BIOLOGY

1. PHILOSOPHY

The curriculum is designed to produce knowledgeable, highly motivated and effective professional teachers of biology who will support learners to develop an appreciation and understanding of biological processes and principles. The programme is also designed to develop the ability to adapt to the changing situations in science and the technologically oriented society.

2. OBJECTIVES

At the end of the programme, the N.C.E. teacher will be able to:

a. view biology as a process of inquiry into the living world;
b. critically analyze the activities of living things in their environment;
c. demonstrate practical skills in handling scientific apparatus;
d. demonstrate excellence and professional competence in teaching biology;
e. exhibit positive scientific attitudes and values in the society;
f. promote positive disposition towards biological science and the scientific enterprise;
g. apply concepts and methods acquired in the course in new areas of study and in everyday situations;
h. make a successful career in biology teaching; and
i. Successfully qualified to undertake a B.Ed./B.Sc. (Ed) degree programmes.

3. GENERAL ADMISSION REQUIREMENTS

a) Senior Secondary School Certificate of WAEC or NECO or any other equivalent Certificate from recognized examination bodies with credit in five (5) subjects including English Language and Mathematics at not more than two sittings. Two of the credits must be in the relevant subjects making up the combinations the candidates wish to offer.

b) A Grade II Teacher's Certificate (TC II) with credit or merit in five (5) subjects, two of which must be relevant to the course the candidate wishes to offer. Credits in English Language and Mathematics are required for candidates wishing to study Biology.

c) All candidates wishing to be considered for direct admission must meet the requirements of an examination organized by an accredited body such as JAMB.

d) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews for some courses. This is legitimate.

4. FACILITIES

i) Laboratory Space

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

ii) Lecture Halls

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.

iii) Staff Offices

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

iv. 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.

v. Equipment and Materials

S/№	Description	Quantity Required
a) Models and charts		
1.	Skeletal System	1
2.	Muscular System	1
3.	Brain and Nervous System	1
4.	Circulatory System	1
5.	Digestive System	1
	Eye and Vision	1
6.	Ear	1
7.	Skin and Excretory Organs	1
8.	Genetic Models	4

S/№	Description	Quantity Required

b) Equipment and Consumables

1.	Hand lenses	40
2.	Microscopes	20
3.	Incubator/Sterilizer	1
4.	Autoclave (Portable)	3
5.	Balances	3
6.	Hot Plates	1
7.	Refrigerator	1
8.	Water Filter	1
9.	Hygrometer	1
10.	Drying Oven ($30^{oc} – 120^{oc}$)	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.	Photometer	1
19.	UV/Visible spectrophotometer	1
20.	Water quality testing kits	1
21.	Kymograph	10
22.	Dissecting Microscopes	2
23.	Insect Light Traps	1
24.	Insect Box Traps	1
25.	Slide Projector	1
26.	Overhead Projector	2
27.	Steel Frame Aquaria	1
28.	Oxygen Meter	1
29.	Binocular Microscopes	4
30.	Embedding Bath	5
31.	Glass distiller	1
32.	Water Bath	1
33.	pH Meter	2
34.	Tissue Grinder	4
35.	Calorimeter	6
36.	Auxanometer (electric)	4
37.	Soil Augur	2
38.	Plant Press	2
39.	Soil Treating Kit	1
40.	Wooden Quadrants	10
41.	Measuring Tape	5
42.	Biological Kit/Dissecting Sets	10
43.	Dissecting Boards/Plate tray	40
44.	Bunsen Burners	20
45.	Giant Gas Cylinder	2

46. Prepared and Plane microscope slides (Assorted)
47. Consumables: Glass wares, stains, chemicals (Assorted)
48. Test tube rack 10
49. Preserved plant and animal specimens (Assorted)
50. Desiccators 3
51. Gloves
52. Safety devices (assorted)

5. PERSONNEL

i) **Academic Staff**

A minimum of 10 academic staff are required to adequately implement the N.C.E. Biology 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.

ii) **Non-Teaching Staff**

a) Technologist - Three
b) Technician - One
c) Junior Staff

One each of the following:

- Laboratory attendant
- Laboratory assistant
- Gardener/Curator
- Cleaner
- Typist
- Office assistant

6. MODE OF TEACHING

For the broad objectives of teaching the subject to be achieved, the following methods are recommended.

a) Lecture method
b) Practical
c) Project method
d) Field trips and excursions
e) Games and simulations
f) Team teaching
g) Demonstration method
h) Tutorial
i) Concept mapping and computer assisted

7. GRADUATION REQUIREMENTS

Biology	24	Credits
Second Teaching subjects	24	Credits
Education	24	
Teaching Practice	6	Credits
General Study	16	Credits

Total **94 Credits**

8. **TEACHING PRACTICE**

The whole of 300 level first semester should be devoted to teaching practice i.e. starting from mid-September to April. This covers two terms to school year or 26 weeks. Teaching Practice earns 6 credits under Education 311.

9. **PROJECT**

Final Year project is compulsory for all graduating students. The project may be written or practical and supervised in any area of the student's chosen subjects and the grade for the Project should be credited to EDU 323. Project carries 2 credits.

10. **SUBJECT COMBINATION**

Only subject combination approved by the National Commission for Colleges of Education (NCCE) is acceptable.

11. **SEMESTER EXAMINATION**

1) Examinations for Practical courses carry 40% and C. A = 60%
2) Examinations for Theory courses carry 60% and C. A= 40%

ll. **COURSE CODE COURSE TITLE CREDIT UNIT AND STATUS**

NCE 1 FIRST SEMESTER				
S/№	COURSE CODE	COURSE TITLE	COURSE CREDITS	STATUS
	BIO 111	Basic Principles & Cell Biology	1	C
	BIO 112	Ecology	1	C
	BIO 113	Viruses, Bacteria & Lower Plants	2	C
	BIO 114	Biology Practical l	1	C
		Total	5C	

NCE 1 SECOND SEMESTER				
	BIO 121	Diversity of Invertebrates	1	C
	BIO 122	Diversity, Anatomy and Histology of spermatophytes	2	C
	BIO 123	Biology Methods	1	C
	BIO 124	Biology Practical II	1	C
		Total	**5C**	

NCE II FIRST SEMESTER				
	BIO 211	Diversity of Chordates	1	C
	BIO 212	Research Methods and Biometry	1	C
	BIO 213	Plant Pathology	1	E
	BIO 214	Biology Practical III	1	C
		Total	**3C + 1E=4**	

NCE II SECOND SEMESTER				
			COURSE	STATUS

S/№	COURSE CODE	COURSE TITLE	CREDITS	
	BIO 221	Plant Physiology	1	C
	BIO 222	Anatomy, Histology & Physiology of Vertebrates	2	C
	BIO 223	Embryology	1	E
	BIO 224	Biology Practical IV	1	C
		Total	4C + 1E=5	

NCE III FIRST SEMESTER				
	EDU 311	TEACHING PRACTICE	6	C

NCE III SECOND SEMESTER				
	BIO 321	Applied Biology	2	C
	BIO 322	Parasitology	1	C
	BIO 323	Genetics and Evolution	2	C
	BIO 324	Biology Practical V	1	C
		TOTAL	6	

COMPULSORY GSE COURSES FOR ALL STUDENTS

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
*GSE 000	Media Information Literacy	2	Compulsory
GSE 111	General English I	1	Compulsory
GSE 112	Introduction to Library Studies	1	Compulsory
GSE 121	General English II	1	Compulsory
GSE123	Introduction to Computer Studies I	1	Compulsory
GSE 124	Family Life & Emerging Health Issues	1	Compulsory
GSE 211	General English III	1	Compulsory
GSE 213	Introduction to Computer Studies II	1	Compulsory
GSE 214	Trafficking in Persons Issues	1	Compulsory
GSE 221	General English IV	1	Compulsory
GSE 223	Citizenship Education	1	Compulsory
GSE 224	Entrepreneurship	1	Compulsory
GSE 322	General English V	1	Compulsory
	TOTAL	= 14	

NOTE: The course below is going to be offered in First and Second Semester NCE I & II (4 semesters)

*GSE 000	Media Information Literacy	2	Compulsory

OTHER GSE COURSES TO BE OFFERED BY STUDENTS OF THE DEPARTMENT

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
GSE 323	Science & Technology in Society	1	Compulsory
GSE 324	Political Economy	1	Compulsory
	TOTAL	= 2	

COURSE DESCRIPTION

NCE 1 FIRST SEMESTER

BIO 111 - BASIC PRINCIPLE OF BIOLOGY 1 Credit. Compulsory

Objectives

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

a. Apply basic biology principles to everyday life.
b. Explain steps involved in scientific method
c. Describe the cell theory
d. Draw and label plant and animal cells
e. List the cell constituents
f. Differentiate between mitosis and meiosis.

Topics

- Definition, brief history and Importance of science
- Scientific Method-Identifying and defining problem, raising question, formulating, Hypotheses, designing experiments to test hypothesis, collecting data, analyzing data, drawing inference and conclusion.
- Science processes/intellectual skills-Basic processes: observation, Classification, measurement etc., Integrated Processes-Experimentation, prediction, Hypothesis, Communicating, Theory formulation etc.
- Science of biology and its subdivisions: Botany, Zoology, Biochemistry, Microbiology, Ecology, Entomology, Genetics, etc.
- The Relevance of Biology to man: Application in conservation, Agriculture, public health, medical sciences etc.
- Relation of Biology to other science subjects
- Principles of classification: Brief history of classification nomenclature, and systematic
- The 5-kingdom system of classification.

- Living and non-living things-General characteristics of living things. Differences between plants and animals, A brief history of the concept of cell and cell theory, The structure of a generalized plant cell and a generalized animal cell, and their comparison
- Protoplasm and its properties.
- Cytoplasmic Organelles-Definition and functions of nucleus, endoplasmic reticulum, cell membrane, mitochondria, ribosomes, golgi complex, plastids, lysosomes and other cell organelles, Chemical constituents of cell – salts, carbohydrates, proteins, fats and oils, nucleic acid, Physical processes of cell-particle size, molecules and ions, suspensions, colloids and true solutions, properties of aqueous system-diffusion, osmosis plasmolysis, turgor, pinocytosis, phagocytosis, Cell Division-Mitosis and meiosis,- Major stages of mitosis and meiosis, comparison of the two divisions, Significance of mitosis and meiosis

BIO 112 ECOLOGY 1 Credits Compulsory

Objectives

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

a. Describe basic concepts used in ecology
b. Explain plant succession and biotic interaction eg. Symbiosis, Commensalism, predation, parasitism, competition etc.

Topics

- Basic terms and concepts of ecology - autecology, syneacology, environment, habitat, niche, ecosystem, adaptation.
- Ecological factors (their measurement and units in which the values are expressed).
- Soil studies – soil components, soil properties, beneficial role of soil organisms, soil fertility and its loss.
- Soil in relation to plant and animal life.
- Aquatic habitats, terrestrial habitats – their nature, distribution, classification, environmental features, ecological hazards to life and adaptations of plants and animals in these habitats.
- Micro-habitants: cracks on rock surfaces, tree crowns, soil litter on the ground, tree barks savannah micro-habitats: termiteria
- Terminology in population studies (species, population, community, population size, biotic potential, natality, mortality, immigration, emigration, carrying capacity, innate capacity, environmental resistance)
- Methods of assessing the size of population;
- Population growth and population growth curves

-Factors affecting size of populations. Reference should also be made to human population.

- Primary and Secondary succession of plants, Processes involved in plant succession, Plant succession in selected habitats, Consequences of population changes on the Ecosystem.
- Symbiosis, commensalisms, Predation, parasitism, competition, saprophytism, epiphytism, phoresis. Energy and material relations of organisms. Concept of biological productivity, energy transfer, trophic interactions, methods of expressing trophic interactions.

BIO 113 VIRUSES, BACTERIA AND LOWER PLANTS. (2Credits) Compulsory

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

a. understand the diversity of lower organism
b. Explain the economic importance of organisms.

Topics

- Viruses - General description: Classification, size, structure, kinds, replication; role in diseased – human (e.g. STD, HIV –AIDS), plants and domestic animals e.g (Coccidiosis in poultry). Bacteriophages – structure and its biochemical activities
- Bacteria - General description: structure; classification based on shape, mode of nutrition, types of flagella, mode of respiration and staining mechanism; life history; nutrition, role in diseases.
- Fungi - General description, classification, and relationship with the environment. Study of various representatives of the phycomycetes e.g. Mucor, Rhizopus. Economic importance.
- Algae - Classification, range of forms i.e. solitary, colonial, filamentous, etc. Reproduction and economic importance of a named example.
- Lichens - An example of symbiotic relationship between fungi and algae. General description, classification and importance.
- Bryophytes - Musci and Hepaticae. Treatment of each class using common examples in Nigeria – Perlia, Funaria generations, habits, problems of the terrestrial environment as encountered by bryophytes in transition from water to land.
- Pteridophytes - Classification, general description of various classes, alternation of generations. Structure, reproduction and habit of Lycopodium, Sellaginella Dryopteris. Types of stele. Transitional position of pteridophytes among vascular and non-vascular plants.

BIO 114 BIOLOGY PRACTICAL I 1 Credit Compulsory

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

a. Identify materials used in biological practical
b. Explain the rules guiding biological drawings
c. Explain the techniques in biology practical.

Topics

- 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
- Requirements for practical classes in biology
- Examining biological specimens using hand lens

- Rules for making biological drawings.
- The microscopes and their uses (including magnification)
- Format for reporting observation in practical biology
- Forms of practical examination in biology (observing and drawing specimens, performing or carrying out experiments, alternative to practical etc)
- Sectioning and staining techniques
- Slide preparation
- Principles and practice of sterilization
- Culturing techniques for microscopic organisms such as bacteria and fungi
- Study of plant and animal cells using onion leaf, Rheo discolour or similar plants (for plant cell) and scraping of the inner lining of the cheek to isolate and study animal cells
- Practical study of mitosis and meiosis
- Experiments on plasmolysis, osmosis and diffusion
- Preparation and observation of slides of Mucor and Rhizopus
- Observation, of slides of some pteridophytes
- Preparation and observation of slides of algae e.g. Spirogyra, Euglena, Chlamydomonas etc
- Preparation and observation of slides of lichens showing various types and forms
- Collection of Bryophytes and observation under the microscope
- Dissection techniques, practice on dissection of toad and lizard (Agama)
- Use of dichotomous key to identify organisms

NCE I SECOND SEMESTER

BIO 121 DIVERSITY OF INVERTEBRATES 1 Credit Compulsory

Objectives

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

a. State the general characteristics of protozoa, porifera Platyhelminthes, nematodes, mollusks and the echinoderms

b. Describe the life cycle of protozoa porifera coelenterate Platyhelminthes, nematodes etc.

Topics

- General Characteristics of protozoa
- Mode of life and life cycle of Sarcodina e.g. Amoeba sp
- Mode of life and life cycle of Mastigophora e.g. Euglena
- Mode of life and life cycle of Sporozoa e.g. Plasmodium
- Mode of life and life cycle of Ciliata, e.g. Paramecium
- Characteristics and structure of sponges
- General Characteristics of major classes of coelenterate
- Mode of life and life cycle of Hydra and Obelia
- General Characteristics of Platyhelminthes
- Mode of life and economic importance of Turbellaria e.g. Planaria, Trematoda e.g. Fasciola, : Cestoda e.g. Taenia, Aphasmidia e.g. Ascertidina, Ascaris - mode of life and economic importance of Annelida,

General Characteristics, mention of mode of life, and economic importance, Oligochaeta - e.g. Earthworms, Polychaeta e.g. Tubeworm/Sand/Lugworm, Hirudinea – e.g. leech,

- General characteristics of the phylum Arthropoda**,** External features of an example of each class, Crustacea, Insecta, Arachnida, Myriapoda, hilopoda, Diplopoda
- General features, mode of life and life history of the following orders of the class Insecta: Diptera, Lepidoptera, Hemiptera, Hymnoptera etc
- General Characteristics of Mollusca**,** Brief classification and examples of each class.
- General description of Echinodermata, Link between invertebrates and Chordata.

BIO 122 DIVERSITY, ANATOMY AND HISTOLOGY OF SPERMATOPHYTES
2 Credits Compulsory

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

a. Outline the general characteristics gymnosperms, conifer and angiosperm
b. Describe the morphology/physiology of angiosperm – stem, leaf, root and their modifications
c. Describe the different types of tissues and their functions

Topics

- 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, fertilization, mega-sporogenesis and microsporogenesis,
- 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.

BIO 123 BIOLOGY METHODS 1 Credit Compulsory

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

a. State the Aims and objectives of teaching biology in Secondary Schools

b. List the resources/strategies used in teaching biology.
c. Identify relevant evaluation techniques as it affects the three domains in the teaching and learning of biology.

Topics

- Aims and Objectives of teaching Biology in Secondary Schools
- Syllabus, Scheme of work, lesson plan and lesson note.
- Stating aims and instructional objectives in biology
- Resources for teaching biology
- Improvisation in biology teaching
- Methods/strategies of teaching biology e.g. discussion, Lecturer, demonstration, small group approaches, activity approach, independent study etc.
- Evaluation of Biology learning outcomes-Cognitive (memory, comprehension and application objectives),Affective-(interest, value, receiving, responding, valuing), psychomotor (how to use hand lens, microscope, etc. (manipulative skills)
- Scientific attitudes – honesty, curiosity, critical/open mindedness etc
- Micro-teaching
- Further strategies in biology teaching: questioning, inquiry, discovery, fieldtrips, use of resource persons, tours and excursions, projects etc.
- Classroom management.
- Evaluation in biology i.e. types of tests and test construction in biology.
- Developing tests at the cognitive (all the six levels), Affective and psychomotor domains.
- Development organization and characterization of test items.
- Further micro-teaching with emphasis on the importance of teaching aids
- Practical work on improvisation of teaching aids in biology equipment and materials (models, charts, mockups, etc).
- Preparation of charts and posters on core message of Population/Family life education and Sexually Transmitted diseases (STD)/AIDS.

BIO 124 BIOLOGY PRACTICALS II 1 Credit Compulsory

Objectives

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

a. Observe, draw, label amoeba, Euglena, paramecium, Hydra, planaria, taenia, class insect, typical gymnosperm and angiosperm
b. Measure various factors of Ecosystem

Topics:

- 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.
- Observation of slides of Amoeba with false feet (Pseudopodia), food vacuoles and contractile vacuoles
- Make temporary slides of specimen collected from a slow flowing stream or pond to identify Euglena with flagellum
- Observe permanent slide of Euglena and study the physical appearance
- Observe the slide of Paramecium to identify the structure (shape, cilia, mega nucleus, micronucleus, star-shaped to contractile vacuole, food vacuole).
- Identify the tentacles, hypostome (mouth), two body walls– Ectoderm and Endoderm separated by mesoglea of hydra
- Observe L/S of the body wall of hydra.
- T.S. slide of Planaria to show the three layers or body walls – (ectoderm mesoderm, endoderm)
- Observe slide to Taenia showing suckers and segmentation
- Collect living earthworms and study the physical appearance
- Observe the T.S. of earthworm
- Collect and observe the general appearance of snail.
- Collect and study the structure of crayfish or any other suitable crustacean
- Study the physical appearance of centipedes and millipedes (note many legs of the myriapode).
- Draw and label (use preserved specimen or freshly killed) specimen in chloroform.
- Study the physical appearance of Spider: Note two body divisions, four pairs of legs
- Study the appearance of cockroach – a representative of insect
- Study mouth parts of these insects-Dipteria (Housefly, Mosquitoes), Hymenoptera: (bees, ants), Lepidoptera (butterfly and moth)
- External morphology of typical Gymnosperm and Angiosperm
- Preparations of Keys for identifying Angiosperms
- Flowers and inflorescence
- Study placentation of seed in fruits, types of fruits and adaptation for dispersal
- Collect and study general external features of star fish
- Habitat studies: on suitable aquatic and terrestrial environments
- Mini project on specific habitat study
- Measurement of physical factors e.g. Temperature, Light intensity, humidity, wind direction and speed, dissolved ages turbidity, depth speed of flow PH in relevant habitats
- Edaphic factors – soil porosity, water holding capacity, soil texture, PH percentage humus, and land slope, soil temperature at various depths and time.

NCE II - FIRST SEMESTER

BIO 211 DIVERSITY OF CHORDATES 2 Credits Compulsory

Objectives

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

a. Identify different classes of chordates
b. Explain the evolutionary advancement of different classes of chordates

Topics:

- General Characteristics of Chordates
- Classification and general distinguishing characteristics of:
- Sub phyla protochordata and vertebrata
- Super classes Agnatha and Gnathostomata
- Agnatha – Class-Cyclostomata, conodonta, pteraspidomorphi, myllokunmingiidae etc.
- Gnathostomata - Classes-Pisces, Amphibia, Reptilia, Aves, Mammalia
- Evolutionary advancement, adaptive radiation, success and special features of interest in the various groups-The transition from water to land and the problem of land life in amphibians,
- The development of the cleidoic egg in the Amniota, and the dominance of mammals over other chordates.

BIO 212 RESEARCH METHODS AND BIOMETRY 1 Credit Compulsory

Objectives

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

a) Describe the procedure involved in conducting a research; and
b) Carry out scientific research

Topics

- 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 (x^2) Correlation Coefficient, T-test and ANOVA)
- Project reporting.

BIO 213 PLANT PATHOLOGY 1 Credit Elective

Objectives

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

i. Identify common diseases of crop plants.

ii. Explain basic principles plant protection.

- Meaning of plant pathology and pathogenicity.
- Plant pathology as it affects food production and quality of life.
- Differences between diseases, parasites and pests
- Classes of diseases, modes of transmission of pathogens
- Entry of pathogens in tissues of hosts
- Diseases enhanced by abiotic factors such as adverse weather conditions and mineral deficiencies
- Phenomenon of infection and factors influencing it.
- Features of the major groups of plant pathogens (viruses, algae, fungi bacteria, worms and nematodes)
- Diseases of food crops such as maize, yams, cassava, rice, tomatoes and any other suitable food crops.
- Biology and control of diseases; a few selected diseases (biological control)
- Diseases of cash crops such as tobacco, groundnut, oil palm and any other suitable cash crop.
- General principles of plant protection.

BIO 214 BIOLOGY PRACTICALS III 1 Credit Compulsory

Objectives:

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

a. Prepare and observed slides of different plants pants.

b. Identify and draw different types of organisms in chordates.

Topics:

- 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.

NCE II – SECOND SEMESTER

BIO 221 PLANT PHYSIOLOGY 2 Credits Compulsory

Objective

At the end of the course, students should be able to explain basic physiological processes in plants

- Plant absorption of water
- Plant Transpiration
- The various mineral requirements of plants-sources and roles of each mineral element (including trace elements) in plant metabolism, Nutrient deficiency diseases in plants etc.
- Plants as Primary producers of food for populations
- General description of food chain
- Raw materials and products of photosynthesis, Mechanism of photosynthesis, chloroplast as the site for photosynthesis-light reaction conversion of light energy into energy; photochemical splitting of water, Calvin cycle, Dark reaction.
- Translocation of manufactured food.
- Reduction of nitrates and production of amino acids.
- General description of aerobic and anaerobic respiration in plants.
- Growth of plants in length, and its measurement
- Movement in plants e.g. tropism, taxism and nastism
- Excretion materials and their removal from the plant body.

BIO 222 VERTEBRATE ANATOMY, HISTOLOGY AND PHYSIOLOGY 2 Credits

Objectives:

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

a. explain the various systems of the body.
b. Describe the functions of the various systems.
    - Meaning, scope and description of vertebrate anatomy and physiology
    - Study of the following systems in mammals and amphibians
    - Digestive system
    - Circulatory system
    - Respiratory system
    - Compare male and female reproductive organs of human being
    - Nervous system
    - Skeletal system
    - Meaning of nutrition, components of food and balanced diet, mineral requirement in animal.
    - Digestive System and Digestion in Mammals and Amphibians
    - Function of liver with emphasis on deamination
    - Definition and nature of enzymes
    - Main categories of enzymes and the system of naming them
    - Factors affecting enzyme activity and the mechanism of enzyme action
    - Co-enzymes and Prosthetic groups.
    - Structure and functions of the circulatory system
    - Blood circulation and control of heart beat.
    - Structure and functions of blood, mechanism of blood clotting

- Blood transfusion, body resistance and AIDS
- Importance of blood screening (to detect cancer, malaria parasites hepatitis, leukemia etc.)
- Structure and functions of respiratory system
- Mechanism of inhalation and exhalation; aerobic and anaerobic respiration, glycolysis and the Kreb's cycle.
- Significance of respiration.
- The need for excretion and major metabolic wastes in vertebrates
- Excretory organs and their functions (the skin, lungs, kidneys)
- Processes of excretion (nitrogenous and gaseous excretion)
- Structure and functions of the central and peripheral nervous system
- Functions of a nerve cell, nerve impulse, synapse, nervous control and coordination.
- Nervous integration, description of the reflex arc
- Sense organs – eye, ear, skin, tongue, nose etc.
- Structure and functions of mammalian skeleton. Mechanism of muscular contraction.
- Meaning, properties and functions of hormones; the pituitary and tropic – hormones (their sources and effects in the body).
- Thyroxin, adrenalin and hormones of the reproductive system (their glands and effects in the body).
- Structure and functions of the male and female reproductive systems in mammals.
- Fertilization, gestation and birth in a named mammal. A brief mention of menstrual cycle is needed.

BIO 223 EMBRYOLOGY 1 Credit Elective

Objectives

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

a. Describe the developmental stages of an organism
b. Explain the process involved in gestation in mammals.

- The concept of embryology
- Fundamental processes in embryonic development- Determination, differentiation, morphogenesis (growth and organogenesis), Gametogenesis (spermatogenesis and oogenesis).
- The structure of spermatozoa and egg cell of a named mammal at the time of fertilization.
- The meaning stages, characteristics, types and significance of cleavage
- Outline of the development of a fertilized ovule and the production of seed and fruit in a dicotyledonous plant
- An outline of the development of an amphibian (frog or toad) or bird, to the neurula stage only.
- Embryonic membranes in birds and mammals
- Functions of the placenta in birds and mammals
- Gestation and abortion: birth in mammals.

BIO 224 BIOLOGY PRACTICALS IV 1 Credit Compulsory

Objectives

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

- demonstrate that Chlorophyll light and cabondioxide, are necessary for photosynthesis.
- show that starch and oxygen are products of photosynthesis
- show tropisms in plants
- Examine various excretory products from plants e.g. trains gums, resins and salts, etc.
- show evidence of transpiration in plants
- show rate of transpiration in plants

Topics

- Factors affecting transpiration rates.
- Study spermatogenesis and oogenesis.
- Gross and microscopic structures of the kidney.
- Slides of various tissues should be examined under strict supervision and guidance of the teacher.
- Examination of slides of various organs.
- Population studies using sampling techniques.
- Observation of succession in the suitable habitat e.g. plant succession
- Identification of diseases associated with cash crops mentioned in the syllabus. Interpretation of data, where available, on distribution of plant diseases and STDs/AIDS in Nigeria.
- Dentition in herbivores, carnivores and omnivores compared
- Enzyme action of food substances, e.g. action of salivary amylase on starch.
- Factors affecting enzyme action
- Measurement of heartbeat and effect of exercise on heartbeat.
- Measurement of breathing rate and effect of exercise on breathing rate.
- Determination of various taste sites on the tongue
- Determination of the blind spot on the eye
- Effect of sight on balancing
- Dissection of mammals showing the location of various organs and system.
- Digestive system
- Respiratory system
- Excretory system
- Circulatory system
- Reproductive system
- The system above could also be shown in the frog/toad for comparison.

NCE III FIRST SEMESTER

EDU 311
TEACHING PRACTICE

NCE III 2ND SEMESTER

BIO 321 APPLIED BIOLOGY 2 Credits Compulsory

Objectives

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

a. Explain simple health habits
b. Explain how the activities of man affect his environment.
c. Identify problems associated with drug abuse
d. Identify the factors affecting population growth

Topics

- Man's Diseases and Health
- Public health and roles of voluntary and international organizations in health control.
- Social and health problems of Tobacco consumption and the effect of smoking on the body; Drugs, their uses and abuses (mentioned use of cocaine, hemp and other dangerous drugs)
- Family life education. Sexually transmitted diseases /HIV-AIDS.
- Other social problems such as: prostitution) sex abuse and the effects on human health and productivity.
- Solution to problems of population growth
- Birth control measures.
- Reproductive behavior e.g. early marriage, pre-marital sex, teenage pregnancy, abortion, their prevention and control.
- Population education in Biology – Preparation of charts and posters on core messages/slogans of effects of uncontrolled population.
- World Human Population Growth and Problems
- Factors accounting for population growth (causes of population change in Nigeria e.g. socio-culture practices and religious beliefs.
- Effects of man on vegetation, atmosphere, soils, water and water resources, other natural resources.
- types of pollution (air pollution, water pollution, land pollution)
- Curses of pollution
- Effects of pollution (effects of air pollution, water pollution and land pollution)
- Control of pollution
- Ethical implications of biotechnology.
- Forms of urban pollution e.g. noise, radiation and ocean pollution, unburnt gases or smokes from motor cars exhaust pipes or motorcycle silencers.
- Wildlife, minerals, forests, soil, water, atmosphere, fuel (e.g. crude oil) Methods of conservation and preservation of these resources.
- Field Trips to game reserves to study rare species in their natural habitats
- Visit to areas of gully and sheet erosion

- Visit to notable areas of pollution e.g. polluted streams; mechanic workshops etc and observe pollution. Watch films on polluted habitats.
- Field trip/Excursion to game reserves or major areas of biological importance is compulsory. Its report is to be presented for accreditation purpose and should form a minimum of 20% of this course.

