

## **COLLEGE OF ENVIRONMENTAL RESOURCES MANAGEMENT (COLERM)**

The College comprises of the following four academic Departments:

**Department of Agrometeorology and Water Resources Management**

**Department of Aquaculture and Fisheries Management**

**Department of Environmental and Toxicology**

**Department of Forestry and Wildlife Management**

The College offers a wide choice of courses and research programmes for study at both the Master's and the Doctorate degree levels. The range of Master's courses include:

### **Masters of Science (M.Sc.) with specialization in**

Agrometeorology

Water Resources Management

Irrigation and Drainage

### **Master of Aquaculture and Fisheries (MAF) with specialization in**

Aquaculture

Fish Pathology

Fish Nutrition

Fisheries Management

### **Master of Environmental Management and Protection (MEMP)**

### **Master of Forestry (MF) with specialization in Silviculture.**

**Agro-Forestry, Ecology, Forest Biology**

### **Master of Wood Science (MWS)**

### **Master of Wildlife Management (MWM)**

Doctor of Philosophy (Ph.D) in the areas of specialisation listed above is also available. The lively interaction of research interests within these subject areas has resulted in exceptional facilities for interdisciplinary studies, not only between Departments but jointly also with other colleges in UNAAB and other neighbouring Research Institutes and other Government parastatals and private industries. This is particularly true for all the Departments because the College's recognized strengths have been developed over many years of close collaboration with local research establishments of international repute like:

International Institute of Tropical Agriculture (IITA), Ibadan

Meteorological Services, Lagos

Nigeria Institute for Oceanography and Marine Research (NIOMR) Lagos

Ogun State Agricultural Development Programme, (OGADEP), Abeokuta

Ogun-Oshun River Basin and Rural Development Authority, Abeokuta

Forestry Research Institute of Nigeria, Ibadan.

National Institute of Horticultural research (NIHORT), Ibadan

Ogun State Environmental Protection Agency, Abeokuta

Federal Environmental Protection Agency (FEPA), Abuja

National Institute for Freshwater Fisheries Research (NIFRR), New Buassa

Nigerian Institute of Water Resources, Kaduna

Ogun State Forestry Department

National Parks Commission, Abuja.

The College contributes to the postgraduate Programmes by offering both the University courses and college courses. They are:

<b>Course Code</b>	<b>Course Title</b>
CSC 701	Use of Computer in Research 431
AMW 717	Advanced Methods of Water Quality Assessment and Pollution control 321
FRM 700	Advanced remote sensing and Photogrammetry
ERM 700	Advanced Biometric 321

There are 30 full-time members of staff who are able to cater for a wide variety of research interests. New postgraduate students arriving in the College enter into a friendly and lively research atmosphere. Activities in which postgraduate students participate include a regular seminar programme with speakers from inside and outside the College and a number of annual social events. Most postgraduate students in the College will find themselves pursuing independent research towards the writing of a thesis.

The departmental entries indicate areas in which expert supervision and relevant facilities are most readily available. We are confident that they are amply available over a wide spectrum and that postgraduate students will find that COLERM offers both strong academic support and a congenial ambience for further study.

### **POSTGRADUATE PROGRAMMES IN THE DEPARTMENT OF WATER RESOURCES MANAGEMENT AND AGRICULTURAL METEOROLOGY**

The Department of Water Resources Management and Agricultural Meteorology came into existence in 1988 with the creation of the University of Agriculture, Abeokuta. The Department started Postgraduate Degree programmes in 1995.

#### **PHILOSOPHY AND OBJECTIVES OF THE POSTGRADUATE DEGREE PROGRAMMES**

The Postgraduates Degree Programmes in the Department of Water Resources Management and Agrometeorology are designed to produce high level Teachers, Researchers and Professionals that are satisfactorily equipped with analytical and technical skills necessary for the adequate performance of their jobs as academic and professionals.

The programme intends to train students to enable them

- (i) Handle the problems of water resources in the area of distribution and availability, management and mode of extraction for domestic agricultural and industrial uses. It will also provide the training required in the sustainable development of drainage basins.
- (ii) Handle the problems of climate as it affects Agricultural practices including specific effects on animal production, Food Crop Production, Forestry and Aquaculture Production. Furthermore it will provide the training needed for understanding current environmental problems on land, ocean and atmosphere.

## AREAS OF SPECIALIZATION

Areas of specialization at the M.Sc and Ph.D levels are:

- (i) **AGROMETEOROLOGY**
- (ii) **WATER RESOURCES MANAGEMENT**

## STRUCTURE

The programme consists of thesis, seminar, core and elective courses. The core are the departmental key courses that cut across the areas of specialization mentioned above while the electives are courses in the specific area of specialization of a candidate.

The structure is as given below:

Courses	Units
College courses (compulsory)	10
Core Courses	12
Electives	7
Thesis Research (AMW 799)	6
Seminar (AMW 799)	2
	<b>37</b>

Minimum Total for the Award of M.Sc. Degree: 36 Units

Course code	Course Title	Units
	<b>University Courses</b>	
CSC 701	Use of Computer	4
	<b>College Courses</b>	3
FRM 741	Advanced Remote Sensing and Photogrammetry	3
AMW 717	Advanced Methods of Water Quality Assessment & Pollution Control.	
	<b>Core Courses</b>	
AMW 701	Analytical Framework for Agrometeorological & Drainage Studies.	3
AMW 702	Micrometeorology	3
AMW 703	Agro-hydrology	3
AMW 794	Analytical Cartography	3
	<b>Elective Course</b>	<b>22</b>
AMW 705	Tropical Weather Disturbances & Forecasting	3
AMW 706	Agro-meteorological Modelling & Yield Prediction	3
AMW 707	Advanced Agricultural Watershed Mgt. & Analysis	3
AMW 708	Water and Agric. In the Tropics	3
		<b>12</b>

Course code	Course Title	Units
AMW 709	Hydraulics	3
AMW 710	Hydrometry	3
AMW 711	Surface Water Evaluation and Monitoring	3
AMW 712	Water Resources Modelling	3
AMW 713	Management of Water Resources Systems	3
AMW 714	Hydrological Process and Analysis	3
AMW 715	Irrigation and Drainage Design	3
AMW 716	Drainage Principles and Design	1
AMW 718	Field Trip	22

### **PH.D PROGRAMMES**

The Ph.D Programmes are designed to produce high level Teachers, Researchers and Professionals in the following areas of specialization:

- (a) Agrometeorology
- (b) Water Resources.

### **SYNOPSIS FOR M.Sc COURSES**

#### **AMW 701 – Analytical Framework for Agro-meteorological and Drainage Studies. (3 Units)**

Developing hypothesis and objectives, Research design, measurement and data collection, interpolation of missing data applications of probability distribution in hydro-meteorological events/processes: Non-parametric tests, analysis of variance. Multivariate analysis: multiple correlation and regression, principal component factor and techniques of time series analysis; stochastic processes.

#### **AMW 702 – Micrometeorology (3 Units)**

Physical phenomena near the soil-atmosphere including solar and thermal radiation, diffusion, turbulence and profile relationships: the transport of heat, matter and momentum within and above plant canopies and combination equations for evaporation, transpiration, carbon dioxide balance and photosynthesis, concept of water use efficiency advertent and inadvertent modification of plant climatic environment.

#### **AMW 702 – Agro-hydrology**

Role of watershed management for arable land use in the tropics. Soil classification and hydrologic soil groups. Water in the unsaturated zone (capillary rise, percolation, and depth to water table). Soil moisture content, soil water potential, soil moisture characteristics, soil-water-plant relationship, crop water requirements, Measuring devices (gravimetric methods, electrical resistance methods, neutron probes, etc.)

Land evaluation and introduction to irrigation techniques. Basic concepts on morphological calculations. Effect of water diversions in rivers and degradation of rivers after dam constructions. Geo-hydrological investigations and mapping.

#### **AMW 704 – Analytical Cartography (3 Units)**

Exploration of selected problems in cartography: extraction and mapping of information from synoptic charts, topographical and geological maps. Computer mapping and advanced map production techniques; cribbing methods representation and selection of statistical measures of agro-meteorological and drainage phenomena.

**AMW 705 – Tropical Weather Disturbances (3 Units)**

Problems in Tropical meteorology; Tropical weather features, analysis and forecasting, characteristics of Tropical cyclone, formation, structure, maturity and decay. Tropical hurricane track prediction, cloud and precipitation processes. Development and forecasts of thunderstorm, predicting of weather from local signs, baroclinic in stability (Eady model), barotropic in stability, Rossby Waves.

**AMW 706 – Agro-meteorological Modelling and Crop Yield Prediction (3 Units)**

A critical evaluation of crop and agro-meteorological models developed for prediction of crop production and agricultural operations, method for climatological analysis and classification. Physiological and correlative approaches to modeling the impact of meteorological variability on crop yield. Layout of Agro-meteorological station and installation for on-farm research. Yield predictions under conditions of uncertainty.

**AMW 707 – Advance Agricultural Watershed Management and Analysis (3 Units)**

Watershed characteristics, Hydrology and shelterbelt: ecosystem approach to watershed management, problems arising from the utilization of drainage basins and their implications. Methods of integrated watershed development: Quantitative analysis of drainage basin characteristics.

