**CENTRE FOR ENVIRONMENTAL MANAGEMENT AND GREEN ENERGY [CEMAGE] POSTGRADUATE PROGRAMMES**

The Centre for Environmental Management and Green Energy offers Postgraduate programmes leading to Postgraduate Diploma (PGD), Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.) degrees in Environmental Management & Control, Green Energy, Disaster Risk Management and Chemical Security Management.

**PHILOSOPHY**

The philosophy of the Centre for Environmental Management and Green Energy (CEMAGE), formerly Centre for Environmental Management and Control (CEMAC), isthe development of a sustainablemulti-disciplinary reservoir of knowledge and skills for appropriate responses to the myriad of environmental challenges of the 21st century, including transition to green energy, while maintaining strong international collaborations.

**OBJECTIVES**

 The objectives of the Centre are to:

* produce PGD graduates with strong foundation for developingstrong careers in environmental management, green energy, disaster risk management and chemical security management.
* foster and enhance multi-disciplinary research and field studies in environmental issues that are socially relevant and people focused;
* produce M.Sc. and Ph.D. graduates with high level of multi-disciplinary environmental problem-solving perspectives necessary to bring innovative solutions to environmental problems at local, state, federal and international levels;
* produce highly skilled manpower that are able toovercome a broad spectrum of challenges in the areas of environmental management, green energy, disaster risk management and chemical security management
* facilitate and encourage collaborative studies between students of the Centre and other national and international research institutions and organizations.

**SCOPE**

The areas of specialization available in the CENTRE are: ***climate change, environmental risk assessment and remediation, green energy, waste management, environmental economics & policy, chemical security management and disaster risk management***. The four broad thematic areas in which students may pursue their studies at the Centre are: i. Environmental Management and Control, ii. Green Energy, iii. Disaster Risk Management and iv. Chemical Security Management.

**ENTRY REQUIREMENTS**

The following are the admission requirements:

1. **Postgraduate Diploma Programme [PGD] in Environmental Management & Control and Disaster Risk Management**

a. Graduates of the University of Nigeria or other recognized universities who have obtained a bachelors degree with a minimum of third class (CGPA of not less than 2.0).

b. Holders of Higher National Diploma [HND] from recognized institutions, with a minimum of upper level credit or its equivalent in relevant areas.

c. Must have obtained a minimum of credit passes in English language and Mathematics at O’ level among the five subjects passed with credit grades

**2. Master of Science (M.Sc.) Environmental Management and Control**

a. Graduates of the University of Nigeria or other recognized universities who have obtained the approved degree, with a minimum of second classhonours lower division (not less than CGPA of 2.5)or its equivalent in the relevant disciplines[Biological Sciences, Physical sciences (chemistry, physics and geology), Agriculture (agric economics, soil science, crop science), Social sciences (economics and geography), Environmental Studies, Engineering (chemical, civil and mechanical engineering)].

b. Candidates with university honours degree who also hold the PGD in Environmental Management and Control of the University of Nigeria or other recognized universities with a minimum CGPA of 3.5 on a 5 - point scale or 3.00 on a 4-point scale.

c. Must have obtained a minimum of credit passes in English language and Mathematics at O’ level among the five subjects passed with credit grades.

3. **Master of Science Disaster Risk Management**

1. Graduates of the University of Nigeria or other recognized universities who have obtained an approved bachelors degree with a minimum of second-class honours(not less than CGPA of 2.5) or its equivalent in any of the relevant disciplines
2. Candidates with university honours degree who also hold the PGD in Disaster Risk Management or Environmental Management and Control, or equivalent qualifications, of the University of Nigeria or other recognized universities with a minimum CGPA of 3.5 on a 5-point scale or 3.00 on a 4-point scale.
3. Candidates who possess HND in related disciplines with at least a credit level pass from recognized institutions and at least a credit pass in Postgraduate Diploma in Disaster Risk Management or Environmental Management and Control of the University of Nigeria in the relevant areas.
4. Must have obtained a minimum of credit passes in English language and Mathematics at O’ level

among the five subjects passed with credit grades.

