easy

2. The mentor shall ask the mentees to reflect on the week

a. How were the plans successful in improving students' learning?
b. What could have been changed to help more students learn?

3. The mentor should examine the mentee's work with him/her and identify what was done

a. Did he/she complete the work he/she set to do in the week?
b. Did learners do any independent work, or is it all copied off the board?
c. If it is copied off the board, find out from the mentee what opportunity he/she would give to enable learners to do independent work.
d. From your assessment, what support do you think is needed to be given to those learners who are "not learning?"
e. How could that support be part of the mentees' planning for the next week?

4. Discuss the mentee's plan for the week

a. How will they plan to help all three groups of students to learn?
b. How will they involve learners in activities?
c. Go through the content and discuss if there is anything the mentee needs to study.

Note that you may be able to give some advice, but you will not be able to solve all the mentee's difficulties. Supporting a mentee to learn about teaching will be very rewarding if you spend the time to help them develop. You will have the pleasure of seeing the growth of someone who may at first lack confidence and find it difficult to learn, thereby ensuring that every mentee learns to become a confident teacher who is ready to join the profession.

Qualities of a good Mentor

It shall be the responsibility of the NCE-degree-awarding institution to select deserving mentors in programmes offered in their institutions. However, the following shall be the qualities that mentors should possess. Mentors shall be academic staff:

a. not below Senior Lecturer or its equivalent among non-teaching staff with proven ability, integrity, and experience in identified areas of interest; and

b. recommended by the head of department through the Dean, Director of Mentoring and Professionalisation, and appointed by the Provost;

c. Directorate of Mentoring and Professionalisation

The Directorate of Mentoring and Professionalisation should exist in all NCE-Degree-Awarding Institutions in Nigeria.

The functions of the directorate are as follows

i. To coordinate and oversee the mentoring activities of teacher educators for better productivity.
ii. To coordinate and oversee the mentoring of students to enhance learning of pedagogy.
iii. To induct new entrants into the teaching profession.
iv. To collect and document relevant information on mentoring activities in the College.
v. To liaise with quality assurance, guidance and counselling and other relevant units for better service delivery on mentorship in the College.
vi. To ensure better standards in professionalisation in teacher education programmes.
vii. To perform all other functions that will improve mentorship and professionalisation of teachers and students.

Officers of the Directorate

The directorate shall have the following officers:

1. The Director

The Director should be a Chief Lecturer with a Ph. D. in his/her area of specialisation.

The functions of the Director are

The Director shall:

i. Be answerable to the Provost;
ii. Ensure effective mentoring in the NCE-degree-awarding institution;
iii. Supervise the activities of Deputy Directors in the Directorate;
iv. Recommend mentors to be appointed by the Provost in consultation with relevant Deputy Directors;
v. Coordinate the affairs of the Directorate;
vi. Keep records of all mentoring activities in the college; and

vii. Coordinate the induction of new staff

2. Deputy Director teaching staff/professionalisation

The Deputy Directors should not be below the rank of Principal Lecturer.

The functions of the Deputy Director:

a. To be responsible to the Director for mentoring and professionalisation (MP);
b. To collate and recommend mentors from schools and departments to the Director;
c. To perform the duty of the Directorate as it relates to mentorship/professionalisation of teaching staff in the college;
d. To collate data on new entrants into the college;
e. To recommend new entrants to the Director for induction exercise; and
f. To liaise with school coordinators about mentorship and professionalisation of teacher educators.

3. Deputy Director Students mentoring

The Deputy Director should not be below the rank of Principal Lecturer.

The functions of the Deputy Director:

a. To be responsible to the Director for mentoring and professionalisation (MP);
b. To perform the duty of the Directorate as it relates to mentorship of students in the college;
c. To collate data on newly admitted students into the college;
d. To recommend newly admitted students to the director for mentorship; and
e. To liaise with school coordinators for teaching practice and micro-teaching with regard to mentorship of students.

4. School coordinators, mentorship

The Coordinators of schools' mentoring programmes should not be below the rank of Senior Lecturer.

Functions of School coordinators, mentorship

The functions of the school mentoring coordinators shall be:

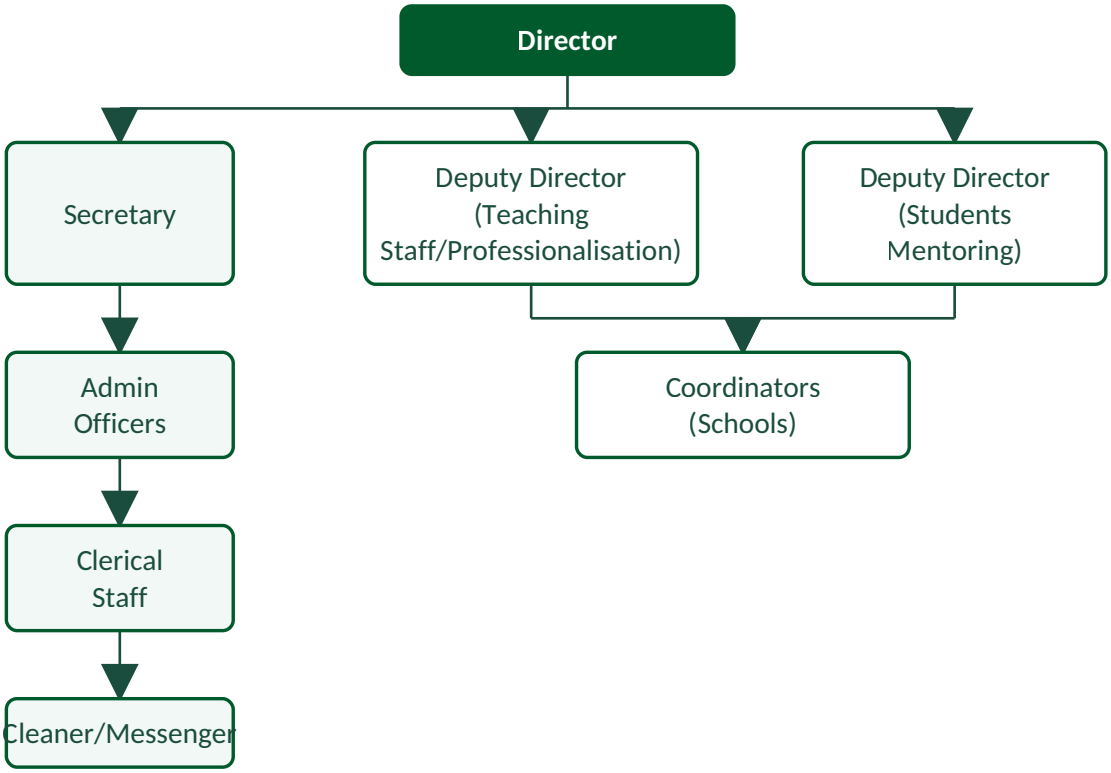
a. To serve as a link between schools and the Directorate;
b. To coordinate mentorship at the school level for both staff and students;

c. To collect and keep data on mentorship at the school level;

d. To organise mentorship meetings at the school level; and

e. To liaise with the Directorate on the professionalisation of teacher educators in the school.

Organogram of the Directorate of Mentoring and Professionalisation



Organogram of the Directorate of Mentoring and Professionalisation

Learning Opportunities

In line with the shift in focus from 'teaching' to 'learning' in the current educational approach, the NCCE emphasises the importance of Institutions creating effective Learning Opportunities for all student teachers. This is with a view to ensuring that there is an appropriate *teaching input* into the 3-year NCE programmes and a quality *learning output*, i.e. what is taught, how it is taught by teachers and how students learn. How are teachers implementing the new NCE curricula?

Learning Opportunities are all those environmental characteristics (classroom, group, and individual activities; learning resources; assessment processes; etc.) that purposefully enhance learning. Therefore, the focus of 'Learning Opportunities' in NCE-Degree-

Awarding Institutions should be the creation of an enabling environment for quality education in all NCE-Degree-Awarding institutions.

Learning Opportunities in NCE-Degree-Awarding institutions shall encompass:

1. teachers taking the suggested content as laid out in the curriculum implementation guide and designing a Learning Programme that is effective in mastery of knowledge, skills and attitudes;
2. mentoring student-teachers to develop and grow as competent teachers of basic education;
3. providing a variety of learning materials: not simply course books, but genuinely effective and high-quality open-source materials available on the Internet and other improvised materials;
4. student-teachers having the opportunity to practise learned content during and after classes as well as asking questions during classes whenever they need to;
5. student-teachers being given regular group assignments;
6. student teachers being given regular individual assignments;
7. student teachers being engaged in sit-in observation;
8. student teachers being given sufficient opportunities to practise their skills in Micro-Teaching and in Teaching Practice;
9. student teachers being given regular feedback on their performance in achieving the Teacher Standards.
10. student teachers being encouraged to use student-centred pedagogies (think-pair-share, problem-based learning in organised groups, activity-based, discovery method, etc.)

During accreditation and monitoring visits, the NCCE will verify the Institution's compliance with the above to ensure adequate development of knowledge, skills and attitudes in the student teachers. The NCCE will also ensure that all learning is based on best practices in Teacher Education.

Educational Approach

Teaching is a dynamic profession that requires continuous review to address contemporary issues and challenges. The public is of the view that there is a decline in the quality of education in the country. Part of the reason for the decline could be attributed to the

existing NCE programme that is not tailored enough towards the production of teachers for the Basic Education Programme.

The new educational approach also has implications for the way lecturers in NCE-Degree-Awarding Institutions conduct assessment, provide learning opportunities and undertake teaching practice. This Framework provides some assistance in these areas as well.

There are two main characteristics of the Education Approach underlying the new Teacher Education Programmes:

1) The shift from Teaching to Learning:

What is of utmost importance to any education system is what learners can *learn*, and not just what teachers are required to *teach*.

This is an important shift in educational approach which recognises that teaching can be ineffective when it focuses solely on the transmission of curriculum content without considering whether anything is being learnt. In an approach that emphasises teaching input only, it is often assumed that content can be perfectly 'transmitted' to students because all learners will automatically 'receive' the correct content. Research has shown that this is not the case. Learners need to be engaged actively in the learning process and their learning must be supported and monitored explicitly. Learning only becomes meaningful if it is centred on the learner and on the development of the learner's ever-growing and changing understanding and application of professional content knowledge, skills and attitudes.

Therefore, in line with the shift from teaching to learning, it is expected that courses will be offered by the lecturers not through a relatively simple 'Teaching Programme', but rather through a comprehensive 'Learning Programme'. A Learning Programme provides a comprehensive plan to ensure that the required knowledge, skills and attitudes are developed by each student-teacher. Therefore, in the 2026 edition of the NCE-Degree Minimum Standards, each course has a prescribed Learning Programme that describes what resources (learning materials, learning activities, tasks, etc.) will be used, as well as what assessment strategies will be applied to show evidence of achievement of learning goals. Such a Learning Programme also focuses on making sure that effective learning takes place, rather than simply providing a plan to cover course content.

The new approach also requires a redefinition of the lecturers'/teacher educators' role from the transmitter of content to a facilitator of learning. Even if resources to be used are described and outcomes are specified, it may still not be clear as to how lecturers will

change their teaching strategies and focus on what and how students learn. How will the transformation from 'transmitter of content' to 'facilitator of learning' take place through mentoring?

The paradigm shift envisaged is in the methodology employed by lecturers/teacher educators to deliver instruction. There must be a shift from methodology that promotes rote learning and mastery of content to constructivist ones that help learners to construct their knowledge using activity-based, learner-centred approaches. There is therefore a need to carry along the teacher educators for them to fit well into the new arrangement by re-orienting and retraining them for successful implementation of the programme.

2) Not only content is learnt, but also skills and attitudes:

The new Teacher Education Programmes aim at producing professional teachers. From this perspective, it is essential that apart from the required content knowledge, student-teachers are also provided with opportunities to acquire the *skills and attitudes* of an effective teacher.

Therefore, the new Teacher Education Programmes use the learning of content (professional knowledge) in such a way that it also relates to and supports the development of professional skills and professional engagement or attitude. The development of appropriate teaching skills will require the provision of adequate opportunities to "practice teaching". It will require not just supervision but a well-organised mentoring system that provides support to the student-teacher and the newly qualified teacher. What this means is that a mentoring component needs to be integrated into the existing teacher preparation exercise, and more time needs to be devoted to practical school experience. Mentoring of both new entrants into the teacher education service and student-teachers shall be complemented by Teaching Practice (TP) supervision that can engender the development of excellent teaching skills; hence the need to re-conceptualise TP and re-organise it as suggested. For instance, in a Mathematics course, it is not enough for student-teachers to learn how to do 'addition'. What is needed as well is that student-teachers learn how to teach 'addition'. That is, the student-teachers themselves need to develop both the content knowledge and the skills to assist their own learners to learn 'addition'.

Course Credit System and Students' Assessment

Course Credit System

The National Policy on Education, FGN (2013), stipulates that a credit system which is transferable among Universities and other institutions of higher learning on a reciprocal basis will be initiated. This is to enable a student who may be compelled to change his residence before completing his course to finish it in another institution.

The insistence by the Government on excellence in education led to the establishment of the National Commission for Colleges of Education (NCCE), the National Universities Commission (NUC) and the National Board for Technical Education (NBTE). These three bodies, ministering to the academic needs at their various levels, have agreed that the issue of Minimum Standards cannot be compromised. On its own part, the NCCE under the current dispensation of Dual Mandate is geared towards ensuring that teachers earning NCE and Degree are professionally, intellectually and morally qualified for the task of servicing the Basic and Post Basic Education system. The Dual Mandate Minimum Standards guarantee the acceptability of the NCE and Degree certificates earned from Colleges of Education in Nigeria.

Definition of Course Credit System

The course credit system is a quantitative system of organising the curriculum in which subject areas are broken into units which are examinable and for which students earn credit (s) if they pass. The courses are arranged in a progressive order or in levels of academic progress, e.g. level 1 or year 1 courses are 100 and level II or year 2 courses are 200 series, etc.

Advantages of Course Credit System

The adoption of the course credit system for all colleges of education and other NCE-Degree-Awarding institutions has the following merits:

i. allows students within limits to move at their own pace;
ii. allows a thematic structuring of the programmes of study; i.e. ability to break courses into convenient and manageable modules;

iii. allows inter-departmental and inter-disciplinary collaboration in curriculum processes (curriculum planning, development, implementation, evaluation) and minimises duplication of courses;

iv. permits a diagnostic approach to a student's learning as well as a continuous examination of students in each subject area;

v. provides students with greater flexibility in taking elective courses from outside their area of specialisation, thereby broadening their educational horizon;

vi. facilitates inter-institution transfers, thus enhancing student mobility;

vii. enhances comparability, national standard and national unity.

