



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

NATIONAL DIPLOMA

IN

OCEANOGRAPHY AND FISHERIES SCIENCE

CURRICULUM AND COURSE SPECIFICATIONS

JUNE, 2026

PREFACE

The transformation of Nigeria's agricultural sector remains central to the nation's aspirations for sustainable economic growth, food security, job creation, industrial development, and poverty reduction. As agriculture continues to evolve in response to technological advancements, climate change, emerging global market demands, and the need for increased productivity across agricultural value chains, it has become imperative to ensure that curricula in Nigerian tertiary institutions remain relevant, responsive, and aligned with contemporary industry requirements. It is against this backdrop that we embarked on the comprehensive review and modernization of Agricultural curricula for Nigerian tertiary institutions. The review process was designed to address identified skills gaps, integrate emerging technologies and innovations, strengthen entrepreneurship and employability competencies, promote climate-smart agriculture, and align training programmes with the industry expectations and global best practices. The successful execution of this important project was made possible through the invaluable support and commitment of key stakeholders. I wish to express profound appreciation to the Honourable Minister of Education for providing the policy direction and leadership that facilitated this initiative. I also extend sincere gratitude to the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their unwavering support, technical contributions, and commitment to strengthening agricultural education and workforce development in Nigeria. Special appreciation goes to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that enabled the conduct of nationwide skills gap analyses and supported the series of national curriculum review and development workshops. The findings from the skills gap studies provided critical evidence and industry insights that guided the review process and ensured that the curricula reflect current and future workforce requirements within the agricultural sector.

I also acknowledge with gratitude the immense contributions of the Sector Skills Council for Agriculture, whose expertise and industry perspectives greatly enriched the curriculum development process. Equally commendable are the efforts of members of the Implementation Committee, resource persons, industry experts, professional bodies, French Embassy in Nigeria, regulatory agencies, academic institutions, employers, development partners, and other stakeholders who devoted their time, knowledge, and experience to the various workshops and technical sessions. The revised curricula represent a collective national effort to produce graduates equipped with relevant knowledge, practical skills, digital competencies, entrepreneurial capabilities, and professional attitudes required to drive innovation and productivity across Nigeria's agronomy, forestry, fisheries and livestock sectors. It is my expectation that Institutions offering these programmes will faithfully implement the curricula and continue to collaborate with industry to ensure sustained relevance and quality. I commend all stakeholders for their dedication and contributions to this landmark achievement and look forward to the successful implementation of these curricula for the benefit of our dear nation.

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee

EXECUTIVE SECRETARY

National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

The National Board for Technical Education (NBTE) expresses its profound appreciation to all individuals and organizations whose invaluable support, expertise, and commitment made the successful review and modernization of the Agricultural Education curricula for Nigerian tertiary institutions possible. Our sincere gratitude goes to the Honourable Minister of Education for providing the policy direction and leadership that made this national initiative possible. We also appreciate the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their technical guidance, collaboration, and unwavering commitment to strengthening agricultural education and workforce development in Nigeria. The Board is particularly grateful to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that funded the nationwide skills gap analyses, stakeholder engagements, curriculum review exercises, validation meetings, and development workshops. The evidence generated through these studies provided a solid foundation for developing curricula that are relevant, industry-driven, and responsive to national and global agricultural priorities.

Special appreciation is extended to the members of the agriculture, curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated actively in the skills gap studies, technical sessions, validation exercises, and curriculum development workshops. Their diverse expertise and practical insights greatly enriched the quality and relevance of the curricula. We further appreciate the support of the French Embassy in Nigeria and other development partners for their collaboration in promoting excellence and innovation in technical and vocational education within the agricultural sector. Finally, NBTE expresses its gratitude to all tertiary institutions, researchers, facilitators, rapporteurs, technical staff, and administrative personnel whose commitment and hard work contributed to the successful completion of this important national assignment. The Board acknowledges that this achievement is the result of a collective effort and remains confident that the effective implementation of these curricula will contribute significantly to producing competent, innovative, and entrepreneurial graduates capable of advancing sustainable agricultural development, food security, and economic prosperity in Nigeria.

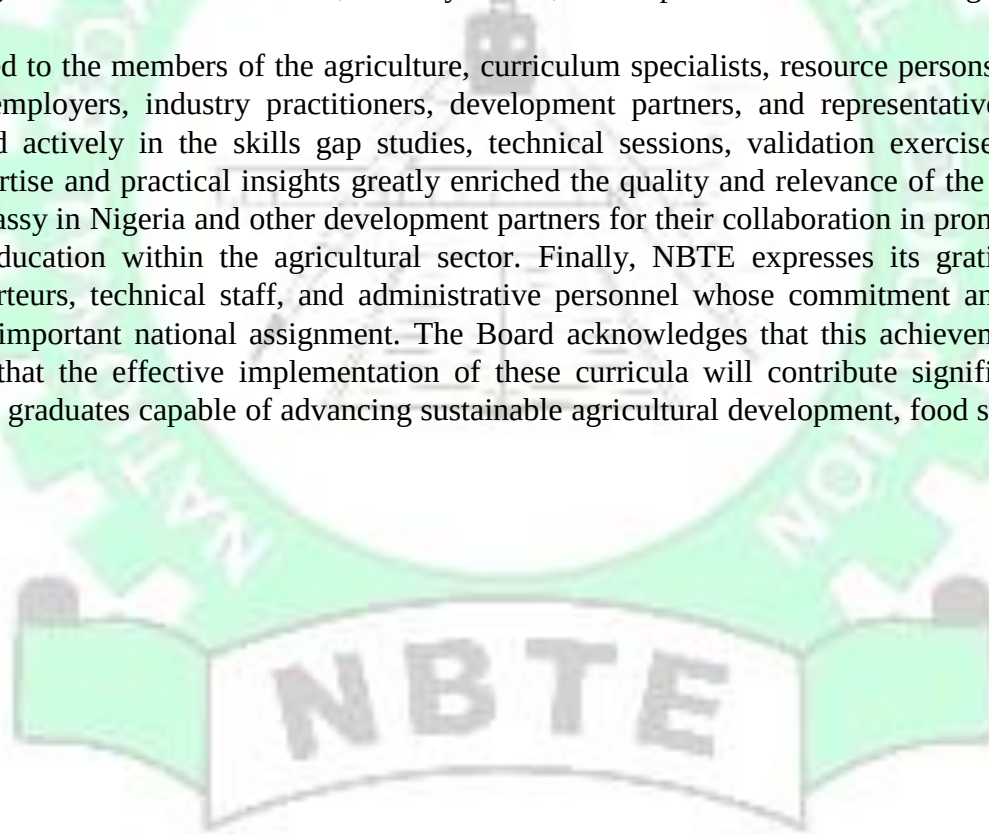


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GENERAL INFORMATION

1.0 TITLE OF THE PROGRAMME

The programme is the National Diploma in Oceanography and Fisheries Science

2.0 PROGRAMME GOAL

The goal of the National Diploma in Oceanography and Fisheries Science programme is to produce technicians equipped with scientific knowledge, technical skills, and professional competence required for effective participation in oceanographic investigations, fisheries production, aquatic resource management, marine environmental protection, and sustainable development of marine and inland water resources.

3.0 PROGRAMME OBJECTIVES

On completion of the programme, diplomates should be able to:

- i. Apply basic scientific principles to oceanographic and fisheries operations;
- ii. Conduct basic oceanographic measurements and marine environmental assessments using standard instruments and techniques;
- iii. Identify and classify marine and freshwater organisms of fisheries importance;
- iv. Carry out fish breeding, hatchery management, aquaculture production, and fish handling operations;
- v. Operate and maintain basic fisheries and oceanographic equipment safely and efficiently;
- vi. Collect, analyze, interpret, and present oceanographic and fisheries data;
- vii. Apply principles of marine ecology, hydrobiology, and aquatic resource conservation in fisheries and ocean management;
- viii. Assist in the monitoring, control, and management of marine and inland fisheries resources;
- ix. Apply safety procedures and environmental protection measures in marine and fisheries operations;
- x. Demonstrate knowledge of ocean laws, maritime regulations, and responsible fisheries practices;
- xi. Participate effectively in field surveys, fisheries extension services, and community-based aquatic resource management;
- xii. Apply entrepreneurship and management skills in fisheries and marine-related enterprises;
- xiii. Use information and communication technology (ICT) tools in oceanography and fisheries science activities;
- xiv. Work effectively as technicians in fisheries industries, marine research institutes, environmental agencies, ports, and related organizations;
- xv. Pursue higher education and professional development in oceanography, fisheries science, marine technology, and related disciplines.

4.0 ENTRY REQUIREMENTS

Applicants with the following qualifications may be considered for admission into the National Diploma programme in Oceanography and Fisheries Science; -

- a) Four (4) GCE, WASSCE, SSCE, SAISSCE, NECO or NABTEB subjects passed at not more than two sittings. The subjects must be passed at Credit level and should include English Language, Mathematics, Biology/Agricultural Science and any one from the following subjects: Geography, Economics or Physics.
- b) Evidence of registration with Joint Admissions and Matriculation Board (JAMB).

5.0 STRUCTURE OF THE PROGRAMME

The National Diploma in Oceanography and Fisheries Science is a terminal programme and is structured to last for two years (four semesters). This includes three to four months of Student Industrial Work Experience Scheme (SIWES) at the end of first year or the first two semesters of the programme.

6.0 CURRICULUM

Curricula of ND programmes consist of four main components. These are:

- a General Studies/Education
- b Foundation Courses
- c Professional Courses
- d Student Industrial Work Experience scheme (SIWES) for ND.

The general education courses shall include:

- i. Arts and Humanity – English Language, Communication and History. These are compulsory.
- ii. Mathematics and Science (for non-science based programmes)
- iii. Social Studies – Citizenship (the Nigerian Constitution), Political Science, Sociology is compulsory.

The general education shall account for not more than 15% of the total contact hours for the programme.

Foundation courses include courses in Mathematics, Pure sciences, Statistics, etc. The number of hours will vary with programme and may account for about 10 – 15% of the total contact hours.

Professional Courses are courses that give the student theory and practical skills they need to practice their field of calling at the technician/technologist level. These may account for between 60 – 70% of the contact hours depending on programme.

Student Industrial Work Experience Scheme (SIWES) shall be taken during the long vacation following the end of the second semester of the first year. See details of SIWES in Guidelines to SIWES in 12.0.

6.1 CURRICULUM STRUCTURE

The structure of the ND programme consists of four semesters of classroom, laboratory and workshop activities in the college and a semester (3-4 months) of supervised industrial work experience scheme (SIWES). Each semester shall be of 17 weeks of teaching i.e. recitation, practical exercise, quizzes, test etc. and 12-16 weeks SIWES shall take place at the end of the second semester of the first year.

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) core teaching staff who should possess at least a HND in Aquaculture and Fisheries Technology or B.Sc. in Oceanography and Fisheries Science or related disciplines with good grade.

7.2 Technical Staff

There should be technical staff;

i) Technologist – HND

A technologist is a highly skilled professional trained at the Higher National Diploma (HND) level. They possess advanced technical and practical knowledge in their field and are capable of supervising operations, managing projects, operating modern equipment, and applying technology to solve practical problems. In agriculture, technologists help in farm management, research support, and the application of improved technologies.

ii) Technician – ND

A technician is a middle-level manpower trained at the National Diploma (ND) level. Technicians are responsible for carrying out technical tasks, operating tools and equipment, and assisting technologists and professionals in practical activities. In agriculture, they assist in crop production, livestock management, farm maintenance, and data collection.

iii) Farm Assistants

Farm assistants are support workers who help in daily farm operations under supervision. They perform basic practical activities such as planting, feeding fishes, harvesting, cleaning tools, and maintaining farm records etc. They contribute to the smooth running of farm activities and help improve productivity.

7.3 Headship of the Department

The Head of Department shall have at least a First and Master's Degree in Oceanography and Fisheries Science or related field. He or she shall not be less than the rank of a Senior Lecturer and registered member of relevant professional body.

7.4 Career/Academic Prospects

The diplomate would work in maritime and fisheries industry, NGOs, relevant ministries, departments, agencies and parastatals. They can also proceed to HND and BSc programmes for further studies.

8.0 CERTIFICATION

A diplomate of this programme shall be awarded ND in Oceanography and Fisheries Science.

9.0 ACCREDITATION

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

10.0 CONDITIONS FOR THE AWARD OF THE ND

Institutions offering accredited programme will award the National Diploma to candidates who successfully completed the programme after passing prescribed coursework, examination, diploma project and the Supervised Industrial Work Experience.

10.1 Classification of Diplomas:

Diploma can be classified as follows:

CGPA	CLASS OF DIPLOMA
CGPA 3.50 and above	Distinction
CGPA 3.00-3.49	Upper Credit
CGPA 2.50-2.99	Lower Credit
CGPA 2.00-2.49	Pass

10.2 Grading of Courses

Courses shall be graded as follows:

MARK RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	

11.0 GUIDANCE NOTE FOR THE TEACHERS TEACHING THE PROGRAMME

The new curriculum is drawn in unit courses. This is in keeping with the provision of the National Policy on Education which stresses the need to introduce the semester unit which will enable a student who so wishes 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, provide the students with technician operative skills, which can be used for employment purposes.

As the success of the credit unit system depends on articulation of programmes between the institutions and industry, the curriculum content has been written in behavioral 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 performances 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 who 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 as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practical in the ratio of 20:80.

12.0 GUIDELINES ON SIWES PROGRAMME

For the smooth operation of the SIWES, the following guidelines shall apply: -

12.1 Responsibility for Placement of Students.

- a.) Institutions offering the ND programme shall arrange to place the students in industry. By April 30, of each year, six copies of the master list showing where each student has been placed shall be submitted to the executive secretary, NBTE which shall, in turn, authenticate the list and forward it to the Industrial Training Fund, Jos.
- b.) The placement officer should discuss and agree with the industry on the following:
 - i) A task inventory of what the students should be expected to experience during the period of attachment. It may be wise to adopt the one already approved for each field.
 - ii) The industry-based supervisor of the students during period likewise the institution- based supervisor.
 - iii) It should be noted that the final grading of the students during the period of attachment should be weighted more on the evaluation by his industry-based supervisor.

12.2 Evaluation of students during the SIWES

In the evaluation of the students, cognizance should be taken of the following items:

- (a.) Punctuality
- (b.) Attendance
- (c.) General attitude to work
- (d.) Respect for authority
- (e.) Interest in the field/technical area
- (f.) Technical competence as a potential technician in his field.

12.3 Grading of SIWES

To ensure uniformity of grading scales, the institution should ensure that the uniform grading of student's work, which has been agreed to, by all polytechnics, is adopted.

12.4 The institution-based supervisor

The institution-based supervisor should initial the logbook during each visit. This will enable him to check and determine to what extent the objectives of the scheme are being met and to assist students having any problems regarding the specific assignment given to them by industry-based supervisor.

12.5 Frequency of Visit

Institution should ensure that the students placed on the attachment are visited within one month of their placement. Other visits shall be arranged so that

- 1) there is another visit six weeks after the first visit; and
- 2) a final visit in the last month of the attachment.

12.6 Stipend for Student in SIWES

The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training Fund and the NBTE.

12.7 SIWES as a Component of the Curriculum

The completion of SIWES is important in the final determination of whether the student is successful in the programme or not. The SIWES should be graded on a fail or pass basis. Where a student has satisfied all other requirements but failed SIWES, he may only be allowed to repeat another four months SIWES at his own expense.

CURRICULUM TABLE**YEAR I SEMESTER I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 101	Use of English I	2	0	0	2	2
2.	GNS 111	Citizenship Education I	2	0	0	2	2
3.	COM 111	Introduction to Computing	2	0	2	4	4
4.	MEC 113	Basic Workshop Technology & Practice	1	0	3	4	4
5.	MSQ 111	Mandatory Skills Qualification	1	0	1	2	2
6.	FIT 114	Introduction to Fisheries Technology	1	0	3	4	4
7.	FIT 115	Development of Life Skills	1	0	1	2	2
8.	OFS 111	Elements of Cell Biology in Marine Fisheries	1	0	3	4	4
9.	OFS 112	Elements of Chemistry in Marine Fisheries	1	0	3	4	4
10.	OFS 113	Elements of Physics in Marine Fisheries	1	0	3	4	4
11.	OFS 114	Elements of Mathematics in Marine Fisheries	1	1	0	2	2
12.	OFS 115	Introduction to Oceanography	1	0	2	3	3
TOTAL			15	1	21	37	37

YEAR I SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 102	Communication In English I	2	0	0	2	2
2.	GNS 121	Citizenship Education II	2	0	0	2	2
3.	ENT 126	Introduction to Entrepreneurship I	2	0	1	3	3
4.	FIT 122	Biology of Fishes	1	0	3	4	4
5.	FIT 124	Fishing Gear and Craft Technology I	1	0	3	4	4
6.	FIT 125	Elements of Navigation and Seamanship	1	0	3	4	4
7.	FIT 126	Introduction to Fisheries Statistics and Computer Applications	1	0	2	3	3
8.	OFS 121	Physical Oceanography	1	0	2	3	3
9.	OFS 122	Chemical Oceanography	1	0	2	3	3
10.	OFS 123	Introduction to Mariculture	1	0	3	4	4
11.	OFS 124	Basic Safety at Sea	1	0	2	3	3
TOTAL			14	0	21	35	35

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 201	Use of English II	2	0	0	2	2
2.	ENT 216	Introduction to Entrepreneurship II	2	0	1	3	3
3.	AGR 201	Research Methods and Experimental Design	1	0	1	2	2
4.	FIT 214	Fishing Gear and Craft Technology II	1	0	3	4	4
5.	OFS 211	Oceanographic Instrumentation	1	0	2	3	3
6.	OFS 212	Marine Biology	1	0	2	3	3
7.	OFS 213	Marine Environmental Pollution and Prevention	1	0	2	3	3
8.	OFS 214	Marine Fish Processing, Storage and Value Addition	1	0	2	3	3
9.	OFS 215	Students Industrial Work Experience Scheme (SIWES)	0	0	4	4	4
TOTAL			10	0	17	27	27

YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 202	Communication in English II	2	0	0	2	2
2.	FIT 222	Non-Food Fish and Fish Products	1	0	2	3	3
3.	OFS 221	Outboard Engine Maintenance	1	0	2	3	3
4.	OFS 222	Digital Oceanography	1	0	2	3	3
5.	OFS 223	Introduction to Ocean Laws	2	0	0	2	2
6.	OFS 224	Coastal Resources Management	1	0	2	3	3
7.	OFS 225	Fishing Operation	1	0	2	3	3
8.	OFS 226	Research Project	0	0	6	6	6
TOTAL			9	0	16	25	25



ELEMENTS OF CELL BIOLOGY IN MARINE FISHERIES

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: ELEMENTS OF CELL BIOLOGY IN MARINE FISHERIES	COURSE CODE: OFS 111	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: 1 SEMESTER: 1	PRE-REQUISITE: NONE	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills in cell biology and its applications in fisheries technology and mariculture system		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and scope of cell biology; 2.0 Know basic microscopy and laboratory skills; 3.0 Know structures and functions of plant and animal cells; 4.0 Understand cellular metabolism and energy production; 5.0 Know cell division processes; 6.0 Understand basic principles of genetics and heredity; 7.0 Know tissues and organs in fin fish and Shell-fish; 8.0 Know how to relate cell biology knowledge to fisheries and mariculture.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: ELEMENTS OF CELL BIOLOGY IN MARINE FISHERIES		COURSE CODE: OFS 111		CONTACT HOURS: 4HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in cell biology and its applications in fisheries technology and mariculture system						
GENERAL OBJECTIVE 1.0: Understand the concept and scope of cell biology						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1. 1Explain the meaning and scope of cell biology. 1. 2Explain the importance of cell biology in fisheries. 1. 3Explain fisheries applications.	- Explain the meaning and scope of cell biology - Discuss the importance of cell biology in fisheries - Discuss fisheries applications	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 2.0: Know basic microscopy and laboratory skills						
2-3	2.1 Describe a microscope. 2.2 Describe different types of microscopes.	- Describe a microscope - Discuss all types of microscopes - Describe	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips,	- Identify different types of microscopes - Identify the different parts of	Guide students to: Identify different types of	Different types of microscopes, Slides, Microorganisms specimen

	2.3 Describe Microorganisms. 2.4 List the different types of microorganisms. 2.5 List different types of aquatic microorganisms.	Microorganisms • Explain the different types of microorganisms • Explain different types of aquatic microorganisms	Charts, Marker, Multimedia Projector, etc.	simple microscope and their functions • Operate simple microscope • Prepare slides of microorganisms like Spirogyra, Amoeba, Paramecium • Sketch the observed microorganisms	microscopes • Identify the different parts of simple microscope and their functions • Operate simple microscope • Prepare slides of micro-organisms like Spirogyra, Amoeba, Paramecium • Sketch the observed micro-organisms	
General Objective 3.0: Know structures and functions of plant and animal cells						

4-5	3.1 Describe cell and their structures. 3.2 Describe different types of cells. 3.3 Differentiate plant and animal cells. 3.4 Explain functions of cell organelles. 3.5 Describe nucleus, mitochondria, ribosomes, etc.	• Explain cells and their structures • Describe different types of cells • Discuss plant and animal cells • Discuss functions of cell organelles • Describe nucleus, mitochondria, ribosomes, etc.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.	• Identify different types of cells • Identify cell structures • Sketch and Label cell diagrams • Identify organelles	Guide students to: • Identify different types of cells • Identify cell structures • Sketch and Label cell diagrams • Identify organelles	Microscope, Slides, Onion, Spirogyra, Slides of Amoeba, Paramecium and Algae.
General Objective 4.0: Understand cellular metabolism and energy production						
6-7	4.1 Explain movement of substances across cell membranes. 4.2 Explain cell membrane functions. 4.3 Explain cellular metabolism. 4.4 Describe Adenosine Tri Phosphate (ATP) and energy transfer. 4.5 Explain enzymes and their functions. 4.6 Explain factors	• Describe movement of substances across cell membranes. • Describe cell membrane functions. • Explain cellular metabolism. • Describe ATP and energy transfer. • Explain enzymes and their functions. • Describe factors affecting enzymes.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.	• Conduct osmosis experiments • Identify membrane models • Analyze metabolic processes • Calculate energy transfer in a cell Conduct enzyme reaction experiment	Guide students to: • Conduct osmosis experiments • Identify membrane models • Analyze metabolic processes • Calculate energy transfer in a cell	Enzyme samples, Membrane models

	affecting enzymes. 4.7 Explain selective permeability. 4.8 Explain respiration and photosynthesis. 4.9 Explain energy production.	• Explain selective permeability. • Discuss respiration and photosynthesis. Discuss energy production.			Conduct enzyme reaction experiment	
General Objective 5.0: Know cell division processes						
8-9	5.1 Explain cell division processes. 5.2 Explain mitosis 5.3 Explain meiosis 5.4 Differentiate mitosis and meiosis	• Discuss cell division processes. • Discuss mitosis • Discuss meiosis • Differentiate between mitosis and meiosis	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.	• Observe prepared slides of mitosis and meiosis • Sketch a well labelled cell division stages • Compare stages of cell division	Guide students to: • Observe prepared slides of mitosis and meiosis • Sketch and label cell division stages • Compare stages of cell division	Prepared slides, Microscope.
General Objective 6.0: Understand basic principles of genetics and heredity						
10-11	6.1 Explain genetics and heredity. 6.2 Explain genes and chromosomes. 6.3 Describe inheritance	• Explain genetics and heredity. • Discuss genes and chromosomes. • Describe	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips,	• Identify different strains of cultured fishes	Guide students to: • Identify different strains of	Goldfish, Tilapia, <i>Clarias</i> species,

	patterns. 6.4 Explain Mendelian genetics 6.5 Describe how to solve genetic problems in fishes	inheritance patterns. • Explain Mendelian genetics • Discuss how to solve genetic problems in fishes	Charts, Marker, Multimedia Projector, etc.		cultured fishes	
General Objective 7.0: Know tissues and organs in fin fish and Shell-fish						
12-13	7.1 Explain fin fish and Shell-fish tissues 7.2 Explain functions of tissues 7.3 Explain fin fish and Shell-fish organs 7.4 Explain functions of organs 7.5 Describe organ systems in fin fish and Shell-fish	• Explain fin fish and Shell-fish tissues • Discuss functions of tissues • Explain fin fish and Shell-fish organs • Discuss functions of organs • Explain organ systems in fin fish and Shell-fish	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.	• Dissect a fish specimen • Identify the tissues of the dissected fish specimen • Identify the organs of the dissected fish specimen • Identify the organ systems in the dissected fish specimen	Guide students to: • Dissect a fish specimen • Identify the tissues of the dissected fish specimen • Identify the organs of the dissected fish specimen • Identify the organ systems in the dissected fish specimen	Sample of fin fish, Sample of Shell-fish, Dissecting set, Hand lens, Hand gloves, Microscope, Slides.

