

**General Studies - National Technical Certificate (NTC) and
Advanced National Technical Certificate (ANTC)**

Biology Courses

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE

COURSE: BASIC BIOLOGY

Year 1

MODULE: CBB10

DURATION: 2hrs/wk

GOAL: This course is designed to introduce students to the fundamental basis of biology

GENERAL OBJECTIVES

On completion of this module, the trainee should be able to:

1. Understand biology as a science.
2. Know the various branches of Biology and their interrelationship.
3. Understand the general characteristics of living non-living things.
4. Know the difference between plants and animals.
5. Understand the basic classification of plants and animals.
6. Understand general Microscopy.
7. Understand the Structure and Functions of Cell Components.
8. Understand Cell as a living Unit and forms in which living cells exist.
9. Understand Organization of life.
10. Understand Cell in relation to its environment.
11. Know the properties and functions of the living Cell.
12. Know the various stages of cell division.
13. Know reproduction in Plants and animals.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Basic Biology - Year 1 term 1		Course Code: CBB 10	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
WEEK	General Objective: 1.0: Understand Biology as a science		
Yr 1 t 1	Special Learning Outcome	Teachers Activities	Resources
1-2	1.1 State the importance of biology 1.2 List the procedures in scientific Method. 1.3 Identify Biology as a branch of science	• Explain importance of Biology as a branch of Science	• Note book and chalkboard
General Objective 2.0 Know the various Branches of biology and their interrelationships			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	2.1 Outline the scope of biology to include such areas as botany, zoology, genetics, cytology, ecology, anatomy, morphology, physiology, biochemistry, microbiology, parasitology, virology, mycology, algology, etc. 2.2 Explain the interrelationship of various areas of biology.	• Explain various branches of Biology and their inter-relationships	
General Objective 3.0: Understand the general characteristics of living and non-living things.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	3.1 List examples of living and non-living things. 3.2 List the characteristics of living things. 3.3 List the characteristics of non-living things. 3.4 Explain virus as living or non-living things.	• Differentiate between living and non-living things. • Explain virus as a living and non-living organism	
General Objective 4.0: Know the differences between plants and animals			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
3-4	4.1 List characteristics of plants. 4.2 List characteristics of animals. 4.3 Differentiate between plants and animals. 4.4 Explain the characteristics of euglena as both plant and animal.	• Describe the differences between plants and animals. • State the function of its part	• Note book and chalkboard • Microscope, Plant tissue • Animal tissue

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Basic Biology - Year 1 term 1		Course Code: CBB 10	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 5.0: Understand the basic classification of plants and animals			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
5-7	5.1 Explain the principles of classification. 5.2 Classify plants and animals into their different phyla and classes. 5.3 Carry out simple experiments on classification of both plants and animals. 5.4 State the characteristics features of each phylum division in 5.2 above giving at least 2 examples from each. 5.5 Classify given organisms into appropriate groups based on their characteristics (Practical Work) 5.6 Describe the external features and life history of an example each from the division/phylum in 5.2 above.	<ul style="list-style-type: none"> Outline classification of plant and animal into different phyla and classes 	Chalkboard, Lesson Note
General Objective 6.0: Understand general Microscopy			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	6.1 Identify the parts of a Microscope. 6.2 State the functions of each of part of the Microscope. 6.3 Prepare wet/temporary mounts. 6.4 Clean and care for the Microscope.	<ul style="list-style-type: none"> Explain microscopy Highlight microscope parts, Function and maintenance 	<ul style="list-style-type: none"> Note book, chalk, handout and microscope
General Objective 7.0: Understand the Structure			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	7.1 Observe cells under the microscope (plant and animal)e.g. onion cells, cheek cells. 7.2 Draw and label cells observed in 7.1 above. 7.3 Explain the various components of the cell and their functions.	<ul style="list-style-type: none"> Explain with a label diagram, cell structures 	<ul style="list-style-type: none"> Cell structure chart

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Basic Biology - Year 1 term 1		Course Code: CBB 10	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 8.0: Understand Cell as a Living unit and Form in which he exists.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	8.1. Identify single and free-living organisms e.g. Amselsa Paramecium, Euglena and Chlamydomonas. 8.2. Draw and label single celled organisms under the microscope. 8.3. Draw and label single celled organisms observed in 8.2 above. 8.4. Differentiate between single and free living organisms colony evolves and filament e.g. spirogyra. 8.5. Differentiate between the groups of cells that form tissues and those that form colonies or filaments.	<ul style="list-style-type: none"> • Explain cell as a unit and form of single and free-living organism. • Demonstrate with a label diagram a single celled organism. 	<ul style="list-style-type: none"> • Note book, chalkboard
General Objective: 9.0 Understand Organization of life.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
8-9	9.1 Explain the cell as a unit of life. 9.2 Differentiate between single celled organism/plants and multicellular organisms 9.3 Describer a tissue and give examples. 9.4 Describer an organ and give examples. 9.5 Describer a system and list examples. 9.6 Differentiate between tissues, organism and system. 9.7 Explain the principles of classification in plants and animals. 9.8 List and identify the major groups of the plant and animal kingdom. 9.9 Outline the characteristics of each of the groups identified in 9.8 above.	<ul style="list-style-type: none"> • Explain the cell as the basic unit of life. • Explain the following terms <ul style="list-style-type: none"> i. Tissue ii. Organ iii. System and give examples 	<ul style="list-style-type: none"> • Notebook and Chalkboard