Credit Unit

Courses are assigned weights called credit units. Credit units consist of a specified number of student-teacher contact hours per week, per semester. Credit units are used in two complementary ways: as a measure of course weighting and as an indicator of student workload.

i) As a measure of course weighting, a course may earn 1, 2, or 3 credit units, etc. 1 credit means 1-hour lecture, plus 1 hour of mentoring and tutorial; 2 credit units mean 2-hour lectures, plus 2 hours of mentoring and tutorial; 3 credit units mean 3-hour lecture, plus 3 hours of mentoring and tutorial per week for 15 weeks of the semester.

ii) For another form of teaching requiring student-teacher contact, the following equivalents may apply:

   a) Two hours of seminar

   b) Three hours of laboratory work, field work, studio work, practicum, stadium supporting activity etc., in addition to lecture hours

iii) **Teaching Practice:** Eighteen (18) and twelve (12) weeks of teaching practice at NCE and Degree levels respectively, to earn 6 credits each.

iv) **Students' Industrial Work Experience Scheme (SIWES):** SIWES for NCE and Degree as prescribed in the dual mandate minimum standards.

v) **Acculturation/Language Immersion:** Minimum of twelve (12) weeks to earn two credits

vi) **Entrepreneurship:** Attachment shall be compulsory for all NCE students in any one of the following key trade areas: **Solar Installation and Maintenance, GSM/ Computer Repairs/Hardware, Cosmetology, Tailoring/Garment Making, Livestock/Poultry and Horticulture.**

vii) Field Work Experience in Adult Education for 8 weeks to earn 2 credit units.

Staff/Student Workload

i) Every full-time student should be required to register for a minimum of 15 and a maximum of 24 credit units per semester, except for students on field experience, teaching practice or industrial attachment.

ii) A full-time academic staff member shall have a minimum teaching load of 4 credit units per semester.

(a) For Science and TVE-based disciplines, this should mean a minimum of 4 lecture hours and 8-hour laboratory work per week.

(b) For Arts and Social Science-Based disciplines, this should mean a minimum of 4 lecture hours and 8-hour tutorial work per week.

(c) For certain service courses, the size may be very large, and therefore, proportionate contact hours should be used.

Grade Point Average (GPA)

i. The NCCE is adopting the grading system using both letter (A–F) and figure (5–0) grades. It is more consistent with the degree classification in use in Nigeria and has therefore been adopted by Colleges of Education.

ii. The percentage score, letter grade, Grade Point Average (GPA), and Cumulative Grade Point Average (CGPA), and the status of pass are:

A minimum pass mark of 40% (equivalent to Grade Point of 1) shall apply in every NCE-degree-awarding institution. Similarly, a minimum GPA of 1.00 is required for graduation.

1. Definitions of Grade Point, Grade Point Average and Cumulative Grade Point Average:

i) Grade Point

Grade point derives from the actual percentage raw score for a given course. To obtain the grade point, the raw score is converted into a letter grade and a grade point. How grade point is obtained is detailed in the table below.

Table 1: Approved Scoring and Grading System

I Credit Units	II Percentage Score	III Letter Grade	IV Grade Point (s) (GP)	V Grade Point Average (GPA)	VI Cumulative Grade Point Average (CGPA)	VII Level of Pass in NCE Subjects	VIII Level of Pass in Degree Subjects
Varies according to contact hours assigned to each course per week, per semester and according to workload earned by the student.	70–100	A	5	Derived by multiplying I & IV and dividing by total Credit Units.	4.50-5.00	Distinction	First Class
	60–69	B	4		3.50-4.49	Credit	Second Upper
	50–59	C	3		2.40-3.49	Merit	Second Lower
	45–49	D	2		1.50-2.39	Pass	Third Class
	40–44	E	1		1.00-1.49	Low Pass	Pass
	0–39	F	0		0.00-0.99	Fail	Fail

ii) Grade Point Average (GPA)

This is the average of weighted grade points earned in the courses taken during the semester. The Grade Point Average is obtained by multiplying the Grade Point attained in each course by the number of credit unit (s) assigned to that course, and then summing these and dividing by the total number of credit unit (s) taken for the semester.

iii) Cumulative Grade Point Average (CGPA)

This is the up-to-date mean of the Grade Point (s) earned by the student in a programme of study. It is an indication of the student's overall performance at any point in the training programme.

$$\text{CGPA} = \frac{\text{Sum of Total Grade Points} \times \text{Respective Credit Units for Semester}}{\text{Total Credits for all courses registered by the Student}}$$

Cumulative Grade Point Average (CGPA) and Related Issues

Credit Units

These refer to the weight in terms of units given to a course. For instance, EDU 111 is given a credit weighting of 1 and EBN 111 is given 2 credit units. The credit units may consist of hours of lecture/practical/seminar/industrial attachment and so on.

Grade Point (GP)

This is the point assigned to a range of percentage scores or a letter grade obtained in a given course. These, according to the Dual Mandate Minimum Standards, are as follows.

No.	Percentage Score	Letter Grade	Grade Points
i	70–100	A	5
ii	60–69	B	4
iii	50–59	C	3
iv	45–49	D	2
v	40–44	E	1
vi	0–39	F	0

Thus, a percentage score of 55 is assigned the letter grade C and a grade point of 3. In the same vein, a percentage score of 70 is assigned the letter grade A and the Grade point of 5. A percentage score of 39 and below is assigned the letter grade F and the grade point of 0.

Grade Point Average (GPA)

This is the average of the grade points earned in all the courses ***taken*** in a semester. This is obtained by multiplying the grade point obtained in each course by the number of credit units assigned to the course. The sum of these is then divided by the total number of credit units ***taken*** in that semester. Consider the example from the first semester (result) of a student (Olu).

Olu's results: First Semester

Subject	Course	Credit	Score	Letter Grade	Grade Point	Total Points
Education	EDU 111	1	77%	A	5	5
	EDU 112	2	50%	C	3	6

Subject	Course	Credit	Score	Letter Grade	Grade Point	Total Points
	EDU 113	3	42%	E	1	3
Social and Citizenship Education	SOS 111	2	57%	C	3	6
	SOS 112	1	62%	B	4	4
	SOS 113	3	72%	A	5	15
English	ENG 111	2	60%	B	4	8
	ENG 112	2	38%	F	0	0
	ENG 113	2	46%	D	2	4
General Studies	GSE 101	1	69%	B	4	4
	GSE 105	2	58%	C	3	6
	GSE 109	2	49%	D	2	4
Total		**23**				**65**

Total Credit Units (Semester 1) = 23

Total Grade Points (Semester 1) obtained = 65

Grade Point Average (GPA) (Semester 1) = 65/23 = 2.83

Cumulative Grade Point Average (CGPA)

This is the average of the GPA for a given session. It is used to determine the academic progress of the student. A minimum CGPA of 1.00 is required for graduation. A CGPA of less than 1.00 earns the student probation for one academic session. *Any student who obtained a CGPA of less than 1.00 during probation is required to withdraw from the institution. An example of calculating* CGPA is given. Consider the student's (Olu's) results for semester II as follows:

Olu's results: Second Semester

Subject	Course	Credit	Score	Grade Point	Total Points
Education	EDU 121	2	60%	4	8
	EDU 122	1	40%	1	1
	EDU 123	2	47%	2	4
English	ENG 121	2	72%	5	10

Subject	Course	Credit	Score	Grade Point	Total Points
	ENG 122	2	49%	2	4
	ENG 123	2	63%	4	8
Social and Citizenship Education	SOS 121	2	59%	3	6
	SOS 122	2	44%	1	2
	SOS 123	2	48%	2	4
	SOS 124	2	79%	5	10
	SOS 125	1	61%	4	4
General Studies	GSE 102	2	55%	3	6
	GSE 103	1	43%	1	1
	GSE 104	1	79%	5	5
Total		**24**			**73**

Total Credits (Semester II) = 24

Total Grade Points (Semester II) = 73

Grade Point Average (GPA) (Semester II) = 73/24 = 3.04

Then his Cumulative Grade Point Average (CGPA) for the first year is:

	Credit	Points
1st Semester	23	65
2nd Semester	24	73
Total Credits	23 + 24 = 47	
Total Grade Points	65 + 73 = 138	
CGPA	**138/47 = 2.94**	

Carrying Failed Courses

Any core or compulsory course failed must be taken at the next opportunity. However, a student must not take, in any semester, a total load of more than 24 credits. Thus, if a student is carrying 6 credit units and the courses are available at the next session, the student should take only a maximum of 18 credit units from the new courses and should take the course he failed – i.e. 6 credit units, making a total of 24 credit units. Of course, the actual credit registered/taken during probation is used in the calculation of the new

GPA and new CGPA. The previous score is, however, reflected in the records of the semester the courses were earlier taken and failed. ***It should be noted that there should be no waiver of attendance of classes during probation.***

Duration of NCE-Degree (Regular)

The duration for obtaining NCE and Degree certificates is a minimum of three academic sessions for NCE and two for Degree, of two semesters each. A semester must not be less than 15 weeks of teaching, plus 3 weeks for registration and examination, making a total of 18 weeks.

The maximum residency period for an NCE student is five academic sessions, and four academic sessions for Degree. ***This means that only two probationary years are allowed at the NCE and Degree level.***

Role of Level Adviser

Level advisers shall be appointed by the Dean to guide students. They help students to navigate academic matters such as course selection, registration and solving academic problems. They monitor and counsel students on their academic progress.

Semester Examinations

With the adoption of the course credit system, examinations come at the end of every semester.

Continuous Assessment (CA)

The Commission approved the following:

i. A weighting of 40% should be adopted for continuous assessment and 60% for semester examinations by all colleges of education in view of the work input expected from students in the various approved programmes of study;

ii. A weighting of 60% should be adopted for continuous assessment with emphasis on practical and hands-on activities and 40% for semester examinations in the schools of computing, technology and vocational education at both NCE and Degree levels;

iii. Assessment should be in workshops, laboratories, studios, etc., as may apply to respective disciplines;

iv. For effective implementation of the course credit system and the continuous assessment scheme, each college should:

a) Provide essential tools for information storage, retrieval and analysis in the form of microcomputers along with relevant software e.g. course administration programmes, licensed databases and word processors. Such computer applications can facilitate access to analytical tools which can greatly facilitate the grading, analysis and interpretation processes.

b) The standard of teaching/instruction and quality of examinations should be raised through the institutions' use of students' opinion surveys and peer evaluation to assess the quality of teaching in all courses. The lecturers evaluated should be informed about the outcome, which should be discussed with them individually as a basis for improvement.

In addition, short courses on teaching and examination methods should be mounted for staff during the long vacation periods. The National Policy on Education, FGN (2013) recognises the need for the re-training of teachers at all levels of the education system.

Conditions for Probation and Withdrawal

i. The common denominator for assessing a student's overall performance in a programme of study, regardless of the number of credit units taken, is the Cumulative Grade Point Average (CGPA).

CGPA should be used as a guide for assessing students for probation and withdrawal, considering the minimum CGPA of 1.00 required for progression.

ii. Probation

Probation is a status of a student whose academic performance falls below an acceptable standard. A student whose Cumulative Grade Point Average (CGPA) is below 1.00 at the end of a year of study earns a period of probation for one academic session. A student on probation will not progress to the next level but will retake all failed courses to enable him or her to meet the 1.00 CGPA requirement.

iii. Withdrawal

A candidate whose Cumulative Grade Point Average (CGPA) is below 1.0 at the end of a period of probation should be advised to withdraw from the College.

iv. Repeating Failed Courses

Subject to the conditions for probation and withdrawal, a student may be allowed to repeat the failed courses at the next available opportunity provided that the total number of Credit

Units carried during that semester does not exceed 24, and that the grade earned at all the attempts shall count towards the calculation of the CGPA.

Moderation

Each Head of Department, through the Dean, shall recommend a list of external examiners to the Academic Board of the College for approval

External Examiners so recommended may either come from sister institutions or Universities outside the geopolitical zones or may be respectable professionals in the field.

External Examiners from Colleges of Education and Polytechnics must not be below the rank of Principal Lecturers, while those from the Universities must be Senior Lecturers and above. Professionals in the field must have not less than fifteen years of post-qualification experience before they can be appointed external examiners in their field of practice.

Such External Examiners shall moderate the questions, the marked answer scripts of 200 and 300 level NCE and 400 and 500 level Degree courses, as well as the projects, and send their written reports to the Academic Board through the Director of Academic Planning. In addition to all the above, the NCCE shall appoint a monitoring team of experts in each discipline to go around Colleges from time to time to vet their academic standards and forward written reports to the Commission.

Academic Year and Semester

i. For proper computation of contact hours for each course in a programme of study, the Commission approved the following:
    a. Two-semester year (first and second semesters for regular courses) for all colleges of education. A long vacation period should be adopted for vacation courses; and
        b. The first and second semesters should last between 17 and 18 weeks each (including registration, teaching and examination periods) provided that not less than 15 weeks during each semester is devoted to teaching. Programmes of study for the long vacation period should last between 11 and 12 weeks, of which 10 weeks are devoted to teaching.
ii. For maximum utilisation of staff and resources, and to give more opportunity to students to take additional courses under the course credit system, Dual Mandate Colleges of Education should operate programmes of the long vacation period in line with the course credit system.

Assessment

In line with the desire of the NCCE to foster quality learning among student teachers, assessment, which measures how well learners have attained the learning outcomes (i.e. the Teacher Standards), is considered pivotal in the 2026 Dual Mandate Minimum Standards for Teacher Education Programmes.

Consequently, accreditation and monitoring exercises in NCE-Degree-awarding institutions shall be geared towards evaluating the extent to which assessment is used to enhance the quality of College graduates as exemplified by the Teacher Standards. The new curricula suggest that Teacher educators need to know and use assessment procedures for learning and not just to gauge student-teachers' mastery of content or skills.

It is expected that each institution has an Internal Quality Assurance (IQA) Unit that shall monitor assessment in the Institution. This IQA Unit should collect, collate, analyse, and regularly update all available forms of data on assessment (from schools, departments, examination offices, student notebooks, teachers' Learning Programmes or Course Outline, etc.).

The NCCE shall audit reports from this Unit during its visits and use them to make judgements about the quality of the programmes of the institution.

In line with the overall educational approach, assessment should not only measure whether student teachers have acquired the necessary content knowledge but also provide evidence that student teachers have acquired the necessary professional skills and attitudes.

Characteristics of Assessment

All NCE-Degree-awarding institutions shall focus on assessments that are:

a. consistent with stipulated Teacher Standards;
b. reliable, valid, credible, and relevant to the learning it measures;
c. held in a suitable and conducive assessment environment;
d. focused on finding out whether students have developed the expected conceptual understanding, as well as problem-solving and practical teaching skills;
e. conducted regularly to enhance and monitor the effectiveness of the learning process; and
f. ensures prompt feedback.

Time and Kinds of Assessment

NCE-Degree-awarding Institutions shall maintain Semester Examination/Continuous Assessment (CA) as currently practised, based on the prescriptions provided in the Dual Mandate Minimum Academic Standards: 60:40 (examination to continuous assessment) for Arts, Humanities, Languages, Sciences and Social Sciences, while for TVET programmes it shall be 40:60 (examination to continuous assessment) with emphasis on practical and hands-on activities.

