Email: iied@fupre.edu.ng

MASTERS OF SCIENCE (M.Sc.) PROGRAMMES

PHILOSOPHY

This programme is a short-term programme designed fundamentally to bridge the gap for those who have academic deficiencies or who cannot obtain their desired kind of jobs with their present degrees to change without starting all over from undergraduate level in related or relevant fields.

The programme will help lower qualification degree and HND holders facilitate their admission into Master's Degree Programme in the College of Postgraduate Studies.

AIM/OBJECTIVES

The aim and objectives of the Postgraduate programme are to:

1. Produce high level man power in the Environmental sciences through the acquisition of requisite skills and knowledge, for national development.
2. Develop in science graduates a sense of inquiry, capacity for independent research and motivation to extend the frontiers of science and technology.
3. Produce graduates who will be adequately equipped for relevance in the global knowledge economy.
4. Produce graduates who are capable of applying appropriate scientific principles for solving problems for the promotion of human wellbeing.
5. Produce manpower with optimal competencies and skills to function effectively in the academia and the private sector.

RATIONALE/JUSTIFICATION

i. Compatibility of programme with institutional mission:

The mission of the Federal University of Petroleum Resources is to train graduates who shall be responsive to the manpower needs of the petroleum industry, allied industries and environmental issues among others. The programmes here proposed are in line with the above mission of the institution.

ii. The programme has also be designed to meet national needs as graduates will be able to compete favourably in resolving environmental global issues.

iii. The presence of the Petroleum Training Institute (PTI) that trains middle manpower (HND) for the oil and gas industries located in same region readily makes their student available for the programme as there is the demand for them to improve their career.

Table 1: List of Academic Staff

S/N	Name	Qualifications	Status	Area of Specialization
1	Prof. Rim-Rukeh Akpofure	B.Sc. M.Sc. Ph.D.	Professor	Environmental studies and Biocorrosion/ Biochemical Engineering,
2	Prof. Prekeyi Tawari-Fufeyin	B.Sc. M.Sc. Ph.D.	Professor	Hydrobiology & Fish Biology & Toxicology
3	Prof. Christopher Onosemuode	B.Sc., PGD GIS, M.Sc, Ph.D.	Professor	Geoinformatics
4*	Prof. B.J.O Efiuvwevwere	B.Sc. M.Sc. Ph.D	Professor	Microbiology (Food Microbiology/ Biodeterioration
5*	Prof. I.E Agbozu	B.Sc, MSc, Ph.D,	Professor	Environmental/Analytical Chemistry and Waste Management
6	Dr. Olalekan Adeyemi	B.Sc., MSc., Ph.D.	Associate Professor	Biochemical Toxicology/ Environmental Biochemistry
7	Dr. David Allenotor	B.Sc., MSc., Ph.D.	Associate Professor	Software Eng., HPC. HVL &Finanacial Options Modelling
8	Dr. D.F. Ogeleka	B.Sc., MSc., Ph.D.	Associate Professor	Analytical/Environmental Chemistry
9	Dr. (Mrs) L.E. Tudararo-Aherobo	B.Sc., MSc., Ph.D.	Senior Lecturer	Environmental & Public Health Microbiology
10	Dr.Asibor, Godwin	B.Sc., MSc., Ph.D.	Senior Lecturer	Hydrobiology, Safety and Occupational Health
11	Dr. Edjere, Oghenekohwiroro	B.Sc., MSc., Ph.D.	Senior Lecturer	Analytical/Environmental Chemistry
12	Dr. (Mrs)Adeyemi, Oyeyemi	B.Sc., MSc., Ph.D.	Senior Lecturer	Toxicology/Biochemical synthesis/Bioremediation

* Adjunct Lecturer

List of Non-Academic Staff

Table 2: Laboratory Technologists

S/N	Name	Qualifications	Status	Area of Specialization
1	Esemedafe Josephine	OND HND PGD in view	Principal Technologist	Chemistry/Biochemistry
2	Enakireru Davis Bobby	OND, HND	Technologist 1	Environmental Technology
3	Ibezim Esther Nkem	OND, HND	Technologist 1	Environmental Technology
4	Makun, Omowumi Jayeola	OND, HND, M.Sc	Technologist 1	Biochemistry