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Basic Biology - Year 1 term 1		Course Code: CBB 10	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 10.0 Understand Cell in Relation to environment			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	10.1 Define (a) Diffusion (b) Osmosis (c) Fungidity (d) Plasmolysis 10.2 Identify sites where the above processes occur in plants. 10.3 List the conditions necessary for 10.1 above to occur. 10.4 Explain the mechanism by which each of the processes in 10.1 takes place. 10.5 Differentiate between osmosis and plasmolysis. 10.6 State the significance of osmosis, fungidity and plasmolysis. Carry out simple experiments to show how 10.1 take place.	<ul style="list-style-type: none"> • Know principles of classifying plant and animal kingdom with their characteristics 	
General Objective: 11.0 Know the Properties and function of living cell			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
10-11	11.1 Explain the following processes within living cell <ol style="list-style-type: none"> a. Nutrition <ol style="list-style-type: none"> i. Autotrophic (Photosynthesis) ii. Heterotrophic (holozoic) iii. Mineral nutrition Macro and Micro-nutrition b. Cellular respiration definitions and processes of: <ol style="list-style-type: none"> i. Aerobic respiration ii. Anaerobic respiration iii. energy release c. Excretions: <ol style="list-style-type: none"> i. Excretion in single 	<ul style="list-style-type: none"> • Explain mode of nutrition within living cell. • Differentiate between aerobic and anaerobic respiration. • Explain excretion and gives examples 	<ul style="list-style-type: none"> • Chalkboard • Excretion chart system

	<p>aquation organism. Diffusion by body surface: by contractile vacuole. ii. Waste product of metabolism</p> <p>11.2 Carry out experiment to show the effect of mineral deficiency in plants especially, nitrogen, phosphorus and potassium.</p> <p>11.3 Differentiate between micro-elements (carbon, hydrogen, oxygen, nitrogen, and iron) and micro-elements) copper, manganese, zinc, boron and cobalt)</p> <p>11.4 Outline the chemical processes involved in glycolysis and Kreb's cycle: Making reference to the role of ATP.</p> <p>11.5 List the waste products of respiration.</p>		
General Objective: 12.0 Know the various stages of cell division.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
	<p>12.1 Explain cell division i.e. mitosis and meiosis</p> <p>12.2 Identify various stages of cell (mitosis) from prepared slides and stage the significance of the process</p> <p>12.3 Identify various stages of meiotic division</p> <p>12.4 Observed and draw different stages of meiotic divisions in the microscope.</p> <p>12.5 Explain the significance of meiotic and mitotic divisions to plants and animals.</p> <p>12.6 Identify points of fastest growth in plants.</p> <p>12.7 Observe root and shoot tip.</p> <p>12.8 Differentiate between mitosis and meiosis.</p> <p>12.9 Explain tropism.</p> <p>12.10 Demonstrate types of tropism</p> <p>12.11 Identify different region of growth and development, cell division, elongation differentiation and mafurations.</p>	<ul style="list-style-type: none"> • Explain cell division i.e. mitosis and meiosis and their significance. • Explain the signifiante of mitosis and meiosis for plants and animal. • Analyze the division under the microscopy perform experiment. 	<ul style="list-style-type: none"> • Notebook, chalkboard cell chart. • Microscopy forceps, staining troughs, animal tissue.

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COURSE: Basic Biology - Year 1 term 1		Course Code: CBB 10	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 13.0: Know re-production in Plants and Animals			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
12	13.1 Explain re-production. 13.2 Differentiate between sexual and asexual re-production. 13.3 Identify the different types of asexual re-production i.e. fusion, budding, vegetative propagation 13. 4 Observe and draw from prepared slides, fusion in paramecium budding in yeast and hydra. 13.5 Identify and demonstrate methods of vegetative propagation. 13.6 Identify the different types of sexual re-production i.e. conjugation and fission of gametes. 13.7 Observe and draw from prepared slides of conjugation in paramecium and spirogyra. 13.8 Explain fission of gametes i.e. fertilization. 13.9 Explain cell differentiation in development	<ul style="list-style-type: none"> • Explain reproduction • Differentiate between sexual and asexual reproduction • State types of asexual reproduction in plants and animal. • Explain fertilization. 	<ul style="list-style-type: none"> • Notebook • Chalkboard, reproduction chart

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: FLOWERING PLANTS AND SOIL SCIENCE	Y 1 T 1	MODULE: CCB11	DURATION: 2hrs/wk
GOAL: This course is designed to introduce students into the interrelationships between the plants and soil.			
GENERAL OBJECTIVES			
On completion of this module, the trainee should be able to:			
1 Understand the structure of a flowering plant.			
2 Understand reproduction in plants.			
3 Understand the process of transpiration and mineral requirements in plants			
4 Understand the process of photosynthesis and respiration in plants.			
5 Understand tropism in plants.			
6 Understand the constituents, structures and characteristics of soil.			
7 Know the various methods of soil and plant conservation and improvement.			