General Objective 8.0: Know how to relate cell biology knowledge to fisheries and mariculture						
14-15	8.1 Relate cell biology to fish breeding 8.2 Explain gametes and fertilization in fish 8.3 Describe embryonic development in fish 8.4 Explain environmental effects on cells. 8.5 Relate pollution to stress in fishes 8.6 Relate water quality to cell function 8.7 Explain toxicity effects on fin fish and Shell-fish	• Discuss cell biology in relation to fish breeding • Discuss gametes and fertilization in fish • Describe embryonic development in fish • Explain environmental effects on cells. • Discuss pollution and stress. • Relate water quality to cell function. • Explain toxicity effects on fin fish and Shell-fish	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.	• Identify reproductive organs in fish • Observe the developmental stages of fish embryos using a microscope	Guide students to: • Identify reproductive organs in fish • Observe the developmental stages of fish embryos using a microscope	Sample of fin fish, Sample of Shell-fish, Dissecting set, Hand lens, Hand gloves, Microscope, Slides.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

ELEMENTS OF CHEMISTRY IN MARINE FISHERIES

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: ELEMENTS OF CHEMISTRY IN MARINE FISHERIES	COURSE CODE: OFS 112	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to acquaint students with knowledge and skills in chemistry relevant for marine fisheries operations		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand basic chemical principles and concepts; 2.0 Understand atomic structure and chemical bonding; 3.0 Know acids, bases, and salts; 4.0 Understand simple chemical laboratory experiments; 5.0 Understand chemical reactions relevant to fisheries systems; 6.0 Know properties of organic and inorganic compounds; 7.0 Understand environmental pollution.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: ELEMENTS OF CHEMISTRY IN MARINE FISHERIES			COURSE CODE: OFS 112		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to acquaint students with knowledge and skills in chemistry relevant for marine fisheries operations						
GENERAL OBJECTIVE 1.0: 1. Understand basic chemical principles and concepts						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the meaning and scope of chemistry in fisheries 1.2 Describe chemistry concepts in fisheries applications 1.3 Explain the effects of chemistry on water and on the fish	- Discuss the meaning and scope of chemistry in fisheries - Describe chemistry concepts and fisheries applications - Discuss the effects of chemistry on water and on the fish	Textbooks, Encycloped ia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI) tools, etc.	.		
General Objective 2.0: Understand atomic structure and chemical bonding						

2	2.1 Explain atomic structure 2.2 Explain atoms, electrons, protons, neutrons. 2.3 Explain atomic models 2.4 Describe elements and compounds 2.5 Explain Chemical bonding 2.6 Explain chemical formulas and equations	• Discuss atomic structure • Discuss atoms, electrons, protons, neutrons. • Illustrate atomic models with labels • Discuss elements and compounds • Explain Chemical bonding • Explain chemical formulas and equations	Textbooks, Encyclopedias, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.			
General Objective 3.0: Know acids, bases, and salts						
3-6	3.1 Describe acids, bases and salts 3.2 Explain pH concepts 3.3 Relate pH of water to fish health 3.4 Explain effect of pH on water quality 3.5 Explain solutions and concentrations	• Explain acids, bases and salts. • Describe pH concepts • Describe effect of pH on fish health • Discuss the effect of pH on water quality • Discuss dissolved oxygen, hardness, and alkalinity • Explain chemical concentrations.	Textbooks, Encyclopedias, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Carry out practical to test acids and bases samples • Conduct pH tests on water in fishponds and other water bodies • Conduct water quality tests	Guide the student to: • Carry out practical to test for acids and bases • Conduct pH tests of water in fishponds and other water bodies • Conduct water quality tests	pH meter, Water samples, Litmus paper, Water test kits.

General Objective 4.0: Understand simple chemical laboratory experiments						
7-9	4.1 Explain analytical chemistry techniques 4.2 Explain laboratory safety procedures 4.3 Explain titration 4.4 Explain filtration 4.5 Explain molarity and dilution	- Discuss analytical chemistry techniques. - Discuss laboratory safety procedures - Discuss titration and filtration - Discuss molarity and dilution.	Textbooks, Encyclopedias, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	- Demonstrate laboratory safety procedure - Determine the volume of acid used from a titration experiment - Carry out filtration experiment	Guide the student to: - Demonstrate laboratory safety procedures - Demonstrate titration and filtration methods	Laboratory equipment, Chemical reagents, PPE, Filter paper.
General Objective 5.0: Understand chemical reactions relevant to fisheries systems						
10-11	5.1 Explain chemical reactions 5.2 Explain rates of chemical reactions 5.3 Explain oxidation and Reduction reaction 5.4 List factors that affect the rate of chemical reaction	- Explain chemical reactions - Discuss the types of chemical reactions - Describe oxidation and Reduction reaction - Explain factors that affect the rate of chemical reaction	Textbooks, Encyclopedias, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	Test the effect of catalyst, temperature, pH and concentration on chemical reaction	Guide students to: Test the effect of catalyst, temperature, pH and concentration on chemical reaction	Laboratory equipment, Chemical reagents, PPE.

General Objective 6.0: Know properties of organic and inorganic compounds						
12-13	6.1 Describe properties of the organic compounds 6.2 Describe inorganic compounds 6.3 Describe the properties of inorganic compound 6.4 Explain carbohydrates, proteins and lipids	- Describe properties of the organic compounds - Describe inorganic compounds - Describe the properties of inorganic compound - Explain carbohydrates proteins and lipids.	Textbooks, Encycloped ia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, AI, etc.	- Carry out test for carbohydrates - Carry out test for protein - Carry out test for lipids	Guide students to: - Carry out test for carbohydrates - Carry out test for protein - Carry out test for lipids	Laboratory equipment, Chemical reagents, Fat, Carbohydrate, Protein, PPE.
General Objective 7.0: Understand environmental pollution						
14-15	7.1 Explain the concept of environmental chemistry 7.2 Describe effects of pollution on marine environment 7.3 Explain gas laws and dissolved gases 7.4 Relate gases to fish survival 7.5 Explain pollutants and toxins 7.6 Explain toxicity effects on fin fish and Shell-fish	- Explain the concept of environmental chemistry. - Describe effects of pollution on fish. - Explain gas laws and dissolved gases. - Relate gases to fish survival.	Textbooks, Encycloped ia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	Carry out chemical oxygen demand (COD) and biological oxygen demand (BOD) tests.	Guide students to: Carry out chemical oxygen demand (COD) and biological oxygen demand (BOD) tests.	Laboratory equipment, Chemical reagents, PPE.

COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%



ELEMENTS OF PHYSICS IN MARINE FISHERIES

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: ELEMENTS OF PHYSICS IN MARINE FISHERIES	COURSE CODE: OFS 113	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to acquaint students with knowledge and skills in physics relevant for fisheries and marine operations		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the basic principles of physics; 2.0 Apply mechanics in fisheries operations; 3.0 Understand properties of fluids and pressure in mariculture systems; 4.0 Know heat transfer and temperature control in oceanography and fisheries; 5.0 Know light and sound applications in marine fisheries; 6.0 Apply electricity and energy concepts in oceanography and fisheries systems.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: ELEMENTS OF PHYSICS IN MARINE FISHERIES		COURSE CODE: OFS 113		CONTACT HOURS: 4HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to acquaint students with knowledge and skills in physics relevant for fisheries and marine operations						
GENERAL OBJECTIVE 1.0: Know the basic principles of physics						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain meaning and scope of physics in oceanography and fisheries 1.2 Explain branches of physics relevant to oceanography and fisheries 1.3 Explain measurement and units	- Discuss concepts of physics applications in oceanography and fisheries - Discuss mechanics, heat, electricity, optics. - Teach SI units and instruments.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	- Demonstrate proper handling of measuring instruments - Use basic measuring instruments	Guide students to - Demonstrate instrument handling - Use basic measuring instruments	Charts, Slides, Measuring tools, Vernier calipers.
General Objective 2.0: Apply mechanics in fisheries operations						
3-4	2.1.Explain motion, force and inertia 2.2.Explain speed, velocity and acceleration 2.3.Explain Friction	2.1. Discuss motion and force 2.2.Discuss speed, velocity, acceleration. 2.3.Explain Friction	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips,	Determine velocity, acceleration and effect of frictional force on a model boat	Guide students to: determine velocity, acceleration and effect of	PPE, Gear, Notepad, Model boat, Measuring tape,

	2.4.Explain work, energy, and power 2.5.Explain boat movement and gear operation	2.4.Explain work, energy, and power. 2.5.Discuss boat movement and gear operations	Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	in a fish pond	frictional force on a model boat in a fish pond	Stopwatch.
General Objective 3.0: Understand properties of fluids and pressure in mariculture systems						
5-8	3.1 Explain fluid mechanics in oceanography and fisheries 3.2 Explain properties of fluids (density, buoyancy, viscosity and surface tension) 3.3 Explain water flow and hydraulics 3.4 Explain pressure in fluids	- Discuss fluid mechanics in oceanography and fisheries - Discuss properties of fluids (density, buoyancy, Viscosity and surface tension). - Discuss water flow and hydraulics - Explain pressure in fluids	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	- Carry out practical to determine properties of fluid using a model boat in a pond - Demonstrate effect of height on water pressure - Construct a siphon using plastic hose	Guide students to: - Carry out practical to determine properties of fluid using a model boat in a pond - Demonstrate effect of height on water pressure - Construct a siphon using plastic hose	Model boat, Water tanks, Pumps, Pressure Gauges, Hose, Measuring tape, Sawblade.
General Objective 4.0: Understand heat transfer and temperature control in fisheries						

9-10	4.1 Explain heat 4.2 Explain temperature 4.3 Explain methods of measuring temperature 4.4 Explain heat transfer methods 4.5 Explain heat principles in fish processing 4.6 Explain refrigeration principle 4.7 Explain cold storage system	• Discuss heat and temperature • Discuss methods of measuring temperature and instrument for measuring temperature • Discuss heat transfer methods • Discuss heat principles in fish processing • Discuss refrigeration principle • Discuss cold storage system	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Measure temperature changes of tank and pond water using a thermometer	Guide students to • Measure temperature changes of tank and pond water using a thermometer	Thermometers, Notepad, Multiprobe meter.
General Objective 5.0: Know light and sound applications in oceanography and fisheries						
11-12	5.1 Explain optics 5.2 Explain sound 5.3 Explain reflection and refraction 5.4 Explain light applications in oceanography and fisheries 5.5 Explain sound applications in	• Discuss optics and sound • Discuss reflection and refraction • Explain light applications in oceanography and fisheries • Explain sound applications in	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence	• Carry out light reflection, refraction and deflection experiments in the laboratory • Demonstrate the applications of light and sound in fisheries	Guide students to: • Carry out light reflection, refraction and deflection experiments in the laboratory • Demonstrate the applications of	Optical materials, Light source, Sound source.

	oceanography and fisheries	oceanography and fisheries	(AI), etc.		light and sound in fisheries	
General Objective 6.0: Apply electricity and energy concepts in oceanography and fisheries systems						
13-15	6.1 Explain the concept of energy 6.2 Explain the concept of electricity 6.3 Explain renewable energy 6.4 Explain integration of renewable energy in mariculture 6.5 Explain electrical safety in fishery operation 6.6 Explain principles of aeration in mariculture. 6.7 Explain pumping systems used in fish farms. 6.8 Explain maintenance of electrical and pumping equipment	• Discuss the concept of energy • Discuss the concept of electricity • Discuss renewable energy (Solar, Water and Wind) • Discuss integration of renewable energy in mariculture • Explain electrical safety in fishery operation • Discuss principles of aeration in mariculture • Explain pumping systems used in fish farms • Explain maintenance of electrical and pumping equipment	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Demonstrate maintenance of solar energy installation • Demonstrate electrical safety procedure in fisheries operations • Operate aeration equipment • Operate water pumping equipment	Guide students to: • Demonstrate maintenance of solar energy installation • Demonstrate electrical safety procedure in fisheries operations • Operate aeration equipment • Operate water pumping equipment	Pipes, Solar panel, Aerator, Water pump, Safety charts, PPE.

COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%



ELEMENTS OF MATHEMATICS IN MARINE FISHERIES

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCES		
COURSE TITLE: ELEMENTS OF MATHEMATICS IN MARINE FISHERIES	COURSE CODE: OFS 114	CONTACT HOURS: 2HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 2HOURS/WEEK
YEAR: 1 SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 0
GOAL: This course is designed to equip students with mathematical knowledge necessary for fisheries and mariculture operations		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Apply basic arithmetic operations in fisheries calculations; 2.0 Know how to use ratios, proportions, and percentages in mariculture management; 3.0 Know algebraic problems related to fisheries systems; 4.0 Know how to use logarithms and indices in scientific calculations; 5.0 Apply geometry and mensuration in pond and tank calculations; 6.0 Apply trigonometry in pond design and construction; 7.0 Know statistical calculations for fisheries and oceanographic data; 8.0 Know practical fisheries management problems mathematically.		

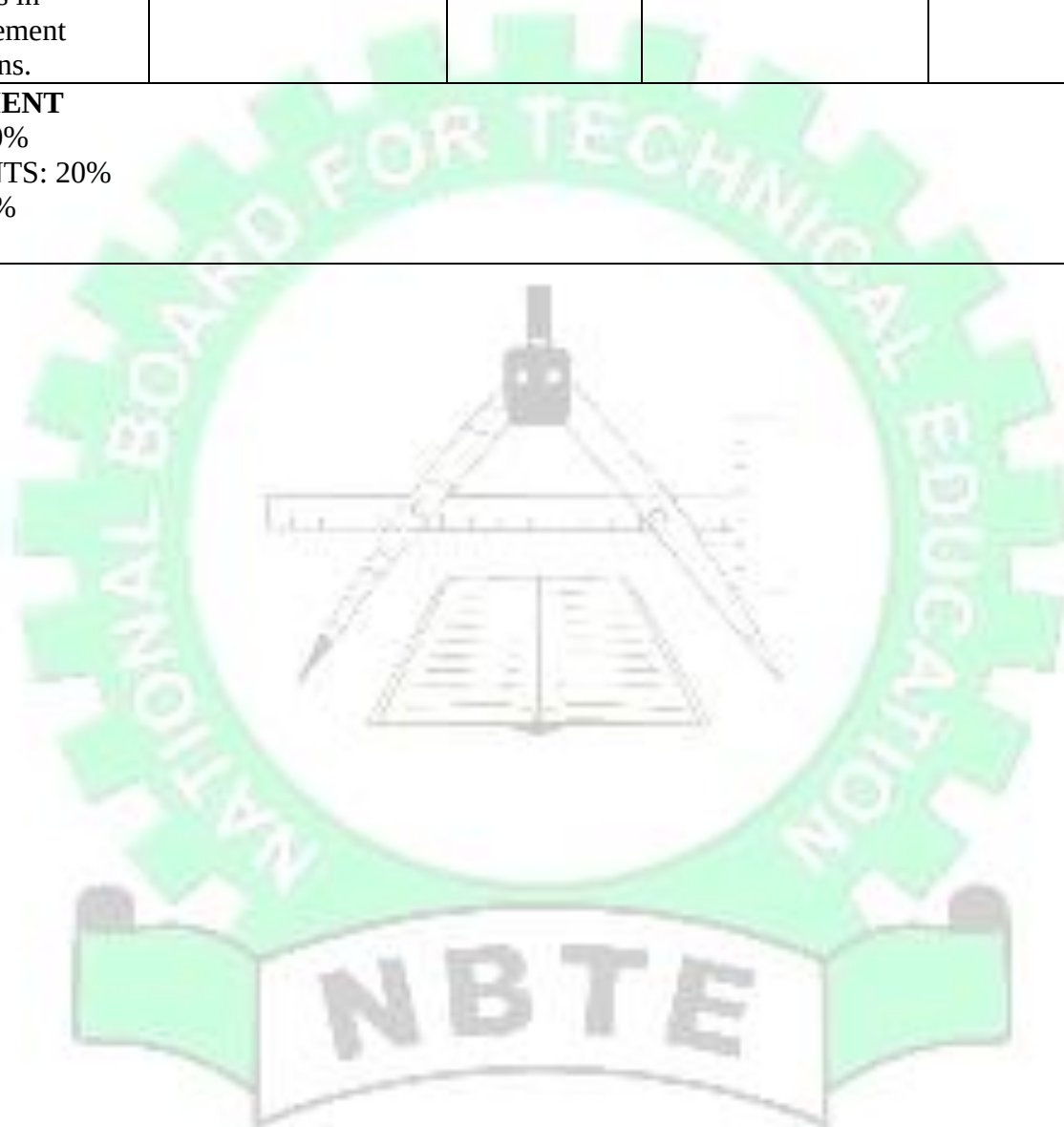
PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCES						
COURSE TITLE: ELEMENTS OF MATHEMATICS IN MARINE FISHERIES			COURSE CODE: OFS 114		CONTACT HOURS: 2HOURS/WEEK	
			CREDIT UNIT: 2		THEORETICAL: 2HOURS/WEEK	
YEAR: 1 SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 0	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with mathematical knowledge necessary for fisheries and mariculture operations						
GENERAL OBJECTIVE 1.0: Apply basic arithmetic operations in fisheries calculations						
THEORETICAL CONTENT			PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain importance of mathematics in fisheries. 1.2 Describe basic arithmetic operations 1.3 Explain mathematical applications in fisheries oceanography. 1.4 Solve problems involving arithmetic operations.	• Discuss the importance of mathematics in fisheries • Solve basic arithmetic operations. • Describe mathematical applications in fisheries.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 2.0: Know how to use ratios, proportions, and percentages in mariculture management						
2-3	2.1 Explain fractions, decimals, and	• Describe fractions, decimals, and	Textbooks, Encyclopedia,			

	percentages. 2.2 Describe feed percentages and mortality rates. 2.3 Explain ratio and proportion problems. 2.4 Describe ratio concepts in pond stocking.	percentages. • Calculate feed percentages and mortality rates. • Solve ratio and proportion problems • Apply ratio concepts in pond stocking.	E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 3.0: Know algebraic problems related to fisheries systems						
4-5	3.1 Explain algebraic expressions and equations. 3.2 Explain algebra problems in fisheries calculations. 3.3 Explain linear equations 3.4 Solve linear equations.	• Explain algebraic expressions and equations. • Apply algebra problems in fisheries calculations. • Explain linear equations	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 4.0: Know logarithms and indices in scientific calculations						
6-7	4.1 Explain indices 4.2 Explain logarithms. 4.3 Describe logarithms in scientific analysis.	• Describe indices • Describe logarithms. • Explain logarithms in scientific	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts,			

	4.4 Explain pH and growth calculations. 4.5 Solve problems in oceanography involving indices and logarithms.	analysis. Relate pH and growth calculations	Marker, Multimedia Projector, Logarithm tables, etc.			
General Objective 5.0: Apply geometry and mensuration in pond and tank calculations						
8-9	5.1 Explain geometry concepts 5.2 Calculate pond and tank dimensions 5.3 Explain mensuration principles 5.4 Estimate water capacity of pond/tanks.	- Discuss shapes and dimensions - Demonstrate practical examples - Describe area and volume calculations - Demonstrate calculations	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 6.0 Apply trigonometry in pond design and construction						
10-11	6.1 Explain trigonometry basics. 6.2 Explain trigonometry in fisheries engineering. 6.3 Solve trigonometric problems	- Introduce sine, cosine, tangent. - Explain slope and height measurements. - Solve trigonometric problems	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Trigonometric table, etc.			

General Objective 7.0: Know statistical calculations for fisheries and oceanographic data						
12-13	7.1 Explain basic statistics concepts. 7.2 Explain probability concepts. 7.3 Explain probability in fisheries analysis. 7.4 Explain graph plotting and interpretation. 7.5 Explain production and growth graphs. 7.6 Sole probability problems.	• Describe mean, median, mode. • Introduce simple probability. • Explain survival and risk estimates. • Demonstrate graph construction. • Explain fisheries trends.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			
General Objective 8.0: Know practical fisheries management problems mathematically						
14-15	8.1 Explain financial mathematics. 8.2 Explain mathematics in fisheries economics. 8.3 Explain mathematical models in fisheries. 8.4 Apply mathematical	• Discuss simple interest and cost analysis. • Demonstrate profit calculations. • Introduce production forecasting.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, etc.			

	analysis in management decisions.					
COURSE ASSESSMENT COURSE WORK : 20% TESTS/ASSIGNMENTS: 20% EXAMINATION: 60% TOTAL: 100%						



INTRODUCTION TO OCEANOGRAPHY

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: INTRODUCTION TO OCEANOGRAPHY	COURSE CODE: OFS 115	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to provide students with knowledge and skills of oceanographic processes, coastal environments, marine resources management and environmental sustainability		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the meaning and scope of oceanography; 2.0 Know the origin, structure, and distribution of the oceans; 3.0 Know the physical and chemical properties of sea water; 4.0 Know tides, waves, and ocean currents; 5.0 Know major coastal and marine ecosystems; 6.0 Understand the relationship between oceanography and fisheries.		