Table 3: List of Administrative Officers

Etinosa Omo Ahanor	Bachelor (LL.B.) Degree in Law (UNIBEN, 2015)	Administrative Officer II
Ekure Oghenevwede Lucy	ND, Science laboratory technology (Delta State Polytechnic, Otefe, 2014)	Executive Officer.
Goddey Akpevwe Onojakpor	ND, Banking and Finance (Kings Polytechnic, Edo State,2013).	Clerical Officer

AREAS OF SPECIALIZATION

a) M.Sc. in Integrated Environment and Development Studies
b) M.Sc. in Environmental Management and Control
c) M.Sc. in Waste Management Technology

ADMISSION REQUIREMENT

A. Applicants for Academic M.Sc. should possess;

i. Five credit passes including English, Mathematics and three other relevant science subjects at 'O' Level.

ii. B.Sc. Honours degree with a minimum of Second Class Honours lower division degree, with a CGPA of 3.0, in Environmental Management and Toxicology from the Federal University of Petroleum Resources or other recognized University.

iii. A minimum of second Class Honours lower division degree in an Environmental Science related discipline, but such candidates upon admission may be required to undertake certain remedial courses where its deficient.

iv. At least a credit pass in University Postgraduate Diploma with a CGPA of 3.5/5.0 in a related discipline or 60% on weighed percentage average.

v. Other qualifications and or experience as approved by the Senate of the Federal University of Petroleum Resources to be adequate and satisfactory.

b) Duration of Programme

i. A full time Master's programmes shall run for twelve (12) Calendar months comprising of three (3) semesters.

ii. Part-time master's programmes shall run for a minimum of 5 semesters and a maximum of 8 semesters.

c) Requirements for Graduation

To be awarded academic master's degree candidates must pass a minimum of 30 credit units made up of as follows:

> Core courses of twenty-four credit units.

> Elective courses of six credit units.

> A student shall carry out research in relevant areas of specialization and submit an acceptable thesis (six credit units compulsory).

> A student shall present at least one seminar, submit and defend a thesis proposal.

d) **Eligibility to Proceed to Ph.D. Programmes**

A candidate who has satisfied the requirements for the award of the M.Sc. in the academic programme shall normally be eligible to proceed to a research-based Ph.D programme in the area of specialization provided the candidate's average score is 60%.

B) **Basic Admission Requirements for Professional Master programmes**

The criteria for admission into the professional Masters programme will be as follows:

i) Matriculation requirements of individual Universities which must be 5 'O' level credits including Mathematics and English Language and three relevant science subjects.

ii) Candidates with Bachelor Honours degree (not below Third Class) in Environmental Management, Environmental Science, Natural or Applied Science based subject, Agriculture, Geology, Medical Science or Technology/Engineering.

iii) Candidates with a PGD in Environmental Management, Environmental Science, Natural or Applied Science based subject, Agriculture, Geology, Medical Science or Technology/Engineering with a minimum of Merit/Pass (i.e. 3.0-3.49 of 5.0 scale).

a) **Duration of Programme**

i) A full time Master's Programme shall run for twelve (12) calendar months comprising of three (3) semesters.

ii) Part-time Master's programme shall run for twenty- four (24) calendar months comprising of six (6) semesters.

COURSE CONTENT OF M.Sc. IN INTEGRATED ENVIRONMENT AND DEVELOPMENT STUDIES (IED)

FIRST ACADEMIC SESSION

COURSE CODE	COURSE TITTLE	CREDIT UNITS	COURSE STATUS
	FIRST SEMESTER		
COS 801	ICT, Research Methods and Proposal Writing	2	C
COS 802	Management and Entrepreneurship	2	C
IED 811	Introduction to Natural Resources & Environmental Management	3	C
IED 812	Health, Safety, Environment and Corporate Social Responsibility	2	C
IED 813	Fundamentals of Environmental Biology	2	C
IED 814	Seminar	2	C
IED 815	Environmental Chemistry & Toxicology	2	E
	Total Units	15	
	SECOND SEMESTER		
IED 821	Sustainable Development: Concept, Principles and Practice	2	C
IED 822	Environmental Assessment Studies (EIA, SIA & HIA)	3	C
IED 823	Ecosystem and Natural Resources Management/Conservation	3	C
IED 824	Waste Management, Pollution Assessment and Remediation	2	C
IED 825	Ecology, Biodiversity, Climate Change and Coastal Zone Management	3	C
IED 826	Fundamentals of GIS and Remote Sensing	3	E
	Total Units	16	

SECOND ACADEMIC SESSION

3RD SEMESTER

COURSE CODE	COURSE TITTLE	CREDIT UNITS	COURSE STATUS
IED 899	Research Project	6	C
IED 816	Fundamentals of Economics and Project Costing/Analysis	2	C
IED 817	Climate Change Trends	2	E
	Total	10	

COURSE DESCRIPTION

COS 801 – ICT, Research Methods and Proposal Writing 2 Units

Spreadsheets – Microsoft Excel, Basic computing knowledge/window 2008; Internet Technology; Statistical packages; precision and accuracy estimates; principles of scientific research; basics of PowerPoint Presentation; concepts of hypothesis formulation and testing; and organization of research and technical report writing.