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
WEEK	General Objective 1.0: Understand the structure of a flowering plant.		
Yr 1 t 2	Specific Learning Outcome	Teachers Activities	Resources
1 - 2	<p>1.1: Describe the external features of a named dicotyledonous flowering plant (e.g.. Croton, Delonix, Caesalpinai, Ageratum, Triad, Aspillia etc.</p> <p>1.2 Describe the external features of named monocotyledonous flowering plant (e.g. Andropogon, Zea Mays, pennisetum, etc.</p> <p>1.3 Draw and label the plants described in 1.1. and 1.2 above.</p> <p>1.4 Differentiate between a monocotyledonous and a dicotyledonous plant.</p> <p>1.5 Describe the functions of the different parts of the flowering plant labeled in 1.3 above.</p> <p>1.6 Observe the internal structure of the root, stem and leaf under the microscope.</p> <p>1.7 Relate the internal structure of the roots, stems and leaves to their functions</p> <p>1.8 Differentiate between the internal structure of the different parts of a monocot and a dicot (leaf. Stem and root.</p> <p>1.9 Draw and label the structures observed in 1.6 above.</p>	<ul style="list-style-type: none"> • Explain the external feature of Dicotyledonous and monocotyledonous flowering plants and give examples. • State differences between monocotyledonous and dicotyledonous plants • Observe root, stem and leaf under the microscope 	<ul style="list-style-type: none"> • Notebook, chalkboard • Microscope • Plant structures

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 2.0: Understand reproduction in Plants			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
3 - 4	2.1 Explain reproduction in plants 2.2 Differentiate between sexual and asexual reproduction. 2.3 List different methods of asexual reproduction in plants,e.g. budding, grafting layering, stem, currying, sectioning, and suckering. 2.4 Carry out experiments on 2.3 above. 2.5 Identify different types of storage organs in plants e.g. rhizomes, bulbs, tubers, corms. 2.6 Draw and label whole flower and a longitudinal section of a flower. 2.7 Identify parts and arrangements of floral parts of names insect pollinated flowers (Allemande, Hibiscus, Deloris, Caesalpinia, Tecoma) and named wind Pollinated flowers (Tridax, Zea, Mays, Guinea corn, penisettum).	<ul style="list-style-type: none"> • Explain reproduction in plants. • State differences between sexual and asexual reproduction in plants and gives examples. 	<ul style="list-style-type: none"> • Notebook and chalkboard • Plant reduction chart

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COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
5 - 6	<p>2.8 Describe the structure and function of the male (Androecium) and female (gynoecium) parts of a flower.</p> <p>2.9 Describe the type of pollination.</p> <p>2.10 List the features of cross-pollinated and self-pollinated flowers.</p> <p>2.11 List the agents of pollination.</p> <p>2.12 Describe the process of development of zygote (fertilization) in flowering plants.</p> <p>2.13 Differentiate between a seed and a fruit.</p> <p>2.14 Identify and classify different types of fruits and seeds.</p> <p>2.15 Draw and label fully 2.14 above (whole and section of e.g. Drupe, Berry, Caryopsis, Bean Seed/Groundnut seed castor oil seed/jatropha).</p> <p>2.16 Describe the agents of dispersal of seed and fruits (sunflower-cotton, cro).</p> <p>2.17 Carry out experiments to show the importance of oxygen, adequate moisture and suitable temperature for germination.</p> <p>2.18 Describe types of germination. The stages of hypogeal</p>	<ul style="list-style-type: none"> • Explain pollination. • State features of cross and self-pollinated flowers. • State the agents of pollination. • Explain fertilization in flowering plant. • Demonstrate and experiment oxygen, moisture and temperature suitable for germination. 	<ul style="list-style-type: none"> • Notebook, chalkboard, seeds, water, sunlight and 9 bucket containing soil etc.

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COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective: 3.0 Understand the Process of Transpiration and mineral requirements in plants.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
7	3.1 Define transpiration in plants and explain the mechanism. 3.2 Identify sites where transpiration takes place in plants (lenticular and stomata) 3.3 Observe stomata guard cells under the microscope. 3.4 Draw the label stoma and its associated guard cells from the observation in 3.3 above. 3.5 Explain the transpiration pull in plants. 3.6 List and explain factors affecting transpiration.	<ul style="list-style-type: none"> • Explain mechanism of transpiration in plant. • State and explain factors affecting transpiration in plant and mineral requirements. • Demonstrate experiment. 	<ul style="list-style-type: none"> • Notebook and chalkboard. • Green plant water bath
	3.7 State the importance of transpiration to plants. 3.8 Carry out experiments to illustrate/demonstrate transpiration. 3.9 Explain the importance of mineral elements to plants. 3.10 Carry out culture experiments to demonstrate 3.9 above.		

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COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective 4.0: Understand the process of photosynthesis and respiration in plants.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
8	4.1 Define photosynthesis. 4.2 Identify the parts of the plants where photosynthesis take place. 4.3 Explain the process of photosynthesis (light and dark reactions) 4.4 List the conditions necessary for photo synthesis to take place. 4.5 Cary out simple experiments to show that conditions listed in 4.4 are necessary of photo synthesis. 4.6 Explain the importance of photo synthesis.	<ul style="list-style-type: none"> • Explain photosynthesis. • Demonstrate experiment on photosynthesis. • State importance of photosynthesis. 	<ul style="list-style-type: none"> • Notebook, chalkboard. • Photosynthesis apparatus
	4.7 Define respiration. 4.8 Identify the parts of the plant where respiration takes place. 4.9 Explain how respiration takes place in all living cells (Gycolysis and Krebs cycle). 4.10 Carry out simple experiments to show that (a) Oxygen in used up and (b) carbon dioxide and Heat are produced during respiration. 4.11 Differentiate between respiration and photo synthesis with the aid of reversible balanced equalism, (catabolism and anabolism). 4.12 Differentiate between respiration, combustion and fermentation.	<ul style="list-style-type: none"> • Explain respiration. • Explain respiration in plant and living cells. • Demonstrate experiment on respiration and state differences between respiration and photosynthesis 	<ul style="list-style-type: none"> • Notebook, plant and animal respiratory chart and apparatus