**AMW 708 – Water and Agriculture in the Tropics (3 Units)**

Water in relation to plant growth and yield, the atmosphere-soil-plant water system, rainfall characteristics, the implications of the nature of tropical rainfall, water balance studies and their application to agriculture, role of Agriculture techniques in crop-water relations: application of crop water requirements to design and operation of irrigation projects.

**AMW 709 - Hydraulics**

Open channel hydraulics

Basic principles of the fluid mechanics applied to an open channel flow! Schematisation of the flow and geometry of an open channel. Uniform flow: definition, formulation and use. Gradually varied flow: use of the principles of conservation of energy and momentum: critical flow: classification of flow profiles; rapidly varied flow: unsteady flow in open channels. Flow in Alluvial channels: Stream form and classification qualitative response to channel stabilization and dredging.

**AMW 710 – Hydrometry**

Water level or stage; Discharge: Procedures to calculate stream discharge; Sediments; bed material sampling, bed load and suspended load measurement, establishment of rating curves.

**AMW 711 – Surface Water Resources Evaluation and Monitoring (3 Units)**

Quantitative evaluation of surface water resources, problems of water pollution, Multipurpose drainage basin management, spatial aspects of water supply planning, open channel flow, turbulent and laminar flow, choice of dam sites and safety consideration of slopes, Drainage characteristics of Nigerian rivers.

**AMW 712 – Water Resources Modelling**

Description of Network, network design, system analysis and design theory and techniques for network design. Criteria for the use of data for modeling – accuracy, time intervals and error detection and correction. Classification of models; Terminology, model technique (physical models, analogue and mathematical models), model-prototype relationship and limitations. Deterministic and stochastic principles, lumped non-linear models.

Introduction to stochastic processes, random events, stationarity, time series analysis. Markovian processes and filtering. Hydrological forecasting: Forecast methods, short-term forecast on-line systems, application to floods, low flow and water temperature.

### **AMW 713 – Management of Water Resources System**

Water demands and Resources, Water Resources Management. Quality requirements and standards for different types of water use; Estimation of water use. Economics of water resources planning, cost-benefit analysis and rate of turnover criteria, Systems Analysis: Analysis of linear Input-Output systems, identification of objectives economic benefits, application of systems analysis to problems of water resources engineering and environmental management. Optimisation methods (Linear, dynamic programming, simulation, sensitivity analysis etc). Hydrological data for design purposes.

### **AMW 714 – Hydrological Processes and Analysis**

Introduction: Hydrological cycle and the terminology precipitation: Forms of precipitation and accuracy of measurement Intensity – duration and depth – duration relationships. Evaporation: Evaporation from open water, intercepted water and bare soil, transpiration, and evapotranspiration. Determination by measurements. (Pans, Lysimeters etc). Infiltration, factors governing infiltration, surface runoff: Depression storage, overland flow, surface detention, discharge floods. Analysis of flood hydrograph, flood routing and analysis of low flow and droughts. Solid Matter Transport, sampling techniques, sediment yield, sediment properties (suspended and bed load).

### **AMW 715 – Irrigation Engineering Design (3 Units)**

Selection of irrigation system: Types of irrigation systems: surface, sprinkler, trickler on drip, subsurface. Comparison of irrigation system. Design and layout of canals; irrigation structures; design of diversion weirs and intakes; types; types of diversion weirs and their location.

Design of service reservoirs; functions of service reservoirs, Subsurface drainage: Determination of drainage spacing by steady state drainage formula and no-steady state drainage formula. Dams: design and materials. Design of gravity dams, earth and rock fill dams.

### **AMW 716 – Drainage Principles and Design (3 Units)**

Drainage theory, soil water potentials, darcy's law; homogeneity design equations and their engineering investigation. Design and specifications of surface and subsurface drains for water logging and salinity control in agricultural soils. Reclamation of saline and sandy soils.

### **AMW 717 – Methods of Water Quality Assessment and Pollution Control**

Water chemistry and water biology: Composition and characteristics of surface and ground water, biochemical cycles, C,N,P and S, main chemical water quality parameters. Surface water quality: Factors affecting water quality and pollution by human, industrial and agricultural wastes. Water quality criteria. Stratification and eutrophication in lakes and reservoirs, thermal stratification and self-purification. Groundwater quality; processes for determining groundwater quality, sources of groundwater pollution and effects on groundwater quality, artificial groundwater recharge, groundwater quality monitoring and sampling techniques.

### **FRM 714 – Advanced Remote Sensing and Photogrammetry**

Basic Photogrammetry and practical use of aerial photographs, instruments in aerial photo interpretation of aerial photographs and radar imagery; aspects of remote sensing including: Infrared, passive microwave, multi-

spatial imageries. Application of remote sensing to Agriculture, forestry, hydrology watershed management and wildlife management.

### TEACHING STAFF

Name	Rank	Qualification	Area of Specialisation	Area of Research Interest
Martins, O.	Professor	B.Sc, M.Sc. (Bochum), Ph.D (Hamburg)	Water Resources Management	Hydro-Chemistry, Water Resources Exploration Development and Mgt
Bello, N. J	Professor	B.Sc. (Ibadan), M.Sc. Ph.D. (Ilorin) Cert. Agroclimatology. (Reading U.K.), IPGC Crop- Weather (Bet Dagan, Israel)	Theoretical and applied Climatology	Climate change and variability, Crop- Weather Modeling, precipitation process and analysis for Agriculture
Salako, F. K	Reader	B. Agric, M.Sc. (Nigeria) Ph.D (Ibadan)	Soil Physico/Soil and Water Conservation	Soil Erosion; control, Soil and Water Management Reliabilitation of degraded soils
Awomeso, J. A.	Lecturer II	B.Sc. DAU Ph.D (Besancon)	Hydrogeology and Water Resources Engineering	Hydrogeology: Groundwater Hydraulics

### M.Sc. PROGRAMMES

The Masters degree programmes in the Department of Water Resources Management and Agricultural Meteorology are designed to produce high level Researchers, Lecturers and Professionals that are satisfactorily equipped with analytical and technical skills necessary for adequate performance of their jobs as academicians or professionals.

The programmes are expected to produce people with the requisite knowledge and skills to use in the following areas.

- (i) water resources development, assessment and management
- (ii) hydrological processes and analysis
- (iii) climatological processes and analysis
- (iv) meteorology as related to water resources, agriculture and the environment in general.

The sectors through which the programmes may have an impact on socio-economic development and management are:

- The productive sector ( food and agriculture)
- The service sector (water supply and sanitation)
- The control and mitigation of natural disaster (floods and droughts)
- Environmental protection and enhancement (pollution and erosion)

### AVAILABLE PROGRAMMES

Areas of specialization at Masters level:

WATER RESOURCES  
IRRIGATION AND DRAINAGE  
AGROMETEOROLOGY

## STRUCTURE

The programme consists of thesis, seminar, core and elective courses. The core is the departmental key courses that cut across the areas of specialization mentioned above while the electives are courses in the specific area of specialization of a candidate.

The structure is as given below:

Courses	Units
College courses (compulsory)	10
Core Courses	12
Electives	7
Thesis Research (WMA 799)	6
Seminar (WMA 799)	2

Minimum Total for the Award of M.Sc. Degree: 36 units

Course Code	Courses	Units
	University course	
<b>CSC 701</b>	<b>Use of Computer</b>	4
	College Courses	
<b>ERM 714</b>	<b>Advanced Remote Sensing and Photogrammetry</b>	3
<b>WMA 717</b>	<b>Advanced Methods of Water Quality</b>	
	<b>Assessment and Pollution Control</b>	3
	Core Course	
<b>WMA 701</b>	<b>Analytical Framework for Agro-meteorological and Drainage Studies</b>	3

Minimum Total for the Award of M.Sc. Degree: 36 units

WMA 702	Micrometeorology	3
WMA 703	Agro-hydrology	3
WMA 704	Analytical Cartography	
	Elective Courses	3
WMA 705	Tropical Weather Disturbances and Forecasting	3
WMA 706	Agro-meteorological Modeling and Yield Prediction	3
WMA 707	Advanced Agricultural Watershed	
	Management and Analysis	3
WMA 708	Water and Agric. in the Tropics	3
WMA 709	Hydraulics	3
WMA 710	Hydrometry	3
WMA 711	Surface Water Evaluation and Monitoring	3
WMA 712	Water Resources Modeling	3
WMA 713	Management of Water Resources Systems	3
WMA 714	Hydrological Process and Analysis	3
WMA 715	Irrigation and Drainage Design	3
WMA 716	Drainage Principles and Design	1
WMA 718	Field Trip	

Minimum Total for the Award of M.Sc. Degree: 36 units



## **Ph.D. PROGRAMMES**

The Ph.D programmes are designed to produce high level Teachers, Researchers and Professionals in the following areas of specialization:

- (a) Water Resources
- (b) Irrigation and Drainage.
- (c) Agrometeorology

## **SYNOPSIS FOR M.Sc. COURSES**

### **WMA 701 - Analytical Framework for Agro-meteorological and Drainage Studies (3 Units)**

Developing hypothesis and objectives, research design, measurement and data collection, interpolation of missing data applications of probability distribution in hydro-meteorological events/processes; non-parametric tests, analysis of variance. Multivariate analysis: multiple correlation and regression, principal component factor and techniques of time series analysis; stochastic processes.

