Email: iied@fupre.edu.ng

POSTGRADUATE DIPLOMA 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

i) Environmental Management and Control **(EMC)**

ii) Environmental Conservation and Biodiversity **(ECB**)

iii) Waste Management **(WMT)**

ADMISSION REQUIREMENTS

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

i) Possession of five credits passes including, Mathematics, English Language and three relevant science subjects at O'Level, to include Biology, Chemistry and Physics or a pass in Physics and a credit pass in Geography.

ii) Possession of at least 3rd class degree in Natural or Applied Sciences, Medical Science, Agriculture, Engineering, Science Education.

iii) Possession of HND in Natural or Applied Sciences, Agriculture and Engineering from recognized higher institutions, with a minimum of Upper Credit or its equivalent.

Duration of Programme

i) Full-Time PGD shall run for twelve (12) Calendar months of three (3) Semesters.

ii) The Part-Time PGD shall run for twenty-four (24) months of six (6) Semesters.

Requirements for Graduation

A candidate must fulfill the following conditions to be awarded the Postgraduate Diploma:

The candidate must pass a minimum of 30 credits Units made up of the following:

> 12 Units of Core Courses

> 12 Units of Electives Courses

> 6 Units of Project

Pass Mark

The minimum pass mark in a course shall be 50%.

Postgraduate Diploma Classification

The determination of the PGD shall be based on the Cumulative Grade Point Average (CGPA) earned at the end of the programme.

Cumulative Grade	**Class of Diploma**
4.50 - 5.00	Distinction
3.50 – 4.49	Credit
3.00 – 3.49	Merit/Pass
Below 3.00	Fail

COURSE CONTENT

POSTGRADUATE DIPLOMA IN ENVIRONMENTAL MANAGEMENT AND CONTROL (EMC)

FIRST SEMESTER

COURSE CODE	COURSE TITLE	COURSE UNITS	COURSE STATUS
IED 713	Soil and plant science	2	C
IED 714	Principles of Toxicology & Risk Assessment	2	C
EMC 710	National and Global Environmental Issues	2	C
EMC 712	Environnemental Pollution: Sources & Control	2	C
EMC 713	Seminar	2	C
EMC 714	Principles of Environment & Ecology	2	E
EMC 715	Environnemental Techniques, GIS & Remote Sensing	2	E
EMC 716	Environmental Monitoring	2	E
EMC 717	Municipal & Industrial Waste Management and Control	2	E
EMC 718	Resource Management & Conservation	2	E
EMC 619	Environmental Aspects of Mining	2	E
	Total Electives	6	
	Total Units	16	

SECOND SEMESTER

COURSE CODE	COURSE TITLE	COURSE UNITS	COURSE STATUS
EMC 720	Introduction to Public Health and Environmental Law	2	C
EMC 721	Introduction to Statistical Techniques and Computer Usage	2	C
EMC 722	Environmental Impact Assessment and Auditing	2	C
EMC 799	Short Research Project	6	C
EMC 723	Ecological Effects of Chemicals on the Environment	2	E
EMC 724	Occupational Health & Safety	2	E
EMC 725	Control & Management of Ecological Disasters	2	E
EMC 726	Environnemental & Resource Economics	2	E
EMC 727	Development & Environnent	2	E
	Minimum Electives Units	6	
	Total Units	18	

COURSE DESCRIPTION

EMC 710 National and Global Environmental Issues2 units

Climate change and Global warming, Acid Rain, Ozone layer depletion, Loss of biological diversity, Trans-boundary movement of toxic wastes, Oil and gas pollution, Desertification, Nuclear Pollution, Land degradation, Deforestation.

EMC 712 Environmental Pollution: Sources and control 2 units

Pollution and their sources. Effects of pollution. Ecological disasters and their causes. Environmental effects of urbanisation and industrial development. Natural climatic changes.

EMC 713 Seminar 2 units

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

EMC 714 **Fundamentals of Ecology** **2 units**

Introduction to Ecological principles and concepts. The scope of ecology i.e. its relation to other sciences and its relevance to human civilization. The subdivisions of ecology i.e. synaecology and autecology.