**4. Master of Science (M.Sc.) in Green Energy**

a. Graduates of the University of Nigeria or other recognized universities who have obtained the approved degree, with a minimum of second class honours lower division (not less than CGPA of 2.5)or its equivalent in the relevant disciplines [Biological Sciences, Physical sciences (chemistry, physics and geology), Agriculture (Agric Economics, Soil science, Crop science), Social sciences (economics and geography), Environmental Studies, Engineering (chemical, civil, agricultural, electrical, electronic, mechatronic and mechanical engineering)].

b. Candidates with university honours degree who also hold the PGD in Environmental Management and Control of the University of Nigeria or other recognized universities with a minimum CGPA of 3.5 on a 5 - point scale or 3.00 on a 4-point scale.

c. Must have obtained a minimum of credit passes in English language and Mathematics at O’ level among the five subjects passed with credit grades

**5. Master of Science (M.Sc.) in Chemical Security Management**

a. Graduates of the University of Nigeria or other recognized universities who have obtained the approved degree, with a minimum of second class honours lower division (not less than CGPA of 2.5)or its equivalent in the relevant disciplines [Biological Sciences, Physical sciences (chemistry, physics and geology), Agriculture (Agric Economics, Soil science, Crop science), Social sciences (economics and geography), Environmental Studies, Engineering (chemical, civil, agricultural electrical, electronic, mechatronicand mechanical engineering)].

b. Candidates with university honours degree who also hold the PGD in Environmental Management and Control of the University of Nigeria or other recognized universities with a minimum CGPA of 3.5 on a 5 - point scale or 3.00 on a 4-point scale.

c. Must have obtained a minimum of credit passes in English language and Mathematics at O’ level among the five subjects passed with credit grades

6. **Doctor of Philosophy (Ph.D.) in Environmental Management**

Graduates of the University of Nigeria or other recognized universities who have obtained the degree of M.Sc. in Environmental Management or the equivalent with a minimum CGPA of 3.50 on a 5-point scale or 3.00 on a 4-point scale. Themode of study is by course work and research.

7. **Doctor of Philosophy (PhD) in Disaster Risk Management**

Graduates of the University of Nigeria or other recognized universities who have obtained the degree of M.Sc. in Disaster Risk Management or the equivalent with a minimum CGPA of 3.50 on a 5-point scale or 3.00 on a 4-point scale. Themode of study is by course work and research

8. **Doctor of Philosophy (PhD) in Green Energy**

Graduates of the University of Nigeria or other recognized universities who have obtained the degree of M.Sc. in Green Energy/Renewable Energy or the equivalent with a minimum CGPA of 3.50 on a 5-point scale or 3.00 on a 4-point scale. The mode of study is by course work and research.

9. **Doctor of Philosophy (PhD) in Chemical Security Management**

Graduates of the University of Nigeria or other recognized universities who have obtained the degree of M.Sc. in Chemical Security Management or the equivalent with a minimum CGPA of 3.50 on a 5-point scale or 3.00 on a 4-point scale. The mode of study is by course work and research.

**MODE OF STUDY**

1. ***Postgraduate Diploma***

The Postgraduate Diploma is for graduates of the University of Nigeria and other recognized universities whose qualifications are at variance with the entry qualifications for master’s degree work. They must have a minimum CGPA of 2.0. The mode of study is by course work and project work to be embodied in a project report assessed solely by the supervisor.

**DURATION OF STUDY**

**PGD** - Full time - 2 semesters minimum and

4 semesters maximum.

2. ***M.Sc. Programmes in Environmental Management and Control; Green Energy;Disaster Risk***

***Management and Chemical Security Management***

The M.Sc. programmes of the Centre inEnvironmental Management and Control, Green Energy, Disaster Risk Management and Chemical Security Managementareby course work and research to be embodied in project reports to be defended orally before external examiners. The Academic Board of CEMAGE requires that candidates must perform satisfactorily in two seminars before they can be certified ready for the M.Sc.defence.