In addition, all assessments shall be designed to reflect the kind of learning that it intends to measure, so that learning of practical skills is not measured by a theoretical test. Lecturers shall also ensure that their students get feedback after every assessment to give the students the opportunity for improvement in their learning. At the end of each course, an overall assessment shall be given. This overall assessment shall show evidence of the students' achievement of the overall learning in that course.

Management of Assessment

The Management of Assessment shall be based on the prescriptions in the Dual Mandate Minimum Standards. In addition, NCCE shall ensure that every institution shall show evidence of effective examination/assessment procedures by:

a. keeping samples of C.A questions/tests that must be made available for monitoring purposes;
b. appointment of qualified external examiners;
c. analysis and action based on comprehensive reports from external examiners;
d. ensuring that student teachers receive results of each CA task or test within 4 weeks, and of final examinations within 8 weeks after assessment;
e. ensuring the use of appropriate examination questions in terms of the Teacher Standards and the coverage of content;
f. ensuring that student teachers' scripts are consistently assessed with quality marking schemes;
g. maintaining an examination system that provides for adequate redress in case of alleged irregularities;
h. ensuring that the entire assessment procedure for a course is investigated by the IQA Unit where the CA results differ significantly from the overall result; and
i. CA results in a course must be submitted to the HOD and captured by the IQA Unit before the examination of that course takes place.

Review of Assessment Guidelines

One of the mandates of the NCCE as encapsulated in the ACT is the revision of assessment methods and the development of a scheme of National Certification for various products of Colleges of Education. The NCCE has reviewed the methods of assessment in Colleges of Education with a view to harmonising them to ensure parity among these Colleges and ensure consistency with recent developments in education. After due consideration of the responses from Colleges, consideration by the Academic Programmes, Evaluation and Accreditation Committee and the approval by the Boards, the following guidelines were arrived at.

Guidelines

i. Types of Question

All NCE-Degree-Awarding institutions shall use essay type questions and/or objective test items. However, equitable weighting shall be given to practical examinations in some specific schools and subjects that are practically oriented.

ii. Venue of Examination

Examination shall be held in the classrooms or lecture halls arranged for the purpose of examination. However, in some specific schools and subjects, practical examinations shall be conducted on the field or in the laboratory (ies).

iii. Number of Questions

Number of questions shall vary according to the number of Credit Unit (s) as follows:

Essay Question

Credit Unit(s)	Maximum No. of Questions Set	No. of Questions to be Answered	Duration
1 Credit Unit	3	2	1 hr 30 mins
2 Credit Units	5	3	2 hrs
3 Credit Units	6	4	3 hrs

Objective Or Multiple-Choice Questions

Credit Units	Minimum Question Items to be Set	Duration
1 Credit Unit	25	45 mins
2 Credit Units	50	1 hr
3 Credit Units	75	1 hr 30 mins

A question bank should be established and operated from the Deputy Provost's (Academic) office.

Examination Personnel

The following Officers/Committees should be appointed to handle examinations:

i) Departmental Examination Officer

ii) School Examination Officer

iii) College Examination Committee

Functions

The College Examination Committee, membership of which shall comprise (i) and (ii) above and chaired by the Deputy Provost (Academic), shall plan college examinations, set the timetable for examinations, arrange rooms and halls for the examination, secure comfortable accommodation for external moderators, among others.

Collection, Collation and Production of Questions

The Head of the Department shall be responsible for collection, collation and production of questions, and may direct the Departmental Examination Officer to carry out the responsibility on his/her behalf. NCE I Examination Questions shall be internally moderated while NCE II – Degree courses shall be externally moderated before production.

General Examination Regulations

All Examinations shall be conducted by:

i) Chief Examiner (HODs)

ii) Examiner (Course Lecturers excluding Corps members and Assistant Lecturers)

iii) External Examiner (s)/Moderator (s)

iv) Departmental and School Examination Officers.

Note: *Every department shall have Examination Officers.*

Functions

i) Chief Examiner

The Chief Examiner shall:

a. Arrange and supervise departmental Examination (s);

b. Present the results of examinations from the department to the School Board of Examiners and the Academic Board;

c. Ensure that result slips are given out before the commencement of the succeeding semester;

d. Receive examination questions and marking schemes from all course lecturers and course coordinators in the department;

e. Ensure that questions are moderated before final production;

f. Arrange the production and supervision of departmental question papers after External Moderation;

g. Ensure submission of External Moderators' reports to the Director of Academic Planning;

h. Ensure that examination results undergo vetting at a Departmental Meeting;

i. Ensure that results are externally moderated before they go to the College Examination Committee;

j. Present the examination results to the Academic Board Business Committee; and

k. Perform any other examination duties referred to him/her by the Provost.

ii) Examiner

The examiner shall:

a. Set examination questions as and when due and provide the marking scheme;

b. Invigilate examination (s) as scheduled;

c. Mark scripts and make returns within two weeks after the paper has been written;

d. Collate and compute results; and

e. Perform any other duty assigned to him/her by the Chief Examiner.

iii) External Moderator

The External Examiner shall:

a) Scrutinise questions and the marking scheme to ensure coverage of the course content.

b) Reject or reframe questions where necessary.

c) Ensure that scripts are treated in line with the set marking scheme.

d) Ensure correctness of mark summation

e) Write a report in which the following are highlighted in detail:

i. Quality of questions and candidates' responses.

ii. Coverage of course content.

iii. Consistency in awarding marks.

iv. General observation (s) and suggestion (s) for future improvement.

f) Shall submit the report to the Director of Academic Planning through the Chief Examination Officer for onward transmission to NCCE.

iv) Departmental Examination Officer

The Departmental Examination Officer shall:

a. Be a member of the College Timetable Committee;

b. Participate in developing the College examination Timetable, and assign invigilators for all departmental courses to be examined in a semester;

c. Collate examination scores and process examination results in line with the guidelines specified in this curriculum implementation framework; and

d. Perform any examination-related functions as may be referred to him/her from time to time by the Chief Examiner.

College Timetable Committee

Members of the College Timetable Committee are:

i. Director of Academic Planning (Chairman)

ii. Departmental Examination Officers

iii. Director of Quality Assurance

iv. Academic Secretary (Secretary)

The Timetable Committee shall be responsible for setting the lecture and examination timetables, assigning invigilators and supervisors for all examinations;

1. Conduct of Examination (s)

The following guidelines shall apply in the conduct of examinations in NCE-Degree-Awarding institutions:

a. All candidates shall register for College examination by completing appropriate forms to be signed by course Lecturers and HOD(s).

b. To qualify for examination a candidate must have fulfilled all College, School and Departmental requirements including 75% attendance at Lectures in respect of the course (s) to be examined.

c. Knowledge of examination date (s), time (s) and place (s) shall be the responsibility of candidates.

d. A candidate shall arrive at the examination hall and be seated at least 15 minutes before the advertised time on the timetable.

e. Candidates shall not be allowed to leave the examination hall unaccompanied by the invigilator.

f. Candidates shall not be allowed to leave examination hall in the last 15 minutes of the examination.

g. It is compulsory for candidates to display their identity cards on the desk.

h. Candidates must ensure that they sign in and out of examination halls.

i. Answer scripts must be handed over to the invigilator before signing out of the examination hall.

j. Candidates shall not give or receive any form of assistance from any source or anybody during an examination.

k. Candidates shall call the attention of the invigilator only by raising a hand.

l. The use of scrap paper is not permitted. All work must be done on the answer booklets provided by the invigilator. Such paper must be submitted to the invigilator after the examination.

m. Handbags, briefcases and unauthorised calculators are prohibited from the examination hall.

n. Any candidate who violates any of the regulations and those issued from time to time shall be deemed to have displayed indiscipline. Such a candidate shall be treated as appropriate.

o. All electronic devices (handsets, smart rings or watches, smart pen, Bluetooth, smart eyeglasses, etc.) are prohibited in the Examination Hall.

p. Colleges can make additional rules and regulations that will enhance the smooth conduct of examinations.

2. Marking of Examination Scripts

Course lecturers shall mark script (s) in respect of course (s) examined by them. Assistant Lecturers or Youth Corpers on National Service shall only mark scripts under the supervision of an officer of higher academic rank.

3. Academic Board of the College

Academic Board shall continue to perform all functions as stated in the Colleges of Education Establishment Acts.

4. Academic Board Business Committee (ABBC)

There shall be an Academic Board Business Committee (ABBC) that shall comprise the following members:

Member	Role
i. Deputy Provost (Academics)	Chairman
ii. Director, Academic Planning	Member
iii. Director, Quality Assurance	Member
iv. Dean, Students' Affairs	Member
v. Deans of Schools (may come with the HODs to present results/memos)	Members
vi. Deputy Registrar, Academic Affairs	Secretary

Functions

The Committee shall be responsible for

i. Vetting students' results,

ii. Scrutinising memos from schools and presenting them to the Academic Board.

iii. Preparing memos to the Academic Board for consideration and approval

iv. Any other assignment given by the Academic Board

v. Any other matter referred to it by the Provost.

5. Handling of Examination and Result Complaints

Examination Complaints Committee is an Academic Board Committee that shall be set up at the beginning of each academic session to ensure neutrality in the consideration of examination and result complaints affecting students. The Committee shall be chaired by an Academic Staff member not below the rank of Chief Lecturer/Professor. Membership shall comprise representatives of each School in the College and the Secretary shall be provided by the Academic Office. The reports and recommendations of the Committee shall be considered and disposed of by the Academic Board of the NCE-Degree awarding institutions.

6. Minimum Credits Required for Graduation

i. **NCE component:** A student must earn a total minimum of 80 credits for NCE
ii. **Degree component:** A student must earn a total minimum of 70 credits, excluding 30% local content.
iii. For NCE, institutions may have additional courses to the minimum, which shall not exceed 10 credit units (making a maximum of 90 credit units) and shall be peculiar to the individual institution's local content.

7. Attendance

A registered student must attain 75% attendance, which includes both physical and virtual lectures, before he/she may write the end-of-semester examination.

8. Record Keeping

All NCE-Degree-Awarding institutions shall have an 'Examinations and Records' Section in the Registry of the institution. The Section shall be responsible for:

a. Keeping all examination records;
b. Issuance of transcripts;
c. Processing and issuance of results, and final certificates as approved by the Academic Board.
d. And any other responsibility that may be assigned by the College Management

9. Transcripts and Grading

The grading systems shall conform with the NCCE Standards clearly stated in the summary of Dual Mandate Minimum Academic Standards. Students are to be issued with transcripts of their performance either on request by the students or by any recognised

institutions for purpose of admission, job placement or transfer from/to a college. The format (sample) for transcripts is attached and marked Appendix 1.

10. Certificate

All Certificates to be issued to graduates of NCE-Degree-Awarding institutions shall be according to the NCCE specifications and guidelines.

The Security Certificate has:

i) Name and Logo of the Institution

ii) Name of the Recipient

iii) Name of the Certificate

iv) Subjects

v) Date of approval by the Academic Board of the institution

vi) Signature of Provost & Registrar

vii) Signature of Executive Secretary of NCCE (State and Private COEs)

viii) The statement “The above programme is accredited by the NCCE” shall also be on the certificate

Note

a. A sample of the type of certificate is attached and marked Appendix II.

b. Students who graduate from unaccredited programmes shall not be certified.

Quality Assurance

NCCE shall carefully monitor curriculum implementation in NCE-Degree-Awarding Institutions to ensure effectiveness. It shall be the focus of the implementation of the curriculum to attain the desired output (professional teachers). To achieve this, the NCCE shall enhance its Quality Assurance system. The Quality Assurance system shall continue to monitor Institutional curriculum inputs, processes and products to determine whether the intended target (the creation of a body of professional teachers) is achieved.

In the case of the new Programmes to be implemented in NCE-Degree-Awarding Institutions QA system will:

1) assess the quality of leadership and support services and their impact on the quality of administration and the quality of graduate output;
2) assess the quality of staff and student welfare in NCE–awarding Institutions in Nigeria;
3) ascertain the conditions and status of equipment, learning materials and facilities in NCE-Degree-Awarding Institutions in Nigeria;
4) encourage innovation and re-orientation toward the changing needs of the target beneficiaries;
5) encourage and facilitate a variety of learning methods within the Institution's Schools, Departments, etc., that is conducted in a consultative and consensus building fashion [mentoring process];
6) ensure the choice of appropriate and credible student assessment methods relevant to the chosen learning methods;
7) be concerned with good outcomes of the curriculum content;
8) ensure there are adequate resources to deliver the curriculum and
9) ensure the quality of input, process, and output variables that provide information on learning outcomes and their improvement for the purpose of decision making and decision taking.

To enhance its effectiveness, Quality Assurance shall be conducted at two levels, namely:

- Internal Quality Assurance (by the institution offering the NCE programme).
- External Quality Assurance (by the NCCE);

In the case of External Quality Assurance, the NCCE shall continue to carry out Accreditation of institutions and Academic Programmes, Resource Visits, (establishment of new

NCE-Degree-Awarding Institutions and mounting of new programmes), and the Monitoring and Evaluation of Academic Standards in NCE-Degree-Awarding institutions.

The NCCE shall also continue with its responsibility of monitoring institutions' level of compliance with the implementation of Teacher Standards, such as, monitoring of the Teaching Practice, monitoring of Assessment procedures, monitoring of Acculturation/ Language Immersion Programmes and the aspects of Professional Practice.

In the case of Internal Quality Assurance, all NCE-Degree-Awarding institutions must establish an Internal Quality Assurance Directorate to ensure that the guidelines provided in this Implementation Framework are followed. The Directorate should be headed by an experienced and accomplished lecturer not below the rank of a Chief Lecturer/Professor. The Director will head the Directorate for a tenure of 2 years which is also renewable for another two years. There should also be a Deputy Director who should also be an accomplished academic staff not below the rank of Principal Lecturer/Associate Professor. The Directorate should have not less than four support staff which should include a clerk, an administrative staff, a data analyst and an Office Assistant.