EMC 715 Introduction to Remote Sensing and GIS in Environmental Management 2 units

Introduction, principles, origin and development of remote sensing and GIS technologies. Sensors for remote sensing systems. Handling of satellite imageries. Application of remote sensing and GIS techniques to environmental monitoring, modeling and assessment. Case studies

EMC 716 Environmental Monitoring 2 units

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

EMC 717 Municipal and industrial waste management & control 2 units

Principles of waste management. Origin, collection, storage and treatment of solid waste from communities. Methods of sewage disposal. Management of municipal sewage system. Major industries and their waste. Waste treatment methods, theories and application. Solid waste minimization (reduction, reuse, recycling and recovery).

EMC 718 Resource 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.

EMC 719 Environmental Aspects of Mining 2 units

Analysis of elements of surface mine. Operation and design of surface mining systems/components (with emphasis on minimization of adverse environmental impacts and maximisation of mineral resources). Environmental pollution, definition and inter-relationships with emphasis on mining and mineral processing operations. Mine atmosphere, detection of mine gases, physiological effects, inflammation and detonation, gas layering and diffusion, dust hazards. Environmental pollution-related hazards. Explosion, gasing, fires, phennoceniosis. Pollution monitoring and control, methods of control of gaseous and particulate pollutants, absorption, combustion, catalytic destruction, cyclone, inertia separators, electrostatic separators, bag filters, wet trawlers, respiratory etc. Effluent treatment methods, flocculations, coagulation, sedimentation etc.

Treatment processes, water recovery and recycling, ventilation technology and design of ventilation systems.

EMC 720 Introduction to Public Health & Environmental Law 2 units

The course will examine the concept of the environment, the meaning and scope of environmental law, public health and environmental laws including the various factories legislations, and the laws proscribing environmental pollution, and including the dumping of the toxic and radioactive substances, within the context of the rights of citizens to a clean environment and good health and ultimately, the rights of life. It will also examine the extent of the responsibilities of the various bodies set up by the Federal and State Governments for the regulations of environmental protection, via-a-vis the rights of individuals, etc. It will further examine the criminal liabilities and offences created under the various laws of relating to environmental protection, the problem of proof, locus standing, and the crucial role of courts in enforcing these laws, as well as the evaluation of our domestic laws with such international framework.

EMC 721 Introduction to Statistical Techniques & computer Usage 2 units

Data collection and presentation. Design and analysis of experiment in environmental management and control. Clearing, coding, information retrieval and computer usage appreciation. Computer concepts. Information representation. Packages – MS-Word, MS- Excel.

EMC 722 Environmental Impact Assessment and Auditing 2 units

Definitions and concept. Framework for environmental impact assessment (EIA) and Auditing. Environmental impact assessment of development projects. Strategic Environmental Assessment.

EMC 799 Research Project 6 units

A research project will be undertaken in any area of environmental specialization under the guidance of a supervisor. The candidate will defend the research before an external examiner appointed by the School of Postgraduate Studies.

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EMC 723 Ecological Effects of Chemicals on the Environment 2 units

Types, nature and characteristics of different kinds of chemicals: physical and chemical properties of chemical which are ecologically important. Toxicants, their formulation, modes of action (structural activity relationships), metabolism and movement in the environment synergism, antagonism, perturbation and relative potency, half-life systematic. Acceptable daily intake (ADI) of pesticides, contact and stomach poison. Dose-response relationships. Handling, storage and safety precautions.

EMC 724 Occupational, Health & Safety 2 units

Components of Occupational Health. Safety in workplaces. Occupational Hazards and Diseases. Occupational Hazards Control. Legislations. Occupational Medicine. Principles of Industrial Ventilation.

EMC 725 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.

EMC 726 Environmental and Resource Economics 2 units.

An introduction to welfare economics, examining basic concepts including consumer 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 benefits analysis. Location theory. Pollution economics. Resource depletion and conservation.