### **WMA 702 – Micrometeorology (3 UNITS)**

Physical phenomena near the soil-atmosphere including solar and thermal radiation, diffusion turbulence and profile relationships; the transport of heat, matter and momentum within and above plant canopies and combination equations for evaporation, transpiration, carbon dioxide balance and photosynthesis, concept of water use efficiency advertent and inadvertent modification of plant climatic environment.

### **WMA 703 - Agro-hydrology (3 Units)**

Role of watershed management for arable land use in the tropics. Soil classification and hydrologic soil groups. Water in the unsaturated zone (capillary rise, percolation, and depth to water table). Soil moisture content; soil water potential, soil moisture characteristics, soil-water-plant relationship, and crop water requirements. Measuring devices (gravimetric methods, electrical resistance methods, neutron probes, etc.)

Land evaluation and introduction to irrigation techniques. Basic concepts on morphological calculations. Effect of water diversions in rivers and degradation of rivers after dam constructions. Geo-hydrological investigations and mapping.

### **WMA 704 - Analytical Cartography (3 Units)**

Exploration of selected problems in cartography; extraction and mapping of information from synoptic charts, topographical and geological maps. Computer mapping and advanced map production techniques; cribbing methods representation and selection of statistical measures of agro-meteorological and drainage phenomena.

### **WMA 705 - Tropical Weather Disturbances (3 Units)**

Problems in Tropical meteorology; Tropical weather features, analysis and forecasting, characteristics of Tropical cyclones, formation, structure, maturity and decay, Tropical hurricane track prediction, cloud and precipitation processes. Development and forecasts of thunderstorm, predicting of weather from local signs, baroclinic and stability (Eady model), barotropic in stability, Rossby Waves.

### **WMA 706 - Agro-meteorological Modeling and Crop Yield Prediction (3 Units)**

A critical evaluation of crop and agro-meteorological models developed for prediction of crop production and agricultural operations, method for climatological analysis and classification. Physiological and correlative

approaches to modeling, the impact of meteorological variability on crop yield. Layout of agro-meteorological station and installation for on-farm research. Yield predictions under conditions of uncertainty.

### **WMA 707 Advanced Agricultural Watershed Management and Analysis (3 Units)**

Watershed characteristics, Hydrology of shelter belt; ecosystem approach to watershed management, problems arising from the utilization of drainage basins and their implications. Methods of integrated watershed development; Quantitative analysis of drainage basin characteristics.

### **WMA 708 - Water and Agriculture in the Tropics (3 Units)**

Water in relation to plant growth and yield, the atmosphere-soil-plant water system, rainfall characteristics, the implications of the nature of tropical rainfall, water balance studies and their application to agriculture, role of agriculture techniques in crop-water relations; application of crop water requirements to design and operation of irrigation projects.

### **WMA 709 – Hydraulics (3 Units)**

Open channel hydraulics

Basic principles of the fluid mechanics applied to an open channel flow! Schematization of the flow and geometry of an open channel, Uniform flow; definition, formulation and use. Gradually varied flow; use of the principles of conservation of energy and momentum; critical flow; classification of flow profiles; rapidly varied flow; unsteady flow in open channels. Flow in Alluvial channels: Stream form and classification, qualitative response to channel stabilization and dredging.

### **WMA 710 – Hydrometry (3 Units)**

Water level or stage; Discharge: Procedures to calculate stream discharge; Sediments; bed material sampling, bed load and suspended load measurement, establishment of rating curves.

### **WMA 711 - Surface Water Resources Evaluation and Monitoring (3 UNITS)**

Quantitative evaluation of surface water resources, problems of water pollution, Multipurpose drainage basin management, spatial aspects of water supply planning, open channel flow, turbulent and laminar flow, choice of dam sites and safety consideration of slopes, Drainage characteristics of Nigerian rivers.

### **WMA 712 - Water Resources Modeling (3 Units)**

Description of Network, network design, system analysis and design theory and techniques for network design. Criteria for the use of data for modeling - accuracy, time intervals and error detection and correction. Classification of models; Terminology, model technique (physical models, analogue and mathematical models), model-prototype relationship and limitations. Deterministic and stochastic principles lumped non-linear models.

Introduction to stochastic processes, random events, stationarity, time series analysis, Markovian processes and filtering. Hydrological forecasting: Forecast methods, short-term forecast, on-line systems, application to floods, low flow and water temperature.

### **WMA 713 - Management of Water Resources System (3 Units)**

Water demands and resources, water resources management. Quality requirements and standards for different types of water use; Estimation of water use. Economics of water resources planning, cost-benefit analysis and rate of turnover criteria, Systems Analysis: Analysis of linear Input - Output systems, identification of objectives economic benefits, application of system analysis to problems of water resources engineering and environmental

management. Optimization methods (Linear, dynamic programming, simulation, sensitivity analysis etc). Hydrological data for design purposes.

#### **WMA 714 - Hydrological Processes and Analysis (3 Units)**

Introduction: Hydrological cycle and the terminology precipitation: Forms of precipitation and accuracy of measurement. Intensity - duration and depth - duration relationships. Evaporation: Evaporation from open water, intercepted water and bare soil, transpiration, and evapo-transpiration. Determination by measurements, (Pans, Lysimeters etc). Infiltration, factors governing infiltration, surface runoff; Depression storage, overland flow, surface detention, discharge floods, Analysis of flood hydrograph, flood routing and analysis of low flow and droughts. Solid Matter Transport, sampling techniques, sediment yield, sediment properties (suspended and bed load).

#### **WMA 715 - Irrigation Engineering Design (3 Units)**

Selection of irrigation system: Types of irrigation systems; surface, sprinkler, trickler on drip, subsurface. Comparison of irrigation system. Design and layout of canals; irrigation structures flow measurement structures, regulation and conveyance structures; design of diversion weirs and intakes; types; types of diversion weirs and their location.

Design of service reservoirs; functions of service reservoirs, Subsurface drainage: Determination of drainage spacing by steady state drainage formula and non-steady stated rainage formula. Dams: design and materials. Design of gravity dams, earth and rock fill dams.

#### **WMA 716 - Drainage Principles and Design (3 Units)**

Drainage theory, soil water potentials, darcy's law; homogeneity design equations and their engineering investigations, design and specifications of surface and subsurface drains for water logging and salinity control in agricultural soils. Reclamation of saline and sandy soils.

#### **WMA 717 - Methods of Water Quality Assessment and Pollution Control (3 Units)**

Water chemistry and water biology: Composition and characteristics of surface and ground water, biochemical cycles, C, N, P and S, main chemical water quality parameters. Surface water quality: Factors affecting water quality and pollution by human, industrial and agricultural wastes. Water quality criteria. Stratification and eutrophication in lakes and reservoirs, thermal stratification and self-purification. Groundwater quality; processes for determining groundwater quality, sources of groundwater pollution and effects on groundwater quality, artificial groundwater charge, groundwater quality monitoring and sampling techniques.

#### **ERM 714 - Advanced Remote Sensing and Photogrammetry (3 Units)**

Basic Photogrammetry and practical use of aerial photographs instruments in aerial photo interpretation Of aerial photographs and radar imagery; aspects of remote sensing including Infrared, passive microwave, and multi-spatial imageries. Application of remote sensing to Agriculture, forestry, hydrology watershed management and wildlife management.

### **STAFF LIST**

<b>Name</b>	<b>Rank</b>	<b>Qualification</b>	<b>Area of Specialisation</b>
Martins, O.	Professor	B.Sc, M.Sc. (Bochum), Ph.D (Hamburg)	Hydrology and Water Recourses
Bello, N. J	Professor	B.Sc. (Ibadan), M.Sc., Ph.D. (Ilorin)	Climatology and Agrometeorology
Akinyemi, J. O	Senior Lecturer	B.Sc., M.Sc., Ph.D. (Ibadan)	Agric. Engineering (Irrigation and Drainage)
Awokola, O. S	Senior Lecturer	B.Sc. (Ottawa), M.Sc(Dar-Es-Salaam), MNSE, COREN, AMSCE, AMEIC	Water Resources Engineering.
Bolaji, G. A	Lecturer	HND (Ondo), M.Eng. (Leuven), MNITE	Irrigation Engineering.
Idowu, O. A	Lecturer	B.Sc. (Geology) M.Sc (Appl. Geol.)	Hydrogeology

### **DEPARTMENT OF AQUACULTURE AND FISHERIES MANAGEMENT**

#### **Brief History**

The Department of Aquaculture and Fisheries Management (AQ & FM) was carved out of former Department of Fisheries Forestry and Wildlife Management (FFWM) in 1992 with a vision to accelerate the teaching/training, adaptive research and out-reach programmes. Before 1992, the former Department of FFWM had jointly trained and produced graduates with Fisheries and Wildlife options from inception of the University in 1989.

Today, the Department is one of the four Departments in the College of Environmental Resources Management (COLERM). She offers programmes leading to award of Bachelors, Postgraduate Diploma, Masters and Doctoral Degrees in Aquaculture and Fisheries Management. In year 2002, the Department was awarded the status of a Centre of Excellence in Aquaculture and Fisheries Management by the Education Tax Fund (ETF) in recognition of giant achievements made in the area of training, research and extension for quality manpower development and capacity building. The Department was also honoured with a Distinguished Service Award in 2005 by the Fisheries Society of Nigeria (FISON) to recognize her achievements in Human Resources Development.