Below is the organogram of the Quality Assurance Directorate:

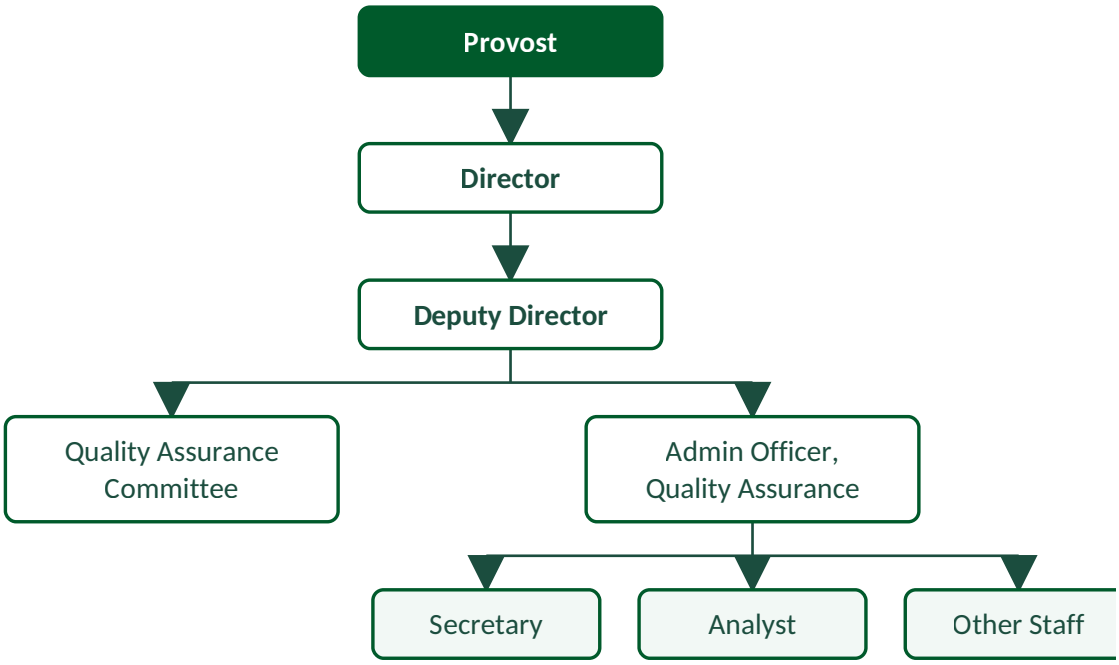


Fig. 1. Structure of the Quality Assurance Directorate (Organogram)

The roles of the Directorate will include the following:

I. Generates formative data that can be used to improve the quality of the management and delivery of the NCE and Degree courses;

II. Provides information to the public and other interested partners about quality and standards;

III. Authenticates and keeps samples of students' journals;

IV. Ensures that quality and standards are maintained in the schools and the college in general;

V. Collates, analyses and provides self-assessment records of the institution and

VI. Reports to the Management on a monthly basis or as the need arises.

VII. Monitors Teaching and learning

VIII. Reports of the external examiner shall be made available to the Directorate.

IX. Periodic internal accreditation is carried out.

The Directorate needs some degree of autonomy and full support from the College Management if it is to achieve its goals.

Internal quality assurance processes and procedures shall be carried out at three levels; input, process and output.

INPUT	PROCESS	OUTPUT
• Entry requirements used to admit candidates • Qualification of students admitted and conformity to entry requirements • Number registered versus carrying capacity • Facilities and equipment (quality and adequacy) • Curriculum availability and content adequacy and relevance • Environment (academic, social, welfare, safety, gender-sensitive)	• Orientation of students and staff • Adequacy of teachers (qualification, experience, number) • Number of lectures and early commencement • Attendance of lectures by students • Adequacy of practical/SIWES/TP • Extent of coverage of curriculum (moderators' report); TP report from schools • Diversity of questions • Standard of examination questions and marking schemes (moderators' report) • Implementation of external examiners' reports • Teacher–student relations • Evaluation of teachers by students	• Distribution of class of degree/certificates • Employers' evaluation • Adaptability of product to open market • Comparative assessment by visiting lecturers; report from collaborators • SIWES report from industries/institutions

To carry out internal accreditation, the Quality Assurance Directorate shall use the Accreditation Toolkits. To get full accreditation of the institution and academic programmes, the institution should score a minimum of 'satisfactory' in key area A and the programme should score a minimum of 'satisfactory' in key area B as contained in the Accreditation Toolkits.

Feedback mechanisms shall be obtained from the following sources among others:

- Teachers assessment by their students
- CA scores and marked scripts (these should get back to students at least two weeks before the examinations).
- Report of internal moderation of Examination questions.
- Feedback from employers
- Report of course experience questionnaire on students
- External moderators report.
- Feedback from products that are self-employed, particularly in some areas like Technical and Vocational Education and Theatre Arts, etc.

Uses of the Feedback

Data from the feedback shall be used by the Institution for decision-making towards improvement in the system.

Students shall also use feedback available to them to improve on their performance and overall conduct in the College.

To enable the Directorate to generate data to monitor input, process and output, instruments shall be developed for each expected task. Samples of the instruments are presented as Appendixes I-III. It is hoped that more shall be developed and validated by the Quality Assurance Directorates of Colleges.

Teaching Practice Unit

Functions

a) Develop, apply and periodically review the Teaching Practice Assessment Booklet; Student Reflective Journal, Training Manual for Mentors, etc.;

b) Plan, organise and coordinate the entire Teaching Practice Programme;

c) Assess and ensure that all schools to be used for TP are learner-friendly and appropriate for the TP exercise;

d) Disseminate information on various quality parameters of Teaching Practice;

e) Organise inter- and intra-institutional workshops and seminars on the effective implementation of Teaching Practice guidelines;

f) Document the various programmes/activities of Teaching Practice;

g) Work closely with academic departments, the Cooperating Schools, relevant stake-holders (e.g. NCCE, NUC, TETFund, SUBEB, etc.) and the Directorate of ICT for the purpose of maintaining /enhancing quality of Teaching Practice exercise;

h) Promote and help sustain the culture of quality in the Teaching Profession;

i) Prepare and submit the Report/result of the Teaching Practice Exercise annually to the Academic Board through the Chairman of the Teaching Practice Committee.

j) Coordinate logistics during external assessment.

Appointment of the Head of Teaching Practice

- The Dean, School of Education, shall be the Chairman of Teaching Practice. The Head of the Department of Curriculum and Instruction is the coordinator of the Teaching Practice and shall be answerable to the Dean of Education, while the Dean is answerable to the Provost and the Academic Board.

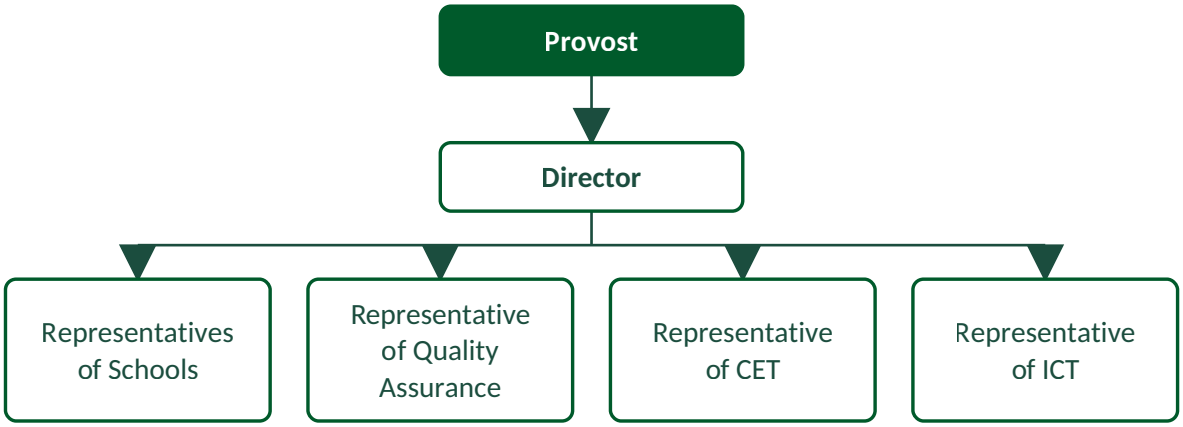
Membership of the Teaching Practice Committee

The members of the Committee shall include:

- The Dean, School of Education (Chairman)
- Director, Academic Planning
- Director of Quality Assurance
- Director of ICT
- Deans of Schools

- Representative of Centre of Educational Technology (CET)
- Coordinator (HOD Curriculum and Instruction) of Teaching Practice (Secretary)

Organogram of the Teaching Practice Directorate



Organogram of the Teaching Practice Directorate

Teaching Practice Guidelines

Teaching Practice (TP) is a crucial aspect of Teacher Education. Teaching Practice provides student teachers with an opportunity for the acquisition of necessary professional skills through practical experience. This will prepare them for effective professional practice after graduation.

The Dual Mandate Academic Minimum Standards lay great emphasis on Teaching Practice. The new Minimum Standards specify that Teaching Practice should be done in the first semester of the third year for a minimum period of 18 weeks. Teachers must be assigned to student-teachers for mentoring. Teachers with not less than 5 years' experience should be appointed and trained by colleges as school-based mentors, using the Mentoring Training Manual. The appointed officers shall mentor the practising teachers in the Cooperating Schools. NCE-Degree-Awarding institutions shall take responsibility for the training of student-teachers on TP. In addition, micro-teaching shall be elevated to continuously support teacher trainees before teaching practice and before they graduate. Evaluative comments on the progress of the students should form part of their Reflective Journals. Colleges must also provide adequate support in the form of orientation for the trainees.

NCE-Degree-Awarding Institutions must assign specialised supervisors to student teachers in their specific areas of study such as ECCE and Special Needs Education to ensure that such supervision is focused, well-informed and based on the supervisors' practical/ professional skills and knowledge.

A prerequisite to Teaching Practice is a pass in Micro-Teaching which should span through the entire duration of the penultimate year. Students must pass Micro-Teaching Practicum (EDU 224) and all first semester courses before proceeding on Teaching Practice. Therefore, it is essential that NCE-Degree-Awarding institutions ensure that methodology courses and their related content are planned to complement Micro-Teaching opportunities. Students shall also take advantage of the Centre for Educational Technology (CET) in acquiring skills in improvisation and teaching aids preparation long before they begin teaching practice.

Consequently, NCE-Degree-Awarding institutions shall ensure that teacher educators design and coordinate a comprehensive Teaching Practice Preparation Programme for student teachers. Such a Preparation Programme shall present student teachers with a gradual building up of TP preparation assignments. These assignments shall require student teachers to design lesson plans, learning materials, and assessment tasks which they can use when they are in a school during Teaching Practice. Micro-Teaching and classroom observation activities are also to be done.

Classroom observation shall begin with teacher trainees taking turns to visit demonstration or relevant schools to observe how teaching and learning take place in the relevant methodology courses. Students shall render relevant reports about their experiences. Such reports shall be reviewed and thoroughly discussed during class sessions with a view to driving home needed experiences for successful Teaching Practice and teaching roles. All students shall undergo a two-week classroom observation towards Teaching Practice preparation and should be carried out in the various College Demonstration Schools. This shall be captured in the Dual Mandate Minimum Standards for General Education curriculum. In this way, student teachers shall be prepared in a consistent and effective manner for a Teaching Practice experience that adds value and allows student teachers to develop and apply professional skills.

Student teachers shall keep extensive Students Reflective Journals as the build-up towards Teaching Practice and during Teaching Practice itself. Such Journals shall be regularly reviewed by mentors in the presence of practising teachers to reinforce desirable skills. In addition, cooperating teachers shall study the Journal and provide comments to aid student teachers to identify strengths and weaknesses in their professional skills. During TP

supervision, Supervisors shall take into account documented records of practising teachers in their assessment and correction of teacher trainees.

NCE-Degree-Awarding Institutions are also expected to design and operate School-based Teachers Professional Development Programmes (SBTD) that assist teachers in these schools to enhance their profession and also to become effective mentors. Meetings of various Departments within a School must be held at least three times in a semester to share ideas on Teaching Practice and provide peer-support for teachers.

NCCE shall carry out a regular quality assurance exercise to ensure that NCE-Degree-Awarding institutions comply with the Teaching Practice guidelines. NCE-Degree-Awarding Institutions shall be required to provide reports outlining the quality of the outcomes of Teaching Practice to NCCE. These reports will include samples of Students Reflective Journals.

Generally, NCE-Degree-Awarding institutions shall provide evidence on how they have assessed students on Teaching Practice in line with the Teacher Standards.

In summary, it is expected that:

1. NCE-Degree-Awarding institutions shall provide a comprehensive Preparation Programme (Classroom observation, scouting/contact/survey, orientation for staff and students, mentorship, etc. shall be carried out by the College) for Teaching Practice, by effectively coordinating content and method courses and linking these meaningfully with Micro-Teaching opportunities;

NCE-Degree-Awarding institutions shall conduct Teaching Practice Orientation that shall address:

a) Student teachers' expectations
b) Ethical and professional issues in Teaching Practice;
c) Areas for Student Teachers to focus on during Teaching Practice;
d) Practical activities: mentoring, improvisation of instructional materials;
e) Relationship between supervisors, mentors and Student Teachers;
f) The importance of feedback; and
g) Different aspects of pedagogy that the students will be trying out in the classroom

Teaching Practice Code of Conduct

Every NCE-Degree-Awarding institution shall provide Code of Conduct for students during Teaching Practice. In general, all Student Teachers are expected to:

a) Have a positive attitude towards teaching
b) Attend school every day
c) Arrive on time
d) Dress smartly and appropriately
e) Build appropriate relationships with pupils and teachers, parents and the school community
f) Plan and prepare lessons in advance
g) Teach classes using a variety of appropriate techniques
h) Manage behaviour of pupils positively without using physical or emotional punishment
i) Meet regularly with the school-based mentor
j) Attend professional development meetings
k) Complete a journal about their experiences
l) Learn from classroom observation by observing different teachers, learning from what they observe and putting new ideas into practice
m) Take part in all the activities in the school (curricular and co-curricular)

2. Micro-Teaching shall be coordinated by the School of Education and the Department of Curriculum & Instruction in collaboration with the Centre for Educational Technology.
3. Teaching Practice shall take place in the appropriate school.
4. Student teachers must go to their practising schools with samples of prepared lesson plans, lesson notes, learning materials, and assessment tasks;
5. Student teachers shall participate in all activities of the school when on Teaching Practice;
6. Each student teacher shall be assessed at least **ten** times during the Teaching Practice period (six assessments by the College (60%), the host institution (20%) and the Reflective Journal (20%)).
7. NCCE is to ensure that NCE-Degree-Awarding Institutions comply strictly with the use of Teaching Practice Assessment Form.
8. Supervision of Teaching Practice exercise shall be carried out by both the internal and external Supervisors/Monitoring Team/ Cooperating Schools.
9. Student teachers shall keep a Student Reflective Journal as part of the Teaching Practice assessment.

Appendices: Official Instruments, Forms and Samples

Teaching Practice Assessment Form

TEACHING PRACTICE ASSESSMENT FORM

NAME OF STUDENT: .....

MATRIC NO: .....

SUBJECT: .....

TOPIC: .....

CLASS TAUGHT: .....

TIME: .....

DATE: .....

TEACHING PRACTICE SCHOOL: .....

DATE: .....