EMC 727 Development& Environment 2 units

Concept of environment, environmental sustainability and sustainable development. Impact of human activities on the environment. Technology and environment. Achieving a harmonious relationship between development and environment.

COURSE CONTENT OF POSTGRADUATE DIPLOMA IN ENVIRONMENTAL CONSERVATION AND BIODIVERSITY

FIRST SEMESTER

COURSE CODE	COURSE TITLE	COURSE UNITS	COURSE STATUS
IED 712	Environnemental Techniques, GIS & Remote Sensing	2	C
IED 713	Soil and plant science	2	C
IED 714	Principles of Toxicology& Risk Assessment	2	C
ECB 739	Field studies	2	C
ECB 749	Seminar	2	C
ECB 711	Natural Resources and Information Management	2	E
IED 711	Principles of Environment & Ecology	2	E
ECB 712	Environmental Geography and Sociology	2	E
	Total Electives	6	
	Total Units	16	

SECOND SEMESTER

COURSE CODE	COURSE TITLE	COURSE UNITS	COURSE STATUS
IED 722	Statistics for environmental science	2	C
IED 723	EIA and Environmental law	2	C
ECB 721	Exploitation and management of non-renewable resources	2	C
ECB 799	Project	6	C
ECB 722	Wildlife Ecology	2	E
IED 721	Environmental microbiology and biotechnology	2	E
EMC 725	Control and Management of Ecological	2	E
	Total Electives	4	
	Total Units	16	

COURSE DESCRIPTION

IED 711: Principles of Environment & Applied Ecology (3 Units)

Concepts of the Environment: Ecology, Ecosystem, Food Chain/Web, Energy Cycle, Water Cycle etc. Environmental Resources: Types of resources, renewable and non renewable, exploration/exploitation etc. Environmental issues of exploration and exploitation: Pollution, Deforestation, Soil Degradation, etc, Managing the Environment: The concept of Sustainable Environment, Environmental Impact Assessment, Environmental Auditing, Monitoring etc. Conservation Concept, Social issues in Environmental Management. Population, Poverty, Culture/Tradition. Principles of sustainable development, sustenance of resources; socio-economic solution to waste management. Renewable Energy Technologies and Solar Solution; How to develop a working Solar System; Harnessing Solar Power in homes and offices. The application of ecological knowledge and principles in examining environmental problems, solutions and management practices e.g. problems of conservation, resource management, conservation and restoration ecology; Application of ecological principles to study and evaluate the effects and consequences of human activities on communities, ecosystems, landscapes and the biosphere; interactions among organisms and between organisms and their physical (abiotic) environment. Further, it considers human dimensions of ecology, especially the ecological effects of human activities.

IED 712: Environmental Techniques, GIS & Remote Sensing (3 Units)

Method of environmental sample collection and preservation.Sampling techniques for terrestrial and aquatic parameters/organisms, as well as Air. Preparation of reagents, media etc. instrumentation: Microscopy, Mannometry, Micrometry, stains and stain preparation. Preparation

of permanent slides, Distillation solvent extraction, chromatographic techniques, ion exchange, electrophoresis, optical methods of analysis: Flame photometry, Atomic Absorption spectrophotometry, gas chromatography, GC/Mass spectrometry, Auto analyzer, chemical separation, Gas analyzers. Electrochemical methods of analysis: potentiometric titration, voltameter, amperimetric/digital titration methods, spectrophotometry/colorimetry, membrane filter analysis, Quality Assurance and Quality control, presentation and interpretation of environmental data. 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. The concept of topological map. Address geo-coding and its processes. Merits and limitations of Raster and Vector data models.geo-coding and its processes.Merits and limitations of Raster and Vector data models.Environmental application; EIA, Land evaluations and landuse planning, soil mapping, resources evaluation and planning, etc. Three dimensional applications; geologic mapping, oil prospecting and exploitation etc

IED 713: Soil and plant science (3 Units)