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective: 5.0 Understand tropism in plants			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
9	5.1 Define tropism in plants. 5.2 List the different forms of Tropism in plants, e.g. Phototropism, Geotropism, Chemotropism, Hydrotropism, Thigmotropism, Travmatotropism and Galvanotropism (or electrotropism). 5.3 Explain how each form of tropism listed in 5.2 takes place. 5.4 Carry out simple experiments to show that phototropism, Geotropism, Hyrdotropism and Chemotropism take place in plants. 5.5 Explain the role of auxins in plants tropism. 5.6 Explain the role of cytokinnis gibberellins in flowering, fruit ripening and leaf e.g. mastic and tactical. 5.7 Identify other types of movement in plants.	<ul style="list-style-type: none"> • Explain tropism in plant. • Describe different forms of plants tropism. • Explain the importance of auxin, cytokinnis and gibberellins in plant • Demonstrate experiment on different forms of tropism in plants 	<ul style="list-style-type: none"> • Notebook and chalkboard. • Seed germination, light, water, chemical etc.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective: 6.0 Understand the constituents, structure and characteristics of soil.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
10	6.1 List the constituents of soil and their importance. 6.2 List types of soil (clayey, sandy and loamy) 6.3 Outline the characteristics of each soil type (physical, chemical and biological.	<ul style="list-style-type: none"> • State constituents of soil and their importance. • State differences between clay, sandy and loamy. • State their biological, chemical and physical importance of soil. 	<ul style="list-style-type: none"> • Notebook, chalkboard, soil.
	6.4 Carry out simple experiments to determine soil profile by both sedimentation and digging methods. 6.5 Describe the process of soil formation. 6.6 Carry out simple experiments to relate soil structure to water retention capacity. 6.7 Determine experimentally the amount of air, water and humans in given soil sample. 6.8 Compare capillary and porosity of different soil samples by simple experiments.	<ul style="list-style-type: none"> • Explain soil formation. • Carry out experiment on soil capillarity and percolation. • Differentiate between soil porosity and capillarity on soil samples. 	<ul style="list-style-type: none"> • Lesson note and chalkboard. • A container fill with soil and water etc.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Flowering Plants and Soil Science		Course Code: CBB 11	Contact Hours: 2hrs/wk
Course Specification: Practical Content			
General Objective: 7.0 Know the various methods of soil and plant conservation and improvement.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
11 - 12	7.1 Identify the various forms of soil erosion such as sheet, gully, wind, water and other forms by which the soil can loose its fertility.e.g. leaching, surface compacting (or reduction of aeration)	<ul style="list-style-type: none"> • Explain process by which soil can loose its fertility. • State various forms of soil erosion. 	• Lesson note and chalkboard
	7.2 Describe ways of preventing soil erosion e.g. vegetative protection (cover crops and trees) terracing, mulching, strip, cropping and contouring of slop ground, the use of natural (compost, animal dung) and artificial manure (fertilizers) crop rotation and shifting cultivation.	<ul style="list-style-type: none"> • Explain ways of preventing soil erosion. 	- ditto-
	7.3 Differentiate forms of soil erosion in a field trip.	<ul style="list-style-type: none"> • State methods of soil cultivation 	
	7.4 Differentiate between the various forms of cultivation e.g. crop rotation, mono-cropping, mixed cropping, mixed farming, following etc		
	7.5 State the economic importance of each form of cultivation in 7.4 to soil.	<ul style="list-style-type: none"> • Explain and state importance of microorganisms, soil fertility and importance of soil conservation 	
	7.6 State and explain the roles of micro-organisms in maintain soil fertility (H ₂ O carbon and nitrogen cycles)		
	7.7 Outline the processes and importance of the cycles in 7.6 above.		
	7.8 Explain the importance of plant conservation (Aforestation and Creation of forest wild life reserve).		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE

COURSE: ANIMAL BIOLOGY

Year 1 Term 3

MODULE: CBB 12

DURATION: 2hrs/wk

GOAL: This course is designed to introduce the students into General characteristics and mechanisms of animal (Vertebrates and Invertebrates as in module II)

GENERAL OBJECTIVES

On completion of this module, the trainee should be able to:

1. Understand the external features and characteristics of invertebrates animals.
2. Understand the external features and characteristics of vertebrates.
3. Know the different types of skeleton and supporting systems in animals.
4. Know the different types of bones that make up the mammalian skeleton.
5. Know the different types of joints in the body of a mammal.
6. Know the mode of animal nutrition's.
7. Understand dentition mammals.
8. Understand the main features of the circulatory systems and the functions of its components in animals.
9. Understand the process of evaporations and the respiratory organ in animals.
10. Know the different excretory organs and the excretory products of animals.
11. Understand control and coordination in animal.
12. Understand reproduction in animals