COS 802: Management and Entrepreneurship 2 Units

This course develops practical abilities and skills in entrepreneurship. It examines the broad areas of entrepreneurial business creation and management and historical perspective. Topics include: history and development of entrepreneurship theory, types of and characteristics of entrepreneurs, creativity and innovation, entrepreneurial process, feasibility study, business plans, pricing and bookkeeping, human resource management and marketing. Business environment and bioenterpises; basics of business and financial management; entrepreneurship development; feasibility studies; marketing and managerial problem solving.

IED 811: Introduction to Natural Resources & Environmental Management 3 Units

The course gives a general overview of the natural resources industry and environmental resources industry and environmental management. It explores the nature of the inter-relationship between environmental systems and human systems, and examines the complexity of environmental policy, planning and management. The course enables students to gain an appreciation of the complex and trans-disciplinary nature of environmental management issues and the inherent challenges in multidisciplinary approaches to environmental management. It introduces renewable and non-renewable natural resources and the issue of consumption and sustainability.

IED 812: Health, Safety, Environment and Corporate Social Responsibility 2 Units

This course enables students to appreciate the issues of health, safety, environment and social responsibility of industries. Companies are increasingly under pressure to address their social and environmental responsibilities. Topics include, social, health and environmental auditing corporate social responsibility (CSR) reporting, engagement of stakeholders and communities,

participation of civil society groups, advocacy and communication.

IED 813: Fundamental of Environmental Biology 3 Units

The Course introduces students to fundamental principles of Environmental Biology including plant, wildlife, marine and fishery resources as well as micro-organisms in relation to the environment. Topics include: habitats and management needs and tools; productivity patterns and stock dynamics ;state of world wildlife and fishery resources and management; micro-organisms; microbial functions and activities in natural environments; microbiological methods and techniques, etc.

IED 814: Seminar

Each student will be given a topic related to his or her research area by the respective supervisor and the students will be required to submit. The student will then deliver a departmental seminar on this topic and evaluated accordingly

IED 815: Environmental Chemistry & Toxicology 2 Units

The course deals with the principles of environmental chemistry and toxicology, focusing on issues relating to the chemistry and toxic potential in the environment and their management. Topics include: Basic concepts in soil chemistry and chemical properties, soil micro and macronutrients, Biogeochemical cycle, Toxicity of oils and dispersants (including OBMs), Dose-response relationship, Quantification of toxicity indices, Range-finding tests, Probit analysis, Abott's correction formula, applicability of toxicity data in risk assessment and environmental monitoring.

IED 816: Fundamentals of Economics and Project Costing/Analysis 2 Units

This course provides a basic understanding of economic principles and its roles in natural resources and environmental management. The course also explores costing techniques, methods and their practical applications as well as economics of ecologically sustainable development. Topics include: market and non-market approaches, microeconomics, macroeconomics, supply and demand, Natural Environment and Human Economy, Resources Economics, Resource Scarcity, and Economic Efficiency, projects progress control and final cost, budgets and budgetary control, effective administration and management of contracts, competitive bidding, selection of successful bid, proper planning, documentation and execution of contract in the Nigerian oil exploration and production ventures.