Soil profile study and description; main systems of soil classification. Soil formation processes and survey methods. Soil microbiology- microorganisms in the lithosphere (soil habitats), Bio-geochemical cycles. Concepts of the five kingdoms and their characteristics.A survey of the plant biochemistry, morphology, physiology, anatomy, and importance of gymnosperms and angiosperms to man.The fundamental principles of plant physiology. Physiological adaptations to

changes in the environment (stress physiology). Principles and practice of phytoremediation. Plant bioassays for monitoring environmental pollution

IED 714: Principles of Toxicology& Risk Assessment (3 Units)

Definitions and overview of toxicology. Dose response relationship, biochemical toxicology, hazard and risk assessment, chronic toxicity, factors affecting toxic responses, biochemical mechanisms of toxicity. Biotoxins, carcinogenesis, teratogenesis and mutagenesis/genetic toxicology, biotransformation of toxicants. Sources, fate and effects of different toxicants in the environment; pesticides, metals, radiation and radioactive materials, plant and animal toxins, polyhalogenated compounds, hazardous wastes, dusts, asbestos, plastics. Factors that influence toxicity, route of administration, chemical and biological factors. Introduction to hazard and risk assessment Sources, fate and effects of toxicants in the environment. Factors that influence environmental toxicity: exposure pathway, chemical factors. Environmental modeling and management plan.

ECB 739: Field Studies (2 Units)

Research methods on field toxicology. Field studies (two weeks) involving sample collection, in situ assessment of major environmental features and major oil and gas facilities and companies. Use of in situ equipment in air quality monitoring, water quality assessment soil sampling, ecological and landforms studies. Presentation of Report based on outcome of field studies.

ECB 749: Seminar (2 Credits)

Student will be given topic from the widespread areas of environmental science. The essence of this course is to familiarize students with the effective use of the library, preparation of project report, journal articles and reviews.

IED 721: Environmental Microbiology & Biotechnology (3 Units)

Ecology of microorganisms in fresh water.Brief studies of marine microbiology.Disease transmission by water.Microbiological examination of water.Microbiology of waste disposal. Biological oxygen demand and chemical oxygen demand tests for sewage and water. Use of microorganisms for Petroleum prospecting and recovery; Petroleum pollution of the environmental and its effects.Biotreatment of Petroleum polluted sites, Microbial deterioration of Petroleum and its products. Microbial deterioration of oilfield equipment.Common applications of biotechnology.Use of biotechnology in environmental preservation and restoration.Economic drivers and societal implications of biotechnology. This course covers the application of biologically-based technologies in environmental control and remediation. Particular emphasis is placed on understanding the key metabolic processes involved in biodegradation and biodeterioration.

IED 722: Statistics for Environmental Science (3 Units)

Meaning of Statistics and its importance to Environmental Studies, Parametric and Non-parametric test, The Student-T-Test, Chi-square, Correlation (Spearman and Product Moment Coefficient, Analysis of Variance, Regression Analysis. Measure of central tendency, measure of dispersion. Experimental design: completely randomised design (CRD), randomised complete bloc design

(RCBD), and Analysis of variance (ANOVA). Statistics for missing data, Duncan multiple range test (DMRT). Analysis of environmental data (mostly observational data) and the presentation of data results using graphics. Statistical estimation and testing (including nonparametric procedures), analysis of variance, linear models, tree-based models, nonparametric regression models, and Bayesian decision making. Biological and environmental data are usually complex, consisting of many observation and variables. This course provides an overview of the main techniques of multivariate data analysis that are relevant and useful in ecology and environmental sciences. Emphasis is on ordination and cluster analysis. Use of computer for statistical analysis.

IED 723: EIA & Environmental Law (3 Units)

The meaning, origin, and development of environmental impact assessment.The benefit and purpose of EIA. Limitations and draw back in the EIA process. Detail EIA process in Nigeria. EIA as environmental management tool.Key sections of EIA.The meaning and families of ISO 14001.The applications and benefits of implementing ISO 14001.Other environmental management tools such as Environmental Audit, Post Impact Assessment (PIA), Environmental Evaluation Report (EER), Environmental Baseline Studies (EBS) and Environmental Sensitivity Index (ESI).Basic concept of environmental standard criteria and regulation. Federal environmental laws organisation of environment protection. States edict and regulation on the environment, plant and animal quarantine. Regulations and enforcement mechanisms, violations and sanctions. Comparative study of environmental laws in some advance countries.e.g. USA, Canada, Thailand, etc. International Laws and conventions.