PROGRAMME: NATIONAL DIPLOMA OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: INTRODUCTION TO OCEANOGRAPHY			COURSE CODE:	CONTACT HOURS: 3HOURS/WEEK		
			CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: I			PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills of oceanographic processes, coastal environments, marine resources management and environmental sustainability						
GENERAL OBJECTIVE 1.0: Understand the meaning and scope of oceanography						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the meaning and scope of oceanography 1.2 Explain branches of Oceanography 1.3 Explain the importance of oceans 1.4 Explain the relationship between oceanography and fisheries science	• Explain oceanography concepts • Discuss marine resource importance • Discuss oceanographic disciplines • Describe the relationship between oceanography and fisheries science	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.			
General Objective 2.0: Know the origin, structure, and distribution of the oceans						
3-4	2.1 Describe the origin of oceans 2.2 Explain	• Describe the origin of oceans • Discuss distribution	Textbooks, Encyclopedia, E-books, Journals,			

	distribution of oceans and seas 2.3 Explain ocean basins 2.4 Explain continental shelf and continental slope 2.5 Explain deep-sea features 2.6 Explain the branches of oceanography	of oceans and seas • Discuss ocean basins • Discuss continental shelf and continental slope • Discuss deep-sea features • Discuss the branches of oceanography (physical, chemical, biological, geological, etc.)	Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.			
General Objective 3.0: Know the physical and chemical properties of sea water						
4-6	3.1 Explain the chemical composition of sea water 3.2 Describe temperature distribution in the ocean 3.3 Describe salinity of the ocean 3.4 Explain density and pressure in the ocean 3.5 Explain sea water circulation	• Discuss the chemical composition of sea water • Describe temperature distribution in the ocean • Discuss salinity of the ocean • Discuss density and pressure in the ocean • Explain sea water	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Conduct basic oceanographic field observations • Conduct simple water quality measurements (pH, Salinity, Temperature, Conductivity, Dissolved Oxygen, Total Dissolved Solid)	Guide students to: • Conduct basic oceanographic field observations • Conduct simple water quality measurements (pH, Salinity, Temperature, Conductivity, Dissolved Oxygen, Total Dissolved	Salinity meter, Thermometer, water samples, Charts, Water testing kits.

	3.6 Explain factors affecting seawater properties	circulation Explain factors affecting seawater properties			Solid)	
General Objective 4.0: Know tides, waves, and ocean currents						
7-9	4.1 Explain tides and tidal cycles 4.2 Describe ocean waves 4.3 Describe ocean currents 4.4 Explain causes and effects of ocean movements 4.5 Describe coastal processes	- Discuss tides and tidal cycles - Describe ocean waves - Describe ocean currents - Discuss causes and effects of ocean movements - Describe coastal processes	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Write observation reports on: - Tides and tidal cycles using video clips - Ocean waves and other ocean movements using video clips	Guide students to: - Observe tides and tidal cycles using video clips - Observe ocean waves and other ocean movements using video clips	Video clips, Charts, Multimedia projector.
General Objective 5.0: Know major coastal and marine ecosystems.						
10-12	5.1 Explain coastal features 5.2 Explain coastal ecosystem 5.3 Explain marine biodiversity	- Discuss the following coastal features (Bay, Straits, Archipelago, Sea caves, Trenches, Beaches, Creeks, etc.) - Discuss coastal ecosystems - Estuaries;	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	Identify major marine and coastal ecosystems and features using video clips	Guide students to: identify major marine and coastal ecosystems and features using video clips	Video clips, Charts, Multimedia projector.

		➤ Lagoons; ➤ Mangroves; ➤ Coral reefs; ➤ Brackish-water. • Discuss marine biodiversity				
General Objective 6.0: Understand the relationship between oceanography and fisheries.						
13-15	6.1 Explain the relationship between oceanography and fisheries 6.2 Explain fish distribution in the ocean 6.3 Explain primary productivity in the marine environment 6.4 Describe marine resources 6.5 Explain coastal fisheries 6.6 Explain blue economy concepts	• Discuss the relationship between oceanography and fisheries • Discuss fish distribution in the ocean • Discuss primary productivity in the marine environment • Describe marine resources • Explain coastal fisheries • Discuss blue economy concepts	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify marine resources using video clips and virtual laboratory.	Guide students to • Identify marine resources using video clips	Charts Multimedia projector, Video clips, Fisheries resource maps.

COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

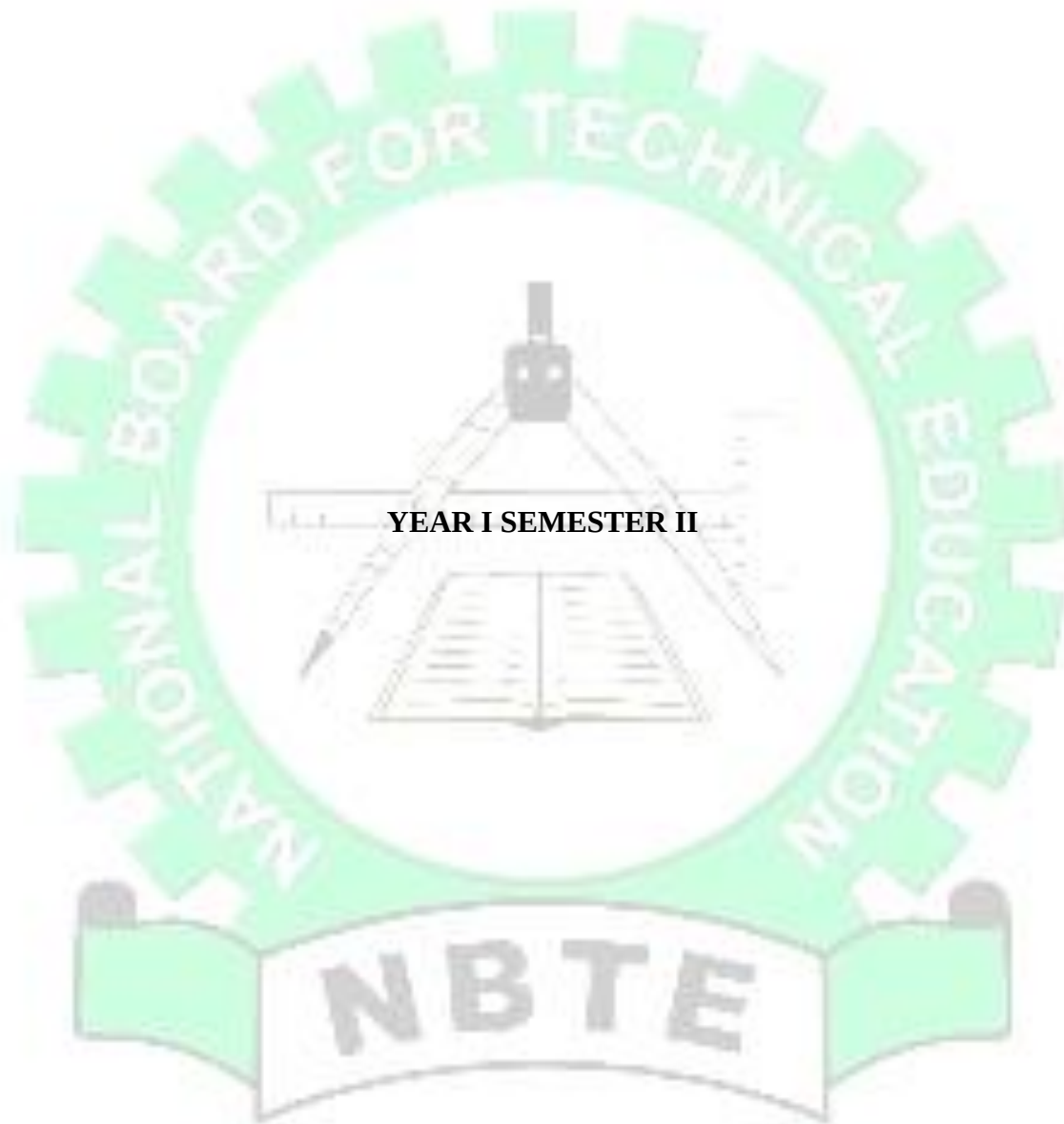
TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%





PHYSICAL OCEANOGRAPHY

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: PHYSICAL OCEANOGRAPHY	COURSE CODE: OFS 121	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to acquaint students with knowledge and skills with foundational knowledge of physical ocean processes and their applications in marine science and fisheries management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope and importance of physical oceanography; 2.0 Know the physical properties of seawater; 3.0 Understand ocean basin formation and topography; 4.0 Know tides, tidal mechanisms, waves and wave dynamics; 5.0 Understand ocean currents and global circulation systems; 6.0 Understand air-sea interactions and climate influence; 7.0 Know influence of physical ocean processes on fisheries productivity.		

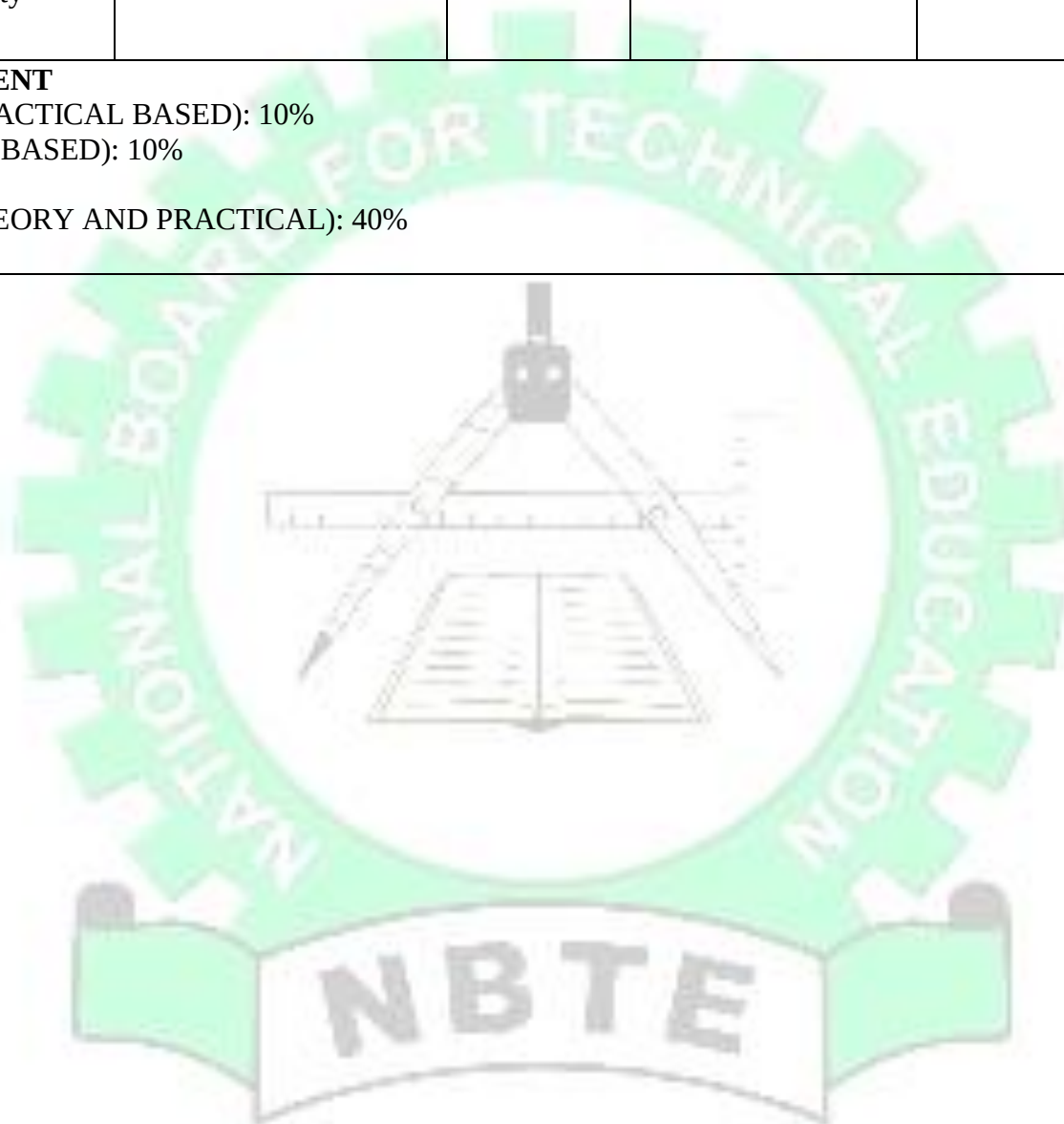
PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: PHYSICAL OCEANOGRAPHY		COURSE CODE: OFS 121		CONTACT HOURS: 3HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to acquaint students with knowledge and skills with foundational knowledge of physical ocean processes and their applications in marine science and fisheries management						
GENERAL OBJECTIVE 1.0: Understand the scope and importance of physical oceanography						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Define physical oceanography. 1.2 Explain importance in fisheries. 1.3 Explain oceanographic variables. 1.4 Explain oceanographic instruments. 1.5 Explain instrument operation. 1.6 Explain calibration. 1.7 Explain sampling methods in physical oceanography	• Discuss physical oceanography. • Outline importance in fisheries. • Discuss oceanographic variables. • Describe oceanographic instruments. • Explain instrument operation and calibration • Discuss sampling methods in physical oceanography	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials	• Identify oceanographic instruments • Calibrate oceanographic instruments • Operate oceanographic instruments • Record ocean data	Guide students to: • Identify oceanographic instruments • Calibrate oceanographic instruments • Operate oceanographic instruments • Record ocean data	Sampling equipment, Multiprobe parameter instruments, Boats, Current meters, GPS, PPE, Notepad, Sampling bottles, Depth sounder, Secchi disc.

General Objective 2.0: Know the physical properties of seawater						
3-4	2.1 Explain temperature 2.2 Explain marine salinity 2.3 Explain ocean density 2.4 Explain ocean pressure 2.5 Explain variation of temperature and salinity with depth 2.6 Explain sediments	• Discuss temperature • Discuss marine salinity • Discuss ocean density and pressure • Discuss variation of temperature and salinity with depth • Discuss sediments	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Measure ocean temperature and salinity • Collect marine water and sediments for analysis. • Identify the type of sediments	Guide students to: • Measure ocean temperature and salinity • Demonstrate how to collect marine water and sediments • Identify the type of sediments	Thermometers, Refractometers. Eckman grab, Sample of sediments, Video clips, Multimedia projector, Charts.
General Objective 3.0: Understand Ocean basin formation and topography						
5-6	3.1 Describe ocean basins 3.2 Explain seafloor features 3.3 Explain ocean formation processes 3.4 Explain different bathymetric zones 3.5 Explain ridges, trenches and shelves	• Discuss ocean basins • Describe seafloor features • Explain ocean formation processes • Describe different bathymetric zones • Discuss ridges, trenches and shelves	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials	• Conduct map reading and interpretation • Interpret bathymetric data	Guide students to: • Conduct map reading and interpretation • Interpret bathymetric data	Bathymetric data, Charts, Models, Maps.
General Objective 4.0: Know tides, tidal mechanisms, waves and wave dynamics						

7-8	4.1 Explain tides and their causes 4.2 Describe tidal types 4.3 Explain ocean wave and wave formation 4.4 Describe ocean wave properties 4.5 Explain ocean wave energy and coastal impact 4.6 Explain coastal erosion and sediment transportation	• Discuss lunar and solar forces • Explain spring and neap tides • Explain wavelength, period and height • Explain ocean wave energy and coastal impact • Discuss coastal erosion and sediment transportation	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Interpret tidal charts • Read tidal tables • Observe wind-wave interaction using video clips	Guide students to: • Interpret tidal charts • Read tidal tables • Observe wind-wave interaction using video clips	Charts, Tidal tables, Video clip, Tidal gauge, Multimedia projector.
General Objective 5.0: Understand Ocean currents and global circulation systems						
9-11	5.1 Explain ocean currents and causes of currents 5.2 Describe surface currents 5.3 Explain deep ocean currents 5.4 Explain global circulation patterns 5.5 Explain effects of ocean current and circulation on climate	• Discuss wind and density differences • Explain gyres and drift. • Discuss thermohaline circulation • Discuss major ocean basins • Discuss heat transport • Discuss ENSO systems	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Identify different types of ocean currents using the world map • Identify causes of ocean currents using world map • Trace different types of ocean currents using world map • Analyze thermohaline circulation within	Guide students to: • Identify different types of ocean currents using the world map • Identify causes of ocean currents using world map • Trace different types of ocean currents using world map • Analyze	World map, Current meter, Video clips, Charts, Multimedia projector.

	5.6 Explain El Niño/La Niña			the ocean	thermohaline circulation within the ocean	
General Objective 6.0: Understand air-sea interactions and climate influence						
12-13	6.1 Explain heat exchange processes 6.2 Explain wind formation 6.3 Explain monsoon effects	- Discuss evaporation and radiation - Discuss atmospheric pressure systems - Discuss seasonal variations	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	- Observe evaporation and radiation processes using video clips - Interpret wind data - Analyze seasonal patterns using weather tracker	Guide students to: - Observe evaporation and radiation processes using video clips - Interpret wind data - Analyze seasonal patterns using weather charts	Weather tracker, Video clips, Charts, Wind data, Multimedia projector.
General Objective 7.0: Know influence of physical ocean processes on fisheries productivity						
14-15	7.1 Explain fish distribution pattern in the ocean 7.2 Explain factors affecting fish distribution in the ocean 7.3 Explain upwelling systems 7.4 Explain coastal	- Discuss temperature and currents. - Discuss nutrient enrichment. - Discuss estuaries and shelves.	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	Identify productivity zones in the ocean using video clips and maps	Guide students to Identify productivity zones in the ocean using video clips and maps	Video clips, Charts, Maps, Multimedia projector.

	productivity					
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



CHEMICAL OCEANOGRAPHY

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: CHEMICAL OCEANOGRAPHY	COURSE CODE: OFS 122	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in marine chemical processes and their applications in oceanography and fisheries studies		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope and importance of chemical oceanography; 2.0 Know the chemical composition of seawater; 3.0 Understand salinity, pH, acidification and alkalinity in marine systems; 4.0 Know major nutrient cycles in the ocean; 5.0 Know dissolved gases and their roles in marine environments; 6.0 Understand chemical processes and fisheries productivity.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: CHEMICAL OCEANOGRAPHY		COURSE CODE: OFS 122		CONTACT HOURS: 3HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in marine chemical processes and their applications in oceanography and fisheries studies						
GENERAL OBJECTIVE 1.0: Understand the scope and importance of chemical oceanography						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1. 1 Explain scope and relevance of chemical oceanography 1. 2 Explain importance of chemical oceanography in marine systems 1. 3 Describe major chemical components of seawater	- Explain scope and relevance of chemical oceanography - Explain importance of chemical oceanography in marine systems - Describe major chemical components of seawater	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.			
General Objective 2.0: Know the chemical composition of seawater						

2-5	2.1 Describe major dissolved salts 2.2 Explain salinity variation 2.3 Explain seawater density 2.4 Describe chemical instruments 2.5 Explain sampling techniques 2.6 Explain calibration procedures 2.7 Explain temperature-salinity relation	- Discuss major dissolved salts (Na^+, Cl^-, Mg^{2+}, etc.) - Discuss salinity variation - Discuss seawater density - Describe chemical instruments - Explain sampling techniques - Explain calibration procedures - Discuss temperature-salinity relation	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	- Identify the equipment used for chemical analysis - Calibrate chemical equipment - Collect samples of sea water for salinity test. - Separate ions from sample sea water - Identify ions from sample sea water - Measure salinity of sample sea water - Identify chemical analysis equipment	Guide students to: - Identify the equipment used for chemical analysis - Demonstrate calibration of equipment - Demonstrate how to collect samples of sea water - Separate ions from sample sea water - Identify ions from sample sea water - Measure salinity of sample sea water - Identify chemical analysis equipment	Water sampling kits, pH meters, Salinometers, DO meters, Refractometers, Titration kits, Sampling bottles, Spectrophotometers, PPE.
General Objective 3.0: Understand salinity, pH, acidification and alkalinity in marine systems						
6-8	3.1 Explain pH in marine systems	Discuss pH in marine systems	Textbooks, Encyclopedia,	Carry out pH and oxygen test	Guide students to: Carry out pH	Buffer solution, pH meters,

	3.2 Explain alkalinity in marine systems 3.3 Explain ocean carbonate system 3.4 Explain causes of ocean acidification 3.5 Explain the effects of acidification on marine life 3.6 Explain mitigation strategies	• Discuss alkalinity in marine systems • Discuss ocean carbonate system • Explain causes of ocean acidification • Discuss the effects of acidification on marine life • Explain mitigation strategies	E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Carry out buffering experiment	and oxygen test • Carry out buffering experiment	Litmus paper, Salinometers, Laboratory glasswares, DO meters, Refractometers, Sampling bottles, Spectrophotometers, PPE.
General Objective 4.0: Know Dissolved Gases and Their Roles In Marine Environments						
9-11	4.1 Explain major dissolved gases in the marine environment 4.2 Explain oxygen dynamics 4.3 Explain respiration and photosynthesis in the ocean 4.4 Explain gas solubility in the ocean	• Discuss major dissolved gases in the marine environment • Discuss oxygen dynamics • Discuss respiration and photosynthesis in the ocean • Explain gas solubility in the ocean	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Carry out experiment to identify dissolved gases in sample seawater • Carry out solubility tests of sample seawater	Guide students to: • Carry out experiment to identify dissolved gases in sample seawater • Carry out solubility tests of sample seawater	Water sampling kits, DO meters, Titration kits, Sampling bottles, PPE, Laboratory glassware, Weighing balance, Chemical reagents.
General Objective 5.0: Know Major Nutrient Cycles in The Ocean						

12-14	5.1 Explain nitrogen cycle in the ocean 5.2 Explain phosphorus cycle in the ocean 5.3 Explain silica cycle in the ocean 5.4 Explain oxidation-reduction reactions in the ocean 5.5 Explain sediment chemistry in the ocean 5.6 Explain nutrient regeneration in the ocean	• Discuss nitrification and fixation • Discuss phosphorus cycle in the ocean • Discuss silica cycle in the ocean • Discuss oxidation-reduction reactions in the ocean • Explain sediment chemistry in the ocean • Explain nutrient regeneration in the ocean	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Sketch the following: ➤ Nitrogen cycle ➤ Phosphorus cycle ➤ Silica cycle • Carry out grain size analysis of ocean sediments	Guide students to; • Sketch the following: ➤ Nitrogen cycle ➤ Phosphorus cycle ➤ Silica cycle • Carry out grain size analysis of ocean sediments	Eckman grab, Sieve, Sediment filter, Sketch pad.
General Objective 6.0: Understand chemical processes and fisheries productivity						
15	6.1 Explain nutrient productivity link 6.2 Explain upwelling chemistry 6.3 Explain eutrophication	• Discuss nutrient productivity link • Discuss upwelling chemistry • Describe eutrophication	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.			

COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%



INTRODUCTION TO MARICULTURE

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: INTRODUCTION TO MARICULTURE	COURSE CODE: OFS 123	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in mariculture production systems		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concepts and importance of mariculture; 2.0 Know major mariculture species and culture systems; 3.0 Know hatchery and nursery operations in mariculture; 4.0 Understand feeding and water quality management practices; 5.0 Know common diseases and parasites in mariculture systems and biosecurity measures; 6.0 Know harvesting, processing, and storage methods; 7.0 Understand environmental sustainability.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: INTRODUCTION TO MARICULTURE			COURSE CODE: OFS 123		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in mariculture production systems						
GENERAL OBJECTIVE 1.0: Understand the concepts and importance of mariculture						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain Mariculture and Aquaculture 1.2 Explain the history and development of mariculture 1.3 Explain the importance of mariculture 1.4 Describe marine and brackish water environments 1.5 Explain environmental factors affecting mariculture 1.6 Explain suitable sites for mariculture	• Explain definitions and concepts of mariculture • Discuss global and local development trends • Discuss food security, employment and export benefits • Explain characteristics of marine ecosystems • Discuss salinity, temperature, dissolved oxygen,	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Observe marine environment features using video clips • Measure water quality parameters • Assess suitable site for mariculture	Guide students to: • Observe marine environment features using video clips • Measure water quality parameters • Assess suitable site for mariculture	Sampling equipment, GPS, Water quality test kits, PPE, Camera, Video clips, Charts, Multimedia projector.

		tides, and pH • Explain criteria for site selection				
General Objective 2.0: Know major mariculture species and culture systems						
3-4	2.1 Explain major groups of mariculture species 2.2 Explain characteristics of commercially important species 2.3 Explain criteria for species selection 2.4 Explain different mariculture systems 2.5 Explain components of mariculture facilities 2.6 Explain advantages and disadvantages of mariculture systems	• Explain finfish, Shell-fish, crustaceans, and seaweeds • Discuss shrimp, oysters, mussels, seaweed, and marine fish • Discuss growth rate, market demand, and environmental adaptability • Discuss ponds, cages, tanks, rafts, and long-line systems • Explain hatcheries, nurseries, and grow-out facilities • Discuss operational requirements and limitations	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify mariculture species • Compare mariculture species • Identify culture systems • Identify facility components	Guide students to: • Identify different finfish and Shell-fish that can be cultured in Marine environment • Identify the culture system to use	Mariculture manuals, Shell-fish, Crustaceans, Seaweeds, Oysters, Mussels, Finfish, Cuttlefish, Bloody-cockle, Cages, Pens, Raft, Line, Rack, Nets.
General Objective 3.0: Know hatchery and nursery operations in mariculture						

5-6	3.1 Explain hatchery operations in mariculture 3.2 Explain larval and juvenile rearing techniques 3.3 Explain acclimatization and stocking procedures	• Discuss broodstock management and spawning • Discuss nursery management procedures • Discuss stocking techniques	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Observe hatchery procedures using video clips • Observe rearing of larvae and juveniles using video clips and/or virtual laboratory • Carry out stocking exercises	Guide students to: • Observe hatchery procedures using video clips • Rear larvae and juveniles • Carry out stocking exercises	Video clips, Charts, Multimedia projector, PPE.
General Objective 4.0: Understand feeding and water quality management practices						
7-8	4.1 Explain nutritional requirements of marine organisms 4.2 Explain feeding methods and schedules 4.3 Explain feed management and storage 4.4 Explain importance of water quality in mariculture 4.5 Explain water quality management	• Discuss proteins, lipids, vitamins, and minerals • Discuss feeding practices • Discuss feed handling and preservation • Discuss effects of water quality on growth and survival of mariculture species • Discuss aeration, water exchange and filtration	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify feed ingredients • Culture live fish food • Store feeds properly • Use testing equipment • Measure water quality parameters • Observe water quality changes	Guide students to: • Identify feed ingredients • Culture live fish food • Store feeds properly • Demonstrate use of testing equipment • Measure water quality parameters • Observe water quality changes	Feed ingredients, Feedmill, equipment, Dryer, Water quality test kits, Plankton net, Reagents, Tanks, PPE, Microscope.

	techniques					
General Objective 5.0: Know common diseases and parasites in mariculture systems and biosecurity measures						
9-10	5.1 Identify common diseases in mariculture systems 5.2 Explain methods of disease prevention and control 5.3 Explain parasites control in mariculture 5.4 Explain fouling in mariculture	• Explain causes and symptoms of diseases • Discuss sanitation and treatment procedures • Discuss predator and parasite control methods • Discuss fouling in mariculture	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Observe disease symptoms • Demonstrate biosecurity measures • Identify common parasites using manual	Guide students to: • Observe disease symptoms • Demonstrate biosecurity measures • Identify common parasites using manual	Microscopes, Slides, Reagents, Microbial test kits, Manual, PPE.
General Objective 6.0: Know harvesting, processing, and storage methods						
11-12	6.1 Explain harvesting techniques in mariculture 6.2 Explain post-harvest handling procedures 6.3 Explain storage and transportation methods	• Discuss harvesting methods • Discuss sorting, grading, and packaging • Discuss preservation techniques	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Observe how to harvest mariculture organisms using video clips • Demonstrate sorting, grading and packaging of mariculture products • Demonstrate storage and transportation of	Guide students to: • Observe how to harvest mariculture organisms using video clips • Demonstrate Sorting, grading and packaging of mariculture products • Demonstrate	Basins, Refrigerators, Ice packs, Smoking kiln, Packaging materials and cartons, Weighing scale, Fish grader, PPE, Video clips, Charts, Multimedia

				mariculture products	storage and transportation of mariculture products	projector.
General Objective 7.0: Understand environmental sustainability						
13-15	7.1 Explain environmental impacts of mariculture 7.2 Explain sustainable mariculture practices 7.3 Explain waste management in mariculture 7.4 Explain regulations governing mariculture operations 7.5 Explain ethical and environmental responsibilities	• Discuss pollution and habitat degradation • Discuss eco-friendly farming techniques • Discuss waste reduction and recycling • Discuss fisheries laws and environmental regulations • Discuss resource conservation and responsible farming	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	• Carry out field trip to identify environmental problems • Demonstrate waste management methods	Guide students to: • Carry out field trip to identify environmental problems • Demonstrate waste management methods	Boats, Camera, PPE, Observation checklist, Drones.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

BASIC SAFETY AT SEA

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: BASIC SAFETY AT SEA	COURSE CODE: OFS 124	CONTACT HOURS: 3
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: 1 SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills necessary for safe participation in marine, fisheries, and coastal operations		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the importance of safety in marine and fisheries operations at sea; 2.0 Know common hazards associated with working at sea; 3.0 Know basic knowledge of personal survival techniques; 4.0 Know fire prevention and basic firefighting procedures onboard vessels; 5.0 Know elementary first aid techniques during emergencies; 6.0 Know personal ethical practices in marine operations; 7.0 Understand emergency communication and evacuation procedures.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: BASIC SAFETY AT SEA			COURSE CODE: OFS 124		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: 1 SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills necessary for safe participation in marine, fisheries, and coastal operations						
GENERAL OBJECTIVE 1.0: Understand the importance of safety in marine and fisheries operations at sea						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the meaning of safety at sea 1.2 Explain the importance of safety at sea 1.3 Explain maritime safety culture; overview of Standards of Training, Certification and Watchkeeping (STCW) concepts; 1.4 Explain safety responsibilities onboard vessels 1.5 Describe causes of marine accidents	• Explain basic maritime safety principles • Discuss accident case studies • Discuss marine safety culture • Discuss STCW safety concepts.	Whiteboard, Projector, Maritime safety charts, STCW introductory materials, Video clips, etc.	• Identify safety signs at sea • Demonstrate safety procedures at sea • Identify the causes of marine accidents using video clips or simulators.	Guide students to: • Identify safety signs at sea • Demonstrate safety procedures at sea • Identify the causes of marine accidents using video clips or simulators.	Safety guide chart, Multimedia projector, Video clips.

General Objective 2.0: Know common hazards associated with working at sea						
3-4	2.1 Describe physical hazards at sea 2.2 Describe chemical hazards at sea 2.3 Describe biological hazards at sea 2.4 Explain electrical and mechanical hazards 2.5 Explain assessment and hazard reporting	- Discuss physical (slips, trips and falls), chemical, biological, electrical and mechanical hazards at sea - Discuss hazard identification techniques - Explain risk assessment procedures	PPE samples, Hazard signs, Safety manuals, Safety charts, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI), etc.	- Identify hazards at sea - Demonstrate basic risk management procedure - Carry out hazard assessment using video clip - Write a technical report on hazard assessment.	Guide students to: - Identify hazards at sea - Demonstrate basic risk management procedure - Carry out hazard assessment using video clip. - Write a technical report on hazard assessment.	Safety charts, Video clips, Multimedia projector, Report writing template.
General Objective 3.0: Know basic knowledge of personal survival techniques						
5-6	3.1 Explain survival principles at sea 3.2 Explain emergencies at sea 3.3 Explain abandon ship procedures 3.4 Explain water survival basics 3.5 Describe hypothermia and	- Discuss survival principles at sea - Describe emergencies at sea - Explain abandon-ship procedures at sea - Discuss water survival basics - Describe	Safety charts, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker,	- Identify basic survival crafts - Demonstrate how use basic survival crafts and PPEs - Use life-saving appliances properly.	Guide students to: - Identify basic survival crafts - Demonstrate how use basic survival crafts and PPEs - Use life-saving appliances	PPEs, Life jackets, Lifebuoys, Life boats, Life raft, Video clips, Survival Manual, Multimedia projector,

	exposure	hypothermia and exposure	Multimedia Projector, Artificial Intelligence (AI), etc.		properly.	Thermal protective aids, Immersion survival suit.
General Objective 4.0: Know fire prevention and basic firefighting procedures onboard vessels						
7-9	4.1 Explain causes of fire onboard vessels 4.2 Explain classes of fire onboard vessels 4.3 Explain fire triangle 4.4 Describe fire prevention methods 4.5 Describe different types of fire extinguishers 4.6 Explain firefighting procedures 4.7 Explain fire emergency response techniques	- Discuss causes of fire onboard vessels - Discuss classes of fire onboard vessels - Explain fire triangle - Discuss fire prevention methods - Describe different types of fire extinguishers - Discuss firefighting procedures - Explain fire emergency response techniques	Fire extinguishers, Fire safety posters, Safety charts, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Identify firefighting equipment used onboard vessels - Operate fire extinguisher - Use fire blanket - Use automatic fire extinguisher ball - Demonstrate fire emergency response	Guide students to: - Identify firefighting equipment used onboard vessels - Operate fire extinguisher - Demonstrate fire emergency response - Demonstrate how to use fire blanket	Fire drilling simulation, Video clips, Automatic fire extinguisher ball, Safety charts, Fire extinguisher, Fire blanket Multimedia projector.
General Objective 5.0: Know elementary first aid techniques during emergencies						
10-11	5.1 Explain principles of first aid 5.2 Explain Cardio Pulmonary	- Explain principles of first aid - Explain Cardio Pulmonary	Textbooks, Encyclopedia, E-books, Journals,	- Demonstrate first aid procedures - Demonstrate CPR	Guide students to: Demonstrate first aid procedures	First aid kits, CPR manikin, Charts, Videos,

	Resuscitation (CPR) technique 5.3 Explain treatment of burns, cuts, fractures, and bleeding 5.4 Explain shock management 5.5 Explain drowning response 5.6 Explain how to handle injured persons	Resuscitation (CPR) technique - Explain treatment of burns, cuts, fractures, and bleeding - Explain shock management - Explain drowning response - Explain how to handle injured persons	Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	technique - Conduct basic injury management and treatment. - Observe how to respond to drowning emergency using video clips	- Demonstrate CPR technique - Conduct basic injury management demonstrations - Observe how to respond to drowning emergency using video clips	Multimedia projector, Dummy, Practical manual etc.
General Objective 6.0: Know personal ethical practices in marine operations						
12-13	6.1 Explain safe work practices 6.2 Explain teamwork onboard vessels 6.3 Explain fatigue and stress management 6.4 Explain drug and alcohol awareness 6.5 Describe communication and reporting procedures	- Discuss safe work practices - Discuss teamwork onboard vessels - Discuss fatigue and stress management - Discuss drug and alcohol awareness - Describe communication and reporting procedures	Textbooks, Encyclopedi a, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)			
General Objective 7.0: Understand emergency communication and evacuation procedures						
14-15	7.1 Describe emergency alarms	Discuss emergency alarms and signals	Emergency charts,	Identify safety equipment	Guide students to: Identify safety	Alarm devices, Emergency

	and signals 7.2 Explain distress communication system 7.3 Explain search and rescue operation 7.4 Explain muster stations 7.5 Explain evacuation procedures	• Discuss distress communication system • Discuss search and rescue operation • Describe muster stations • Explain evacuation procedures	Textbooks, Encyclopedias, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Demonstrate emergency drills	equipment • Demonstrate emergency drills	charts, VHF radio, Loud speaker, Buoyant smoke signal, Safety equipment.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



OCEANOGRAPHIC INSTRUMENTATION

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: OCEANOGRAPHIC INSTRUMENTATION	COURSE CODE: OFS 211	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in the use of oceanographic instruments		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand oceanographic instruments and observation; 2.0 Understand sea temperature instrumentation; 3.0 Understand instrument used in salinity measurement; 4.0 Understand ocean currents and waves measuring instruments; 5.0 Understand meteorological oceanographic instruments; 6.0 Understand the use of instruments in chemical oceanography.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: OCEANOGRAPHIC INSTRUMENTATION			COURSE CODE: OFS 211		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in the use of oceanographic instruments						
GENERAL OBJECTIVE 1.0: Understand oceanographic instruments and observation						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the concept and importance of oceanographic instrumentation 1.2 Explain categories of oceanographic instruments 1.3 Explain safety procedures in instrument handling 1.4 Explain the areas of relevance: EIA, Oceanography, Meteorology, Fisheries, Offshore Installation, Shipping industries, etc.	• Discuss the concept and importance of oceanographic instrumentation • Discuss categories of oceanographic instruments • Discuss safety procedures in instrument handling • Discuss the areas of relevance: EIA, Oceanography, Meteorology, Fisheries, Offshore	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)			

	1.5 Explain where oceanographic instruments can be installed (shore station, fisheries, oil platform, etc.)	Installation, Shipping industries, etc. Explain where oceanographic instruments can be installed (shore station, fisheries, oil platform, etc.)				
General Objective 2.0: Understand sea temperature instrumentation						
3-4	2.1 Describe the general principles of sea temperature observation 2.2 Explain the features of Conductivity, Temperature and Depth (CTD) instrument in oceanographic measurements 2.3 Describe the methods of observation and the basic requirements 2.4 Explain Remote Sensing with Infrared	- Discuss the general principles of sea temperature observation - Discuss the features of Conductivity, Temperature and Depth (CTD) instrument in oceanographic measurements - Discuss the methods of observation and the basic requirements - Discuss Remote Sensing with Infrared Thermometers and applications of	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	Demonstrate the use of temperature-measuring equipment	Guide students to demonstrate the use of temperature-measuring equipment	CTD equipment, Thermometer, PPE.

	Thermometers and applications of Remote Temperature Sensors/IoT	Remote Temperature Sensors/IoT Thermometers and Applications of Remote Temperature				
General Objective 3.0: Understand instrument used in salinity measurement						
5-6	3.1 Define salinity 3.2 Explain Salinity-Temperature-Depth (STD) relationship 3.3 Describe instruments used in salinity measurement 3.4 Explain methods used in measurement of salinity at the surface and at depth 3.5 Explain instruments used in measuring Total Suspended Solids (TSS).	- Explain salinity - Explain Salinity-Temperature-Depth (STD) relationship - Describe instruments used in salinity measurement - Explain methods used in measurement of salinity at the surface and at depth - Describe instruments used in measuring Total Suspended Solids (TSS).	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Identify different instruments for measuring salinity - Use instruments to measure salinity of sea samples.	Guide students to: - Identify different instruments for measuring salinity - Use instruments to measure salinity of sea samples.	Refractometer, Salinometer, Conductivity meter, CTD, Multi-parameter test kits, PPE.
General Objective 4.0: Understand Ocean currents and waves measuring instruments						

7-9	4.1 Explain instruments used in measuring currents and waves 4.2 Explain methods of measuring currents at different depths 4.3 Explain methods of observations of currents and waves from ocean station and vessels 4.4 Describe the specifications for sea and swell waves	- Describe instruments used in measuring currents and waves - Discuss methods of measuring currents at different depths - Discuss methods of observations of currents and waves from ocean station and vessels - Describe the specifications for sea and swell waves	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Demonstrate the use of current meter in the measurement of ocean current - Use Acoustic Doppler Current Profiler (ADCP) to measure ocean currents using video clips - Observe waves from coastal stations	Guide students to: - Demonstrate the use of current meter in the measurement of ocean current - Use Acoustic Doppler Current Profiler (ADCP) to measure ocean currents using video clips - Observe waves from coastal stations	Video clips, Multimedia projector, Current meter, Charts.
General Objective 5.0: Understand meteorological oceanographic instruments						
10-12	5.1 Explain meteorological instruments used in oceanography 5.2 Explain the use of satellite and remote sensing in meteorological data collection 5.3 Explain indigenous knowledge in	- Describe meteorological instruments used in oceanography (Barometer, Anemometer, Pyranometer, Rain gauge, etc.) - Discuss the use of satellite and remote sensing in meteorological data	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Identify different meteorological instruments (Barometer, Anemometer, Pyranometer, Rain gauge, etc.) - Demonstrate how to collect data from	Guide students to: - Identify different meteorological instruments (Barometer, Anemometer, Pyranometer, Rain gauge, etc.) - Demonstrate how to collect	GIS, Meteorological instruments.

	metrological forecasting	Explain indigenous knowledge in metrological forecasting		meteorological instruments (Barometer, Anemometer, Pyranometer, Rain gauge, etc.) Demonstrate the use of remote sensing devices for obtaining meteorological data	data from meteorological instruments (Barometer, Anemometer, Pyranometer, Rain gauge, etc.) Demonstrate the use of remote sensing devices for obtaining meteorological data	
General Objective 6.0: Understand the use of instruments in chemical oceanography						
13-15	6.1 Explain instruments used in chemical oceanography 6.2 Explain the instrument used in dissolved oxygen measurement 6.3 Explain instrument used in pH measurement 6.4 Explain instruments used in measurement of dissolved gasses	- Describe instruments used in chemical oceanography - Describe the instrument used in dissolved oxygen measurement - Describe instrument used in pH measurement - Describe instruments used in measurement of dissolved gasses	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Use DO meter for ocean water analysis. - Use CO₂ analyser. - Use methane analyser - Use spectrophotometer - Use colorimeter to analyse ocean water colour.	Guide students to: - Use DO meter for ocean water analysis. - Use CO₂ analyser. - Use methane analyser - Use spectrophotometer - Use colorimeter to analyse ocean water	DO meter, Methane analyser, Colorimeter, CO ₂ analyser, Gas chromatography, Spectrophotometer, PPE.