		MAXIMUM	MARK AWARDED	COMMENT
1	**PREPARATION (12 Marks)**			
	(a) Statement of objectives: Stated in behavioural terms	5		
	(b) Content: Logical, properly sequenced...	2		
	(c) Adequacy/Comprehensive (as reflecting facts/knowledge, values/attitude & skills).	3		
	(d) Conformity of topic with scheme of work/ Weekly Diary	2		

		MAXIMUM	MARK AWARDED	COMMENT
2.	**PRESENTATION (52 Marks)**			
	(a) Introduction (Relevance) to the topic	5		
	(b) Development of Lesson	5		
	(c) Mastery of subject matter	10		
	(d) Skilful use of chalkboard	3		
	(e) Time Management skills	3		
	(f) Questioning Skills	5		
	(g) Competence in use of instructional materials: – Relevance (2) Appropriate timing (2) – Adequacy (2) Variety (2)	8		
	(h) Competence in Enhancing Class participation	8		
	(i) Capacity for Effective Conclusion.	5		
3.	**SKILLS OF CLASS MANAGEMENT**			
	(a) Class Control	5		
	(b) Class Arrangement	2		
	(c) Reaction of pupils to reinforcement of pupils' responses	2		
4.	**COMMUNICATION SKILLS (7 Marks)**			
	(a) Clarity of Voice/Audibility	2		
	(b) Appropriate use of language	5		
5	**EVALUATION SKILLS (10 Marks)**			
	(a) Suitability of assessment tool	4		
	(b) Comprehensiveness of the assessment	3		
	(c) Attainment of stated objectives.	3		

		MAXIMUM	MARK AWARDED	COMMENT
6.	**TEACHER'S PERSONALITY/PROFESSIONAL ATTITUDE AND VALUES (10 Marks)**			
	(a) Neatness & Appropriate Dressing	3		
	(b) Readiness/Diligence/Adaptability	2		
	(c) Learner-friendliness	2		
	(d) Comportment	3		
	TOTAL SCORE	**100**		
Additional Comments				
……				
Name and Signature of Supervisor: …… Date: ……				

Teaching Practice Monitoring Form A

INSTITUTIONAL MONITORING

1.	Name of Institution:	.....
2.	State:	.....
3.	Programme:	.....
4.	Session:	.....
5.	Duration of Teaching Practice:	.....
6.		.....
a.	Availability of Teaching Practice Committee:	.....
b.	Structure of Teaching Practice Committee:	.....
7.	Availability of Code of Conduct for Student-Teachers:	.....
8.	Organisation of Orientation/Induction Workshop for Supervisors:	.....
9.	Organisation of Orientation/Induction Workshop for Student-Teachers:	.....
10.	No. of Supervisors per student:	.....
11.	Average No. of Visits per student:	.....
12.	Documentation of Cooperating Schools and Teachers	.....
13.	Ratio of Assessment by College and Cooperating Schools	.....
14.	Particulars of External Moderators	.....
i.	Name:	.....
ii.	Address:	.....
iii.	Qualification:	.....
iv.	Rank:	.....
15.	Adequacy of Funds:	.....
i.	Provision of Transport Allowance	.....
ii.	Provision of Night Allowance	.....
iii.	Honorarium	.....
iv.	Provision of Teaching Practice Materials	.....
16.	Availability of a vehicle for Teaching Practice	.....

Instrument for Analysis of Examination Question Papers

Department .....

Session/Semester .....

Course Code .....

Course Title .....

Checklist

No.	Item	Yes	No
1.	**Is the question paper well titled?**		
	(i) Does it have the name of the College?	☐ Yes	☐ No
	(ii) Does it have the name of the School?	☐ Yes	☐ No
	(iii) Does it have the name of the Department?	☐ Yes	☐ No
	(iv) Is the session indicated?	☐ Yes	☐ No
	(v) Is the semester indicated?	☐ Yes	☐ No
	(vi) Is the course code indicated?	☐ Yes	☐ No
	(vii) Is the course title indicated?	☐ Yes	☐ No
	(viii) Is the credit unit indicated?	☐ Yes	☐ No
2.	Are there clear instructions on the question paper?	☐ Yes	☐ No
3.	Is the duration given on the question paper?	☐ Yes	☐ No
4.	Is it in conformity with the credit load?	☐ Yes	☐ No
5.	Is the print on the question paper legible?	☐ Yes	☐ No
6.	Is the language appropriate?	☐ Yes	☐ No
7.	Is the language free from error?	☐ Yes	☐ No
	If no, state the error:		
8.	Are the questions benchmarked?	☐ Yes	☐ No
9.	Do the questions adequately cover the course content?	☐ Yes	☐ No
10.	Are formulae, equations and diagrams well written (where applicable)?	☐ Yes	☐ No
	If no, state the problem:		

No.	Item	Yes	No
11.	Does the number of questions comply with the NCCE guideline?	☐ Yes	☐ No

Essay Questions

Credit Unit(s)	Number of Questions Set	No. of Questions to be Answered
1	3	2
2	5	3
3	6	4

Objective or Multiple-Choice Questions

Credit Unit(s)	Minimum Number of Questions Set
1	25
2	50
3	75

No.	Item	Yes	No
12.	**Do the questions reflect Bloom's Taxonomy?**		
	(i) Knowledge (Remembering)	☐ Yes	☐ No
	(ii) Comprehension (Understanding)	☐ Yes	☐ No
	(iii) Application (Applying)	☐ Yes	☐ No
	(iv) Analysis (Analysing)	☐ Yes	☐ No
	(v) Synthesis (Evaluating)	☐ Yes	☐ No
	(vi) Evaluation (Creating)	☐ Yes	☐ No
13.	What suggestion(s) would you like to make for further improvement?		

Instrument for Monitoring Students' Hostel Accommodation

Using the scale below, please evaluate to the best of your ability the following:

Strongly Agree (A = 4); Agree (B = 3); Disagree (C = 2); Strongly Disagree (D = 1)

Put a circle wherever appropriate

1	Hostel rooms are maintained clean always	4	3	2	1
2	Hostel toilets/bathrooms are kept clean and disinfected	4	3	2	1
3	Hostel environment is grassed and kept clean	4	3	2	1
4	Regular water supply is provided	4	3	2	1
5	Electricity is regularly provided	4	3	2	1
6	Bed spaces are adequate	4	3	2	1
7	Wardrobes are available in the hostel	4	3	2	1
8	Reading tables and chairs are available	4	3	2	1
9	Hostel rules and regulations are enforced	4	3	2	1
10	There is fairness and transparency in room allocation	4	3	2	1
11	There is quick/prompt response to genuine problems in the hostel	4	3	2	1
12	Security in the hostel is adequate	4	3	2	1
13	Availability of functional common rooms/relaxation centres	4	3	2	1
14	Overall I am happy with my accommodation	4	3	2	1

Sample Mentoring Observation Instrument

Purpose

The ***sample mentoring Observation Instrument*** is designed primarily to elicit feedback aimed at improving teaching processes and programme effectiveness in colleges of education. Summative data collected using this instrument will inform the development of quality assurance measures to improve programme efficiency and effectiveness. It will also be used to develop systemic structures for ongoing teacher professional development training during mentoring.

To be successful in its purpose, the use of this instrument is to be **non-judgemental and embedded in mutual respect and trust between mentors and mentees observed**.

The goals of successful mentoring are to:

- Support teacher reflective practice.
- Provide constructive feedback to enhance professional practice.
- Improve the teaching and learning environment.
- Provide a framework for mentor support of less experienced teachers.
- Increase programme effectiveness and efficiency through development and implementation of systemic strategies directly linked to identified areas of need
- Attain best practices in higher education
- Support effective experiences and learning outcomes for higher education students
- Ultimately promote increased effectiveness and capacity of programme graduates to meet required competency in the field

Note

- **Information collected from peer-peer use of this instrument is NOT to be used for determination of promotion or professional benefits.**

Who Should Use this Observation Instrument?

- Peer groups made up of teachers of colleges of education
- Quality Assurance officers in Institution of higher learning
- Mentors assigned mentees in on-going School-based Teacher Development (SBTD)
- Relevant departments of educational organisations

How to Use This Classroom Observation Instrument

Pre-Observation

- Get familiar with the observation instrument
- Meet with the teacher at least 48 hours before the class to be observed.
- During the meeting, explain the goal of the observation i.e. to improve teaching and learning processes by identifying aspects of classroom processes that are working well and aspects that need to be improved/supported.
- Contact the teacher to be observed at least 48 hours before the observation date, to complete sections 1 and 2 of the observation form. The teacher may be contacted via email or other alternative means and the sections provided, allowing time for the teacher to think through and provide answers. This section is crucial to lay the foundation for reflective practice and to engage the teacher as a partner in the observation process.

- Facilitate a positive, friendly meeting. Remember your role is a peer/mentor and researcher. Bear in mind that the goal of the observation is to collect data to strengthen teaching and learning processes within programme departments. The teacher is a volunteer and partner, enabling the process.

Observation

- Arrive before the class starts and preferably before most students should typically arrive.
- Remind the teacher to introduce you to the students and ask the teacher to direct you to sit where you would not obstruct the teaching-learning process.
- Pay attention to student behaviours, reactions, interactions, engagement and participation during the lesson.
- Do NOT participate in classroom activities.
- Take separate notes as the class progresses to assist with your reflections, completion of the instrument and constructive feedback.
- Write specific examples related to each component as specified in the instrument. These examples are critical to grounding feedback and developing relevant professional development strategies. Remain after the class ends to give immediate overall feedback regarding observed strengths/weakness to the teacher.
- Mentors of non-teaching staff should give specific examples of components of assigned duties given to mentees. These examples are critical to grounding feedback and developing relevant professional development strategies.

Post-Observation

- Develop detailed feedback within 48 hours from observation date.
- Use “I” rather than “you” statements to give constructive feedback e.g. instead of saying “you only used one example throughout” say “I found your example about … was very helpful. I think using more of such examples may be powerful to help students connect”.
- Give feedback on areas to be strengthened by using starting phrases such as “what do you think about…”, “I wonder how students would respond if ….”
- Provide copies of the completed observation form and any additional writing to:
    - The teacher.
    - College quality assurance unit.

Note

- Other relevant agencies such as NCCE, FME, NERDC, UBEC etc. may utilise this instrument to gather information for quality assurance purposes.

Observation Instrument

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
Observer/mentee Data	
Name: Rank:	
Phone:	
Years of teaching experience in higher education: Years of teaching the programme:	
Trainings attended in the last three years: 1 ☐ 2 ☐ 3 ☐ 4 and above ☐ Purpose of observation is Monitoring and Mentoring ☐ Others (please specify):_____	
Teacher/mentor Data	
Name: Rank:	
Years of teaching experience in the college of education: Years of teaching the course:	
Phone: email:	
Trainings attended: number of in-service trainings 1☐ 2☐ 3☐ 4 and above☐ Any previous Monitoring and Mentoring experience Yes ☐ No ☐ Others (please specify):_____	
Section 2: Pre-Observation	

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
Course Code: Course Title:	**Semester:**
Lesson Topic:	
Lesson start time: Lesson end time:	
Course objectives:	
Teacher Goals	
Teacher's Lesson Goals: Two key concepts/learning I expect my students to gain from this lesson	
1	
2	
List of instructional materials/aids I (teacher) plan to use for the lesson:	
Specific Feedback: Two areas of my teaching I would like to be observed and receive feedback on	
1	
2	
CLASSROOM OBSERVATION **Reminders:** • **Do NOT participate in classroom activities.** • **Ask the teacher to introduce you to the class and to direct you to sit in a place where you will not obstruct the teaching-learning process.**	
Section 3: Teaching Method	
Please tick all boxes that apply and fill in all observation report boxes	

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
1	Lesson started on time: Yes ☐ No ☐
2	Lesson included: Small group activities ☐ Student Presentation (s) ☐ Game (s) ☐ Small gr discussions ☐ None of the above ☐
3	Strategies used to support student critical thinking included: Open-ended questions ☐ Inviting evaluation/challenge of theoretical ideas ☐ Inviting student interpretation/examples from the field ☐ Others (please specify): _____ None ☐
4	Lesson included content related multimedia in the form of: Presentation slides ☐ Video ☐ Online Resources/Websites ☐ Photos ☐ Animation ☐ Others (please specify): _____ None ☐
5	Lesson consisted primarily of: Note taking ☐ Teacher lecture ☐ Participatory approaches ☐
6	All students were encouraged to participate in activities: Yes ☐ No ☐
7	Students appeared interested and engaged: Most of the time ☐ Half of the time ☐ Not much of the time () Not at all ☐
8	At what point of the lesson (if any) did the attention of students begin to drift? Near the beginning ☐ Near the middle ☐ Near the end ☐ Not applicable ☐
9	Based on your observation, list factors that might have caused students' attentions to drift (if applicable)
10	What did the teacher do to recapture student's attention (if applicable)?
11	All students were treated respectfully: Yes ☐ No ☐ Give example from observation:

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
12	There was a general atmosphere of respect regardless of gender, culture or age: Yes ☐ No ☐ Give example from observation:
13	A general positive and comfortable atmosphere was maintained regardless of gender, culture or age: Yes ☐ No ☐ Give example from observation:
14	Male and female students had equal access to: • Materials Yes ☐ No ☐ • Make presentations Yes ☐ No ☐ • Answer questions Yes ☐ No ☐ • Participate in classroom discussion: Yes ☐ No ☐ Give example from observation:
15	Student questions were answered clearly: Yes ☐ No ☐ Give example from observation:
16	Students were redirected to research the answers to questions for themselves, for discussion at the next class: Yes ☐ No ☐ Give example from observation:
17	Students were mostly addressed by their names: Yes ☐ No ☐
18	Professional ethics was the standard in the classroom: Yes ☐ No ☐ Give example from observation:
Section 4: Curriculum content	
19	Lesson was clearly introduced? Yes ☐ No ☐ One specific example from lesson:
20	Lesson objectives/goals were well clarified: Yes ☐ No ☐ One specific example from lesson:

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
21	Learning concepts were linked to practical real life examples: Yes ☐ No ☐ One specific example from lesson:
22	Clear linkage was made between the previous and current lesson: Yes ☐ No ☐ One specific example from lesson:
23	Lesson content related directly to expected learning outcomes: Yes ☐ No ☐ One specific example from lesson:
24	The following professional practice components were integrated in the lesson: 1. Field work/Community involvement practice Yes ☐ No ☐ 2. Development of play-based activities for children's learning Yes ☐ No ☐ 3. Child observation Yes ☐ No ☐ One specific example from lesson:
25	Delivery of curriculum content was organised to simulate child learning environment wher applicable: One specific example from lesson:
26	Formative evaluation opportunities were used to assess student learning during the lesson Yes ☐ No ☐ One specific example from lesson:
27	Summative evaluation opportunities were used at the end of the lesson to assess student overall attainment of lesson objectives: Yes ☐ No ☐ One specific example from lesson:
28	List all instructional materials used by the teacher:
Section 5: Physical Environment	
29	Total number of students in the class: _____