ECB 711: Natural Resources and Information Management (3 Units)

Renewable and non-renewable resources of Nigeria, Exploitation and uses of natural resources.Principles, problems, policies and strategies of environmental conservation; Protection, conservation and care of natural resource; Reasons and criteria for conservation, Evaluation and selection of sites for nature conservation; Sustainable development; Conservation movements. Introduction to computer science: principles of computing, programming and statistical analysis, use of spreadsheets, system analysis, data bases, and others. Types, collection, preparation and control of data. Data processing management systems. Information processing systems. Monitoring of data for the future.

ECB 712: Environmental Geography and Sociology (2 Units)

Introduction and basic definitions of geographical factors applicable to environmental studies. Theft measurement and presentation. Geographic information systems and remote sensing of environmental resources. Principles, techniques, analysis and applications; discrete and continuous image processing; remote sensing in Geography, science and society. Socioeconomic evaluations in environmental studies.

ECB 721: Wildlife Ecology (3 Units)

Ecological principles I - Introduction, food chains, food web, energy flow, nutrient cycles, the concept of species, population dynamics, communities and eco-systems. Ecological principles II. Diversity and stability of communities, environmental factors influencing diversity. Applied Ecology — Biological indicators of pollution, case studies of perturbed ecosystems, ecological sampling and analysis, endangered species and ecosystems, bio-remediation techniques. General

orientation, including uses and value of wildlife resources, wildlife management, objectives and bases for management decisions. Biodiversity methods of data collection and analysis, species richness and diversity, specimen identification and preservation. Demography, Animal censuring techniques, analysis of population density biomass, Population dynamics, Sociology; Diets and methods of assessment ranging patterns and time budgets. Planning and management of protected areas. Case study

ECB 722: Exploitation and management of non-renewable resources (2 Units)

Definition of technical terminology, classification of non-renewable resources-coal, natural gas, liquid petroleum, tar sand/oil shale etc. formation of non-renewable resources and their J-characteristics, Exploration methods and exploration techniques. Classifying mining methods, geological factors involved in exploitation of mineable resources (tar sands/oil shale/coal). Definition of mining terminology associated with mining leases. Environmental/safety consideration in the exploration of resources.

EMC 725 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.

ECB 799: Project (6 Credits)

A research project will be undertaken in any area of environmental specialization under the guidance of a supervisor. The candidate will defend the thesis before an external examiner appointed by the School of Postgraduate Studies.

COURSE CONTENT OF POSTGRADAUTE DIPLOMA IN WASTE MANAGEMENT TECHNOLOGY

FIRST SEMESTER

S/N	COURSE CODE	COURSE TITLE	CREDIT UNITS	COURSE STATUS
1	IED 711	Principles of Environment & Ecology	2	C
2	IED 712	Environnemental Techniques, GIS & Remote Sensing	3	C
3	IED 713	Soil and plant science	3	C
4	IED 714	Principles of Toxicology &Risk Assessment	3	C
5	WMT 739	Field studies	2	C
6	WMT 749	Seminar	2	C
7	WMT 711	Solid Waste Management and Technology	3	C
8	WMT 712	Environmental Law& Professional ethics	2	C
Total Credit Units			20	

SECOND SEMESTER

S/N	COURSE CODE	COURSE TITLE	COURSE UNITS	COURSE STATUS
1	IED 721	Environmental microbiology and biotechnology	3	E
2	IED 722	Statistics for environmental science	3	C
3	IED 723	EIA and Environmental law	3	C
4	WMT 721	Landfill technology and waste facility Operation	3	C
5	WMT 722	Pollution Control and Occupational Safety	2	C
6	WMT 799	Project	6	C
Total Credit Units			20	

COURSE DESCRIPTION

IED 711 Principles of Environment & Applied Ecology (2 Units)