	(CO ₂ , Methane, etc.) 6.5 Explain the instrument used in measuring heavy metals.	(CO ₂ , Methane, etc.) • Describe the instrument used in measuring heavy metals		• Use gas chromatography	colour. • Use gas chromatography	
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COURSE ASSESSMENT

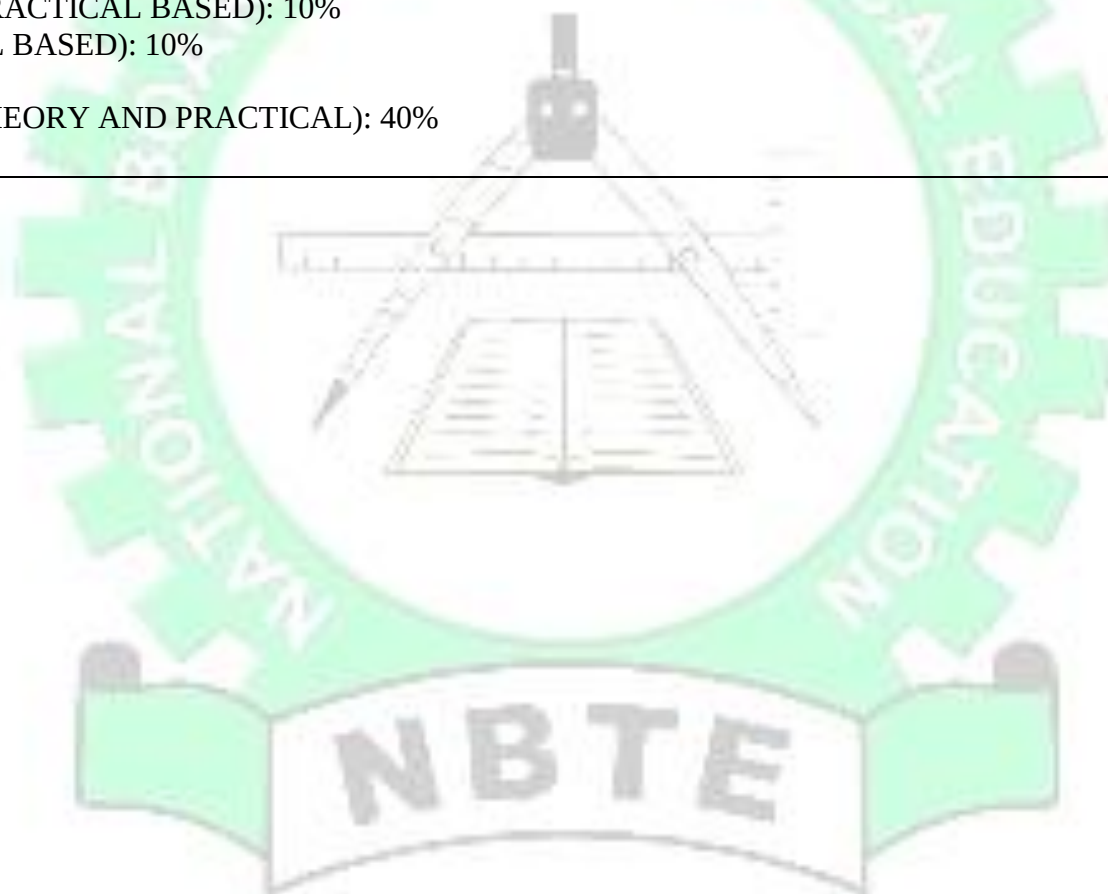
COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%



MARINE BIOLOGY

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND MARINE SCIENCE		
COURSE TITLE: MARINE BIOLOGY	COURSE CODE: OFS 212	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER; I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in the classification and management of marine organisms and their ecosystems		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the scope and importance of marine biology; 2.0 Know major marine habitats and ecosystems; 3.0 Know marine organisms and major taxonomic groups; 4.0 Understand the structure and functions of marine ecosystems; 5.0 Understand adaptations of organisms to marine environments; 6.0 Understand Marine Microbiology; 7.0 Understand Marine Resources and Human Impacts on Marine Ecosystems.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND MARINE SCIENCE						
COURSE TITLE: MARINE BIOLOGY			COURSE CODE: OFS 212		CONTACT HOURS: 3HOURS/ WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER; I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in the classification and management of marine organisms and their ecosystems						
GENERAL OBJECTIVE 1.0: Understand the scope and importance of marine biology						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resource
1	1.1 Explain marine biology 1.2 Explain the importance of marine biology 1.3 Describe the branches of marine biology	- Explain the concept and sc of marine biolo - Discuss econo and ecological importance - Explain marin ecology, oceanography, fisheries biolo	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials			
General Objective 2.0: Know major marine habitats and ecosystems						
2-3	2.1 Describe the marine environment 2.2 Explain major	- Explain physical and chemical characteristics of marine waters - Discuss	Whiteboard, Projector, Oceanographic textbooks, Charts,	Observe marine environment features using video clips	Guide students to: Observe marine environment	Video clips, Charts, Multimedia projector, Water testing

	marine habitats 2.3 Explain factors affecting marine habitats	temperature, salinity, light, and pressure. • Discuss temperature, salinity, light, and pressure.	Journals, Maps, Instructional materials,	• Measure water quality parameters of marine water	features using video clips • Measure water quality parameters of marine water	kits, PPE.
General Objective 3.0: Know marine organisms and major taxonomic groups.						
4-6	3.1 Explain principles of biological classification 3.2 Explain major groups of marine organisms 3.3 Explain marine biodiversity 3.4 Define plankton and explain their importance. 3.5 Explain common plankton species. 3.6 Explain ecological roles of plankton. 3.7 Define benthos and nekton. 3.8 Describe adaptations of benthic organisms. 3.9 Explain ecological roles of nektonic organisms.	• Describe taxonomy and nomenclature • Explain characteristics of algae, invertebrates, and vertebrates • Discuss species diversity and distribution • Explain phytoplankton and zooplankton • Demonstrate plankton identification techniques • Discuss primary productivity and food webs.	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Identify marine organisms using manual • Classify marine organisms using manual • Observe biodiversity patterns • Observe plankton samples • Identify planktons • Sketch well labeled marine food chains • Identify	Guide students to: • Identify marine organisms using manual • Classify marine organisms using manual • Observe biodiversity patterns • Observe plankton samples • Identify planktons • Sketch well labeled marine food chains • Identify	Manuals, Plankton nets, Eckman grab, Sampling bottles, Beach seine net, Drawing set, PPE, Preservatives, Reagents.

		• Explain characteristics and examples • Discuss adaptations to seabed environments • Discuss fish and marine mammals.		benthic and nektonic organisms • Observe their adaptation features	benthic and nektonic organisms • Observe their adaptation features	
General Objective 4.0: Understand the structure and functions of marine ecosystems						
7-9	4.1 Explain marine food chains and food webs. 4.2 Explain energy flow in marine ecosystems. 4.3 Explain nutrient cycling in marine ecosystems 4.4 Explain ecological relationships in marine ecosystems 4.5 Explain population dynamics of marine organisms 4.6 Explain succession in marine ecosystems.	• Discuss trophic levels. • Discuss ecological pyramids • Discuss carbon and nitrogen cycles. • Discuss predation, competition, and symbiosis. • Discuss growth, mortality, and recruitment. • Describe ecological succession	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Sketch well labeled marine food webs. • Construct ecological pyramids • Trace nutrient cycles • Identify ecological interactions	Guide students to: • Sketch well labeled marine food webs. • Construct ecological pyramids • Trace nutrient cycles • Identify ecological interactions	Drawing set, Charts, Preserved specimen Models.
General Objective 5.0: Understand adaptations of organisms to marine environments						

10-11	5.1 Explain adaptations of marine organisms 5.2 Explain osmoregulation in marine organisms 5.3 Explain adaptations to deep sea environments	• Discuss structural and physiological adaptations • Discuss salt balance mechanisms • Discuss bioluminescence and pressure tolerance	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Identify adaptive features of marine organisms using video clips	Guide students to • Identify adaptive features of marine organisms using video clips	Video clips, Charts, Multimedia projector.
General Objective 6.0: Understand Marine Microbiology						
12-13	6.1 Identify marine microorganisms. 6.2 Explain roles of marine microbes. 6.3 Explain harmful algal blooms and marine diseases.	• Explain bacteria, fungi, and viruses in marine systems. • Discuss decomposition and nutrient recycling • Discuss causes and effects	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps, Instructional materials, etc.	• Collect samples for microbial analysis • Culture and identify microorganisms • Identify harmful algae	Guide students to: • Collect samples for microbial analysis • Culture and identify microorganisms • Identify harmful algae	Microscopes, Agar, Autoclave. Laboratory glassware, Reagents, Oven, PPE.
General Objective 7.0: Understand marine resources and human impacts on marine ecosystems						
14-15	7.1 Explain marine fisheries resources 7.2 Explain sustainable utilization of marine resources 7.3 Explain marine	• Discuss finfish, Shell-fish, and seaweed resources. • Discuss responsible	Whiteboard, Projector, Oceanographic textbooks, Charts, Journals, Maps,			

	aquaculture practices. 7.4 Explain human activities affecting marine ecosystems. 7.5 Explain effects of climate change on marine ecosystems. 7.6 Explain methods of marine pollution control. 7.7 Explain marine conservation principles. 7.8 Explain Marine Protected Areas (MPAs). 7.9 Explain international and national marine conservation laws.	fishing practices. • Discuss mariculture systems. • Discuss pollution, overfishing, and coastal development. • Discuss ocean warming and acidification. • Discuss waste management and conservation strategies. • Discuss biodiversity conservation strategies • Discuss establishment and management of MPAs • Discuss fisheries regulations and conventions	Instructional materials, etc.			
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COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%



MARINE ENVIRONMENTAL POLLUTION AND PROTECTION

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: MARINE ENVIRONMENTAL POLLUTION AND PROTECTION	COURSE CODE: OFS 213	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills required for marine environmental pollution and protection		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0: Understand marine environmental pollution; 2.0: Know the major sources of marine pollution; 3.0: Understand Marine Pollution Act (MARPOL) 73/78 Annexes and International Maritime Organisation (IMO) Conventions; 4.0: Know the effects of pollution on marine ecosystems and fisheries; 5.0: Understand basic marine pollution prevention, monitoring and assessment in fisheries operations; 6.0: Know emergency response and contingency planning; 7.0: Know environmental impact assessment (EIA) procedures for coastal developments.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: MARINE ENVIRONMENTAL POLLUTION AND PROTECTION			COURSE CODE: OFS 213	CONTACT HOURS: 3HOURS/WEEK		
			CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK		
YEAR: II SEMESTER: I			PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills required for marine environmental pollution and protection						
GENERAL OBJECTIVE 1.0: Understand marine environmental pollution						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Define marine environmental pollution using UNCLOS Article 1(4) and MARPOL definitions 1.2 Explain the importance of marine environmental protection 1.3 Explain major categories of marine pollutants	• Explain concepts and definitions of pollution • Discuss reports of case studies of Niger Delta oil spills and Lagos lagoon plastic pollution • Discuss ecological and economic significance. • Explain physical, chemical, and biological pollutants	Charts/ Maps of Nigerian coastal zones, Textbooks, Videos – (“UNEP Marine Litter” and “Shell Bonga Spill Documentary”) MARPOL Annex I-VI summary handouts, Environmental reports, Multimedia	• Observe impacts of pollution using video clips • Identify pollutants • Classify pollutants	Guide students to: • Observe impacts of pollution using video clips • Identify pollutants • Classify pollutants	Video clips, Charts, Multimedia projector.

			Instructional materials, etc.			
General Objective 2.0: Know the major sources of marine pollution						
3-4	2.1 Explain land-based sources of marine pollution. 2.2 Explain sea-based sources of marine pollution. 2.3 Explain natural sources of marine pollution.	• Explain industrial, agricultural, and domestic, thermal and noise pollution sources. • Discuss shipping, offshore drilling, dumping; plastic and solid waste pollution. • Discuss atmospheric, offshore, erosion, floods, and volcanic activities, sewage and biological pollution. • Discuss sources and accumulation of plastics. • Discuss sources and accumulation of plastics, domestic and municipal waste discharges, • Discuss ingestion	Pollution case studies, Videos and reports, Maps, Charts, etc.	• Carry out field trip to identify local pollution sources • Analyze marine pollution incidents using video clips • Carry out field trip to natural and human-induced pollution sites • Compare natural and human-induced pollution • Identify physical, chemical, and biological indicators of pollution	Guide students to: • Carry out field trip to identify local pollution sources • Analyze marine pollution incidents using video clips • Carry out field trip to natural and human-induced pollution sites • Compare natural and human-induced pollution • Identify physical, chemical, and biological indicators of pollution.	Video clips, Charts, Multimedia projector, Camera, Water testing kits, Sampling bottle, PPE.

		and entanglement hazards. • Discuss pathogens and waterborne diseases. • Discuss recycling and waste reduction techniques				
General Objective 3.0: Understand MARPOL 73/78 Annexes and IMO Conventions						
5-6	3.1 Explain the MARPOL procedures and precautions to prevent pollution 3.2 Describe key regulations on oil, chemicals, sewage, garbage, air emissions 3.3 Explain MARPOL provisions to Nigerian fisheries operations	• Discuss each MARPOL Annex I-VI using plain language and examples • Discuss how to read an Oil Record Book and Garbage Record Book. • Discuss approaches to the domestication/ applications of MARPOL in Nigeria	IMO MARPOL Consolidated Edition 2024, Sample Oil Record Book and Garbage Record Book, NIMASA Marine Environment Management Regulations 2012, Instructional materials	• Carry out role play as a Nigerian Maritime Administration and Safety Agency (NIMASA) officer assigned for Port State Control inspection • Demonstrate filling a sample Garbage Record Book for a 7-day fishing trip • Interpret oil and garbage record data	Guide students to: • Portray NIMASA officer assigned Port State Control inspection scenario. • Demonstrate filling a sample Garbage Record Book for a 7-day fishing trip • Interpret oil and garbage record data	MCQ test on MARPOL Annex contents Student participation in a 7-day fishing trip
General Objective 4.0: Know the effects of pollution on marine ecosystems and fisheries.						

7-9	4.1 Explain causes of marine oil pollution. 4.2 Describe the effects of oil pollution on fish stocks, marine life/habitats, and biodiversity. 4.3 Explain oil spill control and cleanup methods 4.4 Explain industrial pollutants in marine environments. 4.5 Explain agricultural runoff and eutrophication. 4.6 Explain effects of toxic substances on marine organisms 4.6 Explain causes of marine plastic pollution. 4.8 Explain effects of plastics on marine organisms. 4.9 Explain waste management strategies.	• Discuss oil exploration, transportation, and spills. • Discuss marine spillage—sources and hazards • Discuss pollution from normal shipping operations - ballasting and tank cleaning, special tank vessels and products carriers • Discuss impacts of oil pollution on fisheries, fisher livelihoods, coastal communities and ecosystems. • Demonstrate containment and remediation techniques. • Apply MARPOL-	FAO Technical Paper 505, World Bank reports on Blue Economy in West Africa, Charts on fish landing decline in Niger Delta 2010-2025, Diagrams and videos, Waste management manuals	• Identify any of the following common pollutants in any Nigerian water body: oil spills, plastics, sewage, heavy metals, fishing gear and their causes • Carry out field trip to local fish markets to observe human generated pollutants • Demonstrate spill response procedures • Identify industrial pollutants • Observe eutrophication processes • Identify common marine debris using video clips • Observe impacts of plastic waste • Develop waste	Guide students to: • Identify any of the following common pollutants in any Nigerian water body: oil spills, plastics, sewage, heavy metals, fishing gear and their causes • Carry out field trip to local fish markets to observe human generated pollutants • Demonstrate spill response procedures • Identify industrial pollutants • Observe eutrophication processes • Identify common marine debris using video clips • Observe impacts	Videos clips, Charts, Multimedia projector, Cleanup equipment models, Chemical samples, Plastic waste samples, PPE, Camera, Notepad.
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		compliant procedures for bilge water and oily waste. • Discuss heavy metals and toxic chemicals. • Discuss fertilizers and pesticides. • Discuss bioaccumulation and biomagnification. • Discuss sources and accumulation of plastics. • Discuss ingestion and entanglement hazards. • Discuss recycling and waste reduction techniques.		management plans	of plastic waste • Develop waste management plans	
General Objective 5.0: Understand basic marine pollution prevention, monitoring and assessment in fisheries operations						

10-11	5.1 Explain principles of marine pollution monitoring. 5.2 Explain proper waste handling on board fishing vessels 5.3 Explain MARPOL-compliant procedures for bilge water and oily waste 5.4 Explain gear loss prevention strategies to reduce ghost fishing	• Discuss principles of marine pollution monitoring. • Discuss proper waste handling on board fishing vessels • Discuss MARPOL-compliant procedures for bilge water and oily waste • Explain gear loss prevention strategies to reduce ghost fishing	Monitoring manuals, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Demonstrate collection of water, sediment, and biota samples using standard methods • Measure pH, dissolved oxygen, salinity, and turbidity of the sample collected • Demonstrate sampling and analysis techniques with Van Dorn bottle, Secchi disk, and multiparameter probe • Use of oil-water separators and waste segregation bins • Observe ALDFG – (Abandoned, Lost, Discarded Fishing Gear) retrieval using video clips	Guide students to: • Demonstrate collection of water, sediment, and biota samples using standard methods • Measure pH, dissolved oxygen, salinity, and turbidity of the sample collected • Demonstrate sampling and analysis techniques with Van Dorn bottle, Secchi disk, and multiparameter probe • Use of oil-water separators and waste segregation bins • Observe ALDFG –	Manual for water analysis, Water quality test kits and meters, PPE, Sample bottles, Video clips, Charts, Multimedia projector, Coolers.
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					(Abandoned, Lost, Discarded Fishing Gear) retrieval using video clips	
General Objective 6.0: Know emergency response and contingency planning						
12-13	6.1 Explain steps in the National Oil Spill Contingency Plan (NOSCP) 6.2 Describe use of booms, skimmers, and dispersants 6.3 Explain tabletop oil spill drill 6.4 Explain Health, Safety and Environment (HSE) protocols	• Discuss NOSCP Tier 1, 2, 3 responses. • Describe use of booms, skimmers, and dispersants • Explain tabletop oil spill drill • Explain HSE and safety protocols	NOSCP 2020 Edition, NOSDRA IMO OPRC-HNS Manual, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify chemicals used for oil dispersal • Conduct a tabletop oil spill drill	Guide students to: • Conduct a tabletop oil spill drill • Identify chemicals used for oil dispersal	Videos of oil spill response exercises, Multimedia projector, Charts, Chemicals.
General Objective 7.0: Know environmental impact assessment (EIA) procedures for coastal developments						
14-15	7.1 Define Environmental Impact Assessment (EIA) 7.2 Explain procedures for conducting EIA 7.3 Explain the importance of EIA in marine development	• Explain EIA concepts and objectives • Discuss screening, scoping, and report writing – administrative & legal	EIA reports and guidelines, Case studies, Environmental policies, Textbooks, Encyclopedia, E-books, Journals,	• Identify stages of EIA • Prepare simple EIA reports • Analyze marine project impacts	Guide students to: • Identify stages of EIA. • Prepare simple EIA reports. • Analyze marine project impacts	Samples reports of EIA, Camera.

	projects	framework, project previews, project justification, project description and process. • Discuss mitigation measures and sustainability; stakeholders' consultation, description of the physical & socio-economic environment.	Magazines, Video clips, Marker, Multimedia Projector, AI			
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

MARINE FISH PROCESSING, STORAGE AND VALUE ADDITION

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: MARINE FISH PROCESSING, STORAGE AND VALUE ADDITION	COURSE CODE: OFS 214	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in marine fish processing, storage and value addition		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles, importance, and scope of marine fish processing, storage, and value addition in fisheries and mariculture industries. 2.0 Understand causes of fish spoilage and apply appropriate preservation methods to maintain fish quality and safety. 3.0 Know practical skills in fish handling, processing, packaging, and storage using standard fisheries technologies and hygienic procedures. 4.0 Know various fish preservation techniques such as smoking, drying, salting, chilling, freezing, and canning in fish processing operations. 5.0 Know appropriate equipment, tools, and materials used in fish processing and storage activities. 6.0 Know quality control, food safety, sanitation, and biosecurity measures in fish processing and value addition operations. 7.0 Know the competences in processing fish into value-added products for improved marketability, income generation, and reduced post-harvest losses.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: MARINE FISH PROCESSING, STORAGE AND VALUE ADDITION			COURSE CODE: OFS 214		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in marine fish processing, storage and value addition						
GENERAL OBJECTIVE 1.0: Understand the principles, importance, and scope of marine fish processing, storage, and value addition in fisheries and mariculture industries.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the meaning, of fish processing, storage, and value addition. 1.2 Explain the scope of fish processing, storage, and value addition. 1.3 Explain importance of fish processing, storage, and value addition. 1.4 Explain causes of fish spoilage and post-harvest losses. 1.5 Describe hygienic	- Discuss concepts of fish processing and discuss their economic and nutritional importance - Discuss microbial, enzymatic, and environmental causes of fish deterioration. - Discuss personal hygiene, sanitation, and food safety procedures.	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector	- Identify fish processing and storage facilities. - Identify signs of fresh and spoiled fish. - Apply hygienic handling procedures during fish processing. - Carry out simple fish smoking and drying activities.	- Guide students in identifying processing equipment and storage units. - Demonstrate fish quality assessment techniques. - Demonstrate cleaning and sanitation methods. - Demonstrate traditional fish preservation techniques	Processing tables, Fresh fish, spoiled fish samples, Protective clothing, Disinfectants, Handwashing facilities. Smoking kiln, drying racks, Salt, fish samples.

	handling practices in fish processing. 1.6 Explain traditional fish preservation methods.	Discuss smoking, drying, salting, and fermentation techniques.				
General Objective 2.0: Know causes of fish spoilage and apply appropriate preservation methods to maintain fish quality and safety						
3-4	2.1 Explain the meaning and importance of fish preservation and quality control. 2.2 Explain the causes of fish spoilage. 2.3 Explain factors affecting fish quality during handling and storage. 2.4 Describe principles of fish preservation methods. 2.5 Explain chilling and freezing methods of fish preservation.	- Discuss concepts of fish spoilage, preservation, and food safety through lecture and discussion. - Explain microbial, enzymatic, chemical, and physical causes of spoilage. - Discuss temperature, moisture, contamination, and handling methods affecting fish quality. - Explain preservation principles such as drying, smoking, salting, chilling, and freezing. - Discuss storage temperature	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector	- Identify signs of spoilage in fish samples - Demonstrate proper fish handling procedures. - Identify preservation equipment and materials. - Preserve fish using chilling and freezing methods.	Guide students to: - Demonstrate visual inspection of fish quality characteristics. - Examine spoilage indicators such as odor, texture, and discoloration. - Show correct methods of washing, sorting, and handling fish hygienically. - Demonstrate the use of preservation tools and equipment. - Packaging and cold storage practices	Spoiled fish samples, Freezer, thermometer, PPE.

		requirements and cold chain management.				
General Objective 3.0: Know practical skills in fish handling, processing, packaging, and storage using standard fisheries technologies and hygienic procedures.						
5-6	3.1 Explain the importance of proper fish handling, processing, packaging, and storage in fisheries operations. 3.2 Describe fish quality indicators and handling requirements. 3.3 Explain hygienic procedures in fish processing operations. 3.4 Describe fish dressing and preparation	• Introduce concepts of post-harvest handling, processing, and hygiene practices through lecture and discussion. • Explain freshness indicators, contamination risks, and handling procedures. • Discuss sanitation, personal hygiene, and workplace cleanliness procedures. • Explain fish scaling, gutting, filleting, and	Whiteboard, charts, projector, Charts, videos, textbooks Hygiene manuals, charts, projector Diagrams, videos, textbooks Smoking kiln, charts, videos	• Identify fish handling and processing equipment used in fisheries operations. • Demonstrate proper handling of fresh fish to prevent spoilage and damage. • Apply hygienic practices during fish processing activities. • Carry out dressing and preparation fish using standard processing methods. • Smoke fish using	Guide students to: • Demonstrate identification and functions of processing equipment and tools. • Sort, wash, and handle fish hygienically. • Demonstrate cleaning and sanitation procedures in processing areas. • Demonstrate fish preparation techniques and supervise practice sessions.	Fish processing tools, PPE, fish samples Fresh fish, clean water, gloves, trays Detergents, disinfectants, PPE, cutting boards, fish samples Smoking kiln, charcoal, fish trays

