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| --- | --- | --- | --- | --- | --- | --- |
|  | **Level 100** | | | | | |
| S/N | Course Code | Course Title | Unit | Status | LH | PH |
| 1 | BUK-AGG 101 | Introductory Agricultural Statistics | 2 | C | 30 | - |
| 2 | BUK -FAA 101 | Introduction to Fisheries and Aquaculture | 2 | C | 30 | - |
|  |  | Total | 4 |  |  |  |
|  |  | Grand Total | 30 |  |  |  |

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**Proposed 30% addition to the CCMAS Course Structure/Summary**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Level 200** | | | | | |
| S/N | Course Code | Course Title | Units | Status | LH | PH |
| 1 | BUK-FAA 201 | Fish Adaption and Physiology | 2 | C | 30 | - |
| 2 | BUK-FAA 202 | Biology of Shellfishes | 2 | C | 15 | 45 |
| 3 | BUK-CPS 204 | Introduction to Invertebrate Pests and Agricultural Microbiology | 2 | C | 15 | 45 |
| 4 | BUK-SOS 201 | Introduction to Soil Science | 2 | C | 20 | 10 |
| 5 | BUK-SOS 202 | Agroclimatology and Soil Conservation | 2 | C | 20 | 10 |
| 6 | BUK-AGE 201 | Household Resource Management | 2 | C | 30 | - |
| 7 | BUK-ANS 201 | Introduction to Agricultural Biochemistry | 2 | C | 30 | - |
|  |  | Total | 14 |  |  |  |
|  |  | Grand Total | 30 |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Level 300** | | | | | | | | | | | |
| S/N | Course Code | | Course Title | Unit | | | Status | | LH | | PH | |
| 1 | BUK- FAA 309 | | Fisheries Statistics and Research Methodology | 2 | | | C | | 30 | | - | |
| 2 | BUK-CPS 301 | | Principles of Irrigation and Drainage | 2 | | | C | | 30 | | - | |
|  |  | | Total | 4 | | |  | |  | |  | |
|  |  | | Grand Total | 30 | | |  | |  | |  | |
| **Level 400** | | | | | | | | | | | |
| **S/N** | **Course Code** | **Course Title** | | | **Unit** | **Status** | | **LH** | | **PH** | |
| 1 | BUK-FAA 402 | Fish Parasite and Diseases | | | 2 | C | | 15 | | 45 | |
| 2 | BUK-FAA 406 | Oceanography, Seamanship and Navigation | | | 2 | C | | 15 | | 45 | |
| 3 | BUK-FAA 408 | Introduction to Fish Genetics and Breeding | | | 3 | C | | 15 | | 90 | |
| 4 | BUK-FAA 409 | Production of other Aquatic Products | | | 2 | C | | 15 | | 45 | |
| 5 | BUK-FAA 411 | Water Quality Management and Pollution Control | | | 2 | C | | 15 | | 45 | |
| 6 | BUK-FAA 412 | Fish Farming Engineering, Ornamental Fisheries and Aquaria Design | | | 3 | C | | 15 | | 90 | |
| 7 | BUK-FAA 413 | Fishery Policies and Legislation | | | 2 | C | | 30 | | - | |
|  |  | Total | | | 16 |  | |  | |  | |
|  |  | Grand Total | | | 32 |  | |  | |  | |

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-AGG 101 Introductory Agricultural statistics**

**(2 Credit units; Core; LH = 30; PH = 0; Total = 30)**

**Senate-approved relevance**

To produce graduates who can lead agricultural statistics research and education in Africa. The students will be committed to addressing African developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

Statistics is a familiar and accepted part of modern world that is concern with obtaining an insight into the real word by means of the analysis of numerical relationships. It is used in almost all fields of human endeavour. Since this course Introductory Statistics entails analysis of numerical relationships, we will focus on the meaning of statistics and biostatistics (collections of quantitative information and method of handling such data, descriptive analysis of the observation).

We will also discuss frequency of distribution, measures of locations and probability. This course exposes students to basic statistics and descriptive statistics, the knowledge will be helpful in further statistics at higher levels. It is indeed very interesting field of agriculture and biology.

**Objectives**:

The objectives of the course are to:

1. Illustrate the philosophy and significance of household resource management.
2. Describe family values and its significance in societal development.
3. Discuss the major characteristics of household resource and their management process.
4. Outline the strategies for maximizing the use of household resources.
5. Discuss food security and it’s important to developing countries.
6. Highlight the different type of food insecurity and suggest ways of reducing food insecurity.
7. Describe gender analysis and its application in participatory research approach.
8. Highlight the best approach for household resource inventory and valuation.
9. Explain household resource ownership and control.
10. Discuss the importance of gender inclusion in decision making for household resource utilization.

**Learning** **Outcomes**

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

1. Discuss at least 5 uses of statistics in area of agriculture.
2. Discuss population and samples.
3. Discuss all the different sampling methods and understand the purpose and importance of sampling.
4. Mention 3 types of frequency distributions.
5. Organize data using frequency distribution.
6. Explain the normal and binomial distributions.

**Course** **Contents**

Basic concepts of statistics. Population and Sample. Frequency distribution, measures of location, measures of variation. Probability distribution, normal and binomial distributions. Histograms, means, mode, median, sampling, data collection, data processing techniques.

**Minimum** **Academic** **Standards** **(MAS)**

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK – FAA 101  Introduction to Fisheries and Aquaculture**

**(2 units; Core; LH = 30, PH = 0; Total = 30)**

**Senate approved relevance**

To train high quality graduates who can engage in aquaculture research and lead in the educational aspects in Africa. The students will be committed to addressing African developmental challenges through extensive research and knowledge transfer in agreement with BUK’s mission.

**Overview**

This is a course which has important implications for fishery production because they significantly influence the production of fisheries resources. The course also encompasses a comparative examination of interaction between fishes and their aquatic environment Fisheries and aquaculture support the livelihoods of nearly half a billion people across the world. Yet many of the world’s fisheries are at grave risk from human pressure including overexploitation, pollution and habitat change. Climate change is warming the atmosphere and the oceans and causing changes in rainfall patterns. This affects the quality of the water that supports aquatic life, and increases the frequency of extreme weather events.  Some inland lakes and water bodies are drying up, while, in other areas, destructive floods are becoming a regular occurrence. These events have an impact on the seasonal patterns of fish availability and fishing activities, and disrupt the livelihoods of coastal communities.

Wild fish stocks have been hit by overfishing, illegal and destructive fishing practices, and weak fisheries management. Meanwhile, aquaculture is expanding across the globe, providing opportunities for improved nutrition and poverty reduction. However, this also raises the challenge of ensuring sustainable economic, social and technical growth.

High post-harvest losses and the rights of local communities to access fishery resources are additional concerns. In many cases, the poorest communities in the poorest countries are the most vulnerable

**Objectives**

The objectives of the course are to:

1. state the gross and external morphology of fish (cartilaginous/bony fishes)
2. list the different functions of organs and systems of fish
3. describe the various fish culture system in aquaculture.
4. explain hatchery and pond management
5. list the importance/ prospects of fisheries to man and the nation.
6. identify the challenges of aquaculture.
7. describe feed and feeding habits of different fish
8. enumerate the basic principles of artificial propagation in fish.

**Learning Outcomes**

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

1. list any 5 (five) external morphological features of fish.

2. outline any 4 (four) functions of fish organs and the systems.

