

**NATIONAL BOARD FOR TECHNICAL EDUCATION
KADUNA**

HIGHER NATIONAL DIPLOMA (HND)

IN

**SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENT BIOLOGY OPTION)**

CURRICULUM AND COURSE SPECIFICATIONS

2005

PLOT 'B' BIDA ROAD, P.M.B. 2239, KADUNA-NIGERIA

1.0 HIGER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY (ENVIRONMENTAL BIOLOGY OPTION)

- i. **AIMS AND OBJECTIVES:-** This course is designed to procedure Technologists with good knowledge of Environmental Biology and Toxicology and capable of applying laboratory Techniques in scientific work.
- ii. **LEVEL:- HND I AND HND II**
- iii. **ENTRY REQUIREMENT:-** In addition to National Diploma requirement, the candidate for Higher National Diploma in Environmental Biology must possess at least a lower credit pass in National Diploma in Science laboratory technology and a minimum of twelve (12) months of supervised industrial experience.
In exceptional cases, ND diplomates with a pass (CGPA of 2.00-2.49) in the ND examination that had two or more years of cognate experience in the specific field may be considered for admission into the HND programme.

2.0 CURRICULUM

The curriculum of all ND and HND programme consists of four main components.

- I) General Studies/Education
- II) Foundation courses
- III) Professional courses
- IV) Supervised Industrial work experience scheme (SIWES)

The General Education components shall include courses in.

ART AND HUMANITIES:- English languages, communication, History. These are compulsory. **MATHEMATICS AND SCIENCE:** (for non science based programme)

SOCIAL STUDIES: Citizenship (the Nigerian constitution) Political Science sociology, philosophy, Geography, Entrepreneurship, Philosophy of science and sociology are compulsory.

PHYSICAL AND HEALTH EDUCATION (One semester credit only).

The General Education component shall account for not more than 10% of total contact hours for the programme.

FOUNDATION COURSES include courses in Economics, Mathematics, Pure sciences, Technical Drawing, Descriptive Geometry, Biostatistics, Computer applications and introductory computer system.

The number of hours will vary with the program and may account for about 15-20% of the total contact hours.

PROFESSIONAL COURSES are courses which give the student the theory and practical skills he needs to practice his field of calling at the technician/ technologist level. These may account for between 60-70% of the contact hours depending on the programme.

3.0 STRUCTURE OF THE PROGRAMME: The Higher National Diploma Programme is structured to last for two years (four semesters) all of which shall be taken.

4.0 ACCREDITATION:

Each programme offered either at the ND or HND level shall be accredited by the NBTE before the diplomates can be awarded either of the two diploma certificates. Details about the process of accrediting a programme for the award of the ND and HND are available from the Executive Secretary, National Board for Technical Education Plot B, Bida Road PMB 2239, Kaduna Nigeria.

5.0 CONDITIONS FOR THE AWARD OF THE ND/HND

Institutions offering accredited programmes will award the National Diploma/Higher National diploma candidates who successfully completed the programme after passing prescribe course work, examinations, diploma project and the students industrial work experience scheme. Such candidates should have completed a minimum of between 72 and 80 semester credit units depending on the programme. Diploma shall be classified as follows:

Distinction- GPA of 3.50 and above Upper Credit GPA of 3.00 and 3.49

Lower credit GPA of 2.50 – 2.99

Pass – GPA of 2.00 – 2.49

Fail – GPA of below 2.00.

6.0 GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME

The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy an Education which stress the need to introduce the semester credit units which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.

In designing the units, the principle of the modular system by product has been adopted, thus making each of the professional modules, when completed provides the student with technician operative skills, which can be used for employment purposes. As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the Curriculum content has been written in behavioural objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the Institution.

Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programme offered throughout the polytechnic system.

The teaching of the theory and practical work should, be integrated.

Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from theory.

Practical courses should form an integral part of final examination. For each course, these should be a balance of theory to practice of 50:50:-

- i. Continuous assessment 30% (15% quiz and test 15% practical grades)
- ii. Final written examination 70% (35% theory and 35% practical)

**SCIENCE LABORATORY TECHNOLOGY (HND)
(ENVIRONMENTAL BIOLOGY OPTION)**

CURRICULUM TABLE: FIRST YEAR/FIRST SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
GLT 302	General Instrumentation	1	-	2	2		
GLT 301	Laboratory Management	2	-	-	2		
HLT 311	General Horticulture	2	-	2	3		
STB 311	Applied Ecology and Environmental Management	2	-	2	3		
STB 312	Ecological Disasters and Control	1	-	2	2		
STB 313	Applied Genetics (Plant breeding)	2	-	2	3		
STB 314	Biological Techniques I	1	-	3	3		
STB 315	Research Methodology and Biostatistics	2	-	-	2		
GNS 301	Use of English	2	-	-	2		
SDV 210	Entrepreneurship Development I	2	-	-	2		
	TOTAL	17		13	24		

SECOND SEMESTER/FIRST YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
GLT 303	Biological and Chemical instrumentation	2	-	3	3		
STB 321	Water quality Assessment and pollution	2	-	2	3		
STB 322	Principles of toxicology I	2	-	2	3		
STB 323	Applied Genetics (Animal Breeding)	2	-	2	3		
STB 324	Entomology and Pest control	2	-	2	3		
STB 325	Biological Techniques II	2	-	3	3		
STB 326	Environmental Chemistry	1	-	2	2		
ICT 101	Computer Programming	1	-	3	3		
GNS 302	Communication in English III	2	-	-	2		
	TOTAL	16		19	25		

Electives: i) STE 324 Environmental Education and awareness

FIRST SEMESTER/SECOND YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	PRE-REQUISITE
STB 411	Principles Of Toxicology II	2	-	3	3		
STB 412	Environmental Impact Assessment And Monitoring						
STB 413	Environmental Microbiology	2	-	2	2		
STB 414	Hydrobiology And Fisheries	1	-	2	2		
STB 415	Principles Of National Resources Management	2	-	2	2		
STB 417	Seminar	2	-	-	2		
GNS 401	Literary Appreciation And Oral Composition	2	-	-			
STB 416	Biological Techniques III	2	-	-			
		1	-	2	21		
	TOTAL						
		16		11			

SECOND SEMESTER/SECOND YEAR

COURSE CODE	COURSE TITLE	L	T	P	CU	CH
STB 421	Waste Management	1	-	3	2	
STB 422	Petroleum And The Environment	1	-	2	2	
STB 426	Project	-	-	9	6	
STB 423	Economic Botany	1	-	2	2	
STB 424	Parasitology	2	-	3	3	
STB 425	Plant Pathology	2	-	3	3	
GNS 40	Literary Appreciation And Oral Composition	2	-	3	2	
	TOTAL	9		25	20	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: GENERAL HORTICULTURE HLT 311

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: This course is designed to introduce the students to the scope and economic importance of the horticulture industry.

GENERAL OBJECTIVES:

On completion of this course, the student should be able to:-

- 1.0 Know the scope of horticulture.
- 2.0 Know types of growth regulators used in the horticulture industry.
- 3.0 Know various parts of plants that can be used in horticultural propagation and transplanting processes.
- 4.0 Know types of plants that can be commercially propagated by grafting budding and layering methods.
- 5.0 Know pest control techniques in horticulture.
- 6.0 Understand pruning techniques for specific plants and their use in landscaping.
- 7.0 Understand selection of planting sites for gardens.
- 8.0 Know indigenous horticultural plants in Nigeria.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Horticulture And Land Scape Technology		COURSE CODE: HLT 311	CONTACT HOURS: 2hours Lecture 2Hrs Practical
Course Specification:			
Week	GENERAL OBJECTIVES: 1.0 KNOW THE SCOPE OF HORTICULTURE		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1	<u>Introductory Horticulture</u> 1.1 Define Horticulture 1.2 List and describe environmental requirements for good plant growth. 1.3 Describe the underground environment of plants. 1.4 Identify nutritional requirements of plants 1.5 List and describe soil improvement methods 1.6 Describe and determine soil acidity (pH)- 1.7 Describe the ground environment of plants such as temperature, humidity, plant diseases insects, gases and air particles.	Discuss the scope of hoticulture	PH -meter
WEEK 2	GENERAL OBJECTIVES: 2.0 Know Types Of Growth Regulators Used In The Horticulture		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<u>Growth stimulants, Retardants and Rooting Hormones</u> 2.1 List chemical stimulants of plants viz; kinetin, gibberellins, auxins. Etc. 2.2 List and describe the mode of action of chemical retardants of plants e.g. moleic hydrazide, phosphen. 2.3 Describe rooting hormones 2.4 Explain dwarfing rootstocks 2.5 Describe the chemical blossom set.		

WEEK 3-4	General Objectives: 3.0 Know Various Parts Of Plants That Can Be Used In Horticultural Propagation And Transplanting Processes		
	<p><u>Plant Propagation</u></p> <p>3.1 Explain the general procedure of plant propagation.</p> <p>3.2 Explain the propagation of plants from seeds, including composition of seeds, Identification and selection of seeds and germination media.</p> <p>3.3 Describe the procedure of indirect seeding and direct seeding.</p> <p>3.4 Describe the treatment of seeds for germination.</p> <p>3.5 Describe the method of soft wood and semi-hard wood stem cuttings for propagation.</p> <p>3.6 Describe the methods of collecting woodcuttings and preparing the container and rooting media.</p> <p>3.7 Explain the procedure of treating the cutting with hormones and inserting in media.</p> <p>3.8 Select, collect and store hardwood cuttings.</p> <p>3.9 Describe the propagation of bulbs, corms, rhizomes, tubers etc.</p> <p>3.10 Identify draw and label items listed in 3.9</p>	<p>Demonstrate the treatment of seeds.</p>	

WEEK 5	General Objectives: 4.0 Know Types Of Plants That Can Be Commercially Propagated By Grafting, Budding And Layering Method		
	Grafting, Budding and Layering		
	<p>4.1 Describe the process of grafting, budding and layering.</p> <p>4.2 List requirements for successful grafting, budding and layering.</p> <p>4.3 Explain the methods of grafting, budding and layering processes.</p> <p>4.4 Carry out the processes in 4.1 above.</p>	Demonstrate grafting, budding And layering.	Plant, knife, secateur, rope and polythene bag.
WEEK 6-7	General Objectives: 5.0 Know Pest Control Techniques In Horticulture		
	<u>Pesticides and Insecticides</u>	Explain the use of pesticides And insecticides	
	<p>5.1 Explain the terms “insecticides’ and fungicides</p> <p>5.2 Explain chemical free control atmosphere</p> <p>5.3 Explain the modes of action of common insecticides.</p> <p>5.4 Describe the chemical composition of common insecticides.</p> <p>5.5 Explain the application of insecticides and plants as insect repellants.</p> <p>5.6 Define the term “toxicity”</p> <p>5.7 Identify types of toxicity.</p> <p>5.8 Explain the procedure of measuring acute toxicity.</p> <p>5.9 List safety precaution in insecticide application.</p> <p>5.10 Mix and apply common pesticides and insecticides.</p> <p><u>Fungicides and Herbicides</u></p> <p>5.11 Describe the chemical composition of common fungicides and herbicides.</p> <p>5.12 Describe the effects fungicides and herbicides.</p>	Demonstrate the use of	

	<p>5.13 Apply fungicides and herbicides and observe their effects.</p> <p>5.14 Describe the soil fumigant and Charts.</p> <p>5.15 Describe the soil fumigant and Charts.</p> <p>5.16 Explain the causes of in-activity of herbicides.</p>	Fungicides and herbicides.	
WEEK	General Objectives: 6.0 Understand Pruning Techniques For Specific Plants		
8	<p><u>Techniques of Pruning</u></p> <p>6.1 Explain reasons for pruning of plants.</p> <p>6.2 Identify equipment for pruning</p> <p>6.3 Describe types of pruning</p> <p>6.4 Identify how and when to prune.</p> <p>6.5 Identify plants appropriate for pruning.</p> <p>6.6 Carry out pruning operation on plants.</p>	Demonstrate pruning	Secateur
WEEK	General Objectives: 7.0 Understand selection Of Planting Site For Gardens		
9-10	<p><u>Principles of production of vegetables and Orchards</u></p> <p>7.1 Explain garden layout and garden soil.</p> <p>7.2 Explain soil preparation of vegetable orchard for planting.</p> <p>7.3 Determine varieties of plants for planting and their planting time.</p> <p>7.4 Explain transplanting processes, watering and application of fertilizers.</p> <p>7.5 Explain training and pruning.</p> <p>7.6 Carryout fertilizer application.</p>	Map out an area for garden	

WEEK	General Objectives: 8.0know Indigenous Horticultural Plants In Nigeria.		
11-12	<p><u>Indigenous Horticultural Crops in Nigeria.</u></p> <p>8.1 Identify indigenous vegetables, fruits and ornamental plants in Nigeria.</p> <p>8.2 Explain the proper uses of crops identified in 8.1 above.</p> <p>8.3 Describe the distribution of vegetables, fruits and ornamental Crops identified in 8.1 above, in relation to climatic and soil conditions in Nigeria, e.g.</p> <ul style="list-style-type: none"> i. tomatoes -(North) ii. oranges -(East/West) iii. Pineapples -(East/West) iv. Banana - (East/West) <p>8.4 Develop improved horticultural plant materials through,</p> <ul style="list-style-type: none"> i. hybrid seed ii. pure line seed iii. epical meristem iv. Selection of materials as new breed plants. <p>8.5 Draw and label indigenous vegetables, fruits and ornamental in Nigeria.</p>	<p>Discuss the sources of indigenous horticultural crops in Nigeria.</p>	

HLT 311 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.4	Identify nutritional requirements of plants	List the requirements	
3-4	3.8	Select, collect and store hardwood cuttings	Provide the cuttings	Hardwood cuttings
	3.10	Identify, draw and label items listed in 3.9	Provide these items	Bulbs, corms, rhizomes, tubers
5	4.4	Carry out the processes in 4.1 above	Demonstrate grafting budding and layering	Knife, Secateur, rope, plant.
6-7	5.10	Mix and apply common pesticides and insecticides	Supervise pesticide and insecticide application	Pesticide, insecticide
	5.13	Apply fungicides and herbicides and observe their effects	Demonstrate fungicide and herbicide application	Fungicide, herbicide
8	6.2	Identify equipment for pruning	List the Equipment	Knives, Secateurs
	6.6	Carry out pruning operation on plants	Demonstrate pruning	Secateur
9-10	7.6	Carry out fertilizer application	Supervise fertilizer application	Fertilizer
11-12	8.1	Identify indigenous vegetables, fruits and ornamental plants in Nigeria.	Enumerate indigenous vegetables, fruits and ornamentals	
	8.4	Develop improved horticultural plant materials through, i. hybrid seed ii. pure line seed iii. epical meristem iv. Selection of materials as new breed plants.	Demonstrate improvement of horticultural plants	
	8.5	Draw and label indigenous vegetables, fruits and ornamental in Nigeria.	Supervise the drawing and labeling	Vegetables, fruits, ornamentals

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: APPLIED ECOLOGY AND ENVIRONMENTAL MANAGEMENT

CODE: STB 311

DURATION (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNIT: 3

GOAL: This Course is designed to enable students understand the role of ecology in the survival of man.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:

- 1.0 Know the various ecological terms.
- 2.0 Know agriculture/ecological relationship with particular reference to Nigeria agroecosystems.
- 3.0 Know the use and misuse of water by man in his environment.
- 4.0 Know the factors that contribute to soil depletion and the various methods of conservation and reclamation.
- 5.0 Know the effects of forests on man and his environment.
- 6.0 Know the impact of agriculture on the environment and what management entails.
- 7.0 Know the effects of population pressure on resource utilization.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Applied Ecology And Environmental Management		COURSE CODE: STB 311	CONTACT HOURS: 2hours Lecturer,2Hrs Practical 2-0-2
Course Specification:			
Week	GENERAL OBJECTIVES: 1.0 Know The Various Ecological Terms.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1	1.1 Define Ecology 1.2 Define habitat and describe various kinds of habitat. 1.3 Define population and explain its characteristics. 1.4 Determine population of living things in different habitats. 1.5 Define community. 1.6 Explain community attributes and structure and methods of measuring them. 1.7 Define Ecosystem 1.8 List the components and attributes of ecosystem-abiotic/biotic, physical/chemical factors etc. 1.9 Identify interactions within the ecosystem.	Demonstrate the use of capture-recapture techniques to estimate the population size of any particular animal.	Quadrants

WEEK	GENERAL OBJECTIVES: 2.0 Know agricultural ecological relationship with particular reference to Nigeria agro ecosystem		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
2 - 3	<p>2.1 List different types of agricultural practice: mono cropping, intercropping, crop rotation, shifting cultivation, continuous cropping, mixed cropping, monoculture, mixed farming, dairy/poultry/beef/rabbitary etc.</p> <p>2.2 List the advantages of each of the practices in 2.1 above.</p> <p>2.3 Explain the different types of manuring - artificial (Fertilizers), natural.</p> <p>2.4 List the advantages and disadvantages of both types of manuring.</p> <p>2.5 Define a pest.</p> <p>2.6 List the pests of specific plants and animals</p> <p>2.7 Explain the various pest control methods e.g. chemical, biological, physical etc.</p> <p>2.8 Explain the merits and demerits of the control methods in 2.7 above.</p> <p>2.9 Describe ecological (Biological) methods of pest control.</p>	<p>Discuss the different agricultural practices in Nigeria.</p>	

WEEK	GENERAL OBJECTIVES: 3.0 Know use and misuse of water by man in his environment.		
4	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	3.1 List sources and bodies of water 3.2 Identify the various methods of irrigation. 3.3 Describe the importance of irrigation in agriculture. 3.4 Outline the deleterious effects of irrigation practices 3.5 Explain the advantages of hydro-electricity. 3.6 Explain the deleterious effects of hydro-electricity 3.7 List various ways of using water to dispose sewage. 3.8 Explain aquaculture.		
WEEK	GENERAL OBJECTIVES: 4.0 Know the factors that contribute to soil depletion and the various methods of conservation and reclamation		
5-6	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES

	<p>4.1 List the various ways of soil depletion, such as overgrazing, burning, erosion excessive lumbering, over cropping etc.</p> <p>4.2 Describe the specific effects of each of 4.1 above on the ecosystem (e.g. overgrazing leading to soil compaction, reduced soil aeration in clay soil, and loosening of soil in loamy and sandy soils, erosion, increasing loss of cattle preferred spp, burning leading to leaching, loss of habitat, loss of species, increased heat.</p> <p>4.3 Describe various methods of soil conservation/reclamation such as strip cropping, crop rotation, re-afforestation, manuring, contour farming, terracing, careful addition of fertilizer and planting of trees.</p> <p>4.4 Collect and determine the relative amounts of major nutrients e.g. N, P & K in some samples of soil.</p>		<p>Different soil samples: fertilizers.</p>
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WEEK	GENERAL OBJECTIVES: 6.0 Know the impact of agriculture on the environment and what management entails		
8	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<p>6.1 Define management</p> <p>6.2 Explain the effect of agricultural activities on the environment, such as grazing, ploughing, use of fertilizers, pesticides, Herbicides, land, soil, food, minerals etc.</p> <p>6.3 List management practices of the activities mentioned in 6.2 above.</p> <p>6.4 Determine the effects of some of the agricultural activities in 6.2 on soil nutrients.</p>		

WEEK	GENERAL OBJECTIVES: 7.0 Know the effect of population pressure on resource utilization		
9	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	7.1 Define population pressure. 7.2 Explain the ways population pressure can be exhibited. 7.3 Explain the effect of human activities on natural resources as it relates to Nigeria, such as :- - Human as hunters - Human as shepherds - Human as farmers etc. 7.4 Carryout comparative study of the effect of density on resource utilization.		Quadrant transact etc
WEEK	GENERAL OBJECTIVES: 8.0 Know the administration and management of natural resources in Nigeria.		
10	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	8.1 Define natural resources. 8.2 Classify and explain natural resources under:- - Renewable resources - Non-renewable resources. 8.3 Explain the ways by which natural resources are exploited. 8.4 Explain the administration and management in Nigeria and other parts of the world. 8.5 Carryout visits to companies where natural		

	8.6 Explain how natural resources can be managed to establish the concept of a balanced approach in the environment. The explanation should include childlife management, forestry management.		Transport
WEEK	GENERAL OBJECTIVES: 9.0 Know the methods of environmental conservation		
11	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	9.1 Define environmental conservation 9.2 Explain the need for environmental conservation. 9.3 List the names of organizations involved in environmental conservation and their functions. 9.4 Explain the different methods of conservation.		

STB 311 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.4	Determine population of living things in different habitats	Supervise the determination of population in a habitat	Quadrants
	1.9	Identify interactions within the ecosystem	Explain interactions in the ecosystem	
4	3.2	Identify the various methods of irrigation	Demonstrate irrigation	Sprinkler set, Drip, Channel
5-6	4.4	Collect and determine the relative amounts of major nutrients e.g. N, R, & K in some samples of soil.	Demonstrate analysis for nutrients in the soil	
8	6.4	Determine the effects of some of the agricultural activities in 6.2 on soil nutrients	Supervise soil analysis	Soil test kit
9	7.4	Carry out comparative study of the effect of density on resource utilization.	Explain effects of density on resource utilization	
10	8.5	Carry out visits to companies where natural	Conduct field trip	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: ECOLOGICAL DISASTERS AND CONTROL

CODE: STB 312

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 2

UNITS: 2

GOAL: This course is designed to acquaint the students with the basic knowledge on the consequences of ecological disasters and ways of containing them.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:

- 1.0 Know the various ecological disasters
- 2.0 Know the causes of ecological disasters.
- 3.0 Know how to control the various ecological disasters.

WEEK	General Objectives: 2.0 Know The Causes Of Ecological Disasters		
5	<p>2.1 Define conservation.</p> <p>2.2 State areas of conservation mismanagement (e.g Deforestation, Irrigation, Hydroelectricity, soil depletion, competition etc)</p> <p>2.3 Explain the deleterious effects of deforestation.</p> <p>2.4 Outline the deleterious effects of irrigation practice.</p> <p>2.5 Explain the deleterious effects of hydroelectricity.</p> <p>2.6 Name various ways of soil depletion (e.g overgrazing erosion lumbering, land slides, leaching, burning, slope failure caused by minning etc)</p> <p>2.7 Identify overgrazed and erosion sites.</p>		
6	<p>2.8 List the types of erosion (e.g. sheet, gully, wind and rill erosions)</p> <p>2.9 Explain causes of erosion.</p> <p>2.10 Describe the structure of leached soil.</p> <p>2.11 Explain the consequences of overgrazing, burning, lumbering and over cropping.</p> <p>2.12 Explain the effects of competition among organisms.</p>	<p>Organize visit to erosion sites</p> <p>Undertake visit to areas where environmental pollution occurs.</p>	
7	<p>2.13 List the types of pollution.</p> <p>2.14 Explain various types of pollution.</p> <p>2.15 Identify few places where environmental pollution occurs.</p> <p>2.16 Explain the consequences of improper refuse and sewage disposal.</p> <p>2.17 Identify and visit areas where refuse and sewage are not properly disposed.</p>	<p>Carry out a visit to places where refuse and sewage are improperly deposited.</p>	
8	<p>2.18 Explain the consequences of depletion of ozone layer.</p> <p>2.19 Explain the deleterious effects of oil spillage in an environment.</p>	<p>Undertake a visit to areas with oil spillage.</p>	

	2.20 Identify an area with oil spillage		
WEEK	General Objectives: 3.0 Know How To Control The Various Ecological Disasters		
9	3.1 Explain methods employed in conservation of forests (e.g Re-afforestation)	Undertake/Field work to forest reserve.	
	3.2 State the benefits from forestry such as protection and oethetic services.		
	3.3 Explain the importance of creating wood, permanent forests, fallow wood lands and forest reserves.		
10	3.4 Explain the following terms. a) Forest reserve b) Forest conservation.		
	3.5 List factors in the management of irrigation and hydroelectricity to avert ecological disasters		
	3.6 Describe various methods of soil conservation and reclamation (e.g strip cropping, crop rotation, re-afforestation , manuring, contour farming, terracing etc.)		
	3.7 Explain methods of soil erosion control		
	3.8 Explain how soil leaching can be prevented		
	3.9 List and explain methods of averting overgrazing, burning, overcropping etc in order to control ecological disasters		
	3.10 Explain ways of preventing competitions among organisms		
	3.11 List possible methods of controlling pollutants that cause Ecological disasters (e.g refuse, sewage, oil spillage, industrial effluents etc)		
	3.12 List and describe methods of refuse and sewage disposal.		
	3.13 Explain how oil spillage can be prevented in an environment.		
	3.14 State how depletion of ozone layer is		

	minimized. 3.15 List and explain methods of flood control. 3.16 State administrative measures to avert Ecological disaster e.g. legislation.		
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STB 312 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
2	1.6	Identify areas with natural resources (e.g large bodies of water, forest reserves, oil well etc)	Conduct a field trip	
3	1.7	Identify areas where natural resources have depleted (e.g overgrazed and burnt vegetation, deforested communities, drying up water bodies, oil spillage etc)	Field trip	
6	2.7	Identify overgrazed and erosion sites	Conduct a field trip	
7	2.15	Identify few places where environmental pollution occurs	Conduct a field trip	
8	2.17	Identify and visit areas where refuse and sewage are not properly disposed	Conduct a field trip	
	2.20	Identify an area with oil spillage	Carry out a visit	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: APPLIED GENETICS (PLANT BREEDING)

CODE: STB 313

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: This course is designed to enable students understand the theory and techniques of Plant Breeding.