**DURATION OF STUDY**

**M.Sc. -** Full time - 3 semesters minimum and

 5 semesters maximum

 Part time - 5 semesters minimum and

 8semesters maximum

3. ***Ph.D. Programmes in Environmental Management and Control, Green Energy,Disaster Risk Managementand Chemical Security Management***

ThePh.D.programmesinvolve course work and preponderance of research. The programmes culminate in the submission of *Theses* which must be adjudged to make original contributions to knowledge and have publishableoutcomes. The theses must be defended orally before external examiners. The candidates are required to publish at least one journal article in an impact factor journal recognized by the University before external examination.

The Academic Board of CEMAGE requires that candidates must perform satisfactorily in two seminars before they can be certified ready for the Ph.D.defence.

**DURATION OF STUDY**

**M.Sc./Ph.D.** Full time - 8 semesters minimum and

 12 semesters maximum

 Part time - 10 semesters minimum and

 14 semesters maximum

**Ph.D. Programme**

 Full time - 6 semesters minimum and

 10 semesters maximum

 Part time - 8 semesters minimum and

 12 semesters maximum

**COURSES AND THEIR DISTRIBUTION**

***PGD PROGRAMME IN ENVIRONMENTAL MANAGEMENT***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 0511 | Introduction to Environmental Science | 2 |
| EMC 0513 | Introduction to Built Environment | 2 |
| EMC 0521 | Introduction to Environmental Hazards and Control | 2 |
| EMC 0531 | Introduction to Environmental Law | 2 |
| EMC 0551 | Introduction to Environmental Impact Assessment | 2 |
|  | ELECTIVES | 4 |
|  | **Total**  | **14** |

**ELECTIVES** UNITS

Electives of 4 Units from the following courses:

EMC 0515 Water Resources in Environmental Management 2

EMC 0517 Physical Facilities and Environmental Management 2

EMC 0519 Management of Marine and Coastal Environments 2

EMC 0523 Introduction to Environmental Chemistry and Biology 2

EMC 0525 Air and Water Quality Standards 2

EMC 0527 Introduction to Climate Change 2

EMC 0533 Population and the Environment 2

EMC 0535 Recreation, Tourism and Resource Management 2

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 0512 | Environmental Management and Regional Development  | 2 |
| EMC 0514 | Introduction to Land Resource Management | 2 |
| EMC 0542 | Research Methods and Computer Applications  | 2 |
| EMC 0544 | Introduction to Geographic Information Systems [GIS] | 2 |
| EMC 0592 | Project | 6 |
|  | ELECTIVES | 2 |
|  | **Total**  | **16** |

**ELECTIVES UNITS**

Elective of **2 Units** from the following courses:

EMC 0516 Energy and the Environment 2

EMC 0518 Environmental Management and the Ecosystem 2

EMC 0522 Environmental Conservation and Preservation 2

EMC 0524 Waste Water Treatment 2

EMC 0526 Introduction to Environmental Pollution 2

EMC 0528 Introduction to Environmental Psychology 2

EMC 0532 Human settlements and the Environment 2

EMC 0534 Sustainable Development and the Environment 2

EMC 0536 Health and Safety Management 2

**COURSE DESCRIPTIONS**

**EMC 0511: *Introduction to Environmental Science***

Introduction to environmental sciences; the concept of the ecology; ecosystems and their relevance to the environment; resources, human settlement, development and the environment/sustainable development; interplay of ecological and economic theories. The relationship between disciplines in environmental studies; Study and analysis of human settlements as ecosystems; the relevance of environmental management to the physical environment.