Section 1: General Information **Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date**	**Observation Date:**
30	Seating consisted of: Movable chairs ☐ Movable desks ☐ Fixed desks: ☐ Fixed chairs: ☐ Others (please specify): _____
31	There were enough seats for all students to work comfortably Yes ☐ No ☐
32	Seating arrangements would support small group collaboration when necessary Yes ☐ No ☐
33	Physical space for the number of students was: Cramped ☐ Just adequate ☐ Very large ☐
34	Lighting consisted of: Adequate natural lighting ☐ Adequate electrical lighting ☐ Not enough lighting ☐
35	Functioning technology in the classroom included: Video Cassette Recorder (VCR) ☐ Projector ☐ Linked computer with internet access ☐ Others (please specify): _____ None ☐
36	Location of classroom had: No noise intrusion from outside ☐ Disruptive noise from outside ☐ Source of outside noise (if noisy) _____
37	List all teaching/learning resources available in the classroom
Section 6: Suggestions for Improvement (based on post observation reflection) **Please clearly identify the following:**	
38	What worked well to support lesson goals (based on the teacher's identified lesson goals in section 2)

Section 1: General Information Please complete sections 1 & 2 at least 48 hours before the observation date. Information may be obtained via email/ phone or other means of communication prior to observation date	Observation Date:
39	What did not work well (in relation to achieving the teacher's identified lesson goals in section 2)
40	Provide practical and constructive suggestions for the teacher regarding methods (other/n ideas to further enhance achievement of teacher's identified lesson goals)
41	Provide practical suggestions for management regarding professional development needs the teacher (one to two areas where the teacher will benefit from additional support to further enhance their teaching. Must be clearly linked to identified areas that did NOT wo well in lesson delivery/classroom management)
42	Provide practical suggestions for management regarding facilities (physical facilities of the classroom that need improvement to increase lesson delivery/comfort/student collaborati etc.)
43	Provide specific effective strategies observed that may be shared to support peer development (list successful strategies used by the teacher that contributed to effective student learning and engagement)

Other comments:
Section 7: Comments of the mentee
The mentee's signature in this section is to signify that the mentee has reviewed the completed observation. It does not denote agreement with the mentor's comments.
I have reviewed the content of the observation Yes ☐ No ☐
Other comments:
Signature: Date:

Instrument for Students' Evaluation of Lecturers

(The student should not write his/her name on this form)

Please be honest in your response to the following statements about each of the lecturers of this course. All information supplied shall be treated with utmost confidentiality

A) I. Is the lesson taught by a team of lecturers Yes () No ()

ii. Lecturers' Name……

iii. Lecturers' School…….

iv. Lecturers' Department ……

v. Course Code and Title ……..

vi. Semester ……..

vii. Date …….

viii. Number of Students in the class ……

B) Please tick () in the column that best expresses your opinion with respect to each statement about the lecturer of this course. (5=excellent; 4=very good; 3=good; 2=fair; 1=poor).

S/N	STATEMENT	5	4	3	2	1
1	Lecturer's punctuality for lectures					
2	Lecturer's regularity at lectures					
3	Provision of course outline to the students					
4	Coverage of course content					
5	Explanation of the course content to the under-standing of the students					
6	Avoids scheduling lectures at obscure or odd hours					
7	Lecturer's voice clear and audible					
8	Lecturer communicates well					

S/N	STATEMENT	5	4	3	2	1
9	Lecturer simplifies the course content to the understanding of the students					
10	Practices team teaching					
11	Lecturer's use of teaching resources/aids					
12	Regular attendance taken					
13	Student's participation and involvement in the lesson					
14	Effective time management					
15	Recommendation of relevant and useful textbooks					
16	Attaches score to purchase of textbooks/ learning materials					
17	Accessibility to students					
18	Readiness to answer students questions					
19	Lecturer conducts continuous assessment regularly					
20	Attaches gifts to the award of grades					
21	Lecturer's moral conduct					
22	Dresses decently					
23	Lecturer's comportment					
24	Does not condone academic dishonesty among students					

S/N	STATEMENT	5	4	3	2	1
25	Discourages indiscipline among students					
26	Maintains fairness to all students					

(C) Mention two things you like best about the lecturer
……
……

(D) Mention two things you dislike about the lecturer
……
……

For official use only

Excellent	
Very good	
Good	
Fair	
Poor	

Sample NCE Transcript

Name of College

College Logo

Official Transcript

(Any erasure invalidates this transcript)

(A) Name	……	**Matriculation Number**	……
Date of Birth	……	**Sex**	……
Programme	……	**Year of Admission**	……

Year of Graduation .....

Course Code(s)	Course Title(s)	Course Status	Course Unit(s)	Course Score %	Letter/ Grade Point(s)	Remarks
NCE I 2000/2001: 1st Semester						
i)						
ii)						
iii)						
NCE I 2000/2001: 2nd Semester						
i)						
ii)						
iii)						
NCE II 2000/2001: 1st Semester						
i)						
ii)						
iii)						
NCE II 2000/2001: 2nd Semester						
i)						
ii)						
iii)						
NCE III 2000/2001: 1st Semester						
i)						
ii)						
iii)						
NCE III 2000/2001: 2nd Semester						
i)						
ii)						
iii)						

MUNG ..... **CNUT** ..... **CNUP** ..... **CGPA** .....

Certificate Obtained and Class .....

HOD's Comment .....

.....

Signature/Date .....

_____

Signature of Registrar

Note

MUNG	Minimum Number of Units for Graduation
CNUT	Cumulative Number of Units Taken (Registered)
CNUP	Cumulative Number of Units Passed (Earned)
CGPA	Cumulative Grade Point Average

Sample Degree Transcript

Name of College

College Logo

Official Transcript

(Any erasure invalidates this transcript)

(B) Name ..... **Matriculation Number** .....

Date of Birth ..... **Sex** .....

Programme ..... **Year of Admission** .....

Year of Graduation .....

Course Code(s)	Course Title(s)	Course Status	Course Unit(s)	Course Score %	Letter/ Grade Point(s)	Remarks
400 Level (year): 1st Semester						
i)						
ii)						
iii)						
400 Level (year): 2nd Semester						
i)						
ii)						
iii)						
500 Level (year): 1st Semester						
i)						
ii)						
iii)						
500 Level (year): 2nd Semester						
i)						
ii)						
iii)						

MUNG ..... **CNUT** ..... **CNUP** ..... **CGPA** .....

Certificate Obtained and Class .....

HOD's Comment .....

.....

Signature/Date .....

_____

Signature of Registrar

Note

MUNG	Minimum Number of Units for Graduation
CNUT	Cumulative Number of Units Taken (Registered)
CNUP	Cumulative Number of Units Passed (Earned)
CGPA	Cumulative Grade Point Average

Sample NCE Certificate

Certificate No. ……

THE INSTITUTIONAL LOGO

This is to certify that

_____

having completed an approved course of study, passed the examinations and fulfilled all the requirements prescribed by the College, has this day …… under the authority of the Academic Board been awarded the

NIGERIA CERTIFICATE IN EDUCATION (NCE) ……

in

……

Registrar

…… ……

Date **Provost/Rector**

The above programme is accredited by the National Commission for Colleges of Education (NCCE).

NCCE Seal

Executive Secretary
National Commission for Colleges of Education

Date ……

Sample Degree Certificate

INSTITUTIONAL LOGO

CERTIFICATE OF AWARD

This is to certify that

FULL NAME OF GRADUATE

having satisfied the requirements prescribed by the University

has been duly awarded the degree of

NAME OF DEGREE

CLASSIFICATION / SPECIALISATION, WHERE APPLICABLE

in recognition of the successful completion of the approved programme of study.

Faculty/School	Department	Date of Award	Certificate No.
FACULTY	DEPARTMENT	DATE	[REFERENCE NUMBER]

_____ _____ _____

REGISTRAR **VICE-CHANCELLOR** **DATE**

Certification

At the end of the training, all NCE-degree-awarding institutions shall award Certificates in the approved programmes.

Graduate Employability Tracking Framework for Dual Mandate Curriculum Implementation

Introduction and Rationale

The Dual Mandate allows Colleges of Education to award degrees in education alongside the Nigeria Certificate in Education (NCE). A new curriculum is only as good as the graduates it produces, and the clearest test of that is whether they find work that uses their training.

At present, the colleges of education have no routine way of knowing what happens to graduates after graduation. Accreditation looks mainly at inputs and processes such as staffing, facilities and curriculum delivery. It says little about outcomes beyond employers' rating. Yet, employers continue to report gaps in graduates' teamwork, problem-solving, communication, digital and classroom skills. Without outcome data, colleges cannot tell which programmes are working, and NCCE cannot tell whether the dual mandate is achieving its purpose.

This framework closes that gap. It makes graduate employability tracking a standing part of the curriculum, so that every cohort's outcomes are measured and used to improve the next one.

Purpose and Objectives

The purpose of the framework is to give the NCCE and every college a reliable, comparable measure of how employable their graduates are, and to use it to improve teaching and the curriculum.

The objectives are to:

1. Establish a standard set of employability indicators for NCE and degree graduates across all colleges.
2. Track every graduating cohort at fixed points after graduation, using common instruments.
3. Capture employers' views of graduates' skills and the skills they need.
4. Identify skill gaps at student, programme, college and national level.
5. Feed findings into curriculum review, accreditation and student support.

6. Publish an annual national report on graduate employability in the Colleges of Education sector.

Scope and Coverage

The framework applies to every College of Education approved to run the dual mandate curriculum, whether federal, state or private.

Area	Covered
Graduates	All NCE and Bachelor's Degree Graduates of each cohort, full-time and part-time
Cohorts	Every graduating cohort from the first dual mandate graduates onward; existing NCE cohorts from the last three sessions as a baseline
Programmes	All NCE and degree programmes, reported separately by school and subject combination
Employers	Public and private schools, State Universal Basic Education Boards (SUBEBs), and non-teaching employers of graduates
Students	Final-year students, through the exit survey and employability portfolio

Degree graduates are tracked from the end of their National Youth Service Corps (NYSC) year. NCE graduates, who do not serve, are tracked from graduation.

Definition of Key Terms

Term	Meaning in this framework
Cohort	All graduates who complete the same programme in the same academic session
Dual mandate	The arrangement under which colleges of education award both the NCE and Bachelor's Degrees in education
Employability portfolio	A record, kept by each student, of skills, Teaching Practice reports, projects and certificates
Graduate employability	A graduate's capacity to gain and keep work that uses their training, or to sustain self-employment
Graduate Employability Unit (GEU)	The office in each college responsible for running this framework

Term	Meaning in this framework
Graduate-level employment	Paid work, including teaching, for which the graduate's qualification is required or clearly relevant
Self-employment	Running one's own business or practice, including private tutoring and school ownership, as the main occupation
Skill gap	The difference between the skills employers require and the skills graduates show
Tracer survey	The standard questionnaire used to collect each graduate's employment status at a tracking point
Tracking point	A fixed time after graduation (or after NYSC) at which a cohort is surveyed

Guiding Principles

(i) **Comparability:** All colleges use the same indicators, definitions, instruments and tracking points, so results can be compared across colleges and over time.

(ii) **Whole-cohort coverage:** Every graduate is followed, not a convenient sample. Response rates are reported with every result.

(iii) **Both sides of the market:** Graduates' outcomes are read alongside employers' views of the skills they need.

(iv) **Use, not just collection.** Every indicator must lead to a decision in curriculum review, accreditation or student support.

(v) **Protection of graduates' data:** Personal data are collected with consent and handled in line with the Nigeria Data Protection Act 2023.

(vi) **Fairness:** Results are used to improve programmes and support students, never to penalise individual graduates.

(vii) **Proportionate effort:** Data collection is digital, short and built into existing college processes.

Employability Indicators and How They Are Computed

The headline measure is the **Graduate Employability Rate (GER)** at 12 months: the share of graduates available for work who are in graduate-level employment or self-employment.

$$\text{GER} = \frac{\text{graduates in graduate-level employment + graduates in self-employment}}{\text{respondents} - \text{those in full-time further study} - \text{those not seeking work}} \times 100$$

Graduates in full-time further study, and those not seeking work, are left out of the denominator so that colleges are not penalised for graduates who choose to keep studying. Every indicator below is reported separately for NCE and degree graduates, by programme, sex and college.

No.	Indicator	How it is computed	Tracking point
1	Graduate Employability Rate (headline)	As above, × 100	12 and 36 months
2	Teaching Placement Rate	Graduates employed as teachers ÷ graduates available for work × 100	12 and 36 months
3	Relevant Employment Rate	Employed graduates whose job uses their field of study ÷ all employed graduates × 100	12 and 36 months
4	Self-Employment Rate	Self-employed graduates ÷ graduates available for work × 100	12 and 36 months
5	Graduate Unemployment Rate	Graduates seeking work without a job ÷ graduates available for work × 100	12 and 36 months
6	Further Study Rate	Graduates in full-time further study ÷ all respondents × 100	12 months
7	Time to First Employment	Median months from graduation (or end of NYSC) to first graduate-level job	12 and 36 months
8	Informal Employment Share	Employed graduates without a written contract or pension cover ÷ all employed graduates × 100	12 and 36 months
9	TRCN Registration Rate	Graduates registered with the Teachers Registration Council of Nigeria ÷ all respondents × 100	12 months
10	Employer Satisfaction Index	Mean employer rating of graduates across the standard skills list, on a 1–5 scale	Yearly
11	Skill Gap Score (per skill)	Mean importance employers attach to the skill minus mean rating of graduates on it, both 1–5	Yearly
12	Tracer Response Rate	Completed tracer surveys ÷ graduates in the cohort × 100	Every tracking point

A result is published only when the response rate for that cohort and programme is at least 50%, or is flagged as indicative when it is lower.