BIO 322 PARASITOLOGY 1 Credit Compulsory

Objective
At the end of the course, students should be able to describe common parasites and their life cycles.

Topics
- Meaning and scope of parasitology
- Identification and classification of different types of parasites
- Relationships between organisms e.g. obligate, facultative, parasitic adaptations including change of antigenic structure as in the AIDs virus (HIV).
- Disease – meaning, common tropical diseases, their causes, cure and prevention. Effects of parasites on man e.g. malaria parasite, sleeping sickness parasite etc.
- Adaptation involved in parasitic mode of life and transmission of STDs/AIDS
- Parasitic mode of life of: Entamoeba spp, Malaria parasites, (Plasmodium spp) life cycle and control.
- Trypanosome spp. Life cycle and control
- Trichomonas vaginalis lifecycle, cure and control)
- Helminthes such as Fasciola hepatica: Schistosoma spp.
- Nematodes such as Ascaris spp
- Hookworms such as Ancyclostoma duodenale, Wuchereria bancrofti
- (All these organisms' life cycle, cure and control are expected to be treated).
- Plant parasitic nematodes
- Parasitic insects (Structure, adaptive features and control).

BIO 323 GENETICS & EVOLUTION 2 Credit Compulsory

Objectives
At the end of the course, students should be able to:
a. Explain various terminologies used in genetics.
b. Describe the application of genetics in medicine and agriculture
c. Discuss the various evidences in favour of evolution.

Topics:
- Heredity and Environment:
- Mendel's work on peas. Meaning of basic genetical terms (genotype, homozygous, heterozygous, alleles, etc). Mono and dihybird crosses. Concept of dominance, Incomplete dominance.
- The chromosomes theory of inheritance and the gene hypothesis, nucleic acid, DNA genetic code. Salivary gland chromosomes, RNA, protein synthesis, formation of amino acids and lipoproteins.
- Sex chromosomes, autosomes, sex determination and linkage.

- Mutations: lethal mutations, Polyploidy: Examples of new varieties of plants and animals arising by mutation and polyploidy: production of mutations by radiation and other means.
- Human heredity e.g. colour blindness, paternity, blood groups, hemophilia.
- Problems in family that relate to sex determination, intelligence, membership resemblance and diseases.
- Genetic Counseling on family characteristics e.g. blood groups, blood types and sickle cell anemia
- Applied genetics: in agriculture, medicine etc.
- Evidence for Evolution
- The geological timetable
- Trends and theories of Evolution including pre-Darwinism and Neo-Darwinism theories.
- Darwinism theories.
- Darwin's theory of natural selection.

BIO 324 BIOLOGY PRACTICAL V 1 Credit Compulsory

Objectives

- Observation of slides of Plasmodium, Trypanosome, Taenia, Fasciola, Ascaris, Ancyclostoma, Wuchereria etc.
- Observe sterilization 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. CO_2, CO, SO_2 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, fertilizer, chemical containers, dyes.
- Effects of various fertilizers and herbicides as pollutants in aquatic habitat on biotic community.
- Estimation of population (school or college)
- Excursion to National Park, Lakes and areas of apparent gully erosion.
- Examination of models/charts to illustrate monohybrid and dihybrid crosses in plants and animals.
- Observation of variations (height, weight, finger prints, 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

Laboratory Management- students should be guided to:

- practice ordering of equipment for the laboratory.
- practice safety measures as well as use first aid devices in the laboratory.

- carry out exercises on handling glass wares and chemicals, electrical wiring and fuses.
- construct biological materials that can be used in the laboratory
- Prepare Materials such as herbarium, skeletons, stuffed materials etc. Improvise in biology laboratory, study the importance of local production, basic skills e.g. test-tubes, beakers specimen bottles
- set up Biological garden and outdoor laboratory.
- Set up of a school biological museum and preparation of museum materials, preservation, display etc. (Taxidermy)
- The herbarium – construction and setting up of a herbarium.

NCE CHEMISTRY

1. PHILOSOPHY

The intrinsic and utility values of Chemistry in all spheres of human activity necessitated its inclusion in the NCE curriculum. Consequently, the teaching and learning of Chemistry should be such as to produce competent teachers that can transmit these values to the learners.

2. OBJECTIVES

The objectives of chemistry programme at the NCE level are to produce highly qualified middle-level manpower knowledgeable in the processes of Chemistry and capable of inculcating these in the students. Students should have competencies in chemistry teaching including ability to:

i) develop functional knowledge of chemistry concepts and principles;
ii) observe and explore the chemical environment;
iii) apply the skills and knowledge gained through the study of chemistry to solve day-to-day problems;
iv) explain simple natural phenomena;
v) develop scientific attitudes such as curiosity, objectivity, creativity etc.
vi) manipulate simple apparatus and use of chemicals for purposes of demonstration, production and;
vii) improvise simple equipment from available junk in the local environment

3. GENERAL ADMISSION REQUIREMENTS

a) Senior Secondary School Certificate of WAEC or NECO or any other equivalent Certificate from recognized examination bodies with credit passes in five (5) subjects including English Language and Mathematics at not more than two sittings. Two of the credits must be in chemistry and physics.

b) A Grade II Teacher's Certificate (TC II) with credit or merit in five (5) subjects, two of which must be in general science and agricultural science. Credits/Merits in English Language and Mathematics are required for candidates wishing to study Chemistry.

c) d) All candidates wishing to be considered for direct admission must meet the requirements of a selection examination organized by an accredited body such as JAMB

e) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews for some courses. This is legitimate.

FACILITIES

a) i) An Air-conditioned Laboratory (Dimension: 18 x 8 and 20 x 8 sq. meters)
The Department of Chemistry with 50 students or less in each year would need a minimum of one standard laboratory with the following items:
a) Fume cupboard
b) Air-conditioned preparatory room attached to the laboratory
c) A weighing balance room

d) Spacious chemical store attached to the preparatory room
e) A bulletin boards
f) Two adjoining classrooms each accommodating at least 50 students. Colleges admitting more than 50 students would need additional laboratories.

ii. Staff Offices

Each Senior Staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (Typist, Clerks) with relevant equipment, e.g. Typewriters, duplicating machine, photocopier, computer and printer.

iii. Books in the Departmental mini - Library

There must be enough books to cover all the areas of Chemistry in the ratio of at least ten book titles to one (1) student.

b) EQUIPMENT

Apart from the routine standard equipment and materials required for the teaching and learning of chemistry, the following items of equipment are also required and in numbers that will be adequate for the number of students:

a. Mettler balance,
b. Top loading balance,
c. Thermostat,
d. Water bath,
e. Centrifuge. (Hand and Electric),
f. Oven, hot plate and heating mantle,
g. Steam bath,
h. Magnetic stirrer,
i. Suction pump,
j. Circulating water pump,
k. Soxlet extractor,
l. Rotator evaporator,
m. Calorimeter,
n. pH meter,
o. Constant water supply
p. First aid box and water shower for acid bath,
q. Victor Meyer's apparatus for measuring vapour density,
r. Conductivity meter,
s. Water distiller,
t. Spectrophotometer and colorimeter
u. Kedjahl Digestion flask,
v. Kedjahl Distribution Apparatus,
w. Chromatograph tank.
x. Fume cupboard
y. Muffle Furnace

c) ESSENTIAL NEEDS

Constant supply of (i) water (ii) electricity and (iii) gas.

d) SUPPLY OF CHEMICALS

Chemistry teaching involves the use of chemicals that would need to be replenished. There is therefore, the need to provide adequate potent chemicals/reagents for the experiments specified in the curriculum.

5. PERSONNEL

a) Academic Staff

Minimum of eight (8) academic staff with at least the following qualifications in chemistry is required:
B.Sc. (Hons) with Second Class lower plus PGDE
B.Sc. (Hons) Second Class Lower plus NCE/PGDE
B.Sc. (Ed) Second Class Lower

b) The Head of the department should have at least Master's degree and he/she must be a senior lecturer

6. SUPPORT STAFF

One qualified chemistry Laboratory Technologist (HND), one Laboratory Assistant (OND) and two Laboratory Attendants (SSSC)
One typist/computer operator and clerical officer, one messenger and cleaner.

7. WORKLOAD FOR ACADEMIC STAFF: A minimum of 3 credits per semester

8. MODE OF TEACHING

A teacher of chemistry should be aware and familiar with various teaching methods available. This will enable him/her to use any method or a combination of methods he/she finds appropriate in his special circumstance and setting. A combination of the following methods is recommended.

a. Discussion
b. Activity-Based Learning
c. Demonstration
d. Lecture
e. Project
f. Tutorial
g. Field trips
h. Games and simulation
i. Concept mapping
j. Computer Assisted Instruction

9. GRADUATION REQUIREMENT

Chemistry	-	24	Credits
Second Teaching subjects	-	24	Credits
Education including TP	-	30	Credits
General Study	-	16	Credits
Total		**94**	**Credits**

10. TEACHING PRACTICE

Teaching Practice is compulsory for **all** students to graduate. Teaching Practice earns 6 credits under Education 311

11 ***ASSESSMENT AND CERTIFICATION**: For theory-based courses CA=40% and Examination=60% and for practical courses, CA=60% and Examination=40%. CA is to be administered as quiz (written and/or verbal) and take-home assignments.

12. PROJECT

The final year Project is compulsory for all final year students. The project may be written in any of the subjects offered by the students and credited to EDU 323. Project earns 2 credits.

13. CHEMISTRY COURSE CODES, TITLES CREDIT UNITS AND STATUS

NCE YEAR 1 - FIRST SEMESTER

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
CHE 111	General Chemistry	1(2hrs)	Compulsory
CHE 112	Introductory Organic Chemistry I	1(2hrs)	Compulsory
CHE 113	Chemistry Practicals I	1(3hrs)	Compulsory
CHE 114	Chemistry Methodology I	1(2hrs)	Compulsory
	Total	**4C**	
GSE 000 A	Media Information Litracy		Compulsory
GSE 111	General English I	1C	Compulsory
GSE 112	Introduction to Library Studies	1C	Compulsory
	Total	**2 C**	

NCE YEAR I - SECOND SEMESTER

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
CHE 121	Introductory Physical Chemistry	1(2hrs)	Compulsory
CHE 123	Chemistry Practicals II	1(3hrs)	Compulsory
CHE 124	Introductory Organic Chemistry	1(2hrs)	Compulsory
CHE 126	Application of Mathematics to Chemistry II	1(2hrs)	Compulsory
	Total	**4C**	
GSE 000 B	Media Information Litracy	C	Compulsory
GSE 121	General English II	1C	Compulsory
GSE 123	Introduction to Computer Studies	1C	Compulsory
GSE 124	Family Life & Emerging Health Issues	1C	Compulsory
	Total	**C**	

NCE YEAR 2 - FIRST SEMESTER

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
CHE 211	The Gaseous State	1 (2hrs)	Compulsory
CHE 212	Environmental and Industrial Chemistry	1 (2hrs)	Compulsory
CHE 213	Chemistry Practicals III	1 (3hrs)	Compulsory
*CHE 214	Nuclear Chemistry	1 (2hrs)	Elective

CHE 215	Chemistry of Metals, Non-metals and Alloys	1 (2hrs)	Compulsory
CHE 216	Transition Elements and Ionic Compounds	1 (2hrs)	Compulsory
*CHE 217	Liquid State and Colloids	1 (2hrs)	Elective
	Total	**5 C + 1E= 6**	
GSE 000 C	Media Information Litracy	C	Compulsory
GSE 211	General English III	1C	Compulsory
GSE 213	Introduction to Computer Studies II	1C	Compulsory
GSE 214	Trafficking in Persons Issues	1C	Compulsory
	Total	**3 C**	

*** Choose any ONE of the Electives in Year 2.**

NCE YEAR 2 - SECOND SEMESTER

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
CHE 221	Organic Chemistry I	1 (2hrs)	Compulsory
CHE 223	Chemistry Practicals IV	1 (3hrs)	Compulsory
CHE 224	Basic Analytical Chemistry and Research Techniques	1 (2hrs)	Compulsory
CHE 225	Chemistry Methodology II	1 (2hrs)	Compulsory
	Total	**4C**	
GSE 000 D	Media Information Literacy	2 C	Compulsory
GSE 221	General English IV	1C	Compulsory
GSE 223	Citizenship Education	1C	Compulsory
GSE 224	Entrepreneurship	1C	Compulsory
	Total	**3.5C**	

NCE YEAR III - FIRST SEMESTER

EDU 311 **TEACHING PRACTICE**

NCE III - SECOND SEMESTER

COURSE CODE	COURSE TITLE	CREDIT UNIT	STATUS
CHE 321	Chemical Kinetics	1 (2hrs)	Compulsory
CHE 322	Chemistry of Alcohols, Carbonyl Compounds and Mono Carboxylic Acids	1 (2hrs)	Compulsory
CHE 323	Chemistry Practicals V	1 (3hrs)	Compulsory
CHE 324	Chemical Equilibrium &	1 (2hrs)	Compulsory

	Thermodynamics		
CHE 325	Natural Products & Amines	1 (2hrs)	Elective
CHE 326	Benzene Chemistry	1 (2hrs)	Compulsory
	Total	**5C+1E = 6**	
322			Compulsory
GSE 323	Science and Technology in Society	1C	Compulsory
GSE 324	Political Economy	1C	Compulsory
	Total	**3C**	

The project may be done in the other teaching subject, but it will be credited to EDU 323

SUMMARY

Study Status	First year credit units	Second year credit units	Third year credit units	TOTAL
Compulsory	8	9	5	22
Elective	-	1	1	2
Total	8	10	6	24

Minimum Credits Required for Graduation

Compulsory = 22 Credits
Elective = 2 Credits
Total = 24 Credits

NCE YEAR I - FIRST SEMESTER

COURSE CODE COURSE TITLE CREDIT UNITS /STATUS

CHE 111 GENERAL CHEMISTRY 1Credit Compulsory

Objectives

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

a. Define the concepts taught in relation to atoms and molecules
b. describe how protons and neutrons were discovered
c. explain the principles underlying the periodic table and its properties of elements
d. and explain the types of chemical bonding.

Topics

- Concepts of the atom and the molecule
- Discharge of electricity through gases
- Determination of e/m of cathode rays
- Determination of the charge of an electron
- Discovery of protons and neutrons
- Experiments of Rutherford and Chadwick Isotopes and Mass Spectroscopy
- Atomic orbital, Bohr atom, Dual nature of matter
- Quantum numbers
- Uncertainty principle Hydrogen atom
- Many electron systems, Electrons spin
- Pauli Exclusion Principle, Electronic structure of the elements
- The Periodic Table, Valence shell electrons, Consequences of the Periodic Table, The
- Modern Periodic Law
- Ionization Potential, Electron Affinity. Atomic and Ionic radii, Electro negativity.
- Isotopes and mass spectrometry
- Types of chemical bonds: electrovalent, covalent, dative, hydrogen, metallic and Octet
- Lewis Formulae.
- Multiple electron-pair bonds. Odd – Electron compounds

CHE 112 INTRODUCTORY ORGANIC CHEMISTRY I 1 Credit Compulsory

Objectives

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

a. State the characteristics of organic compounds and their relationship to other branches of chemistry
b. Differentiate between pi and sigma bonds in relation to hybridization, bond length, bond energy and bond angle
c. State the classes of organic reaction using homolytic and heterolytic fission
d. Explain the concept of organic acids and bases

e. Explain functional groups, homologous series, hydrocarbons.
f. Explain Electrophiles and Nucleophiles

Topics

- Characteristics of Organic Chemistry and its relationship to other branches of chemistry through covalent bonding resulting in chain formation.
- Review of ground state electronic structures especially C, H, O, N, S**,** etc. Hybridization
- Review of atomic orbitals.
- Sigma and Pi-bonds
- Molecular orbitals and their relationships to structures.
- Bond characteristics: length, angle and strength.
- Electronegativity, polarization and their effects on physical properties of organic compounds.
- Intermolecular forces and their relationships to physical properties.
- Classification of reactions as involving homolytic and heterolytic fissions. Carbonium ion and free radicals as reactant intermediates.
- Organic Acids and Bases.
- Functional groups and homologous series.
- Chemistry of hydrocarbons.
- Electrophiles and Nucleophiles.

CHE 113 CHEMISTRY PRACTICALS I 1 credit, (3 hours/week) Compulsory

Objectives

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

a. State various safety precautions in the chemistry laboratory,
b. Detect the presence of anions and cations using wet, dry and group analysis,
c. Carry out simple experiments involving acid-base titration.

Topics

- Safety in the Chemistry laboratory precautions
- Maintenance of equipment
- Setting up apparatus for demonstrating:
- Preparation of gases as in SSCE syllabus
- Preparation of salts
- Simple distillation
- Steam distillation
- Sublimation
- Fractional crystallization
- Paper chromatography
- Heating under reflux
- Using drying agents
- Detection of Anions: SO_4^{2-}, SO_3^{2-}, NO_3^-, NO_2^-, CO_3^{2-}, HCO_3^- $C1^-$, Br^-**,** and 1^-
- Detection of cations: Groups 1-6
- Weighing
- Preparation of standard solutions
- pH scale and choice of indicator
- Acid – Base titrations: e.g. NaOH/HCI; H_2SO_4/NaOH

CHE 114 CHEMISTRY METHODOLOGY I 1 Credit Compulsory

Objectives:

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

a. Have thorough understanding of Chemistry Methodology
b. Explain the nature and structure of science
c. Explain the role of science, scientist, science teacher and society
d. State the requirements and needs to become a professional teacher
e. State and Explain the Comparison between science, religion and culture
f. Define and Explain Science, Clubs and Fair
g. How to organize chemistry exhibition

Topics

- Philosophical elements of science education
- Nature and structure of science
- Role of science, the scientist, the science teacher and society
- The concept of integration in science and chemistry
- Professional growth of the science/chemistry teacher
- Science, religion and culture
- Science clubs and fairs
- Exhibitions in chemistry
- Conferences, clubs, seminars, symposia and workshops

NCE YEAR 1 - SECOND SEMESTER

CHE 121 INTRODUCTORY PHYSICAL CHEMISTRY 1 Credit Compulsory

Objectives

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

a. Explain the key concepts of valence bond
b. define hybrid orbital, covalent bonds and Hybridization
c. explain Heisenberg rules, electron pair repulsion and valence shell
d. explain Resonance and delocalization of electrons
e. Explain bond length, Dipole moment and bond character
f. Describe the characteristics of Noble gases
g. explain the nature of ionic crystals
h. Solve simple calculation of lattice energies using Born – Haber cycle
i. Explain the properties of covalent compounds, Homonuclear diatomic, Quantum Mechanics

Topics

- Valence bond theory.
- Molecular orbital approach (qualitative treatment only)
- Directional character of covalent bonds, hybrid orbitals.
- Hybridization involving orbitals of complex compounds.
- Hesenberg's rules, valence shell, electron pair repulsion.
- Resonance.
- Delocalized electrons.
- Bond length.

- Dipole moments.
- Partial covalent bond character, electronegativity and hydrogen bonding.
- Noble gases compounds.
- Ionic crystals.
- Madelung constant.
- Electron Affinity
- Calculation of lattice energy using Born-Haber cycle.
- The covalent bond as related to physical chemistry.
- Description of simple homonuclear diatomic molecules and ions including CO and NO.
- Basic concepts of quantum mechanics.

CHE 123 CHEMISTRY PRACTICALS II QUALITATIVE ORGANIC ANALYSIS
Credit 1 (3 hours/week) Compulsory

Objectives
At the end of the course the students should be able to carry out simple experiment to:

a. Test for unsaturation,
b. Conduct elemental analysis of organic molecules
c. Test of functional groups of organic compounds
d. distinguish the classes of amines
e. distinguish alkanals from alkanones
f. distinguish alkanals from alkanones
g. distinguish the classes of alkanols

Topics

- Test for unsaturation
- Detection of the following elements in organic molecules: N, S, C1, Br, I, C, H, O**.**
- Detection of the following functional groups, carboxyl, hydroxyl, alkanoate (ester), amine, alkanals (aldehyde) and alkanones (ketone).
- Distinguishing the classes of amines
- Distinguishing alkanals from alkanones
- Distinguishing classes of alkanols (alcohols)

CHE 124 INTRODUCTORY ORGANIC CHEMISTRY II 1 Credit Compulsory
Objectives
At the end of the course the students should be able to:

a. Name organic compounds using IUPAC rules
b. Differentiate between alkane, alkenes and alkynes from simple chemical reactions
c. Explain bond dissociation energy
d. Explain the concepts of isomerism
e. Be able to relate the importance of petroleum to everyday life. Stereochemistry

Topics

- Introduction to the rules of IUPAC nomenclature as compared with trivial or common names of compounds.

- Chemistry of the Alkanes: relative inertness, oxidation, halogenation, pyrolysis and catalytic cracking of Alkanes.
- Mechanism and orientation of halogenation.
- Chemistry of Alkenes and alkynes. Bond dissociation energy, heat of reaction, energy of activation, rate of reaction and transition state.
- Isomerism: structural, geometrical and optical.
- Applied alkene chemistry: Petroleum chemistry, fuel and petrochemical, energy considerations.
- Brief elementary introduction to stereochemistry including elements of symmetry and chirality.
- Optical activity and operation of a polarimeter.
- Fischer projection and assignment of configuration e.g. D (+) 2,3– dihydroxypropanal (glyceraldehydes).

CHE 126. APPLICATION OF MATHEMATICS TO CHEMISTRY 1 Credit Compulsory

Objectives

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

a. Apply basic mathematical skills/operation to solve problems in chemistry
b. Application of S.I Units in Chemistry
c. make use of proportion to mole concept, stoicheometry and volumetric analysis
d. Apply ratio, percentage, rates and reciprocal to solve problems in chemistry
e. Demonstrate competence in the use of various mathematical principles to facilitate the learning of chemistry

Topics

- Observation and measurement, precision of experimental measurements. SI Units of measurements, e.g. distance, volume, concentration, time, mass, density, etc. Proportion: Application to mole concept, stoichiometry and volumetric analysis. Ratio, percentage, rates and reciprocals. Quadratic equation and indices. Standard forms and Logarithms, Application to pH calculations.
- Graphical solution to simple equations and linear simple simultaneous equations.
- Application to equilibrium and kinetic calculations. Plotting of graphs and estimating slopes, intercepts, etc. Application to physical chemistry problems.
- Simple treatment of differentiation and integration of functions (rational and algebraic functions).
- Differential equations involving separable variables.
- Application to kinetic theory of gases, rate law and thermodynamics.

NCE YEAR II - FIRST SEMESTER

CHE 211 THE GASEOUS STATE 1 Credit Compulsory

Objectives

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

a. state the gas laws
b. Derive the ideal gas equation

c. state the fundamental kinetic theory of gases
d. Explanation of distribution of molecular velocity of gases
e. Explain deviation of real gases from ideal behavior
f. Explain Mean free path and Heat capacities of gases

Topics

- The physical states of matter.
- Measurement of gas pressure, the barometer and manometer.
- The gas laws: Boyle's law, Charles' law equation of state, and Dalton's law of partial pressure.
- Ideal gas equation: PV = nRT. Derivation from Boyle's and Charles' laws. Kinetic theory of gases.
- Derivation of the fundamental kinetic theory equation from the kinetic theory i.e. $PV = mnc^2$.
- The distribution of molecular velocities Derivation of gas laws from ideal gas equation.
- Determination of molecular mass of real gases.
- The nature of intermolecular forces and deviations from ideal behavior.
- The mean free path of gas molecules.
- The heat capacities of gases and the equi-partition of energy.

CHE 212 ENVIRONMENTAL AND INDUSTRIAL CHEMISTRY 1 Credit Compulsory

(Industrial visit is a major requirement of this course)

Objectives

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

a. list the different types of pollutants and their effects on the environment
b. Describe the techniques involved in some industrial processes
c. Explain causes of Acid Rain and effects on the environment

Topics

- 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, sodium hydroxide, washing soda, baking soda, soaps, detergents, glass, alcohol, matches, iron and steel.
- Production and utilization of allied products by students as assignment or project. Reports on visits to Industries (20 % of the CA).
- Acid rain formation and its effects on the environment.
- Oil pollution and its hazards.
- Environmental studies
- Body Abuse, prevention and control.

CHE 213 CHEMISTRY PRACTICAL III REDOX TITRATIONS

1 Credit (3hours/week) Compulsory

Objectives

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

a. Carry out simple redox titrations

b. Determine the partition coefficient of iodine between polar and non-polar solvents
c. Measure the pH of solutions

Topics

- Balancing of redox equations
- Redox titrations using $KMnO_4$ with Iron (II) ammonium tetraoxosulphate (VI) and sodium dioxonitrate (III), Iodine with $Na_2S_2O_35H_2O$, Silver trioxonitrate (V) with sodium chloride and mixture of $KClO_3$ and K_2SO_4, and $K_2Cr_2O_7$ with iron (II) ammonium tetraoxosulphate (VI).
- Determination of the partition coefficient of iodine between carbon tetrachloride and water.
- Determination of molecular weight by freezing point depression.
- Measurement of pH using indicators.
- Buffer solutions and pH meter.

CHE 214 NUCLEAR CHEMISTRY 1 Credit (2hours) Elective

Objectives

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

a. Understand the concept of nuclear stability and radioactivity
b. identify radioactive isotopes, calculate half-life and list their applications and negative effects
c. state Einstein's mass-energy equation and apply it in solving problems

Topics

- Nuclear stability.
- Natural/ artificial radioactivity: Alpha, beta and gamma rays.
- Einstein's mass-energy equation.
- Kinetic calculations of half-life.
- Identification of Radio Isotopes.
- Application and uses of radioactivity: tracers, dating and nuclear reactors.
- Effects of nuclear reactions on the environment.

CHE 215 CHEMISTRY OF METALS, NON-METALS AND ALLOYS
1 Credit (2hours) Compulsory

Objectives

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

a. list the physical and chemical properties of metals, non-metals and alloys
b. state the differences and similarities among the Groups 15,16 & 17 elements
c. describe the peculiarities of the first row transition elements
d. list properties and uses of non-metal hydrides, oxides, hydroxides and oxo-acids

Topics

- Physical and chemical properties of metals.
- Arrangement of atoms in metals.
- Bonding in metals.

- Valence bond theory of metallic bond.
- Molecular orbital approach to the theory of solids.
- Free electron theory of metals.
- Structure of pure metals.
- Insulators and semiconductors.
- Group 1(the Alkali metals). Group 2 (the Alkaline – earth metals).
- The elements of Groups 13 (Boron group) and 14 (Carbon group).
- Physical and chemical properties of non-metals.
- Groups 15, 16 and 17. Extraction of Sulphur.
- Peculiarities of the first-row transition elements.
- Detailed treatment of group trends.
- Group similarities and differences.
- Simple inorganic compounds of nonmetals: hydrides, oxides, hydroxides and oxo-acids including their properties and uses.
- Alloys: Classification of alloys.
- Structure of simple alloys, interstitial couples and bonding.

CHE 216 TRANSITION ELEMENTS AND PROPERTIES OF IONIC COMPOUNDS
1 Credit (2hours) Compulsory

Objectives

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

a. Define ionization potential and electron affinity
b. Explain formation of an ionic crystal and determination of the geometry
c. Explain X-ray diffraction methods
d. Describe NaCl structure and determine the Avogadro number from lattice dimensions
e. Explain electrolysis, Galvanic cells and the Faraday's laws
f. Explain the position, general properties of the 1^{st} , 2^{nd} and 3^{rd} rows transition elements and their compounds
g. Describe the crystal field, adjusted crystal field and ligand field theories of bonding in transition metal complexes
h. Describe Isomerism and stability of metal coordination complexes
i. Explain the lanthanide contraction

Topics

- Formation of ions.
- Ionization 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 behavior and periodic comparison

CHEM 217 LIQUID STATE AND COLLOIDS 1 Credit (2hours) Elective

Objectives

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

a. Compare the states of matter
b. Compare colligative properties ideal and non-ideal solutions
c. Identify hydrophilic and hydrophobic properties of colloids
d. Explain surface phenomena involved in adsorption, chromatography and catalysis

Topics

- General comparison of solids, liquids and gases.
- The liquefaction of gases and the critical state.
- Vapour pressure. Boiling point.
- Freezing point. Sublimation.
- Viscosity of liquids.
- Surface tension.
- Vapour pressure of solutions.
- Ideal solutions and Raoult's law.
- Non-ideal solutions and Henry's law.
- Boiling points of solutions containing volatile compounds.
- Immiscible components.
- Dilute solutions containing non-volatile solutes.
- Colligative properties: Vapour pressure lowering, boiling point elevation, freezing point lowering and osmotic pressure.
- The Nernst Distribution law.
- The colloidal state: preparation and properties of hydrophilic and hydrophobic colloids.
- Stability of colloids.
- Separation of colloids.
- Surface phenomenon and adsorption.
- Chromatography: gas, solid and liquid.
- Catalysis.