3. explain the 3 (three) fish culture systems in aquaculture;

4. state 10 (ten) pond managements used by the aquaculturists.

5. analyze 4 (four) problems / challenges faced in aquaculture

6. outline 6 (six) principles of fisheries management and aquaculture;

7. indicate 5 (five) prospects in fisheries management and aquaculture to individuals and the country;

8. discuss 4 (four) feeding habits of cartilaginous fishes.

9. list 7 (seven) basic principles of artificial propagation in fish

**Course Contents**

Concepts of fisheries and aquaculture in relation to natural resources. Water bodies and fisheries and aquaculture practices in Nigeria. An Outline of Fisheries - Artisanal Fisheries; Industrial Fisheries; Aquaculture; Marine Fisheries. Fish adaptation to aquatic life. The important fishes of West Africa with emphasis on Nigeria species. Classification, evolution, morphology, and basic structure of fishes. Life cycle of principal species of fishes. Significance of fishes in the life of Nigerians. The fish and aquaculture industries in Nigeria. Feed and feeding habits in fishes. Potentials for Aquaculture in Nigeria. Need for fisheries management and concept of overfishing.

Appraisal of the Nigerian marine fishery. Fundamental principles of fish management (protection, conservation, and sustainable harvest) and production. The role of Fisheries – as an Important Agricultural Resource; A Source of Foreign Exchange Earnings; A Source of Protein; A Source of Income; A Source of Employment; A Valuable Ecological Resource; Towards Sustainable Fisheries Development. Economic Issues - Overfishing, Overcapacity, Bycatch and Discards. Post harvest losses / spoilage - various aspects of fish spoilage. Fish processing – canning, smoking and drying. Ecological, economic and cultural importance of fisheries park. Zoo. Sport fishing. Marine Park, etc. Subsidies - Environmental Issues; Ecosystems Degradation; Destructive Fishing Practices; Negative Impacts of Aquaculture; Water Pollution; Policy and Institutional Issues. Perspectives - Fish Supply Outlook; Towards Responsible Fisheries Management

**Minimum Academic Standards (MAS)**

All required facilities and materials for this course has been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 201      Fish Adaptation and Physiology**

**(2 Credit units; Core; LH = 30; PH = 0; Total = 30)**

**Senate-approved relevance**

Training of high-quality graduates that are conversant in the area of adaptation and physiology of aquatic organisms in Nigeria in line with BUK’s focus in addressing African developmental challenges in producing graduates in fisheries ad aquaculture discipline.

**Overview**

The overall focus of the course is on the functional adjustments that animals use to cope with the various environmental and physiological challenges of life in aquatic environments. The animal groups under discuss are fin fishes, shell fishes (crustaceans, mollusks) and marine mammals. After considering the challenges of life in aquatic environments, the beginning theme (and a central paradigm in physiology) will be the partitioning of energy. Understanding how the flow of energy in animals is regulated is fundamental to understanding virtually every aspect of physiology, reproduction and life history strategies.

Energy obtained through feeding and digestion is allocated to basic maintenance functions (metabolism, movement, repair,), dealing with homeostatic challenges (gas exchange, osmoregulation, thermoregulation), channeled into growth, and ultimately is invested in reproduction. The course will first address the particular challenges faced by animals living in an aqueous medium, and the basics of bioenergetics. It will then deal with the physiology of metabolism, respiration, and homeostasis. The roles of the endocrine system in regulating and coordinating these processes will be discussed, with emphasis on the role of these systems in mediating environmental information. A portion of the course will be devoted to the ultimate measure of success of these processes, reproduction.

**Objectives**

The objectives of this course are to:

1. discuss the important environmental variables in the aquatic environment that impact the physiology of aquatic animals;
2. summarize the fundamentals of bioenergetics as a basis for understanding how animals gain and invest energy in various physiological processes;
3. describe the physiological adaptations of aquatic animals to their environment;
4. compare the basics of gamete development, the diverse reproductive strategies displayed by aquatic animals, and the underlying regulatory mechanisms;
5. develop the ability to access, analyze and critically evaluate key literature in aquatic animal physiology.

**Learning Outcomes**

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

1. analyze 3 (three) physiological processes in fish
2. state 5 (five) anatomic characteristics of fish as a means of adaptation.
3. discuss 2 (two) ways by which physiological processes are regulated.
4. outline 5 (five) limitations of aquatic animals on land.
5. list 7(seven) advantages of living in water versus on land.
6. explain the migration patterns of the aquatic organisms
7. illustrate the life cycles and survival abilities of fish in relation to the ecological parameters

**Course Contents**

Definition of Adaptive structures of fish. Major types of Adaptive features in fish. Different types of adaptations achieve by Fish. Acclimatization and Adaptation in Fish. Heat stress. Physiological changes to heat stress. Adaptation of Fish to Diseases. Habitat and Adaptation of Fish. The different shapes and adaptive designs in fish in relation to the aquatic environment. Natural environmental adaptation of fish, migration, reproduction, feeding habits, salinity, temperatures and life cycle. Modified environmental behavior of fish to pressure, light, electrical field and noise. Bioenergetics. Osmoregulation in Fishes. Fish Larval Physiology. Environmental effects on Fish gill’s structure and function. Effect of Water PH on gas and ion transfer. Endocrine responses to environmental pollution.

**Minimum academic standard**

All required facilities have been adequately captured

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 202 Biology of Shellfishes**

**(2 Credit units; Core; LH = 15; PH = 45; Total = 60)**

**Senate approved relevance**

Training of high-quality graduates that are well skilled and knowledgeable in the study of the biology of economically important shellfishes in the Nigerian waters in line with BUK’s focus in addressing African research challenges.

**Overview**

Biology of shellfishes is a course on aquatic invertebrates, with emphasis placed on those of economic, ecological, and socio-cultural importance (i.e., the “shellfishes”) crustaceans and moluscs in the Nigerian waters. Invertebrates are dazzling in their diversity, and our focus is on the morphology, physiology, ecology, and life history of two highly diversified phyla (Phylum Arthropoda and Phylum Mollusca). These two groups are named as shellfishes because of the presence of exoskeleton made of chitin in arthropods and shells made of calcium in molluscs.

The course survey invertebrate diversity in light of evolutionary diversification and phylogenetic relationships. The unique characters of each group will be emphasized, and we will compare how different groups carry out basic functions, such as feeding, dispersal, and reproduction. Phylogenetic relationships within and among groups will provide the framework for all of the specific biological details.

These two phyla include economically important groups such as lobsters, shrimps, crabs, oysters, squids and cuttlefishes. For conservation and management of fishery resources, the identification of shellfishes is vital. Taxonomical study reveals numerous interesting phenomena in shellfish phylogeny and the study is most indispensable for culturing shellfishes. The correct identification of candidate species of shellfishes is very important for successful aquaculture practices.

**Objectives**

The objectives of the course are to:

1. identify the systemics of the economically important shellfishes
2. examine the representatives from different phyla
3. define common features and differences in the phyla
4. enumerate the systemics and behavioral characteristics for survival of the organisms.
5. explain the relationships between one organism and another and between one group and another.