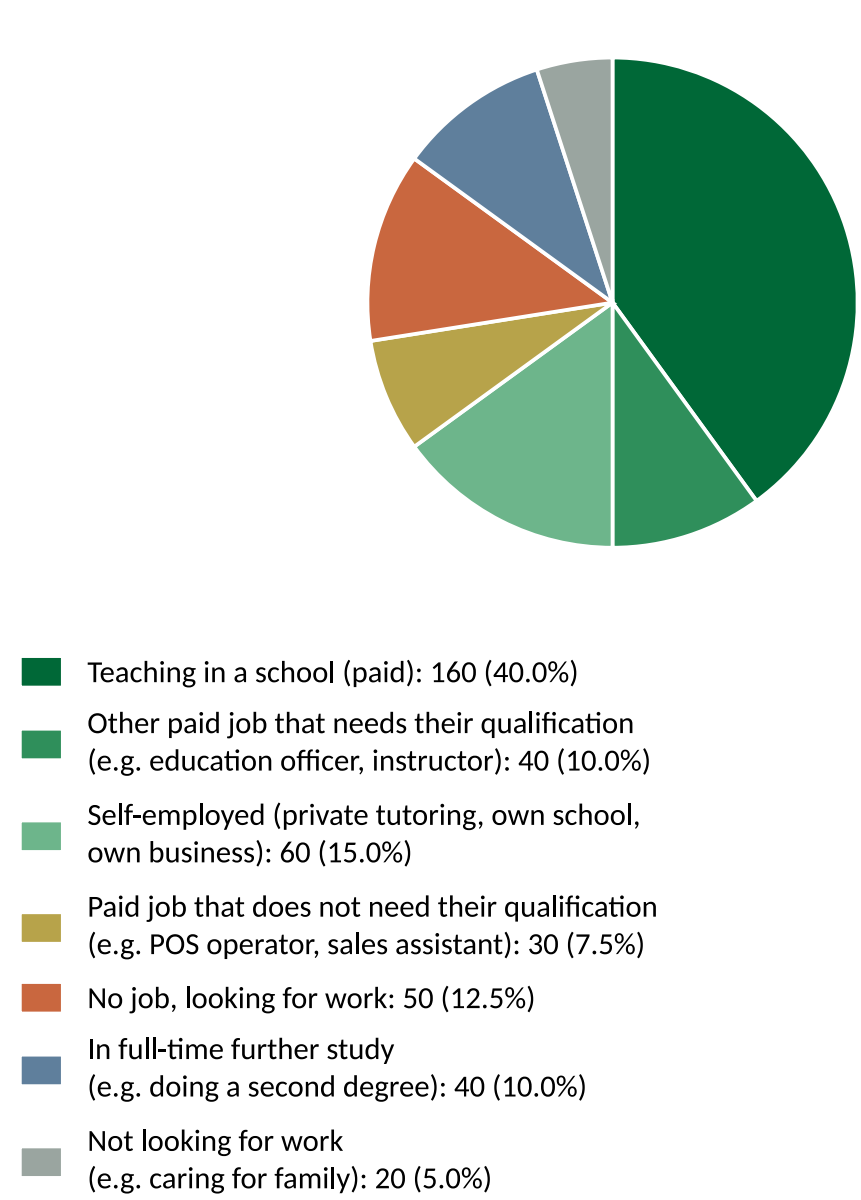
Sample of How to Determine and Interpret Employability Indicators

The data presented below are for illustrative purposes only.

Federal College of Education (Technical), Gombe, had **500 NCE/DEGREE graduates** in 2025. Twelve months later, **400 of them completed the tracer survey**. These 400 are the **respondents**. Their answers:

Table 1: Sample Data

What the graduate is doing	Number
Teaching in a school (paid)	160
Other paid job that needs their qualification (e.g. education officer, instructor)	40
Self-employed (private tutoring, own school, own business)	60
Paid job that does **not** need their qualification (e.g. POS operator, sales attendant)	30
No job, looking for work	50
In full-time further study (e.g. doing a 2nd degree)	40
Not looking for work (e.g. caring for family)	20
Total respondents	**400**



Distribution of graduates in the sample data (Table 1)

Step 1: Get the "graduates available for work". Most of the formulas divide by this number, so it is better to get it first.

Graduates Available for work = Respondents (400) − Further study (40) − Not seeking work (20) = 400 − 40 − 20 = **340**

Step 2: Next, get the "graduate-level employment". These are the people whose paid job requires their qualification: teachers (160) + other relevant paid jobs (40) = **200**.

The headline formula: GER

$$\text{GER} = \frac{\text{graduates in graduate-level employment + graduates in self-employment}}{\text{respondents} - \text{those in full-time further study} - \text{those not seeking work}} \times 100$$

$$\text{GER} = \frac{200 + 60}{400 - 40 - 20} \times 100$$

$$\text{GER} = \frac{260}{340} \times 100$$

$$\text{GER} = 0.7647 \times 100$$

$$\textbf{GER = 76.5\%}$$

This means that about 3 in every 4 graduates who wanted work found good work or created their own. The 30 graduates in jobs that do not require their qualifications are counted as available for work, but not as successes.

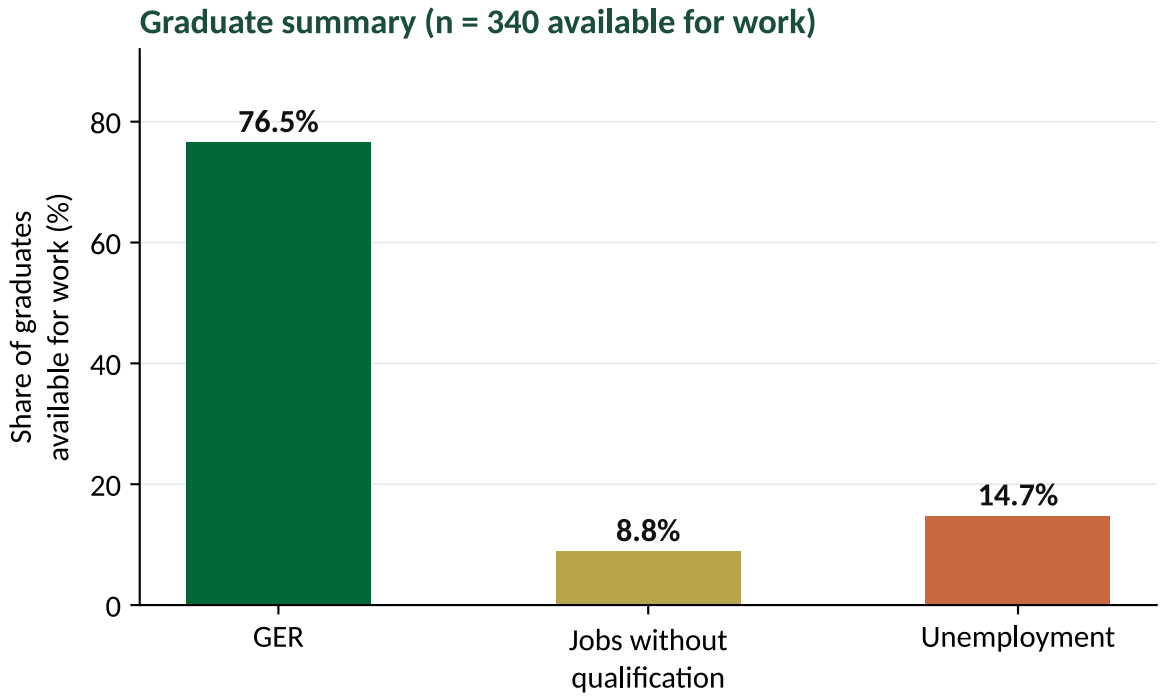
Table 2: Further Calculations

For these other indicators, use the same college and Table 1

No.	Indicator	Working	Result
2	Teaching Placement Rate	Teachers ÷ available = 160 ÷ 340 × 100	**47.1%**
3	Relevant Employment Rate	All employed = 200 + 60 + 30 = 290. Of these, say 215 use their field (160 teachers + 30 out of 40 of the other paid jobs with their qualification + 25 private tutors). So, 215 ÷ 290 × 100 **Note: "say 215" or "say 25" will be the actual data from the survey**	**74.1%**
4	Self-Employment Rate	60 ÷ 340 × 100	**17.6%**
5	Graduate Unemployment Rate	50 ÷ 340 × 100	**14.7%**
6	Further Study Rate	40 ÷ **400** × 100 (all respondents, not 340)	**10%**
8	Informal Employment Share	Say 116 of the 290 employed have no written contract or pension. 116 ÷ 290 × 100 **Note: "say 116" will be the actual data from the survey**	**40%**

No.	Indicator	Working	Result
9	TRCN Registration Rate	Say 180 are registered. 180 ÷ 400 × 100	**45%**
11	Skill Gap Score (per skill)	Mean importance employers attach to the skill minus mean rating of graduates on it, both 1–5 **Go to 10 and 11 below**	Yearly
12	Tracer Response Rate	400 completed ÷ 500 in the cohort × 100	**80%**

Justification: GER (76.5%) + people in jobs that do not need their qualification (30 ÷ 340 = 8.8%) + unemployment (14.7%) = **100%**.



Graduate summary: GER, jobs without qualification and unemployment

The calculations below are not percentages

7. **Time to First Employment (the median).** From the survey, get the number of months it took each graduate to get their first graduate-level job, from smallest to largest, then take the middle value.

Example

- 7 graduates took 3, 5, 6, **8**, 9, 12 and 14 months. The middle (4th) value is **8 months**.

- With an even number, take the two middle values and average them. For 3, 5, 6, 8, 9 and 12 months, the median is (6 + 8) ÷ 2 = **7 months**.

The median is used instead of the average because one graduate who took 40 months would pull the average higher.

10. **Employer Satisfaction Index.** Three employers each rate graduates on 4 skills, on a 1–5 scale (1 means the lowest rating while 5 means a high rating):

- Employer A: skill1: 4, skill2: 3, skill3: 5, skill4: 4 (total 16 in 4 skills)
- Employer B: skill1: 3, skill2: 3, skill3: 4, skill4: 2 (total 12 in 4 skills)
- Employer C: skill1: 5, skill2: 4, skill3: 4, skill4: 3 (total 16 in 4 skills)

$$\text{Index} = \frac{\text{sum of ratings}}{\text{number of ratings}}$$

$$\text{Index} = \frac{44}{12}$$

Index = 3.67 out of 5

11. **Skill Gap Score (one skill at a time).** Gap = average importance employers give the skill − average rating employers give the graduates on it.

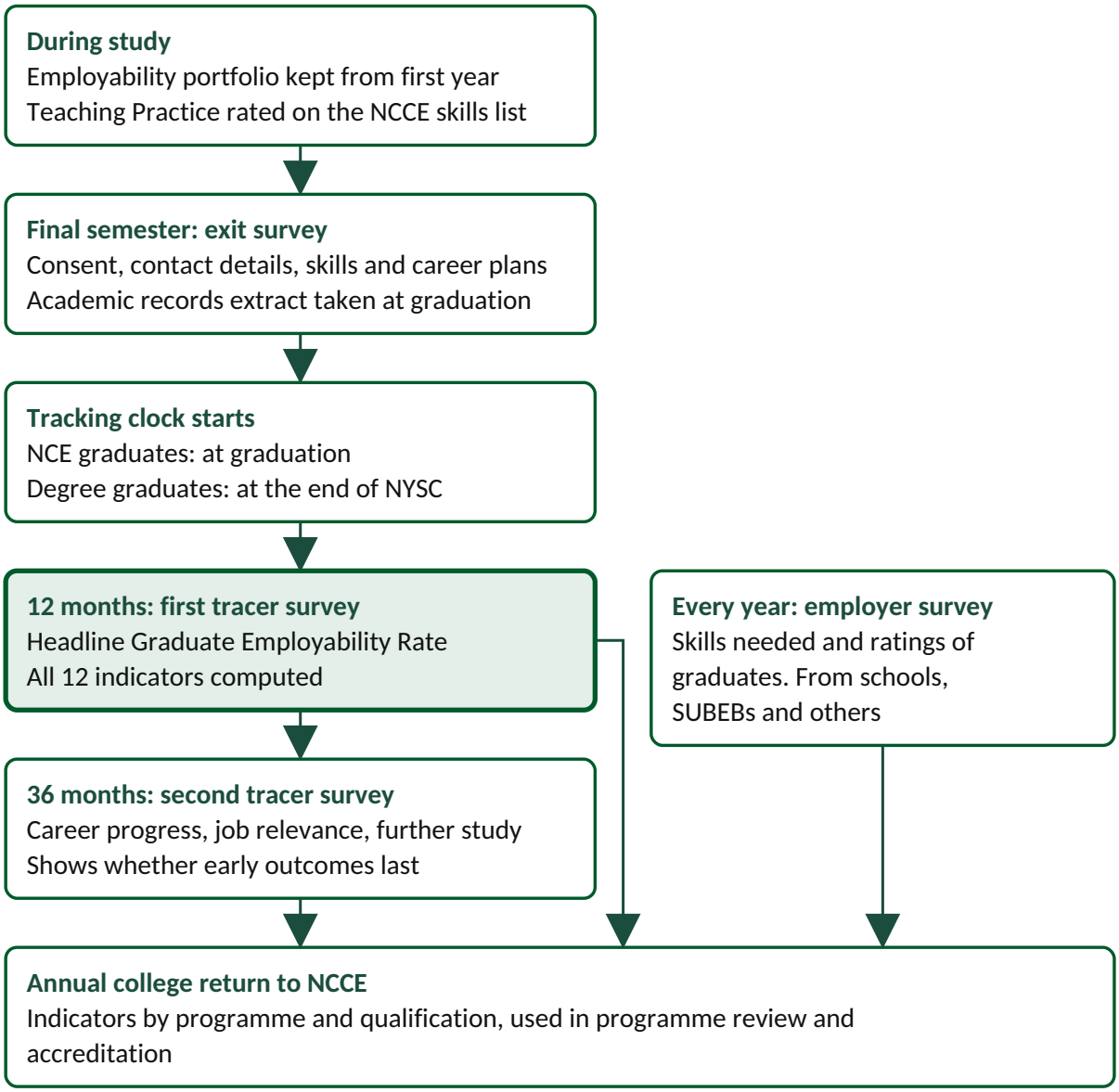
Skill	Importance (3 employers)	Graduates' rating	Gap
Digital skills	5, 5, 4 → average 4.67	3, 2, 3 → average 2.67	**2.00**
Classroom management	5, 4, 5 → average 4.67	4, 4, 5 → average 4.33	**0.33**

Note: *The bigger the gap, the more the curriculum needs to work on that skill. Here, digital skills are the urgent one. A gap near zero means graduates already meet what employers need.*

The Tracking Mechanism

Each graduate is followed at fixed points from study to 36 months after graduation, and every college reports the results to NCCE once a year.

The 12-month tracer survey gives the headline rate; the 36-month survey shows whether early outcomes last. Every survey round runs in the same months nationally, so results are comparable across colleges.



Each tracer round follows the same steps:

a. The GEU sends the online survey to every graduate in the cohort due for tracking.

b. Non-respondents receive SMS and phone reminders over six weeks.

c. The GEU cleans the data and uploads it to the NCCE database.

d. NCCE checks quality, computes the indicators and returns results to the college.

Data Sources and Collection Instruments

Five standard instruments, issued by NCCE and used unchanged by every college, supply the data.

Instrument	Who completes it	When	What it collects
Exit survey	Every final-year student	Final semester, before results are released	Contact details and consent, programme, Teaching Practice and other work experience, self-rated skills, career plans
Graduate tracer survey	Every graduate	12 and 36 months after graduation (degree: after NYSC)	Employment status, employer type, job title, relevance to training, contract type, time to first job, TRCN registration, further study
Employer feedback survey	Schools, SUBEBs and other employers of graduates	Once a year	Skills required and their importance, rating of graduates on the standard skills list, hiring intentions
Academic records extract	College registry	At graduation	CGPA, class of NCE pass or degree class, Teaching Practice grade, programme and subject combination
Job vacancy scan	College GEU, with NCCE	Once a year	Skills and qualifications requested in teaching and other vacancies relevant to graduates

Surveys are completed online, with SMS and phone follow-up for non-respondents. Phone numbers and e-mail addresses given at exit, plus alumni associations and social media, are used to reach graduates.