#### **PROGRAMMES AVAILABLE**

The following postgraduate degree programmes are offered in the Department of Aquaculture and Fisheries Management.

- (i) Postgraduate Diploma in Aquaculture and Fisheries Management.
- (ii) Master of Aquaculture and Fisheries.
- (iii) Doctor of Philosophy (Ph.D)

### **POSTGRADUATE DIPLOMA IN AQUACULTURE AND FISHERIES MANAGEMENT**

#### **OBJECTIVES**

The course is meant to provide the middle level and senior managers an opportunity to acquire a postgraduate education in Aquaculture and Fisheries management. It is also designed for Managers of medium to large scale farms, fisheries staff in ministry, ADPs and extension officers, agricultural officers of Agricultural Banks and other financial institutions to acquire current methods in enhance fisheries production and fisheries project appraisal.

### **ADMISSION REQUIREMENTS**

Candidates for the postgraduate Diploma must have a Bachelor Degree or HND in Fisheries or related fields from the University of Agriculture, Abeokuta or any other institution recognized by the University Senate. Nomination of qualified candidates by the Local Governments, States, Federal Ministries or Private Fisheries establishments and agric-based financial institution may be honoured.

### **DURATION AND MODE OF STUDY**

The programme shall be for twelve (12) calendar months. It runs on sandwich basis and candidates would attend lectures during weekends and also go on field trips. The course would cover a minimum of thirty-four (34) units.

### **STRUCTURE**

The programme consists of the following:

#### **COURSE WORK**

Core Courses	-	26 Units
Electives	-	2 Units
Seminar (Library)	-	2 Units
Project	-	4 Units

<b>Course Code</b>	<b>Courses</b>	<b>Units</b>
PDF 700	Research Methods/Techniques	3
PDF 701	Computer in Fisheries Resources Management	2
PDF 702	Fish Nutrition	2
PDF 703	Pollution Effects on Fisheries Production	2
PDF 704	Fish Disease and care of fishes	2
PDF 705	Fisheries Biology and Assessment	2
PDF 706	Fish Culture and Management	3
PDF 707	Ornamental Fisheries and Aquaria Design	2
PDF 708	Post Harvest Technology and Fisheries Marketing	2
PDF 710	Fisheries Extension and Cooperatives	2
PDF 711	Fishery Statistics	2
PDF 712	Aquaculture Engineering	2
PDF 713	Library Seminar	2
PDF 714	Project	4
	<b>Total</b>	<b>32</b>

#### **ELECTIVES**

PDF 709	Advances in Aquaculture	2
PDF 715	Coastal Water Economic Resources	2
	<b>TOTAL</b>	<b>4</b>

## **COURSE SYNOPSIS**

### **PDF 700 Research Method/Techniques (3 Units)**

#### **Course description**

Survey design Basic scientific principles of fisheries research, concept and by hypothesis formation and testing Organisation of research construction observation and oral interview. Data processing including editing, coding, verification, analysis of data and organization of report writing.

Sampling: Role of sampling in data collection. Probability sampling, random sampling and its properties, simple stratified multistage, systematic sampling cluster etc. Sampling and sampling errors and biases. Precision and accuracy of sample estimates. Examples of demographic sample surveys in Africa. Measures of sampling errors.

### **PDF 701 Computer in Fisheries Resources Management (2 units)**

Types, uses and components of computer. Introduction to computer operating systems, Word processing package, importance of computer in resource management. Common library programmes for analysis of resource data.

### **PDF 702 Fish Nutrition (2 Units)**

Principles of fish nutrition: Nutrient requirements of fish. Factors affecting nutrient requirements: Chemistry and nutritive values of materials used in feeds. Feed formulation methods. The fish feed industry. Practical consideration in fish feed production. Fish feed manufacture on commercial scale.

### **PDF 703 Pollution Effects on Fisheries Production (2 Units)**

Physiological and biochemical effects of industrial, urban and agricultural chemicals on aquatic biota. Specific metabolic effects of various poisonous and inhibitor substances. Modes of pollution of enzyme system of aquatic organisms. Physiological effects of water pollutants on endangered species. Monitoring procedures and assessment of changes fisheries as a consequence of waste effluents.

### **PDF 704 Fish Diseases and Care of Fish (2 units)**

Classification and causes of diseases. Communicable diseases, prevention and known treatments. Techniques of isolation culture and identification of pathogens.

### **PDF 705 Fisheries Biology and Assessment (2 Units)**

The gross external and internal anatomy of a typical bony and cartilaginous fish. Food and feeding habits. Method of stock management in fisheries. Age and growth determination. Reproductive biology (embryology and life history), Marking and tagging .Estimation of population numbers (Mark-recapture, catch per unit effort, direct enumeration etc).

## **MASTER OF AQUACULTURE AND FISHERIES**

The Department offers a 2 years M. Aquaculture and Fisheries Management Programme options in fish Nutrition, fish pathology and fisheries Management. It involves both course work and Research Dissertation.

#### **OBJECTIVE:**

The objective of the Master programme is to produce high-level manpower through broad based advance knowledge for work as professional Aquaculture or Fisheries Scientist in both public and private sectors of the economy.

## STRUCTURE

The programme is structured to have series of courses, seminars and Dissertation. Completion of a research project is part of requirement for the award of the Degree. The aim is for the student to demonstrate ability for understanding an organized work. Each student is required to plan, execute and write up a research work. The courses consist of the following core courses and electives shown under different options.

### MASTER OF AQUACULTURE AND FISHERIES

Course Code	Courses	Units
CSC 701	Computer in Research	4
FRM 714	Advanced Remote sensing and Photogrammetry	3
AMW 717	Advanced methods of water quality assessment and pollution	3
FIS 700	Research Techniques	2
FIS 703	Aquatic ecology and Limnology	3
FIS 704	Advances in Aquaculture	3
FIS 707	Fish Biology	3
FIS 712	Seminar	2
FIS 799	Project	6
	Electives	8
		37

### FISH PATHOLOGY OPTION

Course Code	Courses	Units
CSC 701	Computer in Research	4
FRM 714	Advanced Remote sensing and Photogrammetry	3
AMW 717	Advanced methods of water quality assessment and pollution	3
FIS 700	Research Techniques	2
FIS 703	Aquatic Ecology and Limnology	3
FIS 708	Advances in post-harvest technology	3
FIS 710	Advances in fish diseases	3
FIS 712	Seminar	2
FIS 799	Project	6
	Electives	8
		37

### FISH NUTRITION OPTION

Course Code	Courses	Units
CSC 701	Computer in Research	4
FRM 714	Advanced Remote sensing and Photogrammetry	3
AMW 717	Advanced methods of water quality assessment and pollution	3
FIS 700	Research Techniques	2
FIS 703	Aquatic Ecology and Limnology	3
FIS 706	Fish Nutrition	3
FIS 707	Fish Biology	3
FIS 712	Seminar	2
FIS 799	Project	6
	Electives	8
		<b>37</b>

### FISHERIES MANAGEMENT OPTION

Course Code	Courses	Units
CSC 701	Computer in Research	4
FRM 714	Advanced Remote sensing and Photogrammetry	3
AMW 717	Advanced methods of water quality assessment and pollution	3
FIS 700	Research Techniques	2
FIS 703	Aquatic Ecology and Limnology	3
FIS 707	Fish Biology	3
FIS 715	Fish Stock Assessment	3
FIS 712	Project	2
FIS 799	Electives	6
		8
		<b>37</b>

### ELECTIVES

Course Code	Courses	Units
FIS 701	Fisheries Development and Management	2
FIS 702	Production in Inland and Marine Waters	2
FIS 705	Systematic Study of Aquatic Food Animal Fish	3
FIS 709	Fish marketing and co-operatives	3
FIS 711	Fisheries of Nigeria	2
		<b>12</b>

### COURSE SYNOPSIS

#### **FIS 700- Research Technology (2 units) Core Course**

Experimental design and statistical analysis, sampling methods, information review, report writing and presentation, general laboratory techniques.

#### **FIS 701 –Fisheries Development and Management (2 Units) Elective**

Age determination, food studies, fish population dynamics and their application to fisheries resources planning: management methods.



**FIS 702-Production in inland and Marine Waters (2 Units) Elective**

Types of aquatic ecosystem, limiting factors controlling fish production. Allochthonous and autochthonous production in inland waters, fish husbandry. Inland fisheries resources. Marine fisheries; migration and resource distribution.

**FISH 703- Aquatic Ecology and Limnology (3 Units) Core Course**

Classification of aquatic systems, Physio-Chemical parameters of aquatic environment, plankton and benthos. Primary and Secondary Production, energy budget.

**FIS 704-Advances in Aquaculture (3 Units) core Course**

Supplementary feeding, recent developments in induced breeding, hybridization, stock manipulation and harvesting in fish, culture of shell fish, aquaculture engineering.

**FIS 705 – Systematic Study of Aquatic Food Animals (3 Units) (Elective)**

Principles of taxonomy (morphometric and meristic characteristics), recent techniques in systematic, identification of freshwater, brackish water and marine finfish and shellfish of Nigeria.

**FIS 706- fish Nutrition and Growth (3 Units)**

Nutritional requirements of fish (organic and inorganic nutrients), energy requirements, feed formulation, preservation, evaluation and ration levels. Growth studies (factors affecting growth, food conversion efficiency protein efficiency ration etc).