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
Week	General Objective 1.0: Understand the external features and characteristics of invertebrate animals		
	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 List the general characteristics features of the invertebrate animals. 1.2 List the specific characteristics features of each phylum of the invertebrates e.g. protozoa, coelenterate piathelminthes, rematoda arthropoda, arthropoda, mollusca etc. 1.3 Identify the phylum to which the following invertebrates belong. Amoebas, paramecium, hydra fascicta tape worm, millipede, centipede, mosquito, housefly, bees, coroaches, snail et. 1.4 Draw the external features of the invertebrates listed in 1.3 above. 1.5 Explain the external features and life-history of the invertebrates in 1.3 above. 1.6 List the economic importance of the invertebrates in 1.3 above	<ul style="list-style-type: none"> Describe the diagnostic features of the following phyla of invertebrate: protozoa Colenterates, nematoda, annelida, anthropoda, Pathelminties, mollusca etc. Explain life history of invertebrate 	<ul style="list-style-type: none"> Invertebrate charts skeletal form of unvertobrater Lesson notes Chalk board
General Objective 2.0: Understand the external features and characteristics vertebrates.			
Week	Specific Learning Outcome	Teachers Activities	Resources
2	2.1 List the general characteristic, features of the vertebrates.: 2.2 List the specific characteristics features of each class of the vertebrates e.g. Pisces (fishes), amphibian, reptilian, Ave and mammals. 2.3 Identify the class to which the following animals belong - a bony fish, a toad, a lizard, a bird and a small mammal. 2.4 Describe the external features, life-history and adaptations to their environmental of each animal mentioned in 2.3 above.	<ul style="list-style-type: none"> State general features and characteristics of vertebrates Differentiate characteristic and identify the major classess of invertebrates; Pisces, amphibia, Aves, Mammalia, Reptilian etc 	<ul style="list-style-type: none"> Lesson note and chalk board.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
General Objective 3.0: Know the different types of skeleton and supporting system in animals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
3	3.1 State the biological significance of skeleton and supporting system of animal (protections, support) locomotion/movement and respiratory movement 3.2 Identify skeletal material such as chitin, cartilage and bones. 3.3 Distinguish between the types of skeleton (exoskeleton/endoskeleton).	<ul style="list-style-type: none"> • Explain the importance of skeleton supporting system • Distinguish between exo-skeleton and endo-skeleton 	Lesson notes, Skeleton Charts
General Objective 4.0: Know the different types of bones that make up the mammalian skeleton			
Week	Specific Learning Outcome	Teachers Activities	Resources
	4.1 Describe the general plan of the mammalian skeleton. 4.2 List the components of the axial and appendicular skeleton 4.3 Draw and label the specific bones of axial and appendicular skeleton e.g. cervical, thoracic, lumbar sacral, scapula, radius, ulna, humerus, femur, tibia, fibula.	<ul style="list-style-type: none"> • Explain mammalia skeleton. • Draw and label the specific bones of axial and appendicular skeleton as started and highlights the functions. 	<ul style="list-style-type: none"> • Mammalian skeletal chart. • Skeletal bones. etc
General Objective 5.0: Know the different types of joints in the body of a mammal			
Week	Specific Learning Outcome	Teachers Activities	Resources
5	5.1 List the different types of joints in mammals e.g. movable, immovable ball and socket, hinge, suture/skull. 5.2 Identify where each type of joints listed in 5.1 above occurs in the body of the mammal. 5.3 Explain the role of muscles in movement 5.4 Describe how each joint functions.	<ul style="list-style-type: none"> • Describe the following types of joints: movable, immovable, ball & socket, hinge etc. • State where each of type of joints occurs in mammalian body and their functions. 	<ul style="list-style-type: none"> • Model of mammalian skeletal system. • Skeletal chart.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
General Objective 6.0: Know the mode of animal nutrition			
Week	Specific Learning Outcome	Teachers Activities	Resources
6	<p>6.1 Explain the different types of heterotrophic nutrition in animals (holozoic, parasitic, symbiosis, saprophytic).</p> <p>6.2 List the classes and sources of food substance of man.</p> <p>6.3 State the importance of the classes listed in 6.2 above in human diet.</p> <p>6.4 Describe the importance of balanced diet to good health.</p> <p>6.5 Carry out simple experiment on good test to identify proteins carbohydrate and fats.</p> <p>6.6 List the diseases of man associated with the diseases in 6.6 above.</p> <p>6.7 Describe the symptoms associated with the diseases in 6.6 above.</p> <p>6.8 Describe the methods of curing the diseases in 6.6 above</p> <p>6.9 Draw the label the digestive system in man.</p> <p>6.10 Draw and label the digestive system from a dissected small mammal and bird.</p> <p>6.11 List the different stages of nutrition in higher animals (ingestion, digestion, absorption, assimilation's egestion)</p> <p>6.12 Explain the mechanism involved in the different stages listed 6.11 above.</p> <p>6.13 Carry out simple experiments on the actions of ptyalin, rennin and pepsin.</p> <p>6.14 Explain the functions of liver and pancreas in man.</p> <p>6.15 Differentiate between the food of plants and that of animals.</p> <p>6.16 Differentiate between autotrophic and heterotrophic modes of nutrition.</p>	<ul style="list-style-type: none"> • Explain heterotrophic mode of nutrition in animals • Explain balance diet and its importance to good health. • Explain diseases associated with unbalance diet. • Explain and draw digestive system of a man and its functions. • Outline different between autotrophic and heterotrophic mode of nutrition. 	<ul style="list-style-type: none"> • Lesson notes. • Chalkboard