GENERAL OBJECTIVES:

On completion of this course, the student should be able to:

- 1.0 Know the history and genetics of breeding.
- 2.0 Understand the process of gametogenesis.
- 3.0 Appreciate the general biological and breeding characteristics of self pollinated crops and how these have been modified into various techniques of Plant breeding.
- 4.0 Understand breeding of cross pollinated crops.
- 5.0 Appreciate and apply other specialized techniques of breeding outside ordinary selection of self pollinated plants and intra specific hybridization strategies.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Applied Genetics (Plant Breeding)		Course Code: Stb 313	CONTACT HOURS:60 2hours Lecture 2Hrs Practical 2-0-2
Course Specification:			
Week	General Objectives: 1.0 Know The History And Genetics Of Breeding In General.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1-2	<u>History of Genetics</u> 1.1 Explain Mendel's first and second laws. 1.2 Explain these laws in relation to various stages of meiosis in plants. 1.3 Observe the stages of meiosis on slides using the microscope.. 1.4 Describe the absence of crossing over. 1.5 Observe segregation of alleles on slides 1.6 Explain independent assortment of homologous and non-homologous chromosomes during meiosis. 1.7 Observe on slides the independent assortment of homologous and non-homologous chromosomes during meiosis.	Drawings from Slides. Drawings from slides. Drawing from slides.	Slides on mitosis and meiosis Mitosis (Electric/Light).

WEEK	General Objectives:2.0 Understand The Process Of Gametogenesis		
3-5	<p>Gametogenesis</p> <p>2.1 Define gametogenesis in relation to angiosperms.</p> <p>2.2 Identify, draw and label fully.</p> <p>2.3 Trace the development of the embryo sac (megagametophyte) from the spore mother cell (megasporocyte).</p> <p>2.4 Carryout the process stated in 2.3 above using different stages of the flower bud to the opened flower in a named plant.</p> <p>2.5 Trace the development of the pollen (Microspore) from the spore mother cell (Microsporocyte).</p> <p>2.6 Carryout the process as in 2.3 above using the microspore.</p> <p>2.7 Examine different pollen grains and characterize each according to the plant.</p> <p>2.8 Germinate pollen grains both on the stigma and synthetic media to study pollen tube development.</p>	Drawing from the flower bud to opened flower.	Slides cover slips flower buds. Microscope Petridishes Water Agar,(Glucose) To prepare media.
WEEK	General Objectives:3.0 Appreciate The General Biological And Breeding Characteristics Of Self Pollinated Crops And How These Have Been Modified Into Various Techniques Of Plant Breeding		
6-8	<p><u>Breeding Technology in Self Pollinated Plants</u></p> <p>3.1 Explain the principles of inheritance of economic traits (e.g. qualitative inheritance).</p> <p>3.2 Explain variations as the raw material of production in breeding.</p> <p>3.3 Explain environmental variance as resulting from material environment, nutrition,</p>	Demonstrate breeding of self pollinated crops in botanical garden.	Cellophane bag String, labels.

	<p>management, climate and disease.</p> <p>3.4 Identify the two kinds of behavior of non-allelomorphic characters in linkage groups i.e. coupling and repulsion.</p> <p>3.5 Explain chromosome and gene mutations and how they can affect production in plant breeding.</p> <p>3.6 Carry out field breeding of self-pollinated crops in botanical gardens and collect breeding data for breeding statistical analysis.</p>		
WEEK	General Objectives: 4.0 Understand Breeding Of Cross Pollinated Crops.		
9-10	<p><u>Breeding of Cross Pollinated Crops</u></p> <p>4.1 Identify the principles upon which selection for certain genetic traits could lead to improved crop types in individual selection, family selection, progeny selections and line breeding in cross pollinated plants.</p> <p>4.2 Explain heritability and repeatability as important concepts of population genetics.</p> <p>4.3 Describe and explain Recurrent breeding of common cross-pollinated crops with particular reference to its use in:-</p> <ul style="list-style-type: none"> i) General Combining Ability testing (GCA) ii) Specific Combining Ability Testing (SCA) iii) Reciprocal Recurrent Selection. <p>4.4 Carry out synthetic Breeding of Cross pollinated crops.</p>	<p>Demonstrate synthetic breeding of self pollinated crops.</p>	<p>Practical V</p>

WEEK	GENERAL OBJECTIVES: 5.0 Know other specialized techniques of breeding outside ordinary selection of self pollinated plants and intra-specific hybridization strategies.		
11-12	<p><u>Specialized breeding Techniques</u></p> <p>5.1 Describe and explain breeding for resistance using any of the appropriate methods indicated in 4.3 above using specific local crops.</p> <p>5.2 Carry out mutation breeding.</p> <p>5.3 Carry out inter-specific hybridization Breeding</p> <p>5.4 Carryout tissue culture breeding and choral breeding.</p> <p>5.5 Describe other commonly practiced breeding techniques in use in our local Research Organizations</p>	Demonstrate Mutation breeding and tissue culture breeding.	

STB 313 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1-2	1.3	Observe the stages of meiosis on slides using the microscope	Provide slides on meiosis	Slides, Microscopes
	1.5	Observe segregation of alleles on slides	Provide slides on segregation of alleles	Slides, microscopes
	1.7	Observe on slides the independent assortment of homologous and non-homologous chromosomes during meiosis.	Supervise the drawings from slides	
3-4-5	2.2	Identify, draw and label fully	Explain development of embryo	
	2.3	Trace the development of the embryo sac (Megagametophyte) from the spore mother cell (Megasporocyte)	Explain development of embryo	
	2.4	Carry out the process stated in 2.3 above using different stages of the flower bud to the opened flower in a named plant.	Explain the development of the pollen	
	2.5	Trace the development of the pollen (Microspore) from the spore mother cell (Microsporocyte)		
	2.6	Carry out the process as in 2.3 above using the microspore.	Provide pollen grains	
	2.7	Examine different pollen grains and characterize each according to the plant.	List characteristics of pollen	
	2.8	Germinate pollen grains both on the stigma and synthetic media to study pollen tube development	Explain pollen tube development	
6-7-8	3.4	Identify the two kinds of behaviour of non allelomorphous characters in linkage groups i.e. coupling and repulsion.		
	3.6	Carry out field breeding of self-pollinated crops in botanical gardens and collect breeding data for breeding statistical analysis.	Demonstrate self pollination	

9-10	4.1	Identify the principles upon which selection for certain genetic traits could lead to improved crop types in individual selection, family selection, progeny selections and line breeding in cross pollinated plants	Explain the principles of selection	
	4.4	Carry out synthetic Breeding of cross pollinated crops.	Demonstrate synthetic breeding	
11-12	5.2	Carry out mutation breeding	Demonstrate mutation breeding	
	5.3	Carry out inter-specific hybridization Breeding	Explain inter-specific hybridization	
	5.4	Carry out tissue culture breeding and choral breeding	Demonstrate tissue culture and choral breeding	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: BIOLOGICAL TECHNIQUES 1

CODE: STB 314

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 3

UNITS: 3

GOAL: This course is designed to provide the students with an in-depth knowledge of uses, care and maintenance of various Laboratory Equipment and the theory and techniques of preparing biological materials.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:

- 1.0 Know different types of Microscopes.
- 2.0 Understand the techniques involved in the preparation of common biological reagents.
- 3.0 Understand the methods and techniques for culturing of various laboratory specimens and the conditions for their maintenance.
- 4.0 Understand the principles and techniques of processing biological tissues for microtomic work.
- 5.0 Know the techniques involved in the use, care and maintenance of various types of Microtomes (i.e rocking, rotary, sledge, sliding etc)

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Biological Techniques I		COURSE CODE: STB 314	CONTACT HOURS:60 1Hours theory 3Hrs Practical 1-0-2
Course Specification:			
Week	GENERAL OBJECTIVES: 1.0 Know Different Types Of Microscopes		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES

WEEK	General Objectives: 2.0 Understand The Techniques In The Preparation Of Common Biological Reagents.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
3-5	<p><u>Preparation of Common Biological Reagents</u></p> <p>2.1 Define the terms isotonic, hypertonic, hypotonic, saline ringer and explain their uses.</p> <p>2.2 Relate the solutions in 2.1 above to physiological body saline, considering their uses and functions.</p> <p>2.3 Prepare normal saline and then ringer solutions for the following tissue: human, frog and cockroach.</p> <p>2.4 Explain the principles of kymograph preparation.</p> <p>2.5 Carryout the frog nerve-muscle experiment using a kymograph and explain the significance.</p> <p>2.6 Interpret the graph obtained for several ranges of wavelength in 2.5 above.</p>	<p>Discuss the Saline and ringer solution preparation</p> <p>Demonstrate the Frog nerve muscles experiment</p>	<p>Chemical balance beakers, measuring cylinders, kymograph petridishes.</p> <p>Water distiller pH meter.</p>

	<p><u>Preservatives And Fixatives</u></p> <p>2.7 Explain the term preservative and its uses in the maintenance and storage of biological specimens.</p> <p>2.8 List chemicals that are commonly used as preservatives.</p> <p>2.9 Explain the term fixative and explain its uses in the maintenance and preservation of tissues and organs.</p> <p>2.10 Define simple and compound fixatives and distinguish between cytological, histological, nuclear and cytoplasmic fixatives.</p> <p>2.11 List plant and animal fixatives.</p> <p>2.12 Prepare two commonly used preservatives, (simple fixatives and compound fixatives to include one plant and animal solutions each)</p> <p><u>Buffers And Buffering Systems</u></p> <p>2.13 Explain the principles underlining the use and preparation of buffer solutions.</p> <p>2.14 Define PH and the importance of its accurate measurements in the preparation of buffer solutions.</p> <p>2.15 List the various buffering systems of the human body and explain how these systems function as buffers.</p> <p>2.16 Explain the principles of the pH meter</p> <p>2.17 Prepare two acid and two alkaline buffers of known pH and measure the pH values using a standardized pH meter.</p> <p>2.18 Determine the pH of a known sample using a standard buffer graph.</p> <p><u>Stains and Staining Reactions.</u></p> <p>2.19 Define the term stain and explain the</p>	<p>Demonstrate the Preparation of preservatives.</p> <p>Demonstrate the Preparation of alkaline and buffer solution.</p> <p>Discuss the Preparation of stains</p>	
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	<p>difference between natural and synthetic dyes.</p> <p>2.20 List examples of natural and synthetic dyes.</p> <p>2.21 Explain the theory and techniques of staining reactions and how acid, basic and neutral stains react with tissues.</p> <p>2.22 Prepare an example each of the following: acid, basic and neutral stains, (to include examples of stains specific for plant, animal, and bacteria.)</p> <p>2.23 Explain the importance of accuracy in the measurements of weights and volumes in each of the preparatory methods in 2.22 above and the dangers involved in the use of the various chemicals used for the preparation.</p>		
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WEEK	General Objectives: 3.0 Understand The Methods And Techniques For The Culturing Of Various Laboratory Specimens And The Conditions For Their Maintenance.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
6-7	<p><u>Culturing Of Biological Specimens</u></p> <p>3.1 Define culture and culture media with reference to biological specimens.</p> <p>3.2 Outline the reparatory procedures for the culture media for the following biological specimen fungi bacteria, amoeba, euglena, paramecium, and drosophila.</p>	<p>Discuss the Preparation of culture media.</p>	<p>Incubator, microscope, autoclave, oven, inoculating chamber inoculating loop, refridgerator.</p>

	<p>3.3 Prepare culture media for the cultivation of bacteria, fungi and paramecium.</p> <p>3.4 Explain the importance of sterilization, aseptic techniques and general tidiness in the preparations in 3.3 above.</p> <p>3.5 Explain the various methods of sterilizing culture media especially microbial culture media.</p> <p>3.6 Explain the conditions necessary for the maintenance of cultures of specimens in 3.2 above.</p>		
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WEEK	General objectives: 4.0 understand the principles and techniques of processing biological tissues for microtomic work.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
8	<p><u>Processing Biological Tissues</u></p> <p>4.1 Describe tissue processing in the following sequence: fixation, dehydration, clearing, impregnation, embedding, section cutting/mounting, and staining and microscopic examination.</p> <p>4.2 Explain the necessary precautions to be taken to in each sequence in 4.1 above.</p> <p>4.3 Prepare some animal and plant tissues up to embedding stage and store for future use.</p>	<p>Demonstrate the Preparation of animal and plants tissue</p>	<p>Microscope</p>

WEEK	General Objectives: 5.0 Know The Techniques Involved In The Use Care And Maintenance of Various Types Of Microtones. (i.e Rocking, Rotary Sledge Sliding, Etc.)		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
9-10	Microtomy Techniques	Discuss Microtome techniques	Microtome, microtome knives, parafix wave dispenser.
11-12	<p>5.1 Define microtomy and enumerate the various types of section cutting.</p> <p>5.2 List the types of microtome knives available for various section, cutting and explain the term honing and stropping.</p> <p>5.3 Hone and strope microtome knives.</p> <p>5.4 Explain ‘mounting’ of sectioned tissue onto slide emphasizing the importance of cleanliness of slide, mountants used, the problem of temperature and the use of tissue bath.</p> <p>5.5 Enumerate the problems that could be encountered in the section- cutting of an embedded tissue and how to resolve the problem.</p> <p>5.6 Trim, mount and section cut material.</p> <p>Staining Techniques</p> <p>5.7 List and explain the following terms in staining: regressive, progressive, vital; direct; indirect;, mordant, accelerators, negative staining; metachromatic and specific stains giving examples in each case.</p> <p>5.8 Relate the importance of permanent slides preparation to temporary ones.</p> <p>5.9 Describe the procedures for the staining of bacteria, plant material and animal tissue (i.e gram staining, capsule, spories, heam and fast green, heam and eosin etc).</p>	Demonstrate Staining	Microscopes

	<p>5.10 Explain how the following stains are prepared emphasizing on the dangers of reagents used and the need for accuracy of measurements.</p> <ul style="list-style-type: none"> i) acid stains- eosin, fast green, light green aniline blue etc. ii) basic stains- methylene blue, toluidene blue, basic fuchsin, crystal violet etc. iii) neutral stains- gienisa, wrights and leishman. <p>5.11 Stain two each of the materials in 5.9 above using any suitable stains mentioned in 5.10 above.</p> <p>5.12 Stain some fresh biological specimen (e.g. paramecium, amoeba, epithelial tissue, bacteria etc) as whole and mount the preparation.-</p> <p>5.13 Identify, draw and label faulty specimens from 5.11 and 5.12.</p>		
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STB 314 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1-2	1.2	Identify the various parts of a simple microscope	List parts of a simple microscope	Microscope
	1.4	Draw the object focused in 1.2 above	Supervise the drawing	
3-4-5	2.3	Prepare normal saline and then ringer solutions for the following tissue: human, frog and cockroach.	Demonstrate preparation of solutions	
	2.5	Carry out the frog nerve-muscle experiment using a kymograph and explain the significance	Demonstrate frog nerve-muscle experiment	
	2.12	Prepare two commonly used preservatives, (simple fixatives and compound fixatives to include one plant and animal solutions each)	Demonstrate preparation of preservatives	
	2.17	Prepare two acid and two alkaline buffers of known pH and measure the pH values using a standardized pH meter	Demonstrate the preparation of buffers	
	2.18	Determine the pH of a known sample using a standard buffer graph.	Supervise the determination of pH	
	2.22	Prepare an example each of the following: acid, basic and neutral stains, (to include examples of stains specific for plant, animal and bacteria).	Demonstrate the preparation of stains	
6-7	3.3	Prepare culture media for the cultivation of bacteria, fungi and paramecium.	Supervise preparation of culture media	
8	4.3	Prepare some animal and plant tissues up to embedding stage and store for future use	Demonstrate the preparation of animal and plant tissues up to embedding stage	
9-10	5.6	Trim, mount and section cut material	Supervise the mounting and sectioning of a cut material	
11-12	5.11	Stain two each of the materials in 5.9 above using any suitable stains mentioned in 5.10 above	Supervise staining	
	5.12	Stain some fresh biological specimen (e.g. gparamecium, amoeba, epithelial tissue, bacteria etc) as whole and mount the preparation.	Supervise staining	
	5.13	Identify, draw and label faulty specimens from 5.11 and 5.12		

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: RESEARCH METHODOLOGY AND BIOSTATISTICS

CODE: STB 315

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 0

UNITS: 2

GOAL: The aim of this course is to acquaint the students with the basic knowledge of research methodology and Biostatistics.

GENERAL OBJECTIVES:

On completion of this course the students should be able to:

- 1.0 Know what a research is and how to carry it out.
- 2.0 Know the methodology applied in research.
- 3.0 Know the various methods of data collection.
- 4.0 Know the various methods of processing data.
- 5.0 Understand the use and importance of some measures of central tendency and measures of dispersion in summarizing data.
- 6.0 Understand experimental designs and their analysis.
- 7.0 Know how to search and retrieve literature.
- 8.0 Understand the presentation of research report/research proposal.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Research Methodology And Biostatistics		COURSE CODE: STB 315	CONTACT HOURS: 30 2Hours/WK
Course Specification:			
Week	GENERAL OBJECTIVES: 1.0 Know What A Research Is And How To Carry It Out		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1-2	1.1 Define the following terms: Research, Scientific method, theory, hypotheses. 1.2 Describe various types of research e.g. descriptive, exploratory, casual, experimental and comparative. 1.3 Explain the stages of a research:- - Formulation of a research problem - Hypothesis - Justification of the research.	Discuss what Research is and the process of carrying it out.	
WEEK	GENERAL OBJECTIVES: 2.0 Know The Methodology Applied In Research		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<u>Research Methodology</u> 2.1 Define Sampling 2.2 Explain the two major types of sampling. a) Probability sampling e.g. random. Systematic, stratified and dusters b) Non-probability sampling e.g. accidental quotas and purposive 2.3 Explain the uses of sampling.	Lectures, interactive session including questions and answers.	

WEEK	GENERAL OBJECTIVES: 3.0 Know The Various Methods Of Data Collection		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<u>Data Collection</u> 3.1 Define Data 3.2 State the types of data a) Primary and b) Secondary data 3.3 Explain the methods of collecting data e.g Observation, questionnaire, interview. 3.4 Describe how to design questionnaires for research 3.5 Explain how to administer questionnaires and interview. 3.6 Design and administer sample questionnaires.	Discuss Data Collection. Prepare Questionnaires and administer them. Have interview with people and come to the class to discuss.	
WEEK	GENERAL OBJECTIVES: 4.0 Know The Various Methods Of Processing Data		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<u>Handling the data</u> 4.1 Explain organization of data 4.2 Explain the grouping of data 4.3 Explain tabulation of data 4.4 Analyze the data result obtained 4.5 Present the result of the analysis.	Discuss handling of collected data.	Calculators/computers
WEEK	GENERAL OBJECTIVES: 5.0 Understand The Use And Importance Of Some Measures Of Central Tendency And Measures Of Dispersion In Summarizing Data		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
5-6	<u>Measures Of Tendency And Dispersion</u> 5.1 Define Arithmetic Mean, Geometric Mean, Median, Mode And Harmonic Mean. 5.2 Compute The Measures in 5.1 above given a) Ungrouped Data b) Grouped Data c) Frequency Distribution 5.3 Define Measures Of Dispersion 5.4 Calculate	Analyze The Data Collected In 4.0 Above Manually And Also Using Computer To Analyze.	Calculators And Computers.

	<ul style="list-style-type: none"> a) The Mean Deviation b) Variance And Standard Deviation c) Linear Correlation And Regression d) Chi-Square. 		
WEEK	General Objectives: 6.0 Understand Experimental Designs And Analysis		
7-8	Experimental Designs 6.1 Describe various types of experimental designs. <ul style="list-style-type: none"> a) Randomized block design b) Randomized complete block design 6.2 Design an experiment using (a) and (b) in 6.1 6.3 Explain the analysis of variance for the designs in 6.1 6.4 Explain null-hypothesis and test of significance 6.5 Explain LSD and Duncan's multiple range test. 6.6 Carry out an analysis of variance.	Give many e.g in agriculture, in the laboratory experiments (micro organisms experiments, observation experiments etc.	
WEEK	GENERAL OBJECTIVES: 7.0 Know How To Search And Retrieve Literature		
9-10	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	7.1 Identify the different sections of a typical library 7.2 Explain the different types of libraries 7.3 Explain the different types of classification scheme (DDC and LC). 7.4 Explain classification 7.5 Identify reference sources 7.6 Identify types of serials 7.7 Explain indexing and abstracting 7.8 Describe the use of catalogues 7.9 Explain back of book indexes 7.10 Describe how the library is used in research.	Discuss the importance of a library.	Library

WEEK	GENERAL OBJECTIVES: 8.0 Understand The Presentation Of Research Report/Research Proposal		
11-12	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
	<p><u>Presentation of research reports</u> 8.1 Explain the general format of a research report</p> <ul style="list-style-type: none"> -Title -Abstract/Summary -Introduction -Research Methodology/Experimental -Results/Interpretation/tables -Discussion -Conclusion -Recommendation -Appendix /figures -References. 	<p>Give an example of journal papers and research write ups/research proposals.</p>	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: WATER QUALITY ASSESSMENT AND POLLUTION

CODE: STB 321

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: The course is designed to educate students on water quality assessment and pollution..