**FIS 707 – Fish biology (3 Units) Core Course**

Food and Feeding habits, gut content analysis, predator-prey relationships. Age and growth studies, reproduction (Classification of gonadal stages, breeding and life cycles).

**FIS 708- Advances in Post-harvest Technology (3 Units) Core course**

Principles of fish preservation and processing, factors that affect fish spoilage and deterioration of fish, fish by-products, methods of assessment of fish quality.

**FIS 709- Fish Marketing and Co-operatives (3 Units) Electives**

Marketing (traditional and modern systems). Co-operatives (formation/organization), fish economics,-capital investment and depreciation of equipment, supply and demand, cost of distribution

**FIS 710-Advances in Fish Diseases (3 Units) Core Course**

Types of fish diseases, (parasitic, bacterial, fungal, viral, nutritional etc)  
Laboratory methods for fish disease diagnosis, prevention, control and therapy of fish disease.

**FIS 711- Fisheries of Nigeria (2 Units) Elective**

Overview of current status of fisheries in Nigeria, local technologies in capture and culture fisheries, preservation and processing methods of fisheries products.

**FIS 712-Seminar (2 Units)**

A critical review of literature in current topics in fisheries and aquaculture, (Hard bound copies to be submitted).

**FIS 715- Fish Stock Assessment (3 Units) Core Course**

Biostatistics. Catch assessment and frame survey. Estimation of growth parameters. Sampling commercial catches. Estimation of maximum sustainable yield. Multi species/Multi fleet problems. Use of special computer software for fish stock assessment.

**FIS 799- Project (6 Units)**

A special research project to be preceded by a research seminar in any area of fisheries and aquaculture. Duration of project is a minimum of two semesters.

**DOCTOR OF PHILOSOPHY DEGREE IN AQUACULTURE AND FISHERIES MANAGEMENT**

**OBJECTIVES:**

The Department offers the Doctor of Philosophy (PhD) degree programme in aquaculture and fisheries management with the aim of producing higher level manpower and promoting academic study and research in the different options of aquaculture and fisheries management.

**STRUCTURE**

There may be course work, which will vary depending on the background of the candidate but would contain the relevant course that have not been taken at M.Sc. degree level and in some cases may include courses in related basic sciences.

**STAFF LIST**

Name	Rank	Qualification	Area of Specialisation
Obasa, S. O	Senior Lecturer (Ag. HOD)	B.Sc, M.Sc., Ph.D (Ibadan)	Fish Nutrition and Fisheries Biology
Otubusin, S. O	Professor	B.Sc. (Ife), MSF (Philippines), Ph.D (ABU)	Aquaculture and Fisheries Management
Ezeri, G. N. O	Professor	B.Sc.(Nigeria), M.Sc., Ph.D. (Jos) MFS	Aquaculture and Fish Pathology
Akegbejo-Samsons, Y	Professor	B.Sc,(Ib), M.Sc, Ph.D(Ib)	Coastal Fisheries Management and Aquaculture
Alegbeleye, W. O	Reader	B.Sc, M.Sc, Ph.D (Ib)	Fish Nutrition
Omoniyi, I. T	Reader	B.Sc., M.Sc., Ph.D (Ibadan)	Fisheries biology and Warm Water Aquaculture
Fafioye, O. O	Reader	B.Ed, M.Sc, Ph.D	Ecotoxicology and Aquaculture
Francisca O. A. George		B.Sc, M.Sc, Ph.D	Fish Nutrition and Fisheries Processing
Nafisat, B. Ikenweiwe		B.Sc, M.Sc, Ph.D (UNAAB)	Hydrobiology and Fisheries Management
Adeosun, F. I		B.Sc, M.Sc, Ph.D (UNAAB)	Fisheries Management and Hydrobiology

## **DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND TOXICOLOGY**

The department of Environmental Management and Toxicology, being the first of its kind in Nigeria, was established in 1989 to provide skilled manpower, trained specifically for environmental surveillance, monitoring and management as against the present practice where these tasks were performed by people trained in basic and applied sciences.

The academic programme in the department is designed to provide the training needed for an understanding of the environment and to build upon this foundation by exploring in some depths, specific aspects such as resource depletion, recycling, re-use and the impact of science and technology on the environment.

### **THE POSTGRADUATE PROGRAMME**

The Master' degree programme is designed for science graduates hoping to have distinguished careers, in the environmental field. The fundamental philosophy underlying the programme is the training of graduates from a wide range of disciplines and backgrounds, to the highest academic standards in the identification and resolution of environmental issues.

The present concern about environmental issues results in an increasing need for environmental expertise. The multi-disciplinary character of environmental studies is addressed by using the expertise available in the department and other departments of the University of Agriculture, Abeokuta.

The programme provides an opportunity to study many aspects of the environment and to increase the participants understanding of the multi-disciplinary nature of environmental issues. It is a four semester's programme involving training in selected aspects of both basic and applied environmental science.

The course is made up of lectures, tutorials, laboratory classes and field trips. Students will be expected to carry out independent research project on an environmental problem. The programme is designed to cater for a variety of individual interests and future professional needs.

### **OBJECTIVES**

The Master Degree Programme is designed to;

- (a) Increase the students understanding of the multi-disciplinary nature of environmental issues.
- (b) Provide training in independent research/study resulting in original contributions to knowledge.
- (c) Provide high level skilled manpower relevant to national needs in all facets of national development.

### **ENTRY REQUIREMENTS:**

The candidates for the Master Degree Programme should have a good Honours Degree in Environmental Management and Toxicology, Forestry and Wildlife, Agriculture, and other environmentally related courses from the University of Agriculture, Abeokuta and other Universities recognised by the Senate of the University.

**DURATION**

Four semesters minimum for full time

STRUCTURE	UNIT
(i) University Course	4
(ii) Core Courses	20
(iii) Electives	5
(iv) Thesis Research	6
(v) Seminar	2
<b>MINIMUM TOTAL FOR THE AWARD OF MASTER DEGREE</b>	<b>37</b>

**UNIVERSITY COURSE**

CSC 701 Use of Computer in Research 4 Units

**CORE COURSES**

CODE	DESCRIPTION	UNITS
ERM 700	Advanced Biometrics	3
EMT 701	Global Environmental Issues (Case Studies in Environmental Management – both International and Local)	2
EMT 702	Environmental Pollution Studies (Water, Soil, Air and Noise Pollution).	3
EMT 703	Environmental Impact Assessment and Auditing	2
EMT 704	Comparative Environmental Policy and Law.	2
EMT 705	Environmental and Resource Economics.	2
EMT 706	Waste Management and Control.	2
EMT 707	Ecological Principles for Sustainable Development.	2
EMT 708	Remote Sensing and Geographic Information Systems (GIS) for Environmental Monitoring Modeling and Assessment.	2
		<b>20</b>
EMT 711	Seminar	2
EMT 712	Thesis Research	6
<b>ELECTIVES</b>		
EMT 721	Research Methodology	2
EMT 722	Control and Management of Ecological Disasters	2
EMT 723	Toxicants in the Environment	2
EMT 724	Community Ecology and Ecosystem Management	2
EMT 725	Resource Management and Conservation	2
		<b>10</b>

## **COURSE SYNOPSES**

### **EMT 701: Global Environmental Issues: Case Studies in Environmental Management (2 units)**

Acid rain, Ozone depletion deforestation, loss of biological diversity, trans-boundary movement of toxic wastes. Desertification, oil pollution in the Niger Delta solid waste management; erosion/land degradation. Hydroflouorocarbons, Radioactivity Pollution.

### **EMT 702: Environmental Pollution Studies (water, soil, air, noise). (3 units)**

Micro-meteorology – mixing height, lapse rate, stability classification, air dispersion modeling; source control of air pollutants; sources of noise vibration and sound generation, modeling, noise abatement.

**WATER:** The importance of water, hydrological cycle, water supply and water quality; types and sources of water pollution; biological effects of water pollution; environmental toxicology.

**SOIL:** The importance of soil and various causes of soil contamination and their control measures.

**AIR:** Aerosols, dispersion, modeling; gaseous pollutants - SO<sub>x</sub> NO<sub>x</sub> PAS: odour, etc; sources of air pollution; plant/animal/atmosphere relations air/land/water interactive systems; the effects of pollutants on crops natural vegetation, man, other animals, rising CO<sub>2</sub> levels and their significance; biological effects of other pollutants; nuclear winter, aerial organisms; measurement of pollution – monitoring equipment, bio-monitors, data analysis.

**NOISE:** Sound noise measurement noise sources-traffic, construction, air conditioning, air craft, industrial, under acoustics; the effects of noise on man.

### **EMT 703: Environmental Impact Assessment and Auditing (2 units)**

Introduction and Principles of Environmental Impact Assessment, origins and development, Environmental Impact Assessment and Auditing Processes, Impact Prediction, Evaluation and Mitigation, Monitoring and Auditing, Environmental Impact Assessment of Development Projects e.g. New Settlements Road Network, Electricity Generation, etc. Improving the effectiveness of project assessment. Strategic Environmental Assessment.