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
General Objective 7.0: Understand dentition in mammals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
7	7.1 Describe structure of a tooth and its insertion in the jaw bone. 7.2 Identify the different types of teeth. 7.3 Explain the functions of the different types of teeth. 7.4 Relate dentition to diet as illustrated by herbivore, Carnivore and omnivore. 7.5 Explain the importance of dental care. List and describe dental diseases associated with food habits.	<ul style="list-style-type: none"> • Explain and draw structures of tooth and states that functions. • Explain mode of dentition in diet in animals. 	<ul style="list-style-type: none"> • Dentition chart • Note book
General Objective 8.0: Understand the main features of the circulatory system and the functions of its components in animals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
8	8.1 Explain the need for transportation in animal. 8.2 List the components of blood (white blood cells red blood cells, etc and lymph). 8.3 Differentiate between blood and lymph 8.4 List the functions of blood. 8.5 Identify the organs of the circulatory system. 8.6 Draw and label the major components of the circulatory system, from a described specimen (a mammal). 8.7 Explain the functions of the major components of the circulatory system. 8.8 Explain the process of blood circulation in mammal. 8.9 Differentiate between double, single, open and closed systems of circulation. 8.10 Explain the mechanism of the clotting of blood. 8.11 Carry out simple first aid treatment of bleeding and snake bite.	<ul style="list-style-type: none"> • Explain process of transformation in animal. • Explain component of blood and their difference. • Draw and label circulatory system of mammal. • Explain importance of blood clotting. 	<ul style="list-style-type: none"> • Note book, • Chalk board etc.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
General Objective 9.0: Understand the process of respiration and the respiratory organ in animals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
9	9.1. Define respiration. 9.2 Differentiate between aerobic and anaerobic resouratuibs. 9.3 List various respiratory organs in animals. 9.4 List the components of the respiratory system of mammals. 9.5 Draw and label the respiratory system from dissected small mammal. 9.6 Describe the mechanism of gaseous exchange in fish, toad and mammal.	<ul style="list-style-type: none"> • Explain respiration list various respiratory organ in mammal and functions. • Explain inhalation and exhalation. • Describe the role of oxygen in respiration. 	<ul style="list-style-type: none"> • Lesson note • Chalk board. etc
	9.7 Differentiate between inhalations (breathing-in) and exhalation (breathing-out) 9.8 Carry out experiments to show gaseous exchange and heat production in respiration. 9.9 Explain the role of oxygen in tissue respiration (biochemical details not necessary)		
General Objective 10.0: Know the different excretory organs and the excretory products of animals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
10	10.1 List the different excretory organs of animals and their products. 10.2 Draw and label the cross-section of a kidney. 10.3 Explain the process of excretion as carried out by the kidney. 10.4 Identify the waste products in 10.3 above 10.5 Explain some of the diseases of kidney (causes, symptom and precaution/control) 10.6 Draw and label a cross-section of the skin of a mammal from a prepared slide. 10.7 Explain the process of excretion by the skin. 10.7 Identify the products of excretion by:	<ul style="list-style-type: none"> • Explain and list excretory organs of animals. • Draw the cross-section of a kidney and explain how excretion process been carried out. • Diagrammatically explain mammalia slain. • Outline the product of excretory system. 	<ul style="list-style-type: none"> • Note books • Chalk board.
	(a) Skin (b) Kidney (c) Lungs		

	-Minerals	-Urea	-CQ2		
	- Salt and	-Uric acid	- H2O		
	- Water	- etc			
General Objective 11.0: Understand Control and Co-ordination in Animals					
Week	Specific Learning Outcome			Teachers Activities	Resources
11	<p>11.1 List the components of the central and peripheral nervous system.</p> <p>11.2 Describe the external structure, functions of the brain and spinal cord.</p> <p>11.3 Describe the structure and functions of the somatic and autonomic nervous system.</p> <p>11.4 Describe the structure and functions of neurons.</p> <p>11.5 Classify neurons.</p> <p>11.6 Describe the transmission of nerves impulses by a change in electrical potential.</p> <p>11.7 Distinguish between reflex and voluntary actions.</p> <p>11.8 Trace the paths of reflex arc.</p> <p>11.9 Demonstrate simple reflexion action e.g. Knee-jerk, eye blinking reflex (withdrawn of hand from a hot or sharp object).</p> <p>11.10 List the principal sense organs (eye, ear, nose, skin and tongue)</p> <p>11.11 Identify the location of the sense organs in 11.6 above.</p> <p>11.12 Draw and describe the structure of the eye, ear and skin.</p> <p>11.13 Draw simple eye defects and their methods of corrections.</p> <p>11.14 Identify the site of endocrine glands in man.</p> <p>11.15 State the functions and effects of over and under secretion of each hormone e.g. thyroxin, insulin, adrenaline and sex hormones.</p> <p>11.6 Describe how the body maintain constant temperature and regulate the internal environment (homeostasis).</p>			<ul style="list-style-type: none"> • Explain central nervous system and its sections. • Differentiate between reflex and voluntary actions with examples. • Explain sense organs and functions. • Outline function of hormones. 	<ul style="list-style-type: none"> • Lesson note. • Chalk board

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Animal Biology - Year 2		Course Code: CBB 12	Contact Hours: 60hrs; 5hrs/wk
Course Specification: Practical Content			
General Objective 12.0: Understand reproduction in animals.			
Week	Specific Learning Outcome	Teachers Activities	Resources
12	12.1 Define reproductions 12.2 State the type of reproduction (a sexual and sexual) 12.3 Describe the structure and functions of the male and female reproductive system 12.4 Draw and label the male and female reproductive system of a mammal. 12.5 Differentiate between male and female reproductive organ. 12.6 Describe the structure of gametes (sperm and ovum) 12.7 Explain the process of fertilization in a mammal. 12.8 Explain the development, nutrition and respiration of the embryo, resulting from fertilization in mammals. 12.9 Explain the period of gestation in mammals and parental care for other animals. 12.10 Explain the importance of sex education. 12.11 Describe the different methods of family planning (e.g. condoms, diaphragm, loop, pills, surgery, ovulation, rhythm etc. 12.12 Explain the significance of courtship behaviour in animals. 12.13 Describe the stages in the development (metamorphosis) in housefly, butterfly, cockroach and toad 12.14 Differentiate between complete and incomplete metamorphosis. 12.15 Compare reproduction in protozoan, insects fish, amphibians, reptiles and mammals.	<ul style="list-style-type: none"> • Explain reproduction system. • Describe with label diagram male and female reproductive system and their functions. • Explain importance of family planning. • Explain stages of development in insects. 	<ul style="list-style-type: none"> • Note book • Chalk board • Notebook • Chalk board • Note book • Chalk board

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE

COURSE: GENETICS AND ECOLOGY Year 2

MODULE: TCB 13

DURATION: 2hrs/wk

GOAL: This course is deigned to introduce the students to interrelationship between organism an its environment and to provide the student with an understand o f how characteristics are inherited.