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the qualities of water.
- 2.0 Know water pollution and control.
- 3.0 Know the various types of water borne diseases and their consative agents.
- 4.0 Understand water sampling techniques.
- 5.0 Understand water analysis.
- 6.0 Understand Microbiological considerations of water.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Water Quality Assessment And Pollution		Course Code: STB 321	CONTACT HOURS: 60 2Hours (2HRS lecture 2Hrs Practical)
Course Specification:			
Week	General Objectives: 1.0 Know The Qualities of Water.		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1-2	1.1 Define water 1.2 Explain the uses of water 1.3 Describe the different sources of water. 1.4 Explain the meaning of the following terms. <ul style="list-style-type: none"> i. Quality ii. Quality control, iii. Standard Operating Procedure, iv. Quality Assurance. 1.5 List and explain the important qualities of water 1.6 Describe the water quality indicators 1.7 Explain the meaning of potable water 1.8 State the world health organization standard for potable water. 1.9 State the Federal Ministry of Environment Standard for potable water. 1.10 Describe the water cycles.	Discuss water quality	

WEEK	General Objectives: 5.0 Understand water analysis		
7-10	<p>5.1 Explain water analysis.</p> <p>5.2 Explain the role of the laboratory in water analysis.</p> <p>5.3 Describe aseptic procedures in water analysis.</p> <p>5.4 Describe the aesthetic parameters e.g. appearance, colour, turbidity used in water analysis.</p> <p>5.5 Collect and analyse water samples using the aesthetic parameters describe in 5.4 above.</p> <p>5.6 Describe the organoleptic parameters used in water analysis e.g. odour, taste.</p> <p>5.7 Collect and analyse water samples using the organoleptic parameters described in 5.6 above.</p> <p>5.8 Describe the physical parameters used in water analysis e.g. Total dissolved salts (TDS) conductivity, Total suspended solids (TSS).</p> <p>5.9 Collect and analyse water samples using the physical parameters described in 5.8 above.</p> <p>5.10 Describe the chemical parameters used in water analysis e.g. PH, Dissolved oxygen, total hardness, calcium hardness, Magnesium hardness, iron free chlorine.</p> <p>5.11 Collect and analyse water samples using the chemical parameters described in 5.10 above.</p> <p>5.12 Describe the microbiological parameters used in water analyses e.g. coliform.</p> <p>5.13 Collected and analyse water samples using the microbiological parameters.</p>	<p>Test for TDS, TSS.</p> <p>Test for pH, dissolved oxygen, hardness, magnesium chlorine, and residual chlorine.</p> <p>Test for coliforms and other</p>	<p>Membrane filter apparatus spectrophometer, colorimeter pH meter.</p> <p>Photo meters Colorimeter PH meter. Autoclave Colony Counter, Inoculating Chamber, Incubator. Inoculating</p>

		bacteria indicators of water pollution.	loop.
WEEK	General Objectives: 6.0 Understand microbiological considerations of water		
11-12	<p>6.1 List the types of Microorganism normally found in water.</p> <p>6.2 Collect and analyse water samples for the microorganisms listed in 6.1 above.</p> <p>6.3 Explain the sources and nature of survival of different organism listed in 6.1 done.</p> <p>6.4 Explain the significance of the organisms listed in 6.1 above.</p> <p>6.5 Explain the concept of indicator organism in microbial quality control with special references to streptococcus and E. Coli.</p> <p>6.6 Explain the use of E. Coli as indicator organism in water quality analysis to illustrate the meaning of:-</p> <ol style="list-style-type: none"> i) Presumption coliform test. ii) Conformed coliform test. iii) Completed test. <p>6.7 Estimate the number of coliforms in a sample of water by the MBA membrane filtration technique.</p>	Analyse water for bacteria content	<p>Membrane filters, sampling bottles autoclaves, colony counter, Incubators.</p> <p>-Membrane filler -Apparatus -Colony Counter</p>

STB 321 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
3-5	2.2	Identify the sources of water pollution	Discuss water pollution	
	2.5	Collect polluted water from different sources and identify biodegradable and non biodegradable pollutants in them	Explain biodegradable and non-biodegradable pollutants	Ph meter, turbidimeter, salinometer, Total dissolved solid meter, Centrifuge, Oven, Magnetic stirrer.
	2.7	Analyze polluted water for the major pollutants listed in 2.6 above.	Supervise the analysis of pollutants	
6	3.5	Analyze polluted water for the causative organism listed in 3.2 above.	Demonstrate the analysis of polluted water	
	4.1	Identify the equipment needed for water sampling.	List the equipment for water sampling.	
	4.7	Sample water from lake, river, and well	Explain how to take water samples	
7-10	5.5	Collect and analyse water samples using the aesthetic parameters describe in 5.4 above	Supervise water analysis by aesthetic parameters	Membrane filter apparatus spectrophotometer, colorimeter
	5.7	Collect and analyse water samples using the organoleptic parameters described in 5.6 above	Demonstrate water analysis using organoleptic parameters	
	5.9	Collect and analyse water samples using the physical parameters described in 5.8 above	Supervise analysis of water by physical parameters	
	5.11	Collect and analyse water samples using the chemical parameters described in 5.10 above	Demonstrate chemical parameters used in analyzing water	Photometer colorimeter pH meter
	5.13	Collect and analyse water samples using the microbiological parameters	Demonstrate the analysis of water using microbiological parameters	Autoclave inoculating chamber, colony counter incubator
11-12	6.2	Collect and analyse water samples for the microorganisms listed in 6.1 above	Supervise analysis of water for microorganisms	Membrane filters, sampling bottles, autoclave, incubator, colony counter

	6.7	Estimate the number of coliforms in a sample	Demonstrate the MBA membrane filtration technique	- Membrane filtration apparatus. - Colony Counter
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PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: PRINCIPLES OF TOXICOLOGY I

CODE: STB 322

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

GOAL: This course is designed to acquaint the students with the basic principles of toxicology.

GENEAL OBJECTIVES:

On completion of the course the student should be able to:

- 1.0 Understand the basic concepts of toxicology.
- 2.0 Know the history and scope of technology.
- 3.0 Understand environment toxicology.
- 4.0 Know toxicity factors.
- 5.0 Know hazardous substances.
- 6.0 Understand Pesticide toxicology

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Principles of Toxicology I		Course Code: STB 322	CONTACT HOURS: 60 (2HRS lecture 2Hrs Practical)
Course Specification:			
Week	General Objectives: 1.0 Understand The Basic Concepts Of Toxicology		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1-2	<p>1.1 Define:-</p> <ul style="list-style-type: none"> i) Toxicant ii) Toxic iii) Toxicity iv) Pollutant v) Dose vi) LC 50 and LD 50 <p>1.2 Classify toxicants.</p> <p>1.3 List some environmental toxicants, their sources and effects on the environment and health.</p> <p>1.4 Describe the different types of toxicity namely:- chronic toxicity; development and reproductive toxicity; mutagenicity.</p> <p>1.5 Analysis air, water and soil samples and identify toxicants in them.</p> <p>1.6 Explain the different manifestations of toxicity e.g. physiological malfunction, Carcinogenicity, tetragenicity, mutagenicity, and death.</p> <p>1.7 Explain how toxicity is determined using standardised laboratory test (EP. i.e Extraction Procedure)</p> <p>1.8 Determine toxicity using extraction procedure.</p> <p>1.9 List the contaminants and their maximum concentration used for EP toxicity test..</p> <p>1.10 State when a substance is designated as EP</p>	<p>Conduct the practical analysis of air, soil water for toxicants.</p> <p>Demonstrate the determination of toxicity.</p>	<p>Soil test kits pH meter, Turbidimeter centrifuge, magnetic stirrer shakers. Membrane filtration apparatus.</p>

	toxic.		
Week	General Objectives: 2.0 Know The History and scope of Toxicology		
3	<p>2.1 Explain the different stages in the history of toxicology namely; Antiquity; Middle Ages; Age of Enlightenment; Modern Toxicology.</p> <p>2.2 Describe the different branches of toxicology namely Environmental Toxicology, Forensic toxicology, Clinical toxicology, economic toxicology.</p>		
Week	General Objectives: 3.0 Understand Environmental Toxicology		
4-6	<p>3.1 Explain the meaning and importance of environmental toxicology.</p> <p>3.2 Describe the toxicology of food additives and contaminants.</p> <p>3.3 Determine the toxicity of food additives and contaminants in food samples.</p> <p>3.4 Describe the method of analysis of food toxicants.</p> <p>3.5 List atmospheric pollutants e.g. carbon monoxide, asbestos, chlorofluorocarbon, photochemical smog, oxides of nitrogen and sulphur.</p> <p>3.6 Explain the sources and toxicity of the various atmospheric pollutants listed in 3.5 above.</p> <p>3.7 Describe the method of analysis of atmospheric</p>	<p>Conduct Practical analysis of food toxicants.</p> <p>Demonstrate the Practical determination toxicity of atmosphere, soil and aquatic toxicants.</p>	<p>Centrifuge, hot plate shakers, magnetic stirrer, white tiles melting point apparatus.</p> <p>Air sample anaerobic jar Incubator, thermometer.</p>

	<p>toxicants.</p> <p>3.8 Determine the toxicity of atmospheric toxicants.</p> <p>3.9 List aquatic pollutants.</p> <p>3.10 Explain the sources and describe, the toxicity of the pollutants, listed in 3.9 above.</p> <p>3.11 Describe the methods of analysis of aquatic toxicants.</p> <p>3.12 Determine the toxicity of aquatic toxicants.</p> <p>3.13 List soil pollutants.</p> <p>3.14 Outline the sources and describe the toxicity of soil pollutants listed in 3.13 above.</p> <p>3.15 Describe the methods of analysis of soil toxicants.</p> <p>3.16 Determine the toxicity of soil pollutants.</p>		
Week	General Objectives: 4.0 Know Toxicity Factors		
7-8	<p>4.1 Explain the influence of route of administration on toxicity.</p> <p>4.2 Identify the animals used in toxicity tests.</p> <p>4.3 Administer toxins into a guinea pig through different routes and determine the influence of route of administration on toxicity.</p> <p>4.4 Describe the effects of chemical interactions on toxicity.</p> <p>4.5 Describe the biological toxicity e.g. barriers, biotransformation, sensitivity of organs, etc.</p> <p>4.6 Explain the effects of dose and duration of exposure on toxicity.</p> <p>4.7 Describe the effects of the following host factors on toxicity:</p> <p>i) Species, strain and individual differences.</p> <p>ii) Sex, Hormonal status and pregnancy.</p> <p>iii) Age</p> <p>iv) Nutritional Status</p>	Discuss toxicity	

	v) Diseases. 4.8 Describe the physical and social factors that modify toxicity in organisms.		
Week	General Objectives: 5.0 Know Hazardous substances		
	5.1 Define hazardous substances. 5.2 Explain the characteristics of hazardous substances. 5.3 Identify examples of hazardous wastes generated by Business and industries. 5.4 Describe methods of hazardous substances control from the point of generation to the point of ultimate disposal. 5.5 Carryout a visit to industries and list the different hazardous waste generated by them.	Discuss hazardous substances	Transport.
Week	General Objectives: 6.0 Understand Pesticide Toxicology		
10-12	6.1 Define a pesticide. 6.2 Describe the toxicology of organic chemicals namely organochlorines, organophosphates and carbamates. 6.3 Describe the toxicology of inorganic pesticides e.g.arsenic compounds, Lead salts, copper salts. 6.4 Explain metabolism degradation of pesticides in the body. 6.5 Determine the toxicity of some selected pesticides. 6.6 Explain the dangers of pesticide residues in the environment. 6.7 Determine pesticide residues in the environment. 6.8 List the different types of plant and animal toxins.	Demonstrate determination of toxicity of pesticides Demonstrate determination of toxicity of pesticides residues Demonstrate determination of toxicity of plant and animal toxins.	Osmo meter/Osmotic level determination meter, pH meter, Total dissolved solid meter. Total dissolved oxygen meter balances, melting point apparatus, toxicity kit.

	<p>6.9 Determine the toxicity of various plant and animal toxins.</p> <p>6.10 Describe radioactive materials and their toxicity.</p> <p>6.11 Describe polyhalogenated compounds and their toxicity.</p>		
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STB 322 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1-2	1.5	Analyse air, water and soil samples and identify toxicants in them.	Demonstrate the analysis of air, water and soil samples for toxicity.	EP Kit
	1.8	Determine toxicity using extraction	Explain extraction procedure	
4-5-6	3.3	Determine the toxicity of food additives and contaminants in food samples.	Demonstrate analysis for food toxicants.	Centrifuge, hot plate, shakers, magnetic stirrer, melting point apparatus
	3.8	Determine the toxicity of atmospheric toxicants	Describe the method of analysis of atmospheric toxicants	
	3.12	Determine the toxicity of aquatic toxicants.	Describe the method of analysis of aquatic toxicants	
7-8	4.2	Identify the animals used in toxicity tests.		
	4.3	Administer toxins into a guinea pig through different routes and determine the influence of route of administration on toxicity	Supervise administration of toxins	
9	5.3	Identify examples of hazardous wastes generated by Business and industries.	List hazardous wastes	
	5.5	Carry out a visit to industries and list the different hazardous waste generated by them.	Conduct a field trip	
10-11-12	6.5	Determine the toxicity of some selected pesticides	Describe the method of determining toxicity of pesticides	
	6.7	Determine pesticide residues in the environment.	Supervise how pesticide residues in the environment are determined.	
	6.9	Determine the toxicity of various plant and animal toxins	Demonstrate the determination of toxicity.	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: APPLIED GENETICS (ANIMAL BREEDING)

CODE: STB 323

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: This course is designed to give the student a broad knowledge of the theories and practices of genetics as applied to animal breeding.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:

- 1.0 Know the history of applications of genetics to the breeding of domesticated and laboratory animals.
- 2.0 Understand gametogenesis.
- 3.0 Understand genetic characteristics of animals.
- 4.0 Know the breeding of domesticated animals.
- 5.0 Understand the effects of environmental health/disease and diet on the breeding of domesticated animals.
- 6.0 Know the application of specialized techniques in the breeding of domesticated animals.
- 7.0 Appreciate the importance of good record keeping in the breeding of domesticated animals.
- 8.0 Understand the principle of animal production characteristics and how these could affect increased livestock yield.
- 9.0 Understand performance evaluation and prediction of genetic improvement in commercial livestock breeding.

Programme: Science Laboratory Technology (Environmental Biology Option)			
Course: Applied Genetics		Course Code: STB 323	CONTACT HOURS: 60 2Hours (2HRS lecture 3Hrs Practical) 2-0-2
Course Specification:			
Week	General Objectives: 1.0 Know the history of application of genetics to breeding of domesticated and laboratory animals		
	SPECIFIC LEARNING OBJECTIVE:	TEACHERS ACTIVITIES	RESOURCES
1	1.1 Define Mendel's first and second laws. 1.2 Relate the laws in 1.1 above to the various stages of meiosis in animals. 1.3 Explain the segregation of alleles during meiosis in the presence and absence of crossing over. 1.4 Explain independent assortment of homologous and non-homologous chromosomes during meiosis. 1.5 Identify, draw and label slides on the stages of meiosis in animals.	Discuss the application of Genetics in breeding.	Microscopes.
Week	General Objectives: 2.0 Understand gametogenesis		
2	Reproductive Systems and Gametogenesis 2.1 Explain the anatomy of the mammalian male and female. 2.2 Explain the physiology and function of the male and female reproductive system. 2.3 Define gametogenesis. 2.4 Outline the principles of gametogenesis. 2.5 Explain the processes involved in mammalian spermatogenesis, and oogenesis. 2.6 Explain the process of the libration of gametes.	Display Reproductive organs of animals.	Microscopes.

	2.7 Explain fertilization and zygote formation. 2.8 Identify, draw and label slides on the process of gametogenesis.		
Week	General Objectives: 3.0 Understand genetic characteristics of animals.		
3	Biological and breeding characteristics 3.1 Explain the principles of the inheritance of economic traits (e.g. quantitative inheritance.) 3.2 Explain variation as the raw material of production in the breeding of domesticated animals. 3.3 Explain two kinds of behavior of non-allelomorphic characters in linkage groups (i.e coupling and repulsion) 3.4 Explain two kinds of behavior of non-allelomorphic characters in linkage groups (i.e. coupling and repulsion) 3.5 Explain the effect of chromosome and gene mutations on production in animal breeding.		
Week	General Objectives: 4.0 Know the breeding of domesticated animals		
4	<u>System of breeding</u> 4.1 Explain the principles upon which selection for certain genetic traits could lead to improved level of livestock (i.e. individual selection, family selection and progeny tests) 4.2 Explain habitability and repeatability as an important concept of population physiology genetics. 4.3 Explain the various systems of breeding domesticated animals e.g. mating systems, inbreeding, out breeding, crossbreeding, species hybridization etc. 4.4 Explain the principles of traits of Economic Importance as a means of increasing		

	productivity in animals.		
Week	General Objectives: 5.0 Understand the effects of Environmental health Disease and diet on the breeding of domesticated animals.		
5	<p><u>Factors Affecting Breeding</u></p> <p>5.1 Explain the effect of environmental factors on animal breeding i.e heat/temperature, water supply, nutrition and the presence/absence of male/female.</p> <p>5.2 List the various diseases affecting domesticated animals and their causes.</p> <p>5.3 Describe the prevention, control and treatment of the various animal diseases in 5.2 above.</p>		
Week	General Objectives: 6.0 Know the application of specialized techniques in the breeding of domesticated animals		
6	<p><u>Other breeding Techniques</u></p> <p>6.1 Explain artificial insemination</p> <p>6.2 Explain the principles of artificial insemination, techniques as they vary in different species of animals.</p> <p>6.3 Explain the various stages of artificial insemination techniques as in the following steps:</p> <ul style="list-style-type: none"> i) Collection of semen from the male ii) Examination of semen for quality iii) Semen dilution and preservation techniques iv) Deposition of semen in the female reproduction tract. <p>6.4 Explain the significance of effective heat detection and correct timing for effective mating.</p> <p>6.5 Carryout a visit to veterinary laboratory for 6.3 and report observations.</p>	Demonstrate artificial insemination.	Transport.

Week	General Objectives: 7.0 Appreciate the importance of good record keeping in the breeding of domesticated animals.		
7	<p><u>Record Keeping In animal breeding.</u></p> <p>7.1 Explain the significance of good record keeping as it affects production in animal breeding.</p> <p>7.2 Identify the two types of record keeping in use in animal farms (i.e technical and business records.)</p> <p>7.3 Describe the various aspects of technical records required in animal breeding (i.e. pedigree/herd, feeding, health disease) and production records.</p> <p>7.4 Describe the various aspects of business records in animal breeding (i.e labour records, complete enterprise records etc.)</p> <p>7.5 Undertake a visit to a research institute to obtain records as in 7.3 and report.</p>		Transport.
Week	General Objectives: 8.0 Understand the Principle of animal Production Characteristics and how these could affect increased livestock yield		
8-10	<p><u>Production Characters and their effects in breeding</u></p> <p>8.1 List the valuable products of all domesticated animals including animal waste, carcass and bones.</p> <p>8.2 Explain the dietary values and economic importance of items listed in 8.1 above.</p> <p>8.3 Explain the causes of low production in all domesticated animals as in the following:-</p> <ul style="list-style-type: none"> i) Acute shortage of feeds and fodders. ii) Excess numbers of animals iii) Poor genetic potential for the desired product. iv) Adverse climatic conditions especially 		Transport

	<p>in the tropics.</p> <p>v) Poor nutrition and other environmental factors.</p> <p>vi) Lack of adequate market for products.</p> <p>8.4 List the effects of frequent 'harvest' on livestock products on the breeding of animals.</p> <p>8.5 Explain how reproductive efficiency affects production of livestock yields.</p> <p>8.6 Explain the effects of heredity and environment on the breeding efficiency of domesticated animals.</p> <p>8.7 Explain the effects of nutritional/dietary, improved health, suitable environmental conditions, peace and comfort, good housing, on high level production in animal breeding.</p> <p>8.8 Undertake a visit to a research institute to observe effects of 8.7 on animal breeding.</p>		
Week	General Objectives: 9.0 Understand the Performance evaluation and prediction of genetic improvement in commercial livestock breeding.		
11-12	<p><u>Evaluation and Prediction of Genetic Improvements</u></p> <p>9.1 Explain the significance of gene frequency on the genotypes and phenotypes in a population and its effects on the constitution of future generations.</p> <p>9.2 Relate the principles gene-pool and natural circumstances, (i.e. act of mating, fertilization and over population to improved production) on livestock.</p> <p>9.3 Explain the control of random genetic drift (random sampling errors) as a major factor in genetic improvement of livestock.</p> <p>9.4 List the significance of migration, mutation, and selection of favourable characteristics in animal breeding.</p>		

STB 323 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.5	Identify, draw and label slides on the stages of meiosis in animals.	Explain stages of meiosis in animals	Slides, microscopes
2	2.8	Identify, draw and label slides on the process of gametogenesis.	Explain the process of gametogenesis	Slides, microscopes
6	6.5	Carry out a visit to veterinary laboratory for 6.3 and report observations.	Field trip	
7	7.2	Identify the two types of record keeping in use in animal farms (i.e technical and business records)	Explain types of records kept in animal farms.	
	7.5	Undertake a visit to a research institute to obtain records as in 7.3 and report.	Field trip	
8-10	8.8	Undertake a visit to a research institute to observe effects of 8.7 on animal breeding.	Field trip	

**PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)****COURSE: ENTOMOLOGY AND PEST CONTROL****CODE: STB 324****DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 3****UNITS: 2****GOAL:** This course is designed to acquaint the students with the knowledge of insects of agricultural, medical and veterinary significance and their methods of control.**GENERAL OBJECTIVES:**

On completion of this course the student should be able to:-

1.0 Know the external structures of insects.

- 2.0 Know the internal physiology and anatomy of insects.
- 3.0 Understand the life-cycles of insects.
- 4.0 Know the various orders of the Apterygota and Pterygota.
- 5.0 Know the Biology and control of insects responsible for the spoilage of stored products.
- 6.0 Know the biology and epidemiology of insects of medical and veterinary significance and their methods of control.
- 7.0 Know major field insect pests and their methods of control.
- 8.0 Know arthropod borne venoms, defense secretions and allergies.
- 9.0 Know pesticides and their uses.
- 10.0 Understand the techniques involved in other pest control methods such as quarantine, cultural management, biological control, physical/mechanical control and integrated pest management strategy.
- 11.0 Know the hazards of pesticide handling and the laws governing use of pesticides.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: ENTOMOLOGY AND PEST CONTROL		Course Code STB 324	Contact Hours: 60 hrs. 1-0-3
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 know the external structures of insects.		
	Specific Learning Objective:	Teachers Activities	Resources
1	<p><u>External Structures of Insects</u></p> <p>1.1 Describe the external structure of a typical insect.</p> <p>1.2 Draw and label a typical insect.</p> <p>1.3 Describe and explain the various modifications of insect parts e.g. mouth parts, head, thorax, abdomen, legs, wings, etc. for various functions.</p>	<p>- Discuss the external structure of insects.</p>	<ul style="list-style-type: none"> - Insect charts - Prepared slides - Life specimens of insects. - Microscopes - Dissecting kits - Magnifying glass
WEEK	General Objectives: 2.0 know the external Physiology and anatomy of insects.		
2	<p>2.1 Describe the digestive system of a named insect.</p> <p>2.2 Describe the various modifications of the digestive tract of various insects.</p> <p>2.3 Describe the insect haemocoel including the fat body, muscles and their functions.</p> <p>2.4 Describe the reproductive system of a typical insect.</p> <p>2.5 Explain the phenomenon of diapause</p> <p>2.6 Describe the insect circulatory system their modifications and functions.</p> <p>2.7 Describe the respiratory system of a typical insect.</p> <p>2.8 Describe the nervous system and neuro-muscular co-ordination in a typical insect.</p> <p>2.9 Dissect, draw and label the internal organs of a named insect.</p> <p>2.10 Relate the relevance of the knowledge of</p>	<p>Demonstrate dissection of an Insect.</p>	<p>Dissecting set insect specimens (life)</p> <p>Magnifying glass dissecting kits</p> <p>Dissecting boards.</p>

	insect anatomy and physiology to biological and chemical control methods.		
WEEK	General Objectives: 3.0 Understand the life –cycles of insects		
3	<u>Life Cycles of Insects</u> 3.1 Describe the life-cycle of a typical insect. 3.2 Describe growth processes in insects. 3.3 Define complete metamorphosis. 3.4 Define incomplete metamorphosis. 3.5 Collect, draw and label life stages of insects in complete and incomplete metamorphosis. 3.6 Relate the life cycles of insects to their economic significance, as destructive pests, vectors of diseases and diseases causing agents (e.g. locusts, army worms, mosquito and housefly).	Carry out a field visit to collect the eggs of insects.	Incubation boxes. Insect cages, fly nets.
WEEK	General Objectives: 4.0 know the various orders of the Apterygota and Pterygota		
4	<u>Insect Orders</u> 4.1 List the major diagnostic features used in insect classification. 4.2 Classify insects into the two main groups (Apterygota and Pterygota). 4.3 Classify insects into the main orders with reasons. 4.4 Identify and classify common local insects. 4.5 Identify those insects involved in common diseases and pestilence (e.g myiasis yellow fever, malaria, sleeping sickness, river blindness and filariasis).	Undertake a visit to the field to collect local insects and classify.	Sweep nets.
WEEK	General Objectives: 5.0 know the Biology and Control of insects responsible for the spoilage of stored products		
5	<u>Store Products And Household Insects</u> 5.1 Collect and identify all insects that cause damage to stored products. 5.2 Identify insects that cause household	Collect insects that cause damages to some named grains and tubers. Demonstrate preservation of	Infected grains with insect pests e.g. maize, rice, beans, infected yam tubers and cassava tubers.