**Learning Outcomes**

By the end of the course, the students are expected to be able:

1. identify at least 2 (two) from the major groups of invertebrates,
2. compare several important (mostly local, economically important) species within each of these groups,
3. state 5 (five) behavioral adaptations of each group.
4. illustrate 3 (three) ecological roles in each of these groups,
5. classify 3 (three) phylogenetic relationships among these groups,
6. interpret and synthesize at least 2 (two) primary literatures in invertebrate biology,
7. outline 6 (six) diseases affecting shellfishes in their habitats.
8. discuss the dazzling diversity of invertebrate life.

**Course contents**

An introduction to invertebrate biology. Challenges and opportunities of life in the sea. Invertebrate classification, relationships, and terminology. Life-histories of crustaceans (Lobsters, Shrimp and Crab). Morphometrics and meristic characteristics of crustaceans. Distribution of economically important crustaceans. Morphology of molluscan shellfish. Life-histories of mollusks (oysters, periwinkle and cuttlefish). Distribution of economically important mollusks. Food and feeding habits of the shellfishes. Sexual dimorphism in shellfishes. Ecdysis. Biofouling. Adaptive features of aquatic crustaceans. Adaptive features of aquatic molluscs. Shellfish quality. Shellfish allergen. Shellfish consumption safety. Issues in shellfish biology: Parasitism and disease.

**Minimum Academic Standards (MAS)**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**BUK-CPS 204 Introduction to Invertebrate Pests and Agricultural Microbiology**

**(2 Credit units; Core; LH = 15; PH = 45; Total = 60)**

**Senate approved relevance**

To produce graduates who can lead in Invertebrate Pests and Agricultural Microbiology research and education in Africa. The students will be committed to addressing African developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

               The introduction to Invertebrate Pests and Agricultural Microbiology course is aimed at preparing students to be involved in functional and collaborative teams that to characterize and differentiate different classes of Helminthes, Arthropods, Bacteria, Fungi and Viruses for improved pests management and sustainable crop production.

               The course focuses on understanding knowledge and skills on the general characteristics and morphology of invertebrate pests and agricultural microbes. The practical sessions aim to develop skills in Invertebrate pests’ management, Agricultural Microbiology and research techniques.

**Objectives**

1. Identify and characterize different classes of helminths and Arthropods.
2. Describe major insect orders and diagnose their morphological features.
3. Outline the elementary insect physiology and ecology.
4. Describe the class Insecta - its abundance, variability and versatility.
5. Describe the general characteristics, morphology and reproduction of disease-causing organisms.
6. Explain the concept molecular biology and characterization of diseases pathogens.
7. Describe steps in characterization of pathogens.
8. Describe how to isolate and grow bacteria and fungi.

**Learning Outcomes**

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

1. List any five general characteristics and nomenclature of different invertebrate pests of crops in Nigeria.
2. Characterize at least three classes each of helminths and Arthropods.
3. Enumerate any 3 major insect orders and their morphological features.
4. Describe with examples the concept of the elementary insect physiology and ecology.
5. State the general characteristics, morphology of bacteria, fungi and viruses.
6. Characterize different pathogens using molecular techniques.
7. Isolation and growing of fungi and bacteria

**Course Contents**

*Helminthology*: Phylum Platyhelminthes; general characteristics and morphology of the class Trematoda and sub-classes homogenes and Digenea. General characteristics and morphology of the class Cestoda and sub-classes Cestodaria and Eucestoda. General characteristics and morphology of the class Nematoda and sub-classes Secernentea and Adenophorea. The plant parasitic nematodes.

*Arthropods*: Outline of biological nomenclature; the position of the phylum Arthropoda in the Animal Kingdom. The classification of the Arthropoda; particular mention of the classes: Diplopoda, Cheilopoda, Crustaces, Arachnida and Insecta; their morphology and biology. The class Insecta-its abundance, variability and versatility and the class-Apterygotes, Exopterygotes and Endopterygotes. The major insect orders-their diagnostic morphological features; important families and species. Elementary insect physiology and ecology.

General characteristics, morphology, reproduction and strain reaction of Bacteria. Principles of classification of Bacteria. Distribution, isolation and cultivation of Bacteria. Disinfectants, antiseptics and methods of sterilization. General characteristics, morphology, and cytology of Fungi. Modification of vegetative hyphae. Classifications-the Kingdom Mycetae and the divisions Gymnomycota, Mastigomycota and Amastigomycota. Brief consideration of important subdivisions, class and sub-classes. Soil-borne fungi: type, importance, distribution and mode of dispersal. Survival and competitive ability of soil-borne fungi. General characteristics, morphology and reproduction of viruses. Concepts and methods in molecular biology with emphasis on genetics of insects/microbes. Application of molecular techniques in pathogens/insect biology. Molecular biology and molecular genetics of pathogenic and symbiotic interactions between microbes and plants to explain the mechanisms by which microbe's infection and activation of plant immunity and symbiosis signaling pathways.

**Minimum Academic Standards (MAS)**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**BUK-SOS201 Introduction to Soil Science**

**(2 Credit units; Core; LH = 15; PH = 45; Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates in any field of Agriculture requires basic knowledge of Soil Science. This is in line with BUK’s mission to address African developmental challenges in sustainable food production through production highly-skilled and knowledgeable graduates in Agriculture

**Overview**

            Introductory Soil Science course is critical in preparing the graduate of Agriculture to be able to handle and improve the developmental and infrastructural deficits for sustainable development.

This course is designed to afford the students of any field of agriculture to, first, become familiar with soils as natural units or entities and with their inherent characteristics.

Second, to equip students with understanding of the significance of fundamental soil properties. Third, to set forth basic relationships between soils and plants. And finally, to appraise the students with basic principles involved in soil use and management. General principles of soil science are emphasized and explained in unambiguous terms, while most of the technical detailed are retained for students pursuing soil science at higher levels.

**Objectives**

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

1. Describe basic concepts and terms in Soil Science.

2. Describe and justify the importance of Soil Science.

3. Outline and explain basic chemical, physical and biological properties of soil.

4. Understand the origin, classification, and distribution of soils and their relationships with people and food production.

5. Understand basic principles and management of soil fertility and plant nutrition; and

6. Categorize major types of problem soils and outline their remediation methods.

**Learning Outcomes**

On completion, the students should be able to:

1. Acquire knowledge of the basic concepts of Soil Science.

2. Describe basic physical, chemical, and biological properties of soils.

3. Classify types of problem soils and describe their remediation methods.

4. Differentiate between soil fertility and soil productivity.

5. List and describe roles of essential plant nutrients; and

6. Describe fertilizer and manure types, sources, and their methods of application

**Course contents**

History and development of Soil Science; Soils as a natural body; Soil components: Air, water, mineral and organic matter; Physical properties of soil: soil separates, texture, aggregation and structure, temperature, color, properties of soil mixture, pore space, bulk density, particle density, aeration, drainage and compaction; Chemical properties of soil: Soil colloids, ion exchange, soil reaction and problem soils and their reclamation; Biological properties of soil: Soil organism, microbial transformation of nutrients; Soil fertility and fertilizers: Soil fertility versus soil productivity, essential plants nutrients and their functions, manure and fertilizers (types, sources and methods of application).

**Minimum** **Academic** **Standards** (**MAS**)

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**BUK-SOS 202   Agroclimatology and Soil Conservation**

**(2 Credit units; Core; LH = 15; PH = 45; Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates who are highly skilled and knowledgeable in understanding of climate and weather and their impacts on agriculture. This is in line with BUK’s mission to address African developmental challenges in sustainable food production through production highly-skilled and knowledgeable graduates in Agriculture

**Overview**

           Four factors-edaphic, climate, genotype and management practices shape agricultural growth and sustainability. The study of agroclimatology is fundamentally concerned with the weather and climate of any given area in relation to agriculture. Climatic and weather factors vary from place to place and beyond human manipulations except under a microenvironment. Thus, climate to a large extent, determines type of crop or livestock to be grown in an area, timing, and type of agricultural operations as well as the farming systems.