NCE YEAR II - SECOND SEMESTER

CHE 221 ORGANIC CHEMISTRY I 1 Credit (2hours) Compulsory
(Mechanism in each of the various reactions in the course is necessary)

Objectives

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

a. Describe the geometry of hydrocarbons
b. Identify electrophiles and nucleophiles in a chemical reaction
c. State Markownikoff's rules and its application to unsymmetrical olefins
d. Describe the reactions of unsaturated hydrocarbons including dienes in polymerization and alkyne chemistry

Topics

- Chemistry and molecular geometry of alkanes, Alkenes, Alkynes.
- Electrophilic and nucleophilic addition reactions.
- Oxidative cleavage and its application in structural determination (e.g. Ozonolysis).
- Relative stabilities of carbonium ions.
- The Markownikoff's rule: radical addition.
- Reduction.
- Polymerization: addition of alkenes and vinyl compounds, natural and synthetic rubber.
- Conjugated dienes: electrophilic 1, 2 – and 1, 4 – additions to conjugated dienes. Resonance orbital interaction.
- Alkyne chemistry: acidity of C ≡ C and reactions of –C≡C– compounds.

CHE 223 CHEMISTRY PRACTICALS IV 1 Credit, (3 hours/week) Compulsory
Objectives

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

a. Describe the various separating techniques
b. State the criteria for determining purity of a substance
c. Verify Raoult's law for ideal solutions

Topics

- Separation techniques: Liquid-liquid (solvent) extraction,
- Column Chromatography.
- Criteria for purity
- Determination of melting point
- Determination of solubility and solubility products.
- Determination of equilibrium constant.
- Verification of Raoult's Law.

CHE 224 BASIC ANALYTICAL CHEMISTRY AND RESEARCH TECHNIQUES
1 Credit (2hours) Compulsory

Objectives

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

a. list the preliminaries and title in a research work

b. explain the types of research design
c. differentiate between precision and accuracy
d. state the type of statistical tools for analysis in a research work
e. Identify the units of measurements of some quantities such as time, concentration, mass etc.
f. Carryout complexometric and precipitation titrations

Topics

(i) Project work in Chemistry
   a. Title
   b. Abstract
   c. Introduction
   d. Experimental
   e. Results
   f. Discussion
   g. Summary & Conclusion
   h. References

(ii) Significant figures:
   a. Addition and subtraction
   b. Multiplication and division

(iii) Measurement:
   a. Accuracy
   b. Precision
   c. Errors (concept, types, sources, control, estimation)

(iv) Measures of central tendency: mean, mode, median, range, co-efficient of variance, standard deviation.
(v) Test of significance: Chi^2-Test and T-test.
(vi) Units of concentration: $mol.dm^{-3}$ (molarity), gdm^{-3} (mass concentration), molality, parts per million, percentage concentration.

(vii) Titrations
   a. Complexometric titrations
   b. Precipitation titrations
(viii) Determination of melting and boiling points
(ix) Tests for oxidizing and reducing agents

CHE 225 CHEMISTRY METHODOLOGY II 1 Credit (2hours) Compulsory

Objectives

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

a. Explain the various methods of teaching chemistry
b. Use different methods of teaching chemistry
c. Differentiate between lesson note and lesson plan
d. Identify the personnel involved in organizing chemistry laboratory
e. State the criteria for selecting chemistry textbooks for use

Topics

- Trends in the teaching of chemistry.
- Lesson note preparation.
- Methods of teaching Chemistry. Demonstration, Guided discovery, Discussion, Activity, Tutorial, Project, team teaching
- Organization 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)

NCE YEAR III - FIRST SEMESTER

EDU 311
TEACHING PRACTICE

NCE YEAR III - SECOND SEMESTER

CHE 321 CHEMICAL KINETICS 1Credit (2hours) Compulsory

Objectives

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

a. Define reaction rate, the rate law, molecularity and order of a reaction
b. Explain the various theories of reaction rate
c. Use steady state approximation to derive theoretical rate law from reaction mechanism

Topics

- The reaction rate: Reaction order.
- Molecularity.
- The rate laws.
- Experimental techniques for determining first order reactions.
- Derivation of first-order kinetic equation.
- Example of first order reactions, second order reactions, third order reactions.
- The half-life 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 approximation. Reaction mechanisms.

CHE 322 CHEMISTRY OF ALCOHOLS, CARBONYL COMPOUNDS AND MONOCARBOXYLIC ACIDS 1 Credit (2hours) Compulsory

Objectives

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

a. describe the methods of preparation, properties and uses of alcohol
b. Describe the reaction of carbonyl compounds
c. State the characteristic reactions of carbonyl compounds
d. Mention some reaction of carboxylic acids
e. Differentiate between mesomeric and inductive effect
f. State the reaction and preparation of some aromatic acid derivatives

Topics

- Structure, nomenclature and properties of alcohols, carbonyl and monocarboxylic compounds
- Methods of preparation of alcohols, carbonyl and monocarboxylic compounds
- Uses of alcohols, carbonyl and monocarboxylic compounds
- Chemistry and reactivity of the carbonyl group. Structural survey of alkanals and alkenones.
- General characteristics and nomenclature of alkanals and alkenones.
- Similarities and contracts with other types of double bonded compounds.
- Nucleophilic addition to the carbonyl group.
- Some examples of aliphatic and aromatic. Alkenones and Alkanals.
- Special topics related to carbonyl groups.
- Acetals, ketals and use as protecting groups.
- Introduction to reactions of annulate ions.
- Keto-enol tautomerism.
- Simple aldol condensation and its synthetic utility.
- Halogenation of ketones.
- The haloform reactions.
- The Cannizzaro reaction.
- Chemistry of the carboxylic acids and derivatives.
- Polarity, structure and nomenclature of monocarboxylic acids,
- Hydrogen bonding in carboxylic acids and its medication by inductive effects and mesmeric effects.
- Some reactions of carboxylic acids.
- Some reactions of carboxylic acid derivatives e.g. anhydrides, acyl halides, esters and amides.
- Synthesis and reactions of aromatic sulphonyl acids.

CHE 323 CHEMISTRY PRACTICALS V 1 Credit, (3 hours/week) Compulsory

Objectives

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

a. Synthesize and characterize inorganic complex
b. Determine enthalpies of neutralization and combustion
c. Synthesize some benzene derivatives
d. Test for food content

Topics

- Synthesis and characterization of inorganic complexes.
- Determination of enthalpies of neutralization and combustion.
- Synthesis of some benzene derivatives.
- Tests for proteins, carbohydrates, sucrose, glucose and lipid

CHE 324 CHEMICAL EQUILIBRIUM AND THERMODYNAMICS 1 Credit (2hours) Compulsory

Objectives

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

a. Define thermodynamics terms and principles
b. State and explain the laws of thermodynamics
c. Derive the relationship between heat of reaction at constant pressure and volume
d. Explain the dependence of heat capacity and enthalpy of reaction on temperature
e. Explain the interdependence of Gibb's free energy with equilibrium constant, entropy change and temperature
f. define chemical equilibrium and state factors affecting chemical equilibrium
g. determine the pH of solutions
h. state the effects of common ions on the solubility of salts
i. calculate the equilibrium constants of ionic salts
j. explain phase rule

Topics

- The nature of thermodynamics.
- 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 heat of reaction at constant pressure and at constant volume.
- Heat of solution.
- Enthalpy of formation of ions in solution. Bond energies.

- Dependence of heat capacity and enthalpy of reaction on temperature.
- The second law of thermodynamics.
- Bohr Energy Circle.k 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.
- Aqueous solutions of weak acids and bases.
- The ionization of water and the pH scale.
- Buffer solutions.
- Polyfunctional acids and bases.
- Hydrolysis: Salts of a weak acid and a weak base.
- Metallic ions, salts of dibasic acid.
- Titration of acids and bases: strong acids and strong bases, weak acids and weak bases.
- Indicators.
- Complex ion equilibrium.
- Equilibrium between ions in the solid and liquid phases.
- Solubility and solubility products: effect of a common ion on the solubility of slightly soluble salts.
- Equilibrium in systems containing solid and gaseous phases.
- Phase rule. One component system and two component systems.

CHE 325 NATURAL PRODUCTS AND AMINES 1 Credit (2hours) Elective

Objectives

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

a. State the composition, structure and functions of lipids in living organisms
b. Mention the types of fatty acids
c. Appreciate the economical application of lipids
d. State and explain the classes of carbonhydrates
e. State the characteristics of amino-acids and amines

Topics

- Lipids.
- Triglycerides: structure, composition and functions in living organisms.
- Types of fatty acids encountered in lipids.
- Commercial applications as soaps, edible oils and fats, etc.
- Carbohydrates: aldoses and ketoses.
- General features, configuration in relation to glyceraldehyde.
- 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.

CHE 326 BENZENE CHEMISTRY 1 CREDIT 2hours Compulsory

Objectives:

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

a. explain the concept of aromaticity and stability in relation to benzene structure

b. Explain the reactivity of benzene with the functional groups

c. Write the mechanisms of various aromatic substitution reactions

Topics

- Aromatic compounds.
- Aromaticity and stability. Huckel's rule (4n+2)
- Exemplified by benzene, naphthalene etc.
- Short historical account of benzene
- structure. Inadequacy of cyclohexatriene as the structure of benzene.
- Physio- chemical evidence for the benzene molecule.
- Reactivity of benzene and functional groups attached to benzene ring compared with aliphatic analogues, e.g. addition reaction, halogenation, nitration, sulphonation. Friedel- Craft's alkylation and acylation.
- Electrophilic aromatic substitution. Mechanism of the substitution reactions.
- Orientational and kinetic effects of substituents.
- Nomenclature, chemical reactions, side chain and ring substitution.

COMPUTER SCIENCE DEPARTMENT

1. PHILOSOPHY

Nigeria cannot afford to ignore the role which computer literacy plays in achieving the national goal of technological development. Hence, she has resolved to introduce computer education in primary and secondary schools. For meaningful teaching of computer science in our primary and secondary schools, there is a need to produce professional teachers in the discipline. Hitherto there had been provision for the training of computer scientists in the universities and the polytechnics, but little attention was paid to the training of teachers in computer education. There is now an urgent need for the Colleges of Education to offer computer studies as a subject in the programme of professional preparation of teachers.

2. OBJECTIVES

By the end of the programme, the student should be able to:

i) Effectively teach Computer Studies at the Primary, Secondary and Technical Schools;
ii) Write Computer program and process data with maximum speed and accuracy;
iii) Demonstrate reasonably high level of competence in preparation for further studies in computer science education.
iv) Motivate pupils' and learners' interest in the study of computer studies by adopting appropriate ICT teaching and learning strategies.
v) Apply the use of computer as an aid in daily life activities.
vi) Maintain Computer Hardware.

3. GENERAL ADMISSION REQUIREMENTS

The entry requirements into Nigeria Certificate in Education for Computer Science programmes are as follows:

a) Five credits in Senior Secondary School Certificate (SSCE) or GCE 'O' level or any other equivalent Certificate from the recognized examination bodies like WAEC, NECO and NABTEB. The five subjects must include English, Mathematics and Physics / Computer Studies in not more than two sittings.

4. FACILITIES

For a College to run a computer Science programme, it is essential that the following facilities be provided as a minimum condition:

i) One computer for a group of not more than 2 students

ii) Laboratory for Computer Science, which must be air-conditioned
iii) Cabinet for storage facilities
iv) Regular supply of Software materials
v) One (1) Computer Centre for training/teaching of other students/commercial purposes
vi) Alternative power supply – Generator and Solar-Powered power supply unit
vii) Scanners
viii) Printers (Laser printers and Desk Jet printers
ix) Computer projectors/interactive whiteboard/screen
x) One laptop Computer to each lecturer of the department
xi) Well Equipped Computer Maintenance Laboratory including Students Stations, Management/Teacher Station, Server, PC tools, trainer boards, Computer Repair and Assembly toolkits, Antivirus (5 Users), USB Hard Disk, Online UPS (3 KVA) etc.
xii) Safety Devices
xiii) Internet Connectivity with adequate bandwidth (100 Kilo bits per second)
xiv) Public address system/ multimedia podium

a) All computer systems (Regular/Combo) must be full multimedia system with the following minimum configuration:

- INTEL CORE i7
- 4 GB RAM
- 500GB or 1 TBHDD
- DVD ROM Drive
- Flat Screen Monitor
- USB Keyboard and Mouse
- 650 VA UPS for each computer system
- 1000-Watt stabilizers for each system
- All computers must be on Local Area Network
- Every system must relate to Internet
- Latest Licensed Windows OS
- All required licensed Application Software and Compilers
- Scanners
- Printer (Laser printers, Desk Jet Printers and Laser Colour Printers)
- Photocopier
- Computer projectors
- One Laptop Computer to each lecturer of the department
- Journals – At least 20 different Journal Titles of both Local and international on computer studies must be made available. Not older than 10 years and minimum of three in quantity per each.

Equipment Required for Computer Laboratory

i) Microcomputers with the following minimum configuration:
   a. INTEL CORE i7
   b. 4 GB RAM
   c. 500 GB or 1 TB HDD

d. DVD ROM Drive
e. Latest Licensed Windows OS
f. Flat Screen Monitor
g. USB Keyboard and Mouse
h. 650 VA UPS for each computer system
i. 1000-Watt stabilizers for each system
j. All computers must be on Local Area Network
k. Every system must be connected with Internet

ii) UPS 1.22 KVA or Higher Configuration

iii) Printers
a) HP Colour Printer
b) HP LaserJet 2055 or higher

iv) The Lab should be well cabled.
v) Multimedia Interactive Board
vi) Computer Projector/Screen
vii) Due to the dynamic nature of the advancement of Information and Communication Technology (ICT), equipment and software should be updated regularly (every three years) to meet with the current changes in Technology.

50 PERSONNEL

5.1 Academic Staff

Minimum of eight (8) academic staff with Bachelor's degree in different areas of specialization in Computer Science (at least a Second Class Lower) and a professional teaching qualification or a minimum of Bachelor of Education Degree in Computer Science (at least a Second Class Lower). The staff-students ratio should be 1:25. Also those without teaching qualifications should be advised to take Postgraduate Diploma in Education (PGDE) or Professional Diploma in Education (PDE).

5.2 Support Staff

1 One (1) Computer Technologist per Laboratory
2 one (1) System Engineer
3 Two (2) Computer Operators
4 At least one Cleaner per Laboratory
5 At least one Instructor per Laboratory.
6 At least one Standby Security Staff

6.0 MODE OF TEACHING

Computer studies at the NCE level shall be taught by an appropriate selection or combination of the followings teaching methods.

- Lecture
- Discussion

- Supervised Projects
- Field Trip (Excursion and Exhibition)
- Problem-Based-Instruction / Inquiry
- Demonstration
- E-learning (Blended Approach)
- Seminar

NOTE: The teaching of the theory and practical work should as much as possible be integrated. Every Computer Science student **must** be exposed to 5 hours of practical per week. Practical exercise should not be taught in isolation from the theory. For each course there should be a balance of theory to practical in the ratio of about 40:60.

7.0 Graduation Requirements

Computer Science	-	24	Credits
Second Teaching subjects	-	24	Credits
Education	-	24	Credits
Teaching Practice	-	06	Credits
General Studies	-	16	Credits
Total	**-**	**94**	**Credits**

8.0 **SIWES:** - A one-phase SIWES is recommended: - 8 weeks programme at the end of the second session coded CSC 224 (1 credit unit, Compulsory).

9.0 TEACHING PRACTICE

Every student is required to complete successfully Teaching Practice for a period of 26 weeks. The whole of 300 level first semester should be devoted to teaching practice. The credit earned is recorded in EDU 324. The completion of teaching practice is important in the final determination of whether the student is successful in the programme or not. Failure in the teaching practices is an indication that the student has not shown enough interest in the profession or has no potential to become a computer science teacher. Thus, the teaching practices should be graded on a fail or pass basis. Where a student has satisfied all other requirements but failed teaching practice, the student may only be allowed to repeat another three months at his own expense.

10.0 Final Year Project

Every student is required to write and submit a scientific project research work in Computer Science and the credit is recorded under EDU 323. All topics should reflect computer in education (teaching and learning) and it carries 2 Credit Units.

11.0 Mandatory Refresher Courses

Due to very rapid changes in the field of Information Technology/Computer Science, it is mandatory for all Computer Science Staff to regularly undergo Workshops/refresher courses/programmes in the field and belong to relevant professional bodies.

SUMMARY OF COURSE CODES, TITLE, UNITS AND STATUS OF COMPUTER SCIENCE

NCE I FIRST SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
CSC 111	Introduction to Computer Science	1	C	Nil
CSC 112	BASIC Programming Language	2	C	Nil
CSC 113	Computer Operations/Application and Electronic Data Processing	1	C	Nil
CSC 114	Number Systems	1	C	Nil
TOTAL		**5 Credits**		

NCE I SECOND SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
CSC 121	Introduction to Micro processor	1	C	Nil
CSC 122	Application Packages (MS Word, MS Excel & MS Power point)	1	C	Nil
CSC 123	Computer Maintenance / Troubleshooting	1	C	Nil
CSC 124	The Teaching of Computer Science	1	C	Nil
TOTAL		**4 Credits**		

NCE II FIRST SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
CSC 211	Computer Logic	1	C	CSC 114
CSC 212	Database Management	1	C	NIL
CSC 213	Data Structures	1	C	NIL
CSC 214	C Programming Language	2	C	CSC 112
TOTAL		**5 Credits**		

NCE II SECOND SEMESTER

Course	Course Title	Unit	Status	Prerequisite

Code				
CSC 221	Introduction to Web Design & Development (HTML & CSS)	1	C	NIL
CSC 222	Operating Systems	1	C	NIL
CSC 223	Introduction to Numerical Methods	1	C	NIL
CSC 224	SIWES	1	C	NIL
CSC 225	System Analysis and Design	1	C	NIL
TOTAL		**5 Credits**		

NCE III FIRST SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
EDU 324	Teaching Practice	6	C	CSC 124
TOTAL		**6 Credits**		

NCE III SECOND SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
CSC 321	Advanced Level Programming Language (JAVA, C++, VBASIC, VCOBOL)	2	C	CSC 214
CSC 322	Seminars and Field Trip	1	C	NIL
CSC 323	Introduction to E-learning Design and Development (Blended Approach)	1	E	NIL
CSC 324	Computer Graphics and Desktop Publishing	1	E	NIL
CSC 325	Introduction to Computer Networking	1	C	NIL
TOTAL		**5C + 1E**		

SUMMARY OF COURSE CODES, TITLE, UNITS, AND STATUS OF GSE

NCE 1 – FIRST SEMESTER				
Course Code	**Course Title**	**Unit**	**Status**	**Prerequisite**
GSE 000A	Media Information Literacy		C	
GSE 111	General English I	1	C	
GSE 112	Introduction to Library Studies	1	C	
TOTAL		**2 Credits**		

NCE 1 – SECOND SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
GSE 000B	Media Information Literacy		C	
GSE 121	General English II	1	C	
GSE 123	Introduction to Computer Studies	1	C	
GSE 124	Family Life & Emerging Health	1	C	
TOTAL			**3 Credits**	

NCE 2 – FIRST SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
GSE 000C	Media Information Literacy		C	
GSE 211	General English III	1	C	
GSE 213	Introduction to Computer Studies	1	C	
GSE 214	Trafficking in Persons Issues	1	C	
TOTAL			**3 Credits**	

NCE 2 – SECOND SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
GSE 000D	Media Information Literacy	2	C	
GSE 221	General English IV	1	C	
GSE 223	Citizenship Education	1	C	
GSE 224	Entrepreneurship	1	C	
TOTAL			**3 Credits**	

NCE 3 – SECOND SEMESTER

Course Code	Course Title	Unit	Status	Prerequisite
GSE 322	General English V	1	C	
GSE 323	Science and Technology in Society	1	C	
GSE 324	Political Economy	1	C	
TOTAL			**3 Credits**	

NOTE: GSE 000 will run all through years 1 and 2

COURSE DESCRIPTION FOR COMPUTER SCIENCE

NCE 1 – FIRST SEMESTER

CSC 111 – INTRODUCTION TO COMPUTER SCIENCE (1 Credit; Core)

- History, classification and impact of computer from 1st generation to date
- Components of Computer Hardware and Software
- Introduction to Computer Data processing Systems
- Computer ethics and Human Issues
- Introduction to Information and communication technology (ICT)

CSC 112 – INTRODUCTION TO BASIC PROGRAMMING (2 Credits; Core)

- Introduction to Computer Programming Language (PL)
- Concept of Algorithm, Flowchart and Pseudocode etc.
- BASIC programming language
- BASIC Application
- Concept of System Development Cycle and Program Development

CSC 113 – INTRODUCTION TO BASIC PROGRAMMING (1 Credit; Core)

- Basic Computer operation and application areas of Computer
- Managing Computer files and Introduction to Multimedia system
- Use of Internet for e-mail and Information search
- Installation of Operating system and application packages
- Introduction to Electronic Data Processing (EDP): concepts and career opportunities

CSC 114 – NUMBER SYSTEM (1 Credit; Core)

- Basic number system
- Number system arithmetic
- Sg- Signed and unsigned number

NCE 1 – SECOND SEMESTER

CSC 121 – INTRODUCTION TO COMPUTER SCIENCE (1 Credit; Core)

- Concept of Microprocessor
- Internal structure and basic operation of Microprocessor
- Types of Microprocessor

CSC 122 – COMPUTER APPLICATION PACKAGES (1 Credit; Core)

- Overview of Application Packages
- Use of Microsoft Word Packages
- Use of Electronic Spreadsheet (Microsoft Excel)
- Use of Presentation Packages (Microsoft PowerPoint)

CSC 123 – COMPUTER MAINTENACE/TROUBLESHOOTING (1 Credit; Core)

- Basic concept of Computer upgrading and maintenance for PC
- PC limitation and scope for upgrading
- Technical specification for PC upgrading
- Solution to common Computer problems
- Computer system troubleshooting

CSC 124 – THE TEACHING OF COMPUTER SCIENCE (1 Credit; Core)

- Introduction to teaching profession
- Teaching methods and strategies
- Effective integration to teaching methods, strategies and technology in instructional delivery of Computer studies

NCE 2 – FIRST SEMESTER

CSC 211 – INTRODUCTION TO COMPUTER SCIENCE (1 Credit; Core)

- Concept of Computer Logic
- Types of Logic Gate
- Applications of Computer Logic Gate
- Concept of a simple comparator

CSC 212 – DATABASE MANAGEMENT (1 Credit; Core)

- Overview of Database Management and nature of Database Management System
- Types of DBMS and Models of Database- Network, Hierarchical, Relational, Distributed, Concepts of fields, records, access methods
- Data storage, Retrieval, Security and Integrity
- Database Administrator (DBA)
- Data organization and capturing with design of simple DBMS-Application on students' records, payroll, inventory etc., Practice using Relational Database

CSC 213 – DATA STRUCTURE (1 Credit; Core)

- An overview of Data structure
- Types, Operations and Implementation of Data structures
- Algorithms to implement Data structure

CSC 214 – C programming Language (1 Credit; Core)

- Concepts of C programming Language
- Use of C Expression/Statements
- Concept of C Control structure, Functions, Operators and Classes
- C program design, Coding and Testing

2 – SECOND SEMESTER

CSC 221 – INTRODUCTION TO WEB DESIGN AND DEVELOPMENT (HTML & CSS) (1 Credit; Core)

- Concept of Web Design (HTML and CSS)
- Application of Hypertext Markup Language (HTML)
- Concept of Cascading Style Sheet (CSS)
- Design of HTML table and Links

CSC 222 – OPERATING SYSTEM (1 Credit; Core)

- An overview of Operating System-Definition, Types, Uses, Advantages and disadvantages
- Components of Operating System-Assemblers, Compilers and Interpreters
- Batch processing, Real time processing, Time sharing and Multi-processing
- Allocation and scheduling resources
- Operating System Nucleus and Memory management
- Input/output system
- Intensive practice using available Operating System – emphasis on Windows OS

CSC 223 – INTRODUCTION TO NUMERICAL METHODS (1 Credit; Core)

- Listing of Numeric methods
- Methods of interpolation
- Halving the square method
- Newton-Raphson method
- Trapezoidal method
- Gaussian method
- Using Computer for treating the above

CSC 225 – SYSTEMS ANALYSIS AND DESIGN (1 Credit; Core)

- Concept of Systems Analysis and Design
- Stages of Systems Analysis and Design

- System Development Life Cycle
- Techniques of systems Analysis and Design
- Man- Management Information system (MIS): Concept, levels and tools

NCE 3 – SECOND SEMESTER

CSC 321 – ADVANCED LEVEL PROGRAMMING LANGUAGE (1 Credit; Core)

- An overview of Object-Oriented Programming (OOP)
- Comparison of various level of advanced programming language with other programming language (OOP vs POP)
- Design and write error free OOP programs

CSC 322 – SEMINAR AND FIELD TRIP (1 Credit; Core)

- Conduct Academic seminar presentation
- Conduct field trip (excursion and exhibition) and report writing

CSC 323 – INTRODUCTION TO ELECTRONIC LEARNING (eLearning) (1 Credit; Elective)

- Overview of eLearning
- Learning Management System (LMS) and Social Network
- Concept of WebQuest and its development
- Facilitating online with LMS and Social Network
- Use of CAI/CAL, E-Assessment system and other digital instructional materials

CSC 324 – COMPUTER GRAPHICS AND DESKTOP PUBLISHING (1 Credit; Elective)

- Fundamentals of Computer Graphics
- Basic mathematical background related to Computer Graphics
- Present numerical data/information graphically using charts
- Graphics application and Desktop publishing Packages

CSC 325 – INTRODUCTION TO COMPUTER NETWORKING (1 Credit; Core)

- Basic concept of Computer Networking
- Introduction to World Wide Web (www)
- Basic Networking concepts and their applications
- Introduction to Network Security

NCE INTEGRATED SCIENCE (SINGLE MAJOR)

1. PHILOSOPHY

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 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 school students, the boundaries between the disciplines can only appear as artificial, man-made constructs which interfere with unified view of nature, which children bring to the classroom with them.

Integrated science emphasizes 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 particle theories, conservation, balance and cycles in nature are also emphasized and their relevance to everyday life. Integrated Science also emphasizes inquiry into the 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, recognize 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 specialized skills in the handling and use of laboratory apparatus, living material, and chemicals.

2. OBJECTIVES

The Objectives of teaching Integrated Science are aimed at:

i) Enabling students gain the concept of the fundamental unity of science;
ii) Instilling in students a commonality of approach to problems of a scientific nature i.e. the scientific method;
iii) Increasing students' understanding of the role and functions of science and technology in everyday life;
iv) Making students well informed scientifically and technologically;
v) 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;

vi) Developing in students the ability to impart and encourage in their pupils the spirit of inquiry into living and non-living things in the environment;

vii) Developing the ability and motivation in students to work and think in an independent manner;

viii) Enabling students carry out scientific investigations, emphasizing co-operation, development of appropriate scientific processes and skills and improving their written and oral communications skills.

ix) Developing in students the interest to pursue higher studies in integrated science.

3) (i) GENERAL ADMISSION REQUIREMENTS

a) Senior Secondary School Certificate of WAEC, NECO, NABTEB or any other equivalent Certificate from recognized examination bodies with credit in five (5) subjects including English Language and Mathematics at not more than two sittings.
b) A Grade II Teacher's Certificate (TC II) with credit o**r** merit in five (5) subjects including Mathematics and General Science

c) All candidates wishing to be considered for direct admission must satisfy JAMB requirements.

d) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews.

(ii) Additional Admission Requirements

In addition to the general entry requirements, candidates seeking for admission to NCE (Intergrated Science) with Senior Secondary School Certificate or GCE 'O' Level, the candidatesmust possess credit in any three of the following subjects:

a) Biology
b) Health Science
c) Agricultural Science
d) Physics
e) Chemistry
f) Geography

For candidates with Grade II Certificates, the credit or merit must be from any three of the following groups:

a) Biology/Health Science/Agricultural Science
b) Chemistry
c) Physics
d) Geography
e) General Science/Integrated Science

4.0 FACILITIES

1. Classrooms/Laboratories

i) Classes of a maximum of 30 are suitable teaching groups. Where the student intake exceeds this number, they should be grouped and appropriate teacher students ratios recruited.

ii) Classroom/Laboratory size should be between 10 x 8sq and 12 x 9sq. meters to afford adequate space for practical activities and interaction.
iii) Special purpose laboratories and workshops should have a floor space of between 18 x 8 and 20 x 8sq. meters respectively.
iv) Biological Garden
v) (a) There should be a general purposes laboratory adequately stocked to cater for the interest of the students.
b) Since teaching in the very near future will be I.T. driven the Department should be provided with a Computer and Power point presentation projector. All staff are advised to be Computer literate.
c) There should be a digital laboratory for the Department
d) There should be enough classrooms and lecture venues for students: Computers should be provided to the Departments.
e) There should be an office for each staff (academic) furnished to enable the staff to work effectively.
f) There should be a weather station, fishpond, botanical garden/zoological and a nursery for the plants.

2. Staff Offices

The Head of Department and each senior staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (Typist, Clerks etc.) with relevant equipment e.g. Computer set, duplicating machines, etc. Head Of Department (HOD0 should have a personal office separate from HOD's office.

3. The Library

There must be enough books to cover all the areas of the subject in the ratio of one student to ten book titles.