	<p>damages.</p> <p>5.3 Describe and identify the nature of damages caused on stored grains and other foodstuff by insects.</p> <p>5.4 Describe damages caused to wool clothing, curtains, carpets, warehouse elevators, farmer bins, retail stores, etc.</p> <p>5.5 Describe and identify the various stages in the life cycle of the insects 5.1 and 5.2 above.</p> <p>5.6 Describe methods of quantifying damages caused by insect pests.</p> <p>5.7 List and describe control methods by exclusion and sanitation.</p> <p>5.8 Describe insect control by use of insecticides.</p> <p>5.9 Describe the mode of action of insecticides used in insect control as in 5.8 above.</p> <p>5.10 Describe methods of application of insecticides in the house and on stored products.</p> <p>5.11 Describe possible health hazards in the use of insecticides for the control of domestic and stored product insects.</p> <p>5.12 Describe precautions to be taken in the use of insecticides in the house and on stored products.</p> <p>5.13 Explain control of insects by the use of predator and other means e.g. radiation, fumigants.</p>	insects.	Preservatives like ethanol and other preservatives.
<u>WEEK</u>	General Objectives: 6.0 know the Biology and Epidemiology of insects of medical and veterinary significance and their methods of control		
6	<p><u>Biology and Epidemiology of Insects of Veterinary and Medical Significance.</u></p> <p>6.1 Collect and identify all insects of medical and veterinary significance.</p> <p>6.2 List insect borne diseases and describe their</p>	Collect and identify all the medical and veterinary insects. Preserve these insects using any adequate preservatives.	

	<p>modes of transmission in Nigeria including ticks and mites.</p> <p>6.3 List arthropod transmitted pathogens.</p> <p>6.4 Describe the life cycle of the insects listed in 6.1 above.</p> <p>6.5 Identify the vertebrate host of 6.3 above.</p> <p>6.6 Identify the reservoirs of arthropods transmitted pathogens.</p> <p>6.7 Explain the following terms: Epidermic Endermic Zoonotic Infectious Contageous</p> <p>6.8 List all insect-borne diseases.</p> <p>6.9 Describe the mode of transmission and development of the diseases listed in 6.8 above.</p> <p>6.10 State the relationship between vertebrate pathogens and insect vectors.</p> <p>6.11 Identify and draw a plasmodium parasite under the microscope.</p> <p>6.12 Describe various ways of control of insect vectors.</p>		<p>Prepared slide of plasmodium, microscopes.</p>
WEEK	General Objectives: 7.0 know the major field insect pests and their method of control		
7	<p>Field Pests</p> <p>7.1 Collect and identify all major field pests found in Nigeria.</p> <p>7.2 List the scientific names of the pests identified in 7.1. above.</p> <p>7.3 Identify polyphagous feeders</p> <p>7.4 Identify monophagous feeders</p> <p>7.5 Describe the economic damage(s) caused by crop pests.</p> <p>7.6 Identify and describe the stages in insect life</p>	<p>Conduct practical/on field pest collection and laboratory identification.</p>	<p>Sweep nets. Magnifying glasses.</p> <p>Sweep nets and preservatives.</p>

	<p>cycles that cause damage to field crops.</p> <p>7.7 Describe the nature of damages caused to crops by insects.</p> <p>7.8 Describe various ways of control of pests of crops in the field.</p>		
WEEK	General Objectives: 8.0 know arthropod borne venoms, defense secretions and allergies		
8	<p><u>Arthropod Venoms, Defence Secretions And Allergies</u></p> <p>8.1 List and identify arthropods that produce venoms and defense secretions.</p> <p>8.2 Explain venoms, allergies.</p> <p>8.3 Identify and describe stinging insects.</p> <p>8.4 Identify and describe biting and vesicating insect.</p> <p>8.5 Identify and describe venomous spiders</p> <p>8.6 Describe the effect of scorpion stings.</p> <p>8.7 Describe the external and internal structure of scorpions, venomous ticks, and centipedes.</p>	Demonstrate the identification of insects.	Insect cabinets preserved insect specimens magnifying glasses.
WEEK	General Objectives: 9.0 know Pesticides and their uses		
9	<p><u>Pesticides</u></p> <p>9.1 Define Pesticides.</p> <p>9.2 Classify pesticides into insecticides, miticides, acaricides, nematocides, molluscicides, fungicides, bactericides, herbicides, rodenticide, repelants, piscicides, avicides, attractant, plant growth regulators, defoliant dessicants, anti transpirant, algicides and disinfectants.</p> <p>9.3 Explain the grouping of pesticides into inorganic and synthetic organic pesticides.</p> <p>9.4 Explain how pesticides work as protectants sterilants, contact poison, stomach poisons, systemic poison translocated herbicides and fumignant.</p> <p>9.5 Explain the criteria for chosing insecticides</p>	Demonstrate application of insecticides.	<p>Sprayers</p> <p>Pesticides</p>

	<p>in pest control.</p> <p>9.6 Explain toxicity of pesticides.</p> <p>9.7 Explain the following terms:-</p> <ul style="list-style-type: none"> - Acute toxicity - LD50; LD95 - Chronic Toxicity - Synergists. <p style="text-align: center;">Pesticide Sprayers Application And Calibration Procedure</p> <p>9.8 Identify different types of insecticide sprayers.</p> <p>9.9 Describe the functioning of insecticide sprayers</p> <p>9.10 Apply pesticide using hand sprayers</p> <p>9.11 Calibrate hand sprayers</p> <p>9.12 Identify various formulations for marketing pesticides.</p> <p>9.13 Calculate dilution rate of pesticides</p> <p>9.14 Describe different methods of pesticide application</p> <p>9.15 Select appropriate pesticides for use in crop storage.</p>		
<u>WEEK</u>	General Objectives: 10.0 Understand the techniques involved in other pest control methods such as quarantine, cultural management, biological control, physical/mechanical control and integrated pest management strategy.		
10	<p style="text-align: center;"><u>Other Pest Control Methods:</u></p> <p>10.1 Define the following control methods: quarantine, cultural management, biological control, physical/mechanical control and intergrated pest management strategy.</p> <p>10.2 Describe economic injury levels and thresholds.</p> <p>10.3 Describe biological control methods.</p> <p>10.4 Explain the advantages of cultural management.</p> <p>10.5 Describe biological control methods.</p>	Demonstrate other pest control methods.	

11	<p>10.6 List techniques of rearing insects for control.</p> <p>10.7 Enumerate factors considered in biological control.</p> <p>10.8 Explain physical/mechanical control of pests.</p> <p>10.9 List preventive measure for the control of insects in storage such as correct harvesting time, correct harvesting method, primary processing, and use of natural barrier.</p> <p>10.10 Apply physical and mechanical methods in the control of insects in storage such as high and low temperature radiation control and hermetic storage.</p> <p>10.11 Adopt integrated pest management strategy as techniques of pest control involving more than one method of control.</p>	Physical and mechanical insect control.	
WEEK	General Objectives: 11.0 Know the hazards of pesticide handling and the laws governing use of pesticides		
12	<p><u>Legality and Hazards of Pesticides.</u></p> <p>11.1 Enumerate the safe use and precautions of pesticides.</p> <p>11.2 Describe the first aid procedures in accidents occurring through pesticides.</p> <p>11.3 List the hazards of pesticide use to man and environment.</p> <p>11.4 Describe the precautions in pesticide transportation and storage.</p> <p>11.5 Mix and load pesticides and maintain equipment.</p> <p>11.6 Explain the international laws governing pesticides usage.</p>	Demonstrate the mixing of pesticides.	Sprayers and other pest control equipment.

STB 324 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES	TEACHERS ACTIVITIES	RESORUCES
1.	1.2 Draw and label a typical insect.	Guide students practicals	- Insect Charts - Life specimens of insects, magnifying glass.
2.	2.9 Dissect, draw and label the internal organs of a named insect.	Supervise dissection of insect	- Dissecting kits - Dissecting boards
3.	3.5 Collect, draw and label life stages of insects in complete and incomplete metamorphosis.	Explain complete and incomplete metamorphosis in Insects.	Insect Chart
4.	4.4 Identify and classify common local insects.	List the classes of insects	Insects
5.	5.1 Collect and identify all insects that cause damage to stored products. 5.2 Identify insects that cause household damages.	List insects that cause household Damages.	Insects
6.	6.1 Collect and identify all insects of medical and veterinary significance.	List insects of medical and Veterinary importance.	Insects

	6.5	Identify the vertebrate host of 6.3 above	Supervise identification of vertebrate host.	
	6.6	Identify the reservoirs of arthropods transmitted pathogens.	Locate the reservoirs	
	6.11	Identify and draw a plasmodium parasite under the microscope.		Slides, microscopes
7	7.1	Collect and identify all major field pests found in Nigeria	Supervise collection of insects	Sweep nets. Magnifying glass
	7.3	Identify polyphagous feeders	Explain Polyphgous feeders	
	7.4	Identify monophagous feeders	Explain monophagous feeders	
	7.6	Identify and describe the stages in insect life cycles that cause damage to field crops.	Discuss the different stages in insect life-cycle	Chart of life cycle of insect
8	8.1	List and identify arthropods that produce venoms and defense secretions	Discribe venomous arthropods	Insect carbinets, preserved insects
	8.3	Identify and describe stinging insects	List the stinging insects	Insects
	8.4	Identify and describe biting and vesicating insect.	List the biting and vesicating insects	
	8.5	Identify and describe venomous spiders	List the venomous spiders	
9	9.8	Identify different types of insecticide sprayers	Display different types of sprayers	Sprayers
	9.10	Apply pesticide using hand sprayer	Demonstrate application of pesticide with sprayers	Hand sprayers, pesticides
	9.11	Calibrate hand sprayers	Demonstrate Calibration	Hand Sprayers
	9.12	Identify various formulations for marketing pesticides	Explain formulations of pesticides	
	9.13	Calculate dilution rate of pesticides	Demonstrate the calculation of dilution rates of pesticides	
	9.15	Select appropriate pesticides for use in crop storage.	List appropriate pesticides for	

			storage.	
10	10.10	Apply physical and mechanical methods in the control of insects in storage such as high and low temperature radiation control and hermetic storage.	Supervise physical and mechanical control of insects in storage.	
12	11.5	Mix and load pesticides and maintain equipment	Supervise the mixing and loading of pesticides	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY)

COURSE: BIOLOGICAL TECHNIQUES II

CODE: STB 325

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 3

UNIT: 3

GOAL: The aim of this course is to enable students understand the techniques involved in setting up of botanical and zoological gardens, aquaria, vivaria, frogery and the factors to be considered in raising and breeding of laboratory animals.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Understand the techniques of mounting various biological specimens as a means of preserving them.
- 2.0 Know the techniques of setting up and maintaining aquaria, Vivaria, Frogery etc and the keeping and feeding of laboratory animals in cages.
- 3.0 Know the techniques of setting-up, and maintenance of small biological garden (botanical and zoological).
- 4.0 Understand the techniques of raising/breeding of laboratory animals.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: BIOLOGICAL TECHNIQUES II		Course Code STB 325	Contact Hours: 75 hrs. 5 hours weekly 2-0-3
COURSE SPECIFICATION:			
WEEK	<u>General Objectives: 1.0 Understand the techniques of mounting various biological specimens as a means of preserving them.</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<p>On completion of this course, the student should be able to:</p> <p><u>Mounting of Biological Specimens</u></p> <p>1.1 Explain “Mounting” as a method employed in the preservation and storage of biological specimens.</p> <p>1.2 Explain the difference between wet and dry mounts giving examples of some plants and animal materials as used in herbarium and museum.</p> <p>1.3 Explain the importance of temporary and permanent mounts as they relate to small plants and animals.</p> <p>1.4 Explain the reason that necessitates the use of whole and section mounts giving examples in each case.</p> <p>1.5 Describe the simple preparatory methods and the techniques involved in mounting the following specimens:</p>	Demonstrate the mounting of insect and skeleton	<ul style="list-style-type: none"> - Slide - Microscopes - Insect cabinet mounting boards preservatives.

	<ul style="list-style-type: none"> i. Mounting plant materials to preserve colour for display in museum. ii. Dry mount of plant material using plant press. iii. Maceration and mounting of insects and insect parts. iv. Mounting of stained plant and animal tissues using Canadian balsam. <p>1.6 Explain smears and squash mounts as examples used in temporary preparations for microscopic examination</p> <p>1.7 Collect and mount materials in 1.5 above.</p> <p>1.8 Describe the techniques involved in the preparation of skeleton of fish, frog, crocodile or any reptile, the bird, rabbit and dog.</p> <p>1.9 Prepare and mount any three skeletons in 1.8 above.</p>		
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	<p>2.5 List the types of foods of the aquarium inmates and their dietary importance.</p> <p>2.6 Describe with examples the various types of plants used in different types of aquaria.</p> <p>2.7 Set up cold fresh water, tropical and marine aquaria and introduce the appropriate inmate.</p> <p>2.8 Describe the techniques for the regular measurements of salinity, determination of chlorine, PH and cleanliness of substrate or base media in an aquarium.</p> <p>2.9 Define the term vivaria ad relate this to frogery.</p> <p>2.10 List the materials necessary for setting-up a vivaria, which has both aquatic and terrestrial zones.</p> <p>2.11 Explain how frogs, toads and other vivarian inmates could be reared and fed.</p> <p>2.12 Explain how contamination could be prevented in vivaria.</p> <p>2.13 Draw a typically balanced vivaria.</p> <p>2.14 Set up a typical vivaria and introduce the various inmates.</p>		
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6	<p><u>Feeding and Maintenance of Laboratory Animals in Cages</u></p> <p>2.15 Describe the conditions and the type of environment required for an animal house such as lighting, heating and ventilation.</p> <p>2.16 Describe the construction and the quality of various types of animal cages.</p> <p>2.17 Describe materials that can be used for construction of animal cages.</p> <p>2.18 Explain the importance of a balanced diet in the feeding of caged laboratory animals.</p> <p>2.19 Explain the importance of the control of food infestation and contamination by pests.</p> <p>2.20 Describe the various methods of marking caged laboratory animals as well as other animals raised and bred in animal house.</p>		
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<u>WEEK</u>	General Objectives: 3.0 know the techniques of setting-up and maintenance of small biological garden (Botanical and Zoological).		
7	<p><u>Botanical Garden</u></p> <p>3.1 Describe a typical botanical garden</p> <p>3.2 List the various uses of a botanical garden.</p> <p>3.3 Describe the layout of a suitably sized botanical garden.</p> <p>3.4 Explain the uses of the two units of botanical garden i.e. experimental and production units.</p> <p>3.5 List the plants grown in a botanical garden and give their botanical names.</p> <p>3.6 Describe the essential facilities to be provided in a botanical garden (i.e water supply, deep and shallow water ponds etc.)</p> <p>3.7 List the types of organisms that could normally exist in the pond of a botanical garden (i.e. algae protozoa, diatoms etc).</p>		
8	<p>3.8 Describe the essential features of a green house as related to a botanical garden.</p> <p>3.9 List the plants and other organisms that are cultured in the green house.</p>		

<p>9</p>	<p><u>Zoological Garden</u> 3.10 Distinguish between botanical and a zoological garden. 3.11 List the essential features of a zoological garden. 3.12 Explain the importance of dividing the zoological garden into units (i.e production unit and experimental unit.) 3.13 List the major differences between the two units, in 3.12 above.</p>	<p>Undertake a visit to a botanical garden</p>	<p>Botanical garden</p>
<p>10</p>	<p>3.14 Describe the essential requirements of an animal house (i.e building materials, building material equipment, apparatus, feeding utensils, nesting materials and proper animal feeds.)</p>	<p>Carry out a visit to a zoological garden</p>	<p>Zoological garden</p>

<u>WEEK</u>	General Objectives: 4.0 Understand the techniques of raising/breeding of laboratory animals (Zoological).		
	<p><u>Raising/Breeding of Laboratory Animals</u></p> <p>4.1 List the common laboratory animals that are generally used for biological experiments (example guinea pigs, mice, rabbits, rats etc.)</p> <p>4.2 State the effect of environmental factors on the breeding of the animals listed in 4.1 above.</p> <p>4.3 Explain the methods of breeding of the various species of these laboratory animals.</p> <p>4.4 Select appropriate animal house for at least two animals, design and construct such houses.</p> <p>4.5 Breed animals in the house constructed in 4.4 above and provide them with the necessary facilities.</p> <p>4.6 Explain the significance of record keeping as it affects the breeding of laboratory animals.</p> <p>4.7 Keep records of laboratory animals i.e with regards to number of males, females, young, age, birth, death etc.</p> <p>4.8 Describe the importance of regular cleaning of the animal house.</p> <p>4.9 List common diseases of laboratory animals, their symptoms, prevention and their treatments.</p>	<p>Demonstrate the construction of experimental animal house.</p>	<p>Animal house.</p>

STD 325 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
2	1.7	Collect and mount materials in 1.5 above	Demonstrate mounting of materials	
	1.9	Prepare and mount any three skeletons in 1.8 above.	Supervise mounting of skeletons	
4.	2.7	Set up cold fresh water, tropical and marine aquaria and introduce the appropriate inmate.	Supervise setting up of aquaria	
5	2.13	Draw a typically balanced vivaria		
	2.14	Set up a typical vivaria and introduce the various inmates.	Supervise animal house construction	
11-12	4.4	Select appropriate animal house for at least two animals, design and construct such houses.	Supervise animal house construction	
	4.5	Breed animals in the house constructed in 4.4 above and provide them with the necessary facilities.		
	4.7	Keep records of laboratory animals i.e with regards to number of males, females, young age, birth, death etc.	Design types of records.	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY)

COURSE: ENVIRONMENTAL CHEMISTRY

CODE: STB 326

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 2

UNITS: 2

GOAL: This course is designed to acquaint students with the knowledge of chemical pollutants and its effects on man.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Understand the basic Chemistry of soil.
- 2.0 Understand the application of Chemistry to the solution of environmental pollution.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: ENVIRONMENTAL CHEMISTRY		Course Code STB 326	Contact Hours: 45 hrs. 1 hour lecturer, 2hours practical 1-0-2
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 Understand the basic chemistry of soil.		
1-2	Specific Learning Objective:	Teachers Activities	Resources
	<u>Soil Chemistry</u> 1.1 List the organic matter present in the soil. 1.2 Explain factors affecting decomposition of organic matter in the soil. 1.3 Explain the benefits of organic matter in the soil. 1.4 Carry out a test of organic matter in the soil. 1.5 Define cation exchange capacity of soil. 1.6 Explain the origin of charges in the soil. 1.7 Define Base Saturation of soil 1.8 Explain the significance of Base Saturation of soil. 1.9 Explain the origin and nature of soil acidity and alkalinity. 1.10List elements presents in the soil. 1.11Explain the benefits of elements listed in 1.10 above. 1.12Test soil samples for acidity, alkalinity and element. 1.13Identify causes of deficiencies in the soil. 1.14Describe methods for remedying 1.12 above. 1.15Classify fertilizers in accordance with soil requirement, experimentally. 1.16Describe method of applying fertilizers in the soil. 1.17Determine soil elements e.g. Ca ⁺⁺ , P, K, Zn, Al ³⁺ Na ⁺⁺ etc.	Carry out test of organic matter in the soil.	PH meter, colorimeter, flame photometer. Atomic Absorption spectrophotometer.