IED 817: Climate Change Trends **2 Units**

Rising Temperatures(Temperature Scales, Temperatures Shown by Graphs, Rising Land and Sea Temperatures, Tropospheric Warming and Stratospheric Cooling),Sources of Uncertainty with Temperature Data, Climate Construction from Instrumental Data, Measurement of Temperature (*Global Temperature from Meteorological Stations)*, The Berkeley Earth Surface Temperature (BEST) Study, Land Temperatures from Boreholes, Rising Sea Temperatures (*Relative Distribution of Sea-Surface Temperatures (SSTs), Ocean Heat Content)*, Melting Ice (*Permafrost, Methane, and Clathrates, Methane Clathrates)*, Rising Sea Level, Migration of Plants and Animals, Species Extinctions, Human Health Effects of Rising Temperatures, Attribution, Greenhouse Gases, Components of the Climate Change Process, Other Effects of Global Warming, Forcings and Feedbacks in the Climate System (*Forcings, Positive and Negative Forcing and Their Effects, Feedbacks)*, Climate Sensitivity

IED 821: Sustainable Development: Concept, Principles and Practice **2 Units**

Sustainable Development is the current broadly-endorsed framework for environmental management and the emphasis in this course is exploring conceptual and practical framework for environmental management. Key topics include: development of the concepts of sustainable development and sustainability; Disciplinary perspectives/approaches (philosophy, economic, ecological,socio-cultural, governance health sciences etc.); Critiques of sustainability as a framework for environmental management; problems in practical interpretation and implementation of sustainability; Response to the sustainability framework by different levels of governance, corporations, professionals and International community. Poverty and the environment, community participation in development, practice of sustainable development and environmental management in Nigeria.

IED 822: Environmental Assessment Studies (EIA, SIA, SEA, EER& HIA) 3 Units

This course provides an introduction to the wide range of "tools" used in environmental management and for environmental decision making. Topics include: interrelationship among Assessment; Environment and Development; evolution of Environmental Assessment; Procedures and steps in Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), and Health Impact Assessment (HIA); Public Participation; Strategic Environmental Assessment (SEA); Policy formulation; risk management systems, etc. Effectiveness and challenges of contemporary EA practices. Environmental Auditing and Management Systems. Environmental Evaluation Reviews (EER)

IED 823: Ecosystem and Natural Resources Management/Conservation 3 Units

The course introduces students to the inter-disciplinary nature of ecosystem management/conservation and natural resources (including forest, wildlife, aquatic and geological). The complexity of managing dynamic ecosystems with on-going biodiversity changes. Need to balance ecological needs with economic, political and socio-cultural demands. Other topics include: threats to biodiversity; conservation genetic; wildlife population management; impacts of climate change; balancing stakeholder interests, Water Resources Assessment and Management. Topics include: Concepts of sustainable water resources management and integrated water resources management, water quantity and quality, water use and demand including the value of water to the environment, irrigation agriculture and urban uses, water use efficiency and recycling, water policy and planning including principles of water reform, current developments in water policy and catchment-based decision-making. Climate change and Water Resources Sustainability.

IED 824: Waste Management, Pollution Assessment and Remediation 2 Units

This course provides a comprehensive, interdisciplinary knowledge of waste management, fate and transport of inorganic and organic pollutants in the subsurface and integrated site characterization and assessment for subsurface remediation of contaminated sites.

Topics include; waste management approaches, conceptual site models (CSM), Risk Based Site characterization, advection – dispersion theory, non-aqueous phase (LNAPLs & DNAPLs) in the subsurface, microbial processes, conceptual approach to soil remediation, integrating site characterization with selection of remediation methods, treatment approaches, treatability studies, preparation of remediation action plan, Bioremediation, monitoring and regulation of remediation standards.

IED 825: Ecology, Biodiversity and Coastal Zone Management 3 Units

The concept of conservation – historical perspective; biodiversity and business; Biodiversity Action Plans (BAPs) and parameters for the assessment of biodiversity (Rapid Forest Assessments); Criteria for protecting an area; international coalition for biodiversity – UNCED1992 and biodiversity, the convention on Biological Diversity (CBD); other international agreements and treaties on biodiversity conservation; Biodiversity conservation efforts in Nigeria (public sector and NGOs); forest and range land resources; wildlife and fisheries. Concepts, policies, tools and techniques necessary for coastal zone management with emphasis on trans-disciplinary and large marine Ecosystems (LME) approaches as well as relevance of climate change impacts. Global warming, climate change, sea level rise, overview of coastal zone management (imperatives, implementation and impacts); dynamics and processes along shoreline, coastal erosion, transport, deposition and resultant geomorphologic features; coastal zone anatomy (evolution, classification, characteristics and interrelationships with emphasis on the Nigerian coastal zone); Human-coast interaction

(consequences, use-conflicts and costs); Coastal hazards; Mitigating coastal zone abuse; pollution, erosion and flooding; global warming and sea level rise; ecological changes and conservation; coastal resource over-exploitation/mismanagement; population migration/displacement.