         This course examines the various components of climate and weather as they affect agricultural productivity and proffer possible solutions to climate and weather-related problems confronting agriculture (especially in the tropics). It also focuses on the impact as well as the implications of climate variability/change and global warming on agriculture and how their adverse effects can be ameliorated. In addition, various methods of conserving soil and water resources for improved and sustainable agricultural production will be discussed in the course.

**Objectives**

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

1. Define agroclimatology and identify various elements of weather and climate.

2. Understand the dynamic of atmosphere and its composition.

3. Identify various wind systems and their distribution.

4. Understand the processes and measurements of hydrologic cycle.

5. Describe the characteristics of tropical climate; climate change and its impact of on agriculture and environment.

6. Examine ways to ameliorate climate change and global warming in agricultural systems and practices

7. Explain and appraise different methods of soil conservation practices.

8. Understand the techniques of water harvesting.

9. Identify various types and impacts of tillage practices with respect to soils and crops.

**Learning Outcomes**

On completion, the students should be able to:

1. Explain the meaning of agroclimatology, biogeography and climate change.

2. List the basic elements influencing weather and climate.

3. Describe the structure and composition of atmosphere.

4. Enumerate the wind systems and the pressure belts across the globe.

5. Describe the processes and measurements of hydrologic cycle.

6. Describe the characteristics of tropical climate; climate change and its impact of on agriculture and environment.

7. Illustrate the importance, classification, use and management of groundwater in agriculture.

8. Identify the various types and methods of soil and water management practices.

9. Appraise different techniques of water harvesting.

10. Explain impacts of water resource projects in agriculture and environment.

11. Explain causes, types, effects, prediction, and control of soil erosion; and

12. Present the effects of different tillage practices on soil and crops.

**Course Contents**

Basic definitions and background of agroclimatology and biogeography; Elements of climate and weather; Factors affecting weather and climate; Dynamics of earth’s atmosphere (structure and composition); Radiation and heating of the atmospheric systems; Dynamics of pressure and wind systems; Hydrologic cycle and measurements of its components; Tropical climate, effect of climate on soil, crop, livestock, irrigation, pest and diseases; Climate change, its characteristics, causes and mitigation, impact of climate changes on agriculture; Introduction to weather forecast; variables of weather forecast and numerical weather predictions; Groundwater use and management; water harvesting techniques; soil and water conservation practices; impacts of water resource projects; soil erosion (causes, types, effects, prediction and control); tillage effects on soil and crops

**Minimum Academic Standards (MAS)**

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**BUK-AGE 201 Household Resource Management**

**(2 Credit Units; Core; LH = 30; PH = 0; Total = 30)**

**Senate-approved relevance**

To produce graduates who can lead in household resource management research and education in Africa. The students will be committed to addressing African developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates

**Overview**

          Household resource management is an essential course that assist is preparing Agricultural students to understand the place and value of resources and their management process. The course is essential to assist student in understanding household as a socioeconomic unit which serves as beginning of human development to prepare the household as a contributing member for economic development.

         Rural and urban household are saddled with responsibility of managing human and material resources which serves as the basis for income generation, productivity increase and overall livelihood improvement. The course was objectively designed to provide details of household management, activities for development, food security and gender inclusion, efficiency in household resources as well as sustainable approach for effective control and utilization of the available resources.

**Objectives:**

The objectives of the course are to:

1. Illustrate the philosophy and significance of household resource management.
2. Describe family values and its significance in societal development.
3. Discuss the major characteristics of household resource and their management process.
4. Outline the strategies for maximizing the use of household resources.
5. Discuss food security and it’s important to developing countries.
6. Highlight the different type of food insecurity and suggest ways of reducing food insecurity.
7. Describe gender analysis and its application in participatory research approach.
8. Highlight the best approach for household resource inventory.
9. Discuss the importance of gender inclusion in decision making for household resource utilization.

**Learning Outcomes**

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

1. Identify at least 5 family values, their significance and factors that influence the value system.
2. Enumerate at least 3 major contributions of household to the economy of the nation.
3. Enumerate 5 ways of maximizing the use of household resources.
4. Define food security and highlight its dimensions.
5. Identify and discuss at least 5 ways of reducing household food insecurity.
6. Discuss gender analysis as tool for household assessment

**Course contents**

Philosophy, scope, and objectives of home economics. Historical development of home economics. Examination of basic human needs (food clothing, shelter, and health). Programme approaches in home economic which will help meet this need. Preparation for careers in a variety of occupations. Concept of family as a social unit. Definition of terms related to household resources management. Extended roles of home economics in the face of Globalization. Global trend and household resource management. Designing and implementation of home economics research in rural areas. Socio-economic and gender analysis as a tool for conducting household resources management research. Case studies

**Minimum Academic Standards (MAS)**

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B. Sc Fisheries and Aquaculture**

**BUK-ANS 204    Introduction to Agricultural Biochemistry**

**(2 Credit units; Core; LH = 30; PH = 0; Total = 30)**

**Senate-approved relevance**

To produce graduates who can lead in Agricultural Biochemistry research and education in Africa. The students will be committed to addressing African developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates

**Overview**

Animal nutrition is one of the most diverse disciplines in the animal sciences. Its sub-disciplines range from the biochemistry of nutrient use and digestive physiology among other disciplines. There is a significant overlap between nutrition and biochemistry. These two disciplines are inter-dependent and closely related.

Biochemistry is the basis for studying the utilization of nutrients by animals and humans. Nutritional and biochemical studies are often indistinguishable because both are intended to understand how organic and inorganic molecules interact to support animal metabolism. In essence, biochemistry helps us understand how animals act as transformers of Dry Matter and energy into molecules that are required for all physiological functions. Generally, the course offers broader concept on the chemistry of carbohydrate, proteins, lipids, minerals and vitamins, as well as hormones.

**Objectives**

The objectives of the course are to:

1. Identify the functions of macromolecules (carbohydrates, lipids, proteins, nucleic acids, enzymes, minerals, and vitamins)
2. Recognize the chemistry of macromolecules.
3. State the advances in nutrients studies.
4. Explain the nature of enzymes and hormones.
5. Classify enzymes and hormones
6. Explain the functions of enzymes and hormones.

**Learning outcomes**

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

1. Explain at least 5 functions of different macromolecules.
2. Identify all different functional groups of macromolecules.
3. Explain at least 3 different classifications of macromolecules.
4. Describe the nature of enzymes and hormones.
5. Mention at least five (5) enzymes and hormones.
6. Explain five (5) functions of enzymes and hormones.

**Course contents**

Chemistry of carbohydrates, lipids, proteins and nucleic acids. Water chemistry; vitamins and their coenzyme functions. Minerals. The nature, classification and functions of enzymes and hormones.

