



NATIONAL BOARD FOR TECHNICAL EDUCATION

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

HIGHER NATIONAL DIPLOMA

AQUACULTURE AND FISHERIES TECHNOLOGY

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 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.

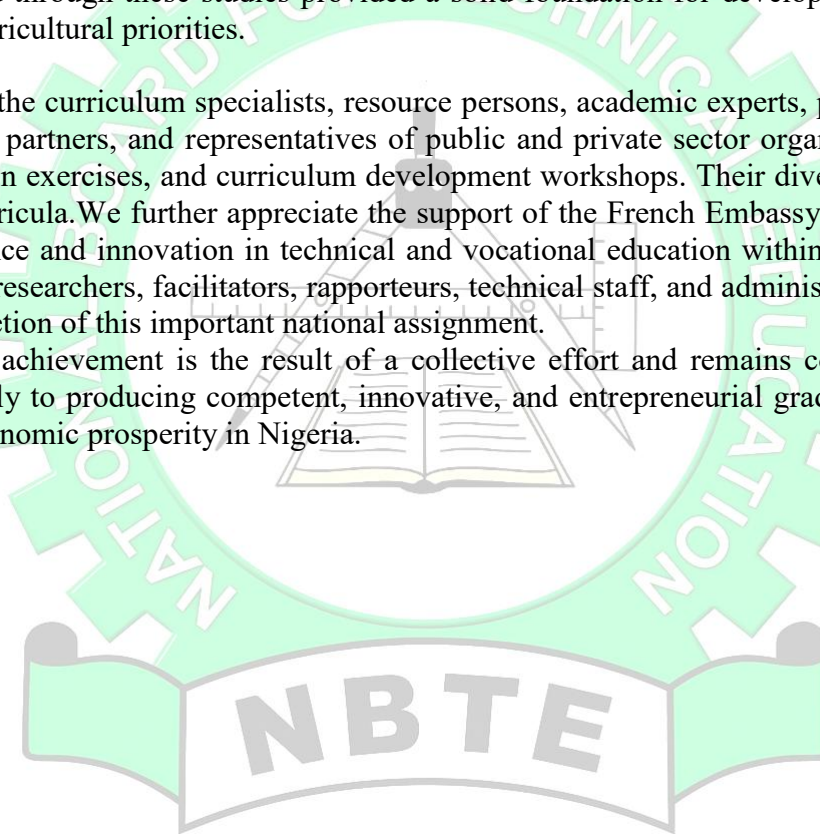
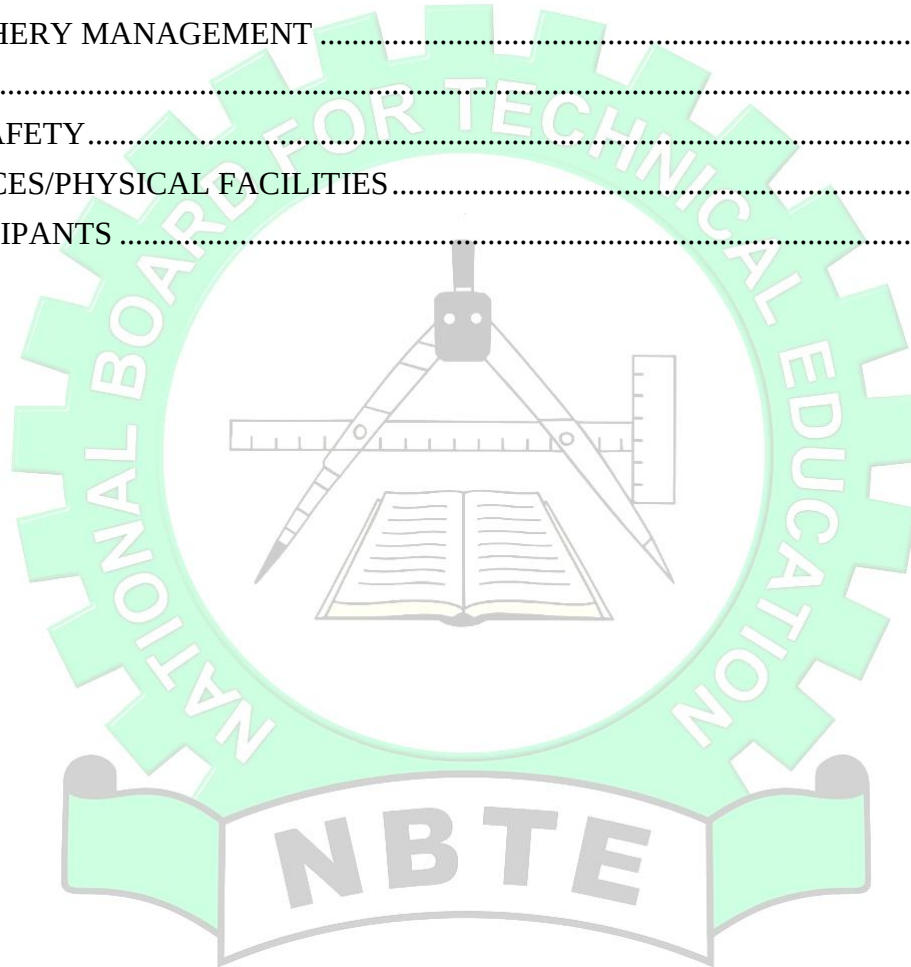


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GENERAL INFORMATION

1.0 TITLE OF THE PROGRAMME

The title of the programme shall be: Higher National Diploma (HND) In Aquaculture And Fisheries Technology

2.0 GOAL AND OBJECTIVES:

2.1 GOAL

The Higher National Diploma programme in Aquaculture and Fisheries Technology is designed to produce aquaculture and fisheries technologists who will be able to apply modern techniques and skills in commercial-scale fish farming, and sustainable management of fisheries.

2.2 PROGRAMME OBJECTIVES

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

- i. Plan, establish, and manage commercial aquaculture enterprises using modern production technologies;
- ii. Apply advanced techniques in fish breeding, hatchery management, seed production, and nursery operations;
- iii. Operate, maintain, and repair fisheries equipment, fishing vessels, and inboard/outboard engines;
- iv. Utilize modern fishing methods and responsible fisheries practices in marine and inland fisheries operations;
- v. Conduct fisheries resource assessment, monitoring, conservation, and management for sustainable exploitation of aquatic resources;
- vi. Apply hydrobiological, limnological, oceanographic, and environmental management principles in fisheries production systems;
- vii. Process, preserve, package, and develop value-added fish and non-food fish products using appropriate technologies;
- viii. Implement quality assurance, food safety standards, and post-harvest management practices in fisheries and aquaculture operations;
- ix. Carry out research activities, data analysis, and statistical interpretation in fisheries and aquaculture studies;
- x. Apply entrepreneurship, innovation, and business management skills in fisheries and aquaculture enterprises;
- xi. Provide extension and advisory services to fish farmers, fisher folk, cooperatives, and related stakeholders;
- xii. Apply information and communication technologies (ICT) and modern digital tools in fisheries management and aquaculture production;
- xiii. Promote sustainable fisheries livelihoods and adherence to national and international codes of conduct for responsible fisheries;
- xiv. Supervise personnel and manage fisheries projects, institutions, and aquatic resource enterprises effectively;
- xv. Demonstrate professional ethics, leadership qualities, and environmental stewardship in fisheries and aquaculture industries.

3.0 ENTRY REQUIREMENTS

- i. The entry qualification into Higher National Diploma in Aquaculture and Fisheries Technology is at least a lower credit pass in National Diploma in Fisheries Technology, Oceanography and Fisheries Science, Agricultural Technology and Animal Health and Production Technology obtained from an accredited Institution.
- ii. Diplomates with distinction, upper and lower credit (CGPA) of 2.50 and above at ND level are required to have undergone at least one-year mandatory relevant industrial experience
- iii. Diplomates with pass grade (CGPA) 2.0 - 2.49 at ND level are required to have undergone at least two-year relevant industrial experience to be eligible for admission.

4.0 CURRICULUM

Curriculum of HND programmes consists of the following components:

- i. General Studies/Education
- ii. Foundation Courses
- iii. Professional Courses

The general Education shall account for not more than 15% of the total contact hours for the programme. The number of hours for foundation courses will vary with programme and may account for about 10 – 15% of the total contact hours. Professional Courses are courses that give the student theoretical and practical skills he or she needs to practice his or her field at technologist level. These may account for between 60 – 70% of the contact hours depending on programme.

4.1 CURRICULUM STRUCTURE

The structure of the HND Programme consists of four semesters of classroom, laboratory and workshop activities in the Institution. Each semester shall be seventeen (17) weeks of duration made up of:

- 15 contact weeks of teaching, i.e. recitation, practical exercises, fieldworks, quizzes, tests, etc.; and
- 2 weeks for examinations and registration.

5.0 STAFFING REQUIREMENTS

5.1 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 Fisheries and Aquaculture or related disciplines at good grade.

5.2 Technical Staff

Technical staff shall have ND, HND or BSc in Aquaculture and Fisheries Technology or related discipline.

5.3 Headship of the Department

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

5.4 Career/Academic Prospects

The diplomate would work in Fisheries Industry, NGOs, relevant ministries, departments, agencies and parastatals.

6.0 CERTIFICATION OF THE PROGRAMME:

A diplomate of this programme shall be awarded HND in Aquaculture and Fisheries Technology

7.0 ACCREDITATION

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

7.1 CONDITIONS FOR THE AWARD OF HND:

Institutions offering accredited programmes will award Higher National Diploma to candidates who successfully completed the programme after passing prescribed course-work, examinations and Higher National Diploma project. Such candidates should have completed a minimum of seventy-three (118) to a maximum of eighty (128) semesters credit units.

7.2 Classification of Diplomas

Higher National Diploma can be classified as follows:

Distinction – GPA of 3.50 and above

Upper Credit – GPA of 3.00 – 3.49

Lower Credit – GPA of 2.50 – 2.99

Pass - GPA of 2.00 – 2.49

7.3 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	0.00

7.4 Evaluation of Award

All terminal Higher National Diploma examination must be externally moderated. In grading the award, the Board's unified grading system should be applied.

8.0 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 performance are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the academic Board of the institution. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programme offered throughout the polytechnic system.

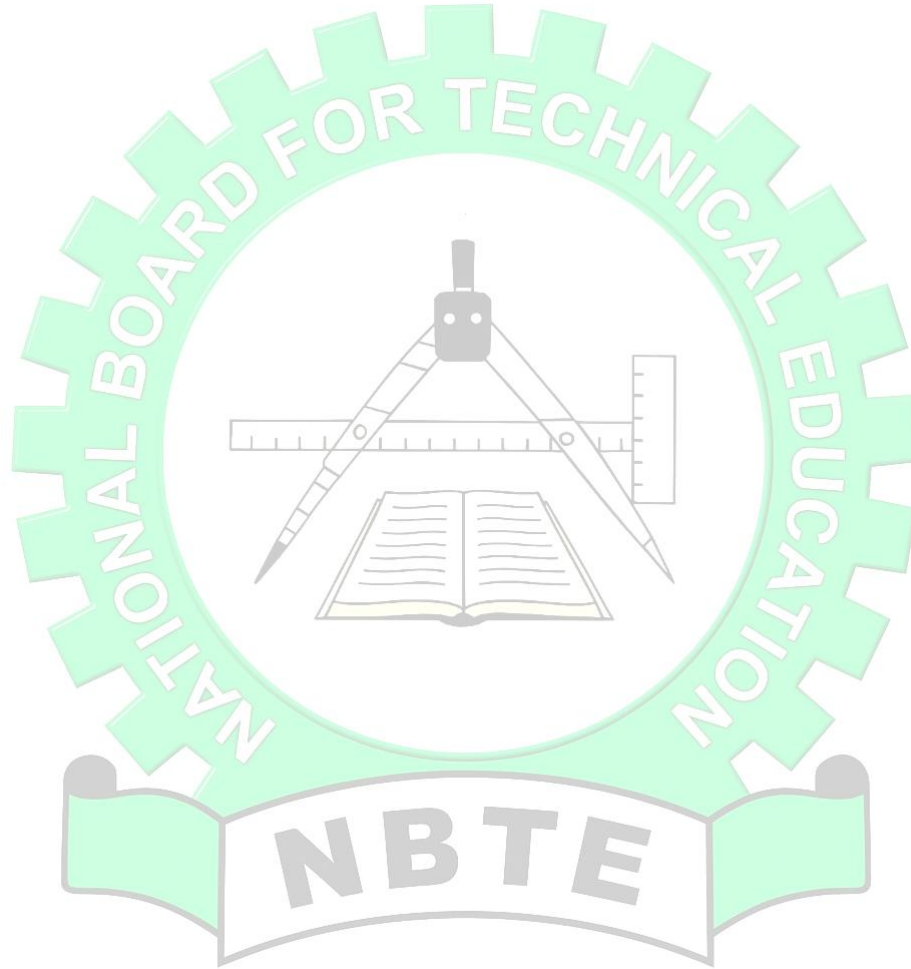
The teaching of the theory and practical work should as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory and practice in the ratio of 20:80.

9.0 PRACTICAL MANUAL

A practical manual should be developed by the Department in line with the practical contents of all the core or professional courses as the case may be.

10.0 PRACTICAL LOGBOOK

A practical Logbook to be kept by each student shall contain all day-to-day, weekly summary and semester summary of all the practical activities from day one to the end of the programme. This is to be checked, marked, endorsed and recorded by the lecturers concerned at the end of every week.



CURRICULUM TABLE

YEAR I SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 301	Use of English III	2	0	0	2	2
2.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
3.	AED 312	Agricultural Extension Methods	1	0	2	3	3
4.	CPT 313	Agro-Climatology and Climate-Smart Agriculture	1	0	2	3	3
5.	AFT 311	Ichthyology	1	0	3	4	4
6.	AFT 312	Hydrobiology and Limnology	1	0	3	4	4
7.	AFT 313	Digital and Precision Aquaculture	1	0	3	4	4
8.	AFT 314	Ornamental Fisheries and Aquarium Technology	1	0	3	4	4
9.	AFT 315	Non-Food Fish Products and Innovation	1	0	3	4	4
10.	AFT 316	Oceanography	1	0	3	4	4
TOTAL			11	0	23	34	34

YEAR I SEMESTER II

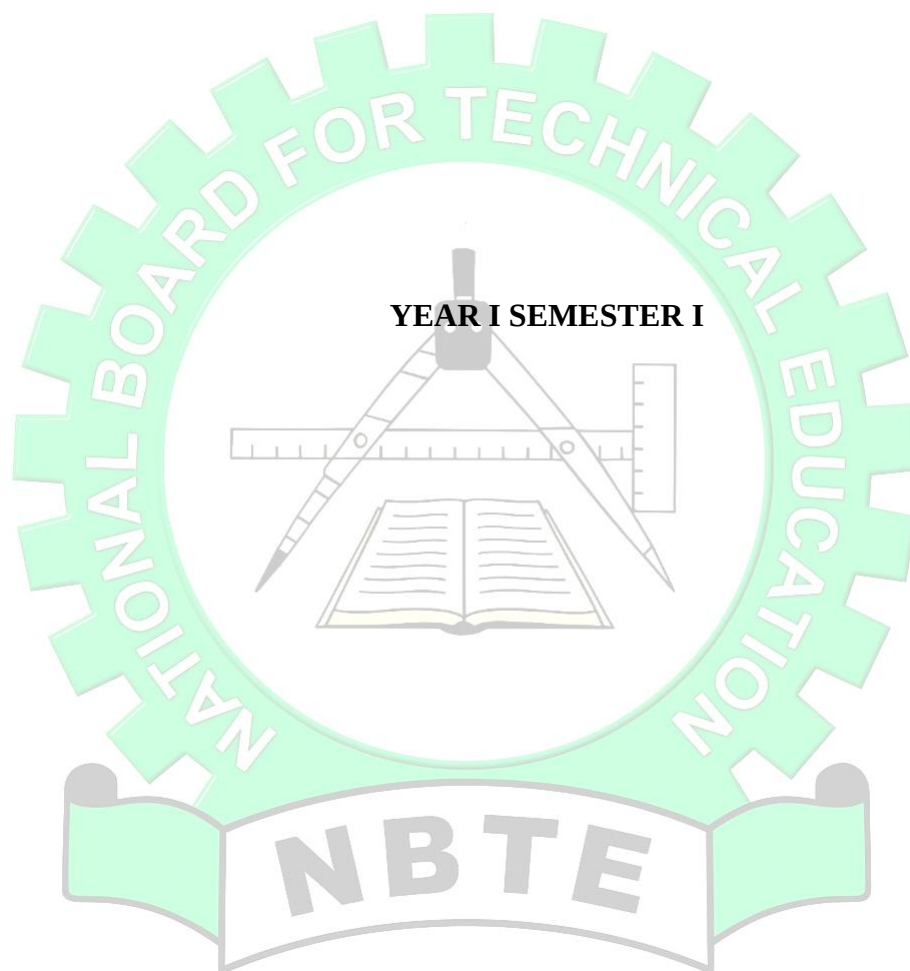
S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	ENT 326	Practice of Entrepreneurship I	2	0	1	3	3
3.	MSQ 321	Practice of Quality Assurance Assessment	1	0	1	2	2
4.	AFT 321	Advanced Fish Feed production	1	0	3	4	4
5.	AFT 322	Advanced Fish Farm Engineering and Management	1	0	3	4	4
6.	AFT 323	Advanced Fishing Gear and Craft Technology	1	0	3	4	4
7.	AFT 324	Mariculture	1	0	3	4	4
8.	AFT 325	Aquaculture Business Management	1	0	3	4	4
9.	AFT 326	Research Methods and Biostatistics in Fisheries	1	0	2	3	3
TOTAL			11	0	19	30	30

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
2.	AED 414	Extension Administration, Personnel Management and Leadership	1	0	2	3	3
3.	AFT 411	Advanced Fish Health and Diseases Management	1	0	2	3	3
4.	AFT 412	Advanced Fish Processing, Storage and Value Addition	1	0	3	4	4
5.	AFT 413	Seamanship and Nautical Knowledge	1	0	3	4	4
6.	AFT 414	Integrated Fish Farming	1	0	2	3	3
7.	AFT 415	Climate-Smart Aquaculture	1	0	3	4	4
8.	AFT 416	Inboard and Outboard Engine Maintenance	1	0	3	4	4
9.	AFT 417	Seminar	0	0	2	2	2
TOTAL			9	0	22	31	31

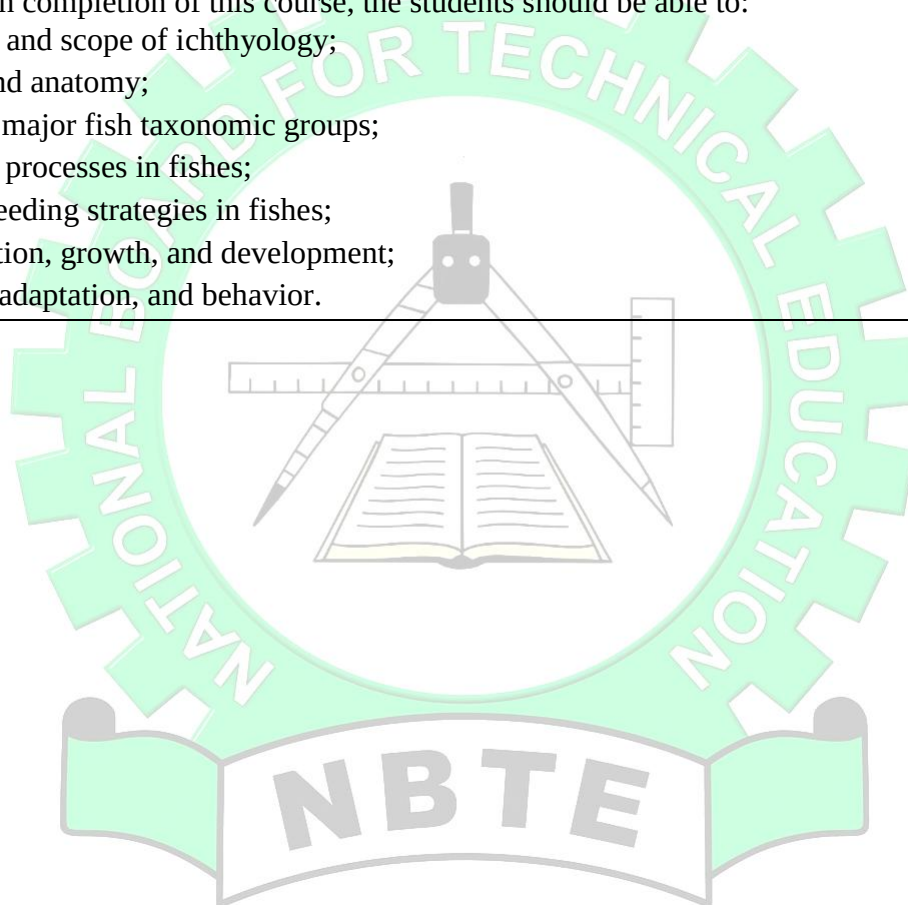
YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	AFT 421	Sustainable Fisheries Livelihoods	1	0	2	3	3
2.	AFT 422	Fisheries Resources Management	1	0	3	4	4
3.	AFT 423	Fish Breeding and Hatchery Management	1	0	3	4	4
4.	AFT 424	Fishing Operations	1	0	3	4	4
5.	AFT 425	Food Legislation and Safety	1	0	3	4	4
6.	AFT 426	Research Project	0	0	4	4	4
TOTAL			5	0	18	23	23



ICHTHYOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ICHTHYOLOGY	COURSE CODE: AFT311	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 the students with knowledge and skills in Ichthyology		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and scope of ichthyology; 2.0 Know fish morphology and anatomy; 3.0 Know fish taxonomy and major fish taxonomic groups; 4.0 Understand physiological processes in fishes; 5.0 Understand feeding and feeding strategies in fishes; 6.0 Understand fish reproduction, growth, and development; 7.0 Understand fish ecology, adaptation, and behavior.		



PROGRAMME: HIGHER NATIONAL DIPLOMA: AQUACULTURE AND FISHERIES TECHNOLOGY							
COURSE TITLE: ICHTHYOLOGY			COURSE CODE: AFT 311		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 the students with knowledge and skills in Ichthyology							
GENERAL OBJECTIVE 1.0: Understand the principles and scope of ichthyology							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome		Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Explain ichthyology.	1.2 Explain the importance of ichthyology.	1.3 Explain the history and development of ichthyology.	1.4 Describe the roles of ichthyology in fisheries and aquaculture.			

2-3	2.1 Describe fish external body structure. 2.2 Explain adaptive features of fish. 2.3 Describe internal organ systems of fish. 2.4 Relate fish anatomy to functions.	• Describe fish external body structure. • Explain adaptive features of fish. • Describe internal organ systems ➤ Digestive system ➤ Respiratory system ➤ Nervous system ➤ Reproductive system ➤ Excretory system ➤ Skeletal system ➤ Circulatory • Relate fish anatomy to functions	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Examine external structures of a typical fish • Sketch well-labelled external features of major classes of fish • Measure fish morphometric characters of tilapia and catfish • Count meristic characters of tilapia and catfish • Dissect fish • Identify the organ in a fish	Guide the students to: • Examine of external structures of a typical fish • Sketch well-labelled external features of major classes of fish • Measure fish morphometric characters of tilapia and catfish • Count meristic characters of tilapia and catfish • Dissect fish and identify the organ systems	Preserved fish samples, Dissecting set, Measuring board, Microscopes, PPE, Thread, Marker.
General Objective 3.0: Know fish taxonomy and major fish taxonomic groups						
4-5	3.1 Explain principles of	• Discuss principles of fish taxonomy.	Whiteboard, Projector,	• Identify fish species	• Guide students to	Preserved fish samples,

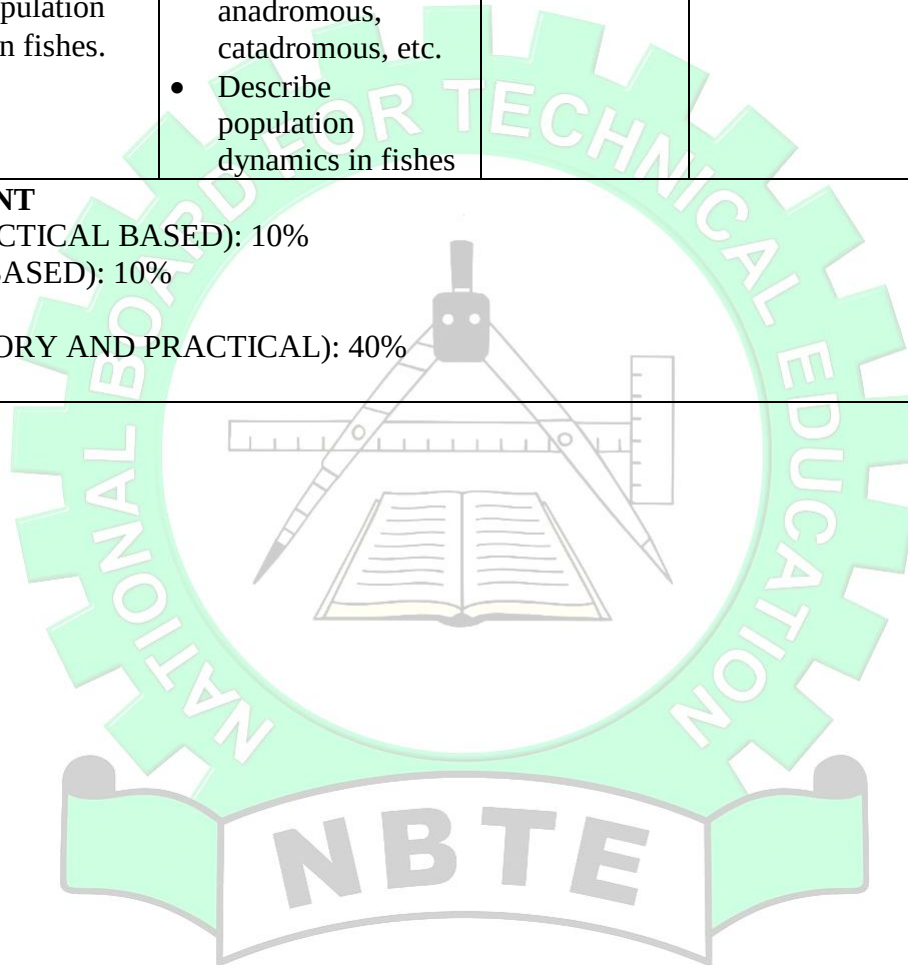
	fish taxonomy. 3.2 Classify fishes into major groups. 3.3 Describe common Nigerian freshwater. 3.4 Describe common marine fish species.	• Explain the major classes of fishes into order, families, genera and species • Discuss common Nigerian freshwater and marine fish species	Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Classify fish species into major groups	Identify and classify fish specimens	Fish Identification guide, Microscopes.
General Objective 4.0: Understand physiological processes in fishes						
6-8	4.1 Explain respiration and gas exchange in fishes. 4.2 Describe air-breathing organs in fishes. 4.3 Describe osmoregulation in freshwater and marine fishes. 4.4 Explain thermoregulation and metabolism in fishes. 4.5 Explain circulation and heart function in fishes. 4.6 Describe sensory organs and their function in fishes.	• Discuss respiration and gas exchange • Explain air-breathing organs in fishes • Explain osmoregulation in freshwater and marine fishes • Discuss thermoregulation and metabolism in fishes • Explain circulation and heart function in fishes • Discuss sensory organs and their	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Dissect various part of fish gill • Identify various part of fish gill • Sketch various part of fish gill • Dissect various air-breathing organs in fishes • Identify various air-breathing organs in fishes • Sketch various air-breathing organs in fishes • Dissect fish hearts and major blood vessels of fish	Guide students to: • Dissect, identify and sketch various part of fish gill • Dissect, identify and sketch various air-breathing organs in fishes • Dissect, identify and sketch various fish hearts and	Preserved and fresh fish, samples Dissecting set, Microscopes, Hand lens, Drawing sets, Practical manual, Log book, PPE.

	4.7 Explain stress response in fish.	- function in fishes - Discuss stress response in fish		- Identify fish hearts and major blood vessels of fish - Sketch various fish hearts and major blood vessels of fish - Dissect a fish to show the swim bladder - Sketch fish swim bladder	major blood vessels of fish Dissect and sketch fish swim bladder	
General Objective 5.0: Understand feeding and feeding strategies in fishes						
9-11	5.1 Describe the digestive system of fish. 5.2 Describe the different modes of feeding in fish. 5.3 Explain the adaptations of fish (morphological adaptations) to different feeding methods. 5.4 Explain feeding strategies in fishes.	- Explain the digestive system of fish - Discuss the different modes of feeding in fish (filter feeding, omnivorous, carnivorous, detritus feeding etc.) - Explain the adaptations of fish (morphological adaptations) to	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify herbivorous, carnivorous and omnivorous fishes using fish teeth - Dissect the digestive system of herbivorous, carnivorous and omnivorous fishes - Sketch the digestive system of herbivorous, carnivorous and omnivorous fishes	Guide student to: - Dissect and sketch the digestive system of herbivorous, carnivorous and omnivorous fishes - Identify herbivorous, carnivorous and omnivorous fishes using	Specimens of herbivorous, carnivorous and omnivorous fishes, Weighing balance, Measuring cylinder, Dissecting set, Microscopes, Hand lens, PPE, Meter rule.

		different feeding methods. • Discuss feeding strategies in fishes		• Carry out direct analysis of fish stomach content • Carry out volumetric analysis of fish stomach content • Carry out gravimetric analysis of fish stomach content.	fish teeth • Carry out direct, volumetric and gravimetric analysis of fish stomach content	
General Objective 6.0: Understand fish reproduction, growth, and development						
12-13	6.1 Explain types of reproduction in fishes. 6.2 Explain mode of reproduction in fishes. 6.3 Describe male and female reproductive systems of fish. 6.4 Describe gonadal development in fishes (gonadosomatic index). 6.5 Explain fecundity and its importance. 6.6 Describe spawning behavior and	• Discuss types of reproduction in fishes (bisexual, hermaphrodite and parthenogenesis) • Explain mode of reproduction in fishes (oviparous, viviparous and ovoviviparous) • Discuss male and female reproductive systems • Explain gonadal development in fishes • Explain fecundity	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify male and female reproductive organs of fishes • Observe gonadal development stages • Calculate gonadosomatic index • Carry out fecundity analysis • Measure length and weight of fishes to plot length-weight relationship and	Guide students to: • Identify fish male and female reproductive organs of fishes • Observe gonadal development stages • Calculate gonadosomatic index • Carry out fecundity analysis • Measure length	Specimens of fish, Weighing balance, Measuring cylinder, Dissecting set, Microscopes, Hand lens, PPE, Meter rule.

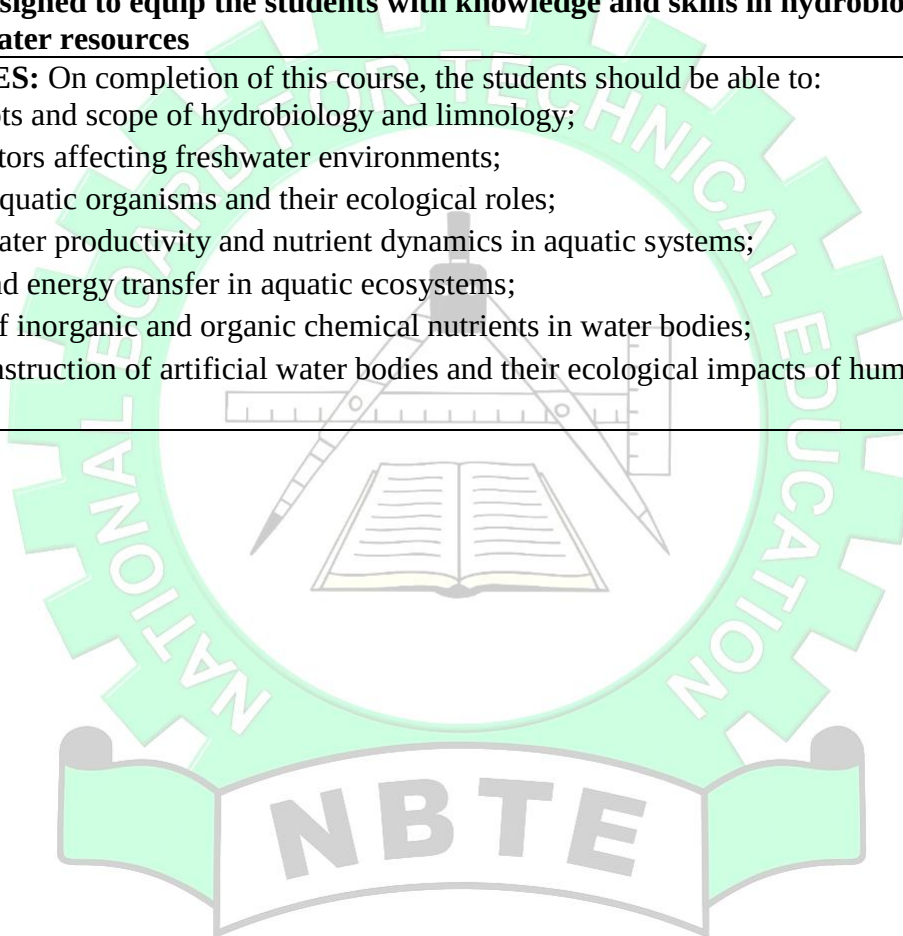
	parental care in fishes. 6.7 Describe embryonic and larval development in fishes. 6.8 Explain growth patterns (isometric and allometric) in fishes. 6.9 Explain factors affecting growth in fishes.	and its importance • Discuss spawning behavior and parental care in fishes • Explain embryonic and larval development in fishes • Discuss growth patterns (isometric and allometric) in fishes • Explain factors affecting growth in fishes		determine their condition factor • Carry out age determination using length frequency data, scales and, otoliths • Calculate condition factor using length weight data	and weight of fishes to plot length-weight relationship and determine their condition factor • Carry out age determination using length frequency data, scales and, otoliths • Calculate condition factor using length weight data	
General Objective 7.0: Understand fish ecology, adaptation, and behavior						
14-15	7.1 Explain fish habitat and ecology. 7.2 Explain behavioural responses in fish e.g., aggregation schools, shoals, aestivation and hibernation. 7.3 Explain fish migration. 7.4 Discuss factors	• Describe fish habitat and ecology • Discuss behavioural responses in fish e.g., aggregation schools, shoals, aestivation and hibernation. • Discuss fish	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

	influencing fish migration. 7.5 Describe types of fish migration e.g., anadromous, catadromous, etc. 7.6 Explain population dynamics in fishes.	migration • Discuss factors influencing fish migration • Describe types of fish migration e.g., anadromous, catadromous, etc. • Describe population dynamics in fishes				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



HYDROBIOLOGY AND LIMNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: HYDROBIOLOGY AND LIMNOLOGY	COURSE CODE: AFT 312	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NONE	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip the students with knowledge and skills in hydrobiology and limnology for sustainable management of inland water resources		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand concepts and scope of hydrobiology and limnology; 2.0 Understand the factors affecting freshwater environments; 3.0 Know freshwater aquatic organisms and their ecological roles; 4.0 Understand freshwater productivity and nutrient dynamics in aquatic systems; 5.0 Understand heat and energy transfer in aquatic ecosystems; 6.0 Know the effects of inorganic and organic chemical nutrients in water bodies; 7.0 Understand the construction of artificial water bodies and their ecological impacts of human activities.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: HYDROBIOLOGY AND LIMNOLOGY		COURSE CODE: AFT 312		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 the students with knowledge and skills in hydrobiology and limnology for sustainable management of inland water resources						
GENERAL OBJECTIVE 1.0: Understand concepts and scope of hydrobiology and limnology.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the concept and scope of hydrobiology. 1.2 Explain the concept and scope of limnology. 1.3 Describe inland water ecosystems. 1.4 Classify inland water bodies. 1.5 Explain importance of freshwater ecosystems. 1.6 Explain the fisheries significance of inland waters.	• Discuss the concept and scope of hydrobiology • Discuss the concept and scope of limnology • Explain inland water ecosystems • Explain different types of water bodies • Explain importance of freshwater ecosystems • Explain the fisheries significance of inland waters	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