EQUIPMENT REQUIRED FOR THE TEACHING OF INTEGRATED SCIENCE

S/№. DESCRIPTION	QUANTITY
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 organs	1
8) Microscope	40
9) Incubator/Sterilizer	1
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) Dissecting Microscope	3
26) Insect Light Traps	3
27) Insect Box (large)	many
28) Slide Projector	1
29) Overhead Projector	2
30) Steel Frame Aquarium	1
31) Oxygen Meter	3
32) Herbarium	4
33) Binocular Microscope	30
34) Embedding Bath	
35) Manesty Still	
36) Water Bath	
37) PH meter	
38) Tissue Grinder lan	
39) Calorimeter	
40) Auxanometer (Electric)	
41) Soil Auger	4
42) Plant Press	2
43) Soil Testing Kit	2
44) Wooden Quadrant	1
45) Measuring Tape	10
46) Biological Tape	1
47) Bunsen Burner	18
48) Gas Cylinder	2
49) Meter Balance	
50) Cone Balance	
51) Thermostat	
52) Steam Bath	
53) Magnetic Stirrer	
54) Suction Pump	
55) Circulating Water Pump	
56) Soxlet Extractor	
57) Rotary Evaporator	
58) Water Tank	
59) First Aid Box	
60) Conductivity Meter	
61) Water Distiller	
62) Spectrophotometer	

63) Oven and Victor Meyer's apparatus
64) Vapour density (density bottle)
65) Ammeter
66) Volmeter
67) Rheostat
68) Triangular Prism
69) Rectangular Prism
70) Pendulum Equipment
71) Stop Clock
72) Meter Rule
73) Convex Mirror
74) Concave Mirror
75) Telescope
76) Vernier Calipers
77) Micrometer Screw Gauge
78) Thermometer
79) Bar Magnet
80) U-shaped Magnet
81) Soft-iron Bar
82) Solenoid
83) Steel Bar
84) Electromagnet
85) Colour Disc
86) Colour Filter
87) Iron Fillings
88) Compass
89) Ticker-Timer
90) Glass String (100ml)
91) Pine-hole Camera (can be made by students
92) Ray Box
93) Ripple Tank
94) Tuning Fork
95) Meter Box
96) Resonance Table
97) Lead-acid-Accumulators
98) Dry Cell
99) Connecting (copper) wire
100) Roll-assorted
101) Plug key
102) Simple Electric Motor Generator
103) Zinc Rod
104) Copper Rod
105) Capillary tubes
106) Glass Tubes
107) Stop Watch
108) Dissecting Kit

109) Hand Lens
110) Beam Balance
111) Spring Balance
112) Computer
113) Workbench with all accessories
114) Vice
115) Toolbox with the following content:
    a. Hammer
    b. Hack saw
    c. Soldering iron and lead
    d. Tri square
    e. Pliers
    f. Files
    g. Glass Cutter
    h. Spoke Shave
    i. Spanners
    j. Tape
    k. Chisel
    l. Tester
    m. Coping Saw
    n. Cross Cut
    o. Tenon Saw
    p. Mallet
    q. Marking Gauge
    r. Collapsible Meter Rule
    s. Hand drill with set of twist drills and drill bits
    t. Punch/pincer
    u. Adjustable Screwdriver
    v. Knife
    w. Rasp plane

Note: the quantity should be determined by the number of students in the programme

Essential Needs

a) Constant supply of (i) water (ii) electricity and (iii) gas.

Supply Of Chemicals

b) Integrated Science teaching involves the use of chemicals that would need to be replenished. There is therefore needed to provide adequate potent chemicals/reagents for the experiments specified in the curriculum.

6. PERSONNEL

i) Academic Staff

The programme staff strength of:

(a) a minimum of 8 lecturers for single major programme

Note; A teacher to students' ratio of 1:25 should be adhere to.

Qualification: At least B.Sc. (Ed) Hons. Degree or its equivalent with NCE or PGDE or B.Ed. with a minimum of Second Class Lower. The staff should preferably be qualified in Integrated Science. Master's degree in science education is acceptable.

v) **Support Staff**

One Laboratory Technologist
One Laboratory Technician
One Laboratory Assistant
One Workshop Attendant
One Laboratory Attendant
One Cleaner
One Typist/Computer Operator

vi) **MODE OF TEACHING**

Any teaching and learning of Integrated Science should emphasis the principle of integration based on the following:

a) Unity of all knowledge
b) Conceptual unity of all Sciences
c) Unified process of science enquires
d) Inter-disciplinary studies
e) Social relevance of Science

Note:

Teaching and learning in Integrated Science should be activity-based and learner-centered.

The development of the science skills of observing, classifying, measuring, organizing, formulating hypothesis, experimenting and interpreting data and reporting results should be a major aim. A brief checklist for an activity-based approach to learning science is that students should be:

(a) Handling materials, living and non-living;
(b) Designing, making or manipulating apparatus using' a variety of materials including 'junk' items;
(c) Moving around freely and finding the materials they need;
(d) Discussing their work with each other and the teacher;
(e) Busy doing things they feel are important;
(f) Trying to work out for themselves what to do, from step to step, and not expecting to be told what to do;
(g) Puzzling over problems;
(h) Comparing their ideas or observations with those of others;
(i) Embarking on Field Trips;
(j) Excursion to places where students can observe science in operation/action to enhance better understanding of science.

The Integrated Science programme should be taught in such a way that those students:

(a) Take the initiative in suggesting what to do and how to set about it;

(b) Try out ideas to see what happens;
(c) Observe things closely – watching, listening, touching, smelling;
(d) Try different ways of approaching a problem;
(e) Classifying things according to their properties or characteristics;
(f) Make sure record of what they find out or observe
(g) Use instruments for aiding observation and measurement;
(h) Devise and apply tests to find out what things will do;
(i) Make predictions of what they expect to happen;
(j) Look for evidence to support the statements they make;
(k) Try to explain their observations;
(l) Confirm their findings carefully before accepting them as evidence;
(m) Have workshop's experience and practice.

8) GRADUATION REQUIREMENT

Integrated Science (Single Major)

Integrated Science	-	24	Credits
Second Teaching Subject	-	24	Credits
Education		24	Credits
Teaching Practice	-	06	Credits
General Studies Education	-	16	Credits
Total	=	**94**	Credits

9. TEACHING PRACTICE

All students must successfully complete Teaching Practice before graduating. Teaching practice earns 6 credits under Education 311.

10. PROJECT

A final year project is to be written in either Integrated Science or second teaching subject. The grade for the project is to be credited to EDU 324. It carries 2 credits.

11. ASSESSMENT AND CERTIFICATION

For theory based courses CA = 40% and Examination = 60% and for Practical courses, CA = 60% and Examination = 40%

FIRST SEMESTER NCE I

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 111	Mathematics for Science I	1	Compulsory
ISC 112	Science Education I	2	Compulsory
ISC 113	Introduction to Scientific methods	1	Compulsory
ISC 114	Components of the environment I	1	Compulsory
ISC 115	Nature of matter I	1	Compulsory
	Total	5	

GSE COURSES			
GSE 000A	Media Information Literacy	2	Compulsory
GSE 111	General English I	1	Compulsory
GSE 112	Introduction to Library Studies	1	Compulsory
	TOTAL	**4**	

SECOND SEMESTER NCE I

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC121	Mathematics for Science II	1	Compulsory
ISC122	Processes of Life	1	Compulsory
ISC123	Man and Energy I	2	Compulsory
	Total	**4**	
GSE COURSES			
GSE 000B	Media Information Literacy	2	Compulsory
GSE 121	General English II	1	Compulsory
GSE 123	Introduction to Computer Studies I	**1**	Compulsory
GSE 124	Family life & Emerging Health Issues	**1**	Compulsory
	TOTAL	**3**	

FIRST SEMESTER NCE II

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 211	Components of the environment II	1	Compulsory
ISC 212	Science Education II	1	Compulsory
ISC 213	Man and the Environment	1	Compulsory
ISC 214	Laboratory management and safety	1	Compulsory
ISC 215	Workshop Practices, Skill Acquisition and ICT	1	Compulsory
	Total	5	
GSE COURSES			
GSE 000C	Media Information Literacy	2	Compulsory
GSE 211	General English III	1	Compulsory
GSE 213	Introduction to Computer Studies II	1	Compulsory
GSE 214	Trafficking in Persons Issues	1	Compulsory
	TOTAL	3	

SECOND SEMESTER NCE II

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 221	Nature of matter II	1	Compulsory

ISC 222	Science Education III	1	Compulsory
ISC 223	Dynamics	1	Compulsory
ISC 224	Research method	1	Compulsory
ISC 225	Carbon Compound I	1	Compulsory
	Total	5	
GSE COURSES			
GSE 000D	Media Information Literacy	2	Compulsory
GSE 221	General English IV	1	Compulsory
GSE 223	Citizenship Education	1	Compulsory
GSE 224	Entrepreneurship	1	Compulsory
	TOTAL	3	

* GSE 000 Runs for year I and year II and ALL carry 2 units

NCE III FIRST SEMESTER

	EDU 311	**Teaching Practice**	**6**

SECOND SEMESTER NCE III

INTEGRATED SCIENCE			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 321	Man and Energy II	2	Compulsory
ISC 322	Reproduction and Growth	1	Compulsory
ISC 323	Carbon compounds II	1	Compulsory
ISC 324	The earth and the moon	1	Elective
ISC 325	Global ecology	1	Elective
	Total	4C+1E= 5	
GSE COURSES			
GSE 322	General English V	1	Compulsory
GSE 323	Science and Technology in Society	1	Compulsory
GSE 324	Political Economy	1	Compulsory
	TOTAL	3	Compulsory

*The project may be done in either Integrated Science or the other teaching subject but it will be credited to EDU 323

Minimum Credit Units Required for Graduation

Compulsory = 24 Credit

NCE 1 – FIRST SEMESTER

ISC 111 Mathematics for Science II (Arithmetic)
1 Credit (2 Hours/Week) Compulsory

- Calculate basic arithmetic functions.
- Simple algebraic equations
- Evaluations of numerical expressions.
- Positive and negative indices and square roots.

ISC 112 Science Education I 1Credit (3 Hours/Week) Compulsory

- History and philosophy of Integrated Science.
- Traditional African ideas about learning.
- Behaviorism.
- Constructivism.
- Skinner's behavioral ideas.
- The Bloom taxonomy of educational objectives.
- Gagne's ideas.
- Piagetian Stage theory.
- Brunner's ideas.
- Ausubel and the alternative conceptions movement.
- Application of education theories to science teaching.
- Stages of cognitive development and the cognitive demands of science curricula.
- Children's alternative conceptions.
- Scientific concepts.
- Science Education research from Nigeria.
- Finding out what children already think and know.
- Presenting counter demonstrations and arguments, generating cognitive conflict.
- Drawing arguments and evidence together.
- Maximizing children's involvement in their own learning.
- Using context to explain concepts.
- Use of analogies (similes and metaphors)

1SC 113 Introductions to Scientific Methods 1 Credit, 2 Hours/Week) Compulsory

- 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 skills

ISC114 Components of the Environment I 1 Credit Compulsory

- Air pollution, sources and consequences of air pollution.

- One method for determining the proportion of oxygen in the atmosphere
- Qualitative and Quantitative composition of air
- Physical properties and uses of oxygen and carbon dioxide and their importance to living things.
- Sources of water and contaminating agents
- Importance of water to Life
- Nature of water as a solvent
- Importance of oxygen dissolved in water.
- Compare rural and urban water supplies
- Methods of water purification
- Water cycle
- Elements of weather
- Simple weather recording instruments
- Organisms that live in soils in our environment.
- Mineral component of the soil
- Soil Formation
- Types of soil
- Importance of soil
- Soil erosion and the relevant preventive measures
- Bush Burning
- Drainage patterns, causes, prevention and effect

ISC115 Nature of Matter I 1 Credit (2 hours/week) Compulsory

- States of Matter
- General physical properties of solids, liquids and gases.
- Boyle's law, Charles' law. Ideal gas law
- Vapour pressure
- Macromolecular structures of NaCl as an ionic solid and carbon (diamond)
- Classification of matter
- Classification of common elements
- Elements, compounds and mixture.
- Structure of the atom
- Concepts of atomic number and mass number
- Isotopes
- Oxidation/Reduction (properties along period and group)
- Ionic and covalent compounds

NCE I
SECOND SEMESTER

ISC 121 Mathematics for Science I 1 Credit (2 hours/week) Compulsory

- Graphs and Forms
- Variables and Scales for graph plotting.
- Slope and intercept on a linear graph;
- Standard linear form y = m x + c
- Forms of common plots such as $\frac{1}{x}$, x^2, $\frac{1}{x^2}$, sinx, cosx, e''x, Sinx, Cosx.
- Slope of a tangent to a curve as a means of obtaining gradient.
- Geometry and Trigonometry
- $\frac{d}{dx}$ For a rate of change with respect to variable x.
- Area below a curve and relate this to integration
- Histograph plots,
- Simple harmonic motion

ISC 122 Processes of Life 1 Credits Compulsory

- Photosynthesis
- Test leaves and storage organs for starch.
- Combustion and respiration.
- Oxidation and reduction
- Respiration
- Energy change during the burning of food
- Respiratory System and problems connected to breathing
- Nutrition (classes, sources and importance of nutrients)
- Interrelationship between population, personal health and nutrition
- Digestive system
- Absorption of food and simple food test.
- Food storage
- Circulatory system
- Excretory system
- Nervous system
- Skeletal system

ISC 123 Man and Energy I 2 Credits, (4 Hours/Week) Compulsory

- Force,
- Work done
- Energy (Forms of Energy)
- 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 eclipse0
- 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

NCE II
FIRST SEMESTER

ISC211 Components of the Environment II
1 Credit (2 Hours/Week) Compulsory

- Characteristics and Classification of Living and Non-Living Things
- Classification of growth (temporary and permanent changes)
- Plant and Animal Cell
- Chromosomes and Genes
- Bacteria and viruses
- Importance of bacteria
- Diseases caused by Viruses and bacteria
- Fungi and state their characteristics.
- Types of fungi.
- Occurrence of fungi, their use as food

ISC212 Science Education II 1 Credit, (2 hours/week) Compulsory

- Time
- Lesson Planning.
- Resources
- Activities.
- Grouping of pupils for activities.
- Traditional role of the teacher.
- Developing or changing subject content.
- School as an encouraging or a restricting environment.
- Finding out what children already think and know.
- Presenting arguments and cognitive conflict.
- Drawing arguments and evidence together.
- Maximizing children's involvement in their own learning.
- Using context to explain concepts.
- Use of analogies (similes and metaphors)

ISC213 Man and the Environment 1 Credit, (2 hours/week) Compulsory

- Human Beings as Higher Animals
- Characteristics of primates
- Application of basic intelligence skills

- Introductory Ecology
- Ecosystem (food chains, food webs)
- Carbon and Nitrogen cycles.
- Importance of fertilizers in food production
- Traditional and modem methods of food preservation
- Associations (parasitism, symbiosis and commensalisms)
- The role of Man in resource development
- Resources exploitation by man (deforestation, desertification mining etc.)
- Environmental pollution (causes, consequences and control.
- Ozone layer
- Conservation and recycling of natural resources
- Population and Effects of urbanization on the environment.
- Field trip

ISC 214 Laboratory Management and Safety 1 Credits (4Hours/week) Compulsory

- Laboratory Management
- Laboratory rules
- Laboratory equipment/apparatus
- Storage and management procedures
- Microscope
- Balances (parts, manipulation and types)
- Preparation of solution - Molar and percentages.
- Indicators - pH ranges.
- Uses of burettes and pipettes and their maintenance
- Bunsen burners, flame parts and adjustments.
- Glassblowing.
- Accumulator, circuit connection - series and parallel.
- First aids for

ISC 215 Workshop Practices, Skill Acquisition And ICT
1 Credits (4Hours/Week) Compulsory

- Improvisation (definition and its advantages.)
- Paperwork in modelling
- Glass work Glass-cutting, construction of aquarium
- Preparation of skeletons and herbariums.
- Elements of painting
- Metal workshop (Soldering, welding and Engraving techniques)
- ICT (meaning component and importance
- Instruments used in electrical workshop.
- Simple circuit connection and types
- Fuses and uses
- Elementary Electronics
- Mechanism of radio and tape recorder and T.V functions
- Wavelengths and channels
- Batteries – types, functions and maintenance
- Meaning and reasons for skill acquisition

NCE II
SECOND SEMESTER

ISC 221 Nature of Matter II 1 Credit (2 hours/week) Compulsory

- Atomic Structure
- Periodic Table
- Physical and Chemical Changes
- Separation Techniques
- Transition Elements and their Properties
- Reactions of Some Ions
- Volumetric Analysis

ISC222 Science Education II 2 Credits (4hours/week) Compulsory

- Developing a course
- Developing a lesson
- Mixed ability groups
- Special educational needs (care)
- Board work
- Demonstration method
- Practical activities
- Discussions method
- Teaching/learning aids.
- Purposes of assessment
- Different modes of writing questions
- Preparing marking schemes
- Evaluation of classroom activities and end of course performance.
- Micro-Teaching

ISC223 Dynamics 1 Credit (2 Hours/Week) Compulsory

- Speed
- Acceleration
- Speed/Time Graph for Linear Motion
- Newton's Law of Motion
- Gravitational Force
- Concept and Purpose of Space Travels.
- Satellite and Its uses in the Society
- Momentum
- Conservation of Linear Momentum.
- Motion in a Circle
- Simple Harmonic Motion

ISC 224: Research Method 1 Credit (2Hours/Week) Compulsory

- Research (Meaning, types and importance)
- Identifying the topics
- Topic selection

- Literature Review
- Construction of instruments
- Data Analysis
- Project reports

ISC 225 Carbon Compounds I 1 Credit (2 hours/week) Compulsory

- Introduction to Carbon Chemistry
- Catenation Of Carbon
- Aliphatic Hydrocarbons
- Crude Oil
- Refining crude oil, its uses and its economic importance
- Cracking
- Octane number of a fuel
- Coal
- Resource management and national wealth
- Mineral exploration
- Pollution management.

NCE III FIRST SEMESTER
SECOND

TEACHING PRACTICE

SEMESTER NCE III

ISC 321 MAN AND ENERGY II 2 Credits (4 hours/week) Compulsory

- Magnetism
- Laws of Magnetism
- Magnetic Induction
- Electrostatics
- Static Electricity and Magnetism
- Electrostatics
- Current Electricity
- Simple Circuit and their Functions
- Conductor and Electrical Insulator
- Series and Parallel Circuits.
- Transfer of Chemical Energy to Electrical Energy
- Electromagnetism
- Ohm's Law
- Direct and Alternating Currents.
- Mains Electrical Circuits
- Principle of A Ring-Main Circuit
- Principle of Earthling Appliances and Other Safety Aspects of Electrical Circuits.
- Radioactivity (Types, Properties, Uses and Danger)

ISC 322 Reproduction and Growth 1 Credits (4hours/week) Compulsory

- Sexual Reproduction

- Reproductive System
- Human Development
- Monthly Cycle,
- Pregnancy
- Contraception and Family Planning
- Growth and Development
- Parturition and Lactation
- Puberty
- Human Potentials for Population Growth
- Growth in Plant
- Introductory Embryology

ISC 323 Carbon Compounds II 1 Credits (4hours/Week) Compulsory

- Haloalkanes (Reactions, Importance and Dangers)
- Alkanols (General Formula, Preparation, Properties and Uses)
- Alkanoic Acids (General Formula, Preparation, Properties and Uses)
- Amines and Amino Acids (General Formula, Classes, Properties and Uses)
- Synthetic Macro-Molecules
- Polymerization

ISC324 Earth and the Moon 1Credit (2Hours/Week) Elective

- Natural Cycles (Days, Lunar Months, And Year)
- Seasons (Harmattan; Summer/Winter, Rainy/Dry)
- Structure of the Earth
- Geological Time Scale
- Atmosphere
- Rocks (Types and Formation)
- The Moon
- Relationship between Moon and the Earth
- Solar and Lunar Eclipse

ISC 325 Global Ecology 1Credit (2Hours/Week) Elective

- 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
- Immunization

NCE INTEGRATED SCIENCE (DOUBLE MAJOR)

1. PHILOSOPHY

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 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 school students, the boundaries between the disciplines can only appear as artificial, man-made constructs which interfere with unified view of nature, which children bring to the classroom with them.

Integrated science emphasizes 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 particle theories, conservation, balance and cycles in nature are also emphasized and their relevance to everyday life. Integrated Science also emphasizes inquiry into the 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, recognize 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 specialized skills in the handling and use of laboratory apparatus, living material, and chemicals.

2) OBJECTIVES

The Objectives of teaching Integrated Science are aimed at:

i) Enabling students gain the concept of the fundamental unity of science;
ii) Instilling in students a commonality of approach to problems of a scientific nature i.e. the scientific method;
iii) Increasing students' understanding of the role and functions of science and technology in everyday life;
iv) Making students well informed scientifically and technologically;
v) 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;
vi) Developing in students the ability to impart and encourage in their pupils the spirit of inquiry into living and non-living things in the environment;
vii) Developing the ability and motivation in students to work and think in an independent manner;

viii) Enabling students carry out scientific investigations, emphasizing co-operation, development of appropriate scientific processes and skills and improving their written and oral communications skills.
ix) Developing in students the interest to pursue higher studies in integrated science.

3) (i) GENERAL ADMISSION REQUIREMENTS

b) Senior Secondary School Certificate of WAEC, NECO, NABTEB or any other equivalent Certificate from recognized examination bodies with credit in five (5) subjects including English Language and Mathematics at not more than two sittings. b) A Grade II Teacher's Certificate (TC II) with credit o**r** merit in five (5) subjects including Mathematics and General Science
c) All candidates wishing to be considered for direct admission must satisfy JAMB requirements.
d) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews.

(ii) Additional Admission Requirements

In addition to the general entry requirements, candidates seeking for admission to NCE (Integrated Science) with Senior Secondary School Certificate or GCE 'O' Level, the candidates must possess credit in any three of the following subjects:

g) Biology
h) Health Science
i) Agricultural Science
j) Physics
k) Chemistry
l) Geography

For candidates with Grade II Certificates, the credit or merit must be from any three of the following groups:

f) Biology/Health Science/Agricultural Science
g) Chemistry
h) Physics
i) Geography
j) General Science/Integrated Science

4.0 FACILITIES

1. Classrooms/Laboratories

vii) Classes of a maximum of 30 are suitable teaching groups. Where the student intake exceeds this number, they should be grouped and appropriate teacher students ratios recruited.
viii) Classroom/Laboratory size should be between 10 x 8sq and 12 x 9sq. meters to afford adequate space for practical activities and interaction.
ix) Special purpose laboratories and workshops should have a floor space of between 18 x 8 and 20 x 8sq. meters respectively.
x) Biological Garden

v) (a) There should be a general purposes laboratory adequately stocked to cater for the interest of the students.

g) Since teaching in the very near future will be I.T. driven the Department should be provided with a Computer and Power point presentation projector. All staff are advised to be Computer literate.

h) There should be a digital laboratory for the Department

i) There should be enough classrooms and lecture venues for students: Computers should be provided to the Departments.

j) There should be an office for each staff (academic) furnished to enable the staff to work effectively.

k) There should be a weather station, fishpond, botanical garden/zoological and a nursery for the plants.

2. Staff Offices

The Head of Department and each senior staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (Typist, Clerks etc.) with relevant equipment e.g. Computer set, duplicating machines, etc. Head of Department (HOD) should have a personal office separate from HOD's office.

3. The Library

There must be enough books to cover all the areas of the subject in the ratio of one student to ten book titles.

EQUIPMENT REQUIRED FOR THE TEACHING OF INTEGRATED SCIENCE

S/№.	DESCRIPTION	QUANTITY
116)	Skeletal System	3
117)	Muscular System	3
118)	Brain and Nervous System	3
119)	Circulatory System	3
120)	Digestive System	3
121)	Eye and Vision	3
122)	Skin and Excretory organs	1
123)	Microscope	40
124)	Incubator/Sterilizer	1
125)	Autoclave (portable)	3
126)	Top Loading Balances	4
127)	Hot Plates	1
128)	Refrigerator	1
129)	Water Filter	1
130)	Hygrometer	1
131)	Drying Oven	1
132)	Microtome	1
133)	Automatic Tissue Processor	3
134)	Centrifuge	1
135)	Herbarium Cabinet	9
136)	Herbarium Index Boxes	3

137)	Air Pump	1
138)	Photometer	1
139)	Kymograph	1
140)	Dissecting Microscope	3
141)	Insect Light Traps	3
142)	Insect Box (large)	many
143)	Slide Projector	1
144)	Overhead Projector	2
145)	Steel Frame Aquarium	1
146)	Oxygen Meter	3
147)	Herbarium	4
148)	Binocular Microscope	30
149)	Embedding Bath	
150)	Manesty Still	
151)	Water Bath	
152)	PH meter	
153)	Tissue Grinder lan	
154)	Calorimeter	
155)	Auxanometer (Electric)	
156)	Soil Auger	4
157)	Plant Press	2
158)	Soil Testing Kit	2
159)	Wooden Quadrant	1
160)	Measuring Tape	10
161)	Biological Tape	1
162)	Bunsen Burner	18
163)	Gas Cylinder	2
164)	Meter Balance	
165)	Cone Balance	
166)	Thermostat	
167)	Steam Bath	
168)	Magnetic Stirrer	
169)	Suction Pump	
170)	Circulating Water Pump	
171)	Soxlet Extractor	
172)	Rotary Evaporator	
173)	Water Tank	
174)	First Aid Box	
175)	Conductivity Meter	
176)	Water Distiller	
177)	Spectrophotometer	
178)	Oven and Victor Meyer’s apparatus	
179)	Vapour density (density bottle)	
180)	Ammeter	
181)	Volmeter	
182)	Rheostat	

183) Triangular Prism
184) Rectangular Prism
185) Pendulum Equipment
186) Stop Clock
187) Meter Rule
188) Convex Mirror
189) Concave Mirror
190) Telescope
191) Vernier Calipers
192) Micrometer Screw Gauge
193) Thermometer
194) Bar Magnet
195) U-shaped Magnet
196) Soft-iron Bar
197) Solenoid
198) Steel Bar
199) Electromagnet
200) Colour Disc
201) Colour Filter
202) Iron Fillings
203) Compass
204) Ticker-Timer
205) Glass String (100ml)
206) Pine-hole Camera (can be made by students
207) Ray Box
208) Ripple Tank
209) Tuning Fork
210) Meter Box
211) Resonance Table
212) Lead-acid-Accumulators
213) Dry Cell
214) Connecting (copper) wire
215) Roll-assorted
216) Plug key
217) Simple Electric Motor Generator
218) Zinc Rod
219) Copper Rod
220) Capillary tubes
221) Glass Tubes
222) Stop Watch
223) Dissecting Kit
224) Hand Lens
225) Beam Balance
226) Spring Balance
227) Computer
228) Workbench with all accessories

229) Vice
230) Toolbox with the following content:
   x. Hammer
   y. Hack saw
   z. Soldering iron and lead
   aa. Tri square
   bb. Pliers
   cc. Files
   dd. Glass Cutter
   ee. Spoke Shave
   ff. Spanners
   gg. Tape
   hh. Chisel
   ii. Tester
   jj. Coping Saw
   kk. Cross Cut
   ll. Tenon Saw
   mm. Mallet
   nn. Marking Gauge
   oo. Collapsible Meter Rule
   pp. Hand drill with set of twist drills and drill bits
   qq. Punch/pincer
   rr. Adjustable Screwdriver
   ss. Knife
   tt. Rasp plane

Note: the quantity should be determined by the number of students in the programme

Essential Needs

c) Constant supply of (i) water (ii) electricity and (iii) gas.

Supply Of Chemicals

d) Integrated Science teaching involves the use of chemicals that would need to be replenished. There is therefore needed to provide adequate potent chemicals/reagents for the experiments specified in the curriculum.

6. PERSONNEL

i) Academic Staff

The programme staff strength of:

(b) a minimum of 8 lecturers for single major programme

Note; A teacher to students' ratio of 1:25 should be adhere to.

Qualification: At least B.Sc. (Ed) Hons. Degree or its equivalent with NCE or PGDE or B.Ed. with a minimum of Second Class Lower. The staff should preferably be qualified in Integrated Science. Master's degree in science education is acceptable.

xi) **Support Staff**

One Laboratory Technologist
One Laboratory Technician
One Laboratory Assistant
One Workshop Attendant
One Laboratory Attendant
One Cleaner
One Typist/Computer Operator

7. MODE OF TEACHING

Any teaching and learning of Integrated Science should emphasis the principle of integration based on the following:

f) Unity of all knowledge
g) Conceptual unity of all Sciences
h) Unified process of science enquires
i) Inter-disciplinary studies
j) Social relevance of Science

Note:

Teaching and learning in Integrated Science should be activity-based and learner-centered.

The development of the science skills of observing, classifying, measuring, organizing, formulating hypothesis, experimenting and interpreting data and reporting results should be a major aim. A brief checklist for an activity-based approach to learning science is that students should be:

(k) Handling materials, living and non-living;
(l) Designing, making or manipulating apparatus using' a variety of materials including 'junk' items;
(m) Moving around freely and finding the materials they need;
(n) Discussing their work with each other and the teacher;
(o) Busy doing things they feel are important;
(p) Trying to work out for themselves what to do, from step to step, and not expecting to be told what to do;
(q) Puzzling over problems;
(r) Comparing their ideas or observations with those of others;
(s) Embarking on Field Trips;
(t) Excursion to places where students can observe science in operation/action to enhance better understanding of science.