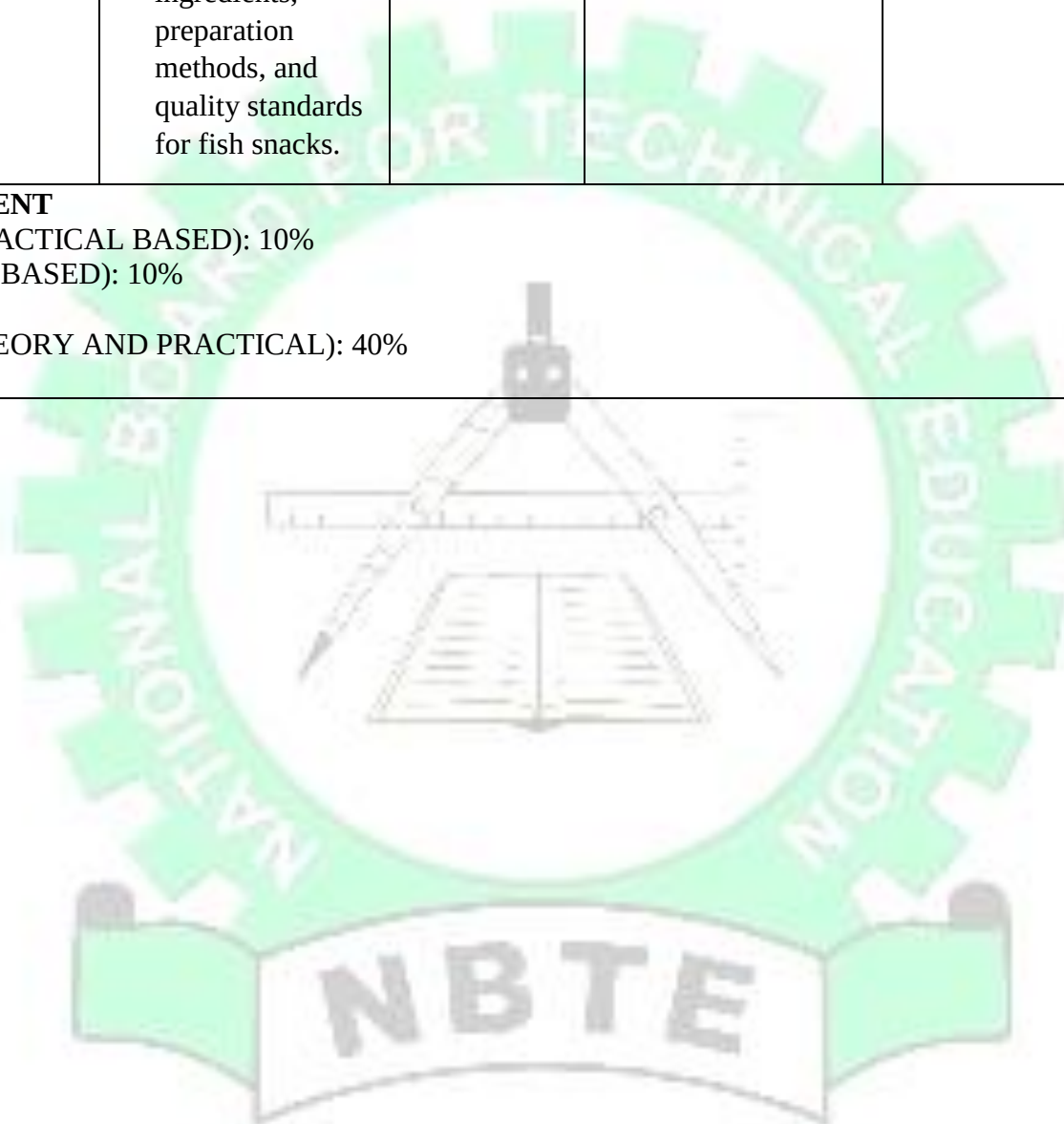
	techniques. 3.5 Explain fish smoking technologies and procedures.	dressing methods. • Discuss types of smoking kilns and smoking methods.		standard smoking techniques.	• Demonstrate fish arrangement, smoking procedures, and monitoring techniques.	
General Objective 4.0: Know various fish preservation techniques such as smoking, drying, salting, chilling, freezing, and canning in fish processing operations						
7-8	4.1 Explain the importance and principles of fish preservation in fisheries operations. 4.2 Explain causes of fish spoilage and methods of prevention. 4.3 Explain fish smoking techniques and procedures. 4.4 Explain drying methods used in fish preservation. 4.5 Explain salting and brining techniques in fish processing.	• Discuss concepts, objectives, and benefits of fish preservation methods through lecture and discussion. • Discuss microbial, chemical, enzymatic, and physical causes of spoilage. • Teach hot smoking and cold smoking methods and safety precautions. • Discuss sun drying, solar drying, and mechanical drying techniques. • Discuss dry	Whiteboard, charts, projector, Charts, videos clip, textbooks Smoking charts, videos, textbooks Drying charts, Salt samples,	• Identify preservation equipment and materials used in fish processing. • Identify signs of spoilage in fresh fish samples. • Smoke fish using standard smoking techniques. • Dry fish using appropriate drying methods. • Preserve fish using salting and brining techniques.	Guide students to: • Identify tools and equipment • Identify fish spoilage indicators • Demonstrate fish preparation, smoking, and monitoring procedures. • Supervise students in drying operations and moisture monitoring. • Demonstrate salting procedures and supervise	Smoking kiln, freezer, drying racks, fish samples Fresh fish, spoiled fish samples, gloves Smoking kiln, charcoal, trays, fish samples Drying racks, solar dryer, fish samples Salt, basins, fish samples

		salting and brining methods and preservation principles.			student practice.	
General Objective 5.0: Know appropriate equipment, tools, and materials used in fish processing and storage activities						
9-10	5.1 Explain the importance of equipment, tools, and materials in fish processing and storage operations. 5.2 Describe classification of fish processing equipment and tools. 5.3 Explain hygienic handling and maintenance of fish processing tools. 5.4 Describe cutting, dressing, and filleting tools used in fish processing. 5.5 Explain smoking	• Discuss types and functions of fish processing and storage equipment through lecture and discussion. • Explain manual and mechanical equipment used in fish processing. • Discuss sanitation, cleaning, and maintenance procedures for equipment and tools. • Explain functions and safety precautions for cutting and dressing tools. • Discuss types of smoking kilns and fuel materials used in fish	Whiteboard, charts, projector textbooks, Diagrams, Hygiene manuals, Processing charts, videos clips Smoking kiln,	• Identify fish processing and storage equipment used in fisheries operations. • Sort equipment and tools according to their uses. • Maintain fish processing equipment properly. • Use fish cutting and dressing tools safely and effectively. • Operate fish smoking equipment correctly.	Guide students to; • Identify and handle equipment and tools. • Sorting and categorizing processing tools. • Demonstrate washing, sanitizing, and maintenance procedures. • Identify fish scaling, gutting, and filleting techniques. • Demonstrate arrangement and operation of smoking kiln.	Fish processing equipment, PPE, fish samples Knives, drying racks Detergents, disinfectants, brushes, cutting boards, fish samples Smoking kiln, charcoal, fish trays

	equipment and materials used in fish preservation.	smoking.				
General Objective 6.0: Know quality control, food safety, sanitation, and biosecurity measures in fish processing and value addition operations.						
11-12	6.1 Explain the concepts of quality control, food safety, sanitation, and biosecurity in fish processing operations. 6.2 Explain causes and sources of contamination in fish processing and storage. 6.3 Explain food safety standards and regulations in fisheries operations. 6.4 Describe sanitation procedures and workplace hygiene practices 6.5 Explain biosecurity principles and	• Discuss principles and importance of quality assurance and safety practices through lecture and discussion. • Discuss biological, chemical, and physical contaminants affecting fish products. • Discuss national and international food safety standards and guidelines. • Discuss cleaning schedules, sanitation methods, and personal hygiene requirements. • Discuss	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector	• Identify sanitation and biosecurity facilities used in fish processing operations. • Identify contamination risks in fish processing environments. • Apply food safety procedures during fish handling and processing. • Perform sanitation and cleaning procedures in fish processing areas • Apply biosecurity measures in fish processing operations.	Guide students to: • Demonstrate identification of hygiene and biosecurity equipment. • Guide students in observing and identifying contamination sources. • Demonstrate proper food handling and contamination prevention practices. • Demonstrate cleaning and disinfection procedures. • Demonstrate disinfection, footbath use,	PPE, disinfectants, fish processing facility, Fish samples, Observation checklist Fish trays, Detergents, Brushes, Footbath.

	measures in fish processing facilities.	biosecurity protocols, access control, and disease prevention measures.			and restricted movement procedures.	
General Objective 7.0: Know the competences in processing fish into value-added products for improved marketability, income generation, and reduced post-harvest losses.						
13-15	7.1 Explain the concept and importance of value addition in fish processing. 7.2 Explain causes of post-harvest fish losses and methods of reduction. 7.3 Describe fish processing methods used in value addition. 7.4 Explain fish filleting and fish cutting techniques for product development. 7.5 Explain preparation of fish snacks and ready-to-eat	• Discuss concepts, benefits, and economic importance of value-added fish products through lecture and discussion. • Discuss spoilage factors, handling practices, and loss prevention strategies. • Describe smoking, drying, salting, frying, and packaging techniques. • Discuss fish dressing, deboning, and filleting procedures. • Discuss	Whiteboard, charts, projector, Charts, textbooks, charts, video clips Diagrams, Textbooks Recipe charts	• Identify common value-added fish products and processing materials. • Apply proper handling methods to reduce post-harvest losses. • Process fish using basic value addition techniques. • Prepare fish fillets and cuts for value-added processing. • Produce fish snacks and ready-to-eat fish products.	Guide students to: • Identify processed fish products and ingredients. • Demonstrate hygienic fish handling and preservation practices. • Demonstrate fish preparation and processing procedures. • Demonstrate fish filleting and trimming techniques. • Prepare fish rolls, fish pie, and fish balls.	Fish samples, Processed fish products, PPE, Fresh fish, Trays, Clean water, Smoking kiln, Drying racks, Knives, Cutting boards, Fish mince, Flour, Spices, Fryer, Vegetable oil.

	products.	ingredients, preparation methods, and quality standards for fish snacks.				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

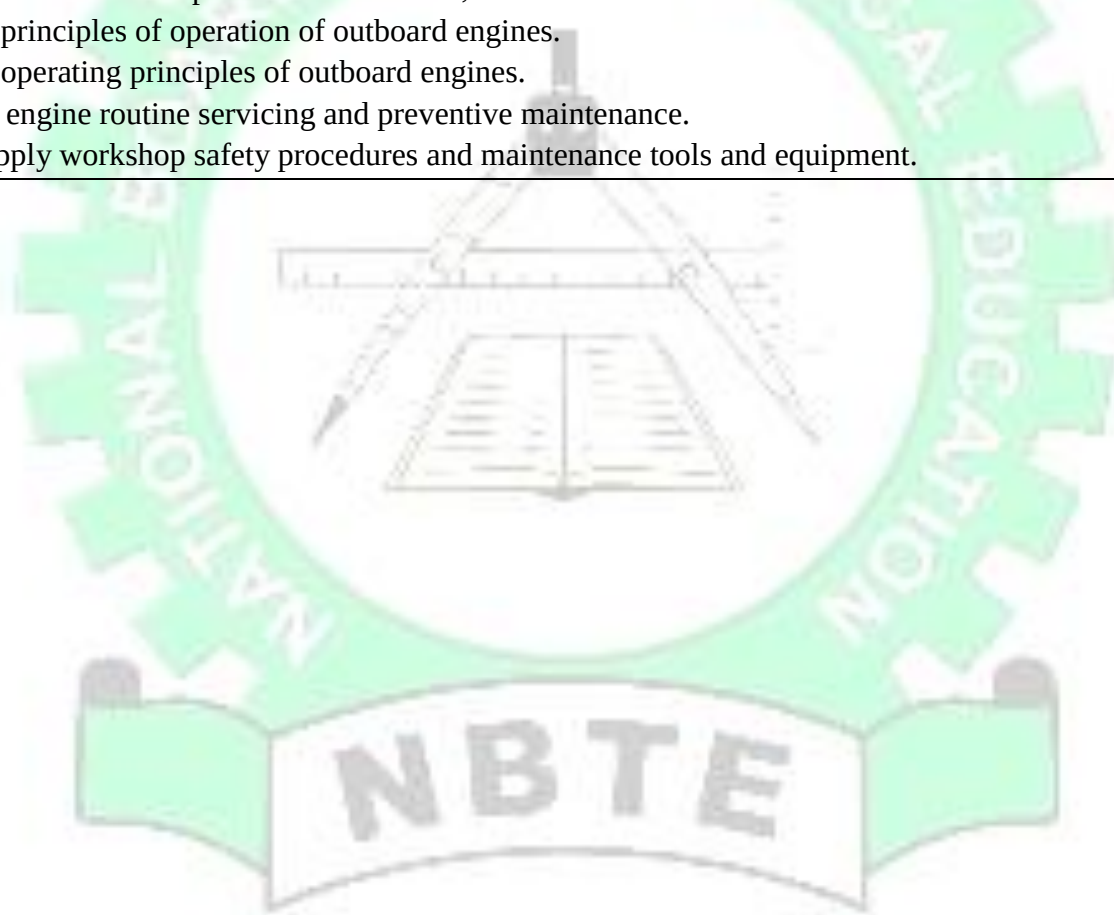




YEAR II SEMESTER II COURSES

OUTBOARD ENGINE MAINTENANCE

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: OUTBOARD ENGINE MAINTENANCE	COURSE CODE: OFS 221	CONTACT HOURS: 3HOUR/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skill in operating and repairing outboard engines		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of operation of outboard engines. 2.0 Understand the operating principles of outboard engines. 3.0 Know outboard engine routine servicing and preventive maintenance. 4.0 Know how to apply workshop safety procedures and maintenance tools and equipment.		



PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: OUTBOARD ENGINE MAINTENANCE			COURSE CODE: OFS 221		CONTACT HOURS: 3HOUR/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skill in operating and repairing inboard outboard engines						
GENERAL OBJECTIVE 1.0: Understand the principles of operation of outboard engines						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain term outboard engine and its importance 1.2 Explain types of outboard engines 1.3 Explain propulsion systems in outboard engines 1.4 Explain the components of outboard engine and their functions	• Discuss outboard engines its importance • Explain types of outboard engines • Discuss propulsion systems in outboard engines • Discuss the components of outboard engine and their functions ➤ Cylinder block ➤ Pistons and piston rings ➤ Crankshaft and camshaft ➤ Valves and timing	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify different components of an outboard engine	Guide students to • Identify different components of an outboard engine	Outboard engine, Scrap outboard engine, Workshop tools, PPE.

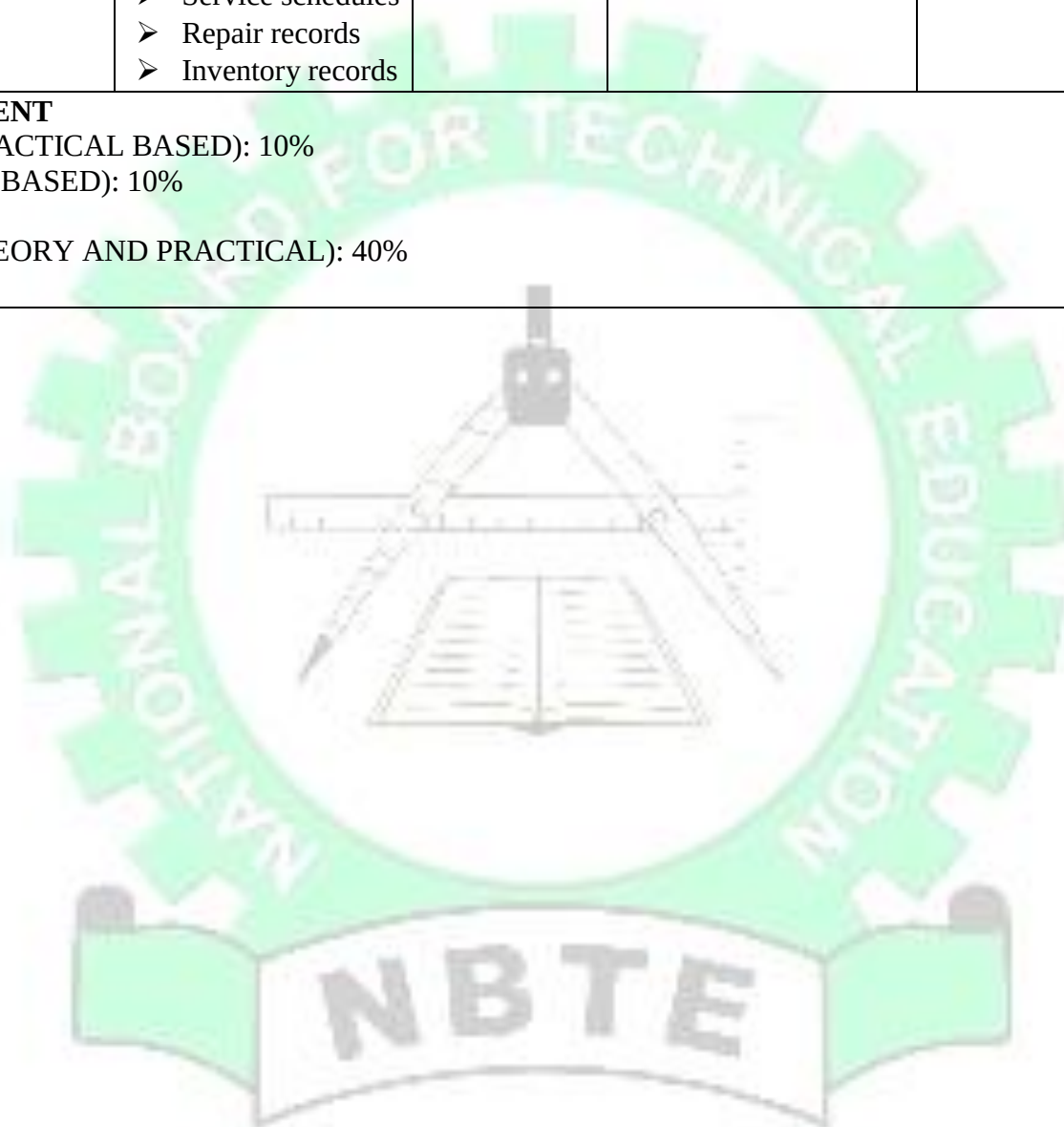
		gears ➤ Propeller systems				
General Objective 2.0: Understand the operating principles of outboard engines						
4-8	2.1 Explain principles of outboard engine operation 2.2 Explain fuel systems in outboard engines 2.3 Explain lubrication system in outboard engine 2.4 Explain cooling system in outboard engine 2.5 Explain ignition and electrical system in outboard engine	- Discuss principles of outboard engine operation: ➤ Two-stroke engines ➤ Four-stroke engines ➤ Combustion process ➤ Power transmission systems - Explain fuel systems in outboard engines ➤ Fuel tanks and fuel lines ➤ Carburetors and fuel injectors ➤ Fuel pumps ➤ Fuel filtration systems ➤ Fuel system maintenance - Explain lubrication system in outboard engine	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	- Carry out fuel systems maintenance under supervision - Carry out lubrication and oil replacement under supervision - Carry out ignition maintenance under supervision - Carry out battery testing and maintenance under supervision	Supervise students to: - Carry out fuel systems maintenance - Carry out lubrication and oil replacement - Carry out ignition maintenance - Carry out battery testing and maintenance	Outboard engine, Scrap outboard engine, Workshop tools, PPE.

		➤ Functions of lubrication systems ➤ Types of lubricants ➤ Oil pumps and oil filters ➤ Oil replacement procedures ➤ Lubrication maintenance practices • Explain cooling system in outboard engine ➤ Water cooling systems ➤ Air cooling systems ➤ Cooling pumps and thermostats ➤ Cooling system servicing ➤ Prevention of overheating • Explain ignition and electrical system in outboard engine - Spark plugs and				
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		➤ ignition coils ➤ Batteries and charging systems ➤ Wiring systems ➤ Electrical troubleshooting ➤ Maintenance of electrical systems				
General Objective 3.0: Know outboard engine routine servicing and preventive maintenance						
9-11	3.1 Explain maintenance schedules of outboard engines 3.2 Explain routine inspection procedures 3.3 Explain cleaning and servicing methods in outboard engines 3.4 Describe preventive maintenance planning	• Discuss maintenance schedules of outboard engines • Discuss routine inspection procedures • Discuss cleaning and servicing methods in outboard engines • Describe preventive maintenance planning	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Demonstrate routine inspection procedure on an engine • Carry out overall cleaning and servicing of an engine under supervision.	Guide students to: • Demonstrate routine inspection procedure on an engine • Carry out overall cleaning and servicing of an engine under supervision.	Outboard engine, Scrap outboard engine, Workshop tools, PPE.
General Objective 4.0: Know how to apply workshop safety procedures and maintenance tools and equipment						
12-15	4.1 Explain workshop safety rules 4.2 Describe method	• Discuss workshop safety rules • Describe method	Textbooks, Encyclopedia, E-books,	• Carry out workshop safety drills • Demonstrate fire	Guide students to: • Carry out workshop	Outboard engine, Scrap

	of handling flammable materials 4.3 Explain fire prevention and control 4.4 Explain the importance of Personal protective equipment (PPE) 4.5 Explain emergency response procedures 4.6 Describe how to operate and maintain hand tools and power tools 4.7 Describe how to use diagnostic equipment 4.8 Explain safe handling and maintenance of workshop tools 4.9 Explain record keeping in marine engine workshop	of handling flammable materials • Discuss fire prevention and control • Discuss the importance of Personal protective equipment (PPE) • Describe emergency response procedures • Describe how to operate and maintain hand tools and power tools • Describe how to use diagnostic equipment • Explain safe handling and maintenance of workshop tools • Explain record keeping in marine engine workshop ➤ Maintenance logs	Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	control procedure • Use diagnostic tool • Demonstrate safe handling of workshop tools • Keep a maintenance log	safety drills • Guide students to: • Use diagnostic tool • Demonstrate safe handling of workshop tools • Keep a maintenance log	outboard engine, Workshop tools, Maintenance logbook, PPE.
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		➤ Service schedules ➤ Repair records ➤ Inventory records			
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%					



DIGITAL OCEANOGRAPHY

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: DIGITAL OCEANOGRAPHY	COURSE CODE: OFS 222	CONTACT HOURS: 3HOUR/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: The course is designed to equip students with knowledge and skills in digital and technologies used in oceanography and fisheries science		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concepts and importance of digital oceanography; 2.0 Know and be able to use digital instruments and technologies used in oceanographic studies; 3.0 Know the use of Geographic Information Systems (GIS) in marine resource mapping; 4.0 Understand the use of remote sensing in oceanography; 5.0 Know how to collect, process, and analyze marine data digitally; 6.0 Understand how to interpret oceanographic charts, maps, and digital datasets; 7.0 Know digital forecasting and monitoring systems.		