General Objective 2.0: Understand the factors affecting freshwater environments						
2-4	2.1 Explain the physical properties of freshwater in terms of temperature, density, current and waves, viscosity, light, and tides. 2.2 Describe how physical parameters affect aquatic life. 2.3 Explain the chemical parameters of freshwater in term of Dissolved gases, Dissolved minerals, pH, Alkalinity, Salinity. 2.4 Describe how chemical parameters affect aquatic life.	- Discuss the physical properties of freshwater in terms of temperature, density, viscosity, light, current and waves, tides - Explain how physical parameters affect aquatic life (e.g., Thermal stratification) - Discuss the chemical parameters of freshwater in term of Dissolved gases, Dissolved minerals, pH, Alkalinity, Salinity - Describe how chemical parameters affect aquatic life	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Carry out test of physical parameters of rivers - Carry out test of physical parameters of ponds - Carry out test of physical parameters of lake - Carry out test of chemical parameters of rivers - Carry out test of chemical parameters of ponds - Carry out test of chemical parameters of lake	Guide students to: - Carry out test of physical parameters of rivers, ponds and lake - Carry out test of chemical parameters of rivers, ponds and lake	Thermometer, Secchi disk, pH meter, Dissolved Oxygen meter, Water quality testing kits, Water samples.
General Objective 3.0: Know freshwater aquatic organisms and their ecological roles.						
5-7	3.1 Describe classes of freshwater aquatic organisms. 3.2 Describe the	- Discuss classes of freshwater aquatic organisms - Discuss the freshwater	Whiteboard, Projector, Fisheries textbooks, Charts,	Carry out phytoplankton and zooplankton collection from	Guide students to: Carry out collection,	Plankton net, Sampling bottles, Eckman grab, Sieve, Identification guide,

	freshwater microorganisms. 3.3 Describe the freshwater invertebrates. 3.4 Describe the freshwater algae and plants. 3.5 Describe the freshwater vertebrates. 3.6 Explain the interrelationship between aquatic organisms with regards to trophism, commensalism, parasitism, food chain and food web. 3.7 Explain the importance of plankton in the aquatic ecosystem. 3.8 Explain the distribution and zonation of freshwater organisms.	microorganisms (bacterial, phytoplankton, zooplankton and fungi) • Discuss the freshwater invertebrates (crustacean, insects, mollusc, etc.) • Discuss the freshwater algae, and plants • Discuss the freshwater vertebrates (fishes, amphibians, reptiles and mammals) • Explain the interrelationship between aquatic organisms with regards to trophism, commensalism, parasitism, food chain and food web • Explain the importance of plankton in the aquatic ecosystem • Discuss the distribution and zonation of freshwater	Journals, Instructional materials, etc.	ponds • Identify phytoplankton and zooplankton • Classify phytoplankton and zooplankton • Carry out collection of invertebrates from pond and river • Identify aquatic insects, crustacean and mollusc, etc. • Classify aquatic insects, crustacean and mollusc, etc	identification and classification of phytoplankton and zooplankton from ponds • Carry out collection, identification and classification of invertebrates from pond and river	Charts, Video clips, Multimedia projector.
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		organisms				
General Objective 4.0: Understand freshwater productivity and nutrient dynamics in aquatic systems						
8-9	4.1 Describe hydrological cycle. 4.2 Explain freshwater productivity and factors affecting it. 4.3 Categorize trophic status of lentic water bodies. 4.4 Describe Nutrient cycle. 4.5 Explain Nutrient enrichment and Eutrophication.	• Explain hydrological cycle • Explain freshwater productivity and factors affecting it • Explain trophic status of lentic water bodies (Oligotrophic, mesotrophic and eutrophic) • Discuss Nutrient cycle (Nitrogen cycle, Phosphorus cycle, Carbon cycle etc.) • Explain Nutrient enrichment and Eutrophication	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out overall productivity test of a pond using chlorophyll-a method	Guide students to • Carry out overall productivity test of a pond using chlorophyll-a method	Plankton net, Sampling bottles, Sieve, Identification guide, Charts, Microscope, Hand lens, Video clips, Multimedia projector.
General Objective 5.0: Understand heat and energy transfer in aquatic ecosystems						
10-11	5.1 Describe the factors determining eutrophic and oligotrophic lakes. 5.2 Explain thermal stratification and its biological implications. 5.3 Describe atmospheric	• Discuss the factors determining eutrophic and oligotrophic lakes • Explain thermal stratification and its biological implications • Discuss atmospheric	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

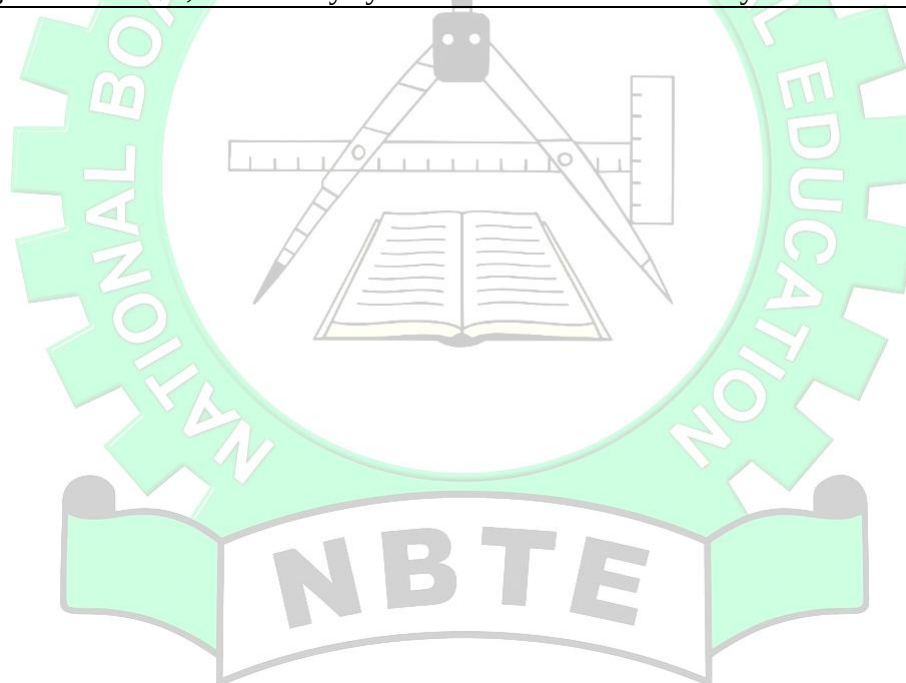
	wind movement on waterbodies. 5.4 Explain waves velocity, oscillation, translation and seiches. 5.5 Explain internal heat energy transfer, temperature as causes of seiches. 5.6 Explain rhythmic and arhythmic water movement. 5.7 Describe water movement and its effects on biological productivity.	wind movement on waterbodies • Discuss waves velocity, oscillation, translation and seiches • Explain internal heat energy transfer, temperature as causes of seiches • Explain rhythmic and arhythmic water movement • Discuss water movement and its effects on biological productivity				
General Objective 6.0: Know the effects of inorganic and organic chemical nutrients in water bodies						
12-13	6.1 Explain chemical limnology. 6.2 Explain Henry's law and gas solubility. 6.3 Describe the major gases found in inland waters. 6.4 Explain the sources of water in freshwater and factors limiting their abundance. 6.5 Explain alkalinity, pH, nitrification and	• Discuss chemical limnology (dissolved gases and salts in inland water bodies) • Explain Henry's law and gas solubility • Discuss the major gases found in inland waters • Explain the sources of water in freshwater and factors limiting	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

	oxygen in natural water. 6.6 Explain the effects of topography, water movement and substratum on salt dissolution in inland waters.	their abundance • Explain alkalinity, pH, nitrification and oxygen in natural water • Discuss the effects of topography, water movement and substratum on salt dissolution in inland waters				
General Objective 7.0: Understand the construction of artificial water bodies and their ecological impacts of human activities						
14-15	7.1 Explain dam and other man-made water bodies. 7.2 Discuss the advantages and disadvantages of man-made water bodies. 7.3 Explain the ecological effects of man-made water bodies on the terrestrial environments. 7.4 Outline the general principles of Environmental Impact Assessment Act of 1992. 7.5 Explain international	• Discuss dam and other man-made water bodies (ponds, borrow pits, mining pits) • Discuss the advantages and disadvantages of man-made water bodies • Explain the ecological effects of man-made water bodies on the terrestrial environments • Discuss the general principles of Environmental Impact Assessment Act of 1992	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

	regulations (UN, FAO) on dam construction and creation of artificial water bodies. 7.6 Explain the impact of location of fish farm facilities in relation to residential and other buildings. 7.7 Explain the principles of landscape and environmental engineering. 7.8 Explain methods of environmental beautification and their effects on fish.	• Explain international regulations (UN, FAO) on dam construction and creation of artificial water bodies • Discuss the impact of location of fish farm facilities in relation to residential and other buildings • Discuss the principles of landscape and environmental engineering • Explain methods of environmental beautification and their effects on fish				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

DIGITAL AND PRECISION AQUACULTURE

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: DIGITAL AND PRECISION AQUACULTURE	COURSE CODE: AFT 313	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 equip students with knowledge and skills in digital and precision aquaculture technologies.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concepts and principles of digital and precision aquaculture; 2.0 Know how to apply Internet of Things (IoT) and smart monitoring systems in aquaculture; 3.0 Know how to use automated aeration and automatic feeding systems; 4.0 Know how to apply GIS, remote sensing and drone technologies in aquaculture; 5.0 Understand the operation and application of smart aquaculture engineering; 6.0 Know how to implement digital fish health, biosecurity systems and farm sustainability.		



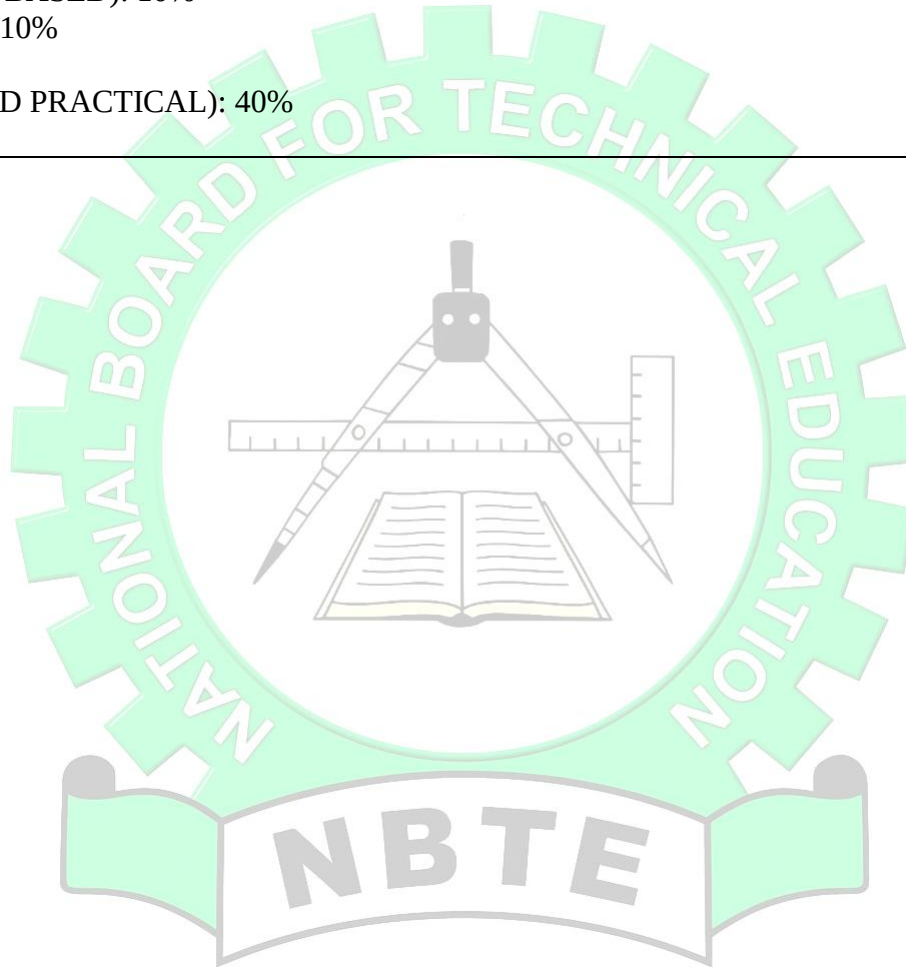
PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: DIGITAL AND PRECISION AQUACULTURE			COURSE CODE: AFT 313		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in digital and precision aquaculture technologies.						
GENERAL OBJECTIVE 1.0: Understand the concepts and principles of digital and precision aquaculture						
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 concepts of digital and precision aquaculture. 1.2 Explain importance of smart aquaculture technologies. 1.3 Explain the digital aquaculture applications. 1.4 Explain trends in modern aquaculture systems.	• Discuss the concept and principles of digital and precision aquaculture • Explain smart aquaculture technologies • Discuss the trends and innovations in aquaculture • Discuss the advantages and challenges of digital and precision aquaculture	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Observe smart aquaculture systems using video clips.	Guide students to • Observe smart aquaculture systems using video clips.	Video clips, Multimedia projector, Charts.
General Objective 2.0: Know how to apply IoT and smart monitoring systems in aquaculture						

3-5	2.1 Explain IoT applications in aquaculture. 2.2 Explain the operation of digital sensors. 2.3 Explain devices used in monitoring aquaculture systems remotely. 2.4 Explain cloud-based monitoring systems.	• Discuss IoT applications in aquaculture. • Explain the operation of digital sensors. • Describe devices used in monitoring aquaculture systems remotely e.g. CCTV Camera, Underwater camera. • Describe cloud-based monitoring systems.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Observe sensor installation in aquaculture system using video clips. • Observe remote monitoring practical in aquaculture system using video clips. • Demonstrate data transmission in aquaculture systems.	Guide the students to: • Observe sensor installation in aquaculture system using video clips. • Observe remote monitoring practical in aquaculture system using video clips. • Demonstrate data transmission in aquaculture systems.	Computer, Software, Projector, CCTV Camera, Underwater camera.
General Objective 3.0: Know how to use automated aeration and automatic feeding systems						
6-8	3.1 Explain how to monitor water quality digitally. 3.2 Explain the operation of automated aeration systems. 3.3 Explain automatic feeding systems. 3.4 Explain how to production efficiency.	• Discuss the various water quality monitoring technologies and their operation • Discuss automated aeration systems ➤ Smart feeding technologies	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Observe water quality monitoring practical in aquaculture system using video clips. • Observe automated feeder operation in aquaculture system	Guide the student to: • Observe water quality monitoring practical in aquaculture system using video clips.	Automatic feeding machine, Water monitoring kit, Digitalized temperature detector, Software,

		➤ Feed optimization systems ➤ Alarm and control systems		using video clips. • Observe aeration control exercises in aquaculture system using video clips.	• Observe automated feeder operation in aquaculture system using video clips. • Observe aeration control exercises in aquaculture system using video clips.	Computer.
General Objective 4.0: Know how to apply GIS, remote sensing and drone technologies in aquaculture.						
9-10	4.1 Explain how to apply GIS in aquaculture planning. 4.2 Explain how to use remote sensing technologies. 4.3 Explain drone applications in aquaculture. 4.4 Explain spatial analysis.	• Describe how to apply GIS in aquaculture planning • Describe how to use remote sensing technologies. • Describe drone applications in aquaculture. • Explain spatial analysis.	GIS, Drones, Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out simple GIS mapping exercises • Practice drone operations • Carry out spatial data interpretation	Guide the student to: • Carry out simple GIS mapping exercises • Practice drone operation • Carry out spatial data interpretation	GIS, Drones, Computer, GIS software, Internet.
General Objective 5.0: Understand the operation and application of smart aquaculture engineering						

11-12	5.1 Explain smart aquaculture engineering systems. 5.2 Explain the use of IoT in re-circulatory aquaculture systems. 5.3 Explain the application of AI technologies in aquaculture. 5.4 Explain the use of predictive analytics in aquaculture.	• Discuss smart aquaculture engineering systems. • Explain the use of IoT in re-circulatory aquaculture systems. • Discuss the application of AI technologies in aquaculture. • Discuss the use of predictive analytics in aquaculture.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Observe Recirculating Aquaculture System (RAS) monitored with IoT • Use AI software in aquaculture	Guide the student to: • Observe RAS monitored with IoT • Operate AI software in aquaculture	Computer with AI software, RAS facilities, Internet, Video clips, Charts, Multimedia projector.
General Objective 6.0: Know how to implement digital fish health, biosecurity systems and farm sustainability						
13-15	6.1 Explain how to monitor fish health digitally. 6.2 Explain digital biosecurity systems. 6.3 Explain sustainable aquaculture practices.	• Discuss how to monitor fish health digitally • Describe digital biosecurity systems • Explain sustainable aquaculture practices.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out digital fish health monitoring using AI • Configure biosecurity and surveillance device • Carry out biosecurity and surveillance	Guide student to: • Carry out digital fish health monitoring using AI • Configure biosecurity and surveillance device • Carry out	Computer with software, RAS facilities, CCTV Cameras, Smart digital devices.

				digitally	biosecurity and surveillance digitally	
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



ORNAMENTAL FISHERIES AND AQUARIUM TECHNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ORNAMENTAL FISHERIES AND AQUARIUM TECHNOLOGY	COURSE CODE: AFT 314	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 equip students with theoretical knowledge and skills in ornamental fisheries and aquarium management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Explain concepts and scope of ornamental fisheries and aquarium technology; 2.0 Know ornamental fish species and aquatic plants; 3.0 Understand aquarium design, construction and water quality management; 4.0 Know breeding and culture techniques for ornamental fishes; 5.0 Understand ornamental fish nutrition, live food production and aquarium maintenance; 6.0 Know ornamental fish diseases diagnosis and treatment.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ORNAMENTAL FISHERIES AND AQUARIUM TECHNOLOGY			COURSE CODE: AFT 314		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 theoretical knowledge and skills in ornamental fisheries and aquarium management.						
GENERAL OBJECTIVE 1.0: Understand concepts and scope of ornamental fisheries and aquarium technology.						
THEORETICAL CONTENT			PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the concept and scope of ornamental fisheries. 1.2 Explain global ornamental fish trade. 1.3 Explain career opportunities in ornamental fisheries.	• Discuss the concept and scope of ornamental fisheries ➤ History and development of aquarium technology ➤ Economic importance of ornamental fisheries ➤ Freshwater and marine ornamental fishes • Discuss global ornamental fish trade • Explain career opportunities in ornamental fisheries	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

General Objective 2.0: Know ornamental fish species and aquatic plants						
2-3	2.1 Explain the classification of ornamental species. 2.2 Describe freshwater ornamental fish species. 2.3 Describe native freshwater ornamental fish species. 2.4 Describe marine ornamental fish species. 2.5 Describe ornamental aquatic plants. 2.6 Explain habitat and environmental requirements of ornamental fishes.	- Explain the classification of ornamental species - Discuss freshwater ornamental fish species - Discuss native freshwater ornamental fish species - Discuss marine ornamental fish species - Discuss ornamental aquatic plants - Explain habitat and environmental requirements of ornamental fishes.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify freshwater exotic and native ornamental fishes - Identify freshwater aquarium plants	Guide students to: - Identify freshwater exotic and native ornamental fishes - Identify freshwater aquarium plants	Live samples of exotic and native ornamental fishes, Fish charts Aquarium plants (Local and exotics, plastics).
General Objective 3.0: Understand aquarium design, construction and water quality management						
4-7	3.1 Explain aquarium design principles. 3.2 Describe aquarium types and construction materials. 3.3 Explain aquarium installation and setup. 3.4 Explain Water quality management in	- Discuss aquarium design principles - Explain aquarium types and construction materials. - Explain aquarium installation and setup. - Discuss Water quality	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Sketch different aquarium layouts - Construct aquarium tank - Set up aquarium units. - Conduct water quality tests.	Guide students to: - Sketch different aquarium layouts - Construct aquarium tank - Set up aquarium	Glass sheet, Silicon sealant, Sealing gun, Diamond glass cutter, Aquarium models, Aquarium accessories,

	aquarium. 3.5 Explain operation of recirculatory systems in aquarium. 3.6 Explain filtration systems in aquarium. 3.7 Explain aeration and lighting systems in aquarium. 3.8 Explain handling, packaging and transportation techniques of ornamental fishes. 3.9 Explain trade standards and regulations. 3.10 Explain export and quarantine regulations.	management in aquarium • Explain operation of recirculatory systems in aquarium • Discuss Filtration systems in aquarium • Discuss lighting, heating and automation systems • Explain Aeration and lighting systems in aquarium • Explain handling, packaging and transportation techniques of ornamental fishes • Discuss trade standards and regulations • Explain export and quarantine regulations		• Operate aquarium systems. • Demonstrate ornamental fish handling and packaging • Demonstrate ornamental fish quarantine	units. • Conduct water quality tests • Operate aquarium systems • Demonstrate ornamental fish handling and packaging • Demonstrate ornamental fish quarantine	Water quality test kits, Filters, Aerators.
General Objective 4.0: Know breeding and culture techniques for ornamental fishes.						
8-10	4.1 Explain reproductive biology of ornamental fishes. 4.2 Explain breeding techniques for ornamental fishes. 4.3 Explain Hatchery management of	• Discuss reproductive biology of ornamental fishes • Explain breeding techniques for ornamental fishes. • Explain Hatchery management of	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out breeding of some common ornamental fishes • Carry out larval and fry rearing of ornamental fishes	Guide students to: • Carry out breeding of some common ornamental fishes • Carry out larval and fry	Broodstock of different ornamental fishes, Aquaria tanks, Spawning substrates, Aerators, Filter,

	ornamental fishes. 4.4 Describe Larval and fry management of ornamental fishes.	ornamental fishes • Discuss Larval and fry management of ornamental fishes			rearing of ornamental fishes	Live fish food, Processed fish food/flakes, Vats.
General Objective 5.0: Understand ornamental fish nutrition, live food production and aquarium maintenance						
11-13	5.1 Explain nutritional requirements of ornamental fishes. 5.2 Explain the major types of food for ornamental fishes (prepared, live, frozen and vegetable-based). 5.3 Explain feeding management in aquarium. 5.4 Explain Live feed production for ornamental fishes. 5.5 Explain Artemia and zooplankton culture. 5.6 Describe aquarium sanitation. 5.7 Explain aquarium maintenance procedures.	• Discuss nutritional requirements of ornamental fishes • Explain the major types of food for ornamental fishes (prepared, live, frozen and vegetable-based) • Explain feeding management in aquarium • Discuss Live feed production for ornamental fishes • Explain Artemia and zooplankton culture • Explain aquarium sanitation • Explain aquarium maintenance procedures	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out culture of Artemia and Zooplankton • Carry out flaked fish food preparation • Carry out feeding trials for ornamental fishes • Carry out aquarium cleaning and maintenance	Guide students to: • Carry out culture of artemia and Zooplankton • Carry out flaked fish food preparation • Carry out feeding trials for ornamental fishes • Carry out aquarium cleaning and maintenance	Artemia egg, Plankton net, Aquarium tank, Vats, Feed ingredients.

General Objective 6.0: Know ornamental fish diseases diagnosis and treatment						
14-15	6.1 Explain ornamental fish diseases and parasites. 6.2 Explain ornamental fish diseases treatment and preventive measures. 6.3 Describe Biosecurity measures in ornamental fish facilities.	• Discuss ornamental fish diseases and parasites • Discuss ornamental fish diseases treatment and preventive measures • Discuss Biosecurity measures in ornamental fish facilities	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify ornamental fish diseases by their symptoms • Demonstrate treatment procedure for ornamental fish diseases • Demonstrate biosecurity measures	Guide students to • Identify ornamental fish diseases by their symptoms • Demonstrate treatment procedure for ornamental fish diseases • Demonstrate biosecurity measures	Ornamental fish, Disease's chart, Diseased fish, Drugs Chemicals, Microscope, Laboratory glassware, Hand lens.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

NON-FOOD FISH PRODUCTS AND INNOVATIONS

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: NON-FOOD FISH PRODUCTS AND INNOVATIONS	COURSE CODE: AFT 315	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills required for the production, processing and utilization of non-food fish products and innovative fish-based products		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and importance of non-food fish products. 2.0 Understand fishmeal and fish oil production 3.0 Understand fish silage and fertilizer production 4.0 Understand production of fish-derived industrial materials and their uses 5.0 Understand fish leather and ornamental product production 6.0 Understand biomedical and pharmaceutical applications of fish by-products 7.0 Understand biological uses of fish		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: NON-FOOD FISH PRODUCTS AND INNOVATIONS			COURSE CODE: AFT 315		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills required for the production, processing and utilization of non-food fish products and innovative fish-based products						
GENERAL OBJECTIVE 1.0: Understand the concept and importance of non-food fish products.						
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 non-food fish products. 1.2 Classify major categories of non-food fish products. 1.3 Explain the economic importance of fishery by-products. 1.4 Explain fish waste recycling and sustainable utilization. 1.5 Discuss global and local trends in fish product innovation. 1.6 Explain environmental impacts of fish wastes. 1.7 Describe waste management strategies. 1.8 Explain value addition opportunities in fish processing	• Discuss the concept of non-food fish products • Describe the major categories of non-food fish products • Discuss the economic importance of fishery by-products • Explain fish waste recycling and sustainable utilization • Discuss global and local trends in fish product innovation • Discuss environmental impacts of fish wastes.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Visit fish processing facilities. • Write observation on the waste that are generated or managed.	Guide students to • Visit fish processing facilities. • Write observation on the waste that are generated or managed.	Notepad, Camera, Practical Manual etc.

	waste.	- Describe waste management strategies. - Discuss value addition opportunities in fish processing waste.				
General Objective 2.0: Understand fishmeal and fish oil production						
3-5	2.1 Explain fish meal production processes. 2.2 Explain sources of raw materials for fish meal. 2.3 Explain the uses of fish meal. 2.4 Explain fish oil extraction methods. 2.5 Describe the various types and uses of fish oil.	- Discuss fish meal production processes. - Explain sources of raw materials for fish meal. - Explain the uses of fish meal. - Discuss fish oil extraction methods. - Describe the various types and uses of fish oil	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Produce fish meal using standard methods - Extract fish oil from fish waste	Guide students to: - Produce fish meal using standard methods - Extract fish oil from fish waste	Fish offal, Drying equipment, Grinder, Weighing balance, Extraction equipment, Oily Fish tissues, Measuring cylinders, Heating devices, PPE.
General Objective 3.0: Understand fish silage and fertilizer production						
6-8	3.1 Describe fish silage and utilizations. 3.2 Explain silage preparation methods. 3.3 Explain fish-based fertilizer. 3.4 Describe fish-based fertilizer production methods.	- Explain fish silage and utilizations - Discuss silage preparation methods - Discuss fish-based fertilizer - Explain fish-based	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Prepare fish silage - Produce organic fertilizer from fish wastes	Guide students to: - Prepare fish silage - Produce organic fertilizer from fish wastes	Fish waste, Fermentation containers, pH meter, Composting materials, PPE.

	3.5 Explain the biogas Production.	fertilizer production methods • Explain the biogas Production				
General Objective 4.0: Understand production of fish-derived industrial materials and their uses						
9-10	4.1 Describe collagen and gelatin and their sources. 4.2 Explain the industrial, medical and cosmetic uses of collagen and gelatin. 4.3 Explain the methods of extracting collagen and gelatin. 4.4 Describe fish-derived cosmetic products.	• Explain collagen and gelatin and their sources • Discuss the industrial, medical and cosmetic uses of collagen and gelatin • Explain the methods of extracting collagen and gelatin • Describe fish-derived cosmetic products	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Produce fish glue	Guide students to • Produce fish glue	Fish skin and bones, Heating equipment, Laboratory glassware, Packaging materials, PPE.
General Objective 5.0: Understand fish leather and ornamental product production						
11-12	5.1 Explain fish skin products and their uses. 5.2 Explain the steps in fish leather production. 5.3 Explain fish taxidermy. 5.4 Describe ornamental fish products from fish scales.	• Discuss fish skin products and their uses (fashion and biomedical) • Discuss the steps in fish leather production (Skinning, preservation, tanning and decoration) • Explain fish taxidermy	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Produce fish skin leather • Produce ornamental products from fish scales	Guide students to: • Produce fish skin leather • Produce ornamental products from fish scales	Fish skins, Tanning chemicals, Cutting tools, Design materials, PPE.

		• Illustrate ornamental fish products from fish scales				
General Objective 6.0: Understand biomedical and pharmaceutical applications of fish by-products.						
13-14	6.1 Explain bioactive compounds. 6.2 Describe various types and uses of pharmaceutical products from fish. 6.3 Explain extraction techniques of bioactive compounds from fish. 6.4 Discuss medicinal applications of bioactive compounds of fish by-products. 6.5 Explain Chitin and chitosan and their uses. 6.6 Explain biotechnology and nanotechnology applications in fish product innovation.	• Describe bioactive compounds • Explain various types and uses of pharmaceutical products from fish. • Discuss extraction techniques of bioactive compounds from fish • Discuss medicinal applications of bioactive compounds of fish by-products • Discuss chitin and chitosan and their uses • Explain biotechnology and nanotechnology applications in fish product innovation.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
General Objective 7.0: Understand biological uses of fish						
15	7.1 Explain the use of fish in aquatic weed control. 7.2 Discuss the control of mosquito	• Discuss the use of fish in aquatic weed control	Whiteboard, Projector, Fisheries textbooks,			

	larval using fish. 7.3 Explain the use of fish parasite control in aquaculture. 7.4 Explain the use of fish vector control in agriculture. 7.5 Explain the use of fish in invasive species control.	• Explain the use of fish in mosquito larval control • Discuss the use of fish parasite control in aquaculture • Explain the use of fish vector control in agriculture • Explain the use of fish in invasive species control	Charts, Journals, Instructional materials, etc.			
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COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

TESTS (PRACTICAL BASED): 10%

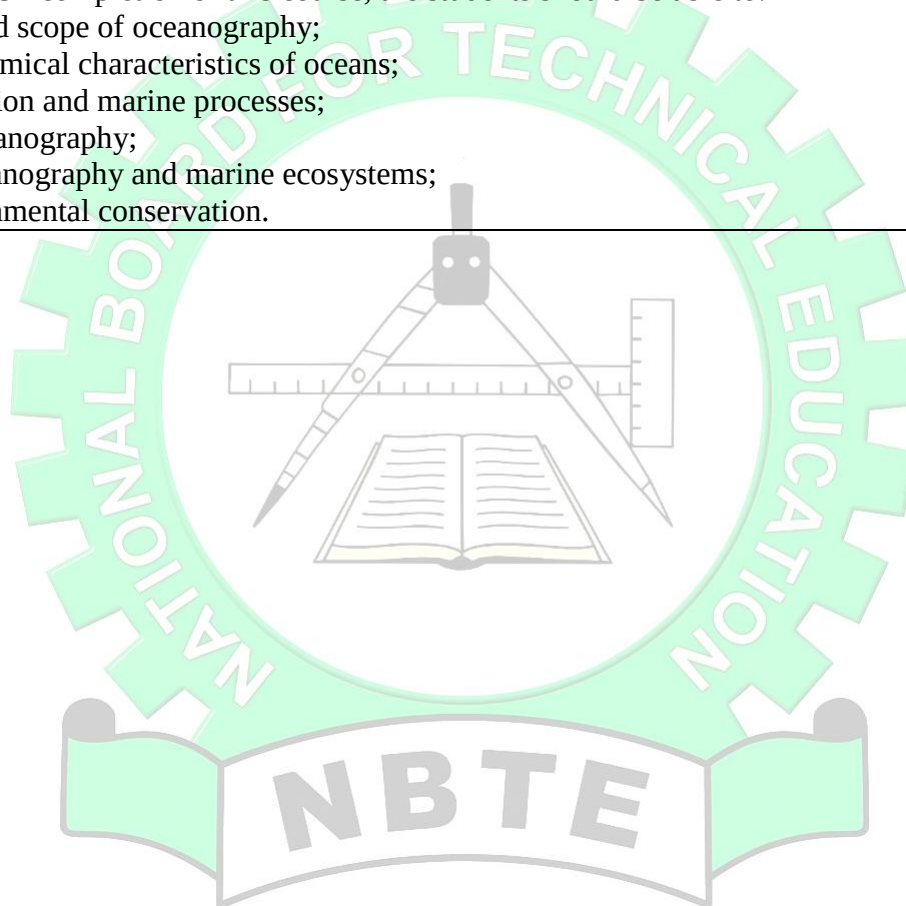
PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%

OCEANOGRAPHY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: OCEANOGRAPHY	COURSE CODE: AFT 316	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 equip students with knowledge and skills in physical, chemical, biological and geological oceanography		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and scope of oceanography; 2.0 Know the physical and chemical characteristics of oceans; 3.0 Understand Ocean circulation and marine processes; 4.0 Understand geological oceanography; 5.0 Understand biological oceanography and marine ecosystems; 6.0 Understand marine environmental conservation.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY

COURSE TITLE: OCEANOGRAPHY	COURSE CODE: AFT 316	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 physical, chemical, biological and geological oceanography****GENERAL OBJECTIVE 1.0: Understand the concept 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 concept and scope of oceanography. 1.2 Explain the branches of oceanography. 1.3 Explain Formation of oceans. 1.4 Explain Distribution of oceans and seas. 1.5 Explain the importance of oceans to fisheries and humanity. 1.6 Explain the use of GIS and remote sensing technologies.	• Discuss the concept and scope of oceanography • Explain the branches of oceanography ➢ Physical oceanography ➢ Chemical oceanography ➢ Biological oceanography ➢ Geological oceanography • Discuss Formation of oceans • Explain distribution of oceans and seas • Discuss the importance of oceans to fisheries and humanity • Explain the use of GIS	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

		and remote sensing technologies				
General Objective 2.0: Know the physical and chemical characteristics of oceans						
3-4	2.1 Explain the physical properties of seawater. 2.2 Describe ocean currents and circulation. 2.3 Describe waves and tides. 2.4 Explain chemical composition of seawater. 2.5 Explain dissolved gases and nutrients in the ocean.	• Discuss the physical properties of seawater ➢ Temperature ➢ Salinity ➢ Density ➢ Pressure • Describe ocean currents and circulation • Discuss waves and tides • Explain chemical composition of seawater • Explain dissolved gases and nutrients in the ocean	Tide charts Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out salinity and temperature measurements of sample ocean water • Write observation report on ocean current and tides.	Guide students to: • Carry out salinity and temperature measurements of sample ocean water • Observe ocean current and tides.	Sample ocean water, Thermometer, Water testing kits, Video clips, Charts, Multimedia projector, Notepads.
General Objective 3.0: Understand Ocean circulation and marine processes						
5-7	3.1 Explain marine meteorology. 3.2 Explain atmosphere-ocean interactions. 3.3 Explain climate systems and variability. 3.4 Explain El Niño and La Niña phenomena in the ocean.	• Discuss marine meteorology • Discuss atmosphere-ocean interactions • Discuss climate systems and variability • Describe El Niño and La Niña phenomena in the ocean	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Access Nigerian Meteorological Agency (NIMET) portal (http://maproom.nimet.gov.ng/maproom/Agriculture/index.html) • Analyse weather	Guide students to • Access Nigerian Meteorological Agency (NIMET) portal and (http://maproom.nimet.gov.ng/m)	Internet, Computer, Data processing software, Practical manual etc.