GENERAL OBJECTIVES

On completion of this module, the trainee should be able to:

1. Understand the basic concepts in genetics.
2. Understand basic concepts in ecology.
3. Know the various diseases of man and their causative agents
4. Know the various forms or pollution (water, air and land)

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Genetics and Ecology - Yr 2		Course Code: TCB 13	Contact Hours: 21/1hours/wk
Course Specification: Practical Content			
WEEK	General Objective 1.0: Understand the basic concepts in genetics		
Yr 2 t 3	Specific Learning Outcome	Teachers Activities	Resources
1 - 2	<p>1.1 Explain the following genetic terms to highlight the transmission and expression of characteristics on organisms.</p> <ul style="list-style-type: none"> a. Gene b. Chromosomes c. Dominance d. Recessive e. Hybrid f. Genotype g. Phenotype h. Filial generation (1st 2nd) i. Back-cross and test-cross j. Complete and incomplete dominance k. Allele or allomorphic pair l. Monohybrid cross m. Dihybrid cross n. Homozygous o. Heterozygous p. Heritable and non-heritable characters q. Continuous and discontinuous variations r. Pedigree s. Co-dominance t. Nucleic acids (DNA & RNA) u. Out breeding and in-breeding. 	<ul style="list-style-type: none"> • Explain and demonstrate diagrammatically the genetic characteristics of an organism. 	<ul style="list-style-type: none"> • Note book. • Chalk board.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Genetics and Ecology - Yr 2		Course Code: TCB 13	Contact Hours: 21/1hours/wk
Course Specification: Practical Content			
	1.2 Explain Mendellian Laws of inheritance and probability in Genetics. 1.3 Sort out the results of simple monohybrid and dihybrid crosses using Puente square or checker board. 1.4 Apply knowledge of genetic studies in: <ul style="list-style-type: none"> a. agriculture e.g. selection of high yielding and disease resistant varieties. b. Health e.g. sickle cell anemia, blood grouping, blood transfusion, hemophilia, etc. (Application of knowledge of heredity in marriage counseling should be emphasized) 		
	1.5 List the advantages and disadvantages of cross-fertilization, out breeding and in-breeding.		
General Objective: 2.0 Understand the basic concepts of Ecology			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
3 - 5	2.1 Define ecology and its importance 2.2 Explain the following ecological terms e.g. habitat, ecosystem, population, ecological succession (1o 2o), niche, food chain, food web, biosphere, trophic level, producers, consumers decomposers, autotroph, heterotroph, climax population, Herbarium, ecological associations (e.g. Parasitism, Symbiosis, Commensation, mutualism), ecological factors (abiotic and biotic). 2.3 Differentiate between aquatic and terrestrial habitats. 2.4 Identify the various ecological factors (abiotic and biotic) affecting the distribution of organisms in an environment. 2.5 Explain the significance of population regulation. 2.6 Use various ecological apparatus and equipment e.g. quadrat, inset net, plankton net, potter, wind vane grometer etc. for populations and factors.	<ul style="list-style-type: none"> • Explain ecology and its importance. • Explain all ecological terms • Describe differences between aquatic and terrestrial habitats and site examples. • Explain significance of population regulation. Ecology carry out ecology practicals apparatus.	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Genetics and Ecology - Yr 2		Course Code: TCB 13	Contact Hours: 21/1hours/wk
Course Specification: Practical Content			
General Objective 3.0: Know the various diseases of man and their causative agents			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
4	3.1 Describe the structure of bacteria and virus.	<ul style="list-style-type: none"> Describe with a label diagram the student of bacteria and virus observe under microscope its different shapes. 	<ul style="list-style-type: none"> Note book. Chalkboard etc.
5	3.2 Observe prepared slides of bacteria under the microscope.		
	3.3 Differentiate between the various morphological forms of bacteria.		
	3.4 List the differences between bacterial cells, a viral cell and a rickettsia.		
	3.5 Identify the causative organisms, mode of transmission symptoms, control and prevention of following bacteria and viral diseases, cholera, tuberculosis, leprosy, bacillary dysentery, typhoid, fever, gonorrhoea, syphilis, poliomyelitis, small pox and AIDS	<ul style="list-style-type: none"> Explain ways of contacting these diseases, causative agents, control and prevention: bacterial and viral diseases, tuberculosis, syphilis, typhoid fever, gonorrhoea, aids etc. Explain food poisoning infection and spelage. Explain the control/prevention stated above. 	Lesson notes and chalk boards etc.
	3.6 Explain the importance of vaccination and inoculation in the control/prevention of diseases.		
6	3.7 Identify the causative organisms, mode of transmission symptoms, control Prevention of other non-bacterial and non viral diseases such as malaria, bilharzia, river blindness, guinea worm etc.		
	3.8 Explain food poisoning and food infection.		
7	3.9 Describe possible sources of food poisoning, food infection and food spoilage.		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE			
COURSE: Genetics and Ecology - Yr 2		Course Code: TCB 13	Contact Hours: 21/1hours/wk
Course Specification: Practical Content			
	3.10 List organism (bacteria, protozoa, viruses, fungus, worms) responsible for food poisoning and infection.		
8	3.11 Describe symptoms of various types of food infection and food poisoning.		
	3.12 Explain the methods of control/prevention of food infection and food poisoning.		
	3.13 Describe methods of investigating food infection and food poisoning.		
General Objective 4.0: Know the various forms of pollution (water air and land)			
WEEK	Specific Learning Outcome	Teachers Activities	Resources
9-12	<p>4.1 Define pollution and pollutants.</p> <p>4.2 List the various forms of environmental pollution (water, air and land) and distinguish between them.</p> <p>4.3 Identify the sources of environmental pollution.</p> <p>4.4 Identify the various forms of pollutants in relation to water, air and land. e.g. detergents, crude oil, sewage, lead, pesticides, smoke, sulphur dioxide, dust, carbon monoxide, old cans, refuse, noise etc.</p> <p>4.5 Describe the effects of the various pollutants mentioned in 4.4 on the environment.</p> <p>4.6 Describe the control measures for the various forms of pollution with emphasis on regulatory bodies (e.g. Federal Environmental Protection Agency - FEPA, United States Environment Programme - USEPA, United Nations Environment Programme - UNEP, United Nations Development Programme - UNDP, United Nations Children Education Fund, UNICEF, World Health Organization - WHO)</p>	<ul style="list-style-type: none"> • Explain and list types of pollution, control measures with emphasis on regulatory bodies. 	<ul style="list-style-type: none"> • Note books and chalk board.