Concepts of the Environment: Ecology, Ecosystem, Food Chain/Web, Energy Cycle, Water Cycle etc. Environmental Resources: Types of resources, renewable and non renewable, exploration/exploitation etc. Environmental issues of exploration and exploitation: Pollution, Deforestation, Soil Degradation, etc, Managing the Environment: The concept of Sustainable Environment, Environmental Impact Assessment, Environmental Auditing, Monitoring etc. Conservation Concept, Social issues in Environmental Management. Population, Poverty, Culture/Tradition. Principles of sustainable development, sustenance of resources; socio-economic solution to waste management. Renewable Energy Technologies and Solar Solution; How to develop a working Solar System; Harnessing Solar Power in homes and offices. The application of ecological knowledge and principles in examining environmental problems, solutions and management practices e.g. problems of conservation, resource management, conservation and restoration ecology and human ecology.

IED 712 Environmental Techniques, GIS & Remote Sensing (3 Units)

Wastewater collection and analysis, leachate quality characterization, basic analytical tools for analysis of waste materials including waste oil drilling mud, cutting and brownfield. Quality Assurance and Quality control, presentation and interpretation of environmental data. 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. The concept of topological map. Address geo-coding and its processes. Merits and limitations of Raster and Vector data models. geo-coding and its processes. Merits and limitations of Raster and Vector data models. Environmental application; Land evaluations and land use planning, soil mapping, resources evaluation and planning, etc. Three dimensional applications; geologic mapping, oil prospecting and exploitation etc

IED 713 Soil and plant science (3 Units)

Soil profile study and description; main systems of soil classification. Soil formation processes and survey methods. Soil chemistry. Geochemical analysis of soil properties. Soil microbiology- microorganisms in the lithosphere (soil habitats), Biogeochemical cycles. Concepts of the five kingdoms and their characteristics. A survey of the plant biochemistry, morphology, physiology, anatomy, and importance of gymnosperms and angiosperms to man. The fundamental principles of plant physiology. Physiological

adaptations to changes in the environment (stress physiology). Principles and practice of phytoremediation. Plant bioassays for monitoring environmental pollution.

IED 714 Principles of Toxicology &Risk Assessment (3 Units)

Definitions and overview of toxicology.Dose response relationship, biochemical toxicology, hazard and risk assessment, chronic toxicity, factors affecting toxic responses, biochemical mechanisms of toxicity. Biotoxins, carcinogenesis, teratogenesis and mutagenesis/genetic toxicology, biotransformation of toxicants. Sources, fate and effects of different toxicants in the environment; pesticides, metals, radiation and radioactive materials, plant and animal toxins, polyhalogenated compounds, hazardous wastes, dusts, asbestos, plastics. Factors that influence toxicity, route of administration, chemical and biological factors. Introduction to hazard and risk assessment Sources, fate and effects of toxicants in the environment. Factors that influence environmental toxicity: exposure pathway, chemical factors. Environmental modeling and management plan.

WMT 749 Seminar (2 Units)

Student will be given topic from the widespread areas of environmental science. The essence of this course is to familiarize students with the effective use of the library, preparation of project report, journal articles and reviews.

IED 721 Environmental Microbiology & Biotechnology (3 Units)

Ecology of microorganisms in fresh water. Brief studies of marine microbiology. Disease transmission by water. Microbiological examination of water. Microbiology of waste disposal. Biological oxygen demand and chemical oxygen demand tests for sewage and water. Use of microorganisms for Petroleum prospecting and recovery; Petroleum pollution of the environmental and its effects. Bio-treatment of Petroleum polluted sites, Microbial deterioration of Petroleum and its products. Microbial deterioration of oilfield equipment. Common applications of biotechnology. Use of biotechnology in environmental preservation and restoration. Economic drivers and societal implications of biotechnology. This course covers the application of biologically-based technologies in environmental control and remediation. Particular emphasis is placed on understanding the key metabolic processes involved in biodegradation and bio-deterioration.