	3.5 Explain climate change impacts on oceans. 3.6 Explain marine weather forecasting.	- Explain climate change impacts on oceans - Explain marine weather forecasting		data in relation to climate change	aproom/Agriculture/index.html) analyse weather data in relation to climate change	
General Objective 4.0: Understand geological oceanography						
8-10	4.1 Describe the structure of ocean basins. 4.2 Describe continental shelves and slopes. 4.3 Describe Mid- Ocean ridges and trenches. 4.4 Explain marine sediments. 4.5 Describe sedimentation processes in the ocean. 4.6 Explain coastal erosion and deposition.	- Discuss the structure of ocean basins - Discuss continental shelves and slopes - Discuss Mid- Ocean ridges and trenches - Explain marine sediments - Describe sedimentation processes in the ocean - Explain coastal erosion and deposition	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
General Objective 5.0: Understand biological oceanography and marine ecosystems						
11-13	5.1 Describe the marine ecosystems. 5.2 Describe marine food chains and food webs. 5.3 Describe coral reefs, mangroves and estuaries. 5.4 Explain marine plankton and their diversity.	- Discuss the marine ecosystems - Describe marine food chains and food webs - Describe coral reefs, mangroves and estuaries - Discuss marine plankton and their diversity	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify marine planktons from charts, video clips and preserved specimen - Carry out marine habitat assessment - Identify some	Guide student to: - Identify marine planktons from charts, video clips and preserved specimen - Carry out	Plankton specimen, Specimen of coral reef, specimen of marine fishes, Microscope, Petri dish, Specimens of

	5.5 Explain primary productivity in the ocean. 5.6 Discuss marine biodiversity.	• Explain primary productivity in the ocean • Discuss marine biodiversity		marine organisms from charts, video clips and preserved specimen	marine habitat assessment • Identify some marine organisms from charts, video clips and preserved specimen	marine invertebrate, Specimen of seaweed Video clips, Charts, Multimedia projector.
General Objective 6.0: Understand marine environmental conservation						
14-15	6.1 Explain fisheries oceanography. 6.2 Describe fish migration and ocean currents. 6.3 Explain upwelling systems and their effects on productivity. 6.4 Discuss marine fisheries productivity. 6.5 Describe offshore fisheries. 6.6 Discuss sustainable marine resource management. 6.7 Explain marine pollution. 6.8 Explain coastal zone management. 6.9 Explain marine protected areas.	• Discuss fisheries oceanography • Discuss fish migration and ocean currents • Explain upwelling systems and their effects on productivity • Discuss marine fisheries productivity • Describe offshore fisheries • Discuss sustainable marine resource management • Explain marine pollution • Explain coastal zone management • Discuss marine protected	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

areas

COURSE ASSESSMENT

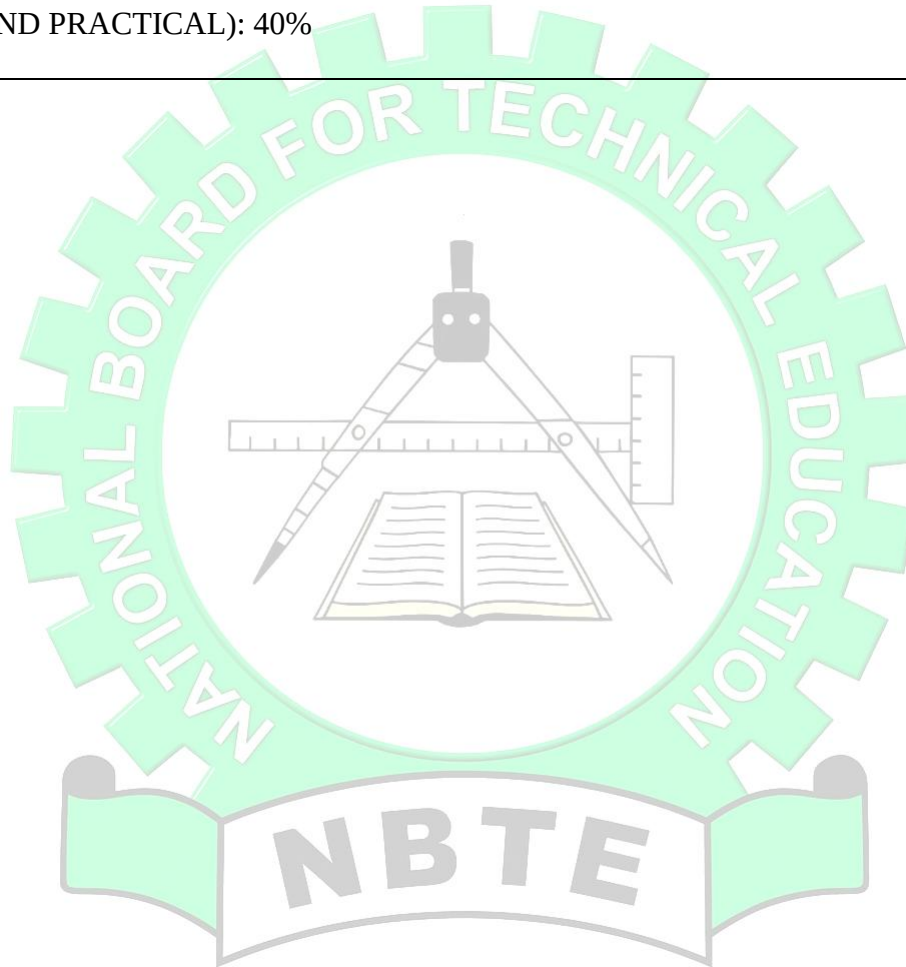
COURSE WORK (PRACTICAL BASED): 10%

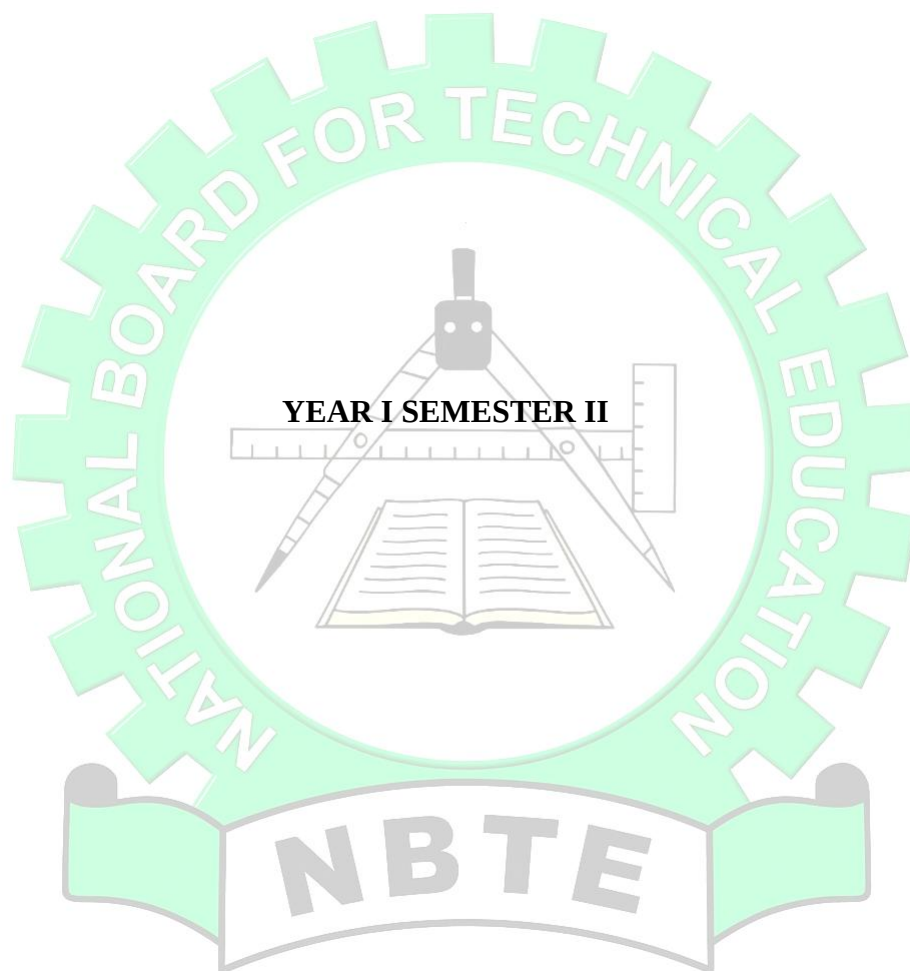
TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

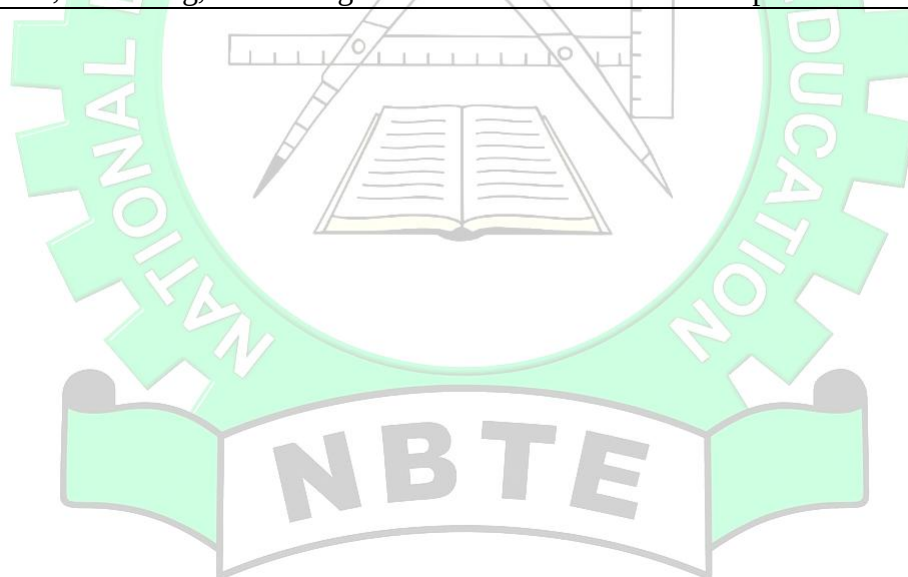
TOTAL: 100%





ADVANCED FISH FEED PRODUCTION

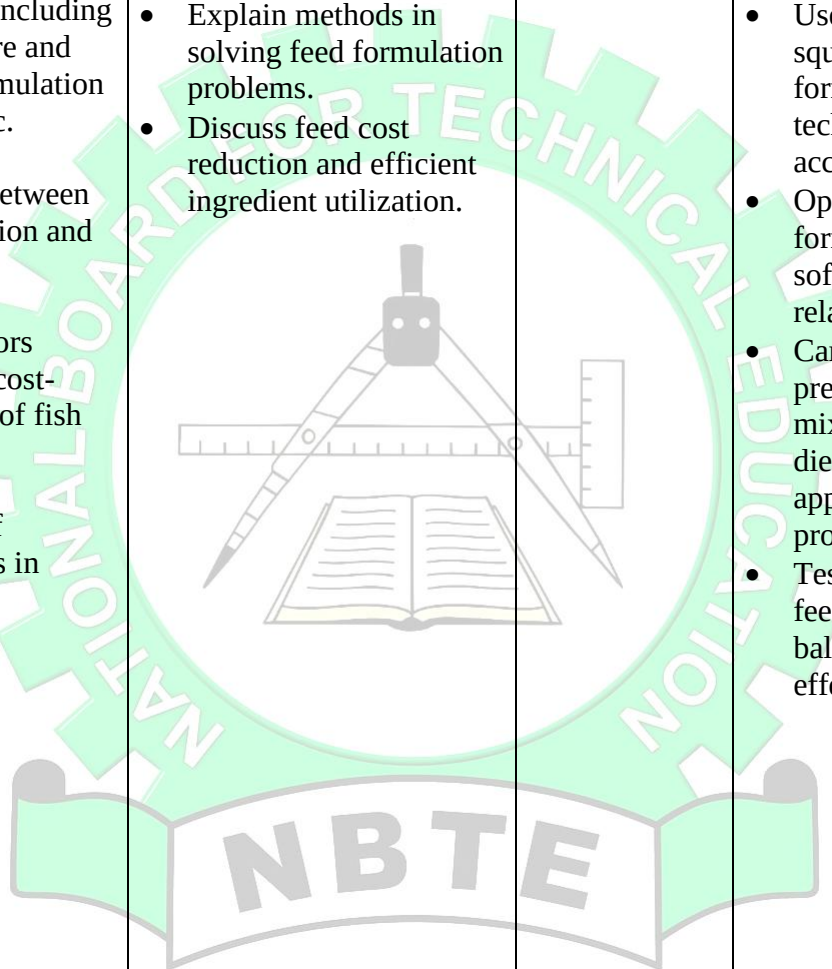
PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ADVANCED FISH FEED PRODUCTION	COURSE CODE: AFT 321	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in fish feed formulation and production		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and importance of fish nutrition and feed technology in aquaculture production; 2.0 Know conventional and non-conventional feed ingredients used in fish feed production; 3.0 Know how to formulate balanced and cost-effective fish diets for different fish species and stages of growth; 4.0 Know fish feed processing equipment used in fish feed production; 5.0 Know quality control measures and proper storage techniques in fish feed production and handling; 6.0 Understand the economics, marketing, and management of commercial fish feed production enterprises.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ADVANCED FISH FEED PRODUCTION			COURSE CODE: AFT 321		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 fish feed formulation and production						
GENERAL OBJECTIVE 1.0: Understand the principles and importance of fish nutrition and feed technology in aquaculture production.						
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 principles and importance of fish nutrition in aquaculture production. 1.2 Explain major feed ingredients used in fish feed formulation and their nutritional values. 1.3 Explain nutrient requirements of different fish species and growth stages. 1.4 Describe various methods and techniques of fish feed formulation and balancing. 1.5 Explain the processing technologies, equipment and quality control	• Discuss the principles and importance of fish nutrition in aquaculture production. • Explain major feed ingredients used in fish feed formulation and their nutritional values. • Describe the nutrient requirements of different fish species and growth stages. • Explain various methods and techniques of fish feed formulation and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify various fish feed ingredients and additives • Formulate fish feed rations for different fish species and growth stages. • Operate basic fish feed production equipment safely and efficiently. • Produce floating and sinking fish feeds using appropriate processing methods.	• Demonstrate the identification and weighing of feed ingredients. • Guide students in practical feed formulation and calculation exercises. • Demonstrate the operation and maintenance of feed milling and	Feed milling, grinding, mixing, Pelletting machines. Weighing balances, Measuring instruments, Moisture meters, Drying trays, Storage containers, Sealing and Packaging materials, PPE.

	measures involved in fish feed production. 1.6 Explain the economic, environmental, and management factors affecting efficient fish feed production and utilization.	balancing. • Discuss the processing technologies, equipment, and quality control measures involved in fish feed production. • Discuss the economic, environmental, and management factors affecting efficient fish feed production and utilization.		• Conduct quality control tests on produced fish feeds for durability, moisture, and pellet quality. • Maintain proper storage, packaging, and record keeping in fish feed production operations.	pelletizing machines. • Supervise students during feed mixing, pelletizing, drying, and packaging processes. • Conduct practical demonstrations on feed quality assessment and laboratory analysis.	
General Objective 2.0: Know conventional and non-conventional feed ingredients used in fish feed production						
3-4	2.1 Explain conventional and non-conventional feed ingredients used in aquaculture. 2.2 Explain feed ingredients based on source, nutrient composition, and function. 2.3 Explain the nutritional values of major feed ingredients used in fish	• Explain the concepts and classifications of feed ingredients • Discuss charts, samples, and illustrations of different feed ingredients. • Explain nutrient composition and functions of feed ingredients. • Discuss conventional and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify common conventional and non-conventional feed ingredients physically. • Classify feed ingredients according to their nutrient sources and functions. • Determine the	Guide students to: • Demonstrate the identification and handling of various feed ingredients. • Guide students in sorting and	Samples of conventional and non-conventional feed ingredients, Laboratory equipment for proximate analysis, Weighing

	feed production. 2.4 Explain the advantages and limitations of conventional and non-conventional feed ingredients. 2.5 Explain factors affecting the selection and utilization of feed ingredients in fish feed formulation. 2.6 Explain the economic importance and availability of feed ingredients in aquaculture production.	non-conventional ingredients using case studies and examples. • Discuss selection and feed cost implications		physical characteristics of feed ingredients such as texture, colour, and smell. • Conduct simple proximate analysis of selected feed ingredients. • Perform comparison of quality and suitability of different feed ingredients for fish feed production. • Prepare feed ingredient samples for practical evaluation and storage	classifying feed ingredient samples. • Demonstrate simple laboratory analysis procedures for feed evaluation. • Supervise students during practical assessment of ingredient quality. • Organize laboratory and field demonstrations on feed ingredient sourcing and preservation	balances, Measuring cylinders, and sample containers, Microscopes, Moisture meters, and drying equipment. PPE, Data sheets.
General Objective 3.0: Know how to formulate balanced and cost-effective fish diets for different fish species and stages of growth						
5-6	3.1 Explain the principles of fish feed formulation and diet balancing.	• Explain concepts and principles of balanced fish diet formulation. • Discuss nutrient	Whiteboard, Projector, Fisheries textbooks,	• Calculate feed ingredient proportions for balanced fish	Guide students to: • Demonstrate practical feed	Feed ingredient samples and nutrient

	3.2 Explain nutrient requirements of different fish species and growth stages. 3.3 Explain different methods used in feed formulation, including Pearson square and least-cost formulation techniques etc. 3.4 Explain the relationship between feed formulation and fish growth performance. 3.5 Describe factors affecting the cost-effectiveness of fish diets. 3.6 Explain the importance of balanced diets in sustainable aquaculture production.	requirement calculations for different fish species and growth stages. • Explain feed formulation methods using examples and charts. • Explain methods in solving feed formulation problems. • Discuss feed cost reduction and efficient ingredient utilization. 	Charts, Journals, Instructional materials, etc.	diets. • Formulate practical diets for different fish species and growth stages. • Use Pearson square and other formulation techniques accurately. • Operate feed formulation software and related tools. • Carry out preparation and mixing formulated diets using appropriate procedures. • Test formulated feeds for nutrient balance and cost-effectiveness.	formulation procedures and calculations. • Guide students in the use of formulation methods and software applications. • Supervise students during weighing, mixing, and preparation of fish diets. • Demonstrate methods of determining feed cost and nutrient composition. • Organize practical exercises on least-cost feed formulation. • Evaluate students' practical performance, records, and formulated	composition tables, Computers with feed formulation software, Weighing balances, Mixers, Measuring instruments, Feed processing and mixing equipment, PPE.
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					feed samples.	
General Objective 4.0: Know fish feed processing equipment used in fish feed production;						
7-9	4.1 Explain different types of fish feed processing equipment used in feed production. 4.2 Explain the principles of grinding, mixing, pelleting, and extrusion equipment. 4.3 Explain the functions of grinding, mixing, pelleting, and extrusion equipment 4.4 Explain the operational procedures of fish feed processing machines. 4.5 Explain safety precautions in handling and operating feed processing equipment. 4.6 Explain routine maintenance practices for feed processing machines. 4.7 Describe common faults and troubleshooting methods associated with feed processing equipment.	• Explain different types of fish feed processing equipment used in feed production • Explain the principles and operations of various fish feed processing machines. • Explain the functions of grinding, mixing, pelleting, and extrusion equipment • Discuss machine components and processes • Discuss operational procedures and safety measures for equipment handling. • Discuss maintenance schedules and troubleshooting techniques. • Discuss machine efficiency and feed processing quality.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Operate grinding machines for particle size reduction of feed ingredients. • Operate feed mixers to achieve uniform feed blending. • Produce feed pellets using pelleting machines. • Operate extrusion equipment for floating fish feed production. • Carry out routine cleaning, lubrication, and maintenance of feed processing equipment. • Carry out detection of and correction of minor operational faults in feed processing	Guide students to: • Operate grinding machines for particle size reduction of feed ingredients. • Operate feed mixers to achieve uniform feed blending. • Produce feed pellets using pelleting machines. • Operate extrusion equipment for floating fish feed production. • Carry out routine cleaning, lubrication, and	Grinding machines, Mixers, Pelletizers, Extruders, Feed ingredients and processing materials, Maintenance tools, Lubricants, Spare parts, PPE, Logbooks, Maintenance record sheets.

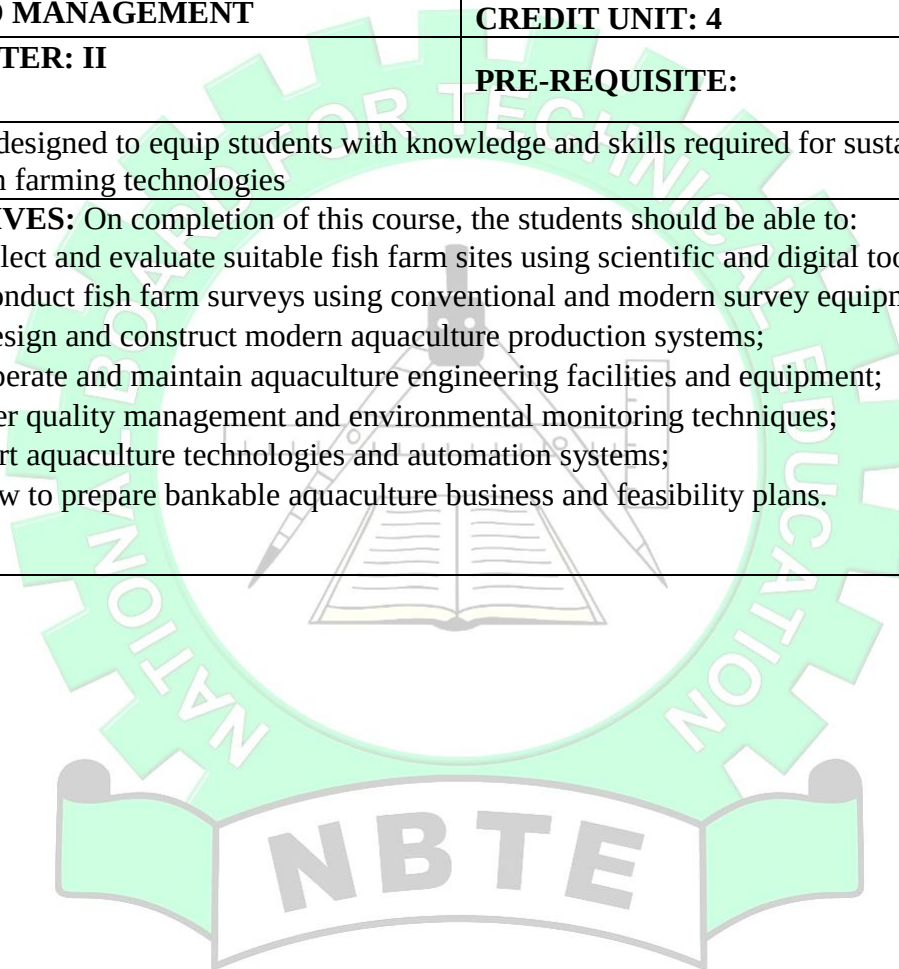
				machines.	maintenance of feed processing equipment. • Detect and correct minor operational faults in feed processing machines.	
General Objective 5.0: Know quality control measures and proper storage techniques in fish feed production and handling						
10-12	5.1 Explain the importance of quality control in fish feed production and handling. 5.2 Explain quality standards and indicators used in fish feed evaluation. 5.3 Explain causes of feed spoilage and contamination during storage and handling. 5.4 Explain proper storage methods for feed ingredients and finished fish feeds. 5.5 Explain safety and hygiene practices in feed production and storage facilities. 5.6 Explain the effects of poor feed quality and	• Explain principles and procedures of quality control in fish feed production. • Discuss the use of charts, samples, and illustrations to identify quality indicators. • Discuss feed spoilage, contamination, and prevention methods. • Explain storage requirements for feed ingredients and finished feeds. • Discuss hygiene and safety standards in feed handling.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Conduct physical quality assessment of feed ingredients and finished feeds. • Measure moisture content and other quality parameters of fish feeds. • Detect signs of feed spoilage, contamination, and deterioration. • Apply proper packaging and storage techniques for fish feeds. • Maintain hygiene and safety standards during feed handling and storage.	Guide students to: • Conduct physical quality assessment of feed ingredients and finished feeds. • Measure moisture content and other quality parameters of fish feeds. • Detect signs of feed spoilage, contamination, and deterioration. • Apply proper packaging and	Moisture meters, Weighing balances, Sampling equipment, Samples of feed ingredients, Finished fish feeds, Storage bags, Containers, Pallets, Packaging materials, PPE.

	storage on fish health and production performance.			Keep accurate records of feed quality inspection and storage management.	storage techniques for fish feeds. - Maintain hygiene and safety standards during feed handling and storage. - Keep accurate records of feed quality inspection and storage management.	
General Objective 6.0: Understand the economics, marketing, and management of commercial fish feed production enterprises.						
13-15	6.1 Explain the principles of economics in commercial fish feed production. 6.2 Explain factors affecting the profitability of fish feed enterprises. 6.3 Explain marketing strategies used in fish feed production and distribution. 6.4 Explain management practices required for efficient fish feed enterprise operation.	- Explain economic concepts and management principles related to fish feed enterprises. - Discuss how to analyze production costs, pricing, and profitability. - Discuss the preparation of simple business plans and budgets. - Discuss marketing channels and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Prepare simple budgets for commercial fish feed production enterprises. - Calculate production costs, selling prices, and profit margins of fish feeds. - Develop basic marketing plans for fish feed products. - Maintain records	Guide students to: - Prepare simple budgets for commercial fish feed production enterprises. - Calculate production costs, selling prices, and profit margins of fish feeds.	Budgeting sheets, accounting record books, Computers Invoices, receipts, sales records, Market survey questionnaire, data collection

	6.5 Explain challenges and opportunities in commercial fish feed production businesses. 6.6 Explain the role of record keeping, budgeting, and financial planning in feed enterprise management.	customer relations in aquaculture businesses. • Present case studies on successful fish feed production enterprises.		of production, sales, and inventory in fish feed enterprises. • Conduct market surveys and analyse customer preferences for fish feeds. • Apply basic management skills in organizing fish feed production operations.	• Develop basic marketing plans for fish feed products. • Maintain records of production, sales, and inventory in fish feed enterprises. • Conduct market surveys and analyse customer preferences for fish feeds. Demonstrate basic management skills in organizing fish feed production operations.	materials.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

ADVANCED FISH FARM ENGINEERING AND MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ADVANCED FISH FARM ENGINEERING AND MANAGEMENT	COURSE CODE: AFT 322	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 required for sustainable commercial aquaculture production using contemporary fish farming technologies		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know how to select and evaluate suitable fish farm sites using scientific and digital tools; 2.0 Know how to conduct fish farm surveys using conventional and modern survey equipment; 3.0 Know how to design and construct modern aquaculture production systems; 4.0 Know how to operate and maintain aquaculture engineering facilities and equipment; 5.0 Understand water quality management and environmental monitoring techniques; 6.0 Understand smart aquaculture technologies and automation systems; 7.0 Comprehend how to prepare bankable aquaculture business and feasibility plans.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ADVANCED FISH FARM ENGINEERING AND MANAGEMENT			COURSE CODE: AFT 322		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 required for sustainable commercial aquaculture production using contemporary fish farming technologies						
GENERAL OBJECTIVE 1.0: Know how to select and evaluate suitable fish farm sites using scientific and digital tools						
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 criteria for selecting suitable fish farm sites for aquaculture production. 1.2 Describe the physical, chemical, biological, and environmental characteristics of suitable fish farm sites. 1.3 Explain the applications of scientific and digital tools used in fish farm site evaluation. 1.4 Explain environmental and climate-related factors affecting fish	• Explain the principles and criteria for fish farm site selection • Discuss the characteristics of suitable soil, water, and topography for fish farming • Explain the use of GPS, GIS, drones, and digital mapping technologies in aquaculture site evaluation • Discuss environmental and climate-related factors affecting fish farm site suitability • Discuss procedures for collecting, analyzing, and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Conduct field inspection and identify suitable locations for fish farming operations • Analyze collected soil and water samples for aquaculture suitability testing • Operate GPS, GIS, and digital mapping tools for fish farm site evaluation • Perform measure	Guide students to • Conduct field inspection and identify suitable locations for fish farming operations • Demonstrate proper soil and water sampling procedures and laboratory analysis techniques • Demonstrate the practical use of	Field notebooks, Cameras, Measuring tapes, Soil auger, Water quality test kits, Sample bottles, GPS devices, GIS software, Drones, levelling equipment,

	farm site suitability. 1.5 Explain methods of collecting, analyzing, and interpreting site evaluation data for aquaculture development. 1.6 Explain the importance of proper site selection in sustainable fish farm management.	interpreting site evaluation data Discuss the importance of proper site selection in sustainable fish farm management		and recording of topographical and environmental features of proposed fish farm sites Present fish farm site evaluation reports prepared using field data	GPS devices, GIS software, and drones for site mapping and evaluation - Supervise students during land surveying and topographical measurement exercises - Guide students in compiling, analyzing, and presenting field assessment reports	Ranging poles, Survey tools, Drones, PPE, Report templates.
General Objective 2.0: Know how to conduct fish farm surveys using conventional and modern survey equipment;						
3-4	2.1 Explain the principles of fish farm survey in aquaculture development. 2.2 Explain the importance of fish farm survey in aquaculture development. 2.3 Describe the functions and operation of	- Discuss the principles and procedures of fish farm surveying using lectures and demonstrations - Discuss methods of land measurement, levelling, and mapping. - Describe the use of GPS, GIS, drones, and digital survey technologies in aquaculture	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify conventional and modern survey equipment used in fish farm surveying - Operate conventional survey equipment for fish farm land measurement.	Guide students to: - Identify conventional and modern survey equipment used in fish farm surveying - Operate conventional survey equipment for	Measuring tapes, levelling equipment, Ranging poles, Engineer's transit, GPS devices, GIS software,

	survey equipment used in land measurement and mapping. 2.4 Explain methods of measuring distances, elevations, and boundaries in fish farm surveys. 2.5 Discuss the applications of digital technologies in modern fish farm surveying. 2.6 Explain the importance of accurate survey data in fish farm planning and construction.	• Discuss the importance of accurate survey data in fish farm engineering.		• Use modern digital survey tools for fish farm mapping and data collection. • Measure distances, elevations, and boundaries of proposed fish farm sites accurately. • Conduct topographical surveys and prepare site maps for fish farm development. • Carry out analysis and interpretation of recorded survey data for aquaculture planning. • Apply safety precautions during fish farm surveying operations.	fish farm land measurement. • Use modern digital survey tools for fish farm mapping and data collection. • Measure distances, elevations, and boundaries of proposed fish farm sites accurately. • Conduct topographical surveys and prepare site maps for fish farm development. • Record, analyze, and interpret survey data for aquaculture planning. • Apply safety precautions during fish farm	Drones, Computers, Topographic maps, Field notebooks, Survey data sheets, PPE.
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					surveying operations.	
General Objective 3.0: Know how to design and construct modern aquaculture production systems						
5-7	3.1 Explain the principles and importance of modern aquaculture production systems. 3.2 Explain different types of aquaculture production systems and their components. 3.3 Describe the design features of ponds, tanks, cages, hapas, and Recirculatory Aquaculture Systems (RAS). 3.4 Explain procedures involved in the construction of modern aquaculture facilities. 3.5 Explain factors affecting the selection and design of aquaculture production systems. 3.6 Explain the advantages and limitations of different aquaculture production systems.	• Explain the concepts and principles of modern aquaculture production systems using lectures and illustrations • Discuss aquaculture system design and construction procedures. • Describe the use of engineering drawings, maps, and digital design tools in aquaculture construction. • Discuss sustainability and efficiency in aquaculture system design	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Design layouts for modern aquaculture production systems. • Construct simple earthen ponds, concrete tanks, cages, and hapas for fish production. • Install plumbing and drainage systems in aquaculture facilities. • Operate basic tools and equipment used in aquaculture construction. • Construct and manage simple recirculatory aquaculture systems (RAS). • Apply safety	Guide students to: • Design layouts for modern aquaculture production systems. • Construct simple earthen ponds, concrete tanks, cages, and hapas for fish production. • Install plumbing and drainage systems in aquaculture facilities. • Operate basic tools and equipment used in aquaculture construction. • Construct and manage simple recirculatory aquaculture systems (RAS).	Shovels, Wheelbarrows, Hammers, Measuring tapes, Cement, Sand, Gravel, Pipes, Valves, Plumbing materials, Tanks, Cages, Hapa materials, Water pumps, Aerators, Computers, AutoCAD software, Engineering design templates, PPE.

				measures during aquaculture construction activities.	• Apply safety measures during aquaculture construction activities. •	
General Objective 4.0: Know how to operate and maintain aquaculture engineering facilities and equipment						
8-9	4.1 Explain the functions and importance of aquaculture engineering facilities and equipment. 4.2 Describe the operational procedures of aquaculture engineering equipment and facilities. 4.3 Explain routine maintenance practices for aquaculture equipment and facilities. 4.4 Explain common faults and troubleshooting methods in aquaculture engineering systems. 4.5 Explain safety precautions and maintenance culture in aquaculture engineering operations.	• Explain the principles and functions of aquaculture engineering facilities and equipment using lectures and illustrations. • Discuss equipment maintenance and servicing procedures • Discuss safety precautions and preventive maintenance practices.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify different types of equipment used in aquaculture production systems • Operate pumps, aerators, feeders, and other aquaculture engineering equipment efficiently. • Carry out routine cleaning, lubrication, and servicing of aquaculture facilities and equipment. • Undertake detection and correction of	Guide students to: • Identify different types of equipment used in aquaculture production systems • Operate pumps, aerators, feeders, and other aquaculture engineering equipment efficiently. • Carry out routine cleaning, lubrication, and servicing of aquaculture facilities and equipment. • Detect and correct minor	Pumps, Aerators, Feeders, Filters, Plumbing systems, Mechanical toolbox, Lubricants, Repair kits Water supply systems, PPE, Maintenance logbooks, Service manuals, Inspection checklists.

				minor faults in aquaculture engineering systems • Maintain water supply, drainage, and aeration systems in aquaculture facilities. • Apply safety measures during equipment operation and maintenance activities. • Keep maintenance records and equipment operation logs accurately	faults in aquaculture engineering systems • Maintain water supply, drainage, and aeration systems in aquaculture facilities. • Apply safety measures during equipment operation and maintenance activities. • Keep maintenance records and equipment operation logs accurately	
General Objective 5.0: Understand water quality management and environmental monitoring techniques						
10-11	5.1 Explain the importance of water quality management in aquaculture production. 5.2 Explain major water quality parameters relevant to fish production. 5.3 Describe the effects of poor	• Discuss the principles and importance of water quality management in aquaculture. • Discuss the characteristics and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials,	• Operate water quality monitoring equipment and environmental assessment tools • Analyze major water quality	Guide students to: • Operate water quality monitoring equipment and environmental assessment tools	Water quality test kits, pH meters, Dissolved oxygen meters, Thermomet

	water quality on fish health and productivity. 5.4 Explain methods and techniques used in water quality monitoring and environmental assessment. 5.5 Explain procedures for maintaining optimum water quality in aquaculture systems. 5.6 Explain environmental factors affecting sustainable aquaculture production.	functions of major water quality parameters. • Discuss the effects of poor water quality on fish performance. • Discuss methods of water quality monitoring and environmental assessment. • Discuss sustainable environmental management practices in aquaculture	etc.	parameters used in aquaculture production • Interpret water quality data for effective fish farm management. • Apply corrective measures for improving water quality in aquaculture systems. • Conduct environmental monitoring of fish ponds and surrounding aquatic environments. • Maintain accurate records of water quality and environmental monitoring activities.	• Measure and analyze major water quality parameters used in aquaculture production • Interpret water quality data for effective fish farm management. • Apply corrective measures for improving water quality in aquaculture systems. • Conduct environmental monitoring of fish ponds and surrounding aquatic environments. Maintain accurate records of water quality and environmental monitoring activities.	ers. Sample bottles, Secchi discs, Laboratory glassware. Fish ponds, Tanks, water sources for practical exercises, Computers, Data sheets, Environmental monitoring software. PPE Record books, Environmental assessment checklists.
General Objective 6.0: Understand smart aquaculture technologies and automation systems						