**Minimum Academic Standards (MAS)**

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 309 Fisheries Statistics and Research methodology**

**(2 Credit units; Core; LH = 30; PH = 0; Total = 30)**

**Senate approved relevance**

To produce graduates who are experts in Fisheries statistics and in the right applications of the research methodology in Africa. The students will be committed to addressing African developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

In this course we will be discussing some of the basic techniques used in collecting, presenting and analyzing fisheries statistical data. But in this introductory topic, we will talk briefly about why we collect fisheries statistics, what types of statistics are collected by and for a fisheries statistical system, the types and levels of detail needed for some of these data and some possible types of statistics collections. Topics will include mathematical distributions, transforming data, significant figures, number of samples needed, effect of sampler size, sample design, mark-recapture and depletion methods of estimating animal abundance, length-frequency analysis, length-weight relationships (K, Wr, ANOCOVA), and basic statistical tests (e.g., t-tests, paired t-tests, tests of normality, correlations, simple ANOVAs, regression analysis).

Additional topics will include ratios, pseudo-replication, nonparametric statistics, repeated-measures ANOVA, multiple comparison testing, and variable selection techniques. Handouts (computer printouts, handbooks, and primary literature) will be used extensively as supporting materials. Students will learn the basics of SAS (Statistical Analysis System), JMP, and EXCEL programming for data management and analysis, along with being introduced to R

**Objectives**

The objectives of this course are to:

1. identify the basic concepts of the statistics and research methodology.
2. interpret the basic introduction to Fisheries related statistics.
3. formulate the relevant methodologies.
4. analyze the applications of the various methodologies.
5. interpret data collected to solve fisheries challenges worldwide.

**Learning Outcomes**

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

1. state 5 (five) basic concepts of statistics
2. formulate 2 (two) scientific methods of identifying problems
3. apply 4 (four) scientific methods to solving problems
4. evaluate 10 (ten) scientific skills of collating, analyzing and presentation of data.
5. compute normal and binomial distribution,
6. interpret the results from basic statistical tests (e.g., mean (arithmetic and geometric), standard deviation, variance, standard error, Z scores, CV, t-tests, paired t-tests, tests of normality, correlation analysis, simple ANOVAs, multiple comparisons, regression analysis (including variable selection techniques), Chi-square test, Kolmogorov-Smirnov test, variance to mean ratio test, analysis of variance, analysis of covariance, correlation and regression analysis. Goodness of fit,
7. develop at least a research design for simple laboratory experiments,
8. formulate a minimum of (3) three research objectives
9. perform at least 1 (one) field experimentation
10. create 5 (five) research instruments.
11. analyze 10 (ten) data emanating from the research instrument,
12. write a scientific report and present it

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**Course contents**

Introduction to scientific methods – nature, scope and propose. Basic statistics – distributions. Research variables and data types. Analyzing data with Excel I and II. Length-weight. relationships K, Wr, Ws, regressions. Length-weight relationships ANOCOVA. Size structure – Length frequency histograms, Chi-Square test, K-S test. ANOVA – multiple comparisons Regression – variable selection techniques. Sample designs, rounding, significant figures. Non-parametric methods, pseudo-replication. Mark-recapture estimates. Formulation of a research problem, statements and development of research objectives and hypotheses. Research design and measurements. Types of data instrument, scaling and questionnaire design and Data collection. Sampling techniques. Probability distribution. Normal and binomial distribution. Inferential statistics. Frequency distribution, descriptive statistics, mean separation, measures of central tendency, measures of dispersion, summary statistics measures of location. Statistical analysis of data – Chi square distribution, tests of hypothesis – F-test, T-test. Analysis of variance 1- one way and multiple ways classification analysis of co-variance, correlation and regression analysis. Analysis of variance 11-determination of goodness of fit, Principal component analysis, discriminant analysis, etc. Data presentation in narrative, tabular and graphic forms. Data processing techniques, manually and digitally. Field experimentation. Guidelines on scientific Report writing. Experimental procedures – cause and control of experimental error; factorial experiments; Surveys and Questionnaires designs and administration;

**Minimum Academic Standards (MAS)**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-CPS 301         Principles of Irrigation and Drainage                (2 Unit, Core; LH:20, PH:10, Total = 30)**

**Senate approved relevance**

To produce graduates who will lead in research and education on irrigation and drainage that are committed to addressing African developmental challenges through, cutting-edge research, knowledge transfer, training, and increased crop production

**Overview**

          Water is one of the most important inputs in agriculture production. Since agriculture in Nigeria is majorly dependent on rainfall, there is a great connectivity between intensity and spread of rainfall to crop production. The uncertainties associated with rainfed agriculture can be met via adoption of methods of irrigation. Irrigation is the number one consumer of water globally, utilizing over 70% of the world’s freshwater. Sustainable water use for food production, human consumption and industrial use are prime global challenges at present.

          Since agriculture is the largest user of water, farmers must accept the challenge of making it to be more efficient in a food secure world. Production of food, fibre, fuel and other industrial inputs with less water availability is becoming a major challenge for both rainfed and irrigated agriculture. Considering these facts, this course is designed to give thorough knowledge of water, agriculture, and their relationships so that associated challenges can be overcome.

**Objectives**

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

1. Identify the roles of water in crop production.

2. Enumerate the different methods of assessing crop water requirement.

3. Analyse the various irrigation systems, adaptabilities, merits, shortcomings, and efficiencies.

4. Enumerate the different sources of water for irrigation in Nigeria.

5. Describe soil drainage systems and their implications on irrigation efficiency.

6. Describe moisture stress and its physiological implication on the productivity of crops.

7. Categorize the different challenges associated with soil salinity and alkalinity and ways of their management.

**Learning outcomes**

On completion, the students should be able to:

1. State at least 5 roles of water in crop production

2. List any 4 methods of assessing crop water requirement.

3. State any 4 merit and demerits of at least two irrigation systems.

4. State any 4 merit and demerit of drainage.

5. Explain at least 5 effects of moisture stress on crop production.

6. List any 3 ways of managing soil salinity and alkalinity.

**Course** **contents**

Role of water in crop growth. Concepts of soil water availability. Irrigation water requirements. Irrigation scheduling; methods of irrigation, water deficits and crop yield. Water use efficiency. Water quality. Principles of soil salinity and alkalinity. Management of problem soils (saline, alkaline, saline – alkaline and flood prone soils). Leaching and drainage. Irrigation resources of Nigeria.

**Minimum Academic Standards (MAS)**

If needed as addition as what is contained in the CCMAS

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 402 Fish Parasites and Diseases**

**(2 units; Core, LH = 15; PH= 45; Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates that are well skilled and knowledgeable in the area of growth, development and environmental physiology of farm animals in Nigeria in line with BUK’s focus in addressing African developmental challenges in producing graduates in animal science discipline. Relevance is seen in graduates of Fisheries ad Aquaculture from BUK being able to recognize, tackle and treat diseases occurring on/ in the fish and its environment in order to produce healthy fishes for human consumption.

**Overview**

This course examines fish health and disease from the perspectives of the fish, the pathogen and the environments that they share. Major bacterial, viral and parasitic diseases of cultured fish are explored and the characteristics, epidemiology, prevention, control and management of the causative agents are investigated. While the major diseases covered are particularly important to catfish culture, the principles and practices are applicable to other species, both warm and cold-water region.

This course is not only to provide the basic background information on fish diseases but also to integrate it with recent developments in vital areas of fish diseases. Capture fisheries, aquaculture and ornamental fish are linked and are both contributing immensely to the supply of food fish as a cheap source of protein in human diets and fishery products for industrial usage and aquarium development. Whatever diseases that affect fish in the wild, pond or race waters also affect fish in the tanks and aquarium.