**EMC 0512: *Environmental Management and Regional Development***

Basic principles of regional science; concepts of region; theories and processes of regional development; regional imbalance, location theory, export multiplier and location quotient; human resources;regional infrastructure and potentials; strategies for regional development planning, regional development planning problems in Nigeria; regional planning as a link between national planning and local planning. Case studies and application of regional planning theories to existing situations. Comparison of regional planning schemes in Nigeria and

selected African and developed countries.

**EMC 0513: *Introduction to Built Environment***

Definitions of the environment, man-made environments; built environment;

structures, infra-structure, and their surroundings;sustainable practice in built environment .

**EMC 0514: *Introduction to Land Resources Management***

Meaning of land in social, agricultural, economic and legal theories; demand and supply of land; land resources in Nigeria; land use and the Nigerian economy; competitive and complementary land uses; conflict and incompatibility; land use economics; land tenure and communication on the use of land;rural and urban land uses and allocation; concepts of property rights; land resources exploitation-renewable and non-renewable, concepts of land development; redevelopment and sustainability; Environmental pollution and land degradation; land conservation.

**EMC 0515: *Water Resources in Environmental Management***

Water Resources (Use and over-utilization of surface and ground water), Global water distribution; the hydrologic cycle; concept of water balance; Occurrence and movement of groundwater; Water act (prevention and control of pollution) Water related environmental problems (floods, drought, conflicts over water). Water conservation; (rain water harvesting, watershed Management).

**EMC 0516: *Energy and the Environment***

Introduction to energy; energy flow and conservation; Heat Energy and Kinetic theory, Energy and Climate change, Energy Sources-renewable and non-renewable energy (electricity generation and transmission, thermal aspects of energy generation), solar energy and other alternative energy resources; health and environmental impact of energy use.

**EMC 0517: *Physical Facilities and Environmental Management***

Space planning; the link between site and services, site services and town planning, cadastral services, street and parking services, mapping and marketing of sites; life cycle costing of environmental infrastructure, environmental asset management and tracking; Computer-Aided Facility Management (CAF) systems and software.

**EMC 0518: *Environmental Management and the Ecosystem***

Introduction to a new approach to environmental management; the concept of ecosystem and biodiversity; properties of ecosystem relevant to environmental management; the conceptual toolbox; ecosystem approach to environmental management; The biological and ecological background; The human dimensions

**EMC 0519: *Management of Marine and Coastal Environments***

Introduction to marine science; overview of the coastal environment; global climate and ocean systems; types and functions of coastal resources; coastal zone management framework; wetland and land use management issues; coastal pollution; coastal tourism; international coastal management; sustainable use of the marine environment.

**EMC 0521: *Introduction to Environmental Hazards and Control***

Definitions and components of natural and man-made environments; pollution control measures; waste management and land use policy. Environmental hazards; causes and ecological consequences on the environment; the use of natural resources, e.g. water, air and land. Environmental planning problems and solutions.

**EMC 0522: *Environmental Conservation and Preservation***

Objectives of environmental conservation and preservation; biodiversity; ecological systems and their interrelationships; endangered species, and other consequences of rapid resource depletion. Techniques and procedure for environmental conservation and preservation; legal aspects of conservation and preservation. International co-operation and developments in conservation and preservation. Preservation of historic and man-made features/land marks; energy conservation; conservation planning; resource conservation planning and management; forestry management; wildlife management; grass land management; swamp management.

**EMC 0523: *Introduction to Environmental Chemistry***

Environmentalpollution. Natural cycles of the environment: hydrological cycle, oxygen and nitrogen cycles. Air pollution and control: types, effects, monitoring and control. Global issues in air pollution: greenhouse effect, depletion of ozone layer, acid rain and climate change. Water pollution and control: types of pollutants, and their effects, entrophication, water and waste treatment, water chemistry and analysis. Land pollution and control: municipal, industrial, agricultural waste and disposal, effects of pesticides and fertilizers on soil.

**EMC 0524: *Waste Treatment Management***

**T**ypes of waste and effect on the environment; roles of the environmental factors; management of waste treatment; hierarchy of waste management; waste prevention and control; waste treatment units; types, physical, chemical and biological treatment processes; choice of treatment processes; space requirements; the concept of sustainable water management; optimization of waste treatment management.