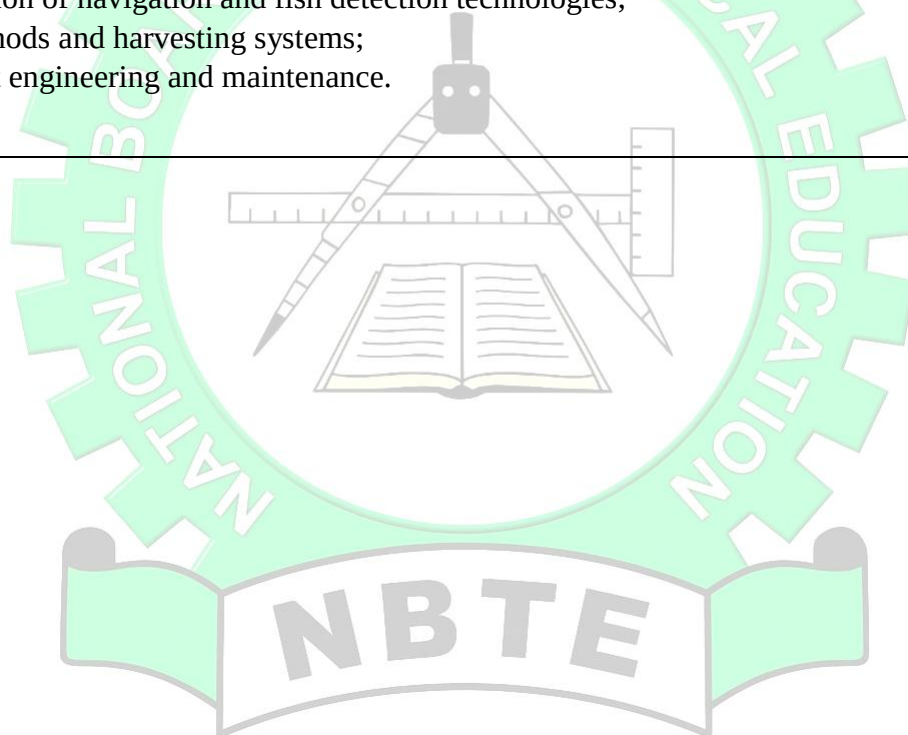
12-13	6.1 Explain the concepts and importance of smart aquaculture technologies in modern fish farming. 6.2 Explain different automation systems and digital tools used in aquaculture operations. 6.3 Describe the functions and applications of sensors, automatic feeders, and monitoring devices in aquaculture 6.4 Explain the role of Internet of Things (IoT), GIS, and mobile applications in smart aquaculture management. 6.5 Explain the advantages and limitations of automation systems in aquaculture production. 6.6 Explain the contribution of smart technologies to	• Discuss the principles and applications of smart aquaculture technologies using lectures and multimedia presentations. • Discuss the functions of automation systems, sensors, and monitoring devices used in fish farming. • Discuss IoT, GIS, and digital technologies in aquaculture management. • Discuss the operation and integration of automatic feeding and environmental monitoring systems. • Discuss the benefits and challenges of automation in aquaculture.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Operate smart aquaculture devices and automation systems effectively. • Carry out installation and configuration of sensors and digital monitoring devices in aquaculture facilities. • Operate automatic feeding systems and smart water quality monitoring equipment • Use mobile applications and digital platforms for aquaculture management and data collection. • Carry out analysis and interpretation data generated from smart aquaculture systems. • Apply safety procedures during the operation and	Guide students to: • Operate smart aquaculture devices and automation systems effectively. • Install and configure sensors and digital monitoring devices in aquaculture facilities. • Operate automatic feeding systems and smart water quality monitoring equipment • Use mobile applications and digital platforms for aquaculture management and data collection. • Analyze and interpret data generated from	Sensors, Automatic feeders, Demand feeder, Smart monitoring systems, Computers, Mobile devices, Internet facilities, GIS software, Aquaculture management applications, Cloud-based monitoring platforms, Fish ponds, Tanks, Smart aquaculture demonstration facilities, PPE.
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				maintenance of automation systems.	smart aquaculture systems. Apply safety procedures during the operation and maintenance of automation systems.	
General Objective 7.0: Comprehend how to prepare bankable aquaculture business and feasibility plans.						
14-15	7.1 Explain the importance of business planning and feasibility studies in aquaculture enterprises. 7.2 Explain the components of a bankable aquaculture business plan. 7.3 Describe procedures for conducting market surveys and financial analysis in aquaculture projects. 7.4 Explain methods of estimating production costs, revenues, and profitability in aquaculture enterprises. 7.5 Describe possible sources of financing and investment opportunities in aquaculture business. 7.6 Explain the role of	• Discuss the principles and procedures involved in preparing aquaculture business and feasibility plans. • Discuss the components and structure of a standard business plan. • Discuss market surveys, budgeting, and financial analysis. • Discuss methods of estimating production costs, revenue projections, and profitability. • Discuss financing options and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Conduct market surveys for aquaculture products and services. • Prepare budgets and cost estimates for aquaculture enterprises. • Carry out financial analysis and profitability assessment of aquaculture projects. • Develop complete aquaculture business plans and feasibility reports. • Prepare cash flow projections and investment	Guide students to: • Conduct market surveys for aquaculture products and services. • Prepare budgets and cost estimates for aquaculture enterprises. • Carry out financial analysis and profitability assessment of aquaculture projects. • Develop complete aquaculture business plans and feasibility	Computers, Spreadsheet software, Sample feasibility reports, Budgeting sheets, Financial templates, Market survey questionnaires, Data collection materials, Internet facilities, Aquaculture market information resources, Business

	feasibility studies in decision-making and sustainable aquaculture.	investment opportunities in aquaculture.		appraisal reports for aquaculture ventures. • Present aquaculture business proposals effectively.	reports. • Prepare cash flow projections and investment appraisal reports for aquaculture ventures. • Present aquaculture business proposals effectively.	plan templates, Record book.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

ADVANCED FISHING GEAR AND CRAFT TECHNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ADVANCED FISHING GEAR AND CRAFT TECHNOLOGY	COURSE CODE: AFT 323	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 acquaint students with knowledge and skill in designing and constructing fishing gears with maintenance of common fishing vessels and crafts		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of fishing gear and craft technology; 2.0 Know the design, construct, repair and maintenance of fishing gears; 3.0 Understand the operation of fishing crafts and onboard equipment safely; 4.0 Know the application of navigation and fish detection technologies; 5.0 Know fishing methods and harvesting systems; 6.0 Know fishing craft engineering and maintenance.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ADVANCED FISHING GEAR AND CRAFT TECHNOLOGY			COURSE CODE: AFT 323		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 acquaint students with knowledge and skill in designing and constructing fishing gears with maintenance of common fishing vessels and crafts						
GENERAL OBJECTIVE 1.0: Understand the principles of fishing gear and craft technology.						
THEORETICAL CONTENT			PRACTICAL CONTENT			
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain fishing gears and their classes. 1.2 Explain the principles of fishing gear. 1.3 Explain fishing craft technology. 1.4 Describe components of fishing crafts.	• Discuss fishing gear and their classes • Discuss principles of fishing gear • Describe fishing gear craft technology • Explain components of fishing crafts.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify fishing gears • Classify fishing gears into ➤ High efficiency or Low efficiency ➤ Active or Passive ➤ Ancient or Modern • Identify fishing craft • Classify	Guide the students to • Identify fishing gears • Classify fishing gears into ➤ High efficiency or Low efficiency ➤ Active or Passive ➤ Ancient or Modern • Identify fishing craft • Classify fishing craft based on: ➤ Material ➤ Operation ➤ Motorized and non-motorized	Models of fishing craft, Models of fishing gears, Boat, Charts, Videos clips, Multimedia projector, Practical manual.

				fishing craft based on: ➤ Material ➤ Operation ➤ Motorized and non-motorized		
General Objective 2.0: Know the design, construct, repair and maintenance of fishing gears						
3-5	2.1 Explain natural and synthetic fiber as sources of netting. 2.2 Outline materials necessary for design and construction of fishing gears. 2.3 Explain Tapering ratio. 2.4 Explain Hanging ratio. 2.5 Explain the design of a gear with gear software. 2.6 Explain the use of Flume tank to test a model gear. 2.7 Explain essential knots for fishing operation. 2.8 Explain splices use in fishing. 2.9 Describe how to repair a torn net. 2.10 Explain how to preserve netting gears onshore. 2.11 Describe the maintenance mode of non-netting gear	• Describe the sources of fibers for making netting • Explain the principle of designing and constructing a gear • Discuss what is Tapering ratio • Describe Hanging ratio • Describe the design of a gear with gear software • Describe the use of Flume tank to test a model gear • Describe essential knots for fishing operation • Explain splices use in fishing	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify fibers • Classify natural and synthetic fibers • Design a gear with a software and run the simulation • Construct a model of the gear simulated • Run the model gear constructed in a flume tank • Construct	Guide the students to: • Identify fibers • Classify natural and synthetic fibers • Design a gear with a software and run the simulation • Construct a model of the gear simulated • Run the model gear constructed in a flume tank • Construct different types of knots • Construct different types of splices • Repair a torn net • Stack the netting gear correctly • Dye the netting • Dose the hooks in oil	Netting, Fisherman needle, Twine, Knives, Ropes, Sample of fibers, Computer, Software, Dyes, Oil, PPE.

	onshore.	- Describe how to repair a torn net - Explain how to preserve netting gears onshore - Describe the maintenance mode of non-netting gear onshore		different types of knots - Construct different types of splices - Repair a torn net - Stack the netting gear correctly - Dye the netting - Dose the hooks in oil		
General Objective 3.0: Understand the operation of fishing crafts and onboard equipment safely						
6-8	3.1 Explain the operational mode of fishing craft. 3.2 Explain how to safely operate the onboard equipment. 3.3 Explain functions of vessel components. 3.4 Explain functions of hull, keel, rudder and propeller. 3.5 Describe mustering point, deck, captain bridge, cabin, fish hold.	- Describe the operational mode of fishing craft - Describe how to safely operate the onboard equipment - Describe functions of hull, keel, rudder and propeller - Discuss mustering point, deck, Captain bridge, cabin, fish	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Operate small fishing boat using: - Paddle - Outboard engine - Identify fishing gear parts: - hull, - rudder, - propeller	Guide the students to: - Operate small fishing boat using: - Paddle - Outboard engine - Identify fishing gear parts: - hull, - rudder, - propeller - Identify locations onboard (using video	Canoe/ Boat Paddle, Outboard engine, Multimedia projector, Video clips, Charts, PPE.

		hold		➤ propeller • Identify locations onboard (using video clips where unavailable): ➤ Captain bridge, ➤ bow, ➤ stern, ➤ cabin, ➤ fish hold, ➤ winch ➤ : ➤ Captain bridge, ➤ bow, ➤ stern, ➤ cabin, ➤ fish hold, ➤ winch	clips where unavailable): ➤ Captain bridge, ➤ bow, ➤ stern, ➤ cabin, ➤ fish hold, ➤ winch	
General Objective 4.0: Know the application of navigation and fish detection technologies						
9-10	4.1 Explain GPS and electronic navigation systems. 4.2 Describe modern navigational aids. 4.3 Explain the following: i. sonar ii. radar iii. buoys 4.4 Describe physical methods of detecting fish school. 4.5 Explain tides, currents and waves. 4.6 Explain marine meteorology and weather forecasting.	• Explain GPS and electronic navigation systems. • Describe modern navigational aids • Explain the following: ➤ sonar ➤ radar ➤ buoys • Describe physical methods of detecting fish school • Explain tides, currents and waves	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Use GPS and electronic navigation system • Use Echo sounder	Guide the students to: • Use GPS and electronic navigation system Use Echo sounder	Echo sounder GPS, Multimedia projector, Video clips, Charts, etc.

	4.7 Explain weather forecasting basics.	• Explain marine meteorology and weather forecasting • Explain weather forecasting basics.				
General Objective 5.0: Know fishing methods and harvesting systems						
11-12	5.1 Describe gill net operation. 5.2 Explain cast net operation. 5.3 Describe the operation of trawl net. 5.4 Describe the operation of Hook and line. 5.5 Explain the operational mode of a fish trap.	• Discuss gill net operation • Describe operation of cast net • Explain how trawl net is operated • Describe the operation of Hook and line • Discuss the operational mode of a fish trap	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Set gill net and haul it • Broadcast cast net and retrieve it • Observe launching of trawl net and hauling using video clips • Throw a hook and line and retrieve it • Set a trap and retrieve it	Guide the students to • Operate the following: ➤ Gill net ➤ Cast net ➤ Hook and line ➤ Traps • Play video clips of launching and hauling trawl net	Hook and line, Gill net, Cast net, Traps, Multimedia projector, Video clips, Charts.

General Objective 6.0: Know fishing craft engineering and maintenance

13-15	6.1 Explain fishing craft engineering systems. 6.2 Describe different boat construction materials. 6.3 Explain routine craft maintenance. 6.4 Describe engine components and maintenance. 6.5 Explain how to preserve outboard engine onshore. 6.6 Explain craft stability and seaworthiness.	• Discuss fishing craft engineering systems. • Describe different boat construction materials • Discuss routine craft maintenance. • Describe engine components and maintenance • Discuss how to preserve outboard engine onshore • Discuss craft stability and seaworthiness	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Remove chaffs on a wooden boat edge • Wash off dross on aluminum body boat • Service an outboard engine • Block leakages on a boat • Hang the outboard engine in proper position	Guide the students to: • Remove chaffs on a wooden boat edge • Observe how to wash off dross on aluminum • Wash off dross on aluminum body boat • Service an outboard engine • Block leakages on a boat • Hang the outboard engine in proper position	Wooden boat, Outboard engine, Video clips, Multimedia projector, PPE.
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COURSE ASSESSMENT

COURSE WORK (PRACTICAL BASED): 10%

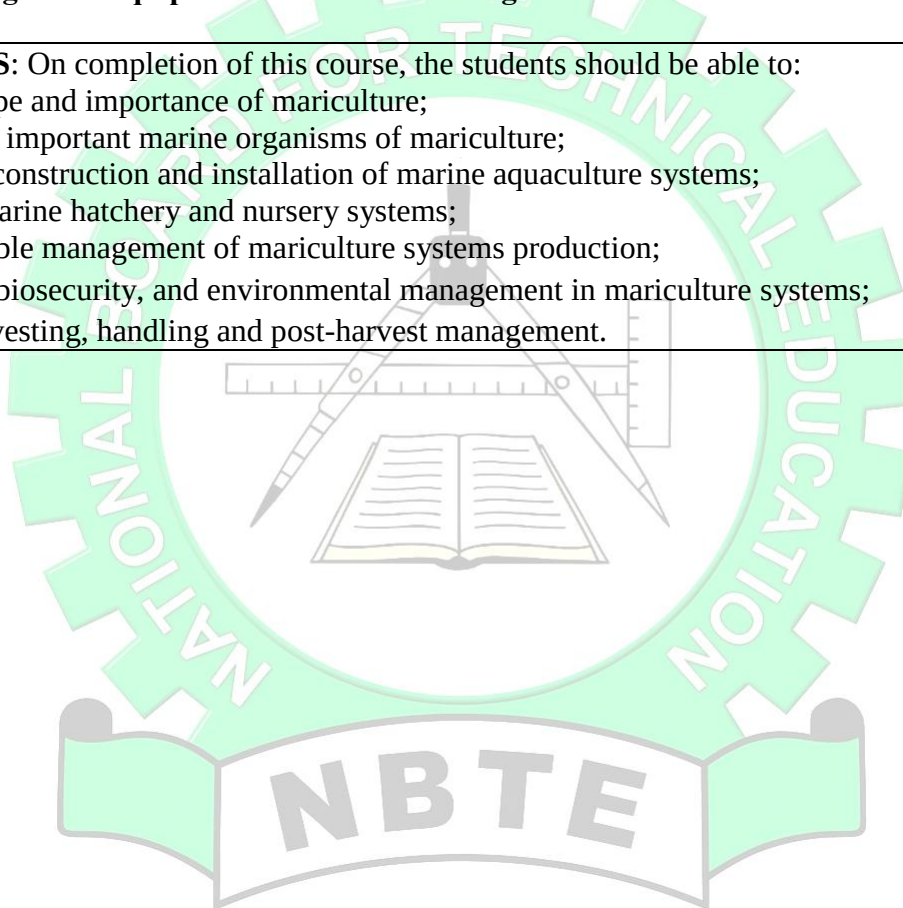
TESTS (PRACTICAL BASED): 10%

PRACTICAL: 40%

EXAMINATION (THEORY AND PRACTICAL): 40%

TOTAL: 100%

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: MARICULTURE	COURSE CODE: AFT 324	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 sustainable marine aquaculture production and management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the concepts, scope and importance of mariculture; 2.0 Know the commercially important marine organisms of mariculture; 3.0 Understand the design, construction and installation of marine aquaculture systems; 4.0 Know how to operate marine hatchery and nursery systems; 5.0 Understand the sustainable management of mariculture systems production; 6.0 Understand fish health, biosecurity, and environmental management in mariculture systems; 7.0 Know how conduct harvesting, handling and post-harvest management.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: MARICULTURE		COURSE CODE: AFT 324		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 sustainable marine aquaculture production and management						
GENERAL OBJECTIVE 1.0: Know the concepts, scope and importance of mariculture						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the concepts of marine aquaculture. 1.2 Explain Scope and global status of mariculture. 1.3 Explain opportunities in mariculture. 1.4 Explain the importance of mariculture in food security and blue economy.	• Discuss the concepts and scope of mariculture • Discuss the history and development of global and local mariculture industries • Discuss the opportunities in marine aquaculture • Explain the importance of cultivation of marine organisms	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Write observation report on marine culture systems in their localities.	Guide students to • Observe marine culture systems.	Video clips, charts, Internet, Multimedia projector.
General Objective 2.0: Know the commercially important marine organisms of mariculture						
2-3	2.1 Explain the categories of marine organisms used in	• Discuss marine finfish species	Whiteboard, Projector, Fisheries	• Identify marine organisms used in	Guide students to:	Identification guide, Charts, Marine fish

	aquaculture. 2.2 Explain biology of marine organisms. 2.3 Explain marine culture systems. 2.4 Explain the factors considered in selection of suitable mariculture production sites.	(finfish, shellfish and crustaceans; seaweeds and aquatic plants) • Discuss the Biology and life cycles of marine organisms • Explain the marine aquaculture systems (Cage, pen, tank systems, recirculatory systems) • Explain site selection criteria	textbooks, Charts, Journals, Instructional materials, etc.	aquaculture. • Observe marine systems and preserved specimen	• Identify marine organisms used in aquaculture. • Observe marine systems and preserved specimen	samples, Video clips, Multimedia projector.
General Objective 3.0: Understand the design, construction and installation of marine aquaculture systems						
3-4	3.1 Explain different mariculture systems. 3.2 Explain the advantages and limitations of culture systems. 3.3 Describe marine production units.	• Discuss different mariculture production systems: ➤ Coastal pond, Floating cage, Pen, Raft and longline, Offshore mariculture systems, Recirculatory Aquaculture Systems (RAS), Biofloc technology) in marine	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Design simple marine culture units • Construct simple marine culture units • Carry out cage installation • Set up aeration system	Guide students to: • Design simple marine culture units • Construct simple marine culture units • Carry out cage installation • Set up aeration system	PVC pipes and accessories, PVC gums, Nets, Aerator, Rope, Anchor and sinkers, Measuring tapes, Floats, Stand, Saw blade,

		aquaculture ➤ Integrated Multi-Trophic Aquaculture (IMTA) ➤ Land-based marine aquaculture systems ➤ Hatchery and nursery system designs ➤ Water circulation and aeration systems ➤ Energy requirements and renewable energy integration • Discuss the design and installation of the mariculture production facilities				Hack saw, PPE.
General Objective 4.0: Know how to operate marine hatchery and nursery systems						
5-7	4.1 Explain how to manage marine hatchery systems. 4.2 Explain how to conduct breeding and spawning operations. 4.3 Explain larvae and juveniles rearing. 4.4 Explain management of nursery systems.	• Discuss brood stock management • Explain the Induced spawning techniques and egg incubation systems • Discuss larval rearing techniques • Discuss nursery management,	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Write observation reports on: ➤ Marine hatchery operation ➤ Larval rearing ➤ Nursery management systems.	Guide students to: • Observe marine hatchery operation using video clips • Observe larval rearing using video clips • Observe nursery management	Multimedia projector, Video clips, Charts.

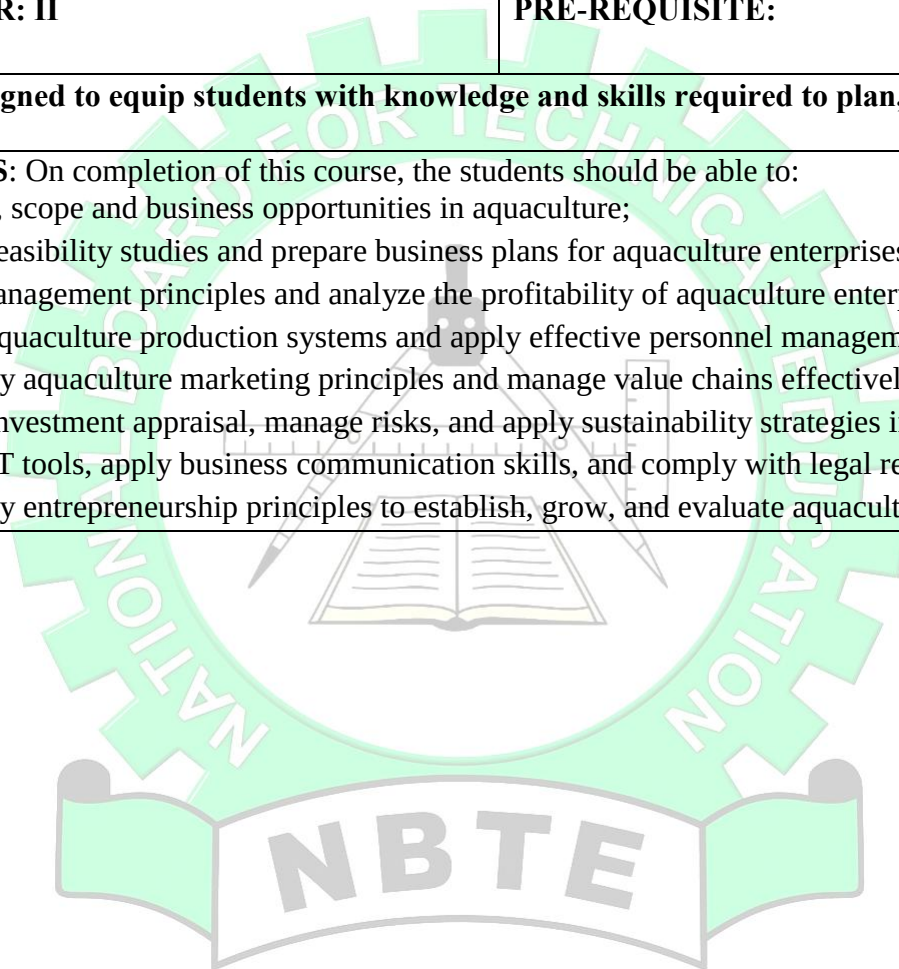
		hatchery sanitation and maintenance			using video clips	
General Objective 5.0: Understand the sustainable management of mariculture systems production						
8-11	5.1 Explain how to monitor seawater quality. 5.2 Explain how to operate life support systems. 5.3 Explain how to apply seawater treatment methods. 5.4 Explain how to maintain marine culture facilities. 5.5 Explain nutritional requirements of marine organisms. 5.6 Explain how to formulate marine feeds. 5.7 Explain how to produce live feeds. 5.8 Explain how to apply feeding management techniques. 5.9 Explain cultivation of marine finfish species. 5.10 Explain how to manage shellfish and crustacean production. 5.11 Explain how to culture seaweeds. 5.12 Explain how to apply integrated marine farming	• Discuss seawater quality parameters • Explain water testing procedures • Discuss filtration and aeration systems • Discuss salinity management • Discuss waste management in marine systems • Discuss nutritional requirements of marine fish and shellfish • Discuss feed formulation principles • Discuss feeding schedules and management • Explain live feed production (Algae, Rotifer, Artemia culture etc) • Discuss feed storage	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc	• Carry out marine water quality test • Observe Filtration system • Carry out feed formulation exercise • Carry out live fish food culture • Apply feeding management techniques. • Write observation reports on: ➤ Marine fish culture ➤ Shellfish culture ➤ Seaweed farming	Guide students to: • Carry out marine water quality test • Observe Filtration system using video clips • Carry out feed formulation exercise • Carry out live fish food culture • Demonstrate feeding management • Observe marine fish culture using video clips • Observe shellfish culture using video clips • Observe seaweed farming	Multimedia projector, Video clips, Charts, Water testing kits, Sample of live fish food, Software, Computer, PPE.

	systems.	- and handling • Discuss marine fish culture techniques; Shrimp and prawn culture, Oyster and mussel culture, Crab farming systems • Discuss seaweed farming techniques • Discuss Integrated Multi-Trophic Aquaculture (IMTA)			using video clips	
General Objective 6.0: Understand fish health, biosecurity, and environmental management in mariculture systems						
12-13	6.1 Explain common diseases in marine culture systems. 6.2 Explain biosecurity procedures. 6.3 Explain environmental pollution prevention. 6.4 Explain sustainable mariculture practices.	• Describe diseases and parasites in marine systems • Describe disease diagnosis and treatment • Discuss quarantine procedures • Discuss biosecurity measures • Discuss environmental management • Discuss climate	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	Write observation report on: • Common diseases in mariculture systems • Biosecurity procedures in mariculture production facilities • Environmental sanitation exercises	Guide students to: • Observe common diseases in mariculture systems using video clips • Observe biosecurity procedures in mariculture production facilities using video clips • Observe environmental sanitation	Video clips, Multimedia projector, Charts etc.

		change and marine aquaculture			exercises using video clips	
General Objective 7.0: Know how to conduct harvesting, handling and post-harvest management.						
14-15	7.1 Explain the steps in safe harvesting of marine organisms 7.2 Explain post-harvest handling procedures. 7.3 Explain how to conduct transportation and export operations 7.4 Explain how to apply marketing strategies	• Discuss harvesting techniques • Discuss handling and preservation methods • Discuss packing and transportation systems • Discuss export standards and procedures • Discuss the marine products marketing and customer relations management	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	Write observation reports on: • Cultured marine organisms harvesting • Packing and transportation of cultured marine organisms	Guide students to: • Observe cultured marine organisms harvesting using video clips • Observe packing and transportation of cultured marine organisms using video clips	Video clips, Multimedia projector, Charts.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

AQUACULTURE BUSINESS MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: AQUACULTURE BUSINESS MANAGEMENT	COURSE CODE: AFT 325	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 required to plan, manage and sustain aquaculture enterprises effectively		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept, scope and business opportunities in aquaculture; 2.0 Know how to conduct feasibility studies and prepare business plans for aquaculture enterprises; 3.0 Understand financial management principles and analyze the profitability of aquaculture enterprises; 4.0 Know how to manage aquaculture production systems and apply effective personnel management principles; 5.0 Understand how to apply aquaculture marketing principles and manage value chains effectively; 6.0 Know how to conduct investment appraisal, manage risks, and apply sustainability strategies in aquaculture; 7.0 Know how to utilize ICT tools, apply business communication skills, and comply with legal requirements in aquaculture business; 8.0 Understand how to apply entrepreneurship principles to establish, grow, and evaluate aquaculture enterprises.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY**COURSE TITLE: AQUACULTURE BUSINESS MANAGEMENT****COURSE CODE: AFT 325****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 required to plan, manage and sustain aquaculture enterprises effectively****GENERAL OBJECTIVE 1.0: Understand the concept, scope, and business opportunities in Aquaculture****THEORETICAL CONTENT****PRACTICAL CONTENT**

Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Explain Aquaculture business management. 1.2 Explain the various types of Aquaculture enterprises. 1.3 Explain the importance of the Aquaculture industry to national economy. 1.4 Explain the opportunities available in Aquaculture business in Nigeria.	- Discuss the concept of aquaculture business management - Discuss the various types of Aquaculture enterprises: - Hatchery - Grow-out, - Fish-feed - Fish processing and marketing - Explain the contributions of	Textbooks, Audio-visual aids, Charts, Statistical reports.	- Identify aquaculture enterprises in their localities. - Carry out field survey of local aquaculture businesses	Guide students to: - Identify aquaculture enterprises in their localities. - Carry out field survey of local aquaculture businesses	Farm visit, Field report templates, Questionnaires, Field notebooks.

		aquaculture to Nigeria's national economy • Discuss business opportunities available in aquaculture in Nigeria				
General Objective 2.0: Know how to conduct feasibility studies and prepare business plans for aquaculture enterprises						
2-3	2.1 Explain feasibility study in aquaculture business 2.2 Explain the importance of feasibility studies in aquaculture business 2.3 Explain the principles of conducting a feasibility study. 2.4 Describe how to conduct a market analysis for an aquaculture enterprise. 2.5 Explain how to assess the technical feasibility of an aquaculture project. 2.6 Explain how to assess the financial feasibility of an aquaculture project. 2.7 Explain how to prepare a business plan for an aquaculture enterprise. 2.8 Explain how to develop	• Discuss feasibility study in aquaculture business • Discuss the relevance of feasibility studies in aquaculture business planning • Explain step-by-step principles involved in conducting a feasibility study • Explain step-by-step principles involved in conducting a market analysis for aquaculture • Explain	Textbooks, Audio-visual aids, Sample feasibility reports, Market survey templates, Charts, Financial templates, Calculator, Sample business plans, Computer, Sample proposals	• Conduct feasibility studies in aquaculture business enterprises • Prepare feasibility reports for a selected aquaculture enterprise • Write a business plan for a proposed aquaculture venture	Guide students to: • Conduct feasibility studies in aquaculture business enterprises • Prepare feasibility reports for a selected aquaculture enterprise • Write a business plan for a proposed aquaculture venture	Feasibility report templates, Computer, Word processing software, Business plan templates.

	an aquaculture enterprise proposal.	parameters for assessing technical feasibility of aquaculture projects • Explain financial feasibility assessment tools and their application • Explain step-by-step principles involved in the preparation of an aquaculture enterprise business plan				
General Objective 3.0: Understand financial management principles and analyze the profitability of aquaculture enterprises						
4-5	3.1 Explain the sources of capital for aquaculture enterprises. 3.2 Explain how to apply budgeting principles in aquaculture production. 3.3 Explain how to maintain bookkeeping and accounting records for an aquaculture enterprise.	• Explain various sources of capital available to aquaculture entrepreneurs • Explain budgeting principles and demonstrate budget preparation for a fish farm	Textbooks, Audio-visual aids, Budget templates, Calculator, Ledger books, Computer, Financial statement templates,	• Prepare a budget for a given aquaculture production scenario • Maintain financial records for a simulated aquaculture enterprise for a given period of time • Analyze the	Guide students to: • Prepare a budget for a given aquaculture production scenario • Maintain financial records for a simulated aquaculture enterprise for a given period of time	Budget templates, Calculator, Computer, Ledger books, Spreadsheet software, financial data sets

	3.4 Explain how to prepare financial statements for an aquaculture business. 3.5 Describe how to conduct cost-benefit analysis of an aquaculture enterprise. 3.6 Explain how to analyze the profitability of an aquaculture enterprise. 3.7 Explain how to conduct break-even analysis for an aquaculture business.	- Describe how to maintain proper bookkeeping and accounting records - Explain preparation of income statements and balance sheets - Describe how to conduct cost-benefit analysis for aquaculture enterprises - Explain profitability ratios and demonstrate their application - Explain break-even analysis for aquaculture enterprises	Spreadsheet software, financial records, Charts	profitability of a given aquaculture enterprise using financial data	Analyze the profitability of a given aquaculture enterprise using financial data	
General Objective 4.0: Know how to manage aquaculture production systems and apply effective personnel management principles						
6-7	4.1 Explain production planning and scheduling in aquaculture. 4.2 Explain how to manage day-to-day operational activities on an aquaculture farm.	Discuss the principles and tools of production planning in aquaculture	Textbooks, Charts, Audio-visual aids, Farm operation manuals & records,	- Develop a production plan and schedule for a fish farm operation - Simulate personnel supervision and	Guide students to: - Develop a production plan and schedule for a fish farm operation - Simulate personnel	Production planning templates, Computer Role-play scenarios, Case study

	4.3 Explain how to apply labor management and supervision principles in aquaculture. 4.4 Explain how to apply leadership and communication skills in farm management. 4.5 Explain human resource management in aquaculture enterprises. 4.6 Evaluate farm performance using appropriate indicators.	• Discuss operational management procedures on a fish farm • Discuss labor management strategies and supervision techniques • Describe leadership styles and effective communication in farm management • Explain HRM principles as applicable to aquaculture enterprises • Explain key performance indicators and methods for farm performance evaluation	Case studies, HR policy templates	labor management on an aquaculture farm	supervision and labor management on an aquaculture farm	materials.
General Objective 5.0: Understand how to apply aquaculture marketing principles and manage value chains effectively						
8-9	5.1 Explain fish marketing systems in Nigeria. 5.2 Describe aquaculture	• Discuss the structure and dynamics of fish	Textbooks, Audio-visual aids, Charts,	• Prepare a marketing plan for a selected aquaculture product	Guide students to: • Prepare a marketing	Marketing plan templates, Computer

	marketing channels. 5.3 Explain how to apply branding and packaging strategies to aquaculture products. 5.4 Explain how to manage customer relations in an aquaculture business. 5.5 Explain how to analyze the aquaculture value chain. 5.6 Explain value addition techniques and product diversification in aquaculture. 5.7 Explain marketing models.	marketing systems in Nigeria • Discuss the various marketing channels used in aquaculture • Explain branding and packaging techniques for aquaculture products • Explain customer relations management principles in aquaculture business • Explain step-by-step procedure in analyzing and mapping the aquaculture value chain • Explain value addition techniques and product diversification in aquaculture • Discuss marketing	Product samples, Case studies, Value chain diagrams.	• Map the value chain of a selected aquaculture product • Develop brand for aquaculture products.	plan for a selected aquaculture product • Map the value chain of a selected aquaculture product • Develop brand for aquaculture products.	Value chain mapping templates, Charts, Multimedia projector, Design software
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		models such as: ➤ Direct to consumer model ➤ Indirect distribution models ➤ Digital/e-Marketing model ➤ Corporative marketing model				
General Objective 6.0: Know how to conduct investment appraisal, manage risks, and apply sustainability strategies in aquaculture						
10-11	6.1 Explain investment appraisal techniques used in aquaculture. 6.2 Explain Return on Investment (ROI) for an aquaculture enterprise. 6.3 Explain how to apply Net Present Value (NPV) in aquaculture investment decisions. 6.4 Explain risks associated with aquaculture businesses. 6.5 Explain how to develop a risk management plan for an aquaculture enterprise. 6.6 Explain the role of	• Discuss the various investment appraisal techniques used in aquaculture • Explain how to calculate and interpretation of ROI for aquaculture enterprises • Explain how to calculate NPV for aquaculture investment decisions	Textbooks, Audio-visual aids, Charts, Calculator, Spreadsheet software, Case studies, Risk management templates, Insurance policy samples	• Conduct investment analysis for a given aquaculture enterprise scenario • Calculate Return on Investment (ROI) for an aquaculture enterprise • Interpret Return on Investment (ROI) for an aquaculture enterprise • Assess risks associated with a given aquaculture enterprise	Guide students to: • Conduct investment analysis for a given aquaculture enterprise scenario • Calculate Return on Investment (ROI) for an aquaculture enterprise • Interpret Return on Investment (ROI) for an aquaculture enterprise • Assess risks associated with a given aquaculture	Investment analysis templates, Calculator, Computer, Risk assessment templates, Case study materials.

	insurance in aquaculture business. 6.7 Explain how to apply sustainable aquaculture practices in enterprise management	• Discuss the various risks associated with aquaculture businesses • Discuss how to develop a risk management plan for an aquaculture enterprise • Discuss the importance and types of insurance available to aquaculture businesses • Discuss sustainability principles and their application in aquaculture enterprise management			enterprise	
General Objective 7.0: Know how to utilize ICT tools, apply business communication skills, and comply with legal requirements in aquaculture business						
12-13	7.1 Explain the applications of ICT tools in aquaculture business management. 7.2 Explain how to use farm management software for	• Explain the role and applications of ICT tools in aquaculture business	Textbooks, Computer, Audio-visual aids, Farm management	• Maintain farm records for a simulated aquaculture enterprise using	Guide students to: • Maintain farm records for a simulated	Report writing templates, Computer, Multimedia projector,

	record keeping and reporting. 7.3 Explain how to apply business communication skills in aquaculture enterprise operations. 7.4 Explain how to prepare reports and business documents for an aquaculture enterprise. 7.5 Explain how to develop business presentations. 7.6 Explain how to deliver business presentations. 7.7 Explain fisheries business regulations in Nigeria. 7.8 Explain the procedures for business registration and taxation. 7.9 Explain the ethical standards in aquaculture business operations.	management • Discuss the use of farm management software for record keeping and reporting • Explain principles of effective business communication in aquaculture operations • Discuss how to prepare reports and business documents for aquaculture enterprises • Discuss how to develop and deliver effective business presentations • Explain relevant fisheries laws and regulations governing aquaculture businesses in Nigeria	software, Case studies, Report templates, Projector, Presentation software, Fisheries policy documents, CAC registration guidelines, FIRS documents	computer applications • Prepare structured business and technical reports for a given aquaculture scenario • Deliver a presentation on a well-developed selected aquaculture enterprise	aquaculture enterprise using computer applications • Prepare structured business and technical reports for a given aquaculture scenario • Develop and deliver a presentation on a selected aquaculture enterprise	Presentation software.
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		- Describe the procedures for registering an aquaculture business and meeting tax obligations - Explain business ethics and their application in aquaculture enterprise management				
General Objective 8.0: Understand how to apply entrepreneurship principles to establish, grow, and evaluate aquaculture enterprises						
14-15	8.1 Explain the principles of entrepreneurship as applied to aquaculture. 8.2 Describe the procedures for establishing an aquaculture enterprise. 8.3 Explain the characteristics small and medium aquaculture enterprises. 8.4 Describe the management of small and medium aquaculture enterprises. 8.5 Explain how to develop strategies for enterprise growth and expansion. 8.6 Explain how to apply	- Discuss the principles and characteristics of entrepreneurship in aquaculture - Explain the step-by-step procedures for setting up an aquaculture enterprise - Explain the features, challenges, and management of SMEs in	Textbooks, Audio-visual aids, Case studies, Enterprise setup guidelines, Business growth models, Performance evaluation templates	- Develop a comprehensive enterprise proposal for a proposed aquaculture business - Simulate the establishment and management of an aquaculture enterprise - Analyze a real-world aquaculture business case study and present findings	Guide students to: - Develop a comprehensive enterprise proposal for a proposed aquaculture business - Simulate the establishment and management of an aquaculture enterprise - Analyze a real-world aquaculture business case study	Proposal templates, Simulation materials, Case study scenarios, Case study materials, Computer, Multimedia projector

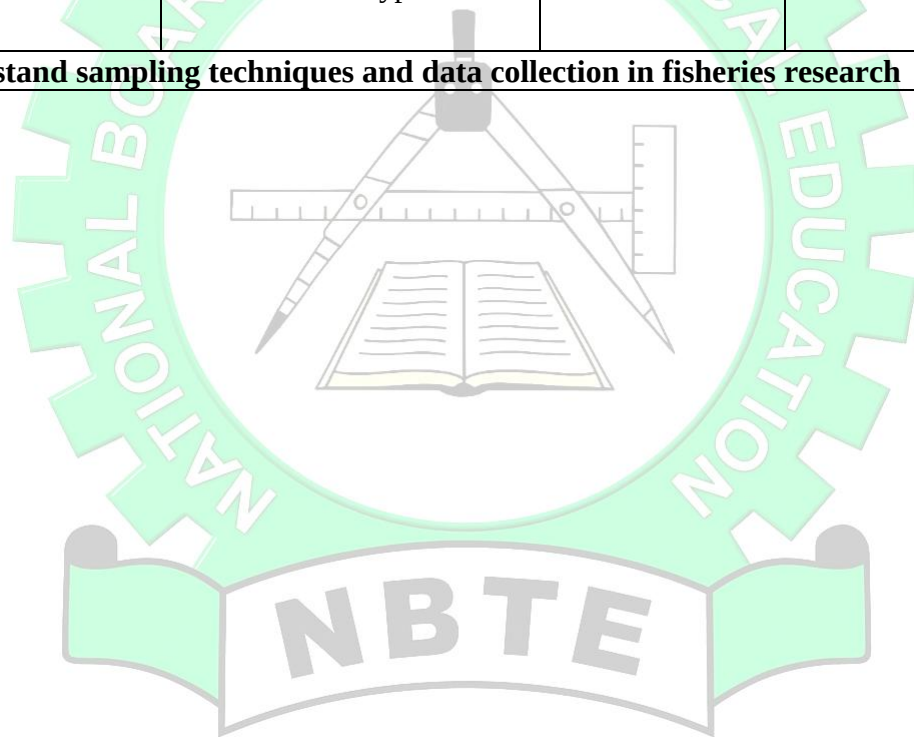
	innovation and competitiveness strategies in aquaculture business. 8.7 Explain evaluation and monitoring of enterprise performance.	aquaculture • Describe how to develop strategies for growing and expanding aquaculture enterprises • Explain innovation strategies and how to maintain competitiveness in aquaculture business • Explain enterprise performance evaluation tools and monitoring frameworks			and present findings	
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

RESEARCH METHODS AND BIOSTATISTICS IN FISHERIES

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: RESEARCH METHODS AND BIOSTATISTICS IN FISHERIES	COURSE CODE: AFT 326	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 in research methodology and biostatistics in fisheries		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and importance of scientific research in fisheries; 2.0 Understand different types of research methods and designs; 3.0 Know how to formulate research problems, objectives, and hypotheses; 4.0 Understand sampling techniques in fisheries research; 5.0 Understand Data Classification and Presentation; 6.0 Know descriptive and inferential statistical methods; 7.0 Understand the use of Statistical software and Research Ethics.		