**Objectives**

The objectives of this course are to:

1. describe gross and external morphology of fish pathology.
2. identify the tools and skills necessary to objectively evaluate the health of fish in culture situations.
3. analyze the causative agents of the major bacterial, viral, fungal and parasitic diseases of fishes.
4. identify infectious and non-infectious parasites.
5. state the major factors that contribute to disease outbreaks in culture.
6. illustrate tools and techniques available to diagnose and respond to many common diseases.

**Learning** **Outcomes**

On successful completion of this unit, the students will be able to:

1. demonstrate how to handle sick fish.
2. list 5 (five) importance of (un) transmissible diseases
3. state 4 (four) spreading processes of their causative agents of the transmissible diseases.
4. distinguish between the clinicopathological and epidemiological perspectives of the transmissible diseases of fish.
5. characterize the main taxa of bio-pathogenic factors (viruses, bacteria, eukaryotic parasites).
6. expound on the variable processes of contagion and disease development, in different kinds of fish transmissible diseases, along with their consequences.
7. outline 5 (five) diagnosis and prognosis formation for the commonest fish transmissible diseases
8. justify at least 4 (four) application of therapeutic and preventive measures for their control of diseases in fish.

**Course** **Contents**

Identification, morphology, taxonomy, life history of fish parasites. The ecological effects of parasites and diseases of fish. The pathological effects of parasites and diseases of fish. Epidemiology of fish parasites populations in water body. Fish diseases and classification. Common bacterial, fungal and viral fish diseases and their control. Other enemies of fish. International restriction binding the transportation of fish across country boundaries. Fish ponds and public health. Fish pond and health hazard. Fish health management. Fish Allergy. Adaptive immune responses of fish. Pollution and fish diseases. Fish toxins. Bath treatment for fish keeping. Sensitivity test control and therapy

**Minimum academic standard**

All required facilities have been adequately captured

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 406 Oceanography, Seamanship and Navigation**

**(2 units; Core, LH= 15, PH= 45; Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates that are experienced in the area of Oceanography, Seamanship and Navigation in Nigeria in line with BUK’s focus in addressing African developmental challenges in producing graduates in fisheries and aquaculture discipline. Relevance of this course is seen when graduates from this department in BUK can conveniently sail around large water bodies safely and also be able to interpret ocean’s charts and figures correctly.

**Overview**

This course will focus on the importance of the oceans to human beings as well as the impact of human activities on the oceans. It is an overview of the Ocean environment with an emphasis of the interrelationship of the subdisciplines of ocean sciences.

It’s a course that provides adequate and useful insight into oceanographic phenomenon that affects diverse operations and activities related to the ocean and marine environment. These theoretical aspects of oceanography will be followed by regional case studies of coastal systems and an introduction to the state of the environment in the Oceans (i.e contamination, oil spills, fisheries exploitation).

This excellent course gives a basic introduction to essential navigation and safety for anyone new to boating; Sailors, power-boaters, sea anglers, divers, boat-masters, experienced dinghy and keelboat sailors, as well as inshore racers.The course content includes charts and publications, safety, buoyage, tidal awareness, basic navigation and pilotage, rules of the road, electronic navigation, anchoring, weather forecasts, and passage planning

**Objectives**

The objectives of the course are to:

1. appraise the overview of the science of oceanography.
2. integrate all specific concepts of oceanography into a multidisciplinary analysis of the Earth,
3. stimulate students’ interest and curiosity in the many and varied sciences used in the study of the ocean
4. demonstrate the complexity of the “water-world” in terms of beauty, control, and vulnerability
5. develop skills in the practical uses of the navigation chart
6. familiarize the midshipmen to the nautical chart format and associated plotting tools and techniques.
7. interpret chart coordinates by measuring and calculating distances, times, directions and speeds.
8. identify navigation rules and maneuvering boards from NS 101.

**Learning Outcomes**

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

1. outline 5 (five) sustainable practices regarding ocean resources (e.g., fisheries, hydrocarbons).
2. sketch the connectivity of the oceans to the major Earth processes, such as atmospheric and oceanic circulation, climate and weather, plate tectonics, and sustainability of human and marine populations.
3. discuss 10 (ten) importance of oceanography in global initiatives and political decisions for the present and future.
4. explain the theory of plate tectonics and list 5 (five) relationship to the formation of major features of the seafloor.
5. analyze the atmospheric and oceanic circulation systems as well as their interconnections and driving forces.
6. describe 3 (three) principles involved in the generation of waves and tides.
7. summarize the major physical and chemical properties of seawater.
8. appraise the relationship between plants and animals in the ocean
9. identify 4 (four) consequences of a rise in sea-level on the coastal zone and society
10. outline 6 (six) possible mitigation and adaptation strategies to prevent a rise in the sea-level.

**Course Contents**

Definition of basic principles and concepts in oceanography. Ocean zones and their properties. Study of the temperature and chemistry of sea water and inland water bodies. Biological activities and their distribution. Marine ecological factors: Salinity, chlorinates, currents, tides, waves, sound and radiation in the sea, conductivity diffusion, viscosity and dynamics of sea water. Organic production in the sea – primary production, distribution and behavior of fish and plankton in the marine environment. Brackish waters (rivers, estuaries): definition, classification, physico-chemical characteristics, adaptive features of estuarine organisms, economic importance. Interrelationship and physiological adaptations of marine organisms. Forecasting fish location. Plate tectonics. Ocean’s resources. Marine pollution. Hydrothermal vent communities. Upwelling Eco system. Laws of the sea. Shoreline and shore line processes. Oceanographic surveying Technique. Current development in oceanography. Management of Data. Important sea terminology; part of a boat, strength of wind and state of sea. Coast lights and light vessels. Measures for distance, depth, speed etc. Launching and boarding of small boats. Lifesaving and firefighting equipment and methods. Swimming

**Minimum academic standard**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 408 Introduction to Fish Breeding and Genetics**

**(3 units; Core, LH = 15, PH= 90; Total = 105)**

**Senate-approved relevance**

Training of high-quality graduates that are competent in the use of modern technologies in the area of fish breeding and genetics in Nigeria in agreement with BUK’s mission in addressing African developmental challenges in producing graduates in fisheries and aquaculture discipline. Relevance of this course is seen when these graduates can compete effortlessly with others around the world to contribute to the production of genetically improved or highly modified fish species ideal and acceptable for consumption for the Nation’s increasing human population.

**Overview**

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| --- |
| This course covers the principles of qualitative and quantitative genetics and breeding of fish and shellfishes. Emphasis is placed on quantitative genetic traits that affect various production parameters, with numerous examples using commonly cultured species.            Upon completion, students should be able to discuss the basic principles of breeding and genetics. They should also be able to design appropriate breeding programs for a variety of commonly cultured species |

**Objective**

The objectives of this course are to:

1. review the recent advances and development of breeding plans
2. identify the basic principles of relatedness among organisms.
3. describe the principles of gene expression.
4. evaluate different methods of improving fish performance through chromosome manipulations.
5. compare the different methods of selection and mating to improve fish performance in aquaculture.
6. enumerate ideal methods of dealing with fish germplasm for effective use in aquaculture.
7. evaluate various tools and strategies that can be used in fish farming breeding
8. identify important social and ethical issues related to the use of breeding and generic engineering methods in aquaculture.
9. assess the value of different sources of information in breeding (phenotypes, different genetic information, relationships, etc).