The Integrated Science programme should be taught in such a way that those students:

(n) Take the initiative in suggesting what to do and how to set about it;
(o) Try out ideas to see what happens;
(p) Observe things closely – watching, listening, touching, smelling;

(q) Try different ways of approaching a problem;
(r) Classifying things according to their properties or characteristics;
(s) Make sure record of what they find out or observe
(t) Use instruments for aiding observation and measurement;
(u) Devise and apply tests to find out what things will do;
(v) Make predictions of what they expect to happen;
(w) Look for evidence to support the statements they make;
(x) Try to explain their observations;
(y) Confirm their findings carefully before accepting them as evidence;
(z) Have workshop's experience and practice.

Credit Units Required for Graduation

Integrated science	=	48 Credits
GSE	=	16 credits
Education	=	24 credits
Teaching Practice	=	06 Credits
Total	=	94 Credits

FIRST SEMESTER NCE I

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 111	Mathematics for Science I	1	Compulsory
ISC 112	Science Education I	2	Compulsory
ISC 113	Introduction to Scientific methods	1	Compulsory
ISC 114	Components of the environment I	1	Compulsory
ISC 115	Nature of matter I	1	Compulsory
ISC 116	Earth in the universe	1	Compulsory
ISC 117	Processes of life	2	Compulsory
	Total	**9**	
GSE COURSES			
GSE 000 A	Media Information Literacy		Compulsory
GSE 111	General English I	1	Compulsory
GSE 112	Introduction to Library Studies	1	Compulsory
	TOTAL	**2**	

SECOND SEMESTER NCE I

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC121	Mathematics for Science II	1	Compulsory
ISC122	Transport Control and Development in living things	1	Compulsory
ISC123	Man and Energy I	2	Compulsory
ISC 124	Fields and Waves	3	Compulsory
ISC 125	Genetics, growth and Development	3	Compulsory
	Total	**10**	

GSE COURSES			
GSE 000 B	Media Information Literacy		Compulsory
GSE 121	General English II	1	Compulsory
GSE 123	Introduction to Computer Studies I	**1**	Compulsory
SECOND GSE 124	Family life & Emerging Health Issues	**1**	Compulsory
	TOTAL	**3**	

FIRST SEMESTER NCE II

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 211	Components of the environment II	1	Compulsory
ISC 212	Man and the Environment	1	Compulsory
ISC 213	Laboratory management and safety	2	Compulsory
ISC 214	**Workshop Practices, Skill Acquisition and ICT**	2	Compulsory
ISC 215	Metals	3	Compulsory
	Total	**9**	
GSE COURSES			
GSE 000 C	Media Information Literacy		Compulsory
GSE 211	General English III	1	Compulsory
GSE 213	Introduction to Computer Studies II	1	Compulsory
GSE 214	Trafficking in Persons Issues	1	Compulsory
	TOTAL	**3**	

SECOND SEMESTER NCE II

INTEGRATED SCIENCE COURSES			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 221	Nature of matter II	1	Compulsory
ISC 222	Science Education II	2	Compulsory
ISC 223	Dynamics	1	Compulsory
ISC 224	Research method	1	Compulsory
ISC 225	Carbon Compound I	1	Compulsory
ISC 226	Fundamentals of Living things	2	Compulsory
ISC 227	Chemical Energetics	1	Compulsory
	Total	**9**	
GSE COURSES			
GSE 000 D	Media Information Literacy	2	Compulsory
GSE 221	General English IV	1	Compulsory
GSE 223	Citizenship Education	1	Compulsory
GSE 224	Entrepreneurship	1	Compulsory
	TOTAL	**5**	

* GSE 000 Runs for year I and year II and ALL carry 2 credit units.

NCE III FIRST SEMESTER

	EDU 311	**Teaching Practice**	**6**

SECOND SEMESTER NCE III

INTEGRATED SCIENCE			
COURSE CODE	**TITLE**	**CREDITS**	**STATUS**
ISC 321	Man and Energy II	2	Compulsory
ISC 322	Reproduction and Growth	2	Compulsory
ISC 323	Carbon compounds II	2	Compulsory
ISC 324	The earth and the moon	1	Elective
ISC 325	Global ecology	1	Elective
ISC 326	Science and Society	3	Compulsory
	Total	**9C+2E=11**	
GSE COURSES			
GSE 322	General English V	1	Compulsory
GSE 323	Science and Technology in Society	1	Compulsory
GSE 324	Political Economy	1	Compulsory
	TOTAL	**3**	Compulsory

*The project may be done in either Integrated Science or the other teaching subject, but it will be credited to EDU 323

NCE 1 – FIRST SEMESTER

ISC 111 Mathematics for Science II (Arithmetic)
1 Credit (2 Hours/Week) Compulsory

- Calculate basic arithmetic functions.
- Simple algebraic equations
- Evaluations of numerical expressions.
- Positive and negative indices and square roots.

ISC 112 Science Education 2 Credit (3 Hours/Week) Compulsory

- History and philosophy of Integrated Science.
- Traditional African ideas about learning.
- Behaviorism.
- Constructivism.

- Skinner's behavioral ideas.
- The Bloom taxonomy of educational objectives.
- Gagne's ideas.
- Piagetian Stage theory.
- Brunner's ideas.
- Ausubel and the alternative conceptions movement.
- Application of education theories to science teaching.
- Stages of cognitive development and the cognitive demands of science curricula.
- Children's alternative conceptions.
- Scientific concepts.
- Science Education research from Nigeria.
- Finding out what children already think and know.
- Presenting counter demonstrations and arguments, generating cognitive conflict.
- Drawing arguments and evidence together.
- Maximizing children's involvement in their own learning.
- Using context to explain concepts.
- Use of analogies (similes and metaphors)

1SC 113 Introductions to Scientific Methods
1 Credit, 2 Hours/Week) Compulsory

- 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 skills

ISC114 Components of the Environment I 1 Credit Compulsory

- Air pollution, sources and consequences of air pollution.
- One method for determining the proportion of oxygen in the atmosphere
- Qualitative and Quantitative composition of air
- Physical properties and uses of oxygen and carbon dioxide and their importance to living things.
- Sources of water and contaminating agents
- Importance of water to Life
- Nature of water as a solvent
- Importance of oxygen dissolved in water.
- Compare rural and urban water supplies
- Methods of water purification
- Water cycle
- Elements of weather

- Simple weather recording instruments
- Organisms that live in soils in our environment.
- Mineral component of the soil
- Soil Formation
- Types of soil
- Importance of soil
- Soil erosion and the relevant preventive measures
- Bush Burning
- Drainage patterns, causes, prevention and effect

ISC115 Nature of Matter I 1 Credit (2 hours/week) Compulsory

- States of Matter
- General physical properties of solids, liquids and gases.
- Boyle's law, Charles' law. Ideal gas law
- Vapour pressure
- Macromolecular structures of NaCl as an ionic solid and carbon (diamond)
- Classification of matter
- Classification of common elements
- Elements, compounds and mixture.
- Structure of the atom
- Concepts of atomic number and mass number
- Isotopes
- Oxidation/Reduction (properties along period and group)
- Ionic and covalent compounds

ISC 116 The Earth in the Universe 1 Credit (2 Hours) Compulsory

- The Solar System
- Space vacuum.
- The Universe **(**stars, planets and satellites)
- Galaxies and other stellar phenomena
- Big Bang Theory of the formation of the universe
- Telescopes (detection and tracking of radiation from wave emitting bodies)
- Flight (kites, gliders, aerofoiled and helicopters)
- Economic importance of air flight.
- Space technology (history, successes and dangers)
- Low weight and weightlessness

ISC 117 Processes of Life 2 Credits Compulsory

- Photosynthesis
- Test leaves and storage organs for starch.
- Combustion and respiration.
- Oxidation and reduction
- Respiration
- Energy change during the burning of food
- Respiratory System and problems connected to breathing

- Nutrition (classes, sources and importance of nutrients)
- Interrelationship between population, personal health and nutrition
- Digestive system
- Absorption of food and simple food test.
- Food storage
- Circulatory system
- Excretory system
- Nervous system
- Skeletal system

NCE I
SECOND SEMESTER

ISC 121 Mathematics for Science II 1 Credit (2 hours/week) Compulsory

- Graphs and Forms
- Variables and Scales for graph plotting.
- Slope and intercept on a linear graph.
- Standard linear form y = m x + c
- Forms of common plots such as $\frac{1}{x}$, x^2, $\frac{1}{x^2}$, sinx, cosx, e"x, Sinx, Cosx;
- Slope of a tangent to a curve as a means of obtaining gradient.
- Geometry and Trigonometry
- $\frac{d}{dx}$ For a rate of change with respect to variable x.
- Area below a curve and relate this to integration
- Histograph plots.
- Simple harmonic motion

ISC 122 Transport Control and Development In Living Thing 1 Credits, (2 Hours/Week) Compulsory

- Root, Leave and Stem system of Plants
- Structure and arrangement of xylem and phloem tissues
- Transportation system in plants
- Distribution system in plants
- Male and female gemmates and systems

- Fertilization and development of fetus
- Blood tests and practical application of blood groups.
- Consequences of excessive reproduction

ISC 123 Man and Energy I 2 Credits, (4 Hours/Week) Compulsory

- Force,
- Work done
- Energy (Forms of Energy)
- 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 eclipse0
- 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

ISC 124 Field and Waves 3 Credits (4 Hours) Compulsory

- Force fields and inverse square law
- Magnetic, electric and gravitational fields
- Application of force fields to the television tube, man-made satellites, natural satellites and the solar systems
- Current trends in communication (Internet, E-mail, voicemail and global communication systems)
- Waves (types of waves, longitudinal and transverse)
- Polarization of transverse wave
- Velocity, frequency and wavelength; the equation v=fn applies to vibrating air columns, radio serials, resonance and beats.
- Doppler Effect and its application on light and sound
- Electromagnetic spectrum in terms of frequency and the applications
- Interference with applications in light, sound and radio waves
- Ripple tank.
- Electromagnetism

ISC 125 Genetics, Growth and Development 3 Credits (4 Hours) Compulsory

- Population and Genetics
- Hereditary
- Principles of gene segregation and independent assortment
- Genetics (blood groups, Down's syndrome, sickle cell anemia)
- Genetic engineering in medicine
- Genetic engineering for human population.
- Development and Growth
- Factors associated with growth
- Characteristics associated with puberty
- Menopause

NCE II

FIRST SEMESTER

ISC211 Components of the Environment II
1 Credit (2 Hours/Week) Compulsory

- Characteristics and Classification of Living and Non-Living Things
- Classification of growth (temporary and permanent changes)
- Plant and Animal Cell
- Chromosomes and Genes
- Bacteria and viruses
- Importance of bacteria
- Diseases caused by Viruses and bacteria
- Fungi and state their characteristics.
- Types of fungi.
- Occurrence of fungi, their use as food

ISC212 Man and the Environment 1 Credit, (2 hours/week) Compulsory

- Human Beings as Higher Animals
- Characteristics of primates
- Application of basic intelligence skills
- Introductory Ecology
- Ecosystem (food chains, food webs)
- Carbon and Nitrogen cycles.
- Importance of fertilizers in food production
- Traditional and modem methods of food preservation
- Associations (parasitism, symbiosis and commensalisms)
- The role of Man in resource development
- Resources exploitation by man (deforestation, desertification mining etc.)
- Environmental pollution (causes, consequences and control.
- Ozone layer
- Conservation and recycling of natural resources
- Population and Effects of urbanization on the environment.
- Field trip

ISC 213 Laboratory Management and Safety 2 Credits (4 Hours/week) Compulsory

- Laboratory Management
- Laboratory rules
- Laboratory equipment/apparatus
- Storage and management procedures
- Microscope

- Balances (parts, manipulation and types)
- Preparation of solution - Molar and percentages.
- Indicators - pH ranges.
- Uses of burettes and pipettes and their maintenance
- Bunsen burners, flame parts and adjustments.
- Glassblowing.
- Accumulator, circuit connection - series and parallel.

- First aids for
-

ISC 214 Workshop Practices, Skill Acquisition And ICT
2 Credits (4Hours/Week) Compulsory

- Improvisation (definition and its advantages.)
- Paper work in modelling
- Glass work Glass-cutting, construction of aquarium
- Preparation of skeletons and herbariums.
- Elements of painting
- Metal workshop (Soldering, welding and Engraving techniques)
- ICT (meaning component and importance
- Instruments used in electrical workshop.
- Simple circuit connection and types
- Fuses and uses
- Elementary Electronics
- Mechanism of radio and tape recorder and T.V functions
- Wavelengths and channels
- Batteries – types, functions and maintenance
- Meaning and reasons for skill acquisition

ISC 215 METALS **3 Credits (4Hours/Week) Compulsory**

- General Properties of Metals
- Reactivity of Metals
- Importance of 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

NCE II
SECOND SEMESTER

ISC 221 Nature of Matter Ii 1 Credit (2 hours/week) Compulsory

- Atomic Structure
- Periodic Table
- Physical and Chemical Changes
- Separation Techniques
- Transition Elements and their Properties
- Reactions of Some Ions
- Volumetric Analysis

ISC222 Science Education II 2 Credits (4hours/week) Compulsory

- Developing a course
- Developing a lesson

- Mixed ability groups
- Special educational needs (care)
- Board work
- Demonstration method
- Practical activities
- Discussions method
- Teaching/learning aids.
- Purposes of assessment
- Different modes of writing questions
- Preparing marking schemes
- Evaluation of classroom activities and end of course performance.
- Micro-Teaching

ISC223 DYNAMICS 1 Credit (2 Hours/Week) Compulsory

- Speed
- Acceleration
- Speed/Time Graph for Linear Motion
- Newton's Law of Motion
- Gravitational Force
- Concept and Purpose of Space Travels.
- Satellite and Its uses in the Society
- Momentum
- Conservation of Linear Momentum.
- Motion in a Circle
- Simple Harmonic Motion

ISC 224: Research Method 1 Credit (2Hours/Week) Compulsory

- Research (Meaning, types and importance)

- Identifying the topics
- Topic selection
- Literature Review
- Construction of instruments
- Data Analysis
- Project reports

ISC 225 Carbon Compounds I 1 Credit (2 hours/week) Compulsory

- Introduction to Carbon Chemistry
- Catenation Of Carbon
- Aliphatic Hydrocarbons
- Crude Oil
- Refining crude oil, its uses and its economic importance
- Cracking
- Octane number of a fuel
- Coal

- Resource management and national wealth
- Mineral exploration
- Pollution management.

ISC 226 Fundamentals of Living Things 2 Credits (4Hours/Week) Compulsory

- Cell Biology
- Nature and Function of Cellular Constituents.
- Process of Cell Division
- Replication of DNA
- Enzymes and Factors Affecting Enzyme Activity
- Chromosomes
- Genes
- Variations
- Huntington's Chorea
- Genotype and Phenotype
- Gene Pools

ISC 227 Chemical Energetics 1 Credit (2Hours/Week) Compulsory

- Energy of Reactions
- Enthalpy Changes During a Relation
- Exothermic and Endothermic Reactions
- Hess's Law
- Rate of a Reaction
- Order of Reaction
- Activation of Energy
- Catalysis
- Enzymes Catalysts
- Equilibrium of Dynamics
- Le Chaterlier's Principle

TEACHING PRACTICE

NCE III FIRST SEMESTER
SECOND

SEMESTER NCE III

ISC 321 MAN AND ENERGY II 2 Credits (4 hours/week) Compulsory

- Magnetism
- Laws of Magnetism
- Magnetic Induction
- Electrostatics
- Static Electricity and Magnetism
- Electrostatics
- Current Electricity
- Simple Circuit and their Functions
- Conductor and Electrical Insulator

- Series and Parallel Circuits.
- Transfer of Chemical Energy to Electrical Energy
- Electromagnetism
- Ohm's Law
- Direct and Alternating Currents.
- Mains Electrical Circuits
- Principle of A Ring-Main Circuit
- Principle of Earthling Appliances and Other Safety Aspects of Electrical Circuits.
- Radioactivity (Types, Properties, Uses And Danger)

ISC 322 Reproduction and Growth 2 Credits (4hours/week) Compulsory

- Sexual Reproduction
- Reproductive System
- Human Development
- Monthly Cycle,
- Pregnancy
- Contraception and Family Planning
- Growth and Development
- Parturition And Lactation
- Puberty
- Human Potentials for Population Growth
- Growth in Plant
- Introductory Embryology

ISC 323 Carbon Compounds II 2 Credits (4hours/Week) Compulsory

- Haloalkanes (Reactions, Importance and Dangers)
- Alkanols (General Formula, Preparation, Properties and Uses)
- Alkanoic Acids (General Formula, Preparation, Properties and Uses)
- Amines and Amino Acids (General Formula, Classes, Properties and Uses)
- Synthetic Macro-Molecules
- Polymerization

ISC 324 Earth and the Moon 1Credit (2Hours/Week) Elective

- Natural Cycles (Days, Lunar Months, And Year)
- Seasons (Harmattan; Summer/Winter, Rainy/Dry)
- Structure of the Earth
- Geological Time Scale
- Atmosphere
- Rocks (Types And Formation)
- The Moon
- Relationship between Moon and the Earth
- Solar And Lunar Eclipse

ISC 325 Global Ecology 1 Credit (2Hours/Week) Elective

- 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
- Immunization

ISC 326 Science and Society 3 Credits(4Hours/Week) Compulsory

- Application Of Science And Technology
- Basic Scientific Principles and Design
- Laboratory Devices and Systems

PHYSICAL AND HEALTH EDUCATION (DOUBLE MAJOR)

PHILOSOPHY

The philosophy of Physical and Health Education is to develop academic and professional competencies which will enable individuals earn a living and healthy lifestyle in society. It provides basis for knowledge and experience that characterize an educated and fully developed person.

2. **OBJECTIVES**

The objectives of Physical and Health Education programmes are to:

a. Produce teachers who promote knowledge, attitude, skills and sound health, at the Basic Education Levels.
b. Produce teachers who can organize and administer sports programmes (both intramurals and extra murals)
c. Prepare teachers that qualify for post-NCE degree programme in Physical and Health Education.

3. ADMISSION REQUIREMENTS

(I) GENERAL

a) Senior Secondary School Certificate of WAEC or NECO or any other equivalent Certificate from recognized examination bodies with credit passes in five (5) subjects including English Language and Mathematics at not more than two sittings.
b) A Grade II Teacher's Certificate (TC II) with credit or merit in five (5) subjects Credits/Merits in English Language and Mathematics.
c) All candidates wishing to be considered for direct admission must meet the selection requirements by an accredited body such as JAMB.
d) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews for some courses. This is legitimate.

(ii) ADDITIONAL REQUIREMENTS

a) In addition to the above requirements, candidates must possess one credits in any of Physical Education, Health Science and Biology.
b) Candidates should pass a physical fitness skill test to be conducted by the Department of Physical and Health Education of his/her choice College of Education.

4. (i) FACILITIES AND EQUIPMENT

(a) 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 of 40mx50, for gymnastics,	
Swimming pool (where local resource permit)	
Squash court	
Hockey field	
Cricket pitch	
Gymnasium	
Lecture Theatre (large, well ventilated)	
Storage room (large, well ventilated)	
Equipped Exercise Physiology Laboratory	
6-8 lane standard athletic track	
PHE Resource Centre (for Audio-Visual equipment for	
Effective teaching of skills)	

(b) 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
Balance Beam	2
Flexometer	2
Padded tables	2
Step Benches	2
Tapes, 30m, 50m, & 100m	3 each
Stop watches 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
Track suits	6
Pairs of high jump stand	4
Aluminum cross bars	4
Landing foams for high jump and pole-vaults	40 pairs
Canvases	20 pairs
Shin guards	20 pairs
Stockings etc	8
Exchange batons	60
Hurdle stands	10

D) BALL GAMES

Soccer balls	10
Inflators	2
Handballs (male)	10
Handballs (female)	10
Volleyballs	10
Basket Ball (Male) and (Female)	10
Hockey balls	10
Handball Protectors	6
Table Tennis tables	4
Table Tennis eggs	12
Cricket kits, balls, bats, protective devices	4 sets

E) RACKET GAMES, ETC

Tennis rackets	12
Badminton rackets	12
Hockey sticks	30
Table tennis bats	20
Hockey keepers 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

1.	Stop watches	10
2.	Measuring tapes	2
3.	Weighing scales	5
4.	Maintenance equipment	5
5.	Whistles (all kinds)	12
6.	Recording sheets	For all sports
7.	Sleeping bags	160
8.	Mosquito nets	35
9.	Tents	160
10.	Camp bed	160
11.	Life jackets	3
12.	First Aid boxes	3
13.	Multi Gym	35
14.	Back Packs	2
15.	Tape recorders	20
16.	Empty tapes	all systems
17.	Anatomy and Physiology charts	all systems
18.	Physiology Models	all systems
19.	Stove	35
20.	Lanterns	160
21.	Camping boots	1 set
22.	Television set	1 set

23.	Video set		1 set
24.	A set of multimedia computer + CD's	2	
25.	Lawn mowers		5
26.	Wheel Barrows		5
27.	Flags (various colors)		
28.	Scoring boards for various games		

4. (ii) 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.
III) 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.

5. PERSONNEL

i. **Academic staff**

A minimum of ten (10) 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 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.

ii. Again, that training and retraining of personnel in PHE should take cognizance of the various areas of specialization i.e. Health, Physical Education, Exercise physiology, Sport Management Recreation etc.

ii. Others

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 PHE department

6. MODE OF TEACHING

i) Mode of teaching is practical and theory, depending on the course except physical activity (sports skills) that must be practice and theory, plus camping, field trips, excursion/educational visits.
ii) Students certified unfit for sports practical e.g. pregnant women, should terminate the programme until after delivery.
iii) Medically unfit students e.g. an epileptic student shall not be allowed to participate in any practical field activities.

7. ASSESSMENTS AND CERTIFICATION

Practical should *be* 60% and theory to attract 40% of overall assessment.

8. GRADUATION REQUIREMENTS

i) Successful completion of Teaching Practice and outdoor Education programmes.
ii) Successful completion of project for the award of NCE Certificate.

Physical and Health Education (DM)		48
Education	-	24
Teaching Practice	-	06
General Study	-	16
Total	=	**94**

RESEARCH PROJECT 311

The Final Year Project which earns 2 credits is compulsory and cannot be waived for any student and shall be credited to EDU 311.

COURSE CODES, TITLES CREDIT UNITS AND STATUS NCE I FIRST SEMESTER

COURSE CODE	TITLE	CREDIT	STATUS
	NCE I FIRST SEMESTER		
PHE 111	Theory and techniques of Football.	1	Compulsory
PHE 112	Theory and techniques of Handball	1	Compulsory
PHE 113	Physical Fitness	1	Compulsory
PHE 114	History and Philosophy of Physical Education	2	Compulsory
PHE 115	Recreation Education	1	Compulsory
PHE 116	Concepts of School and Community Health Education	2	Compulsory
PHE 117	Anatomy and Physiology 1	2	Compulsory
		11 C	
	COMPULSORY GSE COURSES		
GSE 000 A	Media Information Literacy		Compulsory
GSE 111	General English I	1	Compulsory
GSE 112	Introduction to Library Studies	1	Compulsory
	Total	2 C	
	SECOND SEMESTER		
PHE 121	Theory and Techniques of Athletics (Track Events)	1	Compulsory
PHE 122	Theory and Techniques Gymnastics	1	Compulsory
PHE 123	Theory and Techniques of Swimming	1	Elective
PHE 124	Method of Teaching Physical Education	1	Compulsory
PHE 125	First Aid and Safety Education	1	Compulsory
PHE 126	Personal, Mental and Emotional Health	1	Compulsory
PHE 127	Anatomy and Physiology II	1	Compulsory
PHE 128	Methods of Teaching Health Education	1	Compulsory
		8 C+1E =	

		9	
	COMPULSORY GSE COURSES		
GSE 000 B	Media Information Literacy		Compulsory
GSE 121	General English II	1	Compulsory
GSE 123	Introduction to Computer Studies I	1	Compulsory
GSE 124	Family Life & Emerging Health Issues	1	Compulsory
	Total	3 C	
	NCE II FIRST SEMESTER		
PHE 211	Theory and Techniques of Basketball	1	Elective
PHE 212	Theory and Techniques of Volleyball	1	Compulsory
PHE 213	Theory and Techniques of Cricket	1	Elective
PHE 214	Introduction to Sport Management	1	Compulsory
PHE 215	Coaching and Officiating of Sport	1	Compulsory
PHE 216	Nutrition and Drug Education	1	Compulsory
PHE 217	Citizenship and Leadership Training	1	Compulsory
		7C+2E = 9	
	COMPULSORY GSE COURSES		
GSE 000 C	Media Information Literacy		Compulsory
GSE 211	General English III	1	Compulsory
GSE 213	Introduction to Computer Studies II	1	Compulsory
GSE 214	Trafficking in Persons Issues	1	Compulsory
	Total	3 C	
	SECOND SEMESTER		
PHE 221	Theory and Techniques of Tennis	1	Compulsory
PHE 222	Theory And Techniques Of Athletics (Field Events)	1	Compulsory
PHE 223	Theory and Techniques of Hockey	1	Elective
PHE 224	Seminar in Physical and Health Education	1	Compulsory
PHE 225	Physical Education Curriculum	1	Compulsory
PHE 226	Health Education Curriculum	1	Compulsory
PHE 227	Research Methodology in PHE	2	Compulsory
PHE 228	Test & Measurement in Physical & Health Education	2	Compulsory
PHE 229	Introduction to Kinesiology	1	Compulsory
		9 C+ 1 E = 10	
	COMPULSORY GSE COURSES		
GSE 000 D	Media Information Literacy	2	Compulsory
GSE 221	General English IV	1	Compulsory
GSE 223	Citizenship Education	1	Compulsory
GSE 224	Entrepreneurship	1	Compulsory
	Total	5C	
	NCE III FIRST SEMESTER		

EDU 321	Research Methods and Project	2	C
EDU 311	Teaching Practice	6	C
	Total	8C	
	SECOND SEMESTER		
PHE 321	Theory and Techniques of Badminton	1	Compulsory
PHE 322	Theory and Techniques of Table Tennis	1	Compulsory
PHE 323	Exercise Physiology	1	Compulsory
PHE 324	Communicable and Non-Communicable Diseases	1	Compulsory
PHE 325	Introduction to Psychology Of Sport	1	Compulsory
PHE 326	Adapted Physical Education and Sports	1	Compulsory
PHE 327	Family Life and Reproductive Health Education	1	Compulsory
PHE 328	Combat Sport, Traditional Sport and Dance Education	1	Elective
		8C+1E=9	
	COMPULSORY GSE COURSES		
GSE 322	General English V	1	Compulsory
GSE 323	Science and Technology in Society	1	Compulsory
GSE 324	Political Economy	1	Compulsory
		3C	

SUMMARY

Study Status	First year credit units	Second year credit units	Third year credit units	TOTAL
Compulsory	20	19	09	48
Elective (Optional)	1	1		2
Total	21	20	9	48

*The project must be done in Physical and Health Education Department but it will be credited to EDU 311

Minimum Credit Units Required for Graduation

Compulsory = 48 Credits
Elective = 2 Credits
Total = 48 Credits

NCE I - FIRST SEMESTER

PHE 111 THEORY AND TECHNIQUES OF FOOTBALL
OBJECTIVES 2 Credits Compulsory
At the end of this course, students should be able to achieve the following among others:

a. Discuss the historical development of football
b. Acquire basic skills and techniques of football
c. Explain the basic skills of football
d. Construct football pitch.
e. Discuss the officiating official's roles and their duties in the game of football

COURSE CONTENT

- History and development of football,
- Basic skills, in football game
- Tactics, and strategies.
- Rules of the game.
- Construction of the Football pitch
- Officials and officiating in the game of football
- Terminologies and record keeping in the game of football

PHE 112 THEORY AND TECHNIQUES OF HANDBALL
OBJECTIVES 1 CREDIT: COMPULSORY
At the end of this course, students should be able to achieve the following among others:

a. Discuss the historical development of handball
b. Acquire basic skills and techniques of handball
c. Explain the basic skills of handball
d. Construct handball pitch.
e. Discuss the officiating official's, roles and their duties etc

COURSE CONTENT

- History and development of handball,
- Basic skills in the game of handball.
- Tactics, and strategies.
- Rules of the game.

-Construction of the pitch.

- Officials and officiating.
- Terminologies and record keeping.

PHE 113 PHYSICAL FITNESS (1 Credit) C
OBJECTIVE
At the end of this course, students should be able to achieve the following among others:

a. Identify the values of physical fitness
b. Distinguish between health related and performance related components of physical fitness
c. Explain the specialized terms- High blood pressure, BMI etc.
d. Acquire knowledge in prescribing physical fitness exercises
e. Conduct physical fitness test.

COURSE CONTENT:

- Meaning of physical fitness
- Components of physical fitness
- Values of physical fitness
- Effects of physical fitness on the heart rate, blood pressure and physical characteristics of physical fitness (height and weight)
- Test for physical fitness
- Measures to be taken in conducting physical fitness test
- Gender participation in physical fitness
- Guidelines in selecting physical fitness exercises.
- Characteristics of physically fit and physically unfit persons.