### **EMT 704: Comparative Environmental Policy and Law (2 units)**

Environmental policy making in the developed and developing countries, comparative analysis of institutional structures for decision-making on the environment, the nature of policy mechanisms used by different countries and modes of implementation. International Law on Environment, Legal aspects of environmental pollution in Nigeria Legal System; Common laws applicable to environmental control, focusing on such matters as strict liability and torts of nuisance, trespass and negligence statutory controls relating to environmental protection (including general controls in the summary offences ordinance and Public Health and Urban Services Ordinance and Delegated Legislation; The Water Pollution Control Ordinance, Waste Disposal Ordinance and Noise Control Ordinance).

### **EMT 705: Environmental and Resource Economics (2 units)**

An introduction to welfare economics, examining basic concepts including surplus; Pareto optimality, externalities and welfare of future generations; alternative economic approaches to pollution control including the role of taxes and subsidies, the sale of pollution rights and use of environmental standards; basic concepts of cost-benefit analysis and the economic theory relating to resource depletion and conservation.

Resource allocation. Micro-economic theory decision and cost-benefit analysis. Location theory. Pollution economics. Resource depletion and conservation.

**EMT 706: Waste Management Control (2 units)**

Types of Wastes, Waste Prevention (Cleaner Production Technology)

Waste Reduction, Waste Recycle/Re-use... Waste Treatment, Waste Disposal

Water treatment for potable supplies, water screening, coagulation/flocculation sedimentation, activated sludge, anaerobic processing, sludge digestion, disinfection, tertiary treatment, final sludge and effluent disposal; dispersion and modeling.

**EMT 707: Ecological Principles for Sustainable Development -(2 units)**

Nature and objectives of ecological development. Factors of importance in development planning. The relationship of conservation and development. The role of ecology in development planning. The relationship of ecology and economic development. Economic consideration and environmental problems. Application of cost benefit opportunity costs and other economic concepts to environmental problem. Strategies for sustainable living.

**EMT 708: Remote sensing and Geographic Information Systems (G.I.S.)  
for Environmental Monitoring Modelling and Assessment (2 units)**

Introduction and Principles Origin and Development of Remote Sensing and G.I.S. Technologies. Sensors for Remote Sensing Systems. Aerial Photography and Photogrammetry Analysis. Multi spectral data system e.g. LANDSAT, SPOT, ERS-1, MEETEOSAT AND NOAA. Handling of satellite imageries. Interpretation of Remote Sensing Data. Application of Remote Sensing and G.I.S. to Environmental Monitoring Modelling and Assessment Case Studies.

**EMT 721: Research Methodology (2 units)**

Types of environmental data, sampling methods of environmental data. Direct gradient analyses, ordination and classification techniques. Matrix approach to the management of renewable natural resources. Measurement of variability, evenness and similarity indices.

**EMT 722: Control and Management of Ecological Disasters (2 units)**

Types of ecological disaster, Identification of ecological disaster prone areas of the country.

**CASE STUDIES**

- (a) Ecological problems in the Niger Delta Area.
- (b) Soil erosion areas of Southern Nigeria.
- (c) Desertification areas of Northern Nigeria.

Management of ecological disaster in Nigeria: the role of government. NGO'S, and Multi-national companies.

**EMT 723: Toxicants in the Environment (2 units)**

Classification of toxicants, sources and pathways into the environment. Mechanisms of transportation. Impact of residues on biota man, plant, soil, fish livestock and wildlife development of resistance.

Origin of petroleum, Theories of inorganic origin, Theories of organic origin: Genesis of oil from organic matter. Composition of crude oil, composition of refined oils.

Oil pollution: Extent, sources and control.

### **FATE OF OIL IN THE ENVIRONMENT**

- (a) Physical processes, spreading, evaporation, solution emulsification, Direct sea-air exchange; sedimentation.
- (b) Chemical processes
- (c) Biological processes

### **EMT 724: Community Ecology and Ecosystem Management (2 units)**

Standard community sampling procedures. Pattern of change in terrestrial and aquatic ecosystems, principles of ecological succession. The use of multivariate analyses in community ecology. Niche theory and island geography. Structure, dynamics and alteration within communities.

### **EMT 725: Resources Management and Conservation (2 units)**

Land use and land suitability analyses. Ecological management of semi-natural vegetation. Urban ecology and habitat creation. Case studies of protection areas of the country. Type, Bio-indicator, salinity etc.

### **STAFF LIST**

<b>Name</b>	<b>Rank</b>	<b>Qualification</b>	<b>Area of Specialisation</b>
Ojo, L. O	Professor	HND; B.Sc (Ibadan), Ph.D (Wales)	Terrestrial Ecology/Biometrics
Arowolo, T. A	Professor	B.Sc (North-London), M.Sc (Loughboroug), Ph.D (Aberdeen)	Analytical Chemistry
Ola-Adams, B. A	Professor	B.Sc (Ife), M.Sc (Birmingham), Ph.D (Ibadan)	Forest Ecology
Okuneye, P	Professor	B.Sc., M.Sc (Ibadan), Ph.D (Leeds)	Farm Mgt. & Accounting
Martins, O	Professor	B.Sc., M.Sc (Ruhr), Ph.D (Hamburg)Hydrology	
Oluwalana, S. A	Professor	B.Sc., M.Sc., Ph.D(Ibadan), PGD (Dresden)	Forest Economics
Bamgbose, O	Reader	B.Sc., M.Sc., Ph.D (Ibadan)	Applied Analytical Chemistry
Adeofun, C. O	Reader	B.Sc., M.Sc., Ph.D (Ibadan)	Remote Sensing
Gbadebo, A. M		B.Sc Geology, M.Sc Applied Geology	Environmental Geoscience
Adekunle, I. M		B.Sc., M.Sc., Ph.D (Ibadan)	Analytical Chemistry
Oguntoke, O		B.Sc., M.Sc., Ph.D (Ibadan)	Medical Geography/ Env. Health

### **DEPARTMENT OF FORESTRY AND WILDLIFE MANAGEMENT**

#### **BRIEF HISTORY OF THE DEPARTMENT**

The Department of Forestry and Wildlife Management was one of the earliest department created when the University of Agriculture, Abeokuta came into being in January 1988. On October 1, 1994, the Department of

Aquaculture, Fisheries, Forestry and Wildlife Management were created out of the old Forestry, Fisheries and Wildlife Management Department.

The Department now runs a 5-year Bachelor's degree programme in Forestry and Wildlife Management. The postgraduate degree programme at Masters and Ph.D. levels started in 1992. The Department thereby, has consolidated the gains of the first degree with the inception of the postgraduate programme.

### **PHILOSOPHY**

The primary philosophy that guides the training of students is the production of skilled manpower that is adequately furnished with the comprehensive information required, for engaging in Forestry and Wildlife management in an environment characterized by rural setting and adequate land endowment. Such knowledgeable professional manpower has to be produced in an atmosphere with the widest possible human and material resources, through the adoption of effective techniques of instruction, and exposure to the actual practice of forestry. Consequently, there are opportunities for formal training at the Undergraduate and postgraduate levels for the acquisition of basic and higher degrees respectively.

These training programmes are mounted through classroom instruction, laboratory practicals, field demonstration, and workshop practice.

### **THE OBJECTIVES OF THE PROGRAMME**

- (i) To produce graduates with sufficient practical background to create employment from utilisation of Forestry and Wildlife Resources. The graduates are also expected to be able to undertake local sourcing of industrial raw materials, to produce animal protein through demonstration and ranching of farm wildlife and also engage in Food production through agroforestry.
- (ii) To produce the required manpower which will not only be used in staffing Forestry and wildlife establishments nationally but which also would be able to carry out relevant, mission oriented researches into all aspects of forestry and Wildlife, the yet unexplored benefits and products which can serve as basis for newer industries.

### **POSTGRADUATE STUDY PROGRAMME**

The M.F. and Ph.D. degrees are offered. Master of Forestry (M.F.) programme extends over at least two years, and consists of two semesters of lectures and at least two semesters of research period for a study project and dissertation. Admission is normally open to University graduates in Forestry, Agriculture, the Biological Sciences or any other relevant discipline. This programme is essentially an advanced training course for specialist workers. The period of study may be, in some cases, extended to 3 sessions. Individual student may be required to offer some prescribed remedial courses without which they cannot graduate.

The Doctor of Philosophy (Ph.D.) requires a minimum of six semesters full-time or ten semesters for part-time study. Course work and examinations are required but the principal examination is based on the thesis, which must show evidence of the candidate's ability to draw significant conclusions from his own research. Admission to the course is normally by transfer from the M.F.