WEEK	General Objectives:2.0 Understand the application of Chemistry to the solution of Environmental pollution		
	Specific Learning Objective:	Teachers Activities	Resources
<p>3-4</p> <p>5-6</p>	<p><u>Environmental Chemistry</u></p> <p>2.1 Define the term environment.</p> <p>2.2 List the constituents of ecosystem.</p> <p>2.3 Describe the uses to which man puts water, air and land.</p> <p>2.4 Explain the effects of the activities of man on the quality of the environment.</p> <p>2.5 Explain the on-set (threshold) of environmental pollution.</p> <p>2.6 Define environmental pollution.</p> <p>2.7 List sources of environmental pollution</p> <p>2.8 Explain the uses to which the aquatic environment is put by man and aquatic organisms.</p> <p>2.9 Explain water quality.</p> <p>2.10 Explain that water quality standard varies for the intended water uses.</p> <p>2.11 Visit various ecological areas around the school. Report your findings with reference to pollution, effects of activities of man on the environment etc.</p> <p>2.12 Describe parameters that are used to assess water quality e.g. dissolved Oxygen (DO), PH, alkalinity/ acidity, hardness, colour, turbidity, metals, etc.</p>	<p>Demonstrate Practical identification of water pollutants.</p>	<p>Field work II</p> <p>Transport</p> <p>PH- meter, Dissolved Oxygen meter, soil –test kit, turbidimeter.</p>

	<p>2.13 Determine dissolved oxygen (DO), PH, Acidity and alkalinity of water.</p> <p>2.14 State the units for expressing values of the parameters in 2.11 above.</p> <p>2.15 Explain the sanitary significance of parameters determined in 2.11 above.</p> <p>2.16 Explain on-set of water pollution collect and</p> <p>2.17 List major sources of water pollution collect and identify water.</p> <p>2.18 Describe natural purification/water assimilation capacity of a natural body of water.</p> <p>2.19 Explain eutrophication.</p> <p>2.20 Explain acid mine drainage</p> <p>2.21 List parameters used as water pollution index.</p> <p>2.22 Describe water pollution measures under the following.</p> <ol style="list-style-type: none"> i. Water pollution control body ii. Water quality standards iii. Municipal waste water treatment facilities. iv. Pretreatment of industrial water <p>2.23 Collect and identify water pollutants.</p> <p>2.24 Explain the occurrence of DO in the aquatic environment.</p>	<p>Demonstrate Practical measurement of BOD, pH, suspended solids.</p>	<p>PH meter, TDS-meter, Dissolved oxygen meter.</p>
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	<p>2.25 Explain the chemistry of DO measure.</p> <p>2.26 Explain the term waste water.</p> <p>2.27 List types and sources of waste water.</p> <p>2.28 Describe effects of controlled discharge of water into the environment, e.g. into a water course.</p> <p>2.29 List parameters for analyzing wastewater: e.g. PH, suspended solids, settle able solids, biochemical oxygen demand (BOD), chemical oxygen demand (COD), etc.</p> <p>2.30 Define BOD (i.e Biochemical Oxygen demand (COD)). Etc.</p> <p>2.31 Describe the procedure for BOD test</p> <p>2.32 List important uses of the BOD test.</p> <p>2.33 Determine pH, suspended solid, BOD etc.</p> <p>2.34 Carry out BOD test and list important uses of BOD test.</p> <p>2.35 Apply chemical kinetics to the explanation of reactions.</p> <p>2.36 State the formulae for the calculation of BOD results</p> <p>2.37 Define COD (chemical oxygen demand).</p> <p>2.38 List applications of COD data.</p> <p>2.39 Calculate chemical oxygen demand (COD)</p> <p>2.40 Explain the chemistry of COD test</p> <p>2.41 State the formulae for the calculation of result.</p> <p>2.42 Correlate BOD/COD values for waste.</p> <p>2.43 Define ambient air.</p> <p>2.44 Explain effects of high undesirable air pollutants on man's health.</p>		<p>COD meter.</p>
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	<p>2.45 List sources of thermal pollution.</p> <p>2.46 Define once-through cooling.</p> <p>2.47 Explain thermal shock.</p> <p>2.48 Explain tolerance limit of temperature</p> <p>2.49 Explain temperature inversion.</p>		
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STB 326 PRACTICAL CONTENT

WEEK	SPECIFIC LERNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1-2	1.4	Carry out a test of organic matter in the soil	Describe the analysis for organic matter.	
	1.12	Test soil samples for acidity, alkalinity and element.	Demonstrate soil test for acidity etc.	
	1.13	Identify causes of deficiencies in the soil.	Analyze soil	
	1.17	Determine soil elements e.g. Ca ⁺⁺ , P,K,Zn, A13+Na ⁺⁺ etc.	Describe method of determining soil elements.	
3-4	2.11	Visit various ecological areas around the school. Report your findings with reference to pollution, effects of activities of man on the environment etc.	Undertake field trip	
5-6	2.13	Determine dissolved oxygen (DO), PH, Acidity and alkalinity of water	Describe how to determine these items	
	2.23	Collect and identify water pollutants	Supervise the identification of water pollutants.	
7-8	2.33	Determine PH, Suspended solid, BOD etc.	Describe how to determine these parameters	
	2.34	Carry out BOD test and list important uses of BOD test.	Supervise BOD test	
9.11	2.35	Apply Chemical kinetics to the explanation of reactions.	Explain Chemical kinetics	
	2.39	Calculate Chemical oxygen demand (COD)	Explain how to calculate (COD)	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY)

COURSE: PRINCIPLES OF TOXICOLOGY II

CODE: STB 411

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 3

UNITS: 3

GOAL: This course is designed to equip students with knowledge of advanced principles of toxicology.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the toxicants in the environment.
- 2.0 Understand toxic effects of toxicants.
- 3.0 Know absorption, distribution and excretion of toxicants.
- 4.0 Understand metabolism and Biotransformation of toxicants.
- 5.0 Know toxicity testing.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Principles of Toxicology II		Course Code STB 411	Contact Hours: 75 hrs. 2-0-3
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 Know the toxicants in the environment		
	Specific Learning Objective:	Teachers Activities	Resources
1	<p>1.1 List the toxicants in atmospheric, aquatic, and terrestrial environments.</p> <p>1.2 Explain the sources of the toxicants listed in 1.1 above.</p> <p>1.3 Explain the fate of the toxicants in the environment.</p> <p>1.4 Describe the effects of toxicants on the environment and health.</p> <p>1.5 List some toxic metals in the environment e.g. aluminium, copper, mercury, lead bismuth, chromium etc.</p> <p>1.6 Describe the toxicology of the metals listed in 1.5 above.</p> <p>1.7 Determine the toxicity of the metals listed in 1.5 above.</p> <p>1.8 List some toxic pesticides in the environment.</p> <p>1.9 Describe the toxicology of the pesticides listed in 1.8 above.</p> <p>1.10 Determine the toxicity of the pesticides listed in 1.8 above.</p>	<p>Discuss the determination of toxicity</p>	<p>Radiation monitor pH meter Toxicity kit. Radiation monitor pH meter magnetic stirrer, Toxicity kit.</p>

<u>WEEK</u>	<u>General Objectives: 2.0 Understand toxic effects of toxicants.</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
2-3	<p>2.1 Describe the spectrum of toxic effects namely:- local and systemic effects; reversible and irreversible effects, immediate and delayed effects. Morphologic, functional and Biochemical effects; Allergic and idiosyncratic reactions; Graded and Quantal Responses.</p> <p>2.2 Identify target organs of toxicants.</p> <p>2.3 Describe the factors that enable toxicants to act specifically on certain organs e.g sensitivity of the organ, toxicant distribution, selective uptake, and Biotransformation and repair mechanism..</p> <p>2.4 Describe the mechanism of action of some toxicants e.g. carbon monoxide, nitrites, organotins, cyanide, ozone, mutagens, paraquat, Dinitrophenol, rotenone etc.</p> <p>2.5 Describe the effects of toxicants on proteins (receptors, Enzymes, Carriers) structural proteins (collagen, cytoskeleton), Coenzymes, lipids, nucleic acids (Deoxyribonucleic acid and Ribonucleic acid.</p>	Highlight the effects of toxicants.	

	<p>2.6 Describe other effects of toxicants in the body e.g Hypersensitivity, cross-sensitization, destruction of local tissues, Blockade of renal and biliary tubules.</p> <p>2.7 Explain the differences between administered dosage and effective dosage of toxicants in the blood stream.</p> <p>2.8 Explain the effect of dose and duration exposure on the nature and extent of the toxic manifestations in an organism.</p>		
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WEEK	General Objectives: 3.0 Know Absorption, Distribution and Excretion of Toxicants		
	Specific Learning Objective:	Teachers Activities	Resources
4-6	<p>3.1 Describe the structure of a cell maintenance.</p> <p>3.2 Describe the four mechanisms by which a toxicant may pass through a cell membrane namely; passive diffusion; filtration; carrier-mediated transport; endocytosis.</p> <p>3.3 Describe the routes of toxicants absorption into the animal body e.g. gastrointestinal tract, lungs, skin, intraperitoneal; intramuscular and subcutaneous.</p> <p>3.4 Explain the factors that affect the rate of toxicant absorption and distribution in the body.</p> <p>3.5 Describe the different barriers encountered by toxicants during distribution e.g. blood brain barrier, placental barrier.</p> <p>3.6 Explain the role of the erythrocytes in the distribution of certain toxicants e.g. in organic mercury compounds, alkyl mercury compounds.</p> <p>3.7 Describe covalent and non-covalent binding of toxicants.</p> <p>3.8 Explain why liver and kidneys have higher capacity for binding of chemicals and toxicants.</p> <p>3.9 Describe the storage centers for toxicants e.g. bones, adipose tissue, plasma proteins, liver, kidneys.</p> <p>3.10 Explain the forms in which toxicants are eliminated.</p> <p>3.11 Describe toxicants excretion through the major routes namely urine, liver, lungs.</p>	<p>Discuss the absorption, distribution and excretion of toxicants.</p>	

	<p>3.12 Describe toxicant excretion through the minor routes namely the gastrointestinal tract, mother's milk, sweat, saliva, cerebrospinal fluid.</p> <p>3.13 Explain the use of a toxicant's half-life in determining the rate of excretion.</p> <p>3.14 Describe with appropriate methods how the under listed factors can be determined at various organs and tissues of the body.</p> <ul style="list-style-type: none"> i) The rate and extent of absorption of toxicants. ii) The rate and extent of distribution of toxicants. iii) The rate and extent of binding and storage of toxicants. iv) The rate and extent of excretion of toxicants. <p>3.15 Identify animals used in toxicity testing in the laboratory.</p> <p>3.16 Determine the rate and extent of absorption, distribution, and excretion of toxicants using the guinea pig.</p>	<p>Practical determination of rate of action of toxicants</p>	<p>Rats, Rabbits guinea pigs, etc. Guinea Pig, toxicity pig.</p>
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WEEK	General Objectives: 4.0 Understand Metabolism and Biotransformation of Toxicants		
7-9	Specific Learning Objective:	Teachers Activities	Resources
	<p>4.1 Explain biotransformation.</p> <p>4.2 List the sites of biotransformation e.g. liver, kidneys, lung, stomach, intestine.</p> <p>4.3 List the factors that affect biotransformation e.g. species, strains, age, sex, exposures to other chemicals.</p> <p>4.4 List the two phases of reaction during biotransformation.</p> <p>4.5 Describe the three types of phase I reaction's Degradation reactions (Oxidation)</p> <ul style="list-style-type: none"> i) Oxidation (Microsomal and non-microsomal), ii) Reduction (Microsomal and non-microsomal.) iii) Hydrolysis. <p>4.6 Describe the different types of phase II (configuration reactions:</p> <ul style="list-style-type: none"> i) Gluconide formation, ii) Sulfate conjugation, iii) Methylation iv) Acetylation, v) Amino-Acid conjugation vi) Glutathione conjugation. 		

	<p>4.7 Explain bioactivation.</p> <p>4.8 List examples of some notable chemicals that are known to be bioactivated.</p> <p>4.9 List the toxic metabolites of the chemicals listed in 4.8 above.</p> <p>4.10 Explain the mechanism of action of the chemicals listed in 4.8 above.</p> <p>4.11 Describe cases of bioactivation e.g. epoxide formation. N-Hydroxylation. Free Radical and Superoxide Formation. Activation in the gastro-intestinal tract.</p> <p>4.12 Explain the consequences of bioactivation.</p> <p>4.13 Explain the importance of various types of biotransformation of a toxicant.</p>		
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WEEK	General Objectives: 5.0 Know Toxicity Testing		
	Specific Learning Objective:	Teachers Activities	Resources
10-12	5.1 Explain toxicity testing. 5.2 Explain toxicologic evaluation. 5.3 Explain the importance of toxicologic evaluation of new chemicals. 5.4 Describe the different approaches used in estimating the “safety” and ”risk” levels of chemicals e.g. Acceptable daily intake approach (ADI) mathematical models e.g. probability models, mechanistic models. 5.5 List the animals used in toxicity testing. 5.6 Describe the procedure for acute toxicity test LD 50. 5.7 Determine acute toxicity of chemicals LD50 5.8 Describe the procedures for skin and eye irritation test e.g. Draize test.		Toxicity kit Draize kit

	<p>5.21 Describe other types of special animal toxicity tests e.g. inhalation (Behavioural) tests, toxicity test; immunotoxicity of tests, toxicokinetics (absorption, distribution, biotransformation and excretion tests.); the development of appropriate antidotes and treatment regimes for poisoning; development of analytic techniques to detect residues of chemicals in tissues and other biological materials.</p> <p>5.22 Carry out immunotoxicity tests.</p> <p>5.23 Determine residues of chemicals in tissues.</p>		
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STB 411 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.7	Determine the toxicity of the metals listed in 1.5 above.	Describe how toxicity of metals can be determined.	
	1.10	Determine the toxicity of the pesticides listed in 1.8 above.	Demonstrate how toxicity of pesticides can be determined	
2-3	2.2	Identify target organs of toxicants	List the target organs	
4-6	3.15	Identify animals used in toxicity in testing the laboratory.		
	3.17	Determine the rate and extent of absorption, distribution, and excretion of toxicants using the guinea pig.	Supervise toxicant metabolism in the guinea pig.	Guinea Pig
10-12	5.7	Determine acute toxicity of chemicals LD50.	Describe skin and eye irritation test	
	5.9	Carry out skin and eye irritation test using Draize test.	Demonstrate skin and eye irritation test.	
	5.12	Carry out subacute toxicity test using repeated dose	Supervise the testing	
	5.15	Determine chronic and subchronic toxicity of chemicals.	Describe method of determination	
	5.22	Carry out immunotoxicity tests	Demonstrate the test	
	5.23	Determine residues of chemicals in tissues	Describe how residues in tissues can be determined.	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY)

COURSE: ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING

CODE: STB 412

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: This course is designed to provide students with a knowledge of environmental impact assessment techniques and monitoring.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the basic concepts of environmental impact assessment.
- 2.0 Know the institutional and legislative framework of environmental impact assessment and monitoring systems.
- 3.0 Understand the practices and procedures of environmental impact assessment and monitoring.
- 4.0 Know the various environmental impact assessment and monitoring technique
- 5.0 Understand environmental auditing.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Environmental Impact Assessment and Monitoring		<u>Course Code STB 412</u>	Contact Hours: 60rs. (2hrs 2Hrs Lecture 2hours Practical)
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 know the basic concepts of Environmental impact assessment.</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<ul style="list-style-type: none"> 1.1 Explain Environmental impact assessment. 1.2 Explain the meaning and importance of environmental Monitoring systems. 1.3 Explain the meaning and importance of environmental research. 1.4 Define “Environmental impact”. 1.5 Categorize environmental impacts into Primary and secondary impact; Direct and indirect impacts. 1.6 List examples of the different categories of the impacts listed in 1.5 above. 1.7 Describe the different examples of impacts listed in 1.6 above. 1.8 List other types of environmental impacts. 	<p>Introduce concepts of environmental impact assessment.</p>	

<u>WEEK</u>	<u>General Objectives: 2.0 know the Institutional and legislature framework of Environmental impact assessment and monitoring systems.</u>		
<u>2</u>	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
	<p>2.1 Outline the history of environmental impact assessment and monitoring.</p> <p>2.2 State the objectives of Environmental impact assessment decree of Federal Government of Nigeria.</p> <p>2.3 Explain the Federal Ministry of Environment’s procedural and sectoral guidelines on Environmental impact assessment process in Nigeria.</p> <p>2.4 Describe the criteria for project categorization.</p> <p>2.5 List some projects for which environmental impact assessment is mandatory, not mandatory, not required.</p> <p>2.6 Describe the environmental impact assessment requirements for petroleum and petrochemicals, infrastructure, Manufacturing industries, Agriculture, and mining.</p>	<p>Discuss the institutional and legislative basis of environmental impact assessment and monitoring.</p>	

<u>WEEK</u>	General Objectives: 3.0 Understand the practices and procedures of Environmental impact assessment and monitoring		
	Specific Learning Objective:	Teachers Activities	Resources
3-4	<p>3.1 Describe the environmental impact Assessment process namely:-</p> <ol style="list-style-type: none"> 1) Screening 2) Preliminary Assessment 3) Full EIA process <ol style="list-style-type: none"> a) Scoping b) EIA study <ol style="list-style-type: none"> i) Baseline studies ii) Impact prediction and qualification iii) Mitigation. 4) EIA review. 5) Consultation and Public participation 6) Synthesizing the findings of consultation. 7) Decision making 8) Implementation 9) Post-Auditing. <p>3.2 Explain the importance of each EIA process stage in 3.1 above.</p> <p>3.3 Describe the two component parts of EIA viz. Social impact Assessment and Environmental Health impact Assessment.</p>	<p>Highlight the practices and procedures in vogue in Nigeria.</p>	

	<p>3.4 Explain important principles of EIA management.</p> <p>3.5 List the information sources and materials for EIA studies.</p> <p>3.6 Described the difficulties facing the adoption of the concept and principles of EIA in Nigeria</p> <p>3.7 Explain possible solutions to the difficulties described in 3.6 above.</p> <p>3.8 Explain the role of EIA in national development.</p>		
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WEEK	General Objectives:4.0 Know the various Environment impact assessment and monitoring techniques		
5	Specific Learning Objective:	Teachers Activities	Resources
	<p>4.1 Survey and choose a permanent project site for the study e.g. site for construction of oil and gas pipelines, site for the construction of a multi-purpose dam.</p> <p>4.2 Describe the direct and indirect methods of conducting as scooping exercise.</p> <p>4.3 Carry out a scooping exercise in a chosen site.</p> <p>4.4 Describe the various methods used in base line studies e.g sampling, field surveys etc.</p> <p>4.5 Carry out baseline studies of a site.</p> <p>4.6 Describe the use of checklists in identification of potential impacts e.g. Simple list of parameters, descriptive scaled-checklists and weighted checklists.</p> <p>4.7 Describe the use of matrices e.g. Leopold matrix in identification of potential impacts.</p> <p>4.8 Describe the use of networks e.g. Sorensen's network in identification of potential impacts.</p> <p>4.9 Describe the use of Cross Impact matrices e.g. Ross interaction matrix in identification of potential impacts.</p> <p>4.10 Describe other methods used in potential impact identification e.g. Map overlays (such as Mettarg; Gilliland and Riss Flow diagrams and network analysis, Environmental Evaluation system (EES)</p> <p>4.11 Visit a chosen site and identify potential impacts on the environment using the methods described in 4.5-4.9 above.</p>	Demonstrate scooping exercise	Throw-disc, theodolite, computer.

	<p>4.12 Describe the various methods used in the prediction of the magnitude, extent and significance of impact e.g. trend extrapolation, Delphi, metaphors, simulations and analogies, scenario writing, modeling etc.</p> <p>4.13 Describe the different methods used in impact evaluation e.g. trade off analysis, sensitivity Analysis, Subjective impact ranking, Ranking procedure for alternatives within each impact category, weighting procedures e.g. battler's Environmental evaluation system risk assessment.</p> <p>4.14 Predict the magnitude, extent and significance of the impact using the methods described in 4.13 above.</p> <p>4.15 Describe the various methods of organization and presentation of data e.g. graphs, tables write-ups, and audio-visuials.</p> <p>4.16 Organize and present assessment data in charts graphs tables etc.</p> <p>4.17 Describe the elements of EIA report/statement.</p> <p>4.18 Describe the EIA report writing formal.</p> <p>4.19 Write an EIA report</p> <p>4.20 State the Federal Ministry of Environment Criteria for review of EIA reports.</p>	<p>Demonstrate practical assessment and prediction of impact.</p>	<p>Theodolite throw-disk Computer cendrat transect.</p>
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<u>WEEK</u>	General Objectives: 5.0 Understand Environmental Auditing		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
	5.1 Explain the meaning and importance of environmental auditing. 5.2 Describe an environmental auditing scheme. 5.3 List the factors affecting environmental auditing. 5.4 Describe the basic principles and general approach to environmental auditing. 5.5 Describe the types of environmental audit. 5.6 State the composition of an audit team. 5.7 Describe the three major steps of environmental audit namely: i) Pre-audit activities ii) Activities at site iii) Post audit Activities. 5.8 Describe the Environmental audit report-writing format. 5.9 Carry out an environmental audit programme.	Discuss the process of environmental auditing.	

STB 412 PRACTICAL CONTENTS

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITY	RESOURCES
5	4.1	Survey and choose a permanent project site for the study e.g. site for the construction of oil and gas pipelines, site for the construction of a multi-purpose dam.	Supervise the survey and choice of project site.	
	4.3	Carry out a scooping exercise in a chosen site.	Demonstrate scooping exercise	
	4.5	Carry out baseline studies of a site.	Supervise baseline studies	
6-7	4.11	Visit a chosen site and identify potential impacts on the environment using the methods described in 4.5-4.9 above	Field Trip	
	4.16	Organize and present assessment data in charts graphs tables etc.	Explain presentation of data	
	4.19	State the Federal Ministry of Environment Criteria for review of EIA reports.	Discuss report writing	
	5.9	Carry out an environmental audit programme	Explain environment audit programme.	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: ENVIRONMENTAL MICROBIOLOGY

CODE: STB 413

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 2

UNITS: 2

GOAL: This course is designed to inform the student on the presence of microbes in the environment and the activities of soil microbes.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the concept of environment.
- 2.0 Know the composition of the soil.
- 3.0 Know how to isolate micro-organisms from the soil by different methods.
- 4.0 Understand the role of microbes in the soil.
- 5.0 Know the various pollutants of the soil.
- 6.0 Know the sources and analysis of water.
- 7.0 Understand Eutrophication as resulting from water pollution by algae.
- 8.0 Know the various types of water-borne diseases and their causative agents.
- 9.0 Know the conventional methods of waste and waste water treatment.
- 10.0 Understand the sources and effects of air pollutants.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Environmental Microbiology		<u>Course Code STB 413</u>	Contact Hours: 45hrs. (3hrs/week 1-0-2)
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 Know the concept of environment.</u>		
1	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
	<u>Presence and Effects of Microorganisms on the Environment</u> 1.1 Describe the various conditions of the environment e.g. soil-sandy, clay, loamy etc. Water-pure, impure, hard etc. Air-polluted, pure etc. 1.2 Collect different types of soil samples and test for porosity and capillarity. 1.3 Describe changes in the environment with the seasons.	Demonstrate how to collect Soil sample.	Different soil samples soil auger.
<u>WEEK</u>	<u>General Objectives:2.0 Know the composition of the soil</u>		
2	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
	<u>Soil As An Environment</u> 2.1 List the five major constituents of the soil:- Mineral particles, organic residues, water, gases and biological systems. 2.2 List the composition of the microbial floral of the soil. 2.3 Describe the conditions affecting the microbial population in the soil. 2.4 Explain the following ecological interactions in soil: antagonism, predation, Isolation and identification of soil microbes.	Explain soil constituents	

WEEK	General Objectives:3.0 Know how to isolate microorganisms from the soil by different methods.		
3	Specific Learning Objective:	Teachers Activities	Resources
	<p><u>Different methods of isolating microorganism</u></p> <p>3.1 Explain the soil as a culture medium</p> <p>3.2 Isolate microorganisms by selective and differential media from the soil.</p> <p>3.3 Select autotrophic microorganisms by the scheme of Winogradsky.</p> <p>3.4 Isolate phototrophic bacteria by membrane filtration method.</p> <p>3.5 Identify some of the isolated microorganisms in 3.2 above.</p>	<p>Demonstrate practical isolation and identification of microorganisms</p>	<p>Autoclave, Incubator, microscope media.</p> <p>Membrane filtration equipment.</p>

WEEK	General Objectives:4.0 Understand the role of microbes in the soil.		
4	Specific Learning Objective:	Teachers Activities	Resources
	<p><u>Role of Microbes in Recycling of Elements.</u></p> <p>4.1 List and explain biogeochemical activity of microorganisms on soil.</p> <p>4.2 Explain the transformation of carbon compounds in the soil.</p> <p>4.3 Explain the oxygen cycle.</p> <p>4.4 Explain the transformation of nitrogen compounds.</p> <p>4.5 List and describe fixing microorganisms.</p> <p>4.6 Explain Ammonification and Nitrification.</p> <p>4.7 Explain the oxidation of sulfur and sulfur compounds.</p> <p>4.8 Explain phosphorus, iron and manganese cycles.</p> <p>4.9 Explain the relationship between higher plants and soil microorganisms.</p>	<p>Discuss the role of microbes in the soil.</p>	

WEEK	General Objectives:5.0 Understand the role of microbes in the soil.		
5	Specific Learning Objective:	Teachers Activities	Resources
	<p style="text-align: center;"><u>Soil Pollutants:</u></p> <p>5.1 Explain sources of pesticides, petroleum hydrocarbons and detergents polluting the soil.</p> <p>5.2 Describe biodegradation of the pollutants in 5.1 above by the soil microorganisms.</p> <p>5.3 Explain persistence of the pollutants in 5.1 above and their effect on the biota e.g. biomagnification etc.</p> <p>5.4 Describe the control of pollution by petroleum hydrocarbons.</p> <p>5.5 Explain sources of metal pollution of the soil e.g. acid- mine drainage, microbial leaching etc.</p> <p>5.6 Describe the control of metal pollution..</p>		