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: RESEARCH METHODS AND BIOSTATISTICS IN FISHERIES			COURSE CODE: AFT 326		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 research methodology and biostatistics in fisheries						
GENERAL OBJECTIVE 1.0: Understand the principles and importance of scientific research in fisheries.						
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 of research. 1.2 Explain the importance of research. 1.3 Explain types of research: basic, applied, qualitative and quantitative. 1.4 Outline the characteristics of good research.	- Explain the meaning and importance of research - Discuss types of research: basic, applied, qualitative, quantitative - Discuss characteristics of good research	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
General Objective 2.0: Understand different types of research methods and designs						
2	2.1 Describe Scientific methods. 2.2 Explain Steps in the research process. 2.3 Explain Literature Review.	- Discuss Scientific methods - Explain Steps in the research process - Describe literature review	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional			

			materials, etc.			
General Objective 3.0: Know how to formulate research problems, objectives, and hypotheses						
3	3.1 Explain research problem identification. 3.2 Explain Research objectives. 3.3 Explain the term 'Research Questions'. 3.4 Explain Null and alternative hypotheses.	• Discuss research problem identification • Explain research objectives • Explain the term Research questions • Explain Null and alternative hypotheses.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
General Objective 4.0: Understand sampling techniques and data collection in fisheries research						

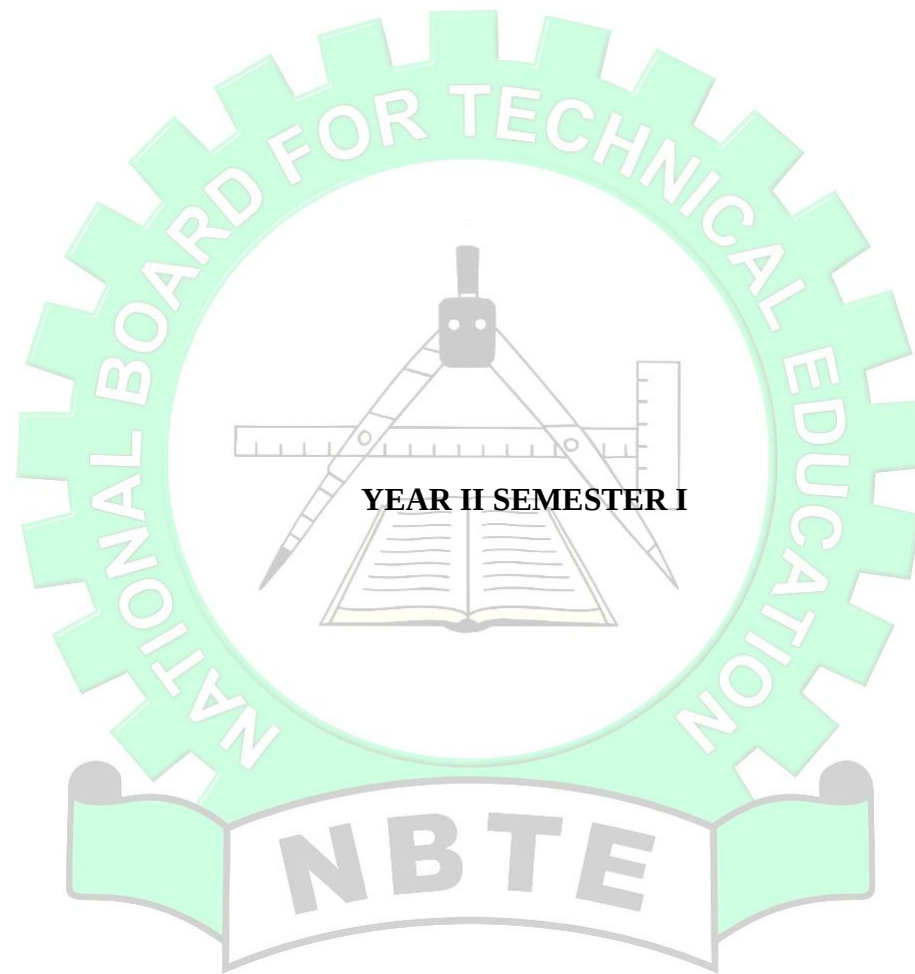


4-6	4.0 Explain population and sample concepts - Random sampling - Stratified sampling - Systematic sampling - Sample size determination, etc. 4.2 Explain primary and secondary data. 4.3 Explain observation methods in research. 4.4 Explain how to design questionnaire. 4.5 Explain interview techniques. 4.6 Describe field survey methods	- Discuss population and sample concepts ➤ Random sampling ➤ Stratified sampling ➤ Systematic sampling ➤ Sample size determination, etc. - Discuss primary and secondary data - Explain observation methods in research - Explain how to design questionnaire - Explain interview techniques - Explain field survey methods	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Demonstrate observation methods in research - Design survey questionnaire - Demonstrate interview techniques - Conduct a field survey to collect fisheries data	Guide students to: - Demonstrate observation methods in research - Guide student to design survey questionnaire - Demonstrate interview techniques - Guide student to conduct a field survey to collect fisheries data	Recorder, Camera, Notepad, Survey tool, Survey template
General Objective 5.0: Understand the use of statistical software and Research Ethics						
7-9	5.1 Explain statistical software used in fisheries research. 5.2 Explain research ethics and integrity. 5.3 Explain the proper use of Artificial Intelligence (AI) in research.	- Discuss statistical software use in fisheries research ➤ Data entry and coding ➤ Data analysis using Excel and SPSS ➤ Output interpretation - Discuss research ethics and integrity	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Carry out data entry and coding using Excel and SPSS - Carry out data analysis using Excel and SPSS - Interpret analysis	Guide student to: - Carry out data entry and coding using Excel and SPSS - Carry out	Samples of fish, Measuring board, Weighing scale, Survey data, Computer, Data processing

		➤ Plagiarism and data falsification ➤ Ethical treatment of research subjects • Discuss the proper use of Artificial Intelligence (AI) in research		outputs	data analysis using Excel and SPSS • Interpret analysis outputs	software.
General Objective 6.0: Understand Data Classification and Presentation						
10-13	6.1 Explain data coding and classification. 6.2 Explain frequency distribution tables. 6.3 Explain graphical presentation of data. 6.4 Describe how to apply histograms, bar charts, pie charts, line graphs, etc.	• Explain data coding and classification • Explain frequency distribution tables • Explain graphical presentation of data • Describe how to apply histograms, bar charts, pie charts, line graphs, etc.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out data coding and classification • Plot frequency distribution tables using data processing software • Visualize processed aquaculture data using statistical software packages. • Interpret histograms, bar charts, pie charts, line	Guide students to: • Carry out data coding and classification • Prepare frequency distribution tables • Produce graphical presentation of data • Interpret histograms, bar charts, pie charts,	Survey data, Computer, Data processing software.

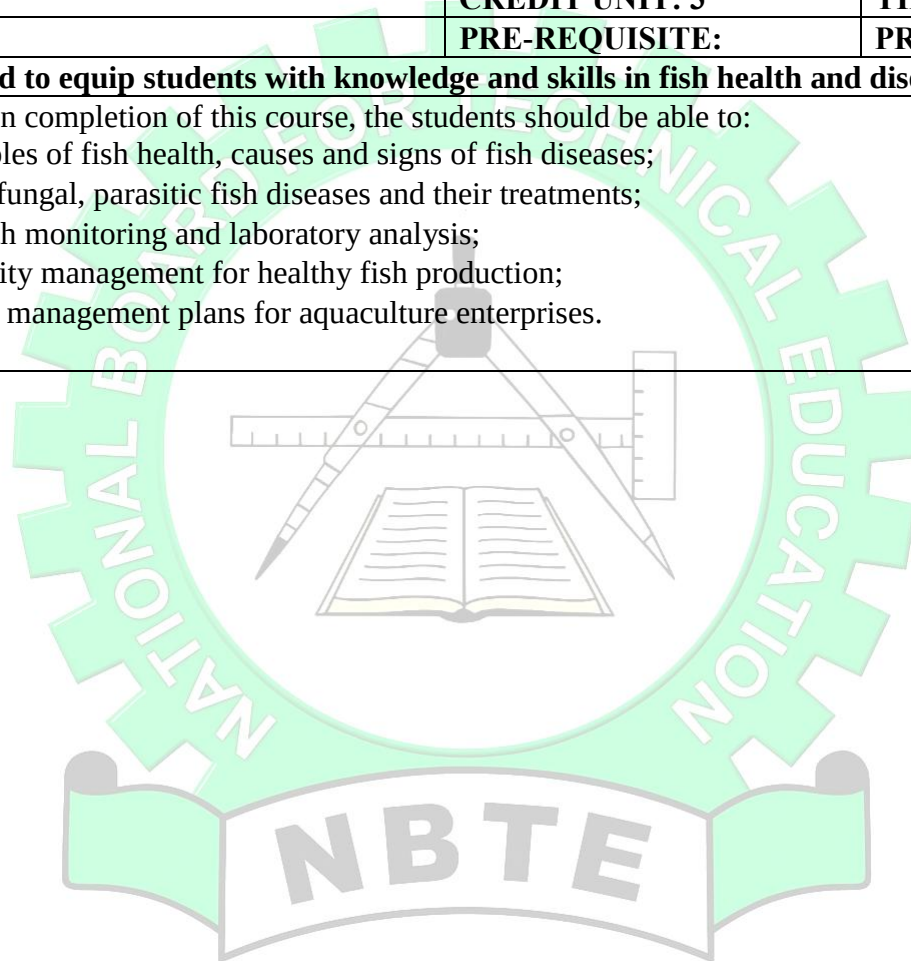
				graphs, etc.	line graphs, etc.	
General Objective 7.0: Know descriptive and inferential statistical methods						
14-15	7.1 Explain descriptive statistics. 7.2 Explain probability concepts. 7.3 Explain inferential statistics and hypothesis testing. 7.4 Explain correlation and regression Analysis. 7.5 Describe Fisheries production forecasting.	- Discuss descriptive statistics - Measures of central tendency - Measures of dispersion - Standard deviation and coefficient of variation - Applications in fisheries data - Explain probability concepts - Probability - Normal distribution - Binomial distribution - Poisson distribution - Fisheries applications of probability - Discuss inferential statistics and hypothesis testing - Concept of hypothesis testing - t-test - Chi-square test - Analysis of variance	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	Calculate Standard deviation and coefficient of variation, t-test, z-test, Chi-square test, Analysis of Variance (ANOVA), correlation and regression analysis of fish samples using data processing software	Guide students to: Calculate Standard deviation and coefficient of variation, t-test, z-test, Chi-square test, Analysis of Variance (ANOVA), correlation and regression analysis of fish samples using data processing software	Samples of fish, Measuring board, Weighing scale, Survey data, Computer, Data processing software.

		(ANOVA) ➤ Interpretation of statistical results • Describe correlation and regression Analysis ➤ Correlation analysis ➤ Pearson correlation coefficient ➤ Regression analysis ➤ Linear regression models • Discuss Fisheries production forecasting				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



ADVANCED FISH HEALTH AND DISEASES MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ADVANCED FISH HEALTH AND DISEASES MANAGEMENT	COURSE CODE: AFT 411	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 fish health and disease management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of fish health, causes and signs of fish diseases; 2.0 Know bacterial, viral, fungal, parasitic fish diseases and their treatments; 3.0 Comprehend fish health monitoring and laboratory analysis; 4.0 Understand water quality management for healthy fish production; 5.0 Understand fish health management plans for aquaculture enterprises.		



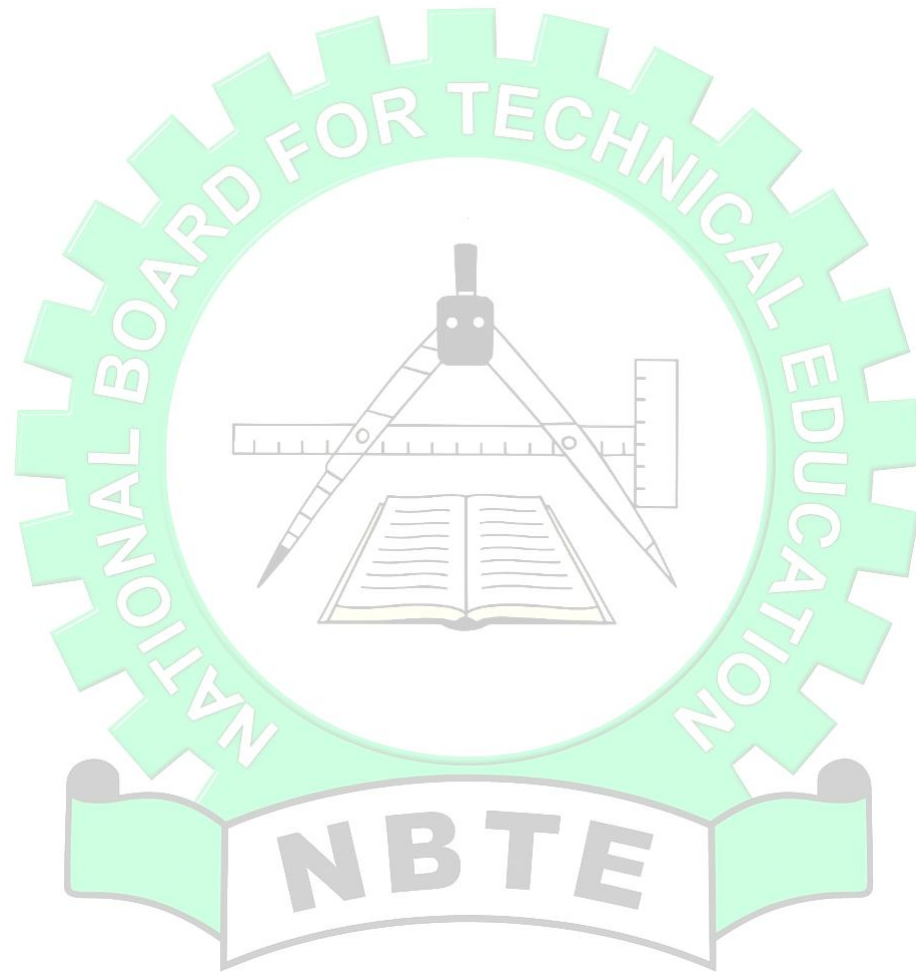
PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ADVANCED FISH HEALTH AND DISEASES MANAGEMENT		COURSE CODE: AFT 411			CONTACT HOURS: 3HOURS/WEEK	
		CREDIT UNIT: 3			THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I		PRE-REQUISITE:			PRACTICAL: 2HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in fish health and disease management						
GENERAL OBJECTIVE 1.0: Understand the principles of fish health, causes and signs of fish diseases						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain fish health management. 1.2 Explain factors affecting fish health. 1.3 Describe signs of healthy and diseased fish. 1.4 Explain fish disease classification.	• Discuss concept and importance of fish health management • Discuss factors affecting fish health (Environmental, Nutritional and Biological factors) • Discuss characteristics of healthy fish • Discuss disease classification (Infectious diseases and Non-infectious diseases)	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Examine healthy and diseased fish • Use laboratory kits to compare healthy and diseased fish • Identify disease symptoms	Guide students to: • Examine healthy and diseased fish • Use laboratory kits to compare healthy and diseased fish • Identify disease symptoms	Healthy and diseased fish samples, Hand lens, Microscope, Aquaria tank, Almanac of fish diseases, Aerator.
General Objective 2.0: Know bacterial, viral, fungal, parasitic fish diseases and their treatments						

3-6	2.1 Explain major fish diseases. 2.2 Explain disease symptoms. 2.3 Explain disease transmission. 2.4 Explain methods of diagnosing fish pathogens. 2.5 Explain different treatment measures for fish diseases. 2.6 Explain how to administer fish treatments safely. 2.7 Explain fish therapeutics. 2.8 Explain vaccination procedures.	• Discuss Bacterial, Viral, Fungal and Parasitic diseases • Discuss disease transmission mechanisms • Discuss fish treatment methods (Bath, Dip and Oral treatments) • Discuss fish medications and chemicals • Explain vaccination principles • Explain drug dosage calculations and duration • Discuss fish therapeutics	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify major fish diseases • Diagnose fish pathogens • Carry out different treatment methods of fish diseases • Conduct drug dosage calculations and duration • Administer medication	Guide students to: • Identify major fish diseases • Diagnose fish pathogens • Carry out different treatment methods of fish diseases • Administer medication	Diseased fish samples, Hand lens, Microscope, Aquaria tank, Almanac of fish diseases, Dissecting kits, Dissecting table, PPE, Laboratory glassware, Disinfectants and chemicals, Drugs, Water testing kits Aerator.
General Objective 3.0: Comprehend fish health monitoring and laboratory analysis						
7-9				• Conduct fish disease diagnosis • Collect and preserve samples • Carry out microbiological, hematological, histopathological,	Guide students to: • Conduct fish disease diagnosis • Collect and preserve samples • Carry out	Diseased fish samples, Hand lens, Microscope, Aquaria tank, Almanac of fish diseases, Dissecting kits, Dissecting

				etc. tests in the laboratory • Analyze fish health data	microbiological, hematological, histopathological, etc. tests in the laboratory • Analyze fish health data	table, PPE, Laboratory glassware, Disinfectants and chemicals, Drugs, Water testing kits, Computer, Aerator.
General Objective 4.0: Understand water quality management for healthy fish production						
10-12	4.1 Explain the effects of water sources on fish health. 4.2 Explain water quality parameters in relation to fish health. 4.3 Explain hatchery sanitation. 4.4 Explain fish rearing facilities sanitation. 4.5 Explain disease outbreaks prevention measures. 4.6 Explain quarantine procedures in aquaculture.	• Discuss the effects of water sources on fish health • Discuss water quality parameters in relation to fish health • Discuss hatchery sanitation • Explain fish rearing facilities sanitation • Describe disease outbreaks prevention measures • Explain quarantine procedures in aquaculture	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out water quality analysis to determine the safe range of water quality parameters for fish health • Carry out hatchery sanitation • Carry out pond sanitation • Demonstrate disease outbreaks prevention measures	Guide students to: • Carry out water quality analysis • Carry out hatchery sanitation • Carry out pond sanitation • Demonstrate disease outbreaks prevention measures	Hand lens, PPE, Laboratory glassware, Water testing kits, Charts, Video clips, Secchi disc, Multimedia projector.

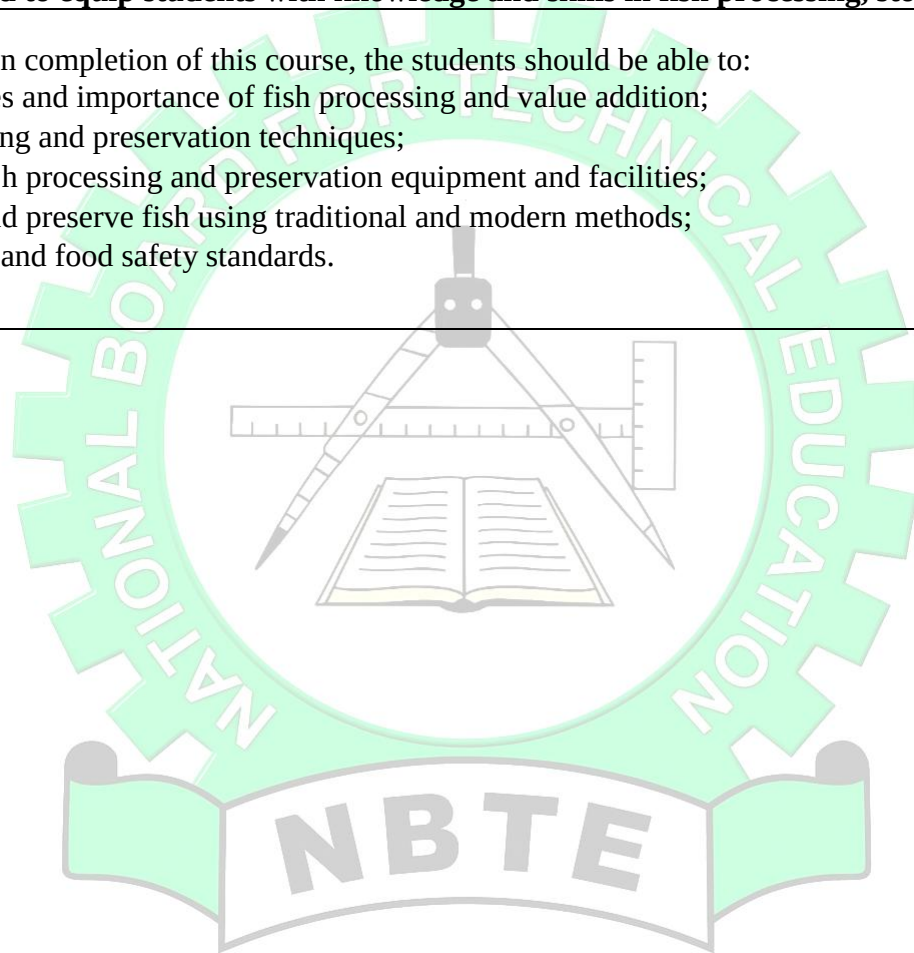
General Objective 5.0: Understand fish health management plans for aquaculture enterprises						
13-15	5.1 Explain hatchery health management systems. 5.2 Explain how to maintain fish rearing facilities hygiene. 5.3 Explain environmental management practices for fish disease prevention. 5.4 Explain economic impacts of diseases. 5.5 Explain fish health regulations. 5.6 Explain how to keep fish health records. 5.7 Explain waste disposal and environmental management. 5.8 Explain economic impact of fish diseases in aquaculture.	• Discuss hatchery health management systems • Discuss how to maintain fish rearing facilities • Discuss fish rearing facilities sanitation procedures • Discuss waste disposal and environmental management • Discuss economic impact of fish diseases in aquaculture • Discuss fish health regulations and legislation • Discuss fish health records and documentation	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out hatchery inspection • Carry out rearing facilities sanitation exercises • Carry out cost benefit analysis on loss as a result of fish diseases • Document incidences of fish diseases • Prepare technical reports on fish diseases	Guide students to: • Carry out hatchery inspection • Carry out rearing facilities sanitation exercises • Carry out cost benefit analysis on loss as a result of fish diseases • Document incidences of fish diseases • Prepare technical reports on fish diseases	Hand lens, PPE, Laboratory glassware, Water testing kits, Charts, Video clips, Secchi disc, Multimedia projector.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40%						

EXAMINATION (THEORY AND PRACTICAL): 40%
TOTAL: 100%



ADVANCED FISH PROCESSING, STORAGE AND VALUE ADDITION

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: ADVANCED FISH PROCESSING, STORAGE AND VALUE ADDITION	COURSE CODE: AFT 412	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in fish processing, storage and value-addition		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and importance of fish processing and value addition; 2.0 Know proper fish handling and preservation techniques; 3.0 Know how to operate fish processing and preservation equipment and facilities; 4.0 Know how to process and preserve fish using traditional and modern methods; 5.0 Know quality assurance and food safety standards.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: ADVANCED FISH PROCESSING, STORAGE AND VALUE ADDITION		COURSE CODE: AFT 412		CONTACT HOURS: 4HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK		
YEAR: II 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 fish processing, storage and value-addition						
GENERAL OBJECTIVE 1.0 Understand the principles and importance of fish processing and value addition						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain fish processing and value addition. 1.2 Explain the importance of fish processing. 1.3 Explain causes of fish spoilage. 1.4 Explain principles of fish preservation.	- Discuss the concept of fish processing and value addition - Outline the importance of fish processing. 1.5 Describe the causes of fish spoilage (microbial, chemical rancidity and enzymatic autolysis) - Discuss the principles of fish preservation	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify fresh and spoiled fish - Conduct microbial analysis of spoiled fish	Guide the students to: - Identify the fresh and spoiled fish - Conduct microbial analysis of spoiled fish	Multimedia projector, Samples of fresh and spoiled fish, Video clips, Autoclave, Laboratory glassware’s, Incubator, Oven, PPE.
General Objective 2.0: Know proper fish handling and preservation techniques						

3-5	2.1 Explain fish handling procedures 2.2 Explain traditional fish preservation methods (smoking, drying, salting and fermentation). 2.3 Explain modern fish preservation methods (freezing, oven-drying, chilling and canning).	- Describe the process of handling fish hygienically. - Discuss the methods of Preservation techniques (smoking, drying salting, freezing, chilling, fermentation, canning and oven drying).	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Carry out the following practices in fish handling sorting, washing, bleeding, scaling, gutting, napping, gaffing, filleting, skinning. - Carry out fish drying in groups using traditional and modern methods	Guide students to: - Carry out Practices in fish handling sorting, washing, bleeding, scaling, gutting, napping, gaffing, filleting, skinning - Carry out fish drying in groups using traditional and modern methods	Fish samples (live and dead), Fish basket, Different types of fishing gear, Smoking kiln, Cold room, Refrigerator, Freezer, Dissecting kits, Plastic bowls, PPE.
General Objective 3.0: Know how to operate fish processing and preservation equipment and facilities						
5-8	3.1 Explain different fish processing equipment. 3.2 Explain the different traditional equipment used for fish preservation and their application. 3.3 Explain different modern equipment used for fish	Discuss different fish processing equipment (deboning machine, filleting machine, descaling machine, deskinning machine etc.)	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify different fish processing equipment - Operate different fish processing equipment - Identify fish preservation	Guide the students to: - Identify different fish processing equipment - Operate	Smoking kiln, Drying racks Thermometer, Mechanical smoker, Chorkor smoker, Traditional

	preservation and their application. 3.4 Explain occupational health and safety measures (OHS) and its importance. 3.5 Explain the proper practices of good hygiene and workplace sanitation.	• Discuss the different equipment used for fish preservation and their application (smoking kiln, drying racks thermometer, mechanical smoker, chorkor smoker, traditional smoking kiln, mechanical filleting machine, stainless table, cutting boards and weighing scale) • Discuss occupational health and safety measures (physical, biological, chemical and agronomical hazard) importance • Discuss the various methods involve in proper hygiene and sanitation		equipment • Operate fish preservation equipment • Demonstrate how use the PPE in fish processing facility • Carry out the general sanitation within the workplace	different fish processing equipment • Identify fish preservation equipment • Operate fish preservation equipment • Demonstrate how use the PPE in fish processing facility • Carry out the general sanitation within the workplace	smoking kiln, Mechanical filleting machine, Stainless table, cutting boards, Weighing balance, PPE.
General Objective 4.0: Know how to process and preserve fish using traditional and modern methods						

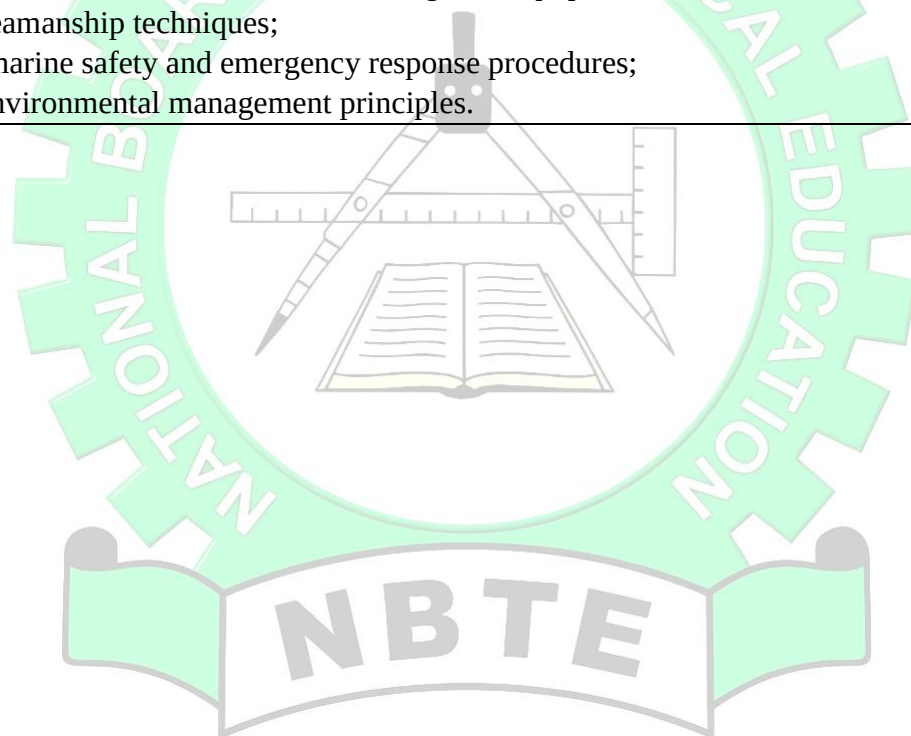
9-13	4.1 Explain the various fish processing and preservation methods. 4.2 Explain the various methods of salt curing. 4.3 Describe the various methods of fermentation. 4.4 Describe principles and methods of fish drying. 4.5 Explain various methods of cold storage of fish. 4.6 Explain the process of fish canning. 4.7 Explain the concept of value addition in relation to fish and its products. 4.8 Explain packaging and labeling of fish products.	• Discuss the various fish processing preservation methods ➢ salt curing, ➢ sun drying ➢ solar drying ➢ oven drying ➢ chilling ➢ fermentation ➢ freezing ➢ smoke drying ➢ canning • Describe the various methods of salt curing. (Dry and ketch, pickle, brining) fermentation • Describe principles and methods of fish drying ➢ sun drying, ➢ Oven drying, ➢ freeze drying ➢ smoke drying • Describe various methods of cold storage of fish ➢ chilling	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Conduct practical on dry and ketch, salting pickle and brining • Constitute a semi-trained panel and carry out organoleptic assessment on some commonly available fish products • Carry out sun drying and smoke drying. • Prepare fermented fish in form of fish sauce, fermented whole fish and fish park; • Carry out fish smoking using the available fish smoking kilns • Carry out icing freezing and cold storage of fish using the commonly available fishes. • Compare the	Guide students to: • Conduct practical on dry and ketch, salting pickle and brining; • Carry out taste panel evaluation of products. • Conduct practical on sun drying and smoke drying and • prepare fermented fish in form of fish sauce, fermented	Containers, Salt, Salinometer, Solar tent, Dryer, Oven, Packaging materials, Sealing machine, Traditional smoking kiln, Gas kiln, Fish drying equipment, Vegetable oil, Flour, Spices, Gas cylinder, PPE.
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		➤ freezing ➤ blast freezing • Describe the process of fish canning • Explain the concept of value addition in relation to fish and its products ➤ Fish kilishi ➤ Fish dambu ➤ Fish sausage production ➤ Fish burger and fish balls ➤ Fish fillets and fish flakes ➤ Fish powder and fish snacks • Discuss packaging and labeling of fish products		keeping quality of chilled and frozen fish. • Produce value-added fish products (fish balls, fish crackers, fish bread, fish kilishi etc) • Package fish products • Label fish products	whole fish and fish pack • Produce value-added fish products. • Package fish products • Label products correctly	
General Objective 5.0: Know quality assurance and food safety standards						
14-15	5.1 Explain quality assurance in fish processing. 5.2 Explain objective, physical and subjective methods of quality assessments. 5.3 Explain the food safety	• Discuss quality assurance in fish processing. • Discuss objective,	Whiteboard, Projector, Fisheries textbooks, Charts, Journals,	• Carry out quality assessment of fish applying the subjective, objective and	Guide students to: • Carry out quality assessment	Oven, Furnace, Nutrient agar, Colony counter,

	principles. 5.4 Explain Good Manufacturing Practices (GMP). 5.5 Explain Hazard Analysis and Critical Control Points (HACCP). 5.6 Explain fish quality control parameters.	physical and subjective methods of quality assessment. • Objective, method: - Chemical, Biochemical, Bacteriological and physical method • Discuss food safety principles • Discuss the Good Manufacturing Practices (GMP) • Discuss the Hazard Analysis and Critical Control Points (HACCP) • Fish quality control parameters	Instructional materials, etc.	physical methods. • Carry out organoleptic assessment on some commonly available fish products • Apply food safety procedures • Conduct quality control tests. • Maintain hygienic processing conditions	t of fish applying the subjective, objective and physical methods • Constitute a taste panel • Carry out organoleptic assessment on some commonly available fish species • Carry out laboratory quality tests	Incubator, Fish samples, Inspection table, washing and sorting facilities, Cold room, Freezers.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