PHE 114 HISTORY AND PHILOSOPHY OF PHYSICAL EDUCATION
OBJECTIVES **2 Credit Compulsory**

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

a. Discuss the nature of contemporary P.E. and show how it has evolved from the ancient time
b. Discuss the key concepts of the philosophy and their application to P.E.
c. Discuss the roles of Ancient Greece, Rome, Germany, Sweden, England, USA, and Japan mode of P.E
d. Discuss the development of P.E. in Nigeria
e. Articulate the contribution of Nigerian sports heroes and professional
f. Identify the current trends and the likely future of P.E. in Nigeria
g. Identify the various agencies and career opportunities in physical education.
h. Discuss the history and Development of physical education in Africa

COURSE CONTENT:

- Meaning, definition, Scope and concept of Physical Education
- Aims and Objectives of Physical Education
- Philosophy of Physical Education
- History of Physical Education in Ancient Greece, Rome,
- Germany, Sweden, England, USA and Japan
- Development of Physical Education in Nigeria
- Nigerian Sports heroes and professionals
- Current Trends in Physical Education in Nigeria
- Future trends in physical Education in Nigeria
- Physical Education, Agencies and Career guidance and opportunities

PHE 115: RECREATION AND TOURISM EDUCATION
OBJECTIVES **1 Credit Compulsory**

At the end of this course, students should be able to achieve the following among others:

a. Explain words the terms recreation and education, tourism, leisure, outdoor, and indoor. activities etc
b. Explain the values of recreation and leisure activities.
c. Explain the relationship between recreation and health

COURSE CONTENT:

- Definitions of Recreation
- Values of Recreation
- Purpose and objectives of Recreation
- Recreation activities under the component of Recreation
- Recreation Agencies: Private, Government etc
- Relationship between health and Recreation
- Relationship between Recreation and Leisure
- Organization and Administration of Recreation education
- Excursions/Visits to Recreation parks, tourist centres (in fulfillment of the requirement of outdoor education)
- Computer games/Sport: types, values and Scales.
- Dramatic and Creative rhythm
- Career opportunities in Recreation and tourism education.

PHE 116: CONCEPT OF SCHOOL AND COMMUNITY HEALTH EDUCATION

OBJECTIVES **2 Credits Compulsory**

At the end of this course, students should be able to achieve the following among others:

a. Explain the holistic concepts of health
b. List and explain factors that affect the health of an individual
c. Acquire and develop skills necessary for healthy living
d. Identify the various health agencies within and outside the community and their functions (WHO, UNICEF, FAO, NAFDAC ETC)

COURSE CONTENT:

- Definition, scope, and concepts of Health and Health Education
- Aims, Purpose and Objectives of Health Education
- History and development of health education in Nigeria
- Theories and evolution of health education
- Components of Health Education Program: Consumer Health, Nutrition Education, Adult Health, contemporary issues in health and health education etc.
- Factors affecting the health of individuals such as heredity, environment, personal factors e.g. lifestyle etc.
- Meaning and scope of School Health programme
- Component of School health programme
- Relationship between school and community health
- General principles and application of health. Emphasis should be on the following: Meanings and methods of Sanitation, Housing, Sewage and refuse disposal
- Air, water supply, sources and qualities of good water environmental pollutions of air, water, land and noise effect and prevention
- Control of Vectors both in rural and urban areas
- Health education, career guidance and opportunities
- Health problems in Nigerian communities
- Health Agencies e.g. WHO, UNICEF, FAO, NAFDAC etc.

PHE 117: HUMAN ANATOMY AND PHYSIOLOGY
OBJECTIVES **2 Credits Compulsory**

After studying this unit the students should be able to:

a. Define Anatomy and Physiology and explain the importance of understanding the relationship between structure and functions
b. Describe levels of organization of the body and provide characteristic of each level
c. Identify organs system i.e. skeletal system, types of bones, body cavities, and types of divisions of the skeleton (axial and appendicle).
d. Identify types of joints and their roles in the body.
e. Discuss muscular, nervous system and sense organs and their roles in human body

COURSE CONTENT:

- Organization of the body structure
- Life characteristics of the body structure
- Skeletal system: types and functions of bones, body cavities, discretional terms; main divisions of the skeleton (axial and appendicular); Types of joints.
- Characteristics of joints and the possible movement at the joints; Bones as levers in human body
- Posture and postural defects, meaning, kind and causes of postural defects.
- Muscular system, Types and characteristics, muscle tone and muscle contractions.
- Nervous systems: structure of nerve cells, structure and functions of sensory Nerves; Central nervous system
- Organization of the Central Nervous System: the reflex action.
- Sense organs: skin, eyes, ears, tongue and nose

NCE I SECOND SEMESTER.

PHE 121: THEORY AND TECHNIQUES OF ATHLETICS (TRACK EVENTS) (TRACK) 2 Credits Compulsory

OBJECTIVES

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

a. Construct a standard athletic track
b. Explain track events
c. Identify the basic rules/regulations in track events
d. Demonstrate the basic athletic crunch starts
e. Distinguish among sprints, middle, and long-distance races
f. Appreciate the importance of various athletic training methods
g. Identify the roles of officiating officials in athletic competitions

COURSE CONTENT:

- History and development of track events
- Tactics and strategies in track events performance
- Rules and Regulations in track athletics
- Construction/laying and maintenance of track

- Description of performance characteristics in: Sprints (100m, 200m, 400m); Middle distance races (800m, 1500m) and long-distance races (5000m, l0.000m and Marathon).
- Description of types and performance characteristics in Relays and Hurdling.
- Officials and officiating in track events.
- Basic skills and techniques in the throwing events (discus, shot put, javelin and Hammer).
- Basic skills and techniques in the Jumps (High jump, Hop, Step and Jump (triple); Long Jump and pole vault;
- Rules governing the jumps, officials and officiating, Terminology and Records keeping.
- Combined events Pentathlon and Decathlon.

PHE 122: THEORY AND TECHNIQUES OF GYMNASTICS
OBJECTIVES **1 Credits Compulsory**

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

a. Explain the meaning of gymnastics
b. Distinguish the various types of gymnastics
c. Distinguish between locomotive movement and non-locomotive movement
d. Observe safety measures in the performance of gymnastics activities
e. Appreciate the values of safety measures in gymnastics activities
f. Explain the values of gymnastics

COURSE CONTENT:

- Fundamental of human movement (Locomotive and non-locomotive) with their examples- walking, jogging, running, jumping, skipping, non-locomotive e.g. stretching, bending, lifting, pushing, twisting.
- History and development of gymnastics
- Values of gymnastics and safety measures---
- Description of stunts and tumbling-forward Roll, backward Roll and apparatus works - etc.
- Types of gymnastics and distinction between the Olympic)and Educational gymnastics

PHE 123: THEORY AND TECHNIQUES OF SWIMMING 1 Credit Elective

OBJECTIVES

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

a. Appreciate the importance of swimming as a survival sport
b. Enumerate the four basic swimming strokes- freestyle, butterfly, backstroke and breaststroke
c. Demonstrate the strokes
d. Appreciate swimming as a recreational and competitive sport
e. Appreciate safety precautions in swimming

COURSE CONTENT:

- Introduction to basic skills, buoyancy, arm and leg actions etc.

- Fundamental and practical approaches of study of strokes: free style (crawl), backstroke, breastbone and butterfly (Dolphin); Diving.
- Safety precautions
- Values of swimming
- Maintenance of pool, equipment and facilities
- Use of swimming aids (floats) etc.

PHE124: METHODS OF TEACHING PHYSICAL AND HEALTH EDUCATION 2 **Credits Compulsory**

OBJECTIVES

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

a. Identify the general format for writing lesson plans - (traditional and tabular)
b. Differentiate among the following concepts- introduction, development/body/presentation and evaluation
c. List the skills or strategies used for effective teaching
d. Apply each of them effectively in the teaching subject areas
e. Differentiate among; general objectives, specific/behavioral objectives, expressive objectives.

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, verbalization, 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, organization, 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
- Preparation of lesson notes (as above).

PHE 125: FIRST AID AND SAFETY EDUCATION 1 Credit Compulsory

OBJECTIVES

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

a. Explain the definitions of first aid and safety education
b. Enumerate the aims/objectives of first aid and safety education
c. Enumerate the qualities expected of a first aider

d. Explain the aims and purpose of first aid administration
e. Identify some emergency situations and types of first aid required
f. Enumerate the duties of a first aider
g. Identify areas in the school, home and community that are prone to accident
h. Explain measures that can be taken to minimize the occurrence of accident in such areas

COURSE CONTENT:

- Definition of First Aid, Characteristics of a first aider, contents of a first aid box and their uses, Qualities of a first aider and meaning of safety education.
- Hazards at home, in school, at work place on the road etc; fire drills.
- Action of a first Aider in emergencies such as bleeding, drowning, fainting, burns, scalds fire wounds and infections disasters, cuts, bruises, poisoning etc
- Description and analysis of sports injuries and management procedures: fractures, sprains, strains, dislocation, transportation (how to carry an injured or sick person) etc.
- Fits and unconsciousness: Emphasis should be on practical's, and where possible, members of voluntary organizations like the Red Cross Society, Boys Brigade etc should be invited to give practical demonstrations and training in the following areas. Bandages and Bandaging, Artificial Respiration.
- Safety and accident, safety measures, classification of accident, causes of road traffic accident and preventive measures.

PHE 126 PERSONAL, MENTAL AND EMOTIONAL HEALTHS 1 Credits Compulsory

OBJECTIVES

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

a. Explain the meaning of personal, mental and emotional health
b. State the characteristics of a healthy person
c. Demonstrate the care of the teeth, skin, eyes, ears, nose and whole body
d. Take care of the clothes, the surroundings e.g. classrooms, toilets etc
e. Identify and appraise health problems
f. Distinguish between mentally and emotionally disturbed person

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

PHE 127: HUMAN ANATOMY AND PHYSIOLOGY II 2 Credits Compulsory
OBJECTIVES
After studying this unit, students should be able to:

a. Name the major organ system and list the organs associated with it
b. Name and describe the locations of organs of each system and their major part
c. Describe the general functions of each organs system
d. Explain the principles mechanisms involve in each organ system – respiratory system, digestive system, circulatory system, blood composition, excretory system, endocrine system and reproductive system (male and female)

COURSE CONTENT:

- Respiratory system: breathing organs, mechanism and the control of respiration.
- Digestive system: Organs of digestion, assimilation and absorption
- Circulatory system: Organs of circulation: structure and functions of the heart, pulmonary and general circulation etc.
- Blood composition: Blood groups, functions of blood and immunity.
- Excretory system: Organs of excretory system, functions of excretory system, functions of the excretory organs (kidney and skin).
- Endocrine system: Organization of the system, different endocrine glands; hormones secreted and their functions (hyper - and hypo-secretions).
- Reproductive system (Male and Female).

2) **PHE 128: Methods of Teaching Health Education 1 Credits Compulsory**

OBJECTIVES
After studying this unit students should be able to:

a. Define the term teaching methods
b. Explain the methods of teaching Health Education
c. Outline the different methods in teaching Health Education
d. Discuss the advantages and the disadvantages of each of the teaching methods identified

COURSE CONTENT:

- Teaching methods: ways or approach of imparting knowledge to students
- Methods of teaching health education include the various approaches of imparting health knowledge, attitude and practices to bring about positive changes among individuals, home, school and the community.

- The different approaches or methods of imparting health knowledge, attitude and practices include the following; lecture method, project method, discussion method, role play, dramatization, demonstration etc.
- Advantages and the disadvantages of each of these methods depend on individual making use of the method, the size of the class and the instructional materials. Teachers are advised to vary in their approaches and methods used in teaching Health Education based on the needs, interest, age, size of the class and the topic he/she is teaching.

NCE II: FIRST SEMESTER

PHE 211: THEORY AND TECHNIQUES OF BASKETBALL 2 Credits Compulsory

OBJECTIVES

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

a. List and describe the basic skills of basketball game
b. Put the basic skills into practice situation
c. Explain some of the rules of the game
d. Draw and label the dimensions of basketball court
e. Explain the scoring system in the game of basketball
f. Explain the tactics and strategies in playing the game of basketball
g. Explain the terminologies of the game e.g. charging; double foul, fast break, jump ball, personal foul, travelling, rebounding etc.
h. Practice officiating in the game of basketball

COURSE CONTENT:

- History and development of basketball game
- Court dimension and maintenance
- Basic Skills in Basketball game
- Tactics and strategies of the game
- Rules of the game of Basketball
- Officials and Officiating in Basketball game
- Terminologies and Records keeping in Basketball game

PHE 212: THEORY AND TECHNIQUES OF VOLLEYBALL 2 Credits Compulsory

OBJECTIVES

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

a. Explain the basic skills in volleyball game
b. List and explain the rules in volleyball game
c. Demonstrate the techniques of the skills in volleyball game
d. Draw and level the dimension of the volleyball court
e. Draw a volleyball court and indicate the positions of the players at the start of the game and rotational order during play
f. Enumerate the defensive and offensive play strategies of the game
g. Explain the terminologies of the game e.g. rotation, set, block, attack, held ball, switch, smash etc.

h. Practice officiating in the game of volleyball

COURSE CONTENT:

- History and development of volleyball
- Court dimension and maintenance
- Basic Skills
- Tactics and strategies of the game
- Rules of the game
- Officials and Officiating in volleyball
- Terminologies and Record keeping in volleyball

PHE 213: THEORY AND TECHNIQUES OF CRICKET 1 **Credit Elective**

OBJECTIVES

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

a. Discuss the historical development of cricket
b. Demonstrate the basic skills in cricket - batting strokes, over's, boundaries, bowling etc
c. State the rules and regulations governing the game
d. Identify the roles of the officiating officials in cricket

COURSE CONTENT:

- History and development of cricket
- Layout and maintenance of cricket
- Facilities, equipment and supplies, oval, pitch
- Basic Skills and Techniques in Cricket: Battling, Bawling and Fielding
- Terminologies and Records: Inning, Over's, boundaries etc
- Rules and Regulations,
- Officials and Officiating in cricket

PHE 214: INTRODUCTION TO SPORTS MANAGEMENT 1 Credits Compulsory

OBJECTIVES

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

a. Think intelligently and make decision about issues they will face in the dynamic world of managing a sport enterprise
b. Develop critical/reflective competencies
c. Conduct themselves with professionalism
d. Discuss the foundations on which the international sport organization has developed with respect to international sport federations, leagues, corporation and events
e. Discuss trends in the field of international sports.

COURSE CONTENT:

- Meaning and Definition of organization and administration
- Types of leadership styles
- Organization and administration of tournaments and meets; types of tournaments, factors to be considered during organization of tournaments.
- Purchase, care and maintenance of sports equipment, facilities and supplies
- Legal liabilities in physical education

- Concept of sports management and duties of sports managers
- The school Intramural sports programme, organization and record Keeping
- Inter college Sports Organization and Management: - Violence in Sports
- Sports and society, marketing and promotion
- Human right issues in sports; child abuse, gender participation in sports, human trafficking in sports.

PHE 215: COACHING AND OFFICIATING IN SPORTS 1 Credits Compulsory
OBJECTIVES
At the end of this course, students should be able to:

a. Explain the meaning of coaching, officiating and teaching
b. Distinguish between coaching and teaching
c. Appreciate the importance of coaching and officiating in sport performance
d. Describe the qualities of a good coach and officiating official
e. Mention the officiating officials in different sporting events and explain their roles or duties
f. Acquire and develop different coaching skills and officiating in different sporting activities
g. Design and implement training programmes etc.

COURSE CONTENT:

- Definition of coaching and officiating
- Distinction between teaching and coaching
- Importance of coaching and officiating
- Qualities of a coach, qualification and functions of specialists in physical and Health Education
- Officials needed in sporting events
- Principles of officiating in sports
- Students exposure to practical officiating in sport competitions

PHE 216: NUTRITION AND DRUGS EDUCATION IN SPORTS 1 **Credits Compulsory**
OBJECTIVES
After studying this unit, the students should be able to:

a. Explain the meaning of nutrition, drugs, drug use, drug abuse etc.
b. Explain the various classes of food and their values to athletic performance
c. Define consumer health education with specific example
d. List the classes of food and explain what balance diet means
e. Explain methods of food preservation
f. Discuss classification of drugs in relation to international standard
g. Appreciate the plight of alcoholic in the society
h. Acquire knowledge on how to prepare nutrition for athletes as a form of career opportunity.

COURSE CONTENT:

- Consumer Health; Meaning, examples of Consumer rights
- Meaning, Classes, types and importance of food: referenced to be made to local foodstuffs and their values to athlete's well-being.

- Balanced diet, its values and preservations of food; deficiency diseases; food fads and fallacies, food and the digestive system; roles of nutrition in sports performance
- Preparation of simple meal for athletes in camp and during competitions.
- Nutrition for special groups e.g. School children, adolescence, and sick person
- Pre-game meal glycogen loading techniques
- Effects of glycogen loading on health and performance
- Definition of Drugs: Classification of drugs and alcohol?
- Drug use and abuse in sports
- Alcoholism: care and treatment therapy
- Importance of labels and expiry date of drugs
- Quacks and Quackery in drug production and dispensing
- Effects of the use of drugs in sports.

PHE 217: CITIZENSHIP AND LEADERSHIP TRAINING 1 Credits Compulsory
OBJECTIVES
At the end of this course, students should be able to:

a. Appreciate the motto of the centers for citizenship and leadership training in Nigeria (build the man and the community)
b. Appreciate the role of the course in developing endurance, courage, perseverance, etc. in Nigerian youth
c. Demonstrate good leadership and followership qualities
d. List and explain types of leadership styles
e. Acquire different life – saving skills in different situations
f. Appreciate its role in the total development of individuals
g. Explain its relevance to Physical Education and General Education etc.

COURSE CONTENT:

- Aims and objectives of the programme
- Mountaineering
- Camping and Hiking
- Origin of outdoor education
- Leadership skills: Inculcation and evaluation (display)
- Followership skills: Patriotism through citizenship and leadership training
- National Agencies: NOA, Man-O-War (Students are expected to attend a two-week camping in any of the leadership training centers (Mountain School) Share Hills Jos; Sea School, Lagos; Forest School, Port Harcourt; Hill Top NYSC Camp Awgu Enugu State etc.
- Emphasis. At least two accompanying PHE staff should stay with the students for the duration of the training and camping.
- Institutions should attend leadership training centers of their choice; and practical aspects should carry greater weights in evaluation/assessment.

SECOND SEMESTER

PHE 221: THEORY AND TECHNIQUES OF TENNIS 1 **Credits Compulsory**

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

a. Give accounts of the development of Tennis
b. Correctly construct and draw Tennis court
c. Acquire the tactics and strategies of the game
d. Describe various equipment used in playing Tennis
e. Officiate the game of Tennis.

COURSE CONTENT:

- History and development of tennis
- Court construction and maintenance in the game of Tennis
- Basic Skills and Techniques of the game
- Tactics and strategies of the game

- Rules of the game
- Officials and officiating of the game
- Terminologies and Record keeping in the game of Tennis

PHE 222: THEORY AND TECHNIQUES OF ATHLETICS (FIELD EVENTS)1 **Credits Compulsory**

OBJECTIVES

After studying this unit, students should be able to:-

a. State and explain the various Field Events in Athletics
b. Acquire the basic skills in Field Events i.e. Discus, shot put, Javelin, Hammer (Throwing Events) and High jump, Long jump, Triple jump and Pole vault (Jumping events)
c. Discuss the roles of Officiating officials.

COURSE CONTENT:

- Basic Skills in throwing events (discus, short put, javelin, hammer)
- Basic skills in jumps (High jump, Triple jump, and pole vault)
- Rules and officiating in field events
- Terminologies and Record keeping
- Practical exposure to the skills.

PHE 223: THEORY AND TECHNIQUES OF HOCKEY 1 **Credits Compulsory**

OBJECTIVES 1 **Credit Elective**

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

a. Discuss the origin of Hockey/ Development
b. Acquire the basic skill of Hockey
c. Explain the team formation, tactics and strategies of playing Hockey
d. Construct Hockey pitch
e. Officiate matches/ Administers the roles correctly
f. Explain different terminologies in the game of Hockey

COURSE CONTENT:

- History and development of hockey
- Court construction and maintenance of the game
- Basic Skills and Techniques of the game
- Tactics and strategies of the game
- Rules of the games
- Officials and officiating of the game
- Terminologies and Record keeping in the game of Hockey.

PHE 224: SEMINAR IN PHYSICAL & HEALTH EDUCATION 2 **Credit Compulsory**

OBJECTIVES

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

a. Discuss contemporary issues in the field of Physical and Health Education
b. Acquire skills require for academic paper presentation
c. Acquire wider scope in matters related to physical and Health Education
d. Present and defend a proposal on related topics of choice – (Practical presentation)

COURSE CONTENT:
The lecturers teaching the course should expose students to current Issues in physical and Health Education, Sports and Dance in order to develop the art of writing and paper presentation.

PHE 225: PHYSICAL AND HEALTH EDUCATION CURRICULUM 1 Credits Compulsory
OBJECTIVE
At the end of the course, the students should be able to:

a. Acquire learning experiences relevant to the scope of Physical and Health Education
b. curriculum designing i.e. guiding principles
c. Understand factors to be considered in designing a physical and Health Education curriculum
d. Understand the Philosophy and Need for designing a standard Physical and Health Education curriculum
e. Provide some instructional materials in Physical and Health Education curriculum

COURSE CONTENT:

- Definition of curriculum
- Principles guiding curriculum development
- Types of curriculum: Subject - centered; child-centered and community centered
- Factors to be considered in Designing a Physical and Health Education Curriculum
- Steps involved in designing a curriculum for PHE
- Facilities and instructional materials in Physical and Health Education curriculum

PHE 226: HEALTH EDUCATION CURRICULUM 1 Credit Compulsory
OBJECTIVE
At the end of the course, students should be able to:

a. Explain the meaning of health education curriculum
b. Differentiate between traditional and modern curriculum
c. Explain the scope of health education curriculum
d. Discuss philosophy and the need for curriculum in health education
e. Identify types of curriculum design in health education
f. Explain factors to be considered in curriculum design
g. Discuss facilities and instructional materials in health education

COURSE CONTENT:

- Definition of health education curriculum
- Differences between traditional and modern curriculum
- Scope of health education curriculum
- Philosophy and need for curriculum design in health education
- Types of curriculum design
- Factors to be considered in curriculum design in health education
- Facilities and instructional materials in health education

PHE 227: RESEARCH METHODOLOGY IN PHYSICAL AND HEALTH EDUCATION
2 Credits Compulsory

OBJECTIVES

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

a. Define the concept of research
b. List and explain types and nature of research
c. Explain the component of research e.g. Population, Research Design, Sample and Sampling techniques research instrument, Element and types of statistics and data analysis
d. Explain the importance of review of literature
e. Understand correct methods of referencing

COURSE CONTENT:

- Meaning and definition of Research
- Types and nature of research: Historical, experimental, survey, casual – comparative
- Elements of the Problem Statement
- Formulation of Hypothesis: Relationship with Research Questions; types of hypothesis, and testing of the hypothesis
- Literature Review in Research report.
- Sampling technique and data analysis
- Stages and steps involved in research report writing
- Elements and types of statistical analysis
- Questionnaire: Types, role of research question; and relationship with statistical analysis.

PHE 228: TESTS AND MEASUREMENT IN PHYSICAL AND HEALTH EDUCATION 2 Credits Compulsory

OBJECTIVES

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

a. Define the Terms, Test, Measurement and Evaluation as they applied to PHE
b. Justify the need for Test, Measurement and Evaluation in PHE
c. Recognize statistical symbol as %, x, , μ, $\bar{x}$,F, F, R, r etc.
d. Apply descriptive statistical tools (Tests) of percentage, frequency, mean, median, mode, standard deviation etc. in data analyses
e. Sketch statistical diagrammatical presentations such as graph: Histogram, Polygon, Pie chart etc.
f. Appreciate the use of statistics in simplifying data in research

COURSE CONTENT:

- Definition of test, measurement and evaluation
- The need for tests, measurement and evaluation in PHE
- Evaluation of tests and criteria for evaluation
- Elementary statistical analysis: Mean, Median, Mode, standard deviation, correlation coefficient, student t-test and chi square.
- Measurement of sport skills.
- Socio-metric tests.

PHE 229: INTRODUCTION TO KINESIOLOGY 1 Credit Compulsory
OBJECTIVES
At the end of the course, students should be able to:

a. Define the term kinesiology
b. Identify the values of kinesiology to Physical Educators and Sports Professionals
c. Explain some terminologies e.g. Agonist, Antagonist, Neutralizes, Stabilizes, synergist etc, in relation to kinesiology.
d. Identify special muscles groups, uses and roles in motion
e. Discuss Newton's laws of motion as they relate to sporting activities
f. Describe projectiles, trajectory of projectile and factors influencing the flight of projectile

COURSE CONTENT:

- Definition of Kinesiology
- Important of Kinesiology to PHE
- Special muscles use and role e.g. Agonist (mover) muscle Antagonist, Neutralizer, Stabilizer, Synergist.
- Muscular Analysis of movement at joints
- Equilibrium/definition types: i.e. stable, unstable, neutral
- Motion/Newton's Laws of Motion as they relate to sporting activities
- Types of Motion: Linear, angular, general, curvilinear
- Projectile: definition
- Trajectory of Projectile
- Factors influencing the flight of projectile, e.g. gravity, air resistance, angle of release.

NCE III: FIRST SEMESTER
EDU 311: TEACHING PRACTICE

NCE III: SECOND SEMESTER

PHE 321: THEORY AND TECHNIQUES OF BADMINTON 1 Credit Compulsory
OBJECTIVES
At the end of course, students should be able to:

a. State the origin and development of Badminton
b. Acquire and demonstrate the basic skills in Badminton
c. Explain the tactics and strategies of playing the game
d. Apply the rules, regulations and state the officials needed in the game of badminton
e. Enumerate the equipment needed for the game of Badminton
f. Construct a standard Badminton court

COURSE CONTENT:

- History and development of the badminton
- Dimensions and Construction of badminton court
- Basic skills of badminton
- Tactics and Strategies of the games
- Rules of the game

- Maintenance of badminton court
- Officials and officiating in the game of badminton
- Terminologies and Record keeping the game of badminton.

PHE 322: THEORY AND TECHNIQUES OF TABLE TENNIS1 Credit Compulsory

OBJECTIVES

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

a. State the origin and development of table tennis
b. Enumerate the equipment needed for the game of table tennis
c. Specify the accurate standard measurement of a table tennis board
d. Demonstrate the basic skills in table tennis
e. Describe the tactics, strategies and rules governing the game of table tennis
f. Enumerate the physical, socio-economic and emotional benefit of participating in the game of table tennis

COURSE CONTENT:

- History and development of the game of table tennis
- Dimensions of the tennis table
- Basic skills of table tennis
- Tactics and Strategies in the game of table tennis
- Rules of the game
- Terminologies and Record keeping in the game of table tennis
- Officials and officiating in the game of table tennis

PHE 323: EXERCISE PHYSIOLOGY 1 Credit Compulsory

OBJECTIVES

After studying this unit, students should be able to:

a. Discuss the nature, of contemporary, concept and scope of exercise physiology
b. Define some specialized areas in exercise physiology
c. Explain the roles of exercise physiology to Health promotion
d. Identify different types of energy systems and their relevance in sports

COURSE CONTENT:

- The concept and scope of exercise physiology
- Meaning of exercise, physiology and physiology of sports
- Physiological effects of training: Biochemical changes, cardiorespiratory changes, other training effects and retraining
- Biological energy cycle and energy sources during physical activities
- Meaning and types of energy; sources of energy for physical activities
- Types of energy systems: Phosphate, lactic Acid system and aerobic system Anaerobic energy system/metabolism
- Factors affecting energy uptake and their relevance in PHE

PHE 324: COMMUNICABLE AND NON-COMMUNICABLE DISEASES 1 **Credit Compulsory**

OBJECTIVES

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

a. Explain the meaning of communicable and non-communicable diseases
b. Define terms as related to communicable and non-communicable diseases, epidemic, endemic, pandemic, sporadic geographic spread etc.
c. Identify the types, causative agents, mode of transmission and preventive measure of these diseases
d. Identify National and International interventions of controlling the spread of these diseases

COURSE CONTENT:

- Definition of communicable and non-communicable disease
- Causes, symptoms, prevention and control of communicable diseases such as cholera, smallpox, chicken pox Tuberculosis, sexually transmitted infections (STI) e g. gonorrhea, syphilis and HIV/AIDS
- Causes, signs, prevention and control of non-communicable diseases such as hypertension, asthma, cancer, epilepsy, diabetes, sickle - cell anemia and other several diseases of the body systems.

PHE 325: INTRODUCTION TO PSYCHOLOGY OF SPORT

OBJECTIVES **1 Credit Compulsory**

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

a. Define different terms and terminologies relevant to psychology of sport
b. Explain the psychological theories and principles relating to athletes' behaviour in sport participation e .g psyching up, psyching down and psyching off
c. Discuss the psychological variables in sport performance and preparation of athletes
d. State the history of sport psychology association in Nigeria

COURSE CONTENT:

- Definition of terms and terminologies
- The relevance of psychology to sport
- Psychological theories and principles relating to athletes' behaviour in sports participation
- Psyching up, psyching down and psyching off
- The roles of sport psychologists
- Psychological factors affecting individuals and group performance i.e. personality, stress, anxiety, etc.
- Psychological variables in sport performance
- Psychological preparation of athletes
- Phases in skill acquisition
- Motivation
- History of sport Psychology Association of Nigeria.