WEEK	General Objectives:6.0 Know the sources and analysis of water.		
6-7	Specific Learning Objective:	Teachers Activities	Resources
	<p><u>Analysis of Potable and polluted Water</u></p> <p>6.1 Explain the occurrence and types of water to include the hydrologic cycle.</p> <p>6.2 List the properties of the aquatic environment.</p> <p>6.3 List the properties and components of</p> <p>i) Potable water</p> <p>ii) Polluted water</p> <p>6.4 Explain the various indices of water pollution.</p> <p>6.5 Explain the terms sewage, Biological oxygen Demand (BOD) Chemical Oxygen Demand (COD)</p> <p>6.6 Determine the extent of water pollution by MPN, Membrane filter technique.</p> <p>6.7 Explain the system of water purification.</p> <p>6.8 List and explain international standards for drinking, recreational and factory waters.</p>	<p>Demonstrate procedure for analysis of water.</p>	<p>Membrane filtration equipment.</p>
WEEK	General Objectives:7.0 Understand Eutrophication as resulting from water pollution by algae		
8	Specific Learning Objective:	Teachers Activities	Resources
	<p><u>Eutrophication</u></p> <p>7.1 Explain the term “Eutrophication” and the various algae involved.</p> <p>7.2 List the sources of nutrients and factors responsible for eutrophication.</p> <p>7.3 Explain the consequences of eutrophication on national economy.</p> <p>7.4 Explain the various methods of control of eutrophication.</p>	<p>Discuss water pollution by algae.</p>	

WEEK	General Objectives:8.0 Know the various types of water-borne diseases and their causative agents.		
9	Specific Learning Objective:	Teachers Activities	Resources
	<p style="text-align: center;"><u>Water Borne Diseases</u></p> <p>8.1 List various water-borne diseases.</p> <p>8.2 List the causative agents (organisms) of the diseases in 8.1 above.</p> <p>8.3 Describe the various sources of the organisms in 8.2 above.</p> <p>8.4 Describe the prevention and control of diseases in 8.1. above.</p>		
WEEK	General Objectives:9.0 Know the conventional methods of waste and waste water treatment.		
10	Specific Learning Objective:	Teachers Activities	Resources
	<p style="text-align: center;"><u>Waste and waste-Water Treatment</u></p> <p>9.1 Describe the various procedures and stages in solid waste treatment-composting, sanitary landfills etc.</p> <p>9.2 Describe the conventional procedures in waste treatment-Biological oxidation, Anaerobic decomposition etc.</p> <p>9.3 Describe modern methods of waste water treatment-Nitrogen stripping, Desalination etc.</p> <p>9.4 Explain the uses of by-products in 9.1 – 9.3 above e.g. composts and agriculture, animal feeds etc.</p>	<p>Explain the process in solid waste treatment.</p>	

<u>WEEK</u>	General Objectives: 10.0 Understand the sources and effects of air pollutants.		
	Specific Learning Objective:	<u>Teachers Activities</u>	<u>Resources</u>
	<p style="text-align: center;"><u>Air Pollution</u></p> <p>10.1 Explain air pollution due to chemical and microbial processes e.g. Gaseous industrial effluents, methanogenesis, automobiles etc.</p> <p>10.2 Identify microbial indicators used in monitoring air pollution e.g. sulfur bacteria.</p> <p>10.3 Describe sample air of air pollutants on man and plants.</p> <p>10.4 Describe control methods of air pollution.-</p>	Carry out identification of air borne bacteria.	<ul style="list-style-type: none"> - <u>Autoclave</u> - <u>Incubators</u> - <u>Microscopes</u>

STB 413 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.2	Collect difference types of soil samples and test for porosity and capillarity.	Demonstrate how to collect soil samples	Anger, soil samples
3	3.2	Isolate microorganisms by selective and differential media from the soil.	Demonstrate how to isolate microorganisms.	
	3.3	Select autotrophic microorganisms by the scheme of Winogradsky	Supervise how to isolate microorganisms.	
	3.4	Isolate phototropic bacteria by membrane filtration method	Demonstrate the isolation process	
	3.5	Identify some of the isolated microorganisms in 3.2 above	Supervise the identification of isolated microorganisms	Autoclave, incubator, microscope.
6-7	6.6	Determine the extent of water pollution by MPN, Membrane filter technique	Demonstrate the membrane filter technique.	Membrane filtration equipment.
10	10.2	Identify microbial indicators used in monitoring air pollution e.g. sulfur bacteria.	List the microbial indicators	- Autoclave - Incubators - Microscope

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: HYDROBIOLOGY AND FISHERIES

CODE: STB 414

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 2

UNITS: 3

GOAL: This course is designed to acquaint the students with the biology of Coastal and Inland Water Fishes and Fishery Practices and techniques.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Understand the theory and techniques of limnology
- 2.0 Understand the features of oceanography and Estuarinology.
- 3.0 Understand Marine fish cropping techniques.
- 4.0 Understand fishery economics.
- 5.0 Know Nigerian and International laws, norms and conventions of the sea, continental shelf.
- 6.0 Understand methods of fish preservation and processing.
- 7.0 Understand agriculture concepts and practices and relate it to fish Pounding in Nigeria and tropical Africa.
- 8.0 Know fish parasites and diseases.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Hydrobiology and Fishery		Course Code STB 414	Contact Hours: 60hrs. 2-0-2
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 0Understand the theory and techniques of limnology		
	Specific Learning Objective:	Teachers Activities	Resources
1-2	<p style="text-align: center;"><u>Limnology</u></p> <p>1.1 Define limnology.</p> <p>1.2 Classify lakes</p> <p>1.3 List major Nigerian lakes.</p> <p>1.4 Explain the origin of lakes.</p> <p>1.5 Describe the morphometry and morphology of lakes.</p> <p>1.6 Describe the structure, physical, chemical and biological properties of water.</p> <p>1.7 Describe the hydrological cycle and water balance of lakes.</p> <p>1.8 Describe the hydro-mechanics of lakes</p> <p>1.9 Describe the optical properties of lakes.</p> <p>1.10 Describe the thermal properties of lakes including thermal stratification and thermoclines</p> <p>1.11. Distinguish between the inorganic ions, of rain, lakes and river.</p> <p>1.12 Describe the oxygen content of lake waters</p>		

	<p>and their biological significance.</p> <p>1.13 Outline the main characters of the carbon dioxide, hydrogen-ion concentration, the redox potential, iron, phosphorus, sulphur, silica and minor metallic elements and their cycles in lake water.</p> <p>1.14 Describe the nitrogen and organic matter in lakes and their biological importance.</p> <p>1.15 Describe the structure of the lacustrine biological community.</p> <p>1.16 Describe associations of phytoplanktons and zooplanktons and seasonal successions.</p> <p>1.17 Explain the vertical migration and horizontal distribution of zooplanktons.</p> <p>1.18 Undertake a trip to a Nearby Lake etc.</p>	Characters	
General Objectives: 2.0 Understand the features of Oceanography and Estuarinology			
3-4	<p>Oceanography and Estuarinology</p> <p>2.1 Describe the general nature of the sea</p> <p>2.2 Describe the physical and chemical features of estuarine waters.</p> <p>2.3 Describe water movements in estuaries and coastal waters including waves, tides, non-tidal circulation and demonstrate methods of current measurement.</p>		

	<p>2.4 Describe the different features of phytoplanktons of fresh waters, estuarine, coastal and oceanic waters.</p> <p>2.5 Describe the estuarine deposits and list their physical and chemical properties.</p> <p>2.6 Describe sediment transport in estuarine and coastal waters e.g. transport by reaction current, wind-induced mechanisms, tidal effect, ebb and flood channel systems.</p> <p>2.7 Describe benthos and describe the distribution of benthic organisms in relation to salinity.</p> <p>2.8 Describe microbenthos and their composition to include bacteria, fungi, algae, diatoms, protozoa and foraminifera.</p> <p>2.9 Describe the vertical, horizontal and seasonal distribution of microbenthos.</p> <p>2.10 Describe and distinguish the macrobenthos of the rocky shore from that of the sedimentary shores.</p> <p>2.11 Describe the floating and boring organisms of estuaries and shores.</p> <p>2.12 List and describe the in-shore harvest of estuaries and coasts to include sea-weeds, fish, invertebrates, fish diseases and parasite production and marine culture.</p> <p>2.13 Outline the general features of estuarine and coastal waters and their management.</p> <p>2.14 Undertake a trip to Coastal waters etc.</p>		
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	General Objectives: 3.0 Understand marine fish cropping techniques		
5	<p>3.1 Describe the general features of trawlers, continental shelf and oceanic fishing.</p> <p>3.2 Describe fish-cropping by other trawling, multi-rig trawling and Bott-pair trawling.</p> <p>3.3 Describe the structure of encycling fish gear and its fishing techniques.</p> <p>3.4 Describe the purse-seine netting and their maintenance.</p> <p>3.5 Identify navigation equipment.</p> <p>3.6 Describethe use, construction and maintenance of fishing nets.</p>		Transport, net, iron rod, wood, hooks, strings etc.
	General Objectives: 4.0 Understand Fishery economics.		
6	<p>Economic Principles In Fishery</p> <p>4.1 Explain demand and supply and interpret their curses.</p> <p>4.2 Explain economic equilibrium.</p> <p>4.3 Describe the operation of a firm in a competitive industry with reference to Fishery.</p> <p>4.4 Describe and interpret production possibility curve.</p> <p>4.5 Describe the economic functions, advantages and problems of cooperative formations including multi-purpose cooperatives with particular reference to fisheries.</p> <p>4.6 Describe extension services methods in fishery.</p> <p>4.7 Describe production function in fisheries.</p> <p>4.8 Describe economic model of fishery.</p>		Transport.

General Objectives: 5.0 Know Nigerian and International laws, norms and conventions of the sea, continental shelf.			
7	<p style="text-align: center;">International Fisheries Regulation</p> <p>5.1 Explain the regulations for fishing and conservation of living resources of international waters.</p> <p>5.2 Outline the international convention on the high seas.</p> <p>5.3 State and interpret convention on continental shelf.</p> <p>5.4 State and Interpret the law of fishing rights.</p> <p>5.5 State the need for legislation and describe the character and functions of fishery management.</p> <p>5.6 Explain democratic control and policy making in fisheries.</p> <p>5.7 List and explain regulations governing fishing in \Nigerian law and territorial waters.</p>	<p>Review international regulations fisheries.</p>	

General Objectives: 6.0 Understand Methods of fish preservation and processing.			
	Fish preservation and Processing	Lecturer and Field trip.	Transport
8-9	<p>6.1 Describe short-term preservation by chilling and curing</p> <p>6.2 Describe fish preservation by freezing and drying.</p> <p>6.3 Describe and demonstrate fish preservation by salting, e.g. salting fermentation, salting and cured salting.</p> <p>6.4 Describe the influence of size, oil content, and salt concentration on salting.</p> <p>6.5 Describe fish preservation by canning and bottling.</p> <p>6.6 Describe fish preservation by smoking.</p> <p>6.7 Undertake a trip to Fish Processing Company/Outfit.</p> <p style="text-align: center;">Fish Marketing</p> <p>6.8 Describe and explain marketing disposition of world landing</p> <p>6.9 Describe methods of distribution and quality assurance of fishery.</p> <p>6.10 Describe various marketing strategies for fresh fish and problems of fresh fish marketing in Nigeria.</p>	<p>Explain fish processing and preservation.</p>	

	General Objectives: 7.0 Understand aquaculture concepts and practices and relate it to fish ponding in Nigeria and tropical Africa.		
10	<p>Aquaculture concepts and Practices</p> <p>7.1 Describe the conditions suitable for fish culture e.g. oxygen requirement of captive fish.</p> <p>7.2 Explain the use of aquaculture and its economic value.</p> <p>7.3 List and describe various types and kinds of fish food.</p> <p>7.4 Describe various equipment and methods of fish food preparation.</p> <p>7.5 Develop fish food formula and prepare fish food.</p> <p>7.6 Explain stocking and production with respect to:</p> <ol style="list-style-type: none"> 1) stocking capacity and choice of stocking fry 2) single species and multi species stocking. 3) Maximum standing crop. <p>7.7 Describe fish ponds with respect to plant animal relationship, nature of pond soil, importance of phytoplankton, zooplankton and zoobenthos.</p>	<p>Demonstrate fish feed formulation</p>	<p>Soil test kit.</p>

General Objectives: 8.0 Know fish parasites and diseases.			
11 - 12	<p align="center">Fish Parasites and Diseases</p> <p>8.1 List all know fish parasites.</p> <p>8.2 Describe the life cycles of most common fish parasites.</p> <p>8.3 Describe bacterial diseases of fishes to include Haemophilus, aerobacter, Aeromonas and Salmonella.</p> <p>8.4 Describe fungal diseases of fishes including Ichthyophorus and saprolegniasis.</p> <p>8.5 Describe fish lesions of protozoan disease including flagellates, Amoeba, Sporozoans, Ciliates and suctionians.</p> <p>8.6 Identify fish lesions due to intenal helminthes, e.g adult trematodes, metacercaria, cestodes, nematodes and acanthocephallans.</p> <p>8.7 Identify fish diseases of crustacea and pisces parasites.</p> <p>8.8 Describe methods of control/prevention and treatment of fish disease e.g.:</p> <ol style="list-style-type: none"> 1) treatment of fish 2) removal of all infected fishes 3) application of brine, lime, caustic soda etc. 4) Disinfection and sterilization of ponds etc 5) total destruction and draining of infected ponds 6) maintenance of sanitary conditions and general cleanliness. 		Preserved specimens or slides of trematodes, metacercasia, cestodes, nematodes and acanthocephallans.

STB 414 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1-2	1.18	Describe the hydro-mechanics of lakes	Field trip	
3-4	2.14	Undertake a trip to Coastal waters etc.	Field trip	
	3.5	Identify navigation equipment	List navigation equipment	
8-9	6.3	Describe and demonstrate fish preservation by salting e.g. salting fermentation, salting and cured salting.	Explain fish preservation methods	
	6.7	Undertake a trip to Fish Processing Company/Outfit	Field trip	
10	7.5	Develop fish food formula and prepare fish food	Demonstrate feed formulation	
11-12	8.6	Identify fish lesions due to internal helminthes, e.g. adult trematodes, metacercaria, cestodes, nematodes and acanthocephalans.	Describe fish lesions due to internal helminthes.	
	8.7	Identify fish diseases of crustacea and pisces parasites	Describe parasitic diseases	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: PRINCIPLES OF NATURAL RESOURCE MANAGEMENT

CODE: STB 415

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 0

UNITS: 2

GOAL: This course is designed to educate students on the principles of natural resources management.

GENERAL OBJECTIVES:

- 1.0 Know the types and origin of Natural resources.
- 2.0 Know wild life resources and management.
- 3.0 Know soil resources and management.
- 4.0 Know Agro-ecosystem resources and management.
- 5.0 Know forest ecosystems and management.
- 6.0 Know aquatic ecosystems resources and management
- 7.0 Understand Ecological Engineering.
- 8.0 Understand resource economics.
- 9.0 Understand environmental conservation.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Principles of Natural Resources Management Microbiology		Course Code STB 415	Contact Hours: 30hrs. (2hrs Lecture, 2hrs practical)
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 0 Know the types and origin of National Resources		
	Specific Learning Objective:	Teachers Activities	Resources
1	1.1 Define environment. 1.2 Define an ecosystem 1.3 List the biotic and a biotic factors of the ecosystem 1.4 Describe the marine, freshwater and terrestrial ecosystems. 1.5 Describe energy flow and nutrient cycles of an ecosystem 1.6 Define resource 1.7 Explain resource management 1.8 Classify resources into renewable and non-renewable resources. 1.9 Explain the origin of natural resources. 1.10 Describe the different types of natural resources.		Chart of Nutrient cycle.

<u>General Objectives: 2.0 Know the wildlife resources and management</u>		
<p>2.1 Define the word “wild”</p> <p>2.2 List wild life resources (plants and animals)</p> <p>2.3 Describe a wilderness the habitat of wild life.</p> <p>2.4 Explain the values of wildlife</p> <p>2.5 Explain the meaning of wildlife destruction</p> <p>2.6 Explain the causes of wild life destruction.</p> <p>2.7 Explain the meaning of endangered species</p> <p>2.8 List examples of endangered species.</p> <p>2.9 Explain the meaning of threatened species.</p> <p>2.10 List examples of threatened species.</p> <p>2.11 Explain the meaning of extinct species.</p> <p>2.12 List examples of extinct species.</p> <p>2.13 Describe the different ways of conserving wild life</p> <p>2.14 Explain the status of wild life conservation in Nigeria.</p> <p>2.15 Carry out a visit to a game reserve and record the wild life animals present</p>		<p>Chart of different wild animals.</p> <p>Charts of endangered species of wild animals charts, of threatened species of wild animals, charts of extinct species of wild animals.</p>
<u>General Objectives: 3.0 Know Soil resources and management</u>		
<p>3.1 Describe the constituents and properties of the soil.</p> <p>3.2 List soil resources e.g. trees, minerals precious stones, <u>tantalite</u> <u>Bitumen</u> Iron ore, oil, coal, zinc, columbite.</p> <p>3.3 Explain the importance of soil resources management.</p> <p>3.4 Explain the causes of soil resources destruction e.g popular growth, mining, erosion, bush burning.</p>		

	3.5 Explain the different ways of achieving soil resources conservation and management.		
	General Objectives: 4.0 Know Agro-Ecosystem Resources and Management		
2-4	<p>4.1 List the different agro-ecosystem resources e.g. food crops, fibre crops.</p> <p>4.2 Explain the importance of agro-ecosystem resources.</p> <p>4.3 Describe methods of managing an agro-ecosystem.</p> <p>4.4 Undertake a visit to an agro ecosystem and record your findings.</p>		A chart of different food and fabric crops.
	<u>General Objectives: 5.0 Know forest Ecosystems and Management</u>		
5	<p>5.1 List the forest resources e.g. timber, non timber forest products, fodder, etc.</p> <p>5.2 Explain the importance of forest resources.</p> <p>5.3 Describe the factors that lead to destruction of forest resources.</p> <p>5.4 Describe methods of managing forest resources.</p> <p>5.5 Carry out a visit to a forest and record your findings</p>		Transport

<u>General Objectives: 6.0 Know Aquatic Ecosystem Resources and Management</u>			
	<p>6.1 List the different aquatic ecosystem resources e.g. water, fish, hydroelectricity, dams.</p> <p>6.2 Explain the importance of aquatic ecosystems resources.</p> <p>6.3 Describe the types of damage to aquatic ecosystem caused by pollution e.g. oil spillage, waste dumping, flooding, irrigation etc.</p> <p>6.4 Describe how the damages listed in 6.3 above can be checked.</p> <p>6.5 Describe the different methods of managing an aquatic ecosystem.</p> <p>6.6 Carry out a Visit to an aquatic ecosystem and record your findings.</p>		Transport.
<u>General Objectives: 7.0 Understand Ecological Engineering</u>			
6	<p>7.1 Explain the meaning of ecological Engineering.</p> <p>7.2 List and explain the dependent and controlling factors in an ecosystem.</p> <p>7.3 Describe a case of ecological engineering using range management.</p> <p>7.4 Describe the scientific approach to ecosystem management.</p>		

<u>General Objectives: 8.0 Understand Resource Economics</u>		
7-8	<p>8.1 Explain the meaning of resource economics.</p> <p>8.2 Explain the meaning of economic efficiency.</p> <p>8.3 State the conditions to be satisfied if resource must be used efficiently.</p> <p>8.4 Explain the meaning of optimal use of resource.</p> <p>8.5 State the conditions to be met if resource must be used optimally.</p> <p>8.6 Describe the circumstances under which free market economy allocates resources efficiently and optimally.</p> <p>8.7 Identify and explain the circumstances under which market is likely to fail to allocate resources efficiently.</p> <p>8.8 Explain the meaning of consumer surplus and externalities.</p> <p>8.9 Explain the concepts of rivalry, exclusion and property rights.</p> <p>8.10 Describe the various levels of natural resources utilization namely:- Individual level, family level, community level, National level and International level.</p> <p>8.11 Explain the importance of rational use of natural resources in sustainable development.</p>	

	<p>8.12 Describe steps to be taken to ensure safe exploitation of natural resources.</p> <p>8.13 Explain the impacts of population growth, Agriculture, mining, urbanization and technological development on natural resources.</p> <p>8.14 Describe the administration and management of natural resources in Nigeria.</p>		
<u>General Objectives: 9.0 Understand Environmental conservation</u>			
	<p>9.1 Explain the meaning and importance of environmental conservation.</p> <p>9.2 Explain the concept of biodiversity</p> <p>9.3 Describe the biodiversity components.</p> <p>9.4 Explain the uses of biodiversity.</p> <p>9.5 Describe the threats to biodiversity in Nigeria.</p> <p>9.6 Explain the measures for biodiversity conservation.</p> <p>9.7 Explain the efforts of the Nigerian conservation foundation on biodiversity conservation in Nigeria.</p> <p>9.8 Describe the efforts of the Nigerian Government on Environmental Resources protection.</p>		

	<p>9.9 Describe the global efforts on sustainable development and conservation of natural resources.</p> <p>9.10 Record conservation projects in a specified wilderness.</p> <p>9.11 Undertake a field trip to an agro ecosystem, observe and record conservation projects</p> <p>9.12 Carry out a visit to an aquatic ecosystem, observe and record conservation projects.</p>		
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PROGRAMME: **HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY**
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: **BIOLOGICAL TECHNIQUES III**

CODE: **STB 416**

DURATION: **(HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 2**

UNITS: **2**

GOAL: This course is designed to broaden the knowledge of students on the various methods of collection, preparation and preservation of biological specimens for museums and herbarium.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Understand the techniques involved in taxidermy preparation.
- 2.0 Know the various methods of collection of museum and herbarium specimens, their transportation, preservation, labeling and storage.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Biological Techniques III		<u>Course Code STB 416</u>	Contact Hours: 45hrs. (3Wks Lecture, 2hrs practical
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 Understand the techniques involved in Taxidermy preparation.</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<p>On the completion of this course, the student should be able to:</p> <p>Taxidermy Techniques</p> <p>1.1 Explain taxidermy as a method of preparing birds and mammals for display.</p> <p>1.2 Explain the importance of accurate measurements of parts of specimens before removing the skin.</p> <p>1.3 Explain the importance of other data that may be valuable preparatory to stuffing specimen (e.g colors, weight, sex, habitat etc.).</p>		Dissecting tools, cotton wool.
5	<p>1.4 Describe the advantages of ventral incisions made on mammals when removing the skin, emphasizing on the advantages of small incision over a large one.</p>		

	<p>1.5 Explain the importance of curing the skin after the removal of all subcutaneous fat.</p> <p>1.6 List stiffing materials for preparing false bodies and materials for preparing the limbs to be in life like posture.</p> <p>1.7 Explain the importance of retexturing of skin with magnesium carbonate powder after all necessary stitching has been made.</p> <p>1.8 Explain how competed specimen could be mounted on a wooden or perspex base after it has been set and false eyes positioned.</p> <p>1.9 Prepare stuffed specimen of a bird, a mice or rat and any reptile.</p>		
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	<u>General Objectives: 2.0 Know the various methods of collection of museum and herbarium specimens, their transportation, preservation, labeling and storage.</u>		
6 12	<p align="center">Collection of Museum And Herbarium Specimens</p> <p>2.1 Describe the techniques and purpose of collecting various biological specimens.</p> <p>2.2 List the equipment/materials required for collection of biological specimens from marine, intertidal and terrestrial environments.</p> <p>2.3 Explain how freshly collected biological specimen could be transported to the laboratory.</p> <p>2.4 Describe the measures to be taken to prevent presenting damaged, misshapen, and distorted specimen for use in the laboratories.</p> <p>2.5 Define the term “Preservative” with reference to herbarium and museum specimens.</p> <p>2.6 Describe the techniques for the preparation of plant and animal preservatives.</p> <p>2.7 Outline the importance of adequate labeling and storage of biological specimens.</p> <p>2.8 Collect and mount in dry state: a herbarium specimen and in wet state, a museum specimen.</p>	<p align="center">Supervise the collection and mounting of herbs</p>	<p>Harbarium weed albums.</p>

STB 416 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
5	1.8	Prepare stuffed specimen of a bird, a mice or rat and any reptile.	Demonstrate the stuffing of specimens	
12	2.8	Collect and mount in dry state: a herbarium specimen and in wet state, a museum	Supervise the collection and mounting of specimen	Herbarium

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: WASTE MANAGEMENT

CODE: STB 421

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 3

UNITS: 2

GOAL: The course is aimed at educating students on different kinds of wastes and waste management techniques.