**EMC 0525: *Air and Water Quality Standards***

Definitions of air and water quality; concepts and role of standardization; local and international standards organizations; air quality parameters and standards; water quality parameters and standards; standard test methods for air and water.

**EMC 0526: *Introduction to Environmental Pollution***

Environmental pollution; sources and types of pollution: Point sources and non-point sources of pollution; water, air, noise and thermal pollution; energy conservation and pollution/hazard; pollutants and their effects on the environment; the relationship between development, natural resources and the physical environment;issues in the management of the physical environment; strategies and procedures for effective environmental pollution control; case studies in environmental pollution control.

**EMC 0527: Introduction to climate *Change***

Definition and Components of Climate; Climate change; Causes of climate change; Impact/effect of climate change; management option of climate change: Adaptation Techniques as management option, Tree planting culture etc.

Nature of environmental system; concepts of system change; environmental change; physical and biological processes of environmental change; anthropogenic factors of environmental change; case studies

**EMC 0528: *Introduction to Environmental Psychology***

Definition and history; territoriality, experimental studies of territories, personal space, privacy. Crowding and social interaction, consideration of social interactions in the design of buildings and institutions; cross-cultural comparison of dwellings in Nigeria; physical and human factors contributing to accidents; accident reduction in the environment; spatial aspects of sports and recreation.

**EMC 0531: *Introduction to Environmental Law***

Definition of environmental law; need for environmental law, values and environmental law; interaction between values and law; law and balancing environmental values; perspectives on environmental law: economic, social, cultural and scientific perspectives; Legal implications of environmental principles; sustainable development; depletion of ozone layer, global warming and climate change; organic laws; major environmental laws; judicial decisions; nuisance, negligence; trespass; rule in Ryland and Fletcher.

**EMC 0532: *Human Settlements and the Environment***

Evolution of human settlements; physical and socio-economic element of human; settlement; land tenure and uses for residential, commercial, agricultural, institutional and transportation purposes; relationship between the natural and man-made environments; environment, ecology and management.

**EMC 0533: *Population and the Environment***

Population and quality of natural environment; concept of sustainable environment; impact of population growth on land and sea resources; population, air pollution and climate change; relationship between population, consumption, and resource distributions; consumption and resource distribution; population, environment and energy; population and urbanization

**EMC 0534: *Sustainable Development and the Environment***

Sustainable development and the triple bottom line; major socio-economic trends and global environmental problems; global economic inter-dependence, inequality and the environment; critical analysis of development paradigms and strategies; their environmental consequences; history of ideas and initiatives in sustainable development; basic concepts of environmental philosophy, economics and politics; contemporary patterns of production and consumption; urbanization, industrialization and sustainability; obstacles and opportunities for sustainable development. The Habitat Agenda and the SustainableDevelopment Goals (SDGs). Local Sustainable Development Programmes (SDP) e.g Ibadan and Enugu SDPs.

**EMC 0535: *Introductionto Recreation, Tourism and Resource Management***

Definition of recreation; supply and demand for recreational resources; recreational planning standards and strategies; indoor and outdoor recreation; local and national parks; countryside and forest recreational resource development; management of recreational resources. Definition of tourism; tourism and regional/national development; elements of tourism; potential and functional tourism resources in Nigeria;development, management and organization of tourism; development of tourist resort centres; design and implementation considerations.

**EMC 0536:  *Health and Safety Management***

Principles and impact of various sanitation processes in improving both rural and urban air and water quality; environmental impact assessment/analysis; industrial hygiene and toxicology; impact of industrial and agricultural exposures on health; principles of control of environmental hazards at work places; principles of ergonomics.