PHE 326: ADAPTED PHYSICAL EDUCATION AND SPORTS 1 Credit Compulsory
OBJECTIVES
At the end of the course, students should be able to:-

a. State the history of adapted Physical Education
b. Define some terms related to adapted Physical Education
c. Explain the types, causes and needs of physically challenge people/handicapped
d. Design programme for the handicapped individual
e. State the role of Physical Education and sport to the disabled

COURSE CONTENT:

- Brief history of adapted physical education and Sports
- Meaning and definition of adapted Physical Education and Sports
- Types and causes of handicapping conditions e.g. hearing defects (deafness, hard of hearing); mental retardation, eye defects (partial blindness, total blindness), orthopedic conditions, speech defects etc.
- Needs of the handicaps
- Integrating and programmes of Physical Education and sports for the challenged individuals
- The role of physical education and sports to the challenged persons
- Agencies responsible for ensuring adequate care and integration of the challenged persons in the society.

PHE 327: FAMILY LIFE AND REPRODUCTIVE HEALTH EDUCTION 1 Credits Compulsory
OBJECTIVES
At the end of this course, the students should be able to:

a. Explain the concept of Sex and Family life Education
b. Identify the scope of family life and reproductive Health Education
c. Explain the functions of reproductive system
d. Discuss the sexually transmitted disease including HIV/AIDS and prevention
e. Explain the principles of Ageing and Death Education

COURSE CONTENT:

- Definition and need for reproductive health education
- Functions of the reproductive system
- Socio cultural aspects of reproductive health education: courting, marriage, family planning (use of different contraceptive devices), divorce etc.
- Children's concept of reproduction and pregnancy and childbirth
- Sexually Transmitted Diseases including HIV/AIDS Prevention
- Issues and opinions about reproductive Health education in public schools
- Religion and family life education, reproductive health and Family relationships.
- Ageing and Death Education

PHE 328: COMBAT SPORT, TRADITIONAL SPORT AND DANCE EDUCATION 1
Credit Elective
OBJECTIVES
At the end of the course, students should be able to:

a. Enumerate the various skills and techniques needed for any of the sport chosen i.e. Combat, Traditional sport and Dance Education
b. Discuss the historical development of any of the sport
c. List the various equipment, facilities and supplies for any selected sport
d. Demonstrate the skills and techniques for any of the chosen sport
e. Identify some of the events in any of the sport
f. Appreciate the relationship between modern, traditional combat or traditional sport or Dance education

COURSE CONTENT:
Combat Sport: Emphasis should be centered on any two of: Judo, Karate, Wrestling, Boxing and Taekwondo and target as follows:

- History of combat sport in Nigeria
- The importance of combat sport in general
- Basic skills of selected combat sport,
- Rules of combat sport.
- Officials and officiating in combat sport.

OR

Traditional Sport (Including Dances).
Emphasis should be on learning and performance of traditional Sport and Dances within the locality. Types, origin, significance and facilities/equipment.

- Dambe (local boxing) in the North
- Langa (North)
- Local Wrestling
- Local hockey and golf
- Local shooting
- Arin (West)
- Abula
- Boat Regatta
- Each: Local draught (East): Any ONE of these to be taught as obtained in locality and two others from other localities in line with the Federal Government policy of uniting Nigeria through Sports. They should be taught under the following sub-headings.
- Basic skills
- History and Development
- Playing area
- Rules and Regulations
- Officials and Officiating

OR

DANCE EDUCATION

- Origin of Dance, Types of Dance and dance steps.
- Dance Formations: African Dance and contemporary/social dances
- Nigerian traditional dance/acrobatic displays

- Basic Dance Movement etiquettes
- Teaching dancing steps: Methodology
- Dance Response to talking drums etc
- The origin of dance
- Dance formations
- Dance Drama e.t.c

PHE 329: PRACTICUM PHYSICAL CONDITIONING (CIRCUIT TRAINING) 1 Credit Compulsory

OBJECTIVES

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

a. Discuss the historical development of those game they have being thought
b. Demonstrate the skills and techniques of performing the selected games
c. Apply circuit training to the development of physical fitness, components and sport skills

COURSE CONTENT:

- Mode of Operation: The circuit training method should be adopted for practicum
- The number of participants are divided into even number
- Strength and ability, the number of activities will be equal to number of groups as each team will operate on a specific activity
- The team will move round on time basis until the whole circuit is completed
- Formation and Skills to be based on the physical activities/sport previously learnt
- Application of circuit training to development of physical fitness components and sport skills
- For C.O.E. Special: Practicum to be adapted to the disabled and the intensity of performance should vary from one station to another.

PHYSICS

1. PHILOSOPHY

The philosophy of the Nigeria Certificate in Education (N.C.E.) physics is inspired by the desire to help students become intellectually informed in physics, and by the need to produce competent and effective teachers with good mastery of content and method, and a knowledge of the development of the learner.

2. OBJECTIVES

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

a. Acquire basic knowledge of the organizational concepts and techniques in practical physics and laboratory management,
b. Discover that the fundamental ideas of physics evolved from a process of inquiry that leads to scientific attitudes which are transferable to other life situations,
c. Plan and effectively execute physics-based lessons in B1-B9 classes in accordance with the UBE policy,
d. acquire sound basic knowledge of the physics concepts and principles to equip them for further studies in physics and physics- related courses,
e. Explain the nature of science,
f. Use science resources effectively,
g. Use Information Technology (IT) effectively to support pupils/students in learning physics,
h. Demonstrate the understanding of concepts of physics and use them and revise them when necessary.
i. Organize physics lessons for the whole class, groups, and individuals effectively,
j. Recognize the difficulties students face in learning physics,
k. Remedy students' misconceptions in physics,
l. Develop pupils' use of physics language,
m. Carry out formative, diagnostic and summative assessment of students' work (theory and practice) in physics very successfully,
n. Transit into undergraduate programmes offered in universities or similar higher institutions.

3.0 i) GENERAL ADMISSION REQUIREMENTS

a) Senior Secondary School Certificate of WAEC, NECO, NABTEB or any other equivalent Certificate from recognized examination bodies with credit passes in five (5) subjects including English Language and Mathematics.

b) All candidates wishing to be considered for direct admission must have acceptable pass in the Unified Tertiary Matriculation Examination (UTME)
c) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews for some courses. This is legitimate.

Note;
A credit in Mathematics and credit in English Language at the senior secondary School Certificate/equivalent are required of all science-based specializations.

ii) ADDITIONAL ADMISSION REQUIREMENTS

A candidate must possess at least a credit in Mathematics at the Senior Secondary School Certificate level, and a credit in physics at the same or equivalent level. e.g. NTC from National Business and Technical Examinations Board, NABTEB.

4.0 FACILITIES

i) Classrooms/Laboratories

a) One standard and well equipped laboratory for at least 30 students.
b) One preparatory room
c) Three Specialized laboratories one each for electronics, optics and workshop.
d) At least one adjoining classroom to the laboratory.
e) One computer room with at least 5 computer systems, overhead projector, slide projector and screen stencil scanners.

(ii) Staff Offices

Each senior member of staff should have a comfortably furnished office to himself/herself. There should also be an office for support staff (clerical staff etc.) with relevant equipment e.g. computers, printers and duplicating machines.

(iii) Books in the Library

There must be enough relevant and current books and journals to cover all the areas of Physics in the ratio of one student to ten books in the Physical Library. There should also be subscription to adequate number of current e-books and e-journals
(iv)Students/Staff should have access to Internet, Library website, campus Hotspots, and intranet.

EQUIPMENT REQUIRED FOR THE TEACHING OF PHYSICS

Ammeters (0-3A, 0-5A, -3A-+3A)	For every student
Voltmeters (0-3V, 0-5V, 0-10V)	For every student
Milliammeter (0-5m A, 0-10mA)	For every student
Millivoltmeters (0-5mV, 0-10mV)	For every student
Rheostat (Various sizes)	10
Triangular prisms	20
Pendulum equipment	10
Stop clocks	10
Meter rulers	30
Convex mirrors	30
Concave mirrors	30

Telescope	2
Vernier callipers	10
Micrometer screw gauge	10
Thermometers	40
Bar Magnets	20
Electromagnets	5
U-shaped Magnet	10
Soft-iron wires	For every student
Solenoid	10
Steel Bars	10
Colour Disc	5
Colour Filters	5
Iron Filings	1kg
Compasses	20
Ticker-Timer	10
Glass beaker	20
Pin-hole camera (can be made by students)	15
Ray boxes	15
Ripple tank and Accessories	3
Tuning Forks	20 boxes
Sonometer Box	10
Resonance tubes	10
Lead acid accumulators	5
Battery charger	2
Hydrometers	2
Dry cells	20
Connecting (Copper) wires (rolls)-assorted	For every student
Plug keys	5
Simple electric motor	2
Generators	2
Capillary tubes	For every student
U-tubes	5
Glass tubes	10
Stop watch	15
Meter Bridge	10
Daniell cells	5
Standard Cells (1.018V)	10
Standard Resistors (1R.2R,3R) assorted	For every student
Retort clamps & Stand	10
Calorimeters	10
Electric Water Heaters	5
Weighing Balances	5
Elastic springs	10
Standard weights	For every student
Optical Pins	10 packets
Spherometer	3

Spectrometer	3
Inclined Plane	5
Pulleys (Various types)	10 each
Wheel & Axle	5
Roll of String	1 big roll
Elastic Bands (variety)	5 packets
Lens Holders	40
Force Board	10
Optical Benches	10
Searle's Apparatus (Elasticity)	5
Travelling Microscope	2
G-Clamps (Variety)	40
Mercury Vapour Lamps, Sodium Lamps, hydrogen lamp	2 each
Lamp holders and Resistors	20 each
Steam Generators	10
Rubber tubing (Variety of sizes)	For every student
Rubber Bungs (Variety of sizes)	For every student
Ordinary Corks (Variety of sizes)	For every student
Tripod Stands Bunsen Burners	30
Bimetallic strip	5
Searles Conductivity Apparatus	2
Lee's Disc Apparatus	2
Radiation Detectors & Apparatus	
Metal Strips and Metal Bars	5 each
Measuring Cylinders (Variety of sizes)	5 each
Glass Bath	2
Variety of liquids such as glycerol, alcohol, kerosene, naphthalene, mercury (250g)	2.5 each
Dip circles	3
Hare's Apparatus	3
Hoffmann's Voltameter	3
Electrodes (Copper, Zinc, Carbon etc)	1 dozen each
Crocodile clips	5 dozen
Electrical Calorimeter	2
Eureka can	3
Platinum Resistance Thermometer	2
Cathode Ray Oscilloscope	2
Perin's tube	2
Power Supply Unit	5
Shunts (Various Values)	10 each
Sonometer	10
Frequency Generator	2
Kundt's tube	2
Boyle's Law Apparatus	2
Aneroid Barometer	2
Transistors (different Values)	30

Viscometer (Oswalds)	2
Gold leaf Electroscope	5
Induction Coil	5
Van de Graaff Generator	2
Worchester Circuit Kits	2
Electrostatic Kits	2
Diodes (solid state)	Many (30) each
Vacuum Diodes (Valves)	2
Capacitors, Inductors, Resistors (Various Values)	30
Variac transformer	2
Frequency counter	2
Plane Mirrors & Holders	20 each
Spherical bobs (Various sizes) of Steel, Copper etc	3 bottles of various diameters
Long Cylindrical tube	5
Ball & Ring	2
Bar Breaking Instrument	2
Leslie Cube	2
Radiometer	2
GM tube	2
(Copper Sulphate) Copper (II) Tetraoxosulphate (VI)	1000g
(Silver Nitrate) Silver Trioxonitrate (V)	1000g
Zinc Rod	5
Porous Pot	5
Jockey	50
Veroboard	30
Breadboard	30
Lycopodium Powder	500g (2bottles)

15. Materials, Tools And Machines Required for fhe College Workshop

A. Machine tools for a Standard Physics Mechanical Workshop

1. Universal Lathe Machine
2. Universal Milling Machine
3. Pillar Drilling Machine
4. Radial Drilling Machine
5. Bench Drilling Machine
6. Universal Grinding Machine
7. Tool Grinding Machine
8. Bench Grinding Machine
9. Sharpening Machine
10. Hand Grinder
11. Gillotine
12. Bending Machine
13. Jig Saw Machine
14. Band Saw Machine
15. Power Saw Machine

16. Hand (Sanding) Grinding Machine
17. Machine Vice
18. Welding Machine (Arc)

B. Hand-tools for a Standard Mechanical Workshop

1. Bench Vice	4
2. Sets of files (rough and smooth)	5 sets
3. Hacksaw with Blades	10
4. Chisels	10
5, Shear snips	4
7. Hammer	5
8. Punchers	10
9. Sets of Spanners	5 sets
10. Sets of screwdrivers	10 sets
11. Plier	10
12. Gripping plier	10
13. Long nose plier	10
14. T-square	10
15. Dividers	10
16. Calipers and odd leg calipers	10 each
17. Tape and Dies (metric and imperial((B.A. thread)	10 each

C. Measuring tools

1. Micrometer screw gauge 0-25, 25-50mm	10
2. Vernier calipers 0-18cm	10
3. Steel Rule	5
4. Inside and outside calipers	20

D. Cutting tools

1. Hacksaw blades	20
2. Power blade	10
3. Lathe cutting tools (turning and Boring tools)	10
4. Thread cutting tools (internal and external)	10

E. Protective wears

1) Plain Goggles	5
2) Dark goggles for gas welding	5
3) Welding shield (opaque glass Dark)	5

F. Others

1) Gas welding set (Oxygen and Acetylene	2 sets
2) Engraver	2

5.0 PERSONNEL

(a) Academic Staff

i)There should be at least eight (8) lecturers each with a minimum of B.Sc. (Ed.) Or B.Ed. Honours degree or B.Sc. (Honours) degree in Physics plus professional qualifications such as NCE or PGDE.
ii) Teacher Student Ratio should be 1:25

b) Support Staff

i) A minimum of three qualified laboratory Technologists/Technicians, one of which must be a workshop technologist to assist the lecturers during practical and to organize the laboratory activities in each of the specialized laboratories. There should also be a workshop technician
ii) A laboratory assistant who has background in the sciences

6.0 ADMINISTRATION OF THE DEPARTMENT

Only senior lecturers and above should head the department.

7.0 MODE OF TEACHING

Physics is the most basic of the sciences and as such the students should be led to develop critical attitudes which can make them function effectively as teachers.

The integration of practical work with theory and the use of teaching aids and modern physics teaching techniques are essential. The practical work and the workshop practice are introduced as compulsory courses in order to achieve the desired effect. The following methods are desirable when reasonably used singly or combined:

i) Lecture
ii) Demonstration
iii) Practical
iv) Project/Assignment
v) Problem-solving in the classroom
vi) Field trip/excursion
vii) Team teaching
viii) Tutorial
ix) Discussion/Seminar/Workshop
x) Computer-Assisted Learning
xi) Internet/E-mail
xii) Game/Simulation
xiii) Any other relevant method.

8.0 GRADUATION REQUIREMENTS

i) A minimum of E in each of the 2 major subjects and education i.e. cumulative Grade point average of 1 point each plus a pass in GSE courses.
ii) Successful completion of Teaching Practice and outdoor Education programmes.
iii) Successful completion of project for the award of NCE Certificate.

Physics	24	Credits
Second Teaching subject	24	Credits
Education	24	Credits
Teaching Practice	06	Credits
General Studies Education	16	Credits
Total	**94**	**Credits**

9.0 TEACHING PRACTICE

Teaching Practice is compulsory for every student to graduate. Teaching practice earns 6 credits under Education 311

10. ASSESSMENT AND CERTIFICATION: For theory-based courses CA (test and assignment) = 40% and Examination = 60% and for Practical courses, CA = 50% and Examination = 50%

11. PROJECT

Final Year Project is compulsory for all graduating students. The project may be written and supervised in any of the student's chosen subject areas. The grade for the project is credited to EDU 323. Project carries 2 credits

12. COURSE CONTENT AND STATUS

NCE I FIRST SEMESTER

Course Code	Credit units	Status
PHY 111 – Mathematics for Physics I	1	C
PHY 112 – Electromagnetism I	1	C
PHY 113 – Mechanics and Properties of Matter I	2	C
PHY 114 – Introduction to Physics Practical	1	C
TOTAL	5	

NCE I SECOND SEMESTER

Course Code	Credit Unit	Status
PHY 121 – Thermal Physics	2	C
PHY 122 – Introduction To Astronomy & Environmental Physics	1	C
PHY 123 – Sound and Light	1	C
PHY 124 – Physics Practical	1	C
TOTAL	5	

NCE II FIRST SEMESTER

Course Code	Credit Unit	Status
PHY 211 – Electromagnetism II	1	C
PHY 212 – Mechanics and Properties of Matter II	2	C
PHY 213 – Mathematics for Physics II	1	C
PHY 214 – Physics Practical II	1	C
TOTAL	5	

NCE II SECOND SEMESTER

Course Code	Credit Unit	Status
PHY 221 – Workshop Practice	1	C
PHY 222 – Atomic and Quantum Physics I	1	C
PHY 223 – Basic and Digital Electronics	2	C
PHY 224 – Physics Methodology	1	C
TOTAL	5	

NCE III FIRST SEMESTER

EDU 311: TEACHING PRACTICE

NCE III SECOND SEMESTER

Course Code	Credit Unit	Status
PHY 321 – Electromagnetism III	2	C
PHY 322 – Atomic & Quantum Physics II	1	C
PHY 323 – Physics Practical III	1	C
TOTAL	4	

16. COURSE CODE COURSE TITLE CREDIT UNIT AND STATUS

NCE I FIRST SEMESTER

PHY 111 MATHEMATICS FOR PHYSICS 1 1 Credit Compulsory

Objectives:

The students will be able to:

a) Solve problems involving significant figures and decimal places
b) State the laws of indices & logarithm and apply them in solving physics problems.
c) Solve simple problems in binomial theorem, matrices and determinants.
d) Solve problems in geometry and trigonometry and applying them in solving problems in Physics.
e) State the basic rules in calculus and apply them in solving physics problems.

Topics

- Significant figures and decimal places
- Indices and Logarithms
- Standard Form
- Simple algebraic equations, inequalities and solutions
- Binomial theorem
- Matrices and determinants.
- Triangular relations (Pythagoras theorem, Sine and cosine rules and area of triangle)
- Compound angle and multiple angle formulae
- Small angle approximations
- Partial fractions
- General rules of differentiation and integration
- Differentials and integrals of common functions

- Introduction to differential equations.

PHY 112 ELECTROMAGNETISM 1 1 Credits Compulsory

Objectives:

The students should be able to:

a) State the laws in electrostatic and compare the electrostatic field with gravitational field.

b) Identify and explain basics concept in current electricity.

c) Identify and explain basics concept in electrolysis.

d) Identify and explain basics concept in magnetostatics.

Topics

- electric charges, forces between electric charges, electric field and electric potential, charge distribution over conductor, Van de Graaf generator.

- Ohm's law, Simple circuit analysis, Thermal electricity and applications (heating effects of Currents-seabeck and Peltic effects).

- Concept of electrolysis, ion velocities, voltmeters. Practical application of electrolysis

- Concepts of magnetic fields including the earth's magnetic induction.

PHY 113 MECHANICS AND PROPERTIES OF MATTER I 2 Credits Compulsory

QUANTITIES, UNITS AND DIMENSIONS

The students will be able to:

a) Differentiate between basic (fundamental) and derived quantities and their units.
b) Solve problems involving dimensional analysis.
c) Differential between scalar and vector quantities with examples.
d) Solve problems involving vectors.
e) Identify types of motion and solve simple problems involving one and two dimensional motion.
f) State the Newton's law of motion and apply them in solving simple physics problems.
g) State and define the concept of energy, work and power.
h) Identify and explain concepts of equilibrium of forces.
i) Define Young shear and bulk modulus as well as Poisson's ratio of materials.

Topics

- Fundamental quantities (mass, length, time, current, temperature, luminous intensity, amount of substance, Plane angle and Solid angle)
- Derived quantities (e.g. volume, speed, momentum etc).

- Fundamental and derived units
- Dimensions - dimensional equations and their uses
- Space and time
- Frame of reference
- Galilean invariance
- Scalar and vector quantities
- Vector components
- Addition and subtraction of vectors
- Composition and resolution of vectors
- Vector and scalar products
- Displacement, velocity and acceleration, One, two-dimensional motions, Relative velocity and Projectiles
- Angular velocity and acceleration,
- Centripetal and Centrifugal force,
- Application to road and rail construction.
- Simple Harmonic Motion (Oscillation)
- Period, amplitude and phase
- Expression for period, frequency, velocity and acceleration
- Damped S.H.M.
- Force, inertia and friction, Momentum
- Newton's second law; F time rate of change of momentum $\left[\frac{mdv}{dt}\right]$
- Law of conservation of linear momentum, Collisions (elastic and inelastic; straight line & oblique).

PHY 114 - INTRODUCTIONS TO PHYSICS PRACTICALS 1 Credit Compulsory

THEORY

Objectives:

By the end of this course, student should be able to acquire basic knowledge of the organizational concepts and techniques in practical physics and laboratory managements.

Topics

- The theory of practical: students are to be referred to relevant texts e.g. by Nelkon, Okeke, Armitage, Tyler etc.
- Reporting practical
- Graphical skills - plotting experimental data, suitable choice of axes and scales; line of best fit Interpretation and expression of equations in the form of y = mx + c Evaluation of slope and intercept - extrapolation and interpolation; plotting with logarithmic scales.
- Experimental errors and their treatment. Use and maintenance of simple measuring instruments e.g. vernier callipers, ammeter, galvanometer, micrometer screw gauge, etc.

NCE I SECOND SEMESTER

PHY 121 THERMAL PHYSICS 1 2 Credits Compulsory

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

a) Differentiate between the concepts of heat and temperature.
b) Identify types of thermometers and their thermometric properties.
c) Solve simple problems on quantity of heat.
d) Explain the concepts of heat transfer.
e) Explain the ideal gas equation and Van der waals equations.
f) Explain the concepts of the kinetic theory and its applications.
g) Second law of thermodynamics.

- Nature (properties) of Heat and Temperature
- Various measurements involving them with emphasis on constant pressure and Resistance thermometers. Other thermometric properties
- Quantity of heat and calorimetry including cooling corrections
- Change of state, molecular interpretations
- Gaseous process and laws;
- Definitions and measurements of latent heats
- Calculations involving quantity of heat and latent heat.
- Heat Transfer - Conduction, convection, radiation
- Assumptions of the kinetic theory model of gases e.g. Brownian motion
- Ideal gas laws and equations
- Quantitative treatment of molecular speed and root mean square speed
- Differences between real and ideal gas
- Van der Waal's equation for real gases
- Zeroth and First laws of thermodynamics
- Application of the concept of kinetic theory to: transport phenomenon in fluids - thermal conductivity, viscosity, diffusion, osmosis and specific heat capacities.
- Second law of thermodynamics including Carnot Cycle and Car not Engine
- Isothermal and adiabatic changes.

PHY 122 INTRODUCTION TO ASTRONOMY AND ENVIRONMENTAL PHYSICS 1

Credits Compulsory

Objectives:

At the end of this course, student 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.

Topics

- **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 non-renewable energy resources and utilizations, ozone layer and ozone layer depletion, earthquakes.

PHY 123 LIGHT AND SOUND 1 Credit Compulsory
Objectives

The students should be able to:

a) Explain the basic concept, types and properties of wave
b) Explain reflection and refraction of light/applications and the concept of deviation, dispersion and aberration
c) State the different types of optical instruments
d) Define and classify sound and state their applications.
e) Explain the wave nature of sound.
f) Identify and classify musical instruments according to type's materials.

Topics

- Basic concepts and properties of waves
- Types of waves
- Wave nature of light
- Geometrical optics – mirrors, Lenses and prisms
- Optical instruments.
- **SOUND**

- Concept of Sound
- Definition of Sound, Classification into infrasonic, sonic (audible) and ultrasonic and their applications.
- Wave Nature of Sound
- Propagation of sound waves

- Characteristics of sound Intensity, quality or timbre, etc
- Speed of sound in various media (solid, liquid, gas)
- Echo, its effects and applications
- Vibrations of sound in strings, air columns and pipes
- Concept of resonance
- Doppler effects

PHY 124 PHYSICS PRACTICALS I 1 Credit Compulsory

Objectives

By the end of this course, student should be able to Carry the prescribed experiments, analyse the resulting data and state the appropriate scientific inference(s).

Topics

Consider at least two (2) practicals from each of the following courses:

- Thermal Physics
- Mechanics and Properties of Matter I
- Electromagnetism I
- Light and sound (A minimum of 10 experiments are expected from all the topes)

NCE II First Semester

PHY 211 ELECTROMAGNETISM II 1 Credit Compulsory

Objectives

By the end of the course, the student should be able to:

a) Identify the variables that affect the capacitance and how each affects the capacitance.
b) Determine the relationships between the charge, voltage and energy store for a capacitor.
c) Describe the process of Charging and discharging a capacitor.
d) Explain how electric current can generate a magnetic field
e) Explain how electricity and magnetic field work together

- Capacitance- Parallel plate capacitor, energy stored in capacitor, Charging and discharging a capacitor.
- Dielectrics

- Fields due to a flat Coil, Solenoid and infinitely long straight wire, forces between current-carrying conductors, D.C. instruments and measurements - Voltmeter, ammeter, galvanometer, Wheatstone bridge, potentiometer, etc., Magnetic induction, Maxwell's equation, electromagnetic oscillations, waves and applications

PHY 212 MECHANICS AND PROPERTIES OF MATTER II 2 Credits Compulsory

Objectives

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

i. Physical properties of matter.
ii. Gravitation.
iii. Surface tension.
iv. Fluid motion.

Topics

- Classification of matter (solids, liquids and gases), Forces between atoms and molecules, Molecular theory of matter, Elasticity, Plasticity, Hooke's Law, Young's Shear and bulk Moduli, Crystalline and non-crystalline materials
- Work, Energy and Power, Simple machine, Equilibrium.

- Kepler's laws of planetary motion, Newton's universal law of gravitation, Measurement of G (universal constant of gravitation), Mass and density of the earth, Earth's satellite, Escape velocity
- **Hydrostatics**- Pressure, Bouyancy, Archemede's Principle
- **Hydrodynamics**- Stream lines, Bernoulli and continuity equations, Turbulence, Reynold's number, Viscosity, Laminar flow, Poisenille's equation, Surface tension, Adhesion, Cohesion, Capillary, Drops and bubbles.

PHY 213 MATHEMATICS FOR PHYSICS II 1 Credits Compulsory
Objectives

By the end of this course, student should be able to discuss the basic mathematical concepts which will enable them to solve problems in relevant areas in physics.

Topics
- Vector differentiation
- D-Grad and D - Vector
- Divergence and curl
- Application of vector algebra
- Divergence (Gauss and Stokes Theorems, dipole, energy relation)

- Introduction Analytical Geometry
- Introduction to complex numbers

PHY 214 PHYSIC PRACTICALS II (3 HOURS A WEEK) 1Credit compulsory
Objectives

At the end of this course, student should be able to carry the prescribed experiments, analyse the resulting data and state the appropriate scientific inference(s).

Topics
Experiments should be selected from topics covered in the courses listed below with at least three (3) experiments drawn from each. A minimum of 10 experiments and maximum of 12 experiments should be covered in courses:
PHY 211 - Electromagnetism II
PHY 212 - Mechanics and Properties of Matter II

NCE II SECOND SEMESTER

PHY 221 WORKSHOP PRACTICE 1 Credit Compulsory

Objective

By the end of this course, the student should be able to construct basic physics teaching aids using locally available materials.
Topics
- Organization and safety in the workshop

- Classification and use of tools (Basic tools e.g. glass, metals, plastics, etc.)
- Construction and improvisation of some basic teaching aids e.g. lens holders, ray boxes, metre bridge, manometer, etc. (the constructions and improvisations, should involve the use of woods, metals, glass, etc.)
- Design of simple electrical/electronic circuits (half, full wave's rectifiers, etc.)
- Basic skills in Technical Drawing (Simple treatment only~ e.g. drawing of angles, isomeric drawing, orthorhombic drawing, etc)

NOTE:
Lecturer(s) may be assigned to guide and supervise the course and assess the works. However, the students are expected to produce individual construction works which will be defended by the students before all the lecturers in the department and this earns the students the (70%) of the total score for the course. Excursion to a manufacturing company and an excursion report to be submitted for assessment. (30%)

PHY 222 ATOMIC AND QUANTUM PHYSICS I 1 Credit Compulsory
STRUCTURE OF ATOM
Atomic models - Thompson's, Rutherford's experiments etc
Determination of e/m for the electron (Milikan's oil drop experiment, Thompson's experiment, etc).

CONCEPT OF QUANTUM THEORY
Photo-electricity and its applications (including Einstein's photoelectric equations) Compton effect
Application of the Bohr's model to the one-electron atom
Pauli Exclusion Principle and its application to the atom
Energy and Spectra.

Objectives
By the end of the course, the student should be able to:
i. List and explain atomic methods.
ii. Describe methods for determination of e/m, the concept of photo electricity, applications of Bohr's model to one – electron atom, Pauli's exclusion principle and its application to the atom energy and spectra.

PHY 223 BASIC AND DIGITAL ELECTRONICS 2 Credits Compulsory
Objectives
The students will be able to:

i. Explain the passage of electricity and their uses in some vacuum tubes electronic devices.
ii. Explain the band theory of solids to explain conductors, semiconductors and insulators.
iii. Explain doping of semi-conductors.
iv. Explain the rectifying properties of a P.N junction transistors and oscillator circuit.
v. Identify and explain basic concepts in integrated circuits.
vi. Explain basic concepts in digital electronics.