IED 826 Fundamentals of GIS and Remote Sensing 3 Units

The course introduces students to principles and applications of geographic information systems (GIS) and remote sensing. It provides the basic theoretical, technical and analytical skills necessary to apply GIS to simple spatial problems. Topics include: A review of analysis functions, selected advanced analysis, Modelling and flowcharting and Raster analysis GIS software package, data capturing techniques, spatial data and data models, cartographic techniques, GIS design and implementation as well as satellite imagery interpretation.

IED 899: Research Project 6 Units

A research project on a relevant topic that would proffer an environmental solution for sustainable development.

COURSE OUTLINE OF M.SC. IN WASTE MANAGEMENT

FIRST ACADEMIC SESSION

FIRST SEMESTER

Course Code	Course Title	Credit Unit	Course Status
COS 801	ICT, Research Methodology and Proposal writing	2	C
COS 802	Management and Entrepreneurship	2	C
WMT 810	Introduction to Solid Waste Management	2	C
WMT 811	Recycling and Resource Management	2	C
WMT 814	Seminar	2	C
WMT 815	Environmental Management Systems	3	E
WMT 816	Occupational Health & Safety	2	E
	Total Credit Units	**15**	
	SECOND SEMESTER		
WMT 820	Waste Management Systems	3	C
WMT 821	Final Disposal/ Landfilling	2	C
WMT 822	Oil and Gas Wastes Management	2	C
IED 826	Environmental Modelling and GIS	3	E
WMT 823	Sustainable Production and Resource Economics	2	E
	Total Credit Units	**12**	

SECOND SESSION

3RD SEMESTER

Course Code	Course Title	Credit Unit	Course Status
WMT812	Mechanical, Biological and Thermal Waste Treatment	3	C
WMT 813	Special waste management (hospital waste, industrial waste, etc)	3	**C**
WMT 899	Project	6	C
	Total	**12**	

COURSE DESCRIPTION

COS 802 ICT and Research Methodology and Proposal Writing 2 Units

This course should cover essentials of Spreadsheets, Internet technology, Statistical Packages, Precision and Accuracy of Estimates, Principles of Scientific Research, Concepts of Hypotheses Formulation and Testing, Organization of Research and Report Writing.

COS 801 Management and Entrepreneurship 2 Units

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

WMT 810: Introduction to Solid Waste Management 2 Units

Waste generation and composition, national and international regulations for waste, waste avoidance, collection and transport of waste, separate collection of recyclables, sorting of recyclables, recycling technologies for paper, glass, metal, plastic, biological treatment of waste, waste disposal, ecological indicator systems, principles of waste management, polluter and producer pays principle, the precautionary principle, waste hierarchy, concept from cradle to grave.

WMT 811: Recycling and Resource Management 2 Units

Material and energy flow management and analysis, influences of production and consumption, ecological and economically valuation of substances, assessment of sustainability of material flows, optimization of material-, energy- and information flows, treatment technologies, design for recycling, upgrading and repair, recycling and reuse, engineering cost estimation, and

regulatory/legal aspects of waste management are included, waste minimization, basic unit processes, processing, application and utilization of reclaimed products.

WMT 812: Mechanical, Biological and Thermal Waste Treatment 2 Units

Design limitations (waste quality and quantity), treatment process, biochemical reactions and microbial ecosystems, thermodynamic waste heat generation and effects on pathogen die-off, biological treatment: anaerobic digestion, composting and mechanical biological treatment, aerobic and anaerobic treatment of bio and green wastes, mechanical and biological treatment of residual waste (MBT), process design to maximize methane production, digester designs, biogas collection and utilization, biomass and bio-fuel production, thermal waste treatment technologies.

WMT 813: Special Waste Management (Hospital Waste, Industrial Waste) 3 Units

Introduction, definition of hazardous health care waste, infectious waste, genotoxic waste, waste sharps, biomedical waste – categories and composition, sources of health care wastes, hospital waste management, potential health hazards, legislation and policies on health care waste management, World Health Organization guidelines, industrial waste definition, industrial waste audit, industrial waste management, hospital and industrial wastes collection, treatment and disposal.

WMT 814: Seminar 2 Units

Each student will be given a topic related to his or her research area by the respective supervisor and the students will be required to submit. The student will then deliver a departmental seminar on this topic and evaluated accordingly.