SEAMANSHIP AND NAUTICAL KNOWLEDGE

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: SEAMANSHIP AND NAUTICAL KNOWLEDGE	COURSE CODE: AFT 413	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in navigation on water bodies		
GENERAL OBJECTIVES: On completion of this course, the students should be able 1.0 Understand the principles and rules of navigation and seamanship; 2.0 Know how to interpret nautical charts and use charts for position fixing and plotting course; 3.0 Understand the use of marine communication and navigation equipment; 4.0 Understand marine seamanship techniques; 5.0 Know how to apply marine safety and emergency response procedures; 6.0 Understand marine environmental management principles.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: SEAMANSHIP AND NAUTICAL KNOWLEDGE			COURSE CODE: AFT 413		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: II 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 navigation on water bodies						
GENERAL OBJECTIVE 1.0: Understand the principles and rules of navigation and seamanship.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain the concepts of navigation and seamanship. 1.2 Explain terminologies in navigation and seamanship. 1.3 Describe the various types of vessels based on usage. 1.4 Explain general steering and sailing rules. 1.5 Describe how to maneuver vessels at the sight of another. 1.6 Describe the condition of vessels under restricted	- Discuss the concepts of navigation and seamanship - Discuss terminologies in navigation and seamanship e.g., astern, ahead maneuvers, man overboard, star board and portend etc. - Describe the various types of vessels based on usage (Fishing, cargo, naval,	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Use simulators to identify various types of vessels. - Maneuver vessels using simulators.	Guide students to: - Use simulators to identify various types of vessels. - Maneuver vessels using simulators	Computer, Software for designing, Video clips, Charts, Multimedia projector, Practical manuals.

	visibility. 1.7 Explain laws of the storms.	tankers, portend etc.) • Describe the various types of vessels based on usage (Fishing, cargo, naval, tankers etc.) • Discuss general steering and sailing rules • Describe how to maneuver vessels at the sight of another • Describe the condition of vessels under restricted visibility • Discuss laws of the storms.				
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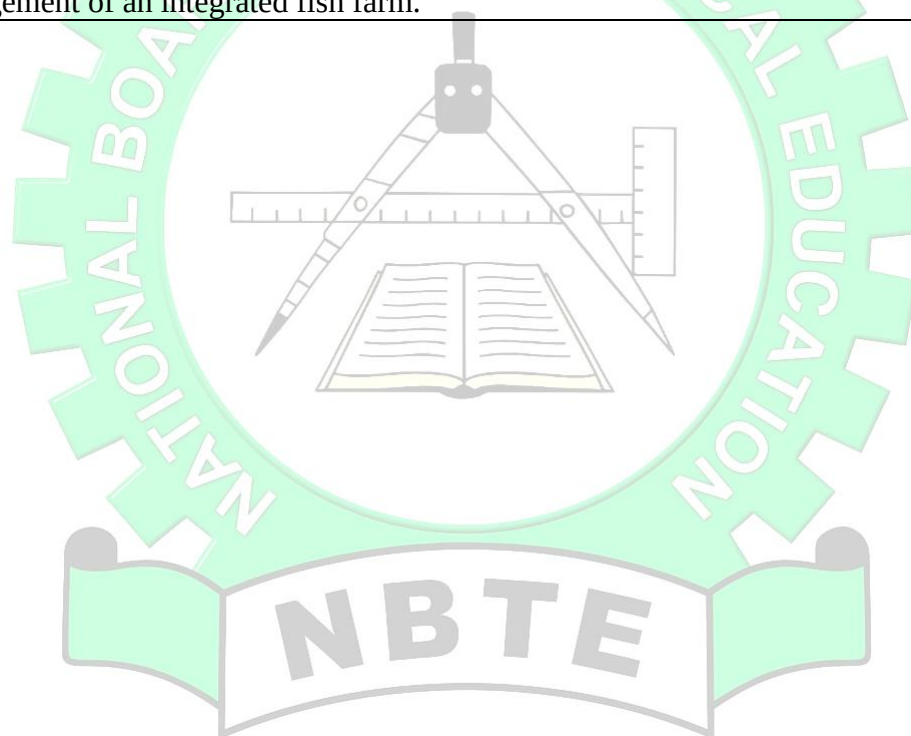
General Objective 2.0: Know how to interpret nautical charts and use charts for position fixing and plotting course						
4-5	2.1 Explain different types of Navigation. 2.2 Explain the application of marine navigation principles in fishing/shipping operation. 2.3 Explain nautical charts. 2.4 Describe the use of navigational equipment. 2.5 Explain chart plotting.	• Discuss different types of navigation. • Describe the application of marine navigation principles in fishing/shipping operation. • Explain how to read and interpret nautical charts • Describe the use of navigational equipment • Explain chart plotting	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Plot nautical chart • Read nautical chart • Operate GPS device	Guide students to: • Plot nautical chart • Read nautical chart • Operate GPS device	Paper charts, GPS device, Plotting sheet, Multimedia projector, Parallel plotter, Protractor, Meter rule, Nautical chart, software.
General Objective 3.0: Understand the use of marine communication and navigation equipment.						
6-7	3.1 Explain marine signaling procedures 3.2 Explain marine radio communication systems 3.3 Explain distress communication methods	• Explain marine signaling procedures • Explain marine radio communication systems • Explain distress communication methods	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify marine communication systems • Write observation reports on: ➤ Marine radio operations; ➤ Lights and sound signal ➤ Different forms of emergency	Guide students to: • Identify marine communication systems • Write observation reports on: ➤ Marine radio operations; ➤ Lights and sound signal ➤ Different	Video clips, Multimedia projector, Marine communication gadgets, Charts, Practical manual.

				communication such as Lights and Sound Signals according to COLREGS	forms of emergency communication such as Lights and Sound Signals according to COLREGS	
General Objective 4.0: Understand marine seamanship techniques						
8-9	4.1 Explain seamanship procedures. 4.2 Explain how to handle and maneuver boats. 4.3 Explain anchoring and mooring. 4.4 Explain maintenance of marine equipment.	- Describe seamanship procedures - Discuss how to handle and maneuver boats. - Discuss anchoring and mooring - Explain maintenance of marine equipment	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Carry out visit to observe knotting and splicing of ropes. - Carry out boat handling practical	Guide students to: - Observe knotting and splicing using video clips - Carry out boat handling practical	Boat, Video clips, Charts, Multimedia projector, PPE.
General Objective 5.0: Know how to apply marine safety and emergency response procedures.						

10-12	5.1 Explain marine safety procedures. 5.2 Explain how to prevent onboard accident. 5.3 Explain marine safety equipment. 5.4 Explain emergency response operations.	• Discuss marine safety procedures • Describe how to prevent onboard accident • Describe marine safety equipment • Discuss emergency response operations	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Demonstrate safety drills • Demonstrate Firefighting drills • Demonstrate the use of life-saving equipment	Guide students to: • Demonstrate safety drills • Demonstrate Firefighting drills • Demonstrate the use of life-saving equipment	Firefighting equipment, Safety charts, PPE, Videos clips, Multimedia projector.
General Objective 6.0: Understand marine environmental management principles						
13-15	6.1 Explain marine environmental management. 6.2 Explain marine pollution. 6.3 Explain maritime laws and conventions. 6.4 Explain sustainable marine operations.	• Discuss marine environmental management • Describe marine pollution • Discuss maritime laws and conventions • Explain sustainable marine operations.	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Simulate onboard environmental sanitation • Carry out maritime regulation case studies	Guide students to: • Observe onboard environmental sanitation • Carry out maritime regulation case studies	Video clips, Charts, Multimedia projector, Copies of maritime regulations.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

INTEGRATED FISH FARMING

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: INTEGRATED FISH FARMING	COURSE CODE: AFT 414	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 acquaint students with the knowledge and skills of integrated aquaculture		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept of integrated fish farming; 2.0 Know energy relationships in grazing and detritus food chain in integrated fish farming; 3.0 Know water quality management in integrated fish farming; 4.0 Understand the concept of aquaponics; 5.0 Know the Management of an integrated fish farm.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: INTEGRATED FISH FARMING			COURSE CODE: AFT 414		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 acquaint students with the knowledge and skills of integrated aquaculture						
GENERAL OBJECTIVE 1.0: Understand the concept of integrated fish farming						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain the concept of integrated fish farming 1.2 Explain possible integrated fish farming combinations. 1.3 Explain the advantages and possible disadvantages of integrated fish farming	• Discuss scope of integrated fish farming. • Discuss the importance of integrated fish farming to the community • Discuss the maximum utilization of both land, animal and space available • Discuss scare of possible disease outbreak due poor	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out study visit to integrated fish farm for practical observation of the farming concept • Write a technical report on the outcome of the study visit (s).	Guide students to • Carry out study visit to integrated fish farm for practical observation of the farming concept • Write a technical report on the outcome of the study visit (s).	Notepad, Camera, Practical manual etc.

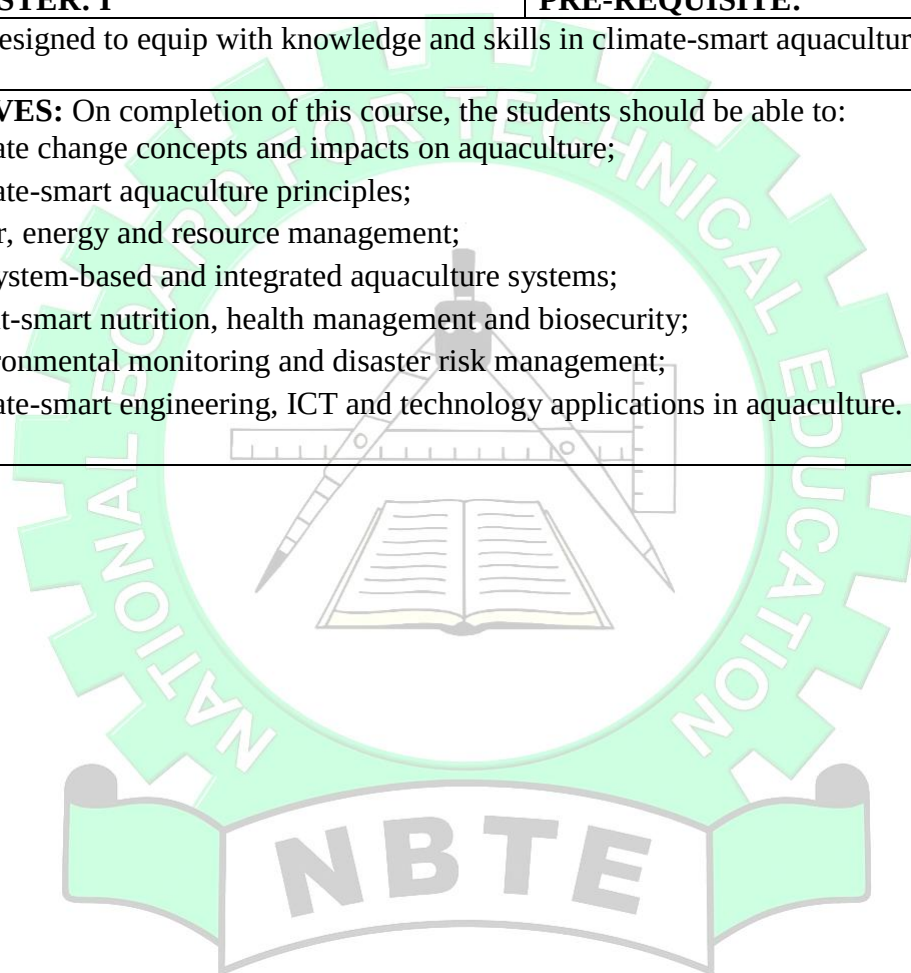
		management				
General Objective 2.0: Know energy relationships in grazing and detritus food chain in Integrated fish farming.						
4-5	2.1 Explain food chain and food web. 2.2 Explain food chain and food web in an integrated fish farm. 2.3 Explain energy transfers in foodchain and food web. 2.4 Explain energy flow within the food chain and food web for fish ponds. 2.5 Explain food chain and food web involving farm animals.	- Discuss food chain and food web - Describe energy flow in fish farm (ponds) - Explain food chain and food web involving farm animals (poultry/piggery /cattle/ goatry, etc.)	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
General Objective 3.0: Know water quality management in integrated fish farming						
6-8	3.1 Explain the nutrient composition of different farm animal droppings, effluent, and decayed plant materials. 3.2 Explain the overloading effects of	Explain the nutrient composition of different farm animal droppings, effluent, and decayed plant	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials,	Carry out water quality test on water samples from an integrated fish farm.	Guide students to Test water from an integrated fish farm.	Water quality test kits, Assorted waste management facilities Earthen ponds, Tanks

	3.1 above on water quality. 3.3 Explain optimum water quantity for integrated fish farming.	materials - Explain the overloading effects of 3.1 above on water quality - Explain optimum water quantity for integrated fish farming	etc.			
General Objective 4.0: Understand the concept of aquaponics						
9-12	4.1 Explain the concept of aquaponics. 4.2 Explain the history of aquaponics. 4.3 Outline different types of aquaponics system. 4.4 Explain the physical components of aquaponics. 4.5 Explain the biological factors of aquaponics. 4.6 Explain hydroponics subsystem. 4.7 Explain design and construction of simple aquaponics system. 4.8 Explain the	- Discuss aquaponics and its principles - Discuss history of aquaponics - Describe different types of aquaponics - Describe the structures and design a simple aquaponics - Discuss biotic factors in aquaponics - Describe	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	Carry out design and construction of simple aquaponics system	Guide students to - Design simple aquaponics system - Construct simple aquaponics system	Fish tank, Grow bed, Seedlings, Hacksaw, Shovel, Wheelbarrow, Fertilizer, PPE. Grow media, Water pump, AFTtings, PVC gum, Measuring tape, PVC pipes and Filter,

	maintenance process of aquaponics system.	hydroponic structures				
		Describe the general management of the aquaponics system				
General Objective 5.0: Know the Management of an integrated fish farm						
13-15	5.1 Explain possible ways of managing an integrated fish farm. 5.2 Explain routine water quality maintenance in an integrated fish pond. 5.3 Explain biosecurity procedure in an integrated fish farm. 5.4 Explain the use of ICT tools in integrated fish farming.	- Discuss possible ways of managing an integrated fish farm - Discuss routine water quality maintenance in an integrated fish pond - Discuss biosecurity procedure in an integrated fish farm - Discuss the use of ICT tools in integrated fish farming	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

CLIMATE-SMART AQUACULTURE

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: CLIMATE-SMART AQUACULTURE	COURSE CODE: AFT 415	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip with knowledge and skills in climate-smart aquaculture systems		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand climate change concepts and impacts on aquaculture; 2.0 Understand climate-smart aquaculture principles; 3.0 Understand water, energy and resource management; 4.0 Understand ecosystem-based and integrated aquaculture systems; 5.0 Understand climate-smart nutrition, health management and biosecurity; 6.0 Understand environmental monitoring and disaster risk management; 7.0 Understand climate-smart engineering, ICT and technology applications in aquaculture.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: CLIMATE-SMART AQUACULTURE		COURSE CODE: AFT 415			CONTACT HOURS: 4HOURS/WEEK	
		CREDIT UNIT: 4			THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I		PRE-REQUISITE:			PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip with knowledge and skills in climate-smart aquaculture systems						
GENERAL OBJECTIVE 1.0: Understand climate change concepts and impacts on aquaculture.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain the concept of climate change. 1.2 Explain greenhouse gases and global warming. 1.3 Explain causes and effects of climate change. 1.4 Describe climate variability and extreme weather events. 1.5 Explain impacts of climate change on fisheries and aquaculture. 1.6 Explain climate risks in	• Discuss the concept of climate change • Explain greenhouse gases and global warming • Explain causes and effects of climate change • Describe climate variability and extreme weather events • Discuss impacts of climate change on fisheries and aquaculture • Explain climate risks in aquaculture production	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

	aquaculture production.					
General Objective 2.0: Understand climate-smart aquaculture principles						
2-3	2.1 Explain climate-smart aquaculture principles. 2.2 Explain sustainability and resilience principles. 2.3 Describe resilient aquaculture systems. 2.4 Explain resource efficiency in aquaculture.	• Explain climate-smart aquaculture principles (Sustainable productivity, enhanced resilience and reduced emission) • Discuss sustainability and resilience principles • Discuss resilient aquaculture systems ➢ Earthen ponds ➢ Cages ➢ Recirculatory aquaculture systems • Explain resource efficiency in aquaculture	Case study video, Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Visit farms and observe different aquaculture systems and identify their level of resilience • Carry out a comparative analysis of aquaculture systems based on resilience	Guide students to: • Visit farms and observe different aquaculture systems and identify their level of resilience • Carry out a comparative analysis of aquaculture systems based on resilience	Video clips, GPS, GIS, Camera.
General Objective 3.0: Understand water, energy and resource management						
4-5	3.1 Explain water conservation techniques. 3.2 Describe water recycling systems. 3.3 Explain renewable	• Explain water conservation techniques • Discuss water recycling systems • Explain renewable	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional	• Write and observation report on water conservation facilities e.g., dams, ponds,	Guide student to: • Observe water conservation facilities e.g., dams, ponds, reservoir, etc.	Shovels, Wheelbarrow, Water testing kit, Video clips of biogas

	energy applications. 3.4 Explain energy-efficient aquaculture technologies. 3.5 Explain waste recycling and pollution control. 3.6 Describe resource management strategies.	energy applications • Explain energy-efficient aquaculture technologies • Discuss waste recycling and pollution control • Discuss resource management strategies	materials, etc.	reservoir, etc. • Carry out aquaculture waste recycling • Carry out renewable energy production using integrated fish farm waste (e.g., biogas production)	• Carry out aquaculture waste recycling • Carry out renewable energy production using integrated fish farm waste (e.g., biogas production)	production, Multimedia projector, Biogas equipment, Agricultural waste, PPE.
General Objective 4.0: Understand ecosystem-based and integrated aquaculture systems						
6-8	4.1 Explain ecosystem-based aquaculture principles. 4.2 Explain the concept of biodiversity conservation. 4.3 Describe Integrated farming systems. 4.4 Explain aquaponics systems. 4.5 Explain Integrated Multi-Trophic	• Discuss ecosystem-based aquaculture principles • Discuss the concept of biodiversity conservation • Explain Integrated farming systems • Explain aquaponics systems • Explain Integrated Multi-Trophic	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Visit an integrated farm to identify interaction of the various cultured organisms • Set-up a model of Integrated Multi-Trophic Aquaculture	Guide students to: • Visit an integrated farm to identify interaction of the various cultured organisms • Set-up a model of Integrated Multi-Trophic Aquaculture	Note pad, PVC pipes and accessories, Plumbing tools, PVC gum, Yarn, Plastic bowls, PPE.

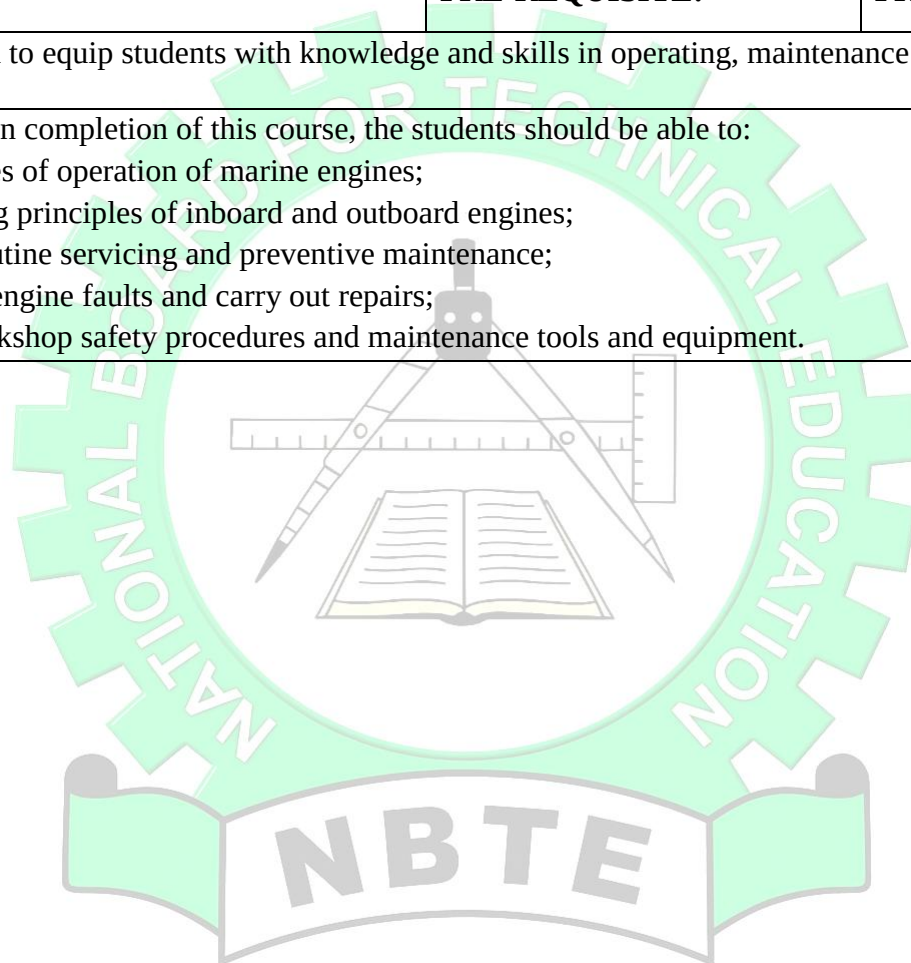
	4.6	Aquaculture (IMTA). Explain environmental sustainability practices.	Aquaculture (IMTA) • Discuss environmental sustainability practices				
General Objective 5.0: Understand climate-smart nutrition, health management and biosecurity							
9-10	5.1	Explain sustainable feed ingredients and their uses aquaculture.	• Discuss sustainable feed ingredients and their uses aquaculture	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify sustainable feed ingredients that can be used in aquaculture	Guide students to: • Identify sustainable feed ingredients that can be used in aquaculture • Demonstrate sustainable feeding practices • Demonstrate biosecurity procedures in a climate smart aquaculture system	Feed ingredients.
	5.2	Explain feeding management under changing climate conditions.	• Explain feeding management under changing climate conditions		• Demonstrate sustainable feeding practices		
	5.3	Explain climate-related fish diseases.	• Describe climate-related fish diseases		• Demonstrate biosecurity procedures in a climate smart aquaculture system		
	5.4	Explain stress management in aquaculture.	• Discuss stress management in aquaculture				
	5.5	Describe biosecurity measures.	• Explain biosecurity measures				
	5.6	Describe sanitation and quarantine procedures.	• Describe sanitation and quarantine procedures				
General Objective 6.0: Understand environmental monitoring and disaster risk management							

11-12	6.1 Describe water quality monitoring. 6.2 Explain climate monitoring techniques. 6.3 Explain flood management methods. 6.4 Explain drought management methods. 6.5 Explain disaster preparedness and response. 6.6 Describe climate adaptation and mitigation strategies. 6.7 Explain tools use in disaster risk assessment.	- Describe water quality monitoring - Explain climate monitoring techniques - Explain flood management methods - Explain drought management methods - Explain disaster preparedness and response - Describe climate adaptation and mitigation strategies - Discuss tools use in disaster risk assessment	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Use software tools in disaster risk assessment (e.g. CLIMADA, RiskScape, PlanSmart) - Simulate disaster response	Guide students to: - Use software tools in disaster risk assessment (e.g. CLIMADA, RiskScape, PlanSmart) - Simulate disaster response	CLIMADA, RiskScape, PlanSmart software, Computer.
General Objective 7.0: Understand climate-smart engineering, ICT and technology applications in aquaculture						
13-15	7.1 Explain the use of climate-resilient aquaculture structures.	Discuss the use of climate-resilient aquaculture	Whiteboard, Projector, Fisheries textbooks,	Set-up a simulation model of a	Guide students to: Set-up a simulation model	Computer, Internet, Note pad, PVC pipes

	7.2 Explain the use of climate-resilient engineering systems. 7.3 Explain ICT applications in aquaculture. 7.4 Describe the use of remote sensing and digital monitoring in climate aquaculture. 7.5 Explain the use automated and demand feeding and aeration systems in aquaculture. 7.6 Explain the economics of climate-smart aquaculture.	structures • Explain the use of climate-resilient engineering systems • Explain ICT applications in aquaculture • Describe the use of remote sensing and digital monitoring in climate aquaculture • Explain the use automated and demand feeding and aeration systems in aquaculture • Explain the economics of climate-smart aquaculture	Charts, Journals, Instructional materials, etc.	recirculatory aquaculture system • Download meteorological data from Nigerian Meteorological Agency (NIMET) portal (http://maproom.nimet.gov.ng/maproom/Agriculture/index.html) • Analyse weather data in relation to climate change	of a recirculatory aquaculture system • Download meteorological data from Nigerian Meteorological Agency (NIMET) portal (http://maproom.nimet.gov.ng/maproom/Agriculture/index.html) • Analyse weather data in relation to climate change	and accessories, Plumbing tools, PVC gum, Yarn, Plastic bowls, PPE.
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						

INBOARD AND OUTBOARD ENGINE MAINTENANCE

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: INBOARD AND OUTBOARD ENGINE MAINTENANCE	COURSE CODE: AFT 416	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in operating, maintenance and repairing inboard and outboard engines		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles of operation of marine engines; 2.0 Understand the operating principles of inboard and outboard engines; 3.0 Know marine engine routine servicing and preventive maintenance; 4.0 Know how to diagnose engine faults and carry out repairs; 5.0 Know how to apply workshop safety procedures and maintenance tools and equipment.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: INBOARD AND OUTBOARD ENGINE MAINTENANCE			COURSE CODE: AFT 416		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skill in operating, maintenance and repairing inboard and outboard engines						
GENERAL OBJECTIVE 1.0: Understand the principles of operation of marine engines						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain inboard and outboard engines and their importance on marine engines. 1.2 Explain types of Inboard and outboard engines. 1.3 Explain propulsion systems in marine engines. 1.4 Explain the components of marine engine and their functions.	• Discuss inboard and outboard engines and their importance on marine engines • Explain types of Inboard and outboard engines • Discuss propulsion systems in marine engines • Discuss the components of marine engine and their functions ➤ Cylinder block ➤ Pistons and piston	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify different components of an inboard and outboard engine	Guide students to: • Identify different components of an inboard and outboard engine	Inboard engine, Outboard engine, Scrap outboard engine, Workshop tools.

		- rings ➤ Crankshaft and camshaft ➤ Valves and timing gears ➤ Propeller systems				
General Objective 2.0: Understand the operating principles of inboard and outboard engines						
3-6	2.1 Explain principles of marine engine operation. 2.2 Explain fuel systems in marine engines. 2.3 Explain lubrication system in marine engine. 2.4 Explain cooling system in marine engine. 2.5 Explain ignition and electrical system in marine engine.	• Discuss principles of marine engine operation ➤ Two-stroke engines ➤ Four-stroke engines ➤ Combustion process ➤ Power transmission systems ➤ Engine performance characteristics • Discuss fuel systems in marine engines ➤ Fuel tanks and fuel lines ➤ Carburetors and fuel injectors ➤ Fuel pumps	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out fuel systems maintenance • Carry out lubrication and oil replacement • Carry out ignition maintenance • Carry out battery testing and maintenance	Guide 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, Fuel, Lubricants, PPE.

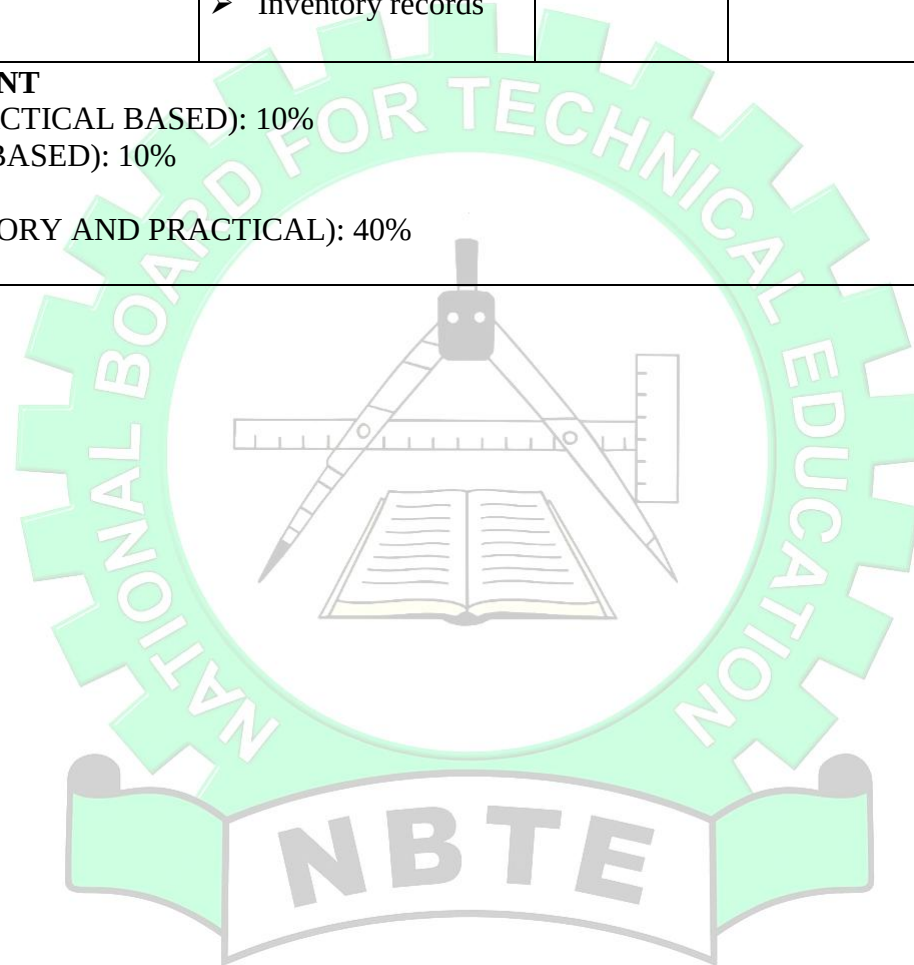
		➤ Fuel filtration systems ➤ Fuel system maintenance • Explain lubrication system in marine engine ➤ Functions of lubrication systems ➤ Types of lubricants ➤ Oil pumps and oil filters ➤ Oil replacement procedures ➤ Lubrication maintenance practices • Describe cooling system in marine engine ➤ Water cooling systems ➤ Air cooling systems ➤ Cooling pumps and thermostats ➤ Cooling system				
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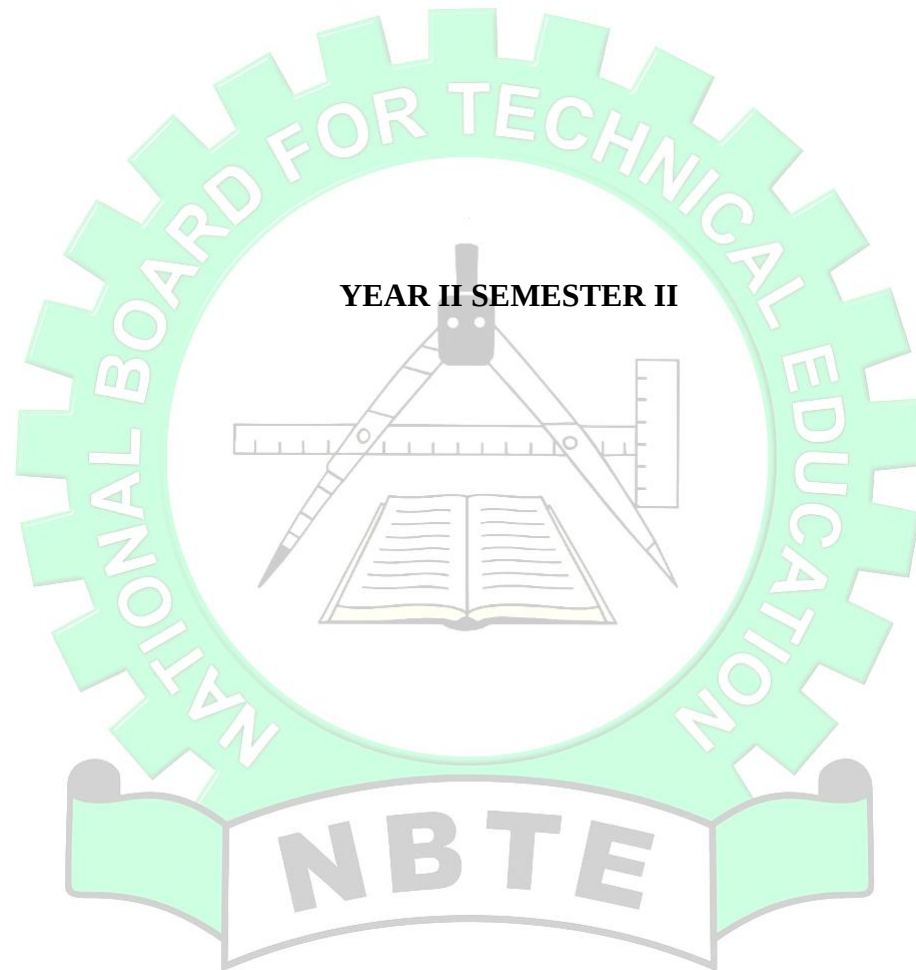
		servicing ➤ Prevention of overheating • Discuss ignition and electrical system in marine engine ➤ Spark plugs and ignition coils ➤ Batteries and charging systems ➤ Wiring systems ➤ Electrical troubleshooting ➤ Maintenance of electrical systems				
General Objective 3.0: Know marine engine routine servicing and preventive maintenance						
7-8	3.1 Explain maintenance schedules of marine engines. 3.2 Explain routine inspection procedures. 3.3 Explain cleaning and servicing methods in marine engines. 3.4 Describe preventive maintenance planning.	• Discuss maintenance schedules of marine engines • Discuss routine inspection procedures • Explain cleaning and servicing methods in marine engines • Describe preventive	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Demonstrate routine inspection procedure on a marine engine • Carry out overall cleaning and servicing of a marine engine.	Guide students to: • Demonstrate routine inspection procedure on a marine engine • Carry out overall cleaning and servicing of a marine engine.	Outboard engine Scrap outboard engine, Workshop tools, Fuel, Lubricants, Brushes, PPE.

		maintenance planning				
General Objective 4.0: Know how to diagnose engine faults and carry out repairs						
9-11	4.1 Describe common engine faults. 4.2 Explain troubleshooting procedures. 4.3 Describe how to replace faulty components of engines. 4.4 Describe how to repair of fuel systems. 4.5 Describe how to repair of ignition systems. 4.6 Describe how to propeller repairs. 4.7 Explain reassembling and testing of marine engine.	• Discuss common engine faults ➢ Engine starting problems ➢ Overheating issues ➢ Fuel supply problems • Discuss troubleshooting procedures • Describe how to replacement of faulty components of engines • Describe how to repair of fuel systems • Describe how to repair of ignition systems • Describe how to propeller repairs • Discuss reassembling and	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out engine troubleshooting procedures • Carry out repairs of fuel system • Carry out repairs of ignition system • Carry out repairs of propeller system	Guide students to: • Demonstrate engine troubleshooting procedures • Demonstrate repair of fuel system • Demonstrate repair of ignition system • Demonstrate repair of propeller system	Outboard engine, Scrap outboard engine, Workshop tools, PPE.

		testing of marine engine				
General Objective 5.0: Know how to apply workshop safety procedures and maintenance tools and equipment						
12-15	5.1 Explain workshop safety rules. 5.2 Describe method of handling flammable materials. 5.3 Explain fire prevention and control. 5.4 Explain the importance of Personal protective equipment (PPE). 5.5 Explain emergency response procedures. 5.6 Describe how to operate and maintain hand tools and power tools. 5.7 Describe how to use diagnostic equipment. 5.8 Explain calibration of equipment. 5.9 Explain safe handling and maintenance of workshop tools. 5.10 Explain record keeping in marine engine workshop.	• Describe workshop safety rules • Describe method of handling flammable materials • Discuss fire prevention and control • Discuss the importance of PPE • Describe emergency response procedures • Describe how to operate and maintain hand tools and power tools • Describe how to use diagnostic equipment • Explain calibration of equipment • Explain safe handling and maintenance of workshop tools • Explain record	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out workshop safety drills • Apply fire control procedures • Use diagnostic tool • Use calibration equipment • Demonstrate safe handling of workshop tools • Record maintenance activities	Guide students to: • Carry out workshop safety drills • Use diagnostic tool • Use calibration equipment • Demonstrate safe handling of workshop tools • Record maintenance activities	Outboard engine, Scrap outboard engine, Workshop tools, Fire extinguisher, Safety charts, Maintenance logbook, PPE.