Topics

- Passage of electricity in gases and in evacuated tubes and applications
- Induced electricity and heir uses in some electronic devices
- Cathode rays, positive rays and their properties
- Simple electronic devices, diodes properties
- Oscilloscope T.V. tubes
- Band theory of solids LC (simple account)
- Energy level diagrams for conductors, semi-conductors and insulators
- Doping
- Types of semiconductors: - P-types and N-types, P-N JUNCTIONS
- Rectifying property of a P-N Junction
- Forward and Reverse Biasings, simple transistors and oscillator circuits
- n-p- and p-n-, basic structures and terminologies and their applications
- Colour coding
- Integrated circuits (ICS)
- Binary, Octal and BCD Hexadecimal numbering system, conversion from one form to another, addition and subtraction of Binary number, switch current, NOR gate, or gate, exclusion or gate, exclusive and gate.

PHY 224 PHYSICS METHODOLOGY 1 Credits Compulsory
Objectives

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

a. Discuss methods of teaching Physics.
b. Write lesson plans and notes in Physics.
c. Use appropriate methods to teach prescribed content

- Philosophy of Science
- What is Science?
- What is Physics?
- Different aspects of Physics?
- Uses of Physics in society (why Physics?)
- Concepts, theories, laws and principles in physics
- Jobs for the physicists
- Assessment in Physics (theory and practical)
- Methods of teaching Physics (e.g. process, inquiry etc)
- Lesson plans and lesson notes in Physics
- The teaching of electricity and magnetism
- The teaching of radioactivity and atomic structure
- The teaching of electronics.
- Physics teaching aids
- Computer - assisted learning in Physics
- Gender and Physics
- Use of Physics Laboratory - Ordering, Cataloguing, storing of equipment; safety rules and First Aid, maintenance of equipment,
- Design of Physics Laboratory

- Micro-teaching
- FLHE- Decision making - Communication, Assertiveness, Negotiation and Finding Help.
- History of Physics - Galileo, Boyle, Newton
- Einstein, Faraday, Von Neumann, James Clark Maxwell, etc.
- (Emphasis should be on how their contributions revolutionized physics)
- The development Physics Education in Nigerian General Science Education Resources for teaching the following Physics concepts;
- Motion; energy, light, kinetic theory and waves.
- National Policy on Education and the Objectives of Science Education.
- The role of Physics in Science Education
- FLHE - Human Development - Body care, Body abuse and Drug abuse.
- STLs/HIV - Abstinence, Puberty and Self-esteem.

NCE III SECOND SEMESTER

PHY 321 ELECTROMAGNETISM III 2 Credits Compulsory
Objectives

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

a. Alternative current circuit theories and its applications.
b. Magnetic properties and their applications

- C. theory and its applications (phase and vector diagrams)
- C AND ELECTRICAL NETWORK
- Reactance, impedance, power in A.C. circuit, power factor, quality factor, concept of resonance and applications.
- Rectification (half wave and full wave) and smoothing (show how the inductive - time constant, capacitive-time constant are used as wave sharpers).
- Concept of electrical oscillation with respect to L/C circuits - generation of radio wave - TUNED circuit - A.M., F.M.
- Diamagnetism, ferromagnetism, and paramagnetism
- Magnetic induction (B), magnetic Intensity (H), hysteresis
- Domain theory.

PHY 322 ATOMIC AND QUANTUM PHYSICS II 1 Credits Compulsory
X-RAYS
Objectives

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

a. Discuss the origin production and the applications of X – rays'.
b. Discuss concept of radioactivity and its applications.
c. Discuss the concept of wave – partible duality of matter.

- Origin, production and properties of X-rays - Bragg's and Moseley's Laws and their applications
- X-ray spectra
- Applications of X-rays.

- Concept of Radioactivity's
- Types of radioactivity
- Nuture and properties of nuclear radiations
- Detection of nuclear radiation. Radiation damage, unit and safety precautions
- Decay laws and half-life
- Radioactive transformation and series
- "Geiger - Nuttal law" detection of nuclear radiations
- "Radiation detection instruments" (GM tube, cloud chamber, etc).
- Production and uses of radioisotopes (e.g. carbon dating, and medical)
- Nuclear atom - history and features (nucleus, nuclide, nuclei, nucleon, atomic number, mass number, neutron, isotopes).
- Binding energy and stability (Apply mass-energy relation) - differentiate between atomic and nuclear binding energies.
- Nuclear fission and fusion
- Chain reactions and their applications
- Uncertainty theory (principle)
- Application (Qualitative treatment only)

PHY 323 PHYSICS PRACTICALS III 1 Credit Compulsory
Objectives

At the end of this course, student should be able to carry the prescribed experiments, analyse the resulting data and state the appropriate scientific inference(s).

Topics

Select experiments spanning through the courses listed below with at least three (3) experiments from each course. A minimum of 10 experiments are expected to be performed.
Courses:
PHY 321 - Atomic and Quantum Physics II
PHY 322 - Electromagnetism III

MATHEMATICS

1.0 PHILOSOPHY

The philosophy of the NCE Mathematics is inspired by:

a. The desire to help students become intellectually informed in mathematical ideas, notations and skills for logical reasoning, scientific enquiry and for the pursuit of techno-scientific education; and
b. The need to produce non-graduates, well-groomed and professionally qualified teachers of mathematics for the Basic Education Levels.

2.0 OBJECTIVES

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

a) Discuss with confidence the historical development of mathematics as a discipline.
b) Solve abstract problems using mathematic skills and ideas
c) Stimulate pupils' interests in mathematics using appropriate teaching/learning strategies particularly at the Basic education levels
d) Make learners appreciate the use of computers in solving mathematical problems
e) Use mathematics to solve day to day problems.
f) Teach mathematics in a way that learners can apply mathematics principles in solving daily problems
g) Make the teaching of mathematics learner friendly through games and simulations
h) Set up a mathematics laboratory
i) Improvise materials for effective teaching/learning of mathematics
j) To prepare the learners for further studies in mathematics and related courses.

3.0 GENERAL ADMISSION REQUIREMENTS

a) Senior Secondary School Certificate of WAEC or NECO or any other equivalent Certificate from recognized examination bodies with credit passes in five credit passes including English Language and Mathematics at not more than two sittings. Two of the credits must be in the subjects making up the combinations the candidates wish to offer

b) A Grade II Teacher's Certificate (TC II) with credit or merit in five (5) credit in not more than two sittings Credits/Merits in English Language and Mathematics are required for candidates wishing to study any science programme.

c) A pass in Pre-NCE Chemistry final examination or a pass in IJMB Chemistry final examination and a pass in JAMB is required for admission.

d) All candidates wishing to be considered for direct admission must enroll for and write the selected examination organized by an accredited body such as JAMB.

e) It should be noted that some colleges may in addition to all the above, administer their own elimination tests and/or interviews for some courses. This is legitimate.

4.0 FACILITIES

a) Classroom

At least three (3) lecture rooms and a lecture theatre.

b) Laboratory

There must be a fully air-conditioned mathematic laboratory with mini microcomputers of not more than three students per one, an overhead projector or multimedia projectors.

c) Workshop: There must be a mathematics workshop where students can make their own instructional materials.

i) **Equipment Required in the Workshop**

S/No.	Description	Quantity Required
1)	Work benches	4
2)	Vice	4
3)	Drilling Machine (manual/electric	4
4)	Drill bit (various sizes)	4 sets
5)	Hand saw (various sizes)	6
6)	Solid shapes (Prisms, Cube, Cuboid, Cylinders, etc.	5 each
7)	Engraving machine	2
8)	Cutting knives	4
9)	Hammer (different sizes)	6
10)	Screwdrivers	3 sets
11)	Mathematical sets	20
12)	Mathematical sets (black board size)	5 sets
13)	Weighing scale	5
14)	Scientific Calculators	20
15)	Scissors (different sizes)	10
16)	Pinchers (big and small)	4
17)	Jack and plane	4
18)	Electronic Organizers	4
19)	Softwares such as SPSS, E-View, STATA, MAT LAB etc and Projectors	

ii) **Consumables**

Cardboard papers	1 ream
Plywood (assorted ¼”, ½” ¾”)	10 sheets Nails (assorted) as required
Binding wire	5
Glue (wood)	5
Gum (liquid)	5
Celotapes	5
Metal sheets	5
Transparences	5
Graph sheets	20
Beads (assorted sizes and colours)	20
Thread	2 Rolls

etc.

d) Staff Offices

The comfort of teaching staff must be taken into consideration. Ideally, there should be an office per Lecturer, equipped with bulletin boards, bookshelves, visitors' seat and standard furniture.

e) The Head of Department should have an office, furnished with other conveniences and file cabinets. There should also be an office for the support staff i.e. typists and clerks.

f) Books in the Library

In addition to the college library, the mathematics department should have a departmental library with current textbooks and journals.

g) Computer Room

There should be a fully air-conditioned computer room for mathematics students.

5.0 PERSONNEL

a) Academic

A minimum of ten (10) academic staff are specifically required for the NCE Mathematics Programme. (The department services other departments). All the academic staff must have an Educational background with a minimum of second class lower Bachelor of Education degree in Mathematics, ie B.Sc. (Ed) or Second Class Lower (Honors') Degree in Mathematics B.Sc. (Hons) plus either of the following NCE, TTC, PDE, or PGDE .

b) Non-Academic

i) A Computer Technical Data Operator
ii) 2 Library Assistant/Attendant
iii) 1 Laboratory Assistant/Attendant
iv) 1 Typist/Secretary
v) 1 office assistant

6.0. MODE OF TEACHING

i) Lectures
ii) Tutorials
iii) Problem-solving
iv) Seminar
v) Demonstration
vi) Drill
vii) Experimentation
viii) Excursion
ix) Discovery Method
x) Laboratory Method and etc..

*Discovery method and laboratory work will be emphasized.

7.0 GRADUATION REQUIREMENTS

Mathematics	-	24	Credits
Second Teaching subjects	-	24	Credits

Education including TP	-	30	Credits
General Study	-	16	Credits
Total	=	**94**	**Credits**

TEACHING PRACTICE
Teaching Practice is compulsory for every student before graduation
Teaching Practice earns 6 credits under (EDU 311).

PROJECT
The Final Year Project is compulsory for all students. The Project may be written and supervised in any of the student's chosen subject areas and the grade for Project must be credited to EDU 323. Project carries 2 credits.

ASSESSMENT AND CERTIFICATION
Continuous Assessment, CA = 40%, Exam 60%

COURSE CODES, TITLES, CREDIT UNITS AND STATUS

Year	Semester	Code Course Title	Credit	Status
NCE I	First Semester	MAT 111 Algebra	2	C
		MAT 112 Trigonometry	1	C
		MAT 113 History of Mathematics	1	C
		MAT 114 Basic Statistics	1	C
		Total	5	
	Second Semester	MAT 121 Differential Calculus	1	C
		MAT 122 Co-ordinate Geometry	1	C
		MAT 123 Maths. Methodology	1	C
		MAT 124 Maths Lab. Practicals	1	C
		MAT 125 Application of computer to mathematics	1	E
		Total	5	
Year	**Semester**	**Code Course Title**	**Credit**	**Status**

NCE II	First Semester	MAT 211 Integral Calculus	1	C
		MAT 212 Problem solving	1	C
		MAT 213 Vector analysis	1	C
		MAT 214 Probability Theory	1	C
		Total	4	
	Second Semester	MAT 221 Dynamics	1	E
		MAT 222 Number Theory	1	E
		MAT 223 Real Analysis 1	1	C
		MAT 224 JSS contents Teaching	1	C
		MAT 225 Research Methodology	1	E
		Total	5	
NCE III	First Semester	TEACHING PRACTICE		
	Second Semester	MAT 321 Statics	1	E
		MAT 322 Linear Algebra	1	C
		MAT 323 Real Analysis II	1	E
		MAT 324 Abstract Algebra	1	E
		MAT 325 Differential Equations	1	C
		Total	5	
GRAND TOTAL			24	

NCE I FIRST SEMESTER

13. COURSE CODES, TITLES CREDIT UNITS AND STATUS

MAT 111 ALGEBRA 2 Credits Compulsory

At the end of course the student should be able to discuss and solve simple problems in algebra.

- Real number system
- Integers, rational and irrational numbers
- Set theory, intersection, complement of set, venn diagram, Algebra of sets.
- Theory of indices
- Theory of logarithms
- Surds
- Linear inequalities
- Partial fractions
- Theory of quadratic equations
- Permutations and Combinations
- Binomial Theorem
  Remainder and Factor Theorems
- Arithmetic progression
- Geometric Progression

MAT 112 TRIGONOMETRY 1 Credits Compulsory

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

a. Discuss with confidence the basic concepts and definition in trigonometry.

a. Solve simple problems using the concepts

- Angle and its measurements
- Basic trigonometric functions and equations
- Trigonometric ratios in each of the 4 quadrants. Applications to bearing, angle of elevation, and depression
- Graphs of trigonometric functions and their applications
- Inverse trigonometric functions
- Half angle formulae
- Addition of factor formulae
- Solution of triangles

MAT 113 HISTORY OF MATHEMATICS 1 Credit Compulsory

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

a. Discuss and narrate the historical development of mathematics as a discipline.

b. Identity the early contributors to the development of mathematics.

- Pre-history Mathematics
- Development of Mathematics in the Ancient times
- Contributions of Babylonians, Greeks, Egyptians, Romans, Hindus, Arabs and Chinese.
- Prominent Ancient Mathematicians and their contributions (Archimedes, Pythagoras, Euclid, Apollonius, etc.)

- Development of mathematics in the Middle Ages and prominent Mathematicians of the period
- The Renaissance and Mathematics (16^{th} to 20^{th} Centuries) and prominent mathematicians and their contributions (Napier, Fermat, Euler, Riemann, Lebesque, Lagrnge, Hilbert, Bannach, Cauchy)
- The use of mathematics in everyday life including its place in Natural and Applied science
- History of African and Nigerian mathematics

MAT 115 STATISTICS **1 Credit** **Compulsory**

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

a. Define the meaning of statistics
b. Discuss the importance of statistics
c. Form frequency distribution table
b. Calculate measures of location, partition and dispersion
a. Explain the meaning of correlation and regression
b. Define sample space and sample point
c. draw normal distribution curve and skewness
d. Carry out test of hypothesis and significance on sample data

Topics

- Frequency distribution
- Measures of location
- Measures of dispersion
- Correlation and Regression
- Sample Space and Sample point
- Data Representations in statistics
- Normal Distribution Curves
- Skewness
- Standardized Normal Curve
- t-scores and Z-scores
- Test of Hypothesis and significance

NCE 1 SECOND SEMESTER

MAT 121 DIFFERENTIAL CALCULUS **1 Credit Compulsory**

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

a) Differentiate some given function
b) Apply differentiation in solving physical problems.

- Functions
- Limit of a function at a point
- Continuity of a function at a point
- Gradient of a function
- The differential co-efficient as a gradient of a function at a point
- Differential product and quotient
- The chain rule and the function of a function

- Differentiations of logarithmic functions
- Trigonometric functions, exponential functions and hyperbolic functions
- Implicit differentiation
- Applications: maximal, minimal, velocity, acceleration and rate of change

MAT 122 CO-ORDINATE GEOMETRY 2 Credits Compulsory

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

a. Obtain the equation of straight line and circle
b. Write the equation of parabola, ellipse and hyperbola in Cartesian polar and parameter coordinator.
c. Change Cartesian coordinates to polar & vice versa
d. Apply the knowledge of coordinate geometry in solving real life problems.

Topics

- Basic Geometry: point' line segment, angle, curve
- Straight lines and circles
- Parabola, Ellipse and Hyperbola in Cartesian, parametric and polar co-ordinates
- Tangents and Normal to the circle, parabola, eclipse and hyperbola (the use of differentiation is acceptable

MAT 123 MATHEMATICS METHODOLOGY 1 Credit Compulsory

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

a. Learn the most current method of teaching mathematics
b. Write lesson plan & lesson notes in mathematics

Topics

- History of Mathematics teaching in Nigeria and the philosophy of current Nigerian Mathematics curricula
- Teaching and learning mathematics, including works of Bruner, Gagne, Piaget and Dienes
- Teaching of concepts, principles, skills and proofs: strategies, nature, definitions and types.
- Inductive, deductive, analytic and synthetic approaches in Mathematics teaching
- Work tools(scheme of work, Lesson plan, lesson presentation and Assessment)
- Item construction and development of marking scheme
- Diagnosis and remediation of difficulty concepts and topics in teaching and learning of upper basic Mathematics curriculum
- Problems and prospects of mathematics education in Nigeria

MAT 124 MATHS LABORATORY PRACTICAL 1 Credit Compulsory

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

a. Design and Construct improvised mathematical teaching aids.

b. Construct triangle, quadrilaterals loci etc. using pair of compass and rulers.

Topics

- Construction, design and improvisation of some basic mathematical teaching aids in relation to primary, junior secondary school and senior secondary school courses. (Using cardboard sheets, clay wood, wires, etc)

- Geometrical construct: construction of triangles, quadrilaterals, bisection of lines, angles and construction of locus.
  -Definition of Mathematics laboratory
  -Roles of laboratory in Mathematics teachings
  -Management of Mathematics laboratory plus other topics in the outline
  -Excursion.

MAT 125 INTRODUCTIONS TO COMPUTER STUDIES 1 Credit Elective

a. State fundamental operations in mathematics structures and their uses in computer studies
b. Define with example binary logic, compound statement and binary operations.
c. Discuss historical development of the computer studies
d. Differentiate between software and hard ware
e. Write simple programme using basic.
f. Apply the application to data processing plus operating systems e.g. Dos, windows

Topics

- Historical development of the Computer
- Essential components of the Computer and their functions
- Number presentation in a Computer
- Logic: - Binary logic, compound statement-logic relations, methods of proofs, binary operations.
- Number bases other than 10
- Data structure and their uses in a Computer
- Computer software and types of software, Basic Programming
- Illustration and the application of simple techniques to Data processing plus-
- Operating systems: Dos, Windows etc.(Emphasis on practical)

NCE II FIRST SEMESTER

MAT 211 INTEGRAL CALCULUS **Credits Compulsory**

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

a) See the link between differentiation and integration.
b) See the link between integration and area
c) Identify and use of different integration methods.
d) Use the different methods of integration in real engineering problems.
e) Appreciate the importance of integration in engineering and science generally.

Topics

- Integration as a reverse process of differentiation
- Integration as area under the curve
- Integration of algebraic functions using different methods, like partial fractions, substitution, etc.
- Integration of non-algebraic functions e.g. logarithmic functions, exponential functions, trigonometric functions, etc.
- Special methods of integrations; substitution and transformation, the reduction formula and other types of systematic integration.
- Integration by parts. Approximate integration by Trapezoidal rule and Simpson's Rule
- Application of integration in determining volumes of solids of revolution and solution to other problems

MAT 212 PROBLEM-SOLVING (JSS & SSS) **1 Credit Compulsory**

(Textbooks on these levels should be provided at least two students to a copy of each)

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

a) Identify what is a problem and decide on the most appropriate approach to the solving problem.
b) Identify as many methods as possible to the solving of identified problems eg discovery, expository child centre approach etc.
c) See that life itself is problem, and always have solutions if given the right approach. Appreciate the different techniques so identified in solving day to day problems.

Topics

- Definitions of problem, problem solving
- Basic elements of a mathematics problem
- Common errors in Mathematics
- Discovery and expository approaches to problem solving techniques
- Functions of questions in the Mathematics class
- Characteristics of a good problem solver
- Polya's problem solving heuristics and application to solving topics in J.S.S.
- S.S.S. Mathematics
- Problem solving of selected difficult topics in Mathematics and further
- Mathematics e.g. solid figures, great cycles, application of the cosine rule to triangles (acute and obtuse angle) e.t.c.

MAT 213 NUMBER THEORY **1 Credit Compulsory**

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

a) Be able to exhibit the proper concept of number system by correctly showing the direction and magnitude of numbers.
b) Be able to play and manipulate different ideas as to the use of numbers, eg : ordering of numbers, mathematical inductions, basic facts on numbers(theorem), congruence etc.
c) Be able to see and appreciate the use of numbers in the real-life situations.

Topics

- Process of counting, Piano's Axons using ordered pairs
- Fundamental operations in Mathematical Structures
- Group – Group properties
- Further properties of Integers
- Well ordering principle
- Mathematical Induction
- Laws of tracheotomy
- Divisibility (Basic definitions, divisions, primes god)
- Basic theorems on god
- (proofs may be required)
- Relatively prime integers (unique factorization)
- The fundamental theorem of arithmetic (proof may be required)
- 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)

MAT 214 PROBABILITY THEORY **1 Credit** **Compulsory**

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

a Learn the concepts of probability
b Solve problems involving addition law, multiplication law of probabilities.
c Formulate hypotheses and arrive at the right decision
d Apply the knowledge of probability in another relevant situation

Topics

- Concept of probability
- Types of probability
- The concept of expectation
- Mutually exclusive and non-mutually exclusive events
- Addition law of probability
- Independent events and dependent events
- Multiplication law of probability
- Conditional probability
- Discrete probabilities
- Continuous probabilities
- The Binomial Poisson and normal distribution with various properties.

NCE II SECOND SEMESTER

MAT 221 DYNAMICS **1 Credits Compulsory**

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

- **a.** Explain the concept of displacement, speed, velocity and acceleration in Cartesian and polar co-ordinate.
- **b.** Discuss relative velocity motion of particles in straight lines.
- **c.** State the principle of conservation of energy.
- **d.** State and discuss types of collision
- **e.** Discuss the concept of projectiles, momentum vertical motion under gravity.
- **f.** Solve problems on dynamics.

Topics

- Displacement, Speed, Velocity and acceleration in Cartesian and Polar co-ordinates
- Velocity and acceleration along the tangent and normal to it
- Relative velocity, motion of particles in straight lines
- Vertical motion under gravity (laws of motion)
- Projectiles: Time of flight, range on a horizontal plane, greatest height reached, the part of a projectile as parabola.
- The momentum equation and derivation of the impulse
- Angular momentum principles
- Impact of two small spheres (direct and oblique)
- The principle of conservation of energy.

MAT 222 NUMBER THEORY **2 Credits Compulsory**

At the end of course the student should be able:

- **a.** Represent vectors in 2-3 dimensions
- **b.** Solve problems in vector algebra
- **c.** Apply the knowledge of vector analysis in solving real life problems.

Topics

- Representation of vectors in 1-3 Dimensions
- Equality of vectors, position vectors (explain using the model of space co-ordinate)
- Triangular, parallelogram and polygon laws of vector addition
- Resultant of vectors
- Associative law of vectors
- Negative and unit vectors
- Magnitude or length of a vector
- Commutative and distribution laws of vectors, Scalar or dot product of vectors
- The vector or cross product of two vectors
- The cosine of angles between two vectors
- Direction cosines
- Relations between dot product and component of work done in a force field
- Triple product of vectors
- Plane and space curves and their vector equations
- Vector differentiation
- The del (or vector operator notation)
- The divergence of a curve vector and the divergence theorem
- Frener –Serret formulae for solution of problems"

MAT 223 REAL ANALYSIS I **1 Credit Compulsory**

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

a. Solve abstract problems using mathematical skills.
b. Use correctly the methods of proofs in mathematics.

Topics

- Basic properties of real number system including boundedness and completeness
- Concept of neighborhood
- Open and close sets
- Basic theorems on open and closed sets
- De Morgan laws
- Function and functional notation
- Rigorous treatment of limits and continuity
- L'Hospital's rule (proof may be required)
- Consequences of differentiation
- Rolle's theorem
- Mean value theorem and Taylor's theorem (proof may be required)
- Successive differentiation
- Leibnitz's formula for nth derivative (proof not required)
- Functions of several variables
- Partial differentiation
- Lagrange's multipliers

MAT 224 JUNIOR SECONDARY SCHOOL CONTENT 1 Credit compulsory

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

a. Learn by heart the sequential arrangements of all the topics in junior secondary school mathematics.
b. Solve difficult problems in junior secondary school mathematics.

Topics

- Fractions decimals and approximation:-harder word problems involving fractions decimals and approximations.
- Expansion & factorization
- Simultaneous linear equations:-elimination, substitutions, graphical methods word problems leading to simultaneous equations.
- Quadratic equation by factorization only, word problems involving quadratic equations.
- Algebraic fractions & Algebraic equations, word problems involving algebraic equations
- Pythagoras theorem and its applications
- Angles of elevation and depression
- Areas and perimeters of plane shapes:- problems involving areas and perimeters
- Properties of solid shapes: - cubes, cuboid, cylinder, spheres, pyramid, cones etc and surface areas and volumes of solid shapes
- Variations: - Direct inverse, joint and partial variation including word problems
- Trigonometric ratios and their application
- Commercial Arithmetic (profit and loss, discount hire purchase, commission), number basis.
- Scale drawing
- Areas and volumes of similar shapes.

MAT 225 RESEARCH METHODOLOGY 1 Credit compulsory

The reason for this course is to prepare students to carry out research works in Mathematics Education without much difficulty.

1. **Research Study**
   a) Background of the study
   b) Statement of problem
   c) Purpose of the study
   d) Scope of the study
   e) Area of the study
   f) Significance of the study
   g) Research questions

2. **Literature Review**
   The relevance of the review to the background of study must be clearly shown to the students.

3. **Method of data organization**
   a) Techniques of getting the sample from sample population such as
      i) Simple ballot system
      ii) Use of table of random numbers and any other
      iii) Slating the population and the sample
   b) Instrument for data collection
   c) Validation of instrument
   d) Analysis of data – Frequency table, percentages, t-test and z-test statistics,
   e) Correlation coefficient
   f) Results and Interpretation
   g) Recommendation

NCE III FIRST SEMESTER

EDU 324
TEACHING PRACTICE

NCE III – SECOND SEMESTER

MAT 321 STATICS 1 Credits Compulsory

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

- **a.** Explain with confidence the concept of statics.
- **b.** Solve simple problems on statics
- **c.** Justify the relevant of statics
- **d.** Resolution of forces and turning points practically

Topics

- Force, definition of force and types of force.

- Resolution of forces acting at a point
- Moments, definition of moment and types.
- Equilibrium conditions of moments
- Equilibrium, definition and types.

- General conditions of equilibrium
- Friction: laws of friction and resistance, angle of friction, the least force problem involving sliding only
- Coplanar forces (centroids)
- Centre of gravity: Centre of mass, simple forms, general formula for centre of gravity
- Compound bodies, centre of gravity by integration

MAT 322 LINEAR ALGEBRA **1 Credit Compulsory**

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

a. Discuss with confidence the concept and the meaning of linear algebra such as vector space over the real field, sub-space, linear independence, basis and dimension, linear transfunctions, eigenvalues etc.
b. solve simple problem on the linear algebra.
c. apply the knowledge of the concept to other areas.

Topics

- Matrices: definition, equality of matrices, addition, scalar multiplication, multiplication of matrices, inverse matrices, adjoint transpose, row equivalence and elementary row operations.
- Determinants: - up to 2x2 matrices. Application of matrices to solutions of linear equations.
- Determinants
- Vector space over the real field, sub-space, linear independence, basis and dimension
- Linear transformations and their representational matrices; range, null space, rank, singular and non-singular transformation and matrices.
- System of linear equations, change of basis, equivalence and similarities
- Minimum and characteristic polynomials of a linear transformation (matrix)

- **MAT 323 REAL ANALYSIS II 1 Credits Elective**

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

a. Discus the meaning of anti-derivatives, Riemann integral and its properties
b. Define and solve problem on multiple integrations, series and sequence.
c. Approve the relevant of real analysis in everyday life and for further studies
d. Solve problems on real analysis

Topics

- Anti-derivative (Integration)
- Definition of Riemann integral
- Properties of Integrals and basic theorems (proof of the fundamental theorems of calculus may be required)
- Series and sequences
- Proof of boundedness; comparison, ratio and root test may be required
- Absolute and conditional convergence
- Power series

MAT 324 ABSTRACT ALGEBRA 1 Credit Elective
ALGEBRAIC STRUCTURES

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

a. Explain the meaning of algebraic structure
b. Define the following: group , semi group , monoid, group and subgroup
c. State lagrange theorem
d. Explain the concepts of cyclic group, ring, integral domain, field
e. Solve problems on polynomials: HCF, LCM and factorization

Topics

- Grouped, semi group, monoid and group, subgroup
- Lagrange theorem, cyclic group, ring, integral domain, division, ring and field
- Polynomials: H.C.F and L.C.M of polynomials
- Factorization

MAT 325 DIFFERENTIAL EQUATIONS 1 Credit Compulsory

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

a. Discuss the meaning of first-order differential equqations
b. State the existence and uniqueness of solution.
c. Apply different methods of solving differential equations
d. State and solve second order differential equation
e. Approve the importance of differential equations in science and technology
f. Formation of differential equation using physical and chemical situations.

Topics

- First – order differential equations
- Existence and Uniqueness of solution
- Example to be limited to equations of the types
- $\frac{dy}{dx} = f(x), \frac{dy}{dx} = f(y)$
- Use of boundary separation restricted only to easy integral
- Homogeneous Equations.

- Exact equations and integrating factor for non-exact equations
- Solution of 2nd – order differential equation. Example to be restricted to the equations of the type.

$$(a)\frac{d^2y}{dx^2} = f(x) \qquad (a)\frac{d^2y}{dx^2} = f(x)$$

Equations with constant co-efficient and Cauchy-Euler types should be treated.
Formation of equations from physical situations.