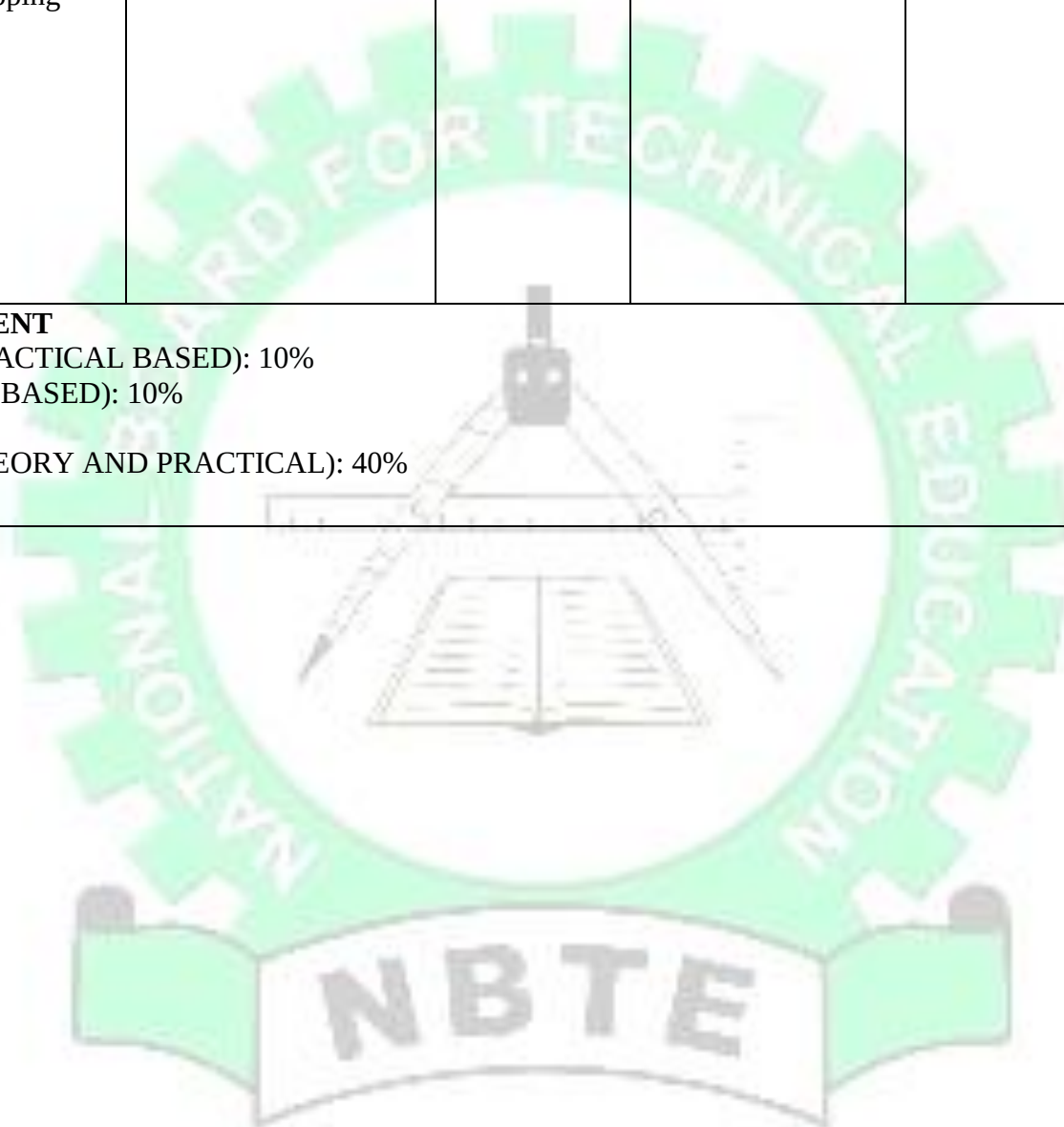
PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: DIGITAL OCEANOGRAPHY			COURSE CODE: OFS 222		CONTACT HOURS: 3HOUR/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to equip students with knowledge and skills in digital and technologies used in oceanography and fisheries science						
GENERAL OBJECTIVE 1.0: Understand the concepts and importance of digital oceanography						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain the concept of digital oceanography 1.2 Explain the importance of digital technologies in oceanography 1.3 Explain components of digital oceanographic systems 1.4 Explain computer applications in marine science	• Explain digital oceanography • Explain the importance of digital technologies in oceanography • Explain components of digital oceanographic systems • Explain computer applications in marine science	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector,	• Identify areas of application oceanography using video clips • Identify digital tools used in oceanography and its applications	Guide students to: • Demonstrate areas of application oceanography using video clips • Guide student on the use of digital tools in the field of oceanography and its applications	Video clips, Multimedia Projector, Artificial Intelligence (AI) tools.
General Objective 2.0: Know digital instruments and technologies used in oceanographic studies						
3-4	2.1 Explain computer applications in	• Explain computer applications in	Textbooks, Encyclopedia,	• Identify useful application and	Guide students to: • Identify and	Video clips, Multimedia

	marine science 2.2 Explain the use of spreadsheet software for marine data entry 2.3 Explain the simple digital reports and presentations	marine science. - Discuss the use of spreadsheet software for marine data entry. - Discuss simple digital reports and presentations	E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	software packages for Oceanography Install relevant application and software for Oceanography on computers.	install Ocean data view, Google map, Microsoft office etc. Demonstrate simple digital report skills	Projector, Artificial Intelligence (AI), Drone, Camera, Software.
General Objective 3.0: Know how to operate basic digital oceanographic equipment						
5-7	3.1 Explain digital oceanographic instruments 3.2 Explain operation of oceanographic sensors. 3.3 Explain maintenance and calibration of instruments	- Describe digital oceanographic instruments - Discuss operation of oceanographic sensors. - Explain maintenance and calibration of instruments. - Discuss the following: ✓ Digital fisheries management ✓ Smart aquaculture ✓ Marine data systems ✓ Sustainability	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Multimedia Projector,	- Identify digital oceanographic instruments - Operate the use of ➤ Projector ➤ Software Maps ➤ Aerial Maps ➤ Digital Map ➤ Population Map ➤ Echo sounder ➤ Sediment trap ➤ Niskin bottle - Demonstrate safe handling of digital devices - Keep a maintenance log	Guide Students to: - Identify digital oceanographic instruments - Operate the use of ➤ Projector ➤ Software Maps ➤ Aerial Maps ➤ Digital Map ➤ Population Map ➤ Echo sounder ➤ Sediment trap ➤ Niskin bottle - Demonstrate safe handling of digital devices - Keep a	Video clips, Multimedia Projector, Software, GPS, Maintenance logbook, Echo sounder Sediment trap Niskin bottle Map.

		analytics			maintenance log	
General Objective 4.0: Know the use of Geographic Information Systems (GIS) in marine resource mapping						
8-9	4.1 Explain marine data collection methods. 4.2 Explain digital devices for field data recording. 4.3 Explain data logging systems. 4.4 Describe examples of GIS data as Vector and Raster data 4.5 Explain the differences in data as geographical or non-geographical data	• Explain marine data collection methods. • Describe digital devices for field data recording. • Explain data logging systems • Describe examples of GIS data as Vector and Raster data • Explain the differences in data as geographical or non-geographical data	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify different types of GIS • Install GIS software on a computer system • Use GIS to produce or develop maps, survey and geolocation	Guide students to: • Identify (ARC GIS (free version), Maptitude and GRASS GIS) • Install GIS software on a computer system • Use GIS to develop maps, survey and geolocation	Video clips, Multimedia Projector, GIS Software, Computer.
General Objective 5.0: Understand the use of remote sensing in oceanography						
10-11	5.1 Explain remote sensing. 5.2 Explain applications of remote sensing in marine science. 5.3 Describe satellite images and marine	• Explain remote sensing. • Explain applications of remote sensing in marine science. • Explain satellite images and marine	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia	• Demonstrate the Application of GIS application with different geographical features • Observe remote	Guide students to: • Deploy ARC GIS Software Map in oceanography	Video clips, Multimedia Projector, Artificial Intelligence (AI), GIS software,

	data	data	Projector, Artificial Intelligence (AI)	sensing images • Analyse different Marine features		Computer.
General Objective 6.0: Know how to collect, process, and analyze marine data digitally						
12-13	6.1 Explain marine data processing techniques 6.2 Explain oceanographic data using software tools 6.3 Explain marine data graphically	• Discuss marine data processing techniques • Explain oceanographic data using software tools • Describe marine data graphically	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Analyse marine data graphically • Plot a hydrographic map	Guide students to: • Analyse marine data graphically • Plot a hydrographic map	Marine data, Computer, GIS software.
General Objective 7.0 Know digital forecasting and monitoring systems.						
14-15	7.1 Explain digital marine forecasting systems. 7.2 Explain the concept of Geometrical principles for marine monitoring systems. 7.3 Explain marine forecast data. 7.4 Explain Remote sensing technique applicable to bathymetry and	• Discuss digital marine forecasting systems. • Discuss marine monitoring systems. • Interpret marine forecast data. • Discuss Remote sensing technique applicable to bathymetry and coastal mapping	Textbooks, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Carry out forecasting procedures of a typical marine environment • Identify parameters for monitoring in a marine environment • Carry out weather forecast of the Ocean	Guide students to: • Carry out forecasting procedures of a typical marine environment • Identify parameters for monitoring in a marine environment • Carry out weather forecast of the Ocean	Weather tracker, Drones, Video clips, Multimedia Projector, Artificial Intelligence (AI).

	coastal mapping					
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



INTRODUCTION TO OCEAN LAWS

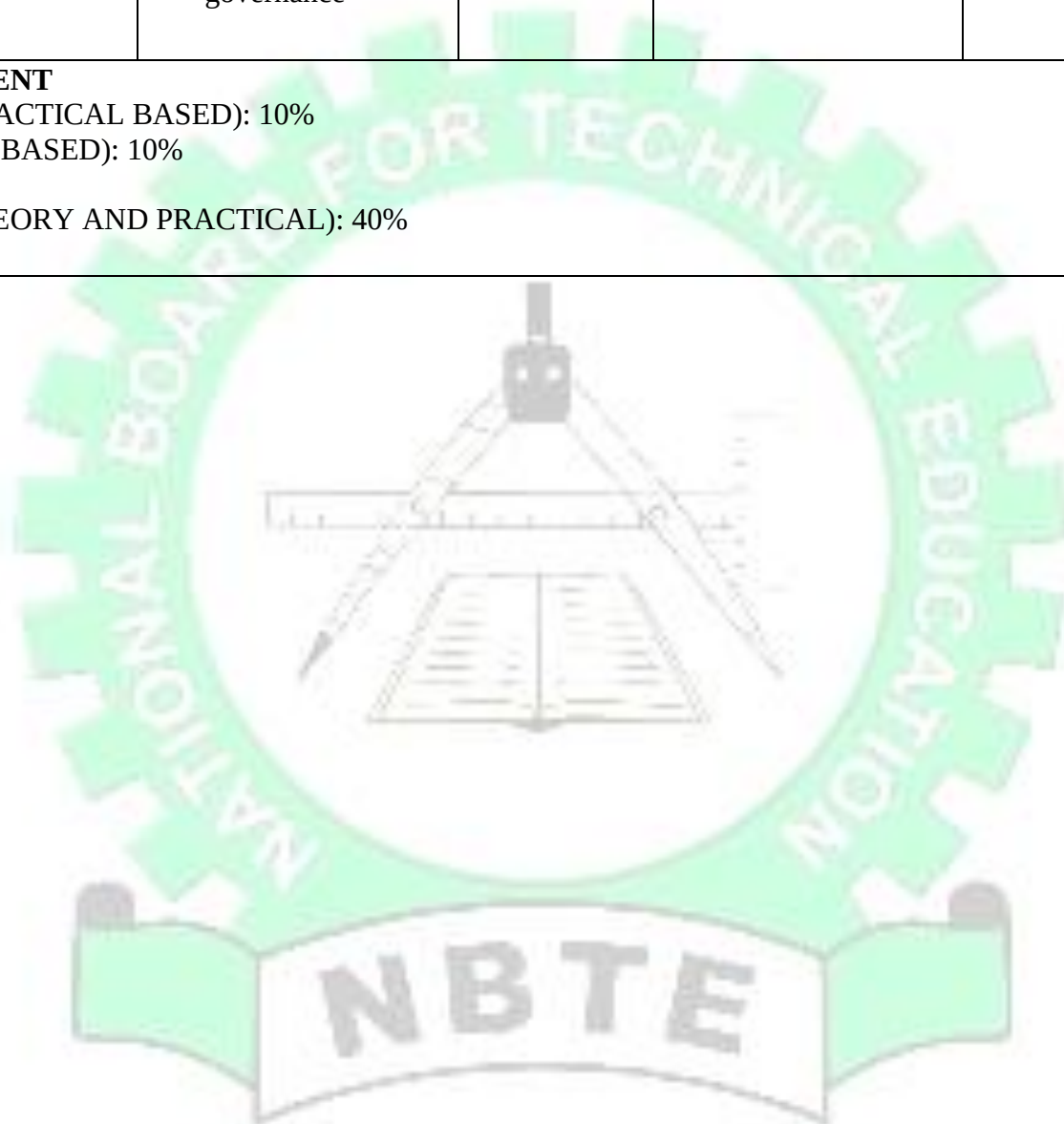
PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: INTRODUCTION TO OCEAN LAWS	COURSE CODE: OFS 223	CONTACT HOURS: 2HOURS/PER WEEK
	CREDIT UNIT: 2	THEORETICAL: 2HOURS/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 0
GOAL: This course is to provide students with knowledge of the national and international laws governing the sustainable use of the ocean		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and importance of ocean laws; 2.0 Know international conventions governing oceans and fisheries; 3.0 Know legal frameworks regulating fisheries and marine resources; 4.0 Know laws relating to marine pollution and environmental protection; 5.0 Know legal institutions responsible for ocean governance.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: INTRODUCTION TO OCEAN LAWS			COURSE CODE: OFS 223		CONTACT HOURS: 2HOURS/PER WEEK	
			CREDIT UNIT: 2		THEORETICAL: 2HOURS/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 0	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is to provide students with knowledge of the national and international laws governing the sustainable use of the ocean						
GENERAL OBJECTIVE 1.0: Understand the concept and importance of ocean laws						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain ocean laws. 1.2 Explain their scope and significance. 1.3 Explain the role of laws in maritime safety, fisheries, and conservation. 1.4 Describe the historical evolution of maritime laws.	- Explain the meaning and scope of ocean laws - Discuss the roles of laws in maritime safety, fisheries, and conservation - Discuss the origin and development of maritime law	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector			
General Objective 2.0: Know international conventions governing oceans						
4-6	2.1 Explain the United Nations Convention on the Law of the Sea (UNCLOS). 2.2 Explain territorial sea, contiguous	- Discuss UNCLOS and its objectives - Discuss maritime zones under UNCLOS - Explain rights and	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips,			

	zone, EEZ, and continental shelf. 2.3 Explain rights and responsibilities of coastal states. 2.4 Explain freedom of navigation and innocent passage.	responsibilities of coastal states • Discuss freedom of navigation and innocent passage	Charts, Marker, Multimedia Projector			
General Objective 3.0: Know legal frameworks regulating fisheries and marine resources.						
7-9	3.1 Explain fisheries laws and regulations. 3.2 Explain licensing and fishing permit requirements. 3.3 Explain Illegal, Unreported, and Unregulated (IUU) fishing. 3.4 Describe fisheries conservation laws.	• Discuss legal frameworks governing fisheries • Discuss licensing procedures and enforcement • Discuss causes and effects of IUU fishing • Explain closed seasons, quotas, and protected species laws	Textbooks, Encyclopedia, E-books, Law Act, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector			
General Objective 4.0: Know laws relating to marine pollution and environmental protection						
10-12	4.1 Explain marine pollution and its legal implications. 4.2 Explain International Conventions on Marine Pollution	• Discuss sources of marine pollution and relevant laws • Explain MARPOL and related conventions • Discuss	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts,			

	(MARPOL). 4.3 Explain coastal and marine environmental protection laws 4.4 Describe legal measures against marine pollution.	environmental impact assessment and habitat protection laws • Explain penalties and enforcement mechanisms	Marker, Multimedia Projector			
General Objective 5.0: Know legal institutions responsible for ocean governance						
13-15	5.1 Explain institutions responsible for ocean governance. 5.2 Explain maritime dispute resolution mechanisms. 5.3 Explain national ocean policies and management strategies. 5.4 Explain the relationship between Sustainable Development Goal (SDG) with responsible ocean governance.	• Explain roles of International Maritime Organisation (IMO), Food and Agriculture Organisation (FAO), and national agencies • Discuss arbitration and international tribunals • Discuss Nigeria's maritime and fisheries policies • Discuss the relationship between Sustainable Development Goal (SDG) with responsible ocean	Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Charts, Marker, Multimedia Projector			

		governance				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



COASTAL RESOURCES MANAGEMENT

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE		
COURSE TITLE: COASTAL RESOURCES MANAGEMENT	COURSE CODE: OFS 224	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: The course is designed to equip students with the knowledge and skills for sustainable management of coastal and marine resources, balancing fisheries, conservation and maritime use		
GENERAL OBJECTIVES: On completion of this course, the students should be able to:		
At the end of the course, the student should be able to: 1.0 Understand the concept and scope of coastal resources management; 2.0 Know the major coastal and marine resources and their importance; 3.0 Understand the principles of sustainable coastal management; 4.0 Know the major human impacts and threats to coastal resources; 5.0 Know the legal and institutional frameworks for coastal conservation and management; 6.0 Know the approaches to coastal zone planning and management; 7.0 Understand climate change adaptation and disaster risk in coastal areas; 8.0 Understand the principles of ethics, safety, and gender equity in coastal resources management.		

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE						
COURSE TITLE: COASTAL RESOURCES MANAGEMENT		COURSE CODE: OFS 224		CONTACT HOURS: 3HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK		
YEAR: II SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to equip students with the knowledge and skills for sustainable management of coastal and marine resources, balancing fisheries, conservation, and maritime use						
GENERAL OBJECTIVE 1.0: Explain the concept and scope of coastal resources management						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain coastal zone, coastal resources, and Integrated Coastal Management (ICM) 1.2 Explain the scope and objectives of coastal management. 1.3 Explain the importance of coastal resources and the interaction among them.	- Explain and explain the concepts of coastal resources management - Explain the scope and objectives of coastal resources management - Explain the importance of coastal ecosystems - Explain single-sector and	Charts/ Maps of Nigerian coastal zones, Textbooks, Videos – Technical Guideline and manuals on ICM, Google Earth imagery of Nigerian coastline,	- Carry out field trip to a coastal area (where possible) to observe different features of the area - Identify types of coastal area using video clips	Guide students to: - Carry out field trip to a coastal area to observe different features of the area - Identify types of coastal area using video clips	Video clips, Charts, Camera, Multimedia projector.

		integration approaches involving oceans, fisheries, and coastal communities • Explain the ecosystem approach and precautionary principle in coastal management.	Multimedia, Instructional materials 			
General Objective 2.0: Know the major coastal and marine resources and their importance						
3-4	2.1 Describe the major coastal ecosystems 2.2 Explain the characteristics of coastal environments 2.3 Explain the ecological functions of coastal habitats 2.4 Explain ecosystem services using local examples	• Explain the major coastal ecosystems/habitats: (mangroves, estuaries, lagoons, seagrass, coral reefs, sandy beaches and mudflats) • Explain the characteristics and socio-economic and ecological values of each	Nigerian Institute for Oceanography and Marine Research NIOMR reports, Satellite images of coastal erosion, Photos, Videos, Habitat manuals, Wetlands	• Identify coastal resources and their functions using charts and video clips • Identify mangrove propagules, shells and seaweed	Guide students to: • Identify coastal resources and their functions • Identify mangrove propagules, shells, seaweed	Specimens mangrove and marine organisms, Video clips, Charts, Multimedia projector, Camera, Manuals, PPE.

		habitat Discuss the types of coastal resources as living, non-living, renewable, and non-renewable (classify fisheries resources, oil and gas resources, tourism resources, minerals and renewable energy; biodiversity resources) and their uses	Handbook, Specimens of mangrove and marine organisms, Videos, Maps, Cameras, Multimedia projectors			
General Objective 3. Understand the principles of sustainable coastal management						
5-6	3.1 Explain sustainability concepts 3.2 Describe sustainable resource use practices 3.3 Explain ecosystem-based management	- Discuss sustainability principles - Discuss ecosystem approach to coastal management - Explain carrying capacity of coastal management - Discuss concepts of integrated	Instructional materials, Cameras, Multimedia projectors	- Prepare a technical report of mangrove restoration using case studies and video clips - Visit Hydrocarbon Pollution Remediation Project (HYPREP) website www.hyprep.gov.ng to observe mangrove restoration projects	Guide students to: - Prepare a technical report of mangrove restoration using case studies and video clips - Visit Hydrocarbon Pollution Remediation Project (HYPREP) website www.hyprep.gov.ng to observe mangrove	Video clips, Charts, Multimedia projector, Computer, Report writing template.

		management			restoration projects	
General Objective 4. Know the major human impacts and threats to coastal resources						
7-8	4.1 Explain the impacts from overfishing, dredging, coastal pollution, coastal development, climate change, coastal erosion and flooding on coastal resources 4.2 Explain the concept of carrying capacity and overexploitation 4.3 Explain the link between fisheries and coastal litter	• Discuss mangrove loss in Nigeria (from 1980-2026). • Explain oil spill, illegal sand mining, coastal pollution and such other incidents. • Explain international requirements for garbage management from vessels • Discuss carrying capacity in relation to exploitation • Discuss the effects of garbage and coastal litter on fisheries.	Manuals, Technical reports, Charts on impacted and pre-impacted areas, Videos and models, Samples of pollution, spills, etc., Plastic waste samples, Videos and case studies.	• Identify impacted ecosystems from given maps and diagrams • Identify types of threats to coastal resources • Observe impacts of threats to coastal resources using video clips • Write reports of video presentation of incidences	Guide students to: • Identify impacted ecosystems from given maps and diagrams. • Identify types of threats to coastal resources. • Observe impacts of threats to coastal resources using video clips • Write reports of video presentation of incidences	Maps of erosion-prone areas in Nigeria, Video clips, Charts, Multimedia projector, Report writing template.
General Objective 5. Know the legal and institutional frameworks for coastal conservation and management						
9-10	5.1 Explain environmental regulations 5.2 Explain agencies responsible for coastal	• Explain relevant Nigerian environmental laws and the agencies responsible:	Legal documents, Convention documents, Textbooks, Encyclopedi	• Review case studies of coastal environmental pollution e.g. Shell versus Ogoni community in Rivers State	Guide students to: • Review case studies of coastal environmental pollution e.g. Shell versus Ogoni community in	Video clips, Charts, Case studies, Multimedia projector.