M.F. courses are available in five areas of specialization:

- Forest Economics and Management
- Agroforestry
- Ecology and Conservation
- Wood science
- Wildlife Management

A number of core courses including such subjects as Use of Computer in Research, Advanced Remote Sensing and Photogrammetry, Advanced Methods of Water Quality Assessment, Advanced Biometry, Production Analysis in Forestry Planning and Control of Forestry Operations and Preparation of a Seminar are compulsory for all candidates. Each of the five specialist areas, however, offers more courses than the required minimum so that candidates may make a further selection from within their chosen area. Courses given in this Department are listed as follows:

### List of Courses

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>UNITS</b>
FRM 701	Advanced Biometry	3
FRM 702	Production Analysis in Forestry Planning and Control of Forestry Operations	3
FRM 703	Advanced Resource Management and Economics	3
FRM 704	Advanced Forest Ecology	3
FRM 705	Forest Tree Genetics: Exploration and Utilization	3
FRM 708	Forest Inventory and Growth	3
FRM 711	Advanced Silviculture	3
FRM 712	Advanced Forest Protection	3
FRM 713	Control and Management of Ecological Disasters	3
FRM 714	Advanced Remote Sensing and Photogrammetry	3
FRM 715	Agroforestry Components Interactions	3
FRM 716	Land Use Analysis and Classification	3
FRM 717	Soil and Water Management in Agroforestry System	3
FRM 718	Socio-Economic Aspects of Agroforestry	3
FRM 719	Resource Inventory Analysis	3
		45

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>UNITS</b>
FRM 720	Modelling	3
FRM 721	Agroforestry Research Methodology and Field Experimentation	3
WLM 700	Fire Ecology	3
WLM 701	Vertebrate Ecology	3
WLM 702	Problems in Wildlife Management	2
WLM 703	Systematic Ornithology	3
WLM 704	Environmental Impact Analysis of Wildlife Protected Areas	3
WLM 705	Wildlife Production Techniques	3
WLM 706	Vertebrate Ethnology	2
WLM 708	Wildlife Nutrition	3
WLM 710	Park Design and Recreation Resources Development	3
WLM 712	Zoo and Museum Techniques	2
WLM 714	Wildlife Policy and Law Enforcement	2
WLM 718	Travel and Tourism	2
WLM 719	Recreation Systems Planning	2
		<b>39</b>

The effective date of the award of the degree shall be the date of the successful oral defence of the thesis.

#### **FORMAT FOR PROJECT/DISSERTATION/THESIS**

The general format recommended for student project; dissertation or thesis in the department is as follows:

- (i) Title page
- (ii) Abstract
- (iii) Dedication (optional)
- (iv) Acknowledgements
- (v) Certification
- (vi) Glossary (where applicable)
- (vii) Table of contents
- (viii) List of tables
- (ix) List of figures (where applicable)
- (x) List of plates (where applicable)
- (xi) Introduction
- (xii) Literature review
- (xiii) Materials and methods
- (xiv) Results
- (xv) Discussions
- (xvi) Conclusions/Recommendations
- (xvii) References
- (xviii) Appendices

The above format may be modified in special cases by the supervisor/supervisory committee, especially, where multiple experiments are being reported upon. In all cases, however, the paging of the dissertation/thesis should be in Arabic numerals, commencing with the title page.

Each of the sections from the introduction to conclusions/recommendations would form a separate chapter, which should be sub-divided as appropriate. Any dissertation or thesis submitted to the department for the purpose of an oral examination must be duly certified by the supervisor(s).

## **SYNOPSIS OF COURSES**

### **FORESTRY ECONOMICS AND MANAGEMENT OPTION**

#### **FRM 700 - Advanced Biometry (Core) 3 Units**

Sampling methods and principles of regression analysis as applied to forest resources and the biological sciences, matrix algebra of relevance to regression analysis, algebra and inference of multiple linear and curvilinear regression, applications to forestry and related field, computer programming exercise, parametric and non-parametric methods, design of experiments.

#### **FRM 701 - Production Analysis in Forestry (Core) 3 Units**

Concepts and procedures used in the evaluation of timber production and forest production manufacturing, organisation work measurement, inventory control, capital budgeting, cost control, network analysis and schematic models.

#### **FRM 702 - Planning and Control of Forestry Operations (Core) 3 Units**

Application of scientific methods to management decision, problems of forestry operations, Mathematical programming, Markov processes, waiting-line analysis sequencing, simulation and competitive strategies.

#### **FRM 703 - Advanced Resource Management and Economics (Core) 3 Units**

Microeconomics of forest resources management and policy analysis, capital investment analysis, financial maturity models, timber harvesting scheduling models, capital replacement models, cost-benefit analysis, economics of multiple-use management of forest resources with emphasis on non-market benefits from the forest, advantages and disadvantages of alternative models for estimating recreation, wildlife and other non-market benefits.

### **FOREST ECOLOGY AND CONSERVATION OPTION**

#### **FRM 704 - Advanced Forest Ecology (Core) 3 Units**

Qualitative and quantitative vegetation survey and analysis, advantages and disadvantages of each technique, Methods of estimating primary productivity of forests with particular reference to its biological and physical basis, biomass and rates of production in forest ecosystems, nutrient cycling, ecological evaluation.

#### **FRM 705 - Forest Tree Genetics: Exploration Conservation and Utilisation (Core) 3 Units**

An advanced course in forest biology dealing with variation, selection and breeding in tree improvement, forest tree genealogy and advanced problem in tree improvement, in situ and ex-situ conservation of forest genetic resources, germplasm exploration and utilisation in forestry.

#### **FRM 708 - Forest Inventory and Growth (Core) 3 Units**

Principles and exploration in details of approaches to inventory, sampling and growth, determination of increment, growth and yield evaluation.

**FRM 713 - Control and Management of Ecological Disasters (Core) 3 Units**

Types of ecological disasters - flood, erosion, desertification, drought, hurricane, etc. Prevention of disasters and amelioration techniques, e.g. sand dune fixation.

**FRM 714 - Advanced Remote Sensing and Photogrammetry (Core) 3 Units**

Advanced photographic and non-photographic systems, new applications of colour and colour infrared aerial photography, study of film characteristic curves and filters, 35mm and 70mm aerial photography, computerised timber type mapping and use of aerial photo volume tables.

**AGROFORESTRY OPTION**

**FRM 721 - Agroforestry Research Methodology and Field Experimentation (Core) 3 Units**

Diagnosis and Design Methodology; Introduction of D & D and why D & D, characteristics of good agroforestry design productivity, sustainability, adaptability, key features of D & D. Basic stages and procedures, pre-diagnostic stage, planning the study, regional reconnaissance, identification and preliminary description of land-use systems, site selection, diagnostic stage, diagnostic survey, diagnostic analysis and specification for appropriate intervention, technology design stage, planning stage, stage of knowledge review and assessment of research needs, research and extension plan, implementation stage, Experimental design principles of field experimentation, replication, randomisation, local control, analysis of variance, assumptions underling the ANOVA model.

**FRM 715 - Agroforestry Component Interactions (Core) 3 Units**

Definition, productive and service roles, biological characterisation, genetic evaluation of Multipurpose tree (MPTS). Selection of tree/crop/fodder combination, factors to be considered, tree crops, agricultural crops, animal classes and types of pastures. Component interaction in different ecological zones, trees/crop/pasture/animals, positive and negative interactions. Nutrient cycling in component systems dynamics of crop residues, animal waste, coppicing nitrogen fixation etc. Case studies of tree/crop/pasture/animal component combination.

**FRM 716 - Land-Use Analysis and Classification (Core) 3 Units**

Justification and objectives of land-use analysis and classification, criteria and systems of land capability and land-use in Nigeria. Policy factors and issues, national and regional, land-use classification systems used in the world FAO, USAID, Ruthernbug etc. Evaluation of soil resources for different land-use practices in relation to soil and water conservation, field mapping and evaluation of selected sites/areas. Land capability classification - problems and potentials.

**FRM 717 - Soil and Water Management in Agroforestry System (Core) 3 Units**

Morphological, physical, chemical and biological properties of humid, sub-humid, semi-arid and arid soils, Tropical soils and their management under different farming systems, shifting cultivation, plantation agriculture, forestry multiple, cropping, taungya system integrated crop/tree, tree/animal and crop/animal/tree production systems for control of soil erosion, maintenance of soil fertility, soil moisture conservation, flood control and soil water harvesting. Nutrient recycling under crop/tree/animal/tree; crop/animal/tree, fertilizer use in the agroforestry systems.

**FRM 718 - Socio-Economic Aspects of Agroforestry (Core) 3 Units**

Relation between human population, productive resources, technology and environment, role of agriculture and agroforestry in solving national and regional economic problems. Basic economic principles, allocation of scarce resource among competing choices, optimising critter, comparative advantage, diminishing returns, substitution

of products and resources, cost analysis, opportunity costs, analytical framework; Unit (Micro-macro), client, time, period, ex ante/ex post, etc. Data collection methods with examples, data requirement and reliability, use of secondary service, informal and formal surveys, monitoring study, "Case" study, experimental results.

## **FOREST BIOMETRY OPTION**

### **FRM 719 - Resource Inventory Analysis (Core) 3 Units**

Quantitative and qualitative sampling of forest resources including timber, wildlife and fish, inventory instruments and their use.

### **FRM 720 - Modelling (Core) 3 Units**

Review of modelling philosophy - distribution functions and the application of their parameters for biological interpretation. Test for normality. Use of specialised application packages for data analysis.

### **FRM 706 - Forest Watershed Management (Elective) 3 Units**

Role of forests in water cycle, effects of logging, mining and other forestland uses on water resources.

### **FRM 707 - Forest Recreation Planning (Elective) 3 Units**

Methods of measuring, analysing and forecasting recreational use of forestlands, concepts of planning and their application to forest recreation management.

### **FRM 709 - Forest Management and Valuation (Elective) 3 Units**

Managing forest properties for sustained yield of timber products, determination of annual cut and effect of taxation, evaluating forest investments, preparation of management plans.

### **FRM 710 - Forest Machinery (Elective) 3 Units**

Power sources for forest operations, construction principles, testing and rating, design and use of forest machinery, power requirements, selection and engineering aspects of machinery systems designs.

### **FRM 711 - Advanced Silviculture (Elective) 3 Units**

Applied silvicultural practices and results of current silvicultural research in important forest types of the country.