**EMC 0542: *Research Methods and Computer Applications***

Basic research methods: (Introduction to types of Research design) data collection and collation; populations and samples, measures of central tendencies, variance and standard deviations, hypothesis testing (finding the p-value and confidence interval); introduction to univariate and multivariate statistical techniques in environmental management;common distributions and their uses, computer applications in research;introduction and overview of statistical packages (e.g. SPSS); introduction to research paper writing tips.

**EMC 0544: *Introduction to Geographic Information Systems (GIS)***

Definition of Geographic Information System (GIS); basic concepts; data: spatial data, attribute data. History of GIS operations; basic concept of space; GIS data models: vector data model and raster data model. Data management: vector data input, spatial data editing, attribute data input and management. GIS applications.

**EMC 0551: *Introduction to Environmental Impact Assessment***

Definition of environmental impact assessment (EIA); history of EIA; the 1992 EIA act and the overarching objectives; the nexus between EIA and sustainable development; the EIA process and stakeholders’ participation; the EIA draft and final reports; environmental impact statement (EIS).

**EMC 0592: *Project***

A student is required to write a well-researched project under the supervision of a supervisor. Choice of topic will also be guided by the supervisor.

***PGD PROGRAMME IN DISASTER RISK MANAGEMENT***

**First Semester**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N** | **Course Code** | **Course Title** | **Units** |
| **Compulsory Courses** |
| 1 | DRM 0511 | Concepts and Typologies ofDisaster | 2 |
| 2 | DRM 0512 | Disaster Planning and Management | 2 |
| 3 | DRM 0513 | Hazard, Risk and Disaster Damage Assessments | 2 |
| 4 | DRM 0514 | Seminar | 2 |
|  |  | Two electives | 4 |
|  |  | **Total** | **12** |
| **Elective Courses** |
| 5 | DRM 0515 | Fire Prevention and control | 2 |
| 6 | DRM 0516 | Disaster Victim management | 2 |
| 7 | DRM 0517 | Disaster Rescue operations | 2 |
| 8 | DRM 0518 | Hydro- Metrological Disasters | 2 |

**Second Semester**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N** | **Course Code** | **Course Title** | **Units** |
| **Compulsory Courses** |
| 1 | DRM 0521 | Economics & Sociology of Disaster | 2 |
| 2 | DRM 0522 | Research Methods in Disaster Studies | 2 |
| 3 | DRM 0523 | Remote sensing and GIS applications in disastermanagement | 2 |
| 4 | DRM 0524 | Field work | 2 |
|  | DRM 0591 | Project | 6 |
|  |  | Two electives | 4 |
|  |  | **Total** | **18** |
| **Elective Courses** |
| 5 | DRM 0525 | Disaster and public Health Management | 2 |
| 6 | DRM 0526 | EIA and Disaster Management in Nigeria | 2 |
| 7 | DRM 0527 | Community Based Approaches to Disaster RiskManagement | 2 |
| 8 | DRM 0528 | Institutional and Policy Framework for DisasterManagement in Nigeria | 2 |

**COURSE DESCRIPTIONS**

**DRM 0511: Concepts and Typologies of Disaster**

This course introduces the students to concepts and terminologies in disaster studies. The contents include: definition and types of disasters - natural disasters, including broad outlines regarding natural disasters such as; earthquake, volcanic eruptions, floods, landslides, avalanches, tsunamis, cyclone, climatic change, drought and epidemics. Man-made Disasters; including war, Industrial accidents, soil degradation, desertification, deforestation, depletion of water resources, destruction of ecological system, landslides, fire, oil spill, breakdown of essential services etc. Causes of extreme natural events including natural and man-made hazards and disasters; Causes and effects of various disasters such as mass movements, desertification, cyclones, floods, fire and droughts etc; Concept of hazard, risk, emergency, preparedness, resilience andvulnerability.