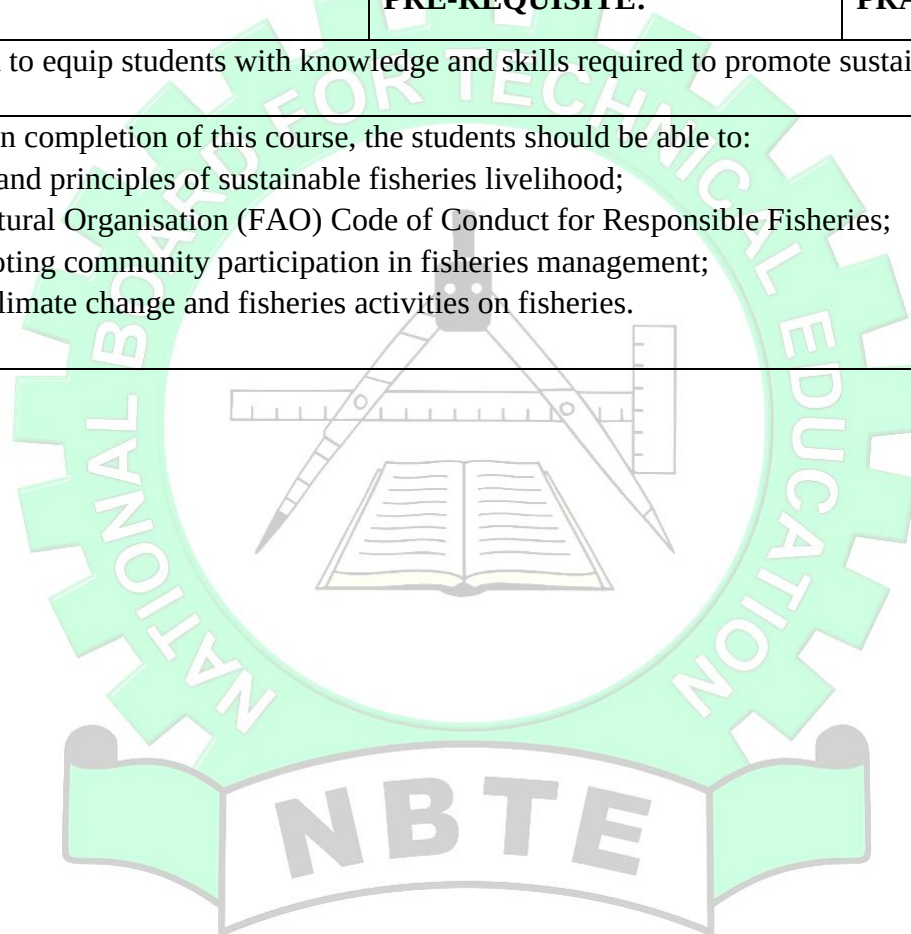
		keeping in marine engine workshop ➤ Maintenance logs ➤ Service schedules ➤ Repair records ➤ Inventory records				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						





SUSTAINABLE FISHERIES LIVELIHOODS

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: SUSTAINABLE FISHERIES LIVELIHOODS	COURSE CODE: AFT 421	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 to promote sustainable fisheries livelihoods and ensure responsible fisheries practices		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and principles of sustainable fisheries livelihood; 2.0 Know Food and Agricultural Organisation (FAO) Code of Conduct for Responsible Fisheries; 3.0 Know methods of promoting community participation in fisheries management; 4.0 Understand impacts of climate change and fisheries activities on fisheries.		



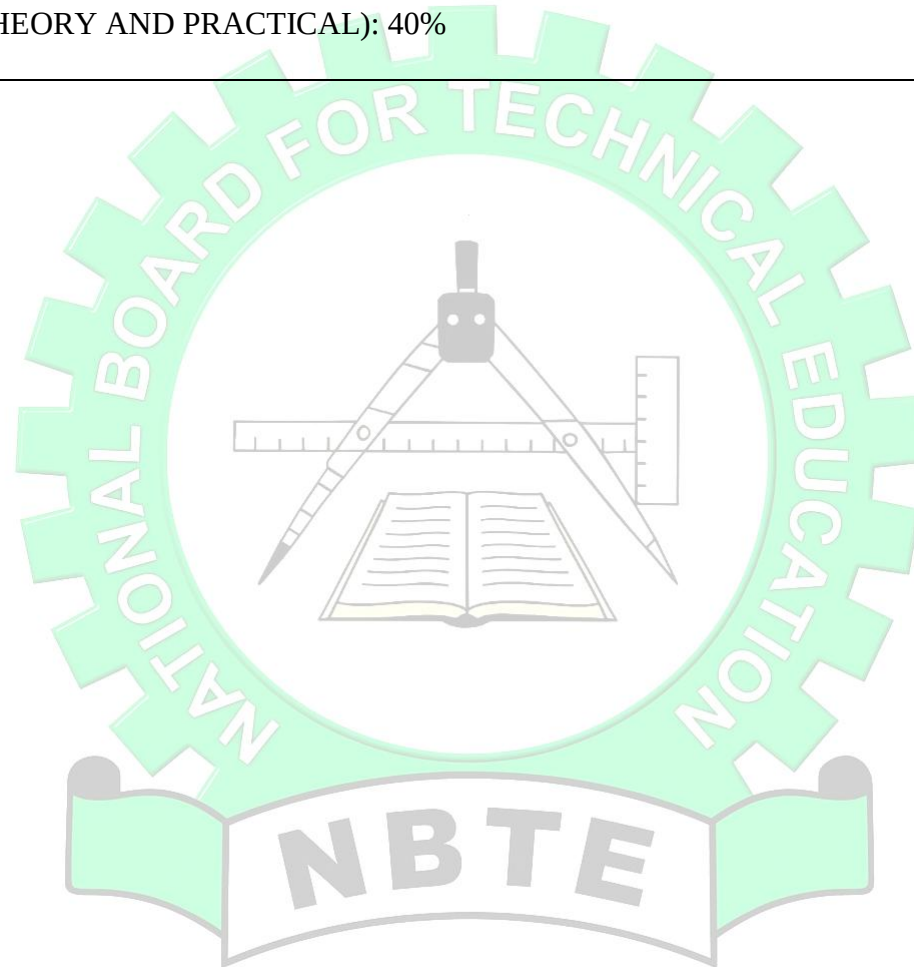
PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: SUSTAINABLE FISHERIES LIVELIHOODS		COURSE CODE: AFT 421		CONTACT HOURS: 3HOURS/WEEK		
		CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK		
YEAR: II SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 2HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills required to promote sustainable fisheries livelihoods and ensure responsible fisheries practices						
GENERAL OBJECTIVE 1.0: Understand the concept and principles of sustainable fisheries livelihood						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain sustainable livelihood concepts. 1.2 Explain fisheries livelihood systems. 1.3 Describe components of livelihood assets. 1.4 Explain the characteristics of sustainable livelihood systems. 1.5 Describe vulnerability context. 1.6 Explain livelihood diversification 1.7 Explain fisheries value chain	- Discuss sustainable livelihood concepts; - Explain fisheries livelihood systems; - Discuss components of livelihood assets (Natural, social, financial, Physical, and Human assets) - Discuss the characteristics of sustainable livelihood systems (ecological, economic, and social sustainability)	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	- Identify indicators of sustainability in a fishing community - Identify livelihood assets of a fishing community - Identify vulnerability context of a fishing community - Identify livelihood opportunities in fisheries	Guide student to: - Identify indicators of sustainability fishing community - Identify livelihood assets of fishing community - Identify vulnerability context of a fishing community - Identify livelihood opportunities in fisheries	Camera, Notepad, Recorder, Map, GPS devices, Charts.

	opportunities. 1.8 Explain the role of small-scale fisheries. 1.9 Explain poverty reduction strategies.	• Discuss Vulnerability context • Discuss livelihood diversification • Explain fisheries value chain opportunities • Explain the role of small-scale fisheries • Discuss poverty reduction strategies				
General Objective 2.0: Know FAO Code of Conduct for Responsible Fisheries						
4-7	2.1 Explain the background and objectives of the Code of conduct for responsible fisheries (CCRF). 2.2 Explain objectives and principles of the CCRF. 2.3 Explain the Rights and obligations of states. 2.4 Explain International fisheries agreements. 2.5 Explain international fisheries standards.	• Discuss the background and objectives of the Code of conduct for responsible fisheries (CCRF) • Explain objectives and principles of the CCRF • Explain the Rights and obligations of states • Explain International fisheries agreements	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc. Charts, FAO manuals FAO Code publications Videos, conservation manuals	• Visit fishing community to: i. Identify responsible fishing gears ii. Identify responsible fishing methods	Guide student to • visit fishing community to: i. Identify responsible fishing gears ii. Identify responsible fishing methods	Camera, Notepad, Recorder, Map, GPS devices, Meter rule, Charts.

	2.6 Describe responsible fishing practices.	• Discuss international fisheries standards • Describe responsible fishing practices ➤ Responsible fishing gear selection ➤ Selective fishing methods ➤ By-catch reduction technologies ➤ Illegal, unreported, and unregulated (IUU) fishing				
General Objective 3.0: Know methods of promoting community participation in fisheries management						
8-11	3.1 Explain fisheries governance concepts. 3.2 Explain the principles of Co-management in fisheries. 3.3 Describe community fisheries organizations. 3.4 Explain participatory fisheries management. 3.5 Explain conflict resolution. 3.6 Explain gender roles	• Discuss fisheries governance concepts • Explain the principles of Co-management in fisheries • Describe community fisheries organizations • Discuss participatory fisheries management • Explain conflict	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Demonstrate conflict resolution in a fishing community using role play • Identify gender roles in fisheries value chain	Guide students to: • Demonstrate conflict resolution in a fishing community using role play • Identify gender roles in fisheries value chain	Video clips, Multimedia projector, Charts.

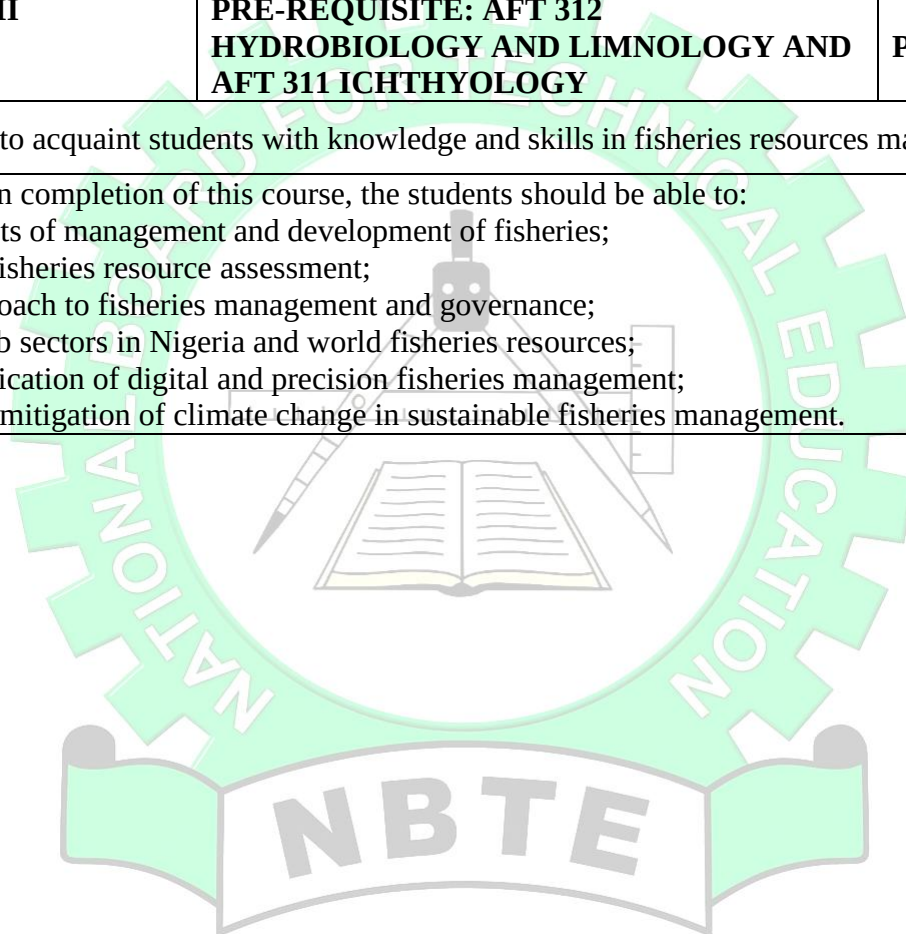
	in fisheries value chain. 3.7 Explain strategies of empowering women and youth in fishing communities. 3.8 Explain social inclusion strategies and equity in fisheries resource access.	resolution • Discuss gender roles in fisheries value chain • Discuss strategies of empowering women and youth in fishing communities • Discuss social inclusion strategies and equity in fisheries resource access				
General Objective 4.0: Understand impacts of climate change and fisheries activities on fisheries						
12-15	4.1 Explain aquatic biodiversity conservation. 4.2 Explain habitat protection measures. 4.3 Explain impacts of climate change on fisheries. 4.4 Describe adaptation strategies to climate change in fishing communities. 4.5 Explain the impact of fisheries activities on	• Discuss aquatic biodiversity conservation • Discuss habitat protection measures • Explain impacts of climate change on fisheries • Discuss adaptation strategies to climate change in fishing communities • Explain the impact of fisheries activities	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify some impacts of climate change on fisheries • Identify impact of fisheries activities on aquatic ecosystems	Guide students to: • Identify some impacts of climate change on fisheries • Identify impact of fisheries activities on aquatic ecosystems	Videos clips, Conservation manuals, Charts, Multimedia projector, Climate reports

	aquatic ecosystems.	on aquatic ecosystems				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



FISHERIES RESOURCES MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: FISHERIES RESOURCES MANAGEMENT	COURSE CODE: AFT 422	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: AFT 312 HYDROBIOLOGY AND LIMNOLOGY AND AFT 311 ICHTHYOLOGY	PRACTICAL: 3HOURS/WEEK
GOAL: The course is designed to acquaint students with knowledge and skills in fisheries resources management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the basic concepts of management and development of fisheries; 2.0 Understand the methods in fisheries resource assessment; 3.0 Understand the various approach to fisheries management and governance; 4.0 Know the major fisheries sub sectors in Nigeria and world fisheries resources; 5.0 Know the concepts and application of digital and precision fisheries management; 6.0 Understand the impacts and mitigation of climate change in sustainable fisheries management.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: FISHERIES RESOURCES MANAGEMENT		COURSE CODE: AFT 422			CONTACT HOURS: 4 HOURS/WEEK	
		CREDIT UNIT: 4			THEORETICAL: 1 HOURS/WEEK	
YEAR: II SEMESTER: II		PRE-REQUISITE: AFT 312 HYDROBIOLOGY AND LIMNOLOGY AND AFT 311 ICHTHYOLOGY			PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to acquaint students with knowledge and skills in fisheries resources management						
GENERAL OBJECTIVE 1.0: Understand the basic concepts of management and development of fisheries						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain the bio-socioeconomic concept of fishery. 1.2 Explain the classification of aquatic resources. 1.3 Explain fishing efforts. 1.4 Explain fisheries management and development. 1.5 Explain the historical trend of exploitation in commercial fisheries. 1.6 Explain the possible levels of sustainability of fisheries resources (overfishing, under fishing and	- Discuss the basic concepts of a fishery and resources - Explain the biological and socio-economic dimension of fishing efforts - Discuss management and development of a fishery - Discuss the evolving phases experienced by a	Whiteboard, Projector, fisheries Textbooks, Charts, Journals, Instructional materials, etc.	- Analyze fish catch and effort data to determine the Catch Per Unit of Effort (CPUE) - Perform analysis and interpretation of fish catch and effort data to determine the phases of development of the fishery	Guide students to - Analyze fish catch and effort data to determine the CPUE - Analyze and interpret fish catch and effort data to determine the phases of development of the fishery	Fish catch and effort data, Official fisheries data, Computer, Excel/SPSS software.

	sustainable fishing). 1.7 Outline the objectives of fisheries management and development. 1.8 Explain the reference points in the management and development of fisheries resources.	commercial fishery as a result of exploitation (virgin, full-exploitation, over-exploitation, senescence, recovery/collapse) • Discuss the objectives of fisheries management and development • Explain the reference points in the management and development of fisheries resources (Maximum Sustainable Yield (MSY), Maximum Economic Yield (MEY) and Bioeconomic equilibrium)				
General Objective 2.0: Understand the methods in fisheries resource assessment						
4-6	2.1 Explain the significance of fisheries resource assessment. 2.2 Explain Fisheries	• Discuss the significance of fisheries resource	Whiteboard, Projector, fisheries Textbooks,	• Visit a fishing community • Review the elements of the	Guide students to: • Visit a fishing community • Review the	Question guide, Camera, Measuring

	survey methods. 2.3 Explain the basics of fish stock assessment. 2.4 Explain steps in fish stock assessment. 2.5 Explain mathematical models in fisheries. 2.6 Describe the structure of model. 2.7 Describe types of models and their uses in fish stock assessment. 2.8 Describe experimental fishery survey methods.	assessment to sustainable fisheries • Discuss the methods of fisheries surveys (Frame, Catch Assessment and Market surveys) • Explain the basics of fish stock • Explain fish stock assessment • Explain steps in stock assessment • Explain mathematical models in fisheries • Describe the structure of model • Describe types of models and their uses in fish stock assessment ➤ Holistic models - (Models for	Charts, Journals, Instructional materials, etc.	fisheries statistics in published official fisheries data (e.g., FDFA) • Collect and organize fisheries data • Carry out experimental fishery survey and data collection under: ➤ Gillnet survey ➤ Comparative yield estimates ➤ Biological data-time series ➤ Chemical ➤ Mark and recaptures.	elements of the fisheries statistics in published official fisheries data (e.g. FDF &A) • Collect and Organize fisheries data • Carry out experimental fishery survey and data collection • Carry out commercial fishingsurvey in lakes, reservoir or river	board, Recorder, Fish identification guide, Charts, GPS devices, Official fisheries publication.
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		potential yield; Empirical regression models; ➤ Morpho-edaphic index; ➤ Surplus production models) ➤ Analytical models (Dynamic pool models) • Describe experimental fishery survey methods Gillnet survey as index of abundance and C.U.E ➤ Comparative yield estimates ➤ Biological data-time series ➤ Chemical method ➤ Acoustic method ➤ Electrofishing				
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		➤ Traps ➤ Active gear ➤ Mark and recapture				
General Objective 3.0: Know the major fisheries sub sectors in Nigeria and world fisheries resources						
7-9	3.1 Describe inland water resources of Nigeria. 3.2 Describe coastal water resources. 3.3 Describe the sub-sectors of fisheries. 3.4 Explain the contribution of the subsectors in 3.3 above to domestic fish production. 3.5 Describe the different types of artisanal fisheries. 3.6 Describe the characteristics of industrial fisheries (on-shore and offshore). 3.7 Explain the drivers of fish productivity in the marine environment – Continental shelf and ocean currents. 3.8 Outline the productive	• Discuss the inland water resources of Nigeria • Discuss the coastal water resources • Describe the sub sectors of fisheries under: i. Artisanal, ii. Industrial, iii. Aquaculture iv. Ornamental v. Recreational • Describe the different types of artisanal fisheries i. Coastal canoe fisheries ii. Brackish water	Whiteboard, Projector, fisheries Textbooks, Charts, Journals, Instructional materials, etc.	• Identify the geographical locations of the inland and coastal water resources of Nigeria using hydrological map • Characterize the performance of fisheries subsectors in Nigeria using fisheries data from the FDFA • Characterize the performance of global fisheries subsectors using FAO	Guide students to • Identify the geographical locations of the inland and coastal water resources of Nigeria • Characterize the performance of fisheries subsectors in Nigeria	Maps, FDFA Fish production statistics, FAO, State of the World Fisheries, Computer.

	fish species in the world oceans stating their adaptive features 3.9 Explain world marine fisheries management	fisheries iii. Freshwater fisheries • • Describe the characteristics of industrial fisheries (on-shore and off shore) • Give a general overview of world fish production from marine, inland and aquaculture • Explain world marine fisheries management				
General Objective 4.0 Understand the various approach to fisheries management and governance						
10-12	4.1 Explain types of fisheries management 4.2 Explain Fisheries management approaches and measures. 4.3 Explain restricted output/Catch control. 4.4 Explain factors that	• Discuss types of fisheries management: ➢ No management ➢ Traditional/ community management ➢ Government led fisheries	Whiteboard, Projector, fisheries Textbooks, Charts, Journals, Instructional materials, etc.	• Carry-out visit to a fishing community • Conduct survey of traditional fisheries management measures in use in a fishing community	Guide the students to: • Carry-out visit to a fishing community • Conduct survey of traditional fisheries management measures in use	Inland fisheries Acts, Sea fisheries Acts, State fisheries edict, Fisheries By-laws.

	determine suitability of management approach. 4.5 Describe traditional management strategies among artisanal fisheries (restriction, floodplain intensification). 4.6 Explain the fisheries laws and regulation available at national and sub-national levels in Nigeria.	management ➤ Co-management • Discuss Fisheries management approaches and measures ➤ Access limitations/input restriction ➤ Restricted effort input/input (effort) control ➤ Restricted output/catch control ➤ Ecosystem Approach to Fisheries (Protected areas Habitat enhancement) ➤ Indirect economic instruments (Tax, market-based tools and			in a fishing community	
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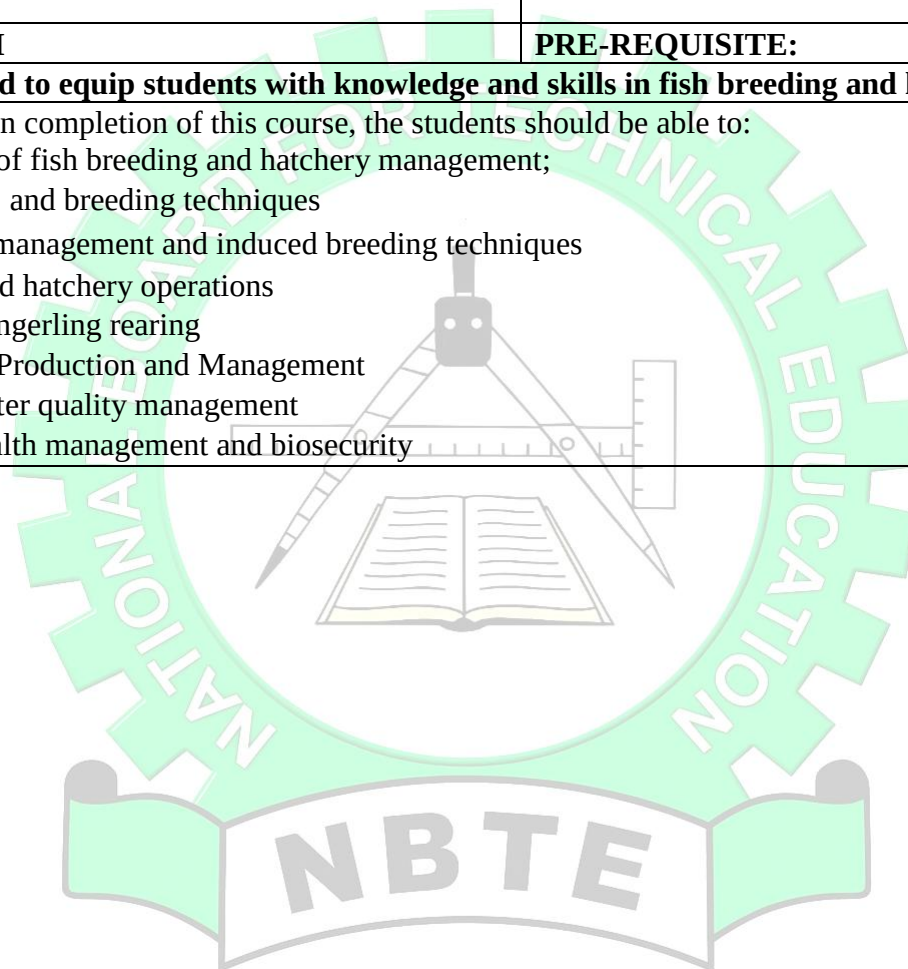
		livelihood diversification) • Explain factors that determine suitability of management approach • Describe traditional management strategies among artisanal fisheries (taboo, ritual restriction, closed season, gear restriction, floodplain intensification) • Discuss the fisheries laws and regulation available at national and sub-national levels in Nigeria				
General Objective 5.0: Know the concepts and application of digital and precision fisheries management						
13-14	5.1 Explain the concept of digital fisheries	• Discuss the fundamentals,	Whiteboard, Projector, fisheries	• Design simple digital survey forms	Guide Students to: • Design simple	GPS devices, Videos, Computer,

	management. 5.2 Explain advantages and challenges of digital systems in fisheries. 5.3 Describe applications of GIS and remote sensing in fisheries. 5.4 Explain how to use GPS devices for fisheries mapping and navigation. 5.5 Explain how to conduct digital fisheries data collection and management. 5.6 Explain the role of drones, sensors and IoT in fisheries. 5.7 Explain how to interpret spatial fisheries data for management decisions.	advantages and application of digital systems in sustainable fisheries • Discuss the applications of GIS and remote sensing in fisheries • Discuss how to use GPS devices for fisheries mapping and navigation. • Discuss the steps in conducting fisheries data collection and management • Discuss the role of drones, sensors, and IoT in fisheries. • Discuss how to Interpret fisheries information for management decisions	Textbooks, Charts, Journals, Instructional materials	• Carry-out Fisheries data entry using spreadsheets • Carry-out Data cleaning and organization	digital survey forms • Carry out Fisheries data entry using spreadsheets • Carry out Data cleaning and organization	Software.
General Objective 6.0: Understand the impacts and mitigation of climate change in sustainable fisheries management						
15	6.1 Explain climate change concept	• Discuss climate change concept	Whiteboard, Projector, fisheries	• Carry out Fisheries vulnerability	Guide students to: • Carry-out	Camera, Video recorder,

6.2 Describe impacts of climate change on fisheries resources	• Explain impacts of climate change on fisheries resources.	Textbooks, Charts, Journals, Instructional materials, etc.	assessment • Carry out climate risk mapping • Carry out analysis of climatic and fisheries datasets	Fisheries vulnerability assessment • Carry-out climate risk mapping • Carry-out analysis of climatic and fisheries datasets	GPS devices, Map.
6.3 Explain fisheries vulnerability to climate-related risks	• Explain fisheries vulnerability to climate-related risks.				
6.4 Explain climate adaptation and mitigation strategies.	• Discuss climate adaptation and mitigation strategies.				
6.5 Explain climate-smart fisheries approaches.	• Explain climate-smart fisheries approaches.				
6.6 Explain resilience-building measures for fisheries communities.	• Discuss resilience-building measures for fisheries communities				
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%					

FISH BREEDING AND HATCHERY MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: FISH BREEDING AND HATCHERY MANAGEMENT	COURSE CODE: AFT 423	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in fish breeding and hatchery management		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept of fish breeding and hatchery management; 2.0 Understand fish genetics and breeding techniques 3.0 Understand broodstock management and induced breeding techniques 4.0 Know egg incubation and hatchery operations 5.0 Understand larval and fingerling rearing 6.0 Know Tilapia Hatchery Production and Management 7.0 Understand hatchery water quality management 8.0 Understand hatchery health management and biosecurity		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: FISH BREEDING AND HATCHERY MANAGEMENT		COURSE CODE: AFT 423			CONTACT HOURS: 4HOURS/WEEK	
		CREDIT UNIT: 4			THEORETICAL: 1HOUR/WEEK	
YEAR: II 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 fish breeding and hatchery management						
GENERAL OBJECTIVE 1.0: Understand the principles and importance of fish breeding and hatchery management						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.5 Explain concept and scope of fish breeding. 1.6 Explain importance of hatcheries in fish production. 1.7 Explain fish reproductive anatomy and physiology. 1.8 Explain hatchery organization and management. 1.9 Explain fish breeding seasons and environmental factors. 1.10 Explain hatchery design and structures. 1.11 Explain factors to be considered in site selection for fish hatchery.	• Discuss concept and scope of fish breeding • Discuss importance of hatcheries in fish production • Discuss hatchery organization and management • Discuss fish breeding seasons and environmental factors	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Visit a fish hatchery • Identify different sections of a fish hatchery	Guide students to: • Visit a fish hatchery • Identify male and female fish using external features • Identify different sections of a fish hatchery	Fish hatchery Incubation tank, Broodstock ponds, Nursery tank, Fingerlings production tank,

General Objective 2.0: Understand the genetic principles in selective breeding and hybridization programs						
3	2.1 Explain the principles of fish genetic and inheritance. 2.2 Explain the modern genetic selection methods used in aquaculture. 2.3 Explain the molecular tools used in fish breeding programme. 2.4 Explain the application of biotechnology in aquaculture. 2.5 Explain the techniques use in hybridization and chromosomes manipulation techniques.	• Discuss the principles of fish genetic and inheritance (Mendelian, dominant and recessive traits, genetic variation, etc.) • Discuss the modern genetic selection methods used in aquaculture • Discuss the molecular tools used in fish breeding programme • Explain the application of biotechnology in aquaculture • Discuss the various techniques use	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.			

		in hybridization, and chromosomes manipulation techniques (gene editor				
General Objective 3.0: Understand broodstock management and induced breeding techniques						
4-5	3.1 Explain characteristics of quality brood stock. 3.2 Explain Brood stock nutrition and feeding. 3.3 Explain Sex differentiation techniques. 3.4 Explain Brood stock conditioning and management. 3.5 Describe Transportation and handling of brood fish. 3.6 Explain Natural and induced breeding. 3.7 Explain Hormones used in aquaculture. 3.8 Explain Hormone dosage calculations. 3.9 Describe injection procedures. 3.10 Explain latency period. 3.11 Describe egg stripping and milt collection.	• Explain characteristics of quality brood stock • Explain Brood stock nutrition and feeding • Explain Sex differentiation techniques • Explain Brood stock conditioning and management • Describe Transportation and handling of brood fish • Explain Natural and induced breeding • Explain Hormones used in	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out brood stock selection exercises • Carry out sexing of brood fish • Demonstrate brood stock handling and conditioning • Carry out hormone preparation and injection • Calculate hormone dosage • Carry out stripping and fertilization	Guide students to: • Carry out brood stock selection exercises • Carry out sexing of brood fish • Demonstrate brood stock handling and conditioning • Carry out hormone preparation and injection • Calculate hormone dosage • Carry out stripping and fertilization	Fish brood stock, Hormones, Syringe and needle, Saline solution, feather, Dissecting kits, Weighing balance, Towel, Plastic bowls, Thermometer, Water analysis kits, Disinfectant s, PPE.

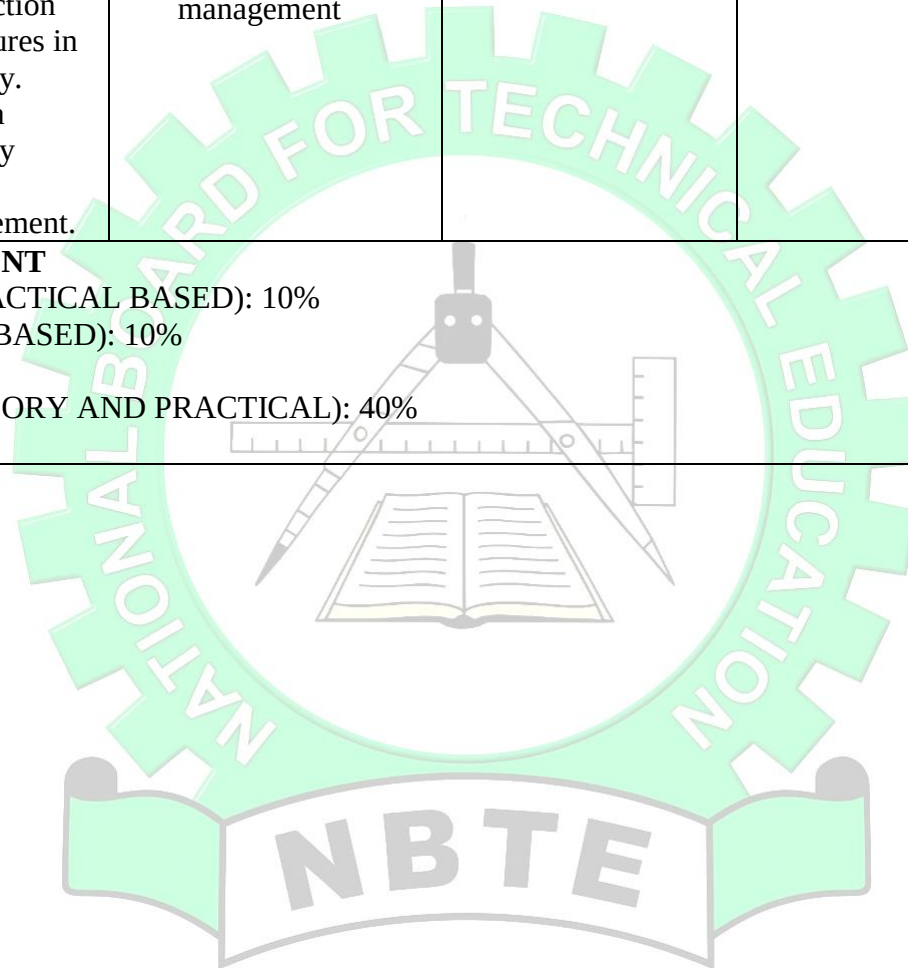
	3.12 Describe artificial fertilization methods.	aquaculture • Explain Hormone dosage calculations • Describe injection procedure • Describe latency period • Describe egg stripping and milt collection • Describe artificial fertilization methods				
General Objective 4.0: Know egg incubation and hatchery operations						
6-7	4.1 Explain incubation equipment and management. 4.2 Describe the embryonic development stages of fish. 4.3 Explain how to carry out hatchability assessment. 4.4 Describe how to calculate	• Discuss egg incubation equipment and management • Describe the embryonic development stages of fish • Explain how to Carry out hatchability assessment • Describe how to calculate	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Set up an incubator • Monitor egg development in the hatchery • Calculate hatchability • Calculate survival rate	Guide students to: • Set up an incubator • Monitor egg development in the hatchery • Calculate hatchability • Calculate survival rate	Spawning tank, Hormones, Syringes Hapas, Plastic bowl Incubation tray, Water testing kits, Thermometer, Weighing balance Microscope, Dissecting

	hatchability and survival rate calculations. 4.5 Describe hatchery sanitation procedures.	hatchability and survival rate calculations • Describe hatchery sanitation procedures				kits, PPE.
General Objective 5.0: Understand larval and fingerling rearing						
8-9	5.1 Explain larval rearing systems. 5.2 Explain fry nutrition. 5.3 Explain fry feeding and feeding methods. 5.4 Explain live feed production. 5.5 Describe fry grading methods. 5.6 Explain nursery management.	• Discuss larval rearing systems • Explain fry nutrition • Discuss fry feeding and feeding methods • Explain live feed production • Describe fry grading methods • Explain nursery management	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out larval feeding exercises • Carry out fry grading practical • Carry out fry nursery management	Guide students to: • Carry out larval feeding exercises • Carry out fry grading practical • Carry out fry nursery management	Fry and fingerling Live fish food, Aerator, Fry feed.
General Objective 6.0: Know Tilapia Hatchery Production and Management						
10-11	6.1 Explain the reproductive biology of Tilapia. 6.2 Explain hatchery systems for	• Discuss the reproductive biology of Tilapia • Discuss hatchery systems for tilapia production:	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify male and female tilapia using external features • Carry out egg collection from	Guide students to: • Identify male and female tilapia using external features • Carry out egg collection from the mouth of brood fish	Hapa net, Incubation jars, Tilapia brood fish Hormone Fry feed, Aerator,

	tilapia production. 6.3 Explain tilapia brood stock management. 6.4 Explain tilapia breeding techniques. 6.5 Describe method of egg collection and handling. 6.6 Explain egg incubation and fry production. 6.7 Explain method of monosex Tilapia production.	➤ Concrete tanks ➤ Earthen ponds ➤ Hapas ➤ Recirculatory systems • Discuss tilapia brood stock management • Discuss tilapia breeding techniques ➤ Natural spawning method ➤ Tank and hapa breeding methods • Describe method of egg collection and handling • Discuss egg incubation and fry production • Discuss method of monosex Tilapia Production		the mouth of brood fish • Carry out egg incubation and fry rearing • Prepare hormone treated feed	• Carry out egg incubation and fry rearing • Prepare hormone treated feed	Bowls, Video clips, PPE.
General Objective 7.0: Understand hatchery water quality management						
12-13	7.1 Explain water sources and quality for hatchery	• Discuss water sources and quality for hatchery	Whiteboard, Projector, Fisheries textbooks, Charts,	• Monitor water quality parameters in	Guide student to: • Monitor water quality parameters in the	Water testing kits, Aerator.