**Learning Outcomes**

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

1. discuss at least 4 (four) basic principles of genetics
2. design 3 (three) appropriate breeding programs for a variety of commonly cultured species
3. state the basic Mendelian genetic theory
4. describe 2 (two) methods of sex determination in fish
5. sketch 4 (four) diagrams of simple monohybrid and dihybrid crosses.
6. explain the concepts of dominance, interaction, sex linkage, pleiotropy, penetrance and expressivity
7. identify 5 (five) concepts of population genetics and selection.
8. enumerate the hybridization techniques to improve fish production
9. estimate the rate of inbreeding within a given population of fish and determine the appropriate population size for future breeding needs.
10. outline 4 (four) uses of biotechnology in fish farming, including sex reversal and production of mono-sex populations, chromosomal manipulation and transgenic fish
11. formulate 5 (five) brood stocks management program for a fish farm.

**Course Contents**

Definition of genetics and importance of its principles. Gene and chromosome as basis of inheritance. Mendel’s law of inheritance-complete and incomplete dominance, monohybrid and dihybrid ratios. Gene interactions- dominant and recessive epistasis, pleiotropism. Linkage and crossing over. Introduction to population genetics-Hardy-Weinberg law and its significance. Chromosome manipulation techniques-Androgenesis, gynogenesis and polyploidy and identification of ploidy. Sex determination and differentiation in fish. Cross breeding (hybridization). Types of cross breeding, heterosis and design of cross breeding programmes, Hybridization in different fishes. Quantitative genetics-Quantitative traits, polygenic traits, heritability. History and present status of selective breeding programs in aquaculture. Selection methods and mating designs. Design for selective breeding. Inbreeding and its consequences. Domestication methods. Seed certification and quarantine procedures. Cryopreservation of gametes.

**Minimum Academic Standards (MAS)**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 409 Production of Other Aquatic Products**

**(2 units; Core; LH = 15; PH =45; Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates that are familiar and conversant with products from the marine and brackish environments in Nigeria in support with BUK’s focus in addressing African developmental challenges in producing graduates in fisheries and aquaculture discipline

**Overview:**

This course involves Mariculture and Aquaculture of shellfish (crustacean and mollusk production). The course synopses focus on the production and management of decapods. Reproductive biology, pathology, endocrinology. Production of tropical shrimp and prawn species; culture of commercially important crustaceans.

Penaeid shrimp culture, freshwater Macrobrachium culture, marine and freshwater crab culture. Extensive, semi-intensive and intensive techniques. Harvesting and marketing of portunid crabs, lobsters and crayfish. Crustacean health, pests and diseases.

**Objectives**

The objectives of this course are to:

1. explain the various methods of shellfish cultures
2. describe the morphology and ecology of shellfishes
3. summarize the products derived from shellfishes
4. illustrate the culture of some economically important shellfishes
5. examine the various ways of processing and storing these animals.

**Learning Outcomes**

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

1. demonstrate the culture of at least 3 (three) shellfishes in the laboratories.
2. enumerate the ecology of 5 (five) shellfishes.
3. identify 5 (five) ways by which these shellfishes and their products can be conserved.
4. outline 10 (ten) products derived from the marine waters
5. list 4 (four) methods used for the preservation and processing of marine products.
6. familiarize students to the act of farming shellfishes for food security.

**Course contents**

Ecology, life histories of crustaceans and aquatic mollusks. Life history of aquatic crustaceans and mollusks. Mariculture. Culture of Economically important shrimps. Culture of Economically important oysters. Culture of Economically important crabs. Culture of Economically important crayfish. Culture of Economically important lobsters. Culture of Economical important cockles. Culture of Economical important periwinkles. Culture of economically important marine gastropods. Culture of frogs. Culture of edible sea weeds and fresh water plants. Resources from the sea that serves as natural feeds for the cultured species. Deep sea and shore farming of some products. Derivatives of marine product. Processing and preservation of marine products

**Minimum academic standard**

All required facilities have been adequately captured

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 411 Water Quality Management and Pollution Control**

**(2 units; Core, LH =15, PH= 45, Total = 60)**

**Senate-approved relevance**

Training of high-quality graduates that are well skilled and conversant with water quality, its biodiversity, management and the control of water pollution in Nigeria in line with BUK’s focus in addressing African developmental challenges in producing graduates in fisheries and aquaculture discipline.

**Overview**

Water Quality Management and Pollution Control aims to provide students with the basic introduction to the composition of water bodies, water chemistry, nutrient cycling in aquatic environments, biological characteristics of natural and polluted water, sampling methods, the management of selected marine, brackish and fresh waters, framework for water pollution control and the methods of water pollution prevention and control.

The study of aquatic biodiversity is of imperative importance to a nation’s economy. Biodiversity is critical to the maintenance of a healthy environment. Its role in meeting human needs directly while maintaining the ecological process upon which our survival depends is enormous. Biodiversity not only provides direct benefits such as food, medicines, and energy; it also affords us a “life support system.” Biodiversity is required for the recycling of essential elements, such as carbon, oxygen, and nitrogen. It is also responsible for mitigating pollution, protecting watersheds, and combating soil erosion. Because biodiversity acts as a buffer against excessive variations in weather and climate, it protects us from catastrophic events beyond human control. In a fundamental sense, experiencing and increasing our knowledge about biodiversity transforms our values and beliefs.

Knowledge about biodiversity is valuable in stimulating technological innovation and providing the framework for sustainable development. Inland water ecosystems, including lakes, rivers, estuaries, wetlands and aquifers, provide numerous services upon which human activities depend. Changes in water availability affect the functionality of aquatic ecosystems, thereby compromising the delivery of ecosystem services. If the functions of inland water ecosystems depend upon the availability of water, it is simple to conclude that moving water away from “natural” inland water ecosystems causes changes in those systems.

Usually, such changes are negative and can result in the loss of species and of related services supplying local populations and dependent water uses. Those changes may also affect river estuaries and coastal regions. Reductions in freshwater flows, or changes in flow regimes, usually accompanied by increased pollution, eutrophication and sedimentation, can lead to significant loss of estuarine/coastal ecological functions and related ecosystem services.

**Objectives**

The objectives of this course are to:

1. describe scientific and technical background in water quality monitoring, pollution control technologies and environmental management.
2. evaluate information on the basic concepts of water pollution and its effects on human and ecosystem health.
3. demonstrate laboratory analysis and the interpretations of the results
4. discuss major water pollutants, their sources, physical, chemical and biological transformations and impacts.
5. explain how natural ecosystems respond to changes in water characteristics, including the self-purification capacity of oxygen-demanding materials and filtration of solid components.
6. discuss the ecosystem species and genetic diversity
7. evaluate the effect of habitat loss
8. discuss the effect of aquatic pollution on biodiversity effect climate change on aquatic biodiversity
9. evaluate the basic methods of aquatic biodiversity monitoring, assessment, conservation and management measures.

**Learning Outcomes**

On completing the course, the students should be able to:

1. identify 5 (five) characteristics of pure water,
2. list 5(five) water quality management techniques.
3. outline 5 (five) pollution control.
4. state 4 (four) biological and ecological characteristics of polluted water.
5. enumerate 5 (five) effects of pollutants on fish, plankton, benthic macro invertebrates, algae and water quality.
6. describe the clean-up and control of any 3 (three) pollutants
7. explain the framework for water pollution control.
8. list 7 (seven) functions of ecosystem.
9. identify 5 (five) Importance and conservation of different ecological niches.
10. explain 5 (five) sea safety and health management of fishery communities.