	management 5.3 Explain international conventions 5.4 Explain key provisions of Nigerian environmental laws 5.5 Explain mitigation measures in relevant Nigerian environmental laws	Coastal and Inland Shipping Act, NESREA Act, Fisheries Act, etc. • Explain Nigerian fisheries regulations and the agencies responsible • Explain international maritime conventions (marine pollution, dumping at sea, movement of hazardous wastes, response to oil pollution, Exclusive Economic Zones (EEZ) and territorial seas, biodiversity conservation, wetlands, etc. • Discuss	a, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Identify endangered coastal species using video clips	Rivers State • Identify endangered coastal species using video clips	
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		conservation strategies (marine protected areas; habitat restoration; biodiversity monitoring; conservation of mangroves and wetlands) • Explain enforcement and compliance measures				
General Objective 6. Know the approaches to coastal zone planning and management.						
11-12	6.1 Explain Integrated Coastal Zone Management (ICZM) 6.2 Explain principles of integrated management 6.3 Explain stakeholder participation 6.4 Explain principles and strategies of conflict resolution	• Discuss concepts of ICZM • Explain principles of ICZM: goals, zoning, actions, M&E. • Explain coastal zone planning • Explain principles and strategies of conflict resolution • Explain the stakeholders in coastal	ICZM Manual, Videos of oil spill response exercises, Textbooks, Encyclopedia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector,	• Fill templates for ICZM project proposal	Guide students to • Fill templates for ICZM project proposal	ICZM project plan manual, ICZM template, Charts, Multimedia projector.

		management: fishers, LGAs, NGOs, industry. • Explain the tools for Participatory Rural Appraisal (PRA) and multi-stakeholder analysis	Artificial Intelligence (AI)			
General Objective 7: Understand climate change adaptation and disaster risk in coastal areas						
13-14	7.1 Explain impacts of sea level rise, erosion, and extreme weather on coastal fisheries 7.2 Explain adaptation options 7.3 Explain Nigerian National Adaptation Plan NAP	• Explain impacts of sea level rise, erosion, and extreme weather on coastal fisheries • Discuss adaptation options: mangrove restoration, early warning, livelihood diversification • Discuss Nigerian National Adaptation Plan NAP	Maps of erosion-prone areas in Nigeria. Intergovernmental Panel on Climate Change (IPCC) manual on oceans and coastal ecosystems, - Nigeria National Adaptation Plan 2021 - Checklist of vulnerability assessment	• Review checklist of vulnerability assessment exercise/adaptation option • Identify the impacts of climate change in different coastal environments in Nigeria	Guide students to: • Review checklist of vulnerability assessment exercise / adaptation option • Identify the impacts of climate change in different coastal environments in Nigeria	Vulnerability assessment template, Maps of erosion-prone areas in Nigeria.

			exercise / adaptation options			
General Objective 8.0: Understand the principles of ethics, safety, and gender equity in coastal resources management						
15	8.1 Explain ethical considerations in working with coastal communities 8.2 Explain basic field safety and Health Safety and Environment (HSE) protocols 8.3 Explain gender roles and inclusion in fisheries and coastal management.	• Discuss community entry protocols and informed consent • Discuss basic field safety and Health Safety and Environment (HSE) protocols • Discuss concepts in gender and gender roles in climate change • Discuss gender mainstreaming in addressing the gender – climate - mobility nexus	Case studies and roles of women in fisheries in (post-harvest fisheries). Textbooks, Encycloped ia, E-books, Journals, Magazines, Video clips, Marker, Multimedia Projector, Artificial Intelligence (AI)	• Demonstrate PPE use in coastal communities • Demonstrate field safety checklist using a template	Guide students to: • Demonstrate PPE use in coastal communities • Demonstrate field safety checklist using a template	PPE, Field safety checklist template.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

FISHING OPERATIONS

PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCES		
COURSE TITLE: FISHING OPERATIONS	COURSE CODE: OFS 225	CONTACT HOURS: 3HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills required for safe, efficient and sustainable fishing operations in marine fisheries		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know suitable habitat for fish and types of gear suitable for each fishing location; 2.0 Understand the essential preparation necessary for a fishing trip; 3.0 Know fishing techniques in marine waters; 4.0 Know safety measures during fishing operations; 5.0 Understand different methods of locating school/shoal of fish; 6.0 Know how best to handle gears onboard and at shore.		

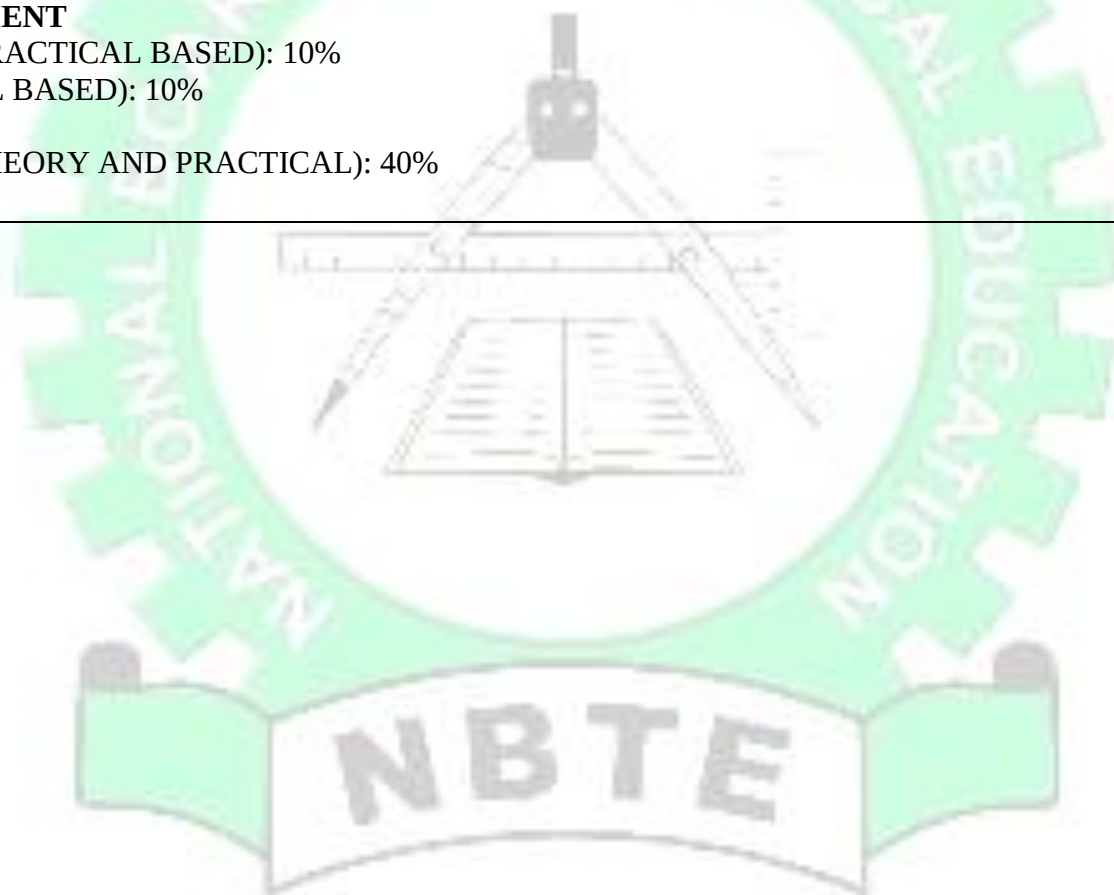
PROGRAMME: NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCES						
COURSE TITLE: FISHING OPERATIONS		COURSE CODE: OFS 225		CONTACT HOURS: 3HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK		
YEAR: II SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills required for safe, efficient and sustainable fishing operations in marine fisheries						
GENERAL OBJECTIVE 1.0: Know suitable habitat for fish and types of gear suitable for each fishing location						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the suitable habitat for fish 1.2 Describe the relationship between habitat and fishing 1.3 Explain which species of fish can be found in different water bodies 1.4 Explain different water bodies -ocean, sea, rivers, lakes, streams	- Describe what constitute a fish habitat - Explain the correlation between fish habitat and fishing - Explain why some fish can only be found in certain water bodies	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials,	- Identify a fish habitat - Identify different water bodies - ocean, sea, rivers, lakes, streams - Identify species of fishes found in different habitats	Guide the students to: - Identify a fish habitat - Identify different water bodies -ocean, sea, rivers, lakes, streams using video clips - Identify species of fishes found in different habitats	Video clips, Multimedia projector, Charts.

General Objective 2.0: Understand the essential preparation necessary for a fishing trip						
2-3	2.1 Explain the need for proper preparation for fishing trip 2.2 Explain materials needed for fishing trip 2.3 Differentiate between preparation for a day fishing trip and a long duration trip 2.4 Explain the importance of each itemized material needed for fishing	- Discuss the need for proper preparation for fishing trip - Discuss the importance of each itemized material needed for fishing - Explain the difference between preparation for a day fishing trip and a long duration trip - Discuss the importance of each itemized material needed for fishing	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials	Identify materials for fishing trip	Guide students to Identify materials for fishing trip	Boat in good shape, Net, Fisherman needle, Twine None netting gear, Cold Fish boxes, Knives, Lighting system, Food, Water.
General Objective 3.0: Know fishing techniques in marine waters						
3-7	3.1 List different fishing gears 3.2 Explain the operational mode of each fishing gear 3.3 Explain how to mend a torn net 3.4 Explain other unconventional fishing methods	- Explain fishing gears into two broad categories -passive and active - Discuss the operational mode of each fishing gear - Explain the functionalities of these fishing methods	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials	- Handle different netting and none netting gears in the Net loft workshop - Demonstrate the use of each gear in a small water body - Mend a torn net - Demonstrate the	Guide students to: - Demonstrate the operational mode of each fishing gear - Demonstrate how to repair a torn net - Demonstrate	Boat, Netting gears, Non netting gear, Twine, Gammalin 20, Rotenone, Grenade, Flash light, Fisherman needle.

	3.5 Describe the gears for sport fishing 3.6 Explain operational mode of trawling	• Explain sport fishing • Discuss operational mode of trawling		use of light in fishing in a small water body • Demonstrate the use of obnoxious fishing methods in a small water body • Carry out fishing field trip	the use of obnoxious items in fishing • Show the operation of a sport fishing gear	
General Objective 4.0: Know safety measures during fishing operations.						
8-10	4.1 Explain the safety precaution require for fishing trip 4.2 Explain the risks of being onboard 4.3 List Personal Protective Equipment (PPE) for fishing operations 4.4 Explain the importance of the use of PPE in fishing operation 4.5 Explain the risks involve in fishing	• Discuss the safety precautions on fishing trip • Discuss the risks involve in fishing trip • Discuss the use of PPE • Explain the importance of the use of PPE in fishing operation • Explain the risks involve in fishing	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials.	• Practice swimming • Use lifejacket • Carry out net arrangement onboard a fishing boat • Carry out net handling while shooting and hauling for netting gears • Carry out none netting gear handling during shooting and retrieving • Wear some PPE	Guide students to: • Take the students for swimming practice • Demonstrate the use of life jacket • Explain the safety precautions on fishing trip	PPE, Netting gears, Spear, Hook, Harpoon, Arrow.

General Objective 5.0: Understand different methods of locating school/shoal of fish						
11-13	5.1 Explain the physical methods of fish detection 5.2 Explain other scientific fish detection methods 5.3 Explain the operational mode of a fish finder	- Discuss different methods of fish detection in different water bodies - Discuss the operational mode of a fish finder	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials	- Observe some fishing sites - Identify parts of an echo sounder - Operate fish finder	Guide the students to: - Demonstrate the use of echo sounder - Demonstrate the use of fish finder	Boat, Echo sounder.
General Objective 6.0 Know how best to handle fishing gears and catch onboard and at shore						
14-15	6.1 Explain best practices in handling fishing gear on board 6.2 Explain the risks involve in poor handling of fishing gear 6.3 Explain how to preserve catch	- Explain the proper way of arranging gear before shooting - Discuss the handling of gear while hurling - Explain the importance of preservation	Whiteboard, lecture notes, Projector, Fisheries textbooks, Charts, Marker board, Journals, Instructional materials	- Demonstrate proper handling of fishing gear - Handle some fishing gear onboard - Demonstrate how to preserve freshly caught fish	- Demonstrate the benefits of proper handling - Demonstrate the danger inherent in poor handling - Show different storage and preservative ways of preserving gears shelf-	Boat, Net, Hook, Baskets, Kelp, Oil, Dyes, Blast freezer (<i>recommended</i>), Fish hold, Ice boxes.

					life • Demonstrate the use of some means of fish preservation •	
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES FOR NATIONAL DIPLOMA IN OCEANOGRAPHY AND FISHERIES SCIENCE

1.0 BIOLOGY/FISH BIOLOGY/MICROBIOLOGY LABORATORY (See Science Laboratory Technology Curriculum)

2.0 CHEMISTRY/BIOCHEMISTRY LABORATORY (See Science Laboratory Technology Curriculum)

3.0 PHYSICS LABORATORY (See Science Laboratory Technology Curriculum)

4.0 OCEANOGRAPHIC EQUIPMENT STORE

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Teaching/Research Boat	1
2	Tide gauge	4
3	Wave recorder	1
4	Current meter	2
5	Conductivity meter	2
6	Eckman grab	2
7	Nansen reversing water bottle	1
8	Reversing thermometer	2
9	Secchi Disc	4
10	Nephelometer	2
11	Echosounder	2
12	Handheld GPS	3
13	Corer	2
14	Waverider Buoy	1
15	pH meter	4
16	Dissolved Oxygen meter	2
17	Salinometer	2
18	Hydrometer set (cylinder, thermometer, TSD graph)	4
19	Bathythermograph	1
20	Bucket Thermometer	4
21	Binocular	10
22	Life jacket	30
23	Compass	10

24	Weather Tracker	2
25	Diving kit	2

5.0 AUDIO VISUALS STUDIO

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Cameras	2
2	Flood Light	2
3	Camera Tripod Stand	1
4	Video Record/Player	1
5	Video Camera	1
6	Multimedia Projector	2
7	Magnetic Board	1
8	Public Address System	1
9	Television	1

6.0 METEOROLOGICAL STATION

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Stevenson's Screen	1
2.	Thermohydrographs	1
3.	Maximum and Minimum Thermometer	2
4.	Measuring Glasses	2
5.	Wind Vane	1
6.	Anemometer	2
7.	Evaporimeters	2
8.	Hygrometers	2
9.	Barometers	2
10.	Digital Meteorological Station	1
11.	Rain Gauge	1

7.0 NET LOFT (GEAR AND CRAFT)

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Space	for 40 students

2.	Model Gillnets	1
3.	Model Trammel Net	1
4.	Model Castnet	1
5.	Model Beach Seine Net	1
6.	Model Purse Seine Net	1 of each
7.	Model Traps (Various)	1
8.	Model Hook And Line	1
9.	Model Mid- Water Trawl	1
10.	Model Bottom Trawl	1
11.	Model Surface Trawl	1
12.	Model Lift Fishing Net	2 of each
13.	Scoop Nets	1
14.	Pole And Lines	1
15.	Fyke Nets	1
16.	Clap Nets	1
17.	Dragnet	1
18.	Spear	1
19.	Harpoon	1
20.	Angling	1
21.	Hook Packet	1 of each
22.	Nylon Ropes	1 of each
23.	Mounting Twine	1 roll of each
24.	Fisherman Needles	1 packet of each
25.	Bundles Of Net	210 ^{D/3} to 60
26.	Knife	2 packets
27.	Razor Blade	1 packet
28.	Lead Sinkers	assorted
29.	Floater	assorted

8.0 FISH FEED MILL

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Grinding Machine	2
2.	Sieves	10
3.	Mixer	1
4.	Black Soldier Fly (Bsf)	1
5.	Pelleting Machine	1
6.	Extruder Machine	1
7.	Bowls	10(different sizes)
8.	Weighing Balance	1
9.	Inventory Sheets	1
10.	Calculators	2
11.	Feed Storage Space/Packaging Space	
	Dryer	1

9.0 BLACK SOLDIER FLY (BSF)

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Breeding Tray	10
2.	Net Cages	5
3.	Insect Sprinklers	1
4.	Sieving Basket	2
5.	Culture Trough	10
6.	Egg Crates	10

10.0 FISH FARM (AQUACULTURE)

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Hatchery Troughs	6
2.	Air Pumps And Accessories	6
3.	Sechi Disc	5
4.	pH Meter	2

5.	Portable Field Analysis Kit	2
6.	Ruttner Water Sampler	1
7.	Eeckman Grab	1
8.	Portable Oxygen Meter	2
9.	Aerators	assorted
10.	Thermometer	10
11.	Sieine Net	5
12.	Sample Bottles	10
13.	Aquarium (Various Sizes)	5
14.	Mac Donald's Jar (For Including Egg)	10
15.	Incubator	1
16.	Cell Counting Chamber	10
17.	Ocular Micrometer	10
18.	Binocular Microscope	10
19.	Water Test Kit	1
20.	Ovaprim /Ovatide Syringe and Any Other Types Of Synthetic Hormone Models of Recirculatory Aquaculture System (RAS)	1
21.	Models Of Fish Cages And Pens	
22.	Rain Boot	5
23.	Blower	1
24.	Hapa Net	5
25.		

11.0 FISH PROCESSING FACILITY

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Cutting Knives	40
2.	Measuring Boards	40
3.	Weighing Balances	2
4.	Hand Gloves	40
5.	Headnet	40
6.	Oven	2
7.	Smoking Kilns (Different Types)	4

8.	Deep Freezers	1
9.	Fish Drying Rack	4
10.	Fish Boxes	4
11.	Salting Trays/ Basins	5
12.	Cold Room	1
13.	Fryer	2
14.	Personal Protective Equipment Ppe	40
15.	Packaging Materials	2 packs
16.	Mortar	1

12.0 FISH MUSEUM

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Aquiria	4
2.	Fish Skeleton	10
3.	Preserved Specimen	assorted

13.0 FISH PONDS

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Concrete Tanks	6
2.	Earthen Ponds	10
3.	Fibre/Plastic Tanks	10
4.	Collapsible Polythene Tanks	10
5.	Cage and Pen	5
6.	Tarpaulin Tanks	5

14.0 WORKSHOPS (BOAT BUILDING, AND MAINTENANCE ETC)

14.1 WOOD WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Bond Saw	1
2.	Cross Cutting Circular Saw	1
3.	Thickening Planer	1
4.	Spindle Molding Machine	1

5.	Mortising Machine	1
6.	Drilling Machine	1
7.	Standing Machine	1
8.	Simple Plalten	1
9.	Grading Machine	1
10.	Router	1
11.	Wood Chippe	1
12.	Lathe (Wood Machine)	1
13.	Dimension Sawing Machine	1
14.	Hand Tool	1
15.	Saw, Chisel, Try Square, Guaguesrule, Screwdrivers, Set Of Drill Bit, Hammer Mallets Pincers, Oilstone Planners Etc	12
16.	First Aid Box	1
17.	Model Boats	Assorted
18.	Model Aquaria	Assorted

14.2 METAL WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Lathe	3
2.	Pillar Drilling Machine	2
3.	Bench Drilling Machine Power Sawing Machine	1
4.	Milling Machine	3
5.	Air Compressor	1
6.	Pedestral Grinding Machine	1
7.	Pipe Bender	2
8.	Hydraulic Pipe Machine	2
9.	Hydraulic Pipe Press Machine	2
10.	Anvil	1
11.	Sheet Metal; Shearing Machine	1
12.	(Guilotine)Blacksmith'S Hearth	3
13.	Bench Grinding Machine	3
14.	Inside Micrometer	3

15.	Out Side Micrometer	2
16.	Stock And Die Set	2
1.	Drill Set	5
2.	Chain Block	5
3.	Electrical Hand Drill	5
4.	Depth Gauges	5
5.	Panel Beating Tools (Bench State)	5
6.	Breast Drill	2
7.	Hack Saw Frames	5
8.	Toque Wrench	3
9.	Plate Rolling Machine	10
10.	Swage Block B27/0120	2
11.	Surface Plate	
12.	Scribers	2
13.	Steel Rule	2
14.	Mallet Set	10
15.	Pipe Screw Threading Machine	10
16.	Wire Brush	10
17.	Dressing Wheels	1
18.	Tong	5
19.	Try Square	2
20.	Files	3
21.	Blow Torch	3
22.	Soldering Iron Tin Snips	20
23.	Soldering Flux	3
24.	Acid Core Wire Solder	3
25.	Resin-Core Wire Solder	3
26.	Emery Cloth	3
27.	Sand Paper	3
28.	Cotton Waste	3
29.	Oxygen And Acetylene Bottles	3
30.	Model Boats	30sheets

31.	Outboard Engines	3 bundles
32.	Oxygen And Acetylene Regulator	3
33.	Oxyacetylene Welding Cutting Outfit	3
34.	Oxygen and Acetylene Hoses	complete
35.	Welding Goggles	3
36.	Cylinder Wrenches	3
37.	Spark Lighter	3
38.	Welding Rods	3 bundles
39.	Welding Fluxes	30
40.	Bracing Rods Model	3

15.0 NAVIGATION AND SEAMANSHIP WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Rules of the road instructional display panel with cable and switch board	1 unit
2.	International code flags display board	1 unit
3.	Binoculars	24
4.	Compass	10
5.	Azimuth mirror	1
6.	Baader planetarium	1
7.	Walker, log	1
8.	Barometer (aneroid)	1
9.	Plastic station pointer	1
10.	Original station pointer	1
11.	Pelorus	1
12.	Instructional magnet board with model	1
13.	Plastic sextants	1
14.	Pyrotechnics box	1
15.	Life buoys/ jacket	1
16.	Buoyage system display	1
17.	Buoyage system model	1 set
18.	International code flags	1
19.	Fog signaling bell	1

20.	Fishing vessels	1
21.	Instructional model life raft (inflated)	1 of each
22.	Echo sounder	1
23.	Sonar	2
24.	Tide	3 types
25.	Navigational (different location)	2
26.	Nautical almanac	1
27.	Fish star finder	1 each
28.	GPS	1
29.	Grinder	1
30.	Winches	1
31.	Crane	1
32.	Valves and gates	1 set
33.	Pipes and pumps	assorted
34.	Marine drone	1

16.0 COMPUTER/GIS LABORATORY

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Pentium-based Computers	10
2	Digital Theodolite	1
3	Printers	2
4	Software DBMS SURFER-S MAPMAKERS Spreadsheet Word-processing ILWIS ARCVIEW/ARCINFO/MAPINFO	Installed on all computers

LIST OF WORKSHOP PARTICIPANTS

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