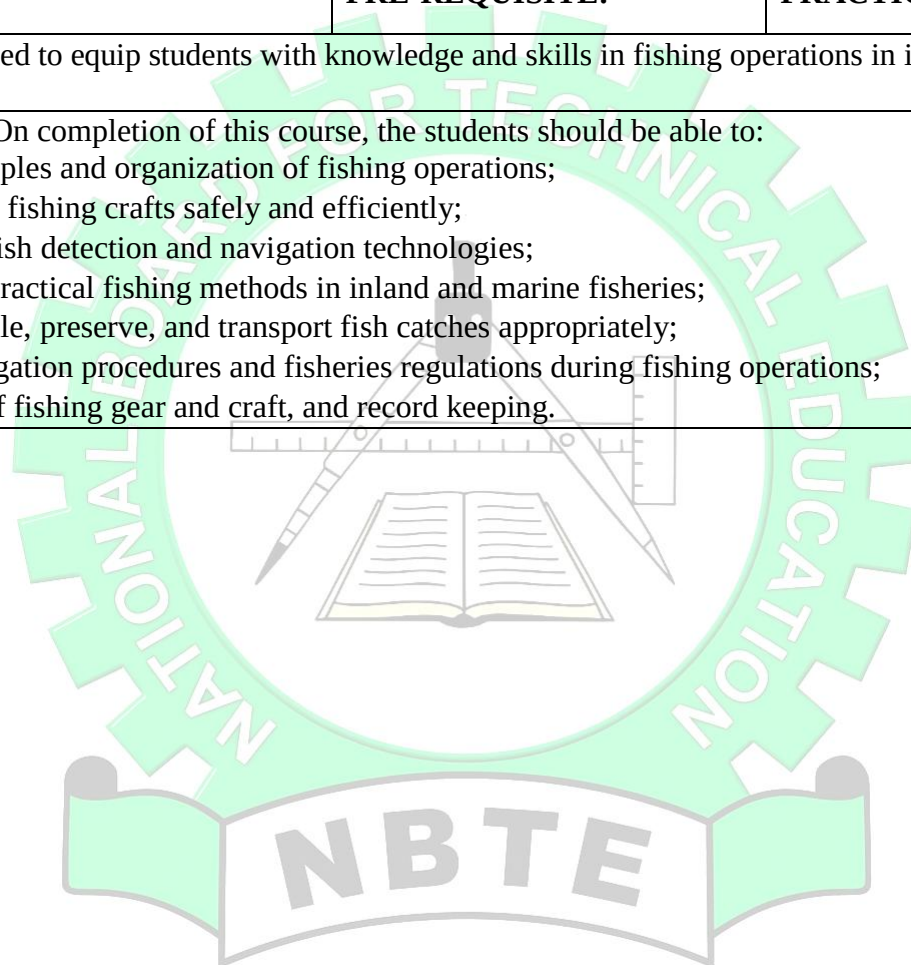
	operations. 7.2 Explain water treatment methods. 7.3 Explain water quality parameters important for hatchery operations. 7.4 Explain water quality monitoring techniques in hatchery.	operations • Discuss water treatment methods • Explain water quality parameters important for hatchery operations ➤ Temperature ➤ pH ➤ Dissolved oxygen ➤ Ammonia ➤ Nitrite ➤ Hardness • Explain water quality monitoring techniques in hatchery	Journals, Instructional materials, etc.	the hatchery	hatchery	
General Objective 8.0: Understand hatchery health management and biosecurity						
14-15	8.1 Explain common hatchery diseases and parasites. 8.2 Explain disease diagnosis and treatment. 8.3 Describe biosecurity	• Discuss common hatchery diseases and parasites • Discuss disease diagnosis and treatment • Describe biosecurity and quarantine measures in hatchery	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Identify common diseases symptoms in hatchery • Carry out biosecurity measure • Carry out sanitation and	Guide students to: • Identify common diseases symptoms in hatchery • Carry out biosecurity measure • Carry out sanitation and disinfection of hatchery	Disinfectants, Sanitizer, Fish disease chart, Salt, Probiotics, PPE.

	and quarantine measures in hatchery. 8.4 Describe sanitation and disinfection procedures in hatchery. 8.5 Explain hatchery waste management.	• Discuss sanitation and disinfection procedures in hatchery • Explain hatchery waste management		disinfection of hatchery		
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



FISHING OPERATIONS

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: FISHING OPERATIONS	COURSE CODE: AFT 424	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: The course is designed to equip students with knowledge and skills in fishing operations in inland, coastal, and marine environments.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and organization of fishing operations; 2.0 Know how to operate fishing crafts safely and efficiently; 3.0 Know how to apply fish detection and navigation technologies; 4.0 Know how to apply practical fishing methods in inland and marine fisheries; 5.0 Know to how to handle, preserve, and transport fish catches appropriately; 6.0 Understand safe navigation procedures and fisheries regulations during fishing operations; 7.0 Know maintenance of fishing gear and craft, and record keeping.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: FISHING OPERATIONS		COURSE CODE: AFT 424		CONTACT HOURS: 4HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK		
YEAR: II SEMESTER: II		PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to equip students with knowledge and skills required for fishing operations using appropriate fishing methods, crafts, and equipment while ensuring safety and sustainability						
GENERAL OBJECTIVE 1.0: Understand the principles and organization of fishing operations..						
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 term and scope of fishing operation. 1.2 Explain the importance of fishing in food security and economy. 1.3 Explain fisheries operations. 1.4 Explain crew organization and responsibilities. 1.5 Explain fishing trip planning.	• Discuss the scope of fishing operation • Discuss the importance of fishing in food security and economy • Discuss the different types of fisheries ➤ Artisanal fisheries operations ➤ Semi-industrial fisheries ➤ Industrial fisheries	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Visit a fishing port or fish landing site	Guide students to • Visit a fishing port or fish landing site	Notepad, Camera.

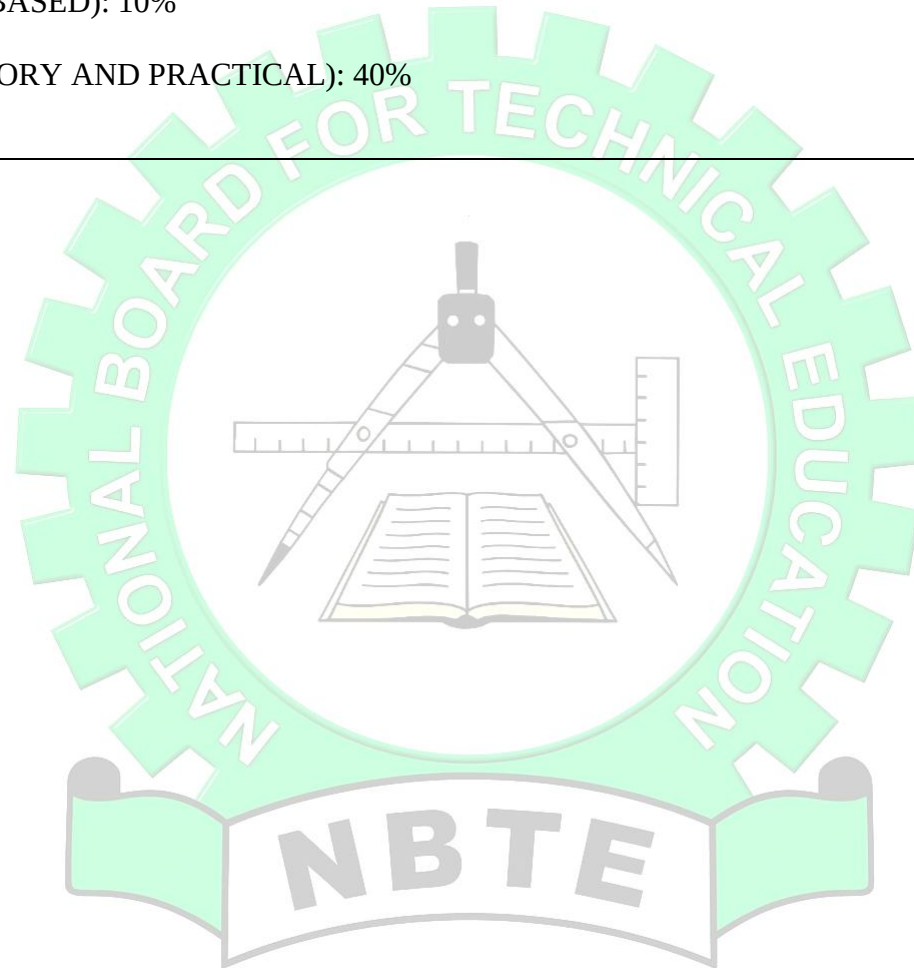
		systems • Discuss crew organization and responsibilities • Explain fishing trip planning				
General Objective 2.0: Know how to operate fishing crafts safely and efficiently						
3-4	2.1 Describe fish craft launching procedures. 2.2 Explain fishing craft anchoring and docking. 2.3 Describe boat maneuvering techniques. 2.4 Explain fishing craft stability and seaworthiness. 2.5 Explain fuel management practices.	• Explain fish craft launching procedures • Explain fishing craft anchoring and docking • Describe boat maneuvering techniques • Discuss fishing craft stability and seaworthiness • Discuss fuel management practices	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out boat handling and maneuvering using simulator.	Guide students to • Carry out boat handling and maneuvering using simulator or video clips	Boat simulator, Video clips, Multimedia projector.
General Objective 3.0: Know how to apply fish detection and navigation technologies.						
5-6	3.1 Explain compass navigation. 3.2 Explain the use of Global Positioning	• Discuss compass navigation • Explain the use of Global Positioning	Whiteboard, Projector, Fisheries textbooks,	• Use GPS and compass in navigation • Use fish finder	Guide students to: • Demonstrate the use of GPS and compass in navigation	GPS devices Compass Fish finder Sonar

	System (GPS) in navigation. 3.3 Explain the use of Radar systems in navigation. 3.4 Explain visual methods of fish finding. 3.5 Explain Sonar and fish finder operations. 3.6 Explain marine communication systems.	System (GPS) in navigation • Explain visual methods of fish finding • Describe the use of Radar systems in navigation • Discuss Sonar and fish finder operations • Explain marine communication systems	Charts, Journals, Instructional materials, etc.	and sonar • Use radar for navigation using simulator.	• Use fish finder and sonar • Use radar for navigation using simulator.	equipment, Video clips, Multimedia projector etc.
General Objective 4.0: Know how to apply practical fishing methods in inland and marine fisheries						
7-9	4.1 Explain fishing methods and their mode of operation. 4.2 Explain the use of baits in fishing operations. 4.3 Explain the principles of responsible fishing.	• Discuss the following fishing methods and their mode of operation ➤ Trawling operations ➤ Purse seining methods ➤ Gillnet operations ➤ Longline fishing ➤ Trap and pot fishing ➤ Cast netting ➤ Lift netting	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Carry out fish harvesting operation using ➤ Gill net ➤ Cast net ➤ Longline ➤ Beach seine net • Identify various types of baits	Guide students to: • Carry out fish harvesting operation using ➤ Gill net ➤ Cast net ➤ Longline ➤ Beach seine net • Identify various types of baits	Cast nets, Gill nets, Seine nets, Hooks and lines, Traps and pots, Longline systems, Baits (natural and artificial), PPE.

		➤ Spear fishing ➤ Beach seining • Discuss the use of baits in fishing operations • Discuss the principles of responsible fishing				
General Objective 5.0: Know to how to handle, preserve, and transport fish catches appropriately						
10-11	5.1 Explain onboard fish sorting and grading. 5.2 Explain hygienic fish handling methods. 5.3 Explain catch icing and chilling. 5.4 Explain catch freezing and storage techniques. 5.5 Explain fish spoilage prevention.	• Discuss onboard fish sorting and grading • Explain hygienic fish handling methods • Discuss catch icing and chilling • Discuss catch freezing and storage techniques • Discuss fish spoilage prevention	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Simulate fish handling, processing and preservation onboard.	Guide students to • Simulate fish handling, processing and preservation onboard.	Video clips, Multimedia projector, etc.
General Objective 6.0: Understand safe navigation procedures and fisheries regulations during fishing operation						
12-13	6.1 Explain safety at sea regulations. 6.2 Describe personal	• Discuss safety at sea regulations • Describe personal	Whiteboard, Projector, Fisheries textbooks,	• Carry out safety drills and emergency	Guide students to: • Carry out safety drills and	Life jackets, Fire extinguishers,

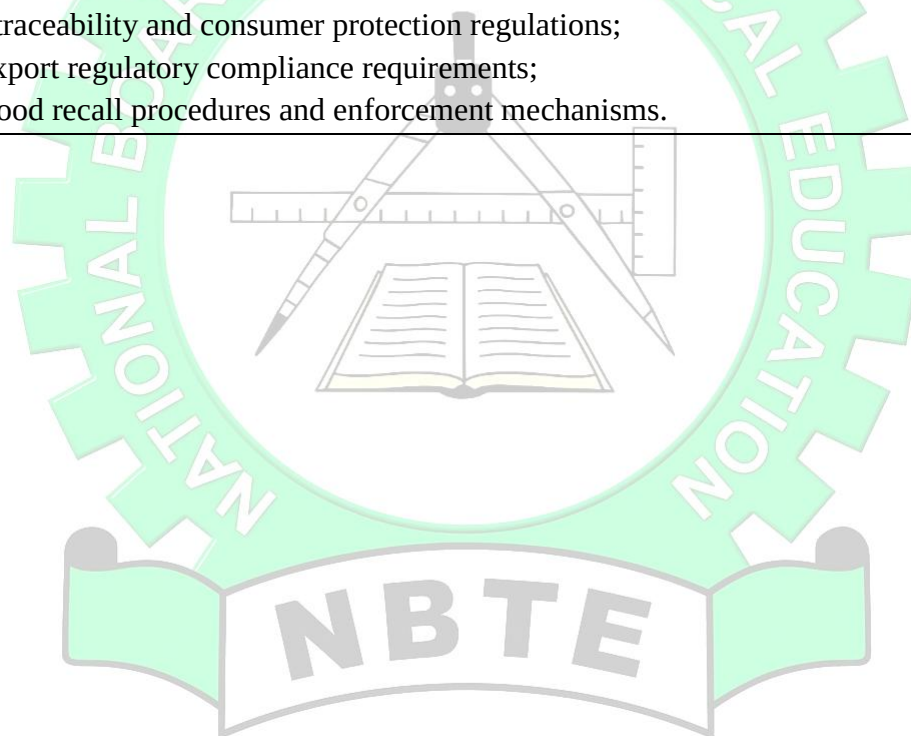
	protective equipment (PPE) used in fishing operations. 6.3 Explain onboard fire prevention and control. 6.4 Explain emergency response procedures. 6.5 Explain onboard first aid techniques. 6.6 Explain fisheries regulations and policies.	protective equipment (PPE) used in fishing operations • Explain onboard fire prevention and control • Explain emergency response procedures • Explain onboard first aid techniques • Discuss fisheries regulations and policies	Charts, Journals, Instructional materials, etc.	response • Simulate first aid techniques onboard	emergency response • Simulate first aid techniques onboard	First aid kits, Emergency communication system, PPE.
General Objective 7.0: Know maintenance of fishing gear and craft, and record keeping						
14-15	7.1 Explain preventive maintenance of fishing gear and equipment. 7.2 Describe net repair methods. 7.3 Describe engine servicing procedures. 7.4 Describe onboard corrosion control. 7.5 Explain fisheries logbooks.	• Discuss preventive maintenance of fishing gear and equipment • Describe net repair methods • Describe engine servicing procedures • Describe onboard corrosion control	Whiteboard, Projector, Fisheries textbooks, Charts, Journals, Instructional materials, etc.	• Mend net • Mount and hang net • Tie knots • Handle rope correctly • Maintain fishing equipment • Service and	Guide students to: • Mend net • Mount and hang net • Tie knots • Handle rope correctly • Maintain fishing equipment • Service and maintain engine	Net mending tools, Engine servicing tools, Repair kits, Lubricants, Toolbox, PPE.

		Explain fisheries logbooks		maintain engine		
COURSE ASSESSMENT COURSE WORK (PRACTICAL BASED): 10% TESTS (PRACTICAL BASED): 10% PRACTICAL: 40% EXAMINATION (THEORY AND PRACTICAL): 40% TOTAL: 100%						



FOOD LEGISLATION AND SAFETY

PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY		
COURSE TITLE: FOOD LEGISLATION AND SAFETY	COURSE CODE: AFT 425	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in food legislation and safety in fisheries		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the Nigerian food safety legislative framework and the roles of regulatory and certification bodies; 2.0 Know food safety standards and quality management systems applicable to fish and fishery products; 3.0 Understand Hazard Analysis Critical Control Point (HACCP) principles and their application in fish processing establishments; 4.0 Know fish product labelling, traceability and consumer protection regulations; 5.0 Understand fish import and export regulatory compliance requirements; 6.0 Know food risk assessment, food recall procedures and enforcement mechanisms.		



PROGRAMME: HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY						
COURSE TITLE: FOOD LEGISLATION AND SAFETY			COURSE CODE: AFT 425		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: II 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 food legislation and safety in fisheries						
GENERAL OBJECTIVE 1.0: Understand the Nigerian food safety legislative framework and the roles of regulatory and certification bodies;						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-2	1.1 Explain food legislation. 1.2 Explain the importance of food legislation to the fish and food industry related to public health. 1.3 Explain the scope and structure of food legislation in Nigeria. 1.4 Describe the relationship between national food law and international food standards obligations. 1.5 Describe the basic	• Discuss the structure of Nigeria's food safety regulatory framework • Discuss the relationship between national food law and international food standards obligations • Discuss the basic provisions of the National Agency for	Whiteboard, Projector, Fisheries and food safety textbooks, NAFDAC Act, SON Act, Charts Journals and instructional materials.	• Demonstrate operations of regulatory bodies such as NAFDAC, SON etc. using video clips • Identify quality assurance information on packaged fish products e.g. NAFDAC number, SON	Guide students to: • Demonstrate operations of regulatory bodies such as NAFDAC, SON etc. using video clips • Identify quality assurance information on packaged fish products e.g. NAFDAC number, SON mark, expiry date etc. • Use charts to illustrate relationships among regulatory and certification bodies	Multimedia projector, Comparative agency mandate template, Video clips, Charts.

	provisions of the National Agency for Food and Drugs Administration and Control (NAFDAC) Act. 1.6 Explain the modes of enforcement of food safety laws in Nigeria. 1.7 Explain the roles of regulatory and certification bodies.	Food and Drugs Administration and Control (NAFDAC) Act. • Discuss the modes of enforcement of food safety laws in Nigeria • Discuss the roles of the following regulatory and certification bodies: ➤ NAFDAC ➤ Standards Organisation of Nigeria (SON) ➤ Consumer Protection Council (CPC) ➤ Halal Certification Authority (HCAN) and recognised Halal bodies ➤ Codex Alimentarius		mark, expiry date etc. • Use charts to illustrate relationships among regulatory and certification bodies • Show video clips of NAFDAC regulatory enforcement	• Show video clips of NAFDAC regulatory enforcement	
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		Commission (CAC) ➤ Food and Agriculture Organisation (FAO) / World Health Organization (WHO) ➤ World Organization for Animal Health (WOAH/OIE) — for fish health and trade ➤ European Union regulatory bodies (for export market compliance)				
GENERAL OBJECTIVE 2.0: Know food safety standards and quality management systems applicable to fish and fishery products						
3-5	2.1 Explain the concept of food safety standards fish handling. 2.2 Explain the importance food safety standards in	• Discuss the concept of food safety standards fish handling • Discuss the importance food	Whiteboard, Projector, ISO 22000:2018 standard document, ISO/TS	• Identify GMP-compliant and FSSC 22000-certified fish processing facility using	Guide students to: • Identify GMP-compliant and FSSC 22000-certified fish processing facility using video clips • Conduct GMP inspection	GMP/GHP inspection checklist, PPE, Camera for documentation (where

	fish handling. 2.3 Describe quality management and food safety systems.	safety standards in fish handling • Discuss the relationship between ISO 9001, ISO 22000, ISO/TS 22002-6 and FSSC 22000 • Discuss GMP and GHP checklists with practical examples from fish processing • Describe the following quality management and food safety systems: ➤ ISO 22000:2018 Food Safety Management Systems ➤ ISO/TS 22002-6 - Prerequisite Programmes for food production (sector-specific) ➤ FSSC 22000 — Food Safety System	22002-6 document, FSSC 22000 scheme documents, Codex Alimentarius fish standards, SON/NAFD AC fish product standards, GMP/GHP checklists, Relevant journals, Instructional materials, etc.	video clips • Conduct a Good Manufacturing Practices (GMP) compliance inspection of a fish processing facility using a standard checklist • Identify GMP violations and document non-compliances if present • Assess hygiene conditions and prepare a compliance report	using provided checklist • Document and classify non-conformances • Prepare written compliance inspection report	allowed), Report writing template, Video clips, Notepads.
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		Certification (industry-recognised scheme) ➤ ISO 9001:2015 — Quality Management Systems (as a foundation standard) ➤ Good Manufacturing Practices (GMP) ➤ Good Hygiene Practices (GHP) ➤ Sanitary and Phytosanitary (SPS) measures				
GENERAL OBJECTIVE 3.0: Understand HACCP principles and their application in fish processing establishments						
6-8	3.1 Explain HACCP principles. 3.2 Explain importance of HACCP principles in fish processing. 3.3 Explain Prerequisite Programmes	• Discuss HACCP principles: ➤ Hazard analysis ➤ Identification of Critical Control Points (CCPs) ➤ Establishment of critical limits ➤ Monitoring	Whiteboard, Projector, Sample HACCP plan documents, HACCP flow chart templates,	• Conduct a hazard analysis for a selected fish product (e.g. dried, smoked or frozen fish) • Identify CPC in a fish	Guide students to: • Conduct hazard analysis for a selected fish product • Identify CCPs using a process flow diagram • Input on HACCP worksheets • Assemble and review a	Fish samples (fresh, smoked, dried) etc, HACCP worksheet templates, HACCP

	(PRPs) supporting HACCP. 3.4 Explain the legal requirements for HACCP in Nigerian fish processing and export facilities. 3.5 Describe the steps in developing HACCP plan. 3.6 Describe the steps in implementing a HACCP plan.	procedures ➤ Corrective actions ➤ Verification procedures ➤ Record-keeping and documentation • Discuss the importance of HACCP principles in fish processing • Discuss how CCPs are identified in fish handling and processing operations • Discuss prerequisite programmes (PRPs) supporting HACCP • Discuss the legal requirements for HACCP in Nigerian fish processing and export facilities • Describe the steps in developing and implementing a	Codex HACCP guidelines, Fisheries textbooks, Journals, etc.	processing flow diagram • Enter on HACCP worksheet emphasizing critical limits, monitoring and corrective actions • Prepare a simple HACCP documentation package	HACCP documentation package	process flow diagram templates.
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		HACCP plan				
GENERAL OBJECTIVE 4.0: Know fish product labelling, traceability and consumer protection regulations						
9-11	4.1 Explain mandatory fish product labelling requirements under NAFDAC and SON regulations. 4.2 Describe labelling elements. 4.3 Explain traceability systems for fish products. 4.4 Describe digital traceability tools and electronic compliance systems used in fisheries. 4.5 Explain consumer protection regulations and deceptive labelling offences. 4.6 Explain fish species mislabeling as a	• Discuss mandatory fish product labelling requirements under NAFDAC and SON regulations • Explain the following labelling elements: ➢ Product name and species identification ➢ Net weight and date markings ➢ Nutritional information ➢ Allergen declarations ➢ Country of origin ➢ Storage conditions • Discuss traceability systems for fish products • Describe digital	Whiteboard, Projector, Sample fish product labels (local and exported), NAFDAC labelling guidelines, Computer/Internet for digital traceability demo, Consumer protection legislation documents, etc.	• Conduct a label compliance audit on at least five commercial fish products • Document identified labelling deficiencies against NAFDAC/SON requirements if present • Prepare a label compliance audit report with recommendations • Use a QR-	Guide students to: • Examine fish product labels critically • Conduct label compliance audit using a structured checklist • Document non-compliant elements and prepare written audit report • Demonstrate use of a QR-code-based traceability system	Assorted commercial fish product labels, Label compliance checklist, NAFDAC/SON labelling regulations, Report writing template, Notepad, QR-code scanner.

	form of food fraud	traceability tools and electronic compliance systems used in fisheries • Explain consumer protection regulations and deceptive labelling offences		code-based traceability system		
GENERAL OBJECTIVE 5.0: Understand fish import and export regulatory compliance requirements						
12-13	5.1 Explain Nigeria's fish import control procedures and documentation requirements. 5.2 Describe the requirements for fish product export to major markets. 5.3 Explain Sanitary and Phytosanitary (SPS) measures in international fish trade. 5.4 Describe the process of obtaining export	• Discuss Nigeria's fish import control procedures and documentation requirements (e.g., NAFDAC's Canned Fish Regulation, Live Fish (Control of Importation) Act • Discuss the requirements for fish product export to major markets: ➤ European Union (EU Hygiene Regulations EC 852/2004 and EC	Whiteboard, Projector, Sample export health certificates, EU and FDA regulatory documents, NAFDAC export guidelines, Journals, Instructional materials, etc.	• Review completed sample export health certificate form • Demonstrate a simulated pre-export inspection of fish products using a regulatory checklist • Prepare a regulatory compliance	Guide students to: • Demonstration simulated pre-export fish inspection • Complete export certificate documentation • Prepare a compliance report for a fish consignment for export	Export health certificate templates, Pre-export inspection checklist, Fish samples for simulated inspection.

	health certificates for fish products. 5.5 Explain Federal Department Fisheries and Aquaculture (FDFA) certification procedures for fish export. 5.6 Explain the consequences of non-compliance with export market requirements.	853/2004) ➤ United States (FDA FSMA requirements) ➤ Regional markets (ECOWAS standards) • Discuss Sanitary and Phytosanitary (SPS) measures in international fish trade • Describe the process of obtaining export health certificates for fish products • Discuss Federal Department Fisheries and Aquaculture (FDFA) certification procedures for fish export • Discuss the consequences of non-compliance with export market		report for a fish consignment		
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		requirements Review sample export certificates and import documentation with the students				
GENERAL OBJECTIVE 6.0: Know food risk assessment, food recall procedures and enforcement mechanisms						
14-15	6.1 Explain the concept of food risk assessment. 6.2 Describe the components of risk assessment. 6.3 Explain food recall procedures under NAFDAC regulations. 6.3 Describe the regulatory framework for antibiotic residues and chemical contaminants in fish. 6.4 Describe food safety incident management and	- Discuss the concept of food risk assessment - Discuss the components of risk assessment: - Hazard identification - Hazard characterisation - Exposure assessment - Risk characterization - Describe food recall procedures under NAFDAC regulations - Discuss the regulatory	Whiteboard, Projector, NAFDAC recall procedure documents/report, Case study materials on food safety incidents, Risk assessment framework templates, Fisheries textbooks and journals, etc.	- Demonstrate a simulated food safety risk assessment for a fish product (e.g. frozen fish) - Demonstrate a simulated product recall (draft recall notice, notify regulatory body and prepare consumer communication) - Prepare a food	Guide students to: - Conduct a risk assessment exercise for a fish product - Simulate a product recall scenario and manage documentation - Prepare a formal food safety incident report	Risk assessment template, Recall notice template/guidelines, Incident report template, Sample fish product data sheets.

	reporting systems. 6.5 Explain NAFDAC's enforcement powers, penalties and sanctions. 6.6 Explain the role of food inspectors and their legal powers.	framework for antibiotic residues and chemical contaminants in fish • Describe food safety incident management and reporting systems • Explain NAFDAC's enforcement powers, penalties and sanctions • Describe whistleblower provisions and compliance monitoring mechanisms • Explain the role of food inspectors and their legal powers		safety incident report following a simulated contamination event		
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

1.0 BIOLOGY/FISH BIOLOGY/ MICROBIOLOGY See Science Laboratory Technology Curriculum

2.0 CHEMISTRY/ BIOCHEMISTRY See Science Laboratory Technology Curriculum

3.0 PHYSICS See Science Laboratory Technology Curriculum

4.0 AUDIO VISUAL 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

5.0 METEOROLOGICAL STATION

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Stevenson's Screen	1
2.	Them Hydrographs	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

6.0 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

7.0 FISH FEED MILL

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Grinding Machine	2
2.	Sieves	10
3.	Mixer	
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	
12.	Dryer	1

8.0 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
7.	Grow bed	

9.0 AQUACULTURE (FISH FARM)

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	1
	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.	Demand feeders	
26.	Automatic feeders	
27.	Drones	

10.0 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.	Head net	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
17.	Sealing machine	1
18.	Autoclave	1

11.0 FISH MUSEUM

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Aquiria	4
2.	Fish Skeleton	10
3.	Preserved Specimen	Assorted
4.	Fish samples for simulated inspection	Assorted
5.	Fish samples for simulated inspection	Assorted

12.0 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

13.0 WORKSHOPS (BOAT BUILDING, AND MAINTENANCE ETC)**13.1 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	12

	Pincers, Oilstone Planners Etc	
16.	First Aid Box	1
17.	Model Boats	Assorted
18.	Model Aquaria	Assorted
19.	Models of Inboard and Outboard Engine	

13.2 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.	Pedestal 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
17.	Drill Set	5
18.	Chain Block	5
19.	Electrical Hand Drill	5
20.	Depth Gauges	5
21.	Panel Beating Tools (Bench State)	5
22.	Breast Drill	2
23.	Hack Saw Frames	5

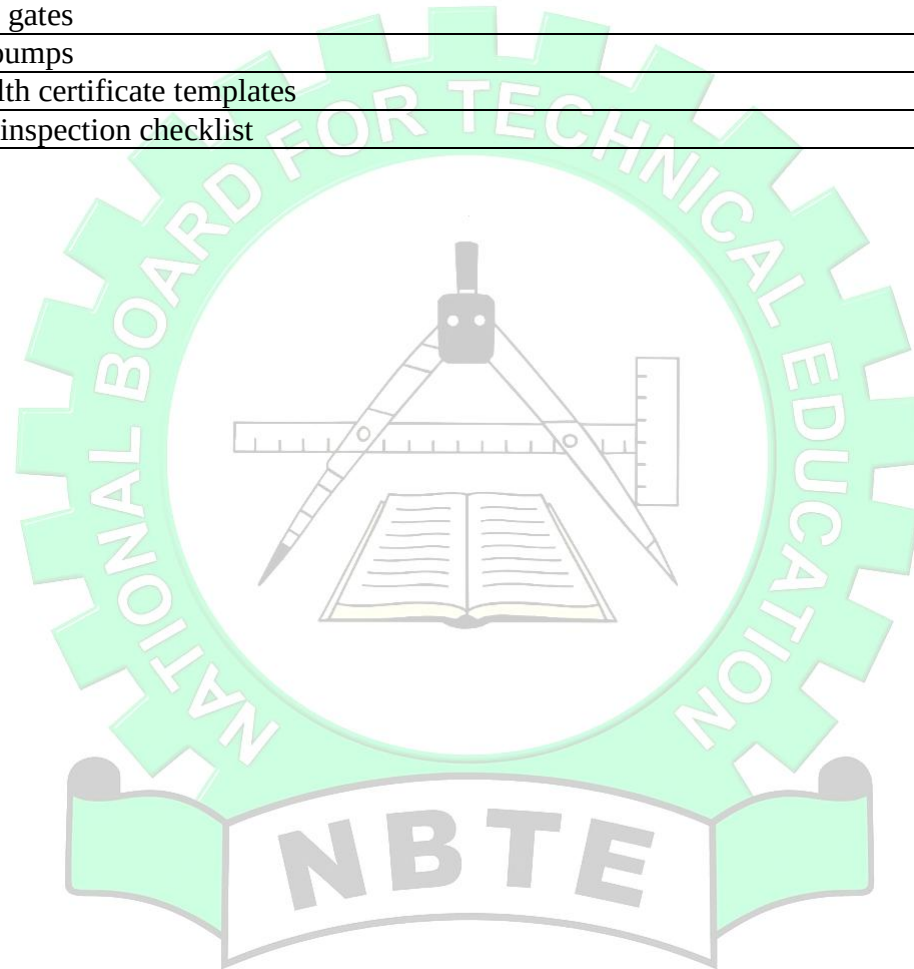
24.	Toque Wrench	3
25.	Plate Rolling Machine	10
26.	Swage Block B27/0120	2
27.	Surface Plate	
28.	Scribers	2
29.	Steel Rule	2
30.	Mallet Set	10
31.	Pipe Screw Threading Machine	10
32.	Wire Brush	10
33.	Dressing Wheels	1
34.	Tong	5
35.	Try Square	2
36.	Files	3
37.	Blow Torch	3
38.	Soldering Iron Tin Snips	20
39.	Soldering Flux	3
40.	Acid Core Wire Solder	3
41.	Resin-Core Wire Solder	3
42.	Emery Cloth	3
43.	Sand Paper	3
44.	Cotton Waste	3
45.	Oxygen And Acetylene Bottles	3
46.	Model Boats	30sheets
47.	Outboard Engines	3 bundles
48.	Oxygen And Acetylene Regulator	3
49.	Oxyacetylene Welding Cutting Outfit	3
50.	Oxygen and Acetylene Hoses	complete
51.	Welding Goggles	3
52.	Cylinder Wrenches	3
53.	Spark Lighter	3
54.	Welding Rods	3 bundles

55.	Welding Fluxes	30
56.	Bracing Rods Model	3

14.0 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.	Bouyage system display	1
17.	Bouyage system model	1 set
18.	International code flags	1
19.	Fog signalling 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 type
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.	Export health certificate templates	
35.	Pre-export inspection checklist	



LIST OF WORKSHOP PARTICIPANTS
NATIONAL CURRICULUM WORKSHOP ON HIGHER NATIONAL DIPLOMA IN AQUACULTURE AND FISHERIES TECHNOLOGY

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