**Course Contents**

Physical composition of water bodies. water chemistry and nutrient cycle. sampling methods. Management of selected marine, brackish and fresh waters. Chemical, mechanical and biological methods for maintaining and improving water quality. Sources and types of aquatic pollutants. Biological ecological characteristics of polluted water. Effect of pollution on fish planktons, benthic macro invertebrates, algae and water quality. Water quality assessment. Aquatic ecosystem. Endemic species and habitat loss. Climate changes on aquatic biodiversity. Study and identification of the characteristic tropical freshwater and coastal swamps flora of importance. Study and identification of the characteristic tropical freshwater and coastal swamps fauna of importance. The ecology, utilizations and management of aquatic flora and fauna. Control of aquatic weeds in ponds – chemical, mechanical and biological. Total aquatic biodiversity value index.

**Minimum academic standard**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 412 Fish Farm Engineering, Ornamental Fisheries and Aquaria Design**

**(3 units; Core, LH=15; PH= 90, Total = 105)**

**Senate-approved relevance**

Training of high-quality graduates that are well skilled and proficient in the construction of ponds and aquaria and are also experts in the successful rearing of ornamentals fish species in Nigeria in conformity with BUK’s mission to address African developmental challenges in producing graduates in fisheries and aquaculture discipline

**Overview**

The course provides applied training on aquaculture engineering. This course will impart valuable skill to the students in order to enhance their hands-on expertise on fish farm engineering. Topics to be covered are Hydrological information for design and operation of aquaculture systems. Soil engineering for designs of ponds, canals and dams. Design and construction of fish farms, hydraulic formulas used in designing fish farms, maintenance of aquafarms.

Pond construction engineering, design and construction of fish cages, tanks, and other impounding structures, classification and design of different types of water pumps, types of aeration and filtration devices, their design and construction. Waste management techniques in aquaculture production, biofiltration system, type of aerators, degassing etc. Water Recirculating systems and aquaponics.

This course aims to familiarize the students with the principles of ornamental fish culture management, history and status of ornamental fish industry. This course also gives an introduction to basic concepts of aquarium science, species and variety of ornamental fish. The students will be learning the biological aspect of ornamental fish such as male-female determination, morphology and symptom of maturation, breeding techniques and larval rearing. The students will be provided with specific detail about aquarium set-up, filtration system, aeration and decoration that are useful in aquarium management

**Objectives**

The objectives of this course are to:

1. discuss the basic aspects of successful farm designing for effective management and optimum yield.
2. apply basic knowledge on technical equipment, methods and systems that are necessary for aquaculture production.
3. state the importance of ornamental industry in Nigeria and globally.
4. outline the factor related with biology, reproduction and management of types of ornamental fish;
5. discuss the ornamental fish species in Nigeria as well as aquarium management.
6. list the aquaria accessories and their appropriate uses.
7. identify locally available materials for construction and their procurement.
8. design, construct and maintain aquaria.

**Learning Outcome**

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

1. design at least 2 (two) ideal aquaculture production systems.
2. apply information and practical experience in aquarium decoration;
3. discuss 4 (four) ways of breeding and rearing ornamental fishes
4. list 10 (ten) ornamental fish species in the world
5. enumerate 5 (five) diseases that affect ornamental fishes in the aquaria and their symptoms
6. examine the feeds and feeding managements for ornamental fishes in confinements.

**Course Contents**

General surveying and site selection. Types and choice of fish ponds. Design and construction of dykes, sluice gates and drainage facilities. Pond construction procedures and steps involved. Pond shapes designs and Layouts. Construction of tanks, pens, cages, rafts and other types of fish rearing facilities. Design of inland fish farms, pumping stations and fish hatcheries. Fresh water and brackish water pond construction. Post-harvest maintenance of ponds. Principles of ornamental Fish Culture. Design, Construction and maintenance of various aquaria. Management and nutrition of ornamental fish species. Ornamental fish breeding. Feed and feeding managements of ornamental fishes. Aquarium plants (types of aquarium plants and their importance). Aquarium accessories and equipment for small scale and large-scale units. Water quality management. Various kinds of aquarium fish and their feeding breeding habit

**Minimum academic standard**

All required facilities have been adequately captured.

**Bayero University, Kano (BUK)**

**Faculty of Agriculture**

**Department of Fisheries and Aquaculture**

**B.Sc. Fisheries and Aquaculture**

**BUK-FAA 413 Fisheries Policy and Legislation**

**(2 units; Core, LH = 30; PH = 0; Total = 30)**

**Senate-approved relevance**

Training of high-quality graduates that are conversant and proficient in international laws, regulations and policies governing fisheries, its management and harvesting of aquatic species in their natural environment in the international waters in Nigeria in agreement with BUK’s mission to address African developmental challenges in producing graduates in fisheries and aquaculture discipline.

**Overview**

Fisheries Policy and legislation is course that helps the students in understanding reasons for fishery regulations and administration; consider the different fisheries legislation in Nigeria, national laws regarding aquatic resource management and its relevance to fisheries.

Other important areas covered in the course are the administrative structure of fisheries management in Nigeria, problems of fisheries conservation in Nigeria and international laws. Fisheries institution, conservation strategies and laws of the sea. The different rolling plans and their contents.

**Objectives**

The objectives of the course are to:

1. demonstrate practical experience in designing a project aimed at addressing a current fisheries management issue through scientifically informed professional practice.
2. evaluate the current scenario of fisheries sector in terms of regulations on fishing effort.
3. outline the Acts and Policies of both local and international fisheries.
4. familiarize with the different Code of conduct for responsible fisheries.
5. justify the legal basis for fisheries management principles and salient features of fisheries regulations
6. discuss the laws related to marine pollution, shipping and transport etc

**Learning Outcomes**

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

1. discuss the complex, multi-dimensional nature of fisheries management problems.
2. state 5 (five) benefits of integrative-interdisciplinary approaches to addressing management problems.
3. outline 5 (five) relevant concepts each in the areas of fisheries systems, stakeholder characteristics and behavior, fisheries governance, fish stock dynamics, fisheries economics, and management and planning processes.
4. demonstrate practical skills in interview and survey methods, institutional analysis, fisheries assessment, economic analysis, and participatory planning.
5. analyze 5 (five) practical experience in analyzing fisheries management issues in a problem- and outcome-oriented, interdisciplinary manner.
6. identify 5 (five) ways to strengthen communication skills in the legislative domains.

**Course contents**

Fisheries institution. Conservation strategies. Fisheries policy and laws of Nigeria. International laws of the sea. Rationale for National Fisheries Policy. Conservation Laws. The territorial sea and contiguous zone. Court of conduct for responsible Fisheries. The continental shelf and exclusive economic zone. Codification of the law of the sea. The evolution of UNCLO (United Nation Convention on Law of the Sea). Marine Space under National jurisdiction: Territorial Sovereignty. Marine Space under National jurisdiction: Sovereign rights. Maritime delimitation. Marine space beyond National jurisdiction. Maintenance of International Peace and Security of the Sea. Peaceful settlements of International Disputes.

**Minimum Academic Standard (MAS)**

All required facilities have been adequately captured.