IED 722: Statistics for Environmental Science (3 Units)

Meaning of Statistics and its importance to Environmental Studies, Parametric and Non-parametric test, The Student-T-Test, Chi-square, Correlation (Spearman and Product Moment Coefficient, Analysis of Variance, Regression Analysis. Measure of central tendency, measure of dispersion. Experimental design: completely randomised design (CRD), randomised complete bloc design (RCBD), and Analysis of variance (ANOVA). Statistics for missing data, Duncan multiple range test (DMRT). Analysis of environmental data (mostly observational data) and the presentation of data results using graphics. Statistical estimation and testing (including nonparametric procedures), analysis of variance, linear models, tree-based models, nonparametric regression models, and Bayesian decision making. Biological and environmental data are usually complex, consisting of many observation and variables. This course provides an overview of the main techniques of multivariate data analysis that are relevant and useful in ecology and environmental sciences. Emphasis is on ordination and cluster analysis. Use of computer for statistical analysis.

WMT 723: Environmental Law and Professional ethics (3 Units)

The meaning, origin, and development of Environmental Impact Assessment (EIA).The benefit and purpose of EIA. Limitations and draw back in the EIA process. Detail EIA process in Nigeria. EIA as environmental management tool. Key sections of EIA. The meaning and families of ISO 14001.The applications and benefits of implementing ISO 14001.Other environmental management tools such as Environmental Audit, Post Impact Assessment (PIA), Environmental Evaluation Report (EER), Environmental Baseline Studies (EBS) and Environmental Sensitivity Index (ESI).Basic concept of environmental standard criteria and regulation. Federal environmental laws organization of environment protection. States edict and regulation on the environment, plant and animal quarantine. Regulations and enforcement mechanisms, violations and sanctions. Comparative study of environmental laws in some advance countries. e.g. USA, Canada, Thailand, etc. International Laws and conventions. Waste Regulatory system; Common Law & Waste Management: International Waste Law; Nigerian Waste Regulatory System (principles, institutions & status). Waste handling Information management; Waste Reception & Documentation. Ethic of waste management; principle of competence, integrity and duty-of-care.

WMT 711 Solid Waste Management and Technology (3 Units)

History and concept of waste and waste management. Principle of Reduce, Reuse, Recycle and Recovery; Cost Benefit and Life Cycle Analysis, Costing Waste Management Service; Funding and Cost Recovery. Waste characterization and classification; Waste Policy; approaches; instruments; drivers and target; Waste Strategy development and presentation. Concept of externality and public goods. Waste to Wealth; Cost

benefit and Life cycle analysis; Costing Waste Management Services, Funding and Cost Recovery. Waste management technology

WMT 721 Landfill Technology and Waste Facility Operation (3 Units)

Opening Dumping and landfill Science; Storm water management; leachate collection and management; Landfill Closure and Restoration. Feasibility studies Site Suitability analysis using GIS; Public participation and EIA (principles, impact, evaluation and interpretation); Waste management facility operation.

WMT 722 Pollution Control and Occupational Safety (2 Units)

Source, Prevention and Control Strategies of Environmental Pollutants. Basic concepts of Occupational Health and safety; Industry Risky and Hazard; Disease and Hygiene; Accident and Ergonomics.

WMT 799 Project (6 Units)

A research project will be undertaken in any area of specialization under the guidance of a supervisor. The candidate will defend the thesis before an external examiner appointed by the Scholl of Postgraduate Studies.

SECTION 7: GRADUATION REQUIREMENT

A candidate must fulfill the following conditions to be awarded the Postgraduate Diploma:

The candidate must pass a minimum of 30 credits Units made up of the following:

- 12 Units of Core Courses
- 12 Units of Electives Courses
- 6 Units of Project

Postgraduate Diploma Classification

The determination of the PGD shall be based on the Cumulative Grade Point Average (CGPA) earned at the end of the programme.

Cumulative Grade	**Class of Diploma**
4.50 - 5.00	Distinction
3.50 – 4.49	Credit
3.00 – 3.49	Merit/Pass
Below 3.00	Fail