WMT **815: Environmental Management Systems 3 Units**

Integration of environmental issues on sustainability in businesses, key elements of the Eco-Management and Audit Scheme (EMAS) and ISO 14001, principles and elements of environmental management systems, environmental management and reporting, examples of Environmental Management System (EMS) manuals, developing a 'mock EMS manual' for an organization developing and implementing an ISO14000 compliant EMS within an organization.

WMT 816: Occupational Health & Safety 2 Units

Basic concepts of Occupational Safety & Health; Industry Risk & Hazard; Industry Occupational Dieses &Hygiene; Accident & Ergonomics; Waste and Public Health; and Waste and Environmental issues.

WMT 820: Waste Management Systems 3 Units

Hazardous waste treatment and disposal; hazardous waste identification, basic properties of hazardous waste, classification of hazardous waste, hazardous waste generation and characteristics, transportation and storage of hazardous waste, physical, chemical and biological treatment, thermal treatment and energy recovery, stabilization and solidification and land disposal of hazardous waste, alternative hazardous waste management programs. Planning of waste management systems (Costs, Aims, Basics), logistics, collection (Storage Systems), transport and transfer Stations (policy, economics, planning), identification of pollution prevention opportunities and implementation of proven methodology as defined by International Environmental Agencies (e.g. EPA), emphasis on economic evaluation of pollution prevention practices and investments for various manufacturing and post-consumer processes, monitoring.

WMT 821: Final Disposal/Landfilling 2 Units

Landfill Emissions, Site Requirements, Landfill Construction, monitoring, landfill technology and operation, sitting and construction, design characteristics, life span, extraction of landfill gas – future energy production, operation and maintenance, emission control and treatment.

WMT 822: Oil and Gas Wastes Management 2 Units

Drilling fluids/ cuttings and produced water management, fugitive gases and condensate management, management of hydrotest water, effluent/wastewater management, waste tracking and disposal strategies.

WMT 824: Sustainable Production and Resource Economics 2 Units

Introduction to sustainable development and sustainable production, impact of production processes on the environment, sustainable production processes in the chemical, metal and ceramic industries, purpose and implementation of CDM/ JI, Kyoto Protocol, CDM Market, Investments, incentives, opportunities- financing, economics of CDM/ JI projects.

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.

IED 826: Environmental Modelling and GIS 3 Units

Environmental information management systems: strategic information systems, environmental informatics, geographical and spatial data bases, distributed databases, impact of information systems on environmental organizations: intelligent machines in man's environment: use of computer in various divisions of the environment: use of environmental and related software packages. Introduction and concepts of modeling; sub-models in ecological modeling; conceptual and static models, modeling population dynamics. Examples of dynamic bio geo-chemical models; application of ecological models in environmental management; ecosystems characteristics and models.
Definition of Remote sensing, Basis of Remote Sensing (Model of Remote Sensing system), Types of Remote Sensing System (Natural, Camera and Satellite), Types of satellite Remote Sensing Systems, Satellite characteristics (orbit & swath, spatial resolution, spectral resolution, radiometric resolution, and temporal resolution). The Electromagnetic Spectrum, Image forming process, elements of image interpretation. Definition of GIS, Development of GIS, Components of GIS, Spatial data types (point, line, polygon and continuous surfaces, Data Conversion. Raster data representation; nature and characteristics of raster data, raster data compression. Vector data representation; nature and characteristic of vector data, vector data input functions. Creating Themes/Layers, Shape-files, Vectorization and Attribute tables. Map production and annotation.

The emphasis of the concluding aspect of the course shall be on the application of GIS and Remote Sensing data on environmental modeling using the following Basic GIS Analysis/Operation: Overlay operations; Proximity analysis; Spatial operations; Terrain analysis and Network Analysis as they apply to diverse fields and discipline of environmental studies.

WMT 899 – THESIS 6 Units

Independent research will be carried out by students with guidance from one or two supervisors. Topics are chosen at the discretion of the student but must be approved by the Supervisor.