The minimum data items for each instrument are listed in the annexes.

Institutional Structures, Roles and Responsibilities

NCCE sets the standard and holds the national data; each college runs the tracking through a dedicated Graduate Employability Unit (GEU).

Actor	Responsibilities
NCCE	Issue indicators, instruments and guidelines; host the national graduate tracking database and dashboard; check data quality; publish the annual national report; use results in accreditation and curriculum review
College management (Provost)	Establish and fund the GEU; appoint a GEU coordinator; approve and submit the college's annual employability return

Actor	Responsibilities
Graduate Employability Unit (GEU)	Run the exit, tracer and employer surveys; maintain graduate contact records; analyse results; prepare the college report; run career guidance and employability activities
Schools and departments	Appoint an employability focal person; review programme results each year; propose curriculum and teaching changes
Academic Board	Approve changes to programmes arising from employability results
Students and graduates	Complete the exit survey and keep an employability portfolio; respond to tracer surveys; update contact details
Alumni association	Help locate graduates and encourage responses
Employers and SUBEBs	Complete the employer survey; host Teaching Practice and placements; sit on an Employer Advisory Panel
Employer Advisory Panel	Advise the college each year on skills in demand and on programme relevance

Embedding Employability in the Curriculum

Tracking measures employability; the curriculum must also build it. Every dual mandate programme should include the following.

(i) **Employability skills mapping:** Each course lists the employability skills it develops, drawn from a standard NCCE skills list covering teaching, digital, communication, problem-solving, teamwork, leadership and entrepreneurial skills.

(ii) **Career guidance:** Structured career guidance in every year of study, led by the GEU, including CV writing, interview preparation and job search.

(iii) **Digital skills:** Practical training in productivity tools, digital teaching tools and online professional presence.

(iv) **Employability portfolio:** Each student keeps a portfolio from first year, reviewed at exit and linked to the exit survey.

(v) **TRCN readiness:** Final-year preparation for TRCN registration and the professional qualifying examination.

Data Management, Privacy and Ethics

Graduates' personal data are collected only with their consent and handled in line with the Nigeria Data Protection Act 2023.

a. **Consent:** Students give informed consent to be contacted for tracking in the exit survey, and may withdraw at any time.

b. **Minimum data:** Only the data items listed in the annexes are collected.

c. **One national database:** Colleges upload data to a secure NCCE database using a standard template. Each record carries a unique graduate identifier, not a name, for analysis.

d. **Access:** Colleges see their own graduates' records. NCCE sees all records. Published results contain no information that identifies an individual.

e. **Small groups:** Results for any group of fewer than 10 graduates are not published separately.

f. **Retention:** Personal contact details are kept for five years after graduation, then deleted. Anonymized records are kept for trend analysis.

g. **Data quality:** NCCE checks each upload for completeness and consistency and returns errors to the college within 30 days.

Analysis, Reporting and Use of Results

Results are reported at four levels and each level has a named user who must act on them.

Report	Prepared by	Goes to	Used for
Student employability feedback	GEU	Each final-year student	Personal skill gaps and suggested training before graduation
Programme report	GEU, with the department	Department, school and Academic Board	Changes to course content, teaching methods and placements
College annual employability return	GEU, approved by the Provost	NCCE	Accreditation evidence and college improvement plan
National graduate employability report	NCCE	Colleges, Federal Ministry of Education, the public	Curriculum review, policy and sector planning

NCCE maintains an online dashboard showing each indicator by College, programme, qualification and year. Colleges see their own results against the national average.

Where data allow, analytics such as predictive models may be used to identify students at risk of poor outcomes early, so that the GEU can support them. Any such tool must explain its results and must not be used to make decisions against an individual student.

Link to Accreditation and Performance Benchmarks

Graduate employability becomes an accreditation criterion for dual mandate programmes, phased in so that colleges first build their data before being judged on results.

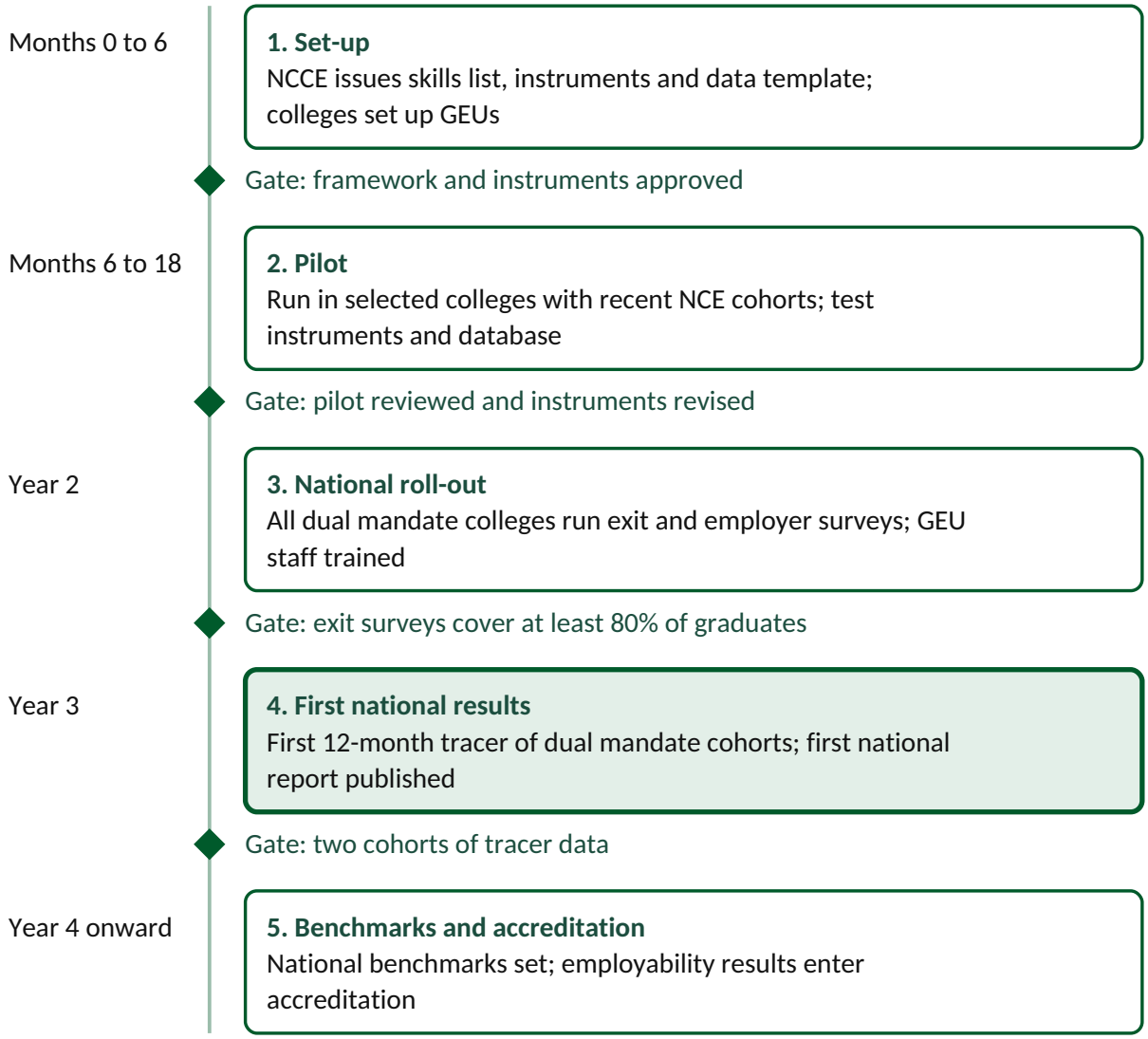
Phase	What accreditation checks
Phase 1 (first two graduating cohorts)	A functioning GEU; exit surveys completed for at least 80% of graduates; tracer survey run on schedule
Phase 2 (from the third cohort)	Tracer response rate of at least 50%; annual return submitted on time; evidence that results were used in programme review
Phase 3 (once national baselines exist)	Programme results compared with the national benchmark for the same qualification; an improvement plan for programmes below it

NCCE sets the national benchmarks for each indicator after two full cohorts of data, rather than in advance. A programme below benchmark is not penalised automatically; it must show a credible improvement plan and progress at the next review.

Implementation Roadmap

The framework is introduced in five phases over about four years, counted from NCCE's approval, with a gate to pass before each next phase.

Employability results enter accreditation only after two cohorts of data



The pilot uses recent NCE cohorts, so that instruments and the database are proven before the first dual mandate graduates leave.

Monitoring and Review of the Framework

NCCE reviews this framework every three years, or sooner if the curriculum changes significantly.

(i) Each year, NCCE reports on how many colleges submitted returns, response rates, and data quality.

(ii) The review checks whether the indicators are still the right ones, whether instruments need updating, and whether results are being used.

(iii) Colleges, employers, SUBEBs, TRCN and graduates are consulted during each review.

(iv) Changes to indicators are introduced at the start of a new cohort, so that each cohort is measured the same way throughout.

Annex A: Minimum Data Items for Exit and Tracer Surveys

Section	Exit survey	Tracer survey (12 and 36 months)
Identification	Graduate ID, college, programme, qualification (NCE or degree), year of graduation	Graduate ID
Background	Sex, age, state of origin	(none)
Contact and consent	Phone, e-mail, alternative contact, consent to be tracked	Updated contact details
Experience	Teaching Practice school type and rating, other work experience, placements	(none)
Skills	Self-rating (1–5) on the standard NCCE skills list	Self-rating on the same list
Career plans	Intended occupation, intention to study further	(none)
Status	(none)	Employed, self-employed, unemployed and seeking work, further study, not seeking work
Job details	(none)	Job title, employer type (public school, private school, SUBEB, other public, other private, own business), state, relevance to training (1–5), contract type, monthly pay band
Job search	(none)	Months to first graduate-level job, main job-search channels
Professional status	(none)	TRCN registration, further qualifications
Feedback	Rating of the programme's preparation for work	Skills most needed in current job and not taught

Annex B: Employer Feedback Items

(i) Employer type, sector, state and number of graduates employed from colleges of education.

(ii) For each skill on the standard list: importance to the job (1–5) and rating of recent graduates (1–5).

(iii) Overall satisfaction with recent graduates (1–5).

(iv) Skills hardest to find in graduates.

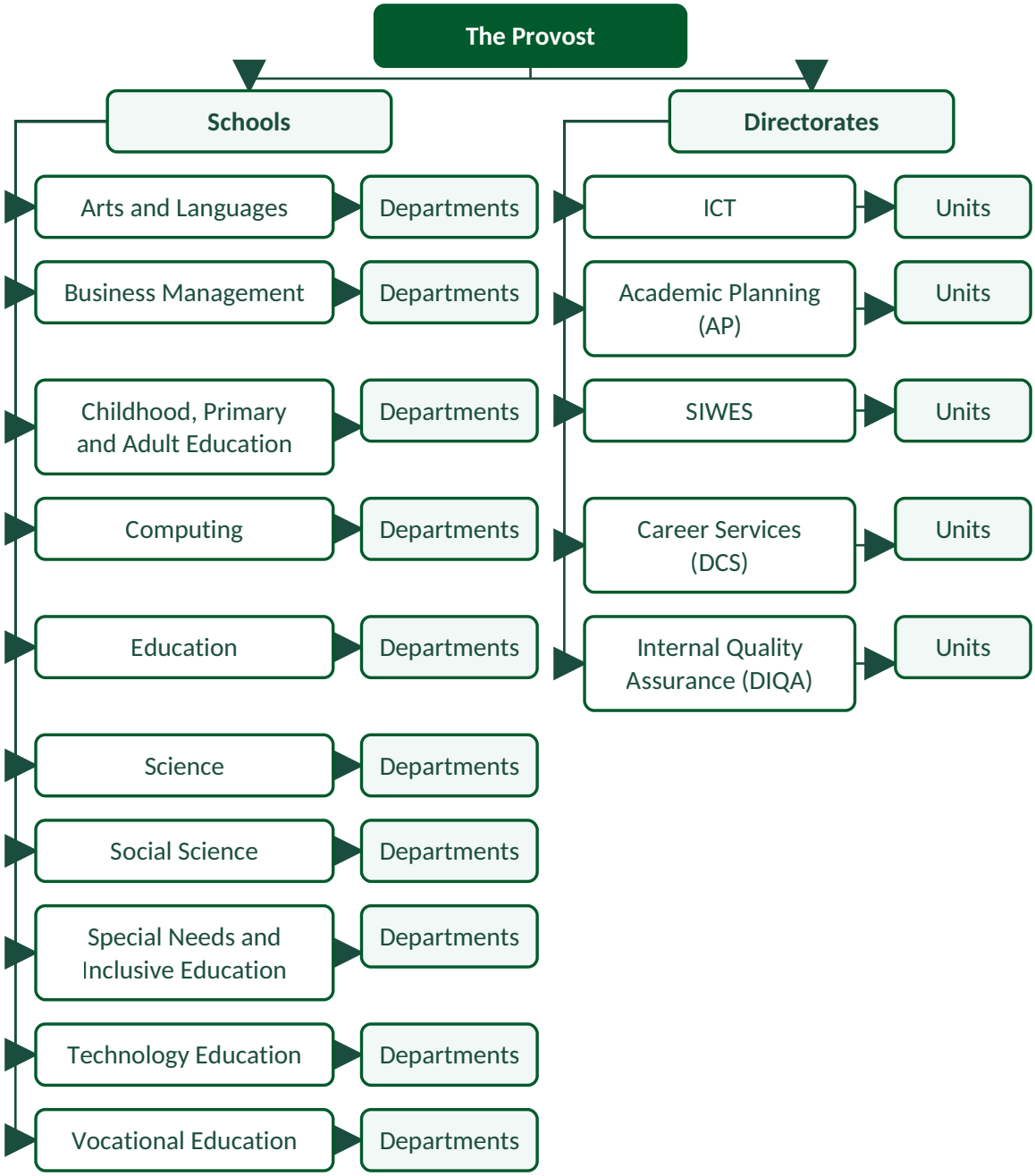
(v) Expected hiring of NCE and degree graduates in the next year.

(vi) Willingness to host Teaching Practice students or join the Employer Advisory Panel.

Annex C: Outline of the College Annual Employability Return

1. College profile and GEU staffing.
2. Cohorts tracked and response rates by programme and qualification.
3. Results for the 12 indicators, with the previous year and national averages.
4. Employer feedback and the five largest skill gaps.
5. Actions taken on last year’s results and their effect.
6. Planned curriculum, teaching and student-support changes for the coming year.

Proposed Organogram for Academic Schools and Directorates



Proposed organogram for academic Schools and Directorates

** Colleges running degree programmes could create a directorate for an undergraduate programme, or such a programme should come under the Directorate of Academic Planning.*