GENERAL OBJECTIVES:

- 1.0 Understand the various types of solid wastes and its management.
- 2.0 Know the various solid waste management techniques.
- 3.0 Understand liquid wastes and effluent management.
- 4.0 Know the gaseous wastes.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: waste management		Course Code STB 421	Contact Hours: 60Hrs. 1-0-3
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 Understand the various types of solid wastes and its management</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<ul style="list-style-type: none"> 1.1 Define waste. 1.2 List examples of wastes in your immediate environment. 1.3 Explain solid wastes. 1.4 Classify solid wastes. 1.5 Give examples of wastes in each of the categories in 1.4 above 1.6 List the different sources of solid wastes. 1.7 Classify solid wastes into domestic, municipal, commercial, institutional, and industrial wastes. 		

General Objectives: 2.0 Know the various solid waste management techniques			
2	<p>2.1 Explain the problems posed by solid waste in the environment e.g. clogging up of drains leading to flooding, deface of the land surface, health hazards.</p> <p>2.2 State the motivation for solid waste management e.g.</p> <ul style="list-style-type: none"> i) Economic reasons such as land values, recycling may save importation and foreign exchange. ii) Environmental reasons e.g. pollution, land degradation, health. <p>2.3 Undertake visits to different locations eg. roads, lagoons, oceans, waste disposal sites.</p> <p>2.4 Identify the presence of solid wastes and ecological problems caused by solid waste dumping in 2.3 above.</p> <p>2.5 Describe the stages of social waste management namely.</p> <ul style="list-style-type: none"> i) Generation ii) Storage iii) Collection iv) Disposal v) Resources recovery. 	Field trip transport reports.	
3	<p>2.6 Explain the factors to be considered before embarking on an effective waste management e.g.</p> <ul style="list-style-type: none"> i) The amounts of waste produced ii) The nature of waste iii) Options available for treatment or disposal. iv) The Environmental safety of those 		

4	<p>waste management options.</p> <p>2.7 List the different types of industries and the solid wastes they generate e.g. chemical industries, glass industries, food and beverage industries, manufacturing industries etc.</p> <p>2.8 Describe the various methods of industrial waste treatment and disposal e.g. treatment and disposal e.g.</p> <p>i) Physical methods (phase separation involving filtration and sedimentation Phase transition involving distillation evaporation, and physical Precipitation, phase transfer involving extraction and absorption, membrane osmosis, hyper and ultrafiltration</p> <p>ii) Chemical methods: Acid/base neutralization, chemical extraction and leaching, chemical precipitation, Oxidization reduction Ion Exchange, Electrolysis, Hydrolysis, Photolysis.</p> <p>iii) Thermal Treatments: Incineration, Wet oxidation, Plasma arc, molten salt, super heated water.</p> <p>iv) Biotechnological methods</p> <p>v) Ocean dumping</p> <p>vi) Perpetual storage e.g. Land filing.</p> <p>vii) Composting.</p> <p>2.9 Carry and composting</p>	Visit to beverage industry	
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5	<p>2.10 Describe municipal wastes.</p> <p>2.11 Explain the use of the following techniques in municipal waste management.</p> <p style="padding-left: 40px;">A) Curative Techniques.</p> <p style="padding-left: 80px;">i) Sanitary land fill</p> <p style="padding-left: 80px;">ii) Incineration</p> <p style="padding-left: 80px;">iii) Compaction</p> <p style="padding-left: 80px;">iv) Shredding and baling</p> <p style="padding-left: 80px;">v) Pulverization and recovery</p> <p style="padding-left: 40px;">B) Preventive techniques</p> <p style="padding-left: 80px;">i) Waste reduction strategies</p> <p style="padding-left: 80px;">ii) Reuse</p> <p style="padding-left: 80px;">iii) Recycling</p> <p style="padding-left: 80px;">iv) Recovery</p> <p>2.12 List and describe methods of reworking solid wastes.</p> <p>2.13 Explain the use of reworked solid wastes for fuel, fertilizers, animal feeds, cellulose, acetate, production of biogas.</p> <p>2.50 Explain the safety precautions to be observed by waste management workers.</p>		
<p><u>General Objectives: 3.0 Understand Liquid wastes and effluent management</u></p>			

7	<p>3.1 Define sewage</p> <p>3.2 Define effluent</p> <p>3.3 Explain the meaning of a sewer lines and possible destinations of sewer lines</p> <p>3.4 List sources of industrial effluents e.g. cooling water, wash water, process water etc.</p> <p>3.5 Visit various industrial areas, observe and record the presence of effluents and their sources.</p> <p>3.6 List and describe the principal types of sewers namely Building sewers, lateral or branch sewers, Trunk sewers,</p> <p>3.7 Describe a simple sewer treatment plant.</p>		<p>Salinometer, Hot-Plate, TDS-Meter Flask- shaker, Thermometer, Melting point apparatus.</p>
8-9	<p>3.8 Estimate total organic matter in waste water.</p> <p>3.9 Define and calculate Biochemical Oxygen Demand (BOD) and chemical Oxygen Demand (COD) of waste effluent.</p> <p>3.10 List possible chemical and biochemical toxic substances and microorganism efficient from processing plants.</p> <p>3.11 Collect and analyze effluents for possible chemical and biochemical tonic substances and pathogenic microorganisms.</p> <p>3.12 Explain the principles of physical treatment of waste water under the following: sedimentation, centrifugation and concentration, flotation methods, absorption processes, ultrafiltration, reverse osmosis, electro dialysis.</p> <p>3.13 Explain the limitation's of each process in 3.12 above.</p>		<p>Microscopes oven, incubator anaerobic jar.</p> <p>Glass wares PH Meter Melting point apparatus, colorimeter Spectrophoto meter Anaerobic jar.</p> <p>PH meter Magnetic stirrer Hot plate Osmometer, centrifuge Membrane filters Total dissolved solid, filtrate shaker melting point apparatus, membrane filters.</p>

10	<p>3.14 <u>Carry out physical treatment of water using the methods described in 3.12 above.</u></p> <p>3.15 Explain the principles of chemical treatment of waste water under the following methods: coagulation process, emulsion breaking process, neutralization, precipitation, chemical oxidation methods.</p> <p>3.16 Explain the limitations of each of the processes in 3.15 above.</p> <p>3.17 Treat waste water using the chemical process described in 3.15 above.</p> <p>3.18 Explain the principles of biological treatment of waste water under aerobic biological process; activated sludge process; trickling filter; aerated lagoons, stabilization ponds; anaerobic biological processes, aerobic-anaerobic facultative process.</p> <p>3.19 Explain the limitation of each of the methods in 3.18 above.</p> <p>3.20 Demonstrate the process of chlorination of water.</p> <p>3.21 List and describe various methods of wastes utilization including production of biomass; production of single cell protein; recycling of waste water.</p>	Practical Chlorination	
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General Objectives: 4.0 Know the gaseous wastes		
10-12	<p>4.1 List the different types of gaseous wastes e.g. carbondioxide, carbon monoxide, Nitrous oxide, Hydrogen sulphide, Sulphur oxide.</p> <p>4.2 Describe dusts, droplets, fog, Fumes.</p> <p>4.3 Explain the sources of gaseous wastes e.g. plating, melting, welding, quarrying etc.</p> <p>4.4 Describe the effects of atmospheric gases on ozone layer; greenhouse effect, acid rain, global warming.</p> <p>4.5 Estimate the magnitude of gaseous wastes generated from plating, smelting, welding and quarrying sites.</p> <p>4.6 Explain the different ways of controlling gaseous wastes.</p>	

STB 421 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
2	2.3	Undertake visits to different locations e.g. roads, lagoons, oceans, waste disposal sites	Field trip	
	2.4	Identify the presence of solid wastes and ecological problems caused by solid waste dumping in 2.3 above	Describe the characteristics of solid wastes	
3-4	2.9	Carry and composting	Supervise composting	
7	3.5	Visit various industrial areas, observe and record the presence of effluents and their sources.	Conduct a field trip	
8-9	3.8	Estimate total organic matter in waste water	Describe method of estimating organic matter in waste water	
	3.11	Collect and analyze effluents for possible chemical and biochemical toxic substances and pathogenic microorganisms.	Supervise analysis of effluents	
	3.14	Carry out physical treatment of water using the methods described in 3.12 above.	Supervise physical treatment of water	
	3.17	Treat waste water using the chemical processes described in 3:15 above	Demonstrate chemical process of waste water treatment	
	3.20	Demonstrate the process of chlorination of water	Supervise chlorination process	
10-12	4.5	Estimate the magnitude of gaseous wastes generated from plating, smelting, welding and quarrying sites	Describe the process of estimating magnitude of gaseous wastes.	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: PETROLEUM AND THE ENVIRONMENT

CODE: STB 422

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 2

UNITS: 2

GOAL: The aim of this course is to provide the student with a general knowledge of petroleum and its impact on the people and the environment.

GENERAL OBJECTIVES:

- 1.0 Know the importance of petroleum.
- 2.0 Know the origin of Petroleum.
- 3.0 Know the methods of searching for petroleum.
- 4.0 Understand drilling of oil wells and “Bringing in”.
- 5.0 Know the transportation methods of petroleum and its products.
- 6.0 Know the components and chemistry of petroleum.
- 7.0 Know the principles of oil refining and cracking.
- 8.0 Know the sources of oil pollution and its effects.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Petroleum and the Environment		<u>Course Code STB 422</u>	Contact Hours: 45Hrs. 2hrs lecture)
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 Know the Importance of Petroleum</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<p>On completion of this course, the student should be able to:</p> <p>1.1 List the uses of petroleum e.g.</p> <p>i) Fuel in automobiles, modern jet engines and tractors.</p> <p>ii) Lubricants in all machines from most delicate wristwatches to large complex generators in power stations.</p> <p>iii) Bitumen in road construction etc.</p> <p>1.2 State the importance of petroleum in the manufacture of house hold materials e.g. wrappers petroleum jelly, polish, plastics, textiles, insecticides, cosmetics etc.</p> <p>1.3 Describe the uses of petroleum products as raw materials in textiles, detergents, weed killers, paints, cosmetics, polish, rubber and plastic materials.</p> <p>1.4 Carry out a visit to a nearby chemical industry. Report your observation.</p>		

General Objectives: 2.0 Know the origin of Petroleum			
2	<p>2.1 Define inorganic theory of the origin of petroleum.</p> <p>2.2 Explain the process of formation of petroleum based on the inorganic theory.</p> <p>2.3 Demonstrate the principle of inorganic theory of origin of petroleum by mixing calcium carbide and water.</p> <p>2.4 Define organic theory of origin of petroleum.</p> <p>2.5 Explain the stages in the formation of petroleum according to the organic theory of origin of petroleum.</p> <p>2.6 Compare the inorganic and organic theories of origin of petroleum.</p>		Calcium carbide, water, glasswares.

<u>General Objectives: 4.0 Know Drilling of oil wells and “Bringing in”</u>			
5-6	<p>4.1 Define the terms “drilling” and “bringing in”</p> <p>4.2 Identify the parts of an oil rig e.g. derrick, crown block, traveling block, hook, swivel, rotary table, Kelly, mud hose, mud pump, rotary drilling string, drilling bits etc)</p> <p>4.3 Undertake a visit to an oil field and report your findings.</p> <p>4.4 Describe the working mechanism of an oil rig.</p> <p>4.5 Explain the casing of an oil well.</p> <p>4.6 List the problems encountered during drilling process.</p> <p>4.7 Explain the methods of overcoming the problems encountered and the ways of preventing them (like mud column, blow-out preventers and well head or “ Christmas Tree”</p> <p>4.8 Explain how oil is driven to the bottom of oil well from reservoirs.</p>		Oil rig.
	<p>4.9 Describe how oil is brought to the ground surface from the well.</p> <p>4.10 Explain how the rate of vertical flow of oil is controlled.</p> <p>4.11 Explain the reasons for the regulation of vertical oil flow from the well.</p>		

General Objectives: 5.0 Know the transportation methods of Petroleum and its products			
7	<p>5.1 Describe pipeline network involving oil field, tank farm, trunk line, storage tanks, refinery, depot storage tanks, service stations etc.</p> <p>5.2 List the problems encountered in the survey of routes for laying pipeline.</p> <p>5.3 Explain the methods of solving the problems listed in 5.2</p> <p>5.4 Explain the processes involved in pumping the processes involved in pumping petroleum products (Petrol, kerosene and diesel) through a single pipeline.</p> <p>5.5 Explain methods of solving the problems in 5.4 above.</p> <p>5.6 Visit to a nearby NNPC depot. Report your findings</p>		Transport.

<u>General Objectives:6.0 Know the components and chemistry of petroleum</u>			
8	<p>6.1 Describe the physical appearance of petroleum or crude oil.</p> <p>6.2 List the factors that determine the appearance and components of crude oil.</p> <p>6.3 List the components of crude oil.</p> <p>6.4 Classify the components of oil into solid, liquid and gas.</p> <p>6.5 Define hydrocarbons</p> <p>6.6 Classify hydrocarbons into</p> <ul style="list-style-type: none"> a) paraffins and aromatics. b) Normal paraffins, isoparaffins and cycloparaffins. <p>6.7 Illustrate the structures of hydrocarbons.</p> <p>6.8 Describe the physical and chemical properties of the various groups of hydrocarbons.</p> <p>6.9 Name specific examples of each group of hydrocarbons</p>		
<u>General Objectives: 7.0 Know the principles of oil Refining and Cracking</u>			

9-10	<p>7.1 Explain the main principle of refining petroleum.</p> <p>7.2 Define and explain fractional distillation/fractionation.</p> <p>7.3 Describe the structure of fractionating tower</p> <p>7.4 Explain the working principle of fractionating towers including main tower, side strippers and special towers.</p> <p>7.5 Explain the working principles of each type of towers</p> <p>7.6 Explain the role of special towers in obtaining lubricating oils and sorting out different petroleum gases.</p> <p>7.7 Define and explain the term “cracking”</p> <p>7.8 Describe the principles of crackers (thermal and catalytic)</p> <p>7.9 Describe component parts of thermal cracker and catalytic cracker</p> <p>7.10 Explain the processes occurring in each component of “cat craker” (reactor, fractionating tower and regenerated).</p> <p>7.11 Define octane number and explain its use as index of quality of petroleum products.</p> <p>7.12 Define alkylation</p> <p>7.13 Explain importance of alkylation in refining of oil.</p> <p>7.14 Explain the principle of treatment process in oil refinery.</p> <p>7.15 Describe the stages in the removal of aromatics from petroleum products like kerosene.</p>		
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	7.16 Explain the role of sulphur in treatment process.		
<u>General Objectives: 8.0 Know the sources of oil pollution and its effects.</u>			
11-12	<p>8.1 Explain the concept of oil pollution due to oil spillage.</p> <p>8.2 List the sources of oil pollution e.g. burst pipelines, leaked tankers, storage tanks, refineries, oil fields, depots etc.</p> <p>8.3 Conduct a visit to locations of oil spillage and sources of spilled oil.</p> <p>8.4 Observe obvious effects of oil pollution in affected areas.</p> <p>8.5 Explain the effects of spilled oil on vegetation, wildlife, soil, water bodies, farm lands and settlements.</p> <p>8.6 Describe the methods of controlling the effect of oil pollution e.g. spreading polluted areas with detergent, clean – up exercise, afforestation.</p> <p>8.7 Explain the term “gas flaring”</p> <p>8.8 Explain the economic and environmental implications of gas flaring e.g. loss in revenue/foreign exchange earning; possible fire outbreak leading to destruction of life and property, air pollution etc.</p> <p>8.9 Describe the means of transporting crude oil and its products.</p>		

	<p>8.10 Explain the implications of surface pipelines. e.g. – Easy access to vandals - Exposure to harsh weather conditions</p> <ul style="list-style-type: none"> - Exposure to fire outbreaks from bush burning leading to expansive destruction. 		
	<p>8.11 Explain the consequences of road transportation of oil products e.g.</p> <ul style="list-style-type: none"> - economic loss from road mishap - problem of indiscriminate packing of oil tankers - damage to highways by oil ladden motor tankers etc. <p>8.11 Define and explain oil pollution monitoring</p> <p>8.12 Explain the methods of monitoring oil-polluted areas. e.g. use of bioindicators, biomarkers extraction, sampling techniques.</p> <p>8.13 Explain the use of algae, lichenes and bryohytes as indicators of oil pollution.</p>		

STB 422 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.4	Carry out a visit to a nearby chemical industry. Report your observation.	Undertake a field work	
	2.3	Demonstrate the principle of inorganic theory of origin of petroleum by mixing calcium carbide and water.	Discuss the principle of inorganic theory of origin of petroleum	
3-4	3.7	Identify the rock types that are associated with petroleum deposits.	Describe rocks associated with petroleum deposits.	
	3.15	Identify the various survey equipment used in oil prospecting	List survey equipment	
5-6	4.2	Identify the parts of an oil rig e.g. derrick, crown block, traveling block, hook, swivel, rotary table, Kelly, mud hose, Mud pump, rotary drilling string, drilling bits etc.	Visit an oil rig	
	4.3	Undertake a visit to an oil field and report your findings.	Field trip	
7	5.6	Visit to a nearby NNPC depot. Report your findings.	Field trip	
11-12	8.3	Conduct a visit to locations of oil spillage and sources of spilled oil	Field trip	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY
(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: ECONOMIC BOTANY

CODE: STB 423

DURATION: (HOURS/WEEK) LECTURE = 1 TUTORIAL = 0 PRACTICAL = 3

UNITS: 2

GOAL: The aim of this course is to provide the students with a broad knowledge of the economic plants of tropical Nigeria.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the importance of economic plants to the society.
- 2.0 Know the process of cultivation of cereal crops, their economic importance and organisms responsible for their spoilage.
- 3.0 Know important leguminous plants in Nigeria, their cultivation, preservation and economic importance.
- 4.0 Know different types of roots and tuber crops, their method of cultivation and uses.
- 5.0 Know the cultivation and economic importance of common vegetable crops.
- 6.0 Know some tropical fruits and nuts, their cultivation, processing and uses.
- 7.0 Know plants that are used as raw materials in beverages and pharmaceutical industries.
- 8.0 Know the sources and extraction of vegetable fibers, oils and fats.
- 9.0 Know industrially important plant oils.
- 10.0 Understand the production and preservation of wood.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Economic BOTANY		<u>Course Code STB 423</u>	Contact Hours: 60Hrs. 1hr lecture) 3hrs practical
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: Know the importance of economic plant to the society in general</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<p>On the completion of this course, the student should be able to:</p> <p>Introduction And General Description</p> <p>1.1 List the importance of plants to man and his environment.</p> <p>1.2 Outline the scope of economic Botany.</p> <p>1.3 Describe the tropical environment.</p> <p>1.4 Explain rainfall effects on the tropical environment.</p> <p>1.5 List the effects of temperature on the tropical environment.</p> <p>1.6 Explain solar radiation and day length effects on the tropical environment.</p> <p>1.7 Describe methods of crop improvement</p> <p>1.8 Collect and classify tropical economic plants under different heads e.g. Food crops, Tree crops, Fibre crops etc.</p>	<p>Conduct a field trip</p>	<p>Herbarium, weed album.</p>

	<u>General Objectives: 2.0 Know the process of cultivation of cereal crops their economic importance and organisms responsible for their spoilage.</u>		
2	<p style="text-align: center;">The Cereal Crops</p> <p>2.1 Identify the vegetative and reproductive features of members of family gramineae.</p> <p>2.2 Describe the common methods of cultivating cereal crops.</p> <p>2.3 Explain the features and process of cultivation of rice.</p> <p>2.4 Describe the features and process of cultivation of maize.</p> <p>2.5 Explain the cultivation of sorghum.</p> <p>2.6 Describe the features of sugar cane and its method of cultivation.</p> <p>2.7 Describe the various factors that may cause the spoilage of cereal crops.</p> <p>2.8 Describe the various methods of preservation and storage of cereal crops.</p> <p>2.9 List the use of cereal crops.</p>	Discuss the cultivation of cereal crops.	herbarium
	<u>General Objectives: 3.0 Know important leguminous plants in Nigeria their cultivation preservation sand economic importance</u>		
3	<p style="text-align: center;">The legumes</p> <p>3.1 Describe the vegetative and reproductive features of the members of family leguminosae.</p> <p>3.2 Describe the methods of cultivation of grain legumes.</p>		

	<p>3.3 Describe the features and methods of cultivation of groundnut (<i>Arachis hypogea</i>).</p> <p>3.4 Describe the features and methods of cultivation of common bean (<i>Vigna unguiculata walp</i>) and soyabean (<i>Glycine max</i>).</p> <p>3.5 List the importance of forage legumes.</p> <p>3.6 Describe factors responsible for the spoilage of legumes.</p> <p>3.7 List the uses of legumes domestically and industrially.</p>		
General Objectives: 4.0 Know types of roots and tuber crops their method of cultivation and uses.			
4	<p><u>The Root And Tuber Crops</u></p> <p>4.1 Identify types of root and tuber crops found in Nigeria.</p> <p>4.2 Describe the features and methods of cultivation of sweet potato (<i>Ipomea batatas</i>).</p> <p>4.3 Describe the features and methods of cultivation of yams (<i>Dioscorea spp</i>).</p> <p>4.4 Describe the features and method of cultivation of coco yam (<i>Colocasia esculenta</i>, <i>Xanthosoma sagittifolium</i>).</p> <p>4.5 List methods of preservation and storage of root and tuber crops.</p> <p>4.6 List uses of root and tuber crops domestically and industrially.</p>	<p>Conduct practical Identification</p>	<p>Various root and tuber crops.</p>

	General Objectives: 5.0 Know the cultivation and economic importance of common vegetable crops.	
5-6	<p style="text-align: center;"><u>Vegetable Crops and spices</u></p> <p>5.1 Identify various types of vegetable crops.</p> <p>5.2 Describe the features and cultivation process of sweet melon (<i>Cucumis spp</i>) and water melon (<i>Citrullus lanatus</i>)</p> <p>5.3 Describe the features and process of cultivation of tomato (<u><i>Lycopersicon esculentum</i></u>) and pepper (<u><i>Capsicum annum</i></u>)</p> <p>5.4 Describe the features and process of cultivation of okro (<i>Abelmoschus esculentus</i>), Jute.</p> <p>5.5 Describe the features and cultivation of onion (<i>Allium cepa</i>).</p> <p>5.6 Explain the factors that contribute to the spoilage of vegetable crops and spices.</p> <p>5.7 Describe the various methods of preservation and storage of vegetable crops and spices.</p> <p>5.8 Outline the economic importance of vegetable crops and spices in Nigeria.</p>	Conduct Practical identification