COURSE CONTENT OF M.Sc. IN ENVIRONMENTAL MANAGEMENT & CONTROL (EMC)

FIRST ACADEMIC SESSION

FIRST SEMESTER

Course Code	Course Title	Credit Units	Status
SCI 801	ICT and Research Methodology	2	C
SCI 802	Management and Entrepreneurship	2	C
EMC 811	National & Global Environmental Issues	2	C
EMC 812	Principles & Concept of Environmental Impact Assessment	2	C
EMC 813	Environmental Pollution & Control	2	C
EMC 814	Seminar	2	C
EMC 817	Compliance Monitoring & Enforcement	2	E
	Total Units	**14**	
	SECOND SEMESTER		
EMC 821	Practical/Field work	2	C
EMC 822	Environmental Analysis	2	C
EMC 823	Environmental Pollution Studies	2	C
IED 826	Remote Sensing, GIS & Modelling	3	E
EMC 824	Principles of Environmental Auditing & post-project commissioning	2	E
	Total	11	

SECOND ACADEMIC SESSION

3RD SEMESTER

Course Code	Course Title	Credit Units	Status
EMC 899	Research Project	6	C
EMC 815	Ecological Principles for Sustainable Development	2	C
EMC 816	Environmental Law & Policy	2	C
EMC 818	Industrial Wastewater Pollution & Control	3	E
	Total	13	

COURSE DESCRIPTION

EMC 811 National & Global Environmental Issues 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 Hydrofluorocarbons, Radioactivity pollution.

EMC 812 Principles & Concept of Environmental Impact Assessment 2 Units

Assessment, development and the environment. Guidelines procedures, methods and applications of EIA. Preparation of EIA report.

EMC 813 Environmental Pollution & Control 2 Units

Pollution, pollutants and their sources. Effects of pollution. Environmental degradation. Ecological disasters and their causes. Environmental effects of urbanization, Natural climatic change. Environmental effects of industrial development. Effects of agricultural activities. Ecological principles for economic development. Case histories.

EMC 814 Seminar 2 Units

Literature/field search and presentations on topical and special local, national and global environmental issues.

EMC 815 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. 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 benefits analysis. Location theory. Pollution economics. Resource depletion and conservation

EMC 816 Environmental Law & Policy 2 Units

Comparative study of environmental laws in some advanced and developing countries e.g USA, Canada, EEC countries, Thailand etc. International laws and conventions.

EMC 817 Compliance Monitoring & Enforcement 2 Units

A detailed study of requirements to ensure compliance and enforcement of environmental laws (National and International). Compliance monitoring of environmental exploration and production activities, water and wastewater effluents, in line with recommended National and International standards.

EMC 818 Industrial Wastewater Pollution & Control 2 Units

Effluent treatment, sedimentation process, filtration, coagulation and flocculation, membrane separation process, flotation, absorption, non-exchange, chemical exudation and reduction, disinfection biological treatment process. Treatment of sludge. Waste water management from chemical, electro-chemical metal treatment processes. Iron and steel industry, gas, coal and tar industry, pharmaceutical industry, textile industry, tanning industry, plastics industry, foodstuff, pulp, paper and wood. Soap and detergents. Petroleum and petro-chemicals, alkaline industry and radioactive waste water.

EMC 821 Practicals/Field Work 2 Units

Laboratory and field work on environmental management and control (including pollutant characterization and analysis in various environmental media).

EMC 822 Environment Analysis 2 Units

Introduction, principles and applications. Environmental sampling methodology, Sample preservation, processing, etc. Analytical techniques for environmental analysis. Criteria for selection of methods. Analysis of air, water, sediment, fish, clinical samples for inorganic and organic chemical pollutants. Data management and presentation.

EMC 899 Research Project 6 Units

A novel research that provides solution to an environmental challenge in the oil and gas/ allied industry.

EMC 823 Environmental Pollution Studies 2 Units

Principles of chemical pollution of environmental media (air, soil and water) and associated resources. Water/waste water chemistry, soil chemistry and fate of pollutants, air pollution chemistry, fate, effects and monitoring. Environmental toxicology. Chemistry f persistent toxic substances including persistent organic pollutants (POPs). Environmental indicators of chemical pollution and marker compounds. Remediation of contaminated environment.

IED 826 Remote Sensing, GIS & Modelling 3 Units

Introduction, principles, origin and development of Remote Sensing and GIS technologies. Sensors for remote sensing systems. Aerial photography and photogrammetry analysis. Multi spectra data system e.g. LANDSAT, SPOT, ERS-1, METEOSAT and NOAA. Handling of satellite imageries. Interpretation of remote sensing data. Application of remote sensing and GIS to environmental monitoring, modelling and assessment. Case studies.

EMC 824 Principles of Environmental Auditing & Past Project Commissioning 2 Units

Development of environment nexus. Principles and guidelines on environment. Guidelines on environmental audit and post commissioning assessments. Procedures and format for environmental audit reports (EARS).