### **FRM 712 - Advanced Forest Protection (Elective) 3 Units**

Forest relationships and control of major tropical forest pests and diseases, fire protection, case studies of selected problems.

### **FRM 799 - Special Study: Thesis Research (Elective) 6 Units**

Research projects on an approved topic leading to a dissertation.

### **FRM - Seminar - 2 Units**

## **MASTER OF WOOD SCIENCE**

### **WSC 700 - Wood Science (Core) 3 Units**

The mechanical properties of wood and wood composites and their use in structural applications, the relationship of mechanical and physical properties to basic processing techniques.

**WSC 702 - Wood Physics (Core) 3 Units**

Study and evaluation of non-mechanical physical properties of wood, principally response to liquids, vibrational simulation, heat, electricity and ionising radiation.

**WSC 704 - Chemistry of Wood (Core) 3 Units**

Chemical composition of wood, structure, reactions and derivatives of wood and cellulose, chemistry of lignin, hemicelluloses and related compounds. The extraneous components of wood, extension of elementary principles to application of physical, organic and polymer chemistry in forest products utilisation.

**WSC 708 - Pulp and Paper Technology (Core) 3 Units**

Physical and Chemical properties of wood in relation of pulping, chemicals used in pulping, paper manufacturing.

**ELECTIVES**

**WSC 701 - Research Methods in Wood Anatomy (Elective) 3 Units**

Preparation of woody tissue for light microscopic examination and recording, including micro-techniques and photomicrograph methods, introduction to electron microscopy and interpretation of wood ultrastructure and its effect on wood properties.

**WSC 703 - Timber Engineering (Elective) 3 Units**

Trusses, arches, straight and arched plate girders, stressed skin structures, towers, trestles, grandstands, timber-composites and special timber structures.

**WSC 706 - Wood Deterioration and Preservation (Elective) 3 Units**

Natural deterioration of wood by fungi and insects, types of decay organisms, decay conditions, mechanisms and consequences, alternatives for wood protection against deterioration, chemicals used for wood preservation and techniques employed for applying wood preservatives.

**WSC 707 - Lumber Manufacturing (Elective) 3 Units**

Industrial methods and equipment used in the manufacture of lumber, modern milling and marketing practice, sawmill analysis, techniques, saw doctoring and lumber grading.

**WSC 799 - Special Study: Thesis Research (Elective) 6 Units**

Research projects on an approved topic leading to a dissertation.

**WSC - Seminar - 2 Units**

**Ph.D. Forestry**

**STRUCTURE**

Ph.D. is basically a research degree in specialised areas of Forest Science. There may be course work, which will vary depending on the background of the candidate but would contain the relevant courses that have not been taken at Master of Forest Science degree level and in some cases may include courses in related basic sciences.

**MASTER OF WILDLIFE MANAGEMENT**

**SYNOPSIS OF COURSES**

**WLM 700 - Fire Ecology (3 Units)**

Principles governing fire and natural phenomenon. Significance in the evolution of vegetation, adaptations to environment, fire as a management tool fire ratings.

**WLM 701 - Vertebrate Ecology (3 Units)**

Ecology of the individual, population and ecosystem, epistemology of major ecological concepts. Niche. Theory evolved in the study of vertebrates.

**WLM 702 - Problems in Wildlife Management (2 Units)**

Individual study and research on selected problem approved by graduate adviser. Problem to be addressed could be on human dimension aspect of Wildlife Management. Wildlife habitats, protected or no-protected sites, interpretation and extension services.

**WLM 703 - Systematic Ornithology (3 Units)**

Birds of the world, diversity, radiation, adaptation, distribution and past history. Contrasts both between the taxa and between the continental avifaunas. Identification of avian-species by size, form and sound.

**WLM 704 - Environmental Impact Analysis of Wildlife Protected Areas (3 Units)**

Analysis and critique of contemporary environmental analysis methods in current use, environmental impact statements. National policies, political, social and legal ramifications as related to utilization.

**FRM 700 - Advanced Biometry (3 Units)**

Sampling methods and principles of regression analysis as applied to forest resources and the biological sciences, matrix algebra of relevance to regression analysis, algebra and inference of multiple linear and curvilinear regression, applications to forestry and related field, computer programming exercise, parametric and non-parametric methods, design of experiments.

**WLM 705 - Wildlife Production Techniques (3 Units)**

Health and Welfare requirements of wildlife species in captivity. Domestication and multiplication techniques for selected African mammals, birds and reptiles. Ranching techniques.

**WLM 706 - Vertebrate Ethnology (2 Units)**

Phylogenetic evolution of behaviour, the behaviour patterns that animals exhibit for functioning in their environments. Social organisation problems of everyday activities breeding seasons, agnostic behaviour, territoriality and population integration, reproductive behaviours predator-prey relations, domestication.

**WLM 707 - Animal Breeding (3 Units)**

Concepts from Mendelian, population and quantitative genetics, heritability, selection response, selection criterion, selection index, genetic relationship, inbreeding, amaturing systems, hybrid vigour and genetic-environmental interaction applied to animal breeding and to production systems.

**WLM 708 - Wildlife Nutrition (3 Units)**

Current fundamental concepts in protein and energy metabolism relating to nutrients required for maintenance, growth and development of animals.

**WLM 709 - Comparative Pathology (2 Units)**

Pathology of laboratory animals, primates, fish and marine animals.

**WLM 710 - Park Design and Recreation Resources Development (3 Units)**

Fundamental of the recreation planning process, historical prospective and objective of planning models, major component analysis including public involvement, resource evaluation, demand analysis, classification of system and standards.

**WLM 712 - Zoo and Museum Techniques (2 Units)**

Health and welfare requirements of wildlife species on captivity. Zoo design and layout museum techniques, principles of collecting preserving and existing animal specimens in museum for educational purposes.

**WLM 713 - Communication in Conservation (3 Units)**

Conservation education, extension services and park interpretative techniques. Setting up of effective learning milieu in rural areas, motivation principles of adult learning. Communication and diffusion processes, practice of selected kindred education methods.

**WLM 714 - Wildlife Policy and Law Enforcement (2 Units)**

Analysis of present wildlife conservation policy identification and justification of policy for update. Role of law enforcement and machinery for effective wildlife management and conservation. History and development of law and relationship to present policies. Organisation, operations and duties of personnel.

**WLM 715 - Field and Laboratory Methods (2 Units)**

Experiences in field studies, organising field notes collecting and preserving wildlife for teaching and museum purposes. Methods of mounting live animals and for identifying animals collected. Training in preparation of skeletons, animal mounts, models diorama and other exhibits.

**WLM 716 - Ecosystem Approach to Range Management (3 Units)**

The ruche concept, populations communities, energy flow, nutrient cycle on the ecosystem, natural regulation of animal numbers, adaptation, man's role in biological communities.

**WLM 717 - Physiological Ecology of Wildlife Species (2 Units)**

Effects and limitation of temperature, photoperiod and other environmental factors in the distribution and abundance of animals, comparative behavioural and physiological adjustments to environment as an evolutionary response, physiological indices of reproduction, charges in metabolites, hepatic and extra-hepatic enzymes of wild animals.

**WLM 718 - Travel and Tourism (2 Units)**

Tourism and recreational travel, origins, present characteristics and societal impacts, implication of non-business travel in Nigeria and the merging importance of international recreation.

**WLM 719 - Recreation Systems Planning (2 Units)**

Components of the tourism - park-recreation development system and the concepts of planning resources use at the larger-than-site scale. Physical and programme factors important to development for visitor use. Computer techniques for land assessment.

**WLM 799 - Special Study: Thesis Research (Elective) 6 Units**

Research projects on an approved topic leading to a dissertation.

**WLM 720 - Seminar - 2 Units**



### Ph.D. Wildlife Management

Ph.D. is basically a research degree in specialised areas of Wildlife Management.

### STRUCTURE

There may be course work, which will vary depending on the background of the candidate but would contain the relevant courses that have not been taken at M.Sc. degree level and in some cases may include courses in related basic sciences.

### STAFF LIST

Name	Rank	Qualification	Area of Specialisation
Onadeko, S. A	Professor	B.Sc. (Ib.), M.Sc. (Texas), Ph.D. (Ib.)	Wildlife Management/ Park Interpretation
Oluwalana, S. A	Professor	B.Sc., M.Sc., Ph.D. (Ib.), Dipl. E.M.P (Dresden)	Forest Economics and Management
Aduradola, A. M	Professor	B.Sc. (Ib.), M.Sc. (Ib.) Ph.D (Ib.)	Agro-forestry and Silviculture
Adedire, M. O	Reader	ND (Jos), M.Sc. (Voronezh), M.Sc., Ph.D. (Ib.)	Silviculture and Agroforestry
Inah, E. I	Reader	B.Sc., M.Sc., Ph.D. (Ib.)	Ecology & Conservation
Smith, O. F	Senior Lecturer	B.Sc. M.Sc., Ph.D. (Phillipines)	Wildlife Management (Reproduction)
Adetogun, A. C		B.Sc. M.Sc. Ph.D.(Ib.)	Forest Pathology
Adekunle, M. F		B.Sc (Ib), M.Sc. (Ib)	Forest Economics and Management
Oyatogun, M. O. O		B.Sc (Ib), M.Sc (Ib)	Range Management
Aina, O. M			Wood Science