	General Objectives: 6.0 Know some tropical fruits and nuts, their cultivation, processing and uses.		
	<p style="text-align: center;"><u>Tropical Fruits And Nuts.</u></p> <p>6.1 Identify major tropical fruits and nuts in Nigeria.</p> <p>6.2 Describe the features and cultivation of bananas and plantains. (Musa spp).</p> <p>6.3 Describe the features and cultivation process of citrus fruits (<u>Citrus Spp</u>) and papaw (<u>Carica Papaya</u>)</p> <p>6.4 Describe the features and cultivation of Date palm (phoenix dactylifera and oil palm (Elaies guinensis)</p> <p>6.5 Describe the features and process of cultivation of Guava (psidium guajava) cashew (Anacardium Occidentale) and mango (mangifera indica)</p> <p>6.6 Describe the features and methods of cultivation of pine apple (Ananas comosus).</p> <p>6.7 List and describe the factors responsible for the spoilage of tropical fruits and nuts in Nigeria.</p> <p>6.8 List economic importance of tropical fruits and nuts in Nigeria.</p>	<p>Conduct Practical Identification of fruits and nuts</p>	<p>Sample of fruits and nuts.</p>

General Objectives: 7.0 Know Plants that are used as raw materials in beverages and pharmaceutical Industries		
8-9	<p><u>Beverage, Masticatory and Drug Plants.</u></p> <p>7.1 List various types of beverage, masticatory and drug plants in Nigeria.</p> <p>7.2 Describe the features and economic importance of tea (<i>Camellia sinensis</i>).</p> <p>7.3 List the features and economic importance of coffee (<i>Coffea</i> spp).</p> <p>7.4 Explain the features and economic importance of cocoa (<i>Theobroma cacao</i>)</p> <p>7.5 Describe the features and economic importance of kola (<i>Cola</i> spp)</p> <p>7.6 Describe the features and economic importance of tobacco (<i>Nicotiana glauca</i>)</p> <p>7.7 List the features and economic importance of quinine and ginger (<i>Cinchona</i> spp) and Zingiber (<i>Zingiber officinale</i>).</p> <p>7.8 Explain the features and medicinal value of other tropical plants in Nigeria.</p>	Transport

	General Objectives: 8.0 Know The sources and extraction of vegetable Fibres, oils and fats.		
10	<p align="center"><u>Vegetable Fibres, Oils and Fats.</u></p> <p>8.1 List the features and types of vegetable fibres, oils and fats found in Nigeria. –</p> <p>8.2 Describe the vegetative and reproductive features of cotton (<i>Gossypium</i> spp).</p> <p>8.3 List the economic importance of cotton.</p> <p>8.4 Explain types, sources, extraction and economic importance of drying oils and semi drying oils.</p> <p>8.5 List types and methods of extraction of non drying oils and fats such as castor, groundnut, coconut and palm oils.</p> <p>8.6 List the economic importance of the oils in 8.5 above.</p>		Transport.
	General Objectives: 9.0 Know industrially important plant oils.		
11	<p align="center"><u>The Essential Oil Crops and Rubber</u></p> <p>9.1 Collect and classify types and commercial values of essential oil crops.-</p> <p>9.2 Describe the extraction and use of citrus oils from Citrus Spp</p> <p>9.3 Describe the process of extraction and uses of geranium oil from <i>petargonium</i> spp.</p>	Identification of oil crops.	
	<p>9.4 Describe the extraction process and commercial value of camphor and camphor oil from <u><i>Cinnamomum camphora</i></u>.</p> <p>9.5 Describe the features and extraction of lemon grass oil from lemon <u><i>Cymbopogon citratus</i></u>.</p>		

	General Objectives: 10.0 Understand the Production and Preservation of wood.		
12	<p><u>Wood Production and Preservation</u></p> <p>10.1 Explain the origin of wood from the secondary growth of plants.</p> <p>10.2 Explain timber tree production in managed and natural forests.</p> <p>10.3 List physical properties of wood.</p> <p>10.4 Explain biodeterioration of wood and factors responsible for it.</p> <p>10.5 Examine deteriorated wood and identify organisms associated with the spoilage.</p> <p>10.6 List methods of wood preservation.</p> <p>10.7 List economic importance and uses of wood.</p>	Identification of timber trees.	

STB 423 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
1	1.8	Collect and classify tropical economic plants under different heads e.g. Food crops, Tree Crops, Fiber Crops etc.	List tropical economic plants	
2	2.1	Identify the vegetative and reproductive features of members of family gramineae	Describe the vegetative and reproductive features of family gramineae	
4	4.1	Identify types of root and tuber crops found in Nigeria.	List root and tuber crops	
5-6	5.1	Identify various types of vegetable crops	List types of vegetable crops	
7	6.1	Identify major tropical fruits and nuts in Nigeria	List major tropical fruits and nuts	
11	9.1	Collect and classify types and commercial values of essential oil crops.	List essential oil crops	
12	10.5	Examine deteriorated wood and identify organisms associated with the spoilage.	Describe features of a deteriorated wood and mention causative organisms	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: PARASITOLOGY

CODE: STB 424

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 3

UNITS: 3

GOAL: The course is designed to enable students know parasites and diseases they cause in man and animals.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know protozoan parasites and diseases caused by them.
- 2.0 Know nematode parasites and diseases caused by them.
- 3.0 Know cestodes and diseases caused by them.
- 4.0 Know trematode parasites and diseases caused by them.
- 5.0 Know other parasitic organisms.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Parasitology		Course Code STB 424	Contact Hours: 75Hrs. (5hr/Wk) 2-0-3
COURSE SPECIFICATION:			
WEEK	General Objectives: 1.0 Know protozoan parasites and diseases caused by them.		
	Specific Learning Objective:	Teachers Activities	Resources
1	1.1 Outline the general classification of the phylum protozoa. 1.2 Describe the general characteristics of members of the phylum protozoa. 1.3 Describe the morphology of the <u>Entamoeba histolytica; Trichomonas vaginalis, T. hominis, Blantidium coli, Trypano soma spp, T. gambiense, T. congolensis, Plasmodium vivax, P. falciparum, Eimeria species, etc.</u>	Carryout practical on i) Various stages in the life cycle of selected protozoa. ii) Slides iii) Specimens from infected hosts. iv) Excursion/Field trips.	Permanent slides Slides Microscope.
2	1.4 Describe the life cycle of representatives of the various protozoan classes of medical and		

	<p>Veterinary importance in Nigeria.</p> <p>1.5 Stain and examine various stages in the life cycle of the protozoan listed in 1.3 above.</p> <p>1.6 Identify hosts of the parasites in 1.3 above and describe their modes of transmission of infection.</p> <p>1.7 Describe the effect of parasites in 1.4 above on the hosts.</p> <p>1.8 Explain the economic importance of the parasites enumerated in 1.3 above.</p> <p>1.9 Collect and identify the specimens listed in 1.3 above.</p> <p>1.10 Collect specimen from infected hosts, prepare mounts and examine slides of parasites in 1.3 above.</p> <p>1.11 Describe the various measures that can be adopted to prevent infections by parasitic protozoa.</p>	<p>Conduct Practical staining sessions.</p> <p>Field trip to collect specimen Preparation of mounts and microscopic examination.</p>	<p>Microscopes, magnifying glasses, stains.</p>
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General Objectives: 2.0 Know Nematode parasites and diseases caused by them.			
3	<p>2.1 Outline the general classification of the phylum Nematode.</p> <p>2.2 Describe with the aid of diagram the morphology and general characteristics of the phylum Nematode.</p> <p>2.3 List and distinguish between parasitic nematodes in animals and plants, and free-living nematodes.</p> <p>2.4 Draw and describe the life cycle of each type in 2.3 above.</p>		<p>Microscopes magnifying glasses.</p>

4	<p>2.5 Describe modes of transmission, symptoms and pathology of common parasitic nematodes e.g Anaylostoma, Ascaris Lumbricoides Oxyuris vermicularis, Tylenchus tritici.</p> <p>2.6 Isolate, identify and draw various stages in the life cycle of the nematodes in 2.5 above applying various techniques such as concentration, floatation and sedimentation.</p> <p>2.7 Describe the various measures that can be adopted to prevent infection by parasitic nematodes</p>	Supervise Isolation, identification and drawings of nematode parasites.	
General Objectives: 3.0 Know Cestodes and diseases caused by them.			
5	<p>3.1 Outline classification of the class cestoda.</p> <p>3.2 Describe with the aide of diagrams the morphology and general characteristics and life history of members of the class cestoda.</p> <p>3.3 Draw the life cycles of important members of the class cestoda e.g. <u>Taenia solium</u>, <u>T. saginata</u>, <u>Dipylidium caninum</u>.</p> <p>3.4 Describe the symptoms of infection by</p>		

	<p style="text-align: center;">tapeworms.</p> <p>3.5 Describe the damage done to host by tapeworms.</p> <p>3.6 Isolate and examine various stages in the life history of tapeworm.</p> <p>3.7 Collect specimens from infested hosts and prepare slides of various stages in the life history of tapeworm.</p> <p>3.8 Describe various measures that can be adopted to prevent infestation by parasitic cestodes.</p>	<p>Practical collection and preparation of specimen examination and drawing</p>	<p>Charts and prepared slides</p> <p>Microscopes, magnifying glasses.</p>
General Objectives: 4.0 Know Trematode parasites and the diseases they cause			
	<p>4.1 Outline the classification of the class Trematoda (the Flukes).</p> <p>4.2 Describe with the aid of diagrams the morphology, life history and general characteristics of common flukes in Nigeria such as <u>Fasciola hepatica, schistosoma haematobium, S. japonicum, S. mansoni, etc.</u></p> <p>4.3 Isolate and identify various stages in the life cycle of the flukes in 4.1 above applying various methods such as centrifugation, sedimentation, etc.</p> <p>4.4 Describe the modes of infection and damage to host tissue by the flukes.</p> <p>4.5 Describe methods of prevention and treatment of fluke infection.</p>	<p>Supervise practical collection and preparation of specimen</p>	<p>Charts and prepared slides</p> <p>Microscopes, magnifying glasses</p>

General Objectives: 5.0 Know other parasitic organisms			
6	<p>5.1 List some common viral diseases e.g. Acquired immune deficiency syndrome (AIDS), Yellow fever, Poliomyelitis, common cold, small pox, measles, mumps, etc.</p> <p>5.2 List common diseases caused by bacteria e.g. diarrhea, cholera (<i>V. cholerae</i>), leprosy (<i>Mycobacterium leprae</i>), tuberculosis (<i>M. tuberculosis</i>), Gonorrhoeae (<i>Neisseria gonorrhoeae</i>)</p> <p>5.3 List parasitic Annelids, e.g. <u>Hirudo medinensis</u>.</p> <p>5.4 List vertebrate parasites e.g. lemprey</p> <p>5.5 Explain the economic importance of each parasite in 5.1-5.4.</p> <p>5.6 Collect and identify specimens from each of 5.1 to 5.4 above.</p>	<p>Conduct collection of specimen and identification drawings.</p>	<p>Posters</p> <p>Charts</p>

STB 424 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITIES	RESOURCES
2	1.5	Stain and examine various stages in the life cycle of the protozoan listed in 1.3 above	Demonstrate staining techniques	Stains, Microscopes, Magnifying Glasses
	1.6	Identify hosts of the parasites in 1.3 above and describe their modes of transmission of infection.	Describe hosts of the parasites	
	1.9	Collect and identify the specimens listed in 1.3 above	Supervise collection of specimens	
	1.10	Collect specimen from infected hosts, prepare mounts and examine slides of parasites in 1.3 above	Demonstrate preparation of mounts and use of microscopes	
3	2.4	Draw and describe the life cycle of each type in 2.3 above	List parasitic nematodes in Plants and animals	
4	2.6	Isolate, identify and draw various stages in the life cycle of the nematodes in 2.5 above applying various techniques such as concentration, floatation and sedimentation.	Demonstrate how to isolate nematodes using various techniques.	
5	3.3	Draw the life cycles of important members of the class cestoda e.g. <u>Taenia solium</u> , <u>T. Saginata</u> , <u>Dipylidium Caninum</u>	List the members of the class cestoda	
6.	3.6	Isolate and examine various stages in the life history of tapeworm	Supervise the examination of stages in the life history of tapeworm	
	3.7	Collect specimens from infested hosts and prepare slides of various stages in the life history of tapeworm.	Demonstrate preparation of slides.	
7	4.3	Isolate and identify various stages in the life cycle of the flukes in 4.1 above applying various methods such as centrifugation, sedimentation, etc.	Describe the methods used in identification	
10	5.6	Collect and identify specimens from each of 5.1 to 5.4 above	Supervise identification of specimens	

PROGRAMME: HIGHER NATIONAL DIPLOMA SCIENCE LABORATORY TECHNOLOGY

(ENVIRONMENTAL BIOLOGY OPTION)

COURSE: PLANT PATHOLOGY

CODE: STB 425

DURATION: (HOURS/WEEK) LECTURE = 2 TUTORIAL = 0 PRACTICAL = 3

UNITS: 3

GOAL: This course is aimed at broadening the Students knowledge of plant pathogens and diseases caused by them and their control measures.

GENERAL OBJECTIVES:

On completion of this course the student should be able to:-

- 1.0 Know the scope of plant pathology.
- 2.0 Distinguish non-parasitic from parasitic plant diseases.
- 3.0 Know how to recognize plant diseases caused by Fungi, bacteria and viruses.
- 4.0 Understand the effect of environment on the development of plant diseases.
- 5.0 Know the relationship between parasites and their hosts, as well as the defence mechanisms of hosts.
- 6.0 Know the various disease control measures.

PROGRAMME: Higher National Diploma Science Laboratory Technology (Environmental Biology Option)			
COURSE: Plant Pathology		<u>Course Code STB 425</u>	Contact Hours: 45Hrs. (3hr/wk) 2-0-3
COURSE SPECIFICATION:			
<u>WEEK</u>	<u>General Objectives: 1.0 Know the scope of plant pathology.</u>		
	<u>Specific Learning Objective:</u>	<u>Teachers Activities</u>	<u>Resources</u>
1	<p>On the completion of this course, the student should be able to:</p> <p>Scope of Plant Pathology</p> <p>1.1 Outline the scope of plant pathology</p> <p>1.2 Explain the meaning of the following pathological terms:- incitant, causal organism, saprophyte, parasites pathogen, pathogenicity, pathogenic infection, penetration, incubation etc.</p>		Microscopes, magnifying glasses
2	<p>1.3 Classify various plant diseases into endemic, epidemic and sporadic.</p> <p>1.4 Classify diseases according to major causal agents viz: non parasitic and parasitic.</p> <p>1.5 Outline the economic significance of plant diseases.</p> <p>1.6 Identify diseased plants.</p>	Conduct practical/field work on identification of plants.	

	General Objectives: 2.0 Distinguish non-parasitic from parasitic plant diseases.		
3	<p align="center">Non-Parasitic Diseases</p> <p>2.1 Define non parasitic plant diseases.</p> <p>2.2 Explain low temperature effect on plants</p> <p>2.3 Explain high temperature effect on plants</p> <p>2.4 Explain oxygen-plant relationship</p> <p>2.5 Explain light effects and lighting injury on plants.</p> <p>2.6 Explain the effect of moisture on plants.</p> <p>2.7 Explain the effect of atmospheric impurities on plants.</p> <p>2.8 Identify nutritional disorders in plants.</p>	Conduct practical visual identification in the field.	
4			
	General Objectives: 3.0 Know how to recognize plant diseases caused by fungi, bacteria and virus.		
5	<p align="center"><u>Parasitic Diseases</u></p> <p>3.1 Define parasitic diseases</p> <p>3.2 List the major parasitic plant diseases in Nigeria.</p> <p>3.3 Explain the mode of entry and symptoms of major plant diseases caused by mastigomycotina, zygomycotina, Ascomycotina, Basidomycotina and Denteromycotina.</p> <p>3.4 Explain the modes of entry and effects of bacterial attack on food and cash crops.</p> <p>3.5 List major plant diseases caused by viruses.</p> <p>3.6 Explain the nature, development and transmission of plant viral diseases.</p> <p>3.7 Investigate diseased plants and identify associated parasites or pathogens based on Koch's postulates.</p> <p>3.8 Identify symptoms, life cycle and control measures of nematode diseases.</p> <p>3.9 Isolate and identify nematodes associated with some plant diseases.</p>	Conduct identification of disease plants	<p>Forceps</p> <p>Insect classification manual</p> <p>Preservatives</p> <p>Magnifying glasses.</p>
6			

	General Objectives: 4.0 Understand the effect of environment on the development of plant diseases.		
7	<p align="center"><u>Relation of Environment to Disease Development</u></p> <p>4.1 List and identify the diseases of plant parts in storage and transit.</p> <p>4.2 Identify diseases associated with soil borne pathogens.</p> <p>4.3 Identify diseases caused by air-borne pathogens</p>	Conduct practical/field work visual identification	
8	<p>4.4 Explain epidemiology of diseases and forecasting.</p> <p>4.5 Explain restriction of diseases by climate.</p>		
	General Objectives: 5.0 Know the relationship between parasites and their hosts, as well as the defence mechanisms of hosts.		
	<p align="center">Host parasite Interactions</p> <p>5.1 List and explain the various relationship of pathogens with host tissues.</p> <p>5.2 Explain the host resistance.</p> <p>5.3 Explain the variability in pathogenicity of microorganisms.</p>		

	General Objectives: 6.0 Know the various diseases control measures.		
	<p style="text-align: center;"><u>Disease Control</u></p> <p>6.1 Explain disease control by non-chemical methods through exclusion and eradication.</p> <p>6.2 Explain eradication method by crop rotation, sanitation and elimination of over wintering hosts.</p> <p>6.3 List the common pesticides for major crops and describe their mixtures for use.</p> <p>6.4 Describe disease control by chemical methods: Use of pesticides such as fungicides, insecticides, fumigants, e.t.c</p> <p>6.5 Explain disease control through legislation, cultural and handling practice.</p> <p>6.6 Explain various disease control methods through host resistance viz: inheritance of disease resistance; environment.</p>	<p>Demonstration</p> <p>Conduct practical/field work</p>	<p>Audio visual</p> <p>Sprayer Commercial Pesticides.</p>

STB 425 PRACTICAL CONTENT

WEEK	SPECIFIC LEARNING OBJECTIVES		TEACHERS ACTIVITY	RESOURCES
1	1.6	Identify diseased plants.	Describe diseased plants	
3	2.8	Identify nutritional disorders in plants	Explain nutritional disorders.	
5-6	3.7	Investigate diseased plants and identify associated parasites or pathogens based on Koch's postulates	Supervise investigation of diseased plants.	
	3.8	Identify symptoms, life cycle and control measures of nematode diseases.	Describe symptoms of nematode diseases.	
	3.9	Isolate and identify nematodes associated with some plant diseases.	Demonstrate isolation of nematodes.	
7-8	4.1	List and identify the diseases of plant parts in storage and transit.	List diseases of plant parts in storage and transit.	
	4.2	Identify diseases associated with soil borne pathogens	Describe diseases associated with soil borne pathogens.	
	4.3	Identify diseases caused by air-borne pathogens	List diseases caused by air-borne pathogens.	

**SCIENCE LABORATORY TECHNOLOGY
HIGHER NATIONAL DIPLOMA BIOLOGICAL SCIENCES OPTIONS
(ENVIRONMENTAL BIOLOGY OPTION)**

MINIMUM LIST OF EQUIPMENT.

1. BIOLOGY LABORATORY

See list of equipment for Biology Laboratory ND SLT.

Additional list of Equipment required are:-

S/No	Description	Quantity	Remarks
1.	Chromatographic equipment	4	
2.	Extraction equipment – Soxhlet e.t.c	4	

2. MICROBIOLOGY LABORATORY

S/No	Description	Quantity	Remarks
1.	Autoclave (for preparatory and media room)	2	
2.	Portable autoclave preparatory and media room	4	
3.	Steamers	2	
4.	Dryer (Big)	2	
5.	Hot air oven	2	
6.	Distillation apparatus	2	
7.	Blender	4	
8.	Top loading balance	5	
9.	Analytical balance	2	
10.	Incubators	2	
11.	Centrifuges (manual)	2	
12.	Centrifuges (Electrical)	2	
13.	Water bath (thermostatically controlled)	3	

14.	Shaker/Incubator	2	
15.	Anaerobic jars	5	
16.	Inoculating hood	1	
17.	Magnetic Stirrer	2	
18.	Hot plate	2	
19.	Colony counter (electrically controlled)	2	
20.	Manual colony counter	10	
21.	Air sample	2	
22.	Hand lenses	30	
23.	Lovibond colour comparator	5	
24.	pH meters	2	
25.	Seitz Filtration apparatus	1	
26.	Seitz Filters	(Various sizes)	
27.	Membrane filtration apparatus	1	
28.	Candle filtration unit	2	
29.	Spectrophotometer	2	
30.	Membrane filter	3pkts.	
31.	Colorimeters	2	
32.	Viscometers	2	
33.	Freeze dryer	1 (optional)	
34.	Thermometer various ranges	10 each	
35.	Vacuum pump	2	
36.	Blood grouping kits	2	
37.	Scapel holders	10	
38.	Forceps	10	

MICROSCOPES

S/No	Description	Quantity	Remarks
39.	Binoculars	30	
40.	Monocular	1	
41.	Fluorescent	1	
42.	Dark field	1	
43.	Phase Contrast	1	
44.	Projection Microscope		

INSTRUMENT ROOM

S/No	Description	Quantity	Remarks
1.	Measuring Instruments:		
	Moving coil	2	
	Moving iron	2	
	Thermocouple	2	
	Oscilloscope	2	
	Signal generators	2	
	Pressure Measuring instruments		
	Barometers	2	
	Manometers	2	
	Pressure gauges	2	
2.	Spectrophotometer (uv and ir)	1 each	
3.	Colorimeter	1	
4.	Flame Photometer	1	
5.	Raman Spectrophotometer	1	
6.	Atomic absorption Spectrophotometer	1	
7.	X-ray Spectrophotometer	1	
8.	Electrolytic conductivity bridge	1	
9.	Coulometric titrator	1	
10.	pH meter	1	
11.	Autotitrator	2	
12.	Polarograph	1	
13.	Radio active detector	1	
14.	Fluorimeter	1	
15.	Polarimeter	1	
16.	Refractometer	1	
17.	Autoradiograph	1	
18.	Camera Lucida	3	
19.	Voltmeter	5	
20.	Ammeter	5	
21.	Resistors	2 each	
22.	Conductivity meter	1	

23.	Ion-selecture electrodes	2	
24.	Ion-exchange electrodes	2	
25.	Microscopes	10	
26.	Autodiography	1	
27.	Camera Lucida	1	
28.	Colony counter	3	
29.	Autoclave	2	
30.	Centrifuge	2	
31.	Incubator	2	
32.	Melting point apparatus	2	
33.	Gas/Liquid Chromatography	2	
34.	Liquid/Liquid Chromatography	2	
35.	Column Chromatography	2	
36.	Rotary Evaporator	2	

ENVIRONMENTAL BIOLOGY LABORATORY

Knife

Secateurs

Ropes

Polythene bags

Kymograph

Water distiller

pH meter

Calculator

Computers

Turbidimeter

Salinometer

Total dissolved solid meter

Magnetic stirrer

Photo meter

Soil test kits

Hot plate shakers

Melting point apparatus

Air sampler

Osmo meter/Osmotic level determination meter

Total dissolved oxygen meter

Toxicity kit

Insect cages

Fly nets
Sweep nets
Sprayers and other pest control equipment
Radiation monitor pH meter
Theodolite Throw- disk
Filtrate shaker

NAMES OF PARTICIPANTS

ENVIROMENTAL BIOLOGY OPTION

NAMES

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