LIST OF MINIMUM LABORATORY, INSTRUMENTS/EQUIPMENT FOR BIOLOGY

ITEMS	Minimum Quantity Required	Resources
Aspirator transparent plastic with bow front complete with cover, 60 × 3x × 30cm	2	
Aspirator, Polythene Azlon M, 5,000cm ³	4	
Analytical balance (various types)	2	
Top loading balance	2	
Bottle stand for 60cm ³ dropping bottles	22	
Clinostat, clockwork, rotates once per hour	22	
Crucible, porcelain 43mm diameter	22	
Crucible, lids for 43mm diameter crucible	22	
Crucible tongs with bow, 15mm	22	
Desecrator, scheibler pattern 15cm	22	
Desecrator lid for above, 15cm	22	
Forceps, fine points	22	
Forceps, blunt	22	
Gauge, finger	2	
Magnifiers, hand lens, 7.5cm diameter	12	
Magnifiers, folding × 10	12	
Microscope, student, mirror × 10 widefield eyepiece × 4 × 10 × 20 objectives.	10	
Microscope teacher/demonstration × 10 widefield eyepiece × 4 × 10 × 40 retractable objective, abbey focusing condenser with iris diaphragm and filter holder, marrow model.	2	

Items	Minimum Quantity Required
Microscope slides, 7mm × 26mm, plain and circular cavity	5 boxes
Microslide storage box, for 100	10
Microtome and type	4
Dissecting kits	30
Dissecting boards	30
Net, pond	5
Plant press	2
Resirometer, simple	2
Thermometer, 35cm long, 5 to 50oC × 0.1oC	5
Thermometer, 30cm long, 10 to + 110 × 1oC	10
Haemoeytomer	3
Chemical balance	4
Heating mantle	2
Water bath	2
Water distiller	2
Amarond barometer	1
Blender	2
Colomy Co	2 unter
Kynagaph	2
Incubator	2
Items	Minimum Quantity Required
Slides	
Plant and animal tissue	Various
Histology Slides	Various
Embryology Slides	Various
Charts	
Blood and lymph circulation	1 each type
Blood structure	1 each type
Nervous system	1 each type
Muscles	1 each type
Reproductive organs (mammal)	1 each type
Growth of Foetus	1 each type
Development of embryo	1 each type

Items	Minimum Quantity Required
Plant structures (monocot and dicot)	1 each type
Flowers parts	1 each type
Flowers - inflorescence and pollinations	1 each type
Flowers fertilization	1 each type
Fruit and Seed Dispersal	1 each type
Seed germination	1 each type
Taxomical charts	1 each type
Genetic Charts	1 each type
Items	Minimum Quantity Required
Meiosis and mitosis	1 each type
Mammalian organs	1 each type
Models	
Jaw	1 each type
Eye, ear,	1 each type
Heart, Kidney	1 each type
Skin, heart	1 each type
Full siz skeleton of man, rabbit, birds, snakes, toad, rabbits	1 each type
Vertebrate bones	1 each type
Preserved Specimens	
Fish	Various types
Snakes	Various types
Mammalian Foetus	Various types
Rabbits, Rats, etc.	Various types

LIST OF PARTICIPANTS

BIOLOGICAL SCIENCE

1. Prof. P.T.C. Ozoh - Biological Science Department, Federal University of Technology, Owerri.
2. A. Adewumi - Department of Applied Science, College of Science & Tech. Kaduna Polytechnic, Kaduna
3. Mohammed S. Yunusa - Department of Science, Isa Kaita College of Education, Katsina.
4. M. Agbakwura (Mrs) - Department of Science Federal Technical College Yaba, Lagos.
5. L.U. Okeke - National Board for Technical Education, Kaduna.
6. E.B. Umo-Otong - National Board for Technical Education, Kaduna
7. F.I. Omoniwa (Mrs) - National Board for Technical Education, Kaduna
8. Miss. Olofinbiyi Bola Stella - National Board for Technical Education.

LIST OF TEXT BOOK

1. Introduction to Biology
Second Edition by D.G Mackeam
2. Modern Biology
1st Edition.
3. A Functional Approach
Third Edition by Roberts Nelson
4. Biology of Plants
Fifth edition by
 - i) Peter H. Raven
 - ii) Ray F. Evert
 - iii) Susan E. Eichorn