# DRM 0512 Disaster Planning and Management

This introduces the students to the basic concept of disaster planning and management; prevention, mitigation, preparedness, disaster impact, response, recovery and development. Significance of disaster planning and management; Modern challenges in disaster management;traditional versus disaster threats; Major requirements for coping with disasters: organization, planning, utilization of resources, specialist skills and training needs; Disaster managementcycle, Main activities links between hazards mitigation and sustainable development. Disaster Appreciations based on Mock drill exercises undertaken in collaboration with specialized agencies like Nigerian Army, Fire Service Department and otherfunctionaries.

# DRM 0513: Hazard, Risk and Disaster Damage Assessment

Hazard and Risk Identification and management, Risk assessment; Hazard vulnerability analysis and evaluation, environmental parameters influencing risk; risk mitigation strategies, Disaster monitoring; Disaster damage and loss assessment.

# DRM 0514: Seminar

This course is to develop students’ writing skill and prepare them for final year project research. Every student shall work on and present a power point seminar on any disaster related subject under the guidance of the course tutor. The Seminar will be presented before a jury - the staff and students of the Centre.

# DRM 0515: Fire prevention and control

This course focuses on fire disaster management. The contents include: Definition of fire; Principles of prevention, control and detection; Causes of fires, types of fires; forest and rangeland fires, domestic fires; Fire safety and prevention methods; Methods of detection, control and extinguishments of fire; Damages caused by fire; Types of firefighting equipment; Fire drill demonstration.

# DRM 0516: Disaster Victims Management

Disaster victims identification; Emergency needs – transportation, shelter, communication and supplies; relief mobilization and distribution; Problems of refugee; right of a refugee; refugee care and management; Care for the most vulnerable group - women, children, the aged and persons with disabilities; rehabilitation needs of disastervictims.

# DRM 0517: Disaster rescue operations

Types of rescue operation, organizing search and rescue operations, formation of emergency response team (ERT), technologies for search and rescue operations**;** Organization, planning and equipment for disaster rescue; Functions of rescue team; First aid training; The Psychology of

Rescue Team composition; The Rescue Plan; Equipment safety in training and operations; Casualty handling.

# DRM 0518: Hydro- Meteorological Disasters

**I**ntegrated Water Resources Management (IWRM): definition, Need for IWRM; Hydro-Meteorologicaldisasters; Occurrence and Impacts of hydro disasters; Role of weather, climate and environment in hydro disasters; Water related disasters (droughts, floods, landslides and other forms of hydro disasters); Causes of flooding disaster; Socio-economic impacts of flooding; Flood control and management techniques; Case studies

# DRM 0521: Disaster Economics

Economic and Social impacts of disaster; Risk management and planning; Disaster Risk Management Process, Phases of disaster Risk Management; Risk transfer and finance; Risk Reduction with sustainable livelihood; Measuring economic impacts of disaster; Input- Output Analysis; Problems in assessment of economic impacts of disaster; Mobilizing resources in disaster management. Macro-economic impacts of disaster: Impacts on GDP and interest rates; Impacts on prices, inflation and unemployment; Benefit-cost Analysis of disaster recovery; Role of insurance and Micro credit in disaster management; Resource need for disaster risk reduction, resource generation techniques - budgetary allocations, levies and taxes, fund raising strategies; Resource tracking and policing.

# DRM 0522: Research methods in Disasters Studies

Introduction to research methods; Types and sources of disaster data; Hazard and Disaster data acquisition techniques; Sample design and sampling procedures; Quantitative techniques for data analysis; Proposal development and report writing

**DRM 0523: Remote Sensing and GIS Applications in Disaster Management**

This course will introduce the students to the basics of remote sensing (RS) and Geographical information system (GIS); General principles and overview of RS and GIS; GIS data sources; Electromagnetic Radiation, Interactions with the Atmosphere; Passive and Active Remote Sensing; RS data and characteristics of Images; Visual interpretation, Digital processing; digitization of data, hazard identification and mapping, Risk Mapping; Use of remote sensing and GIS in natural disaster forecasting, early warning and management of extreme natural events;

Assembling spatial information for disaster management and analysis. Case studies of hazards and application of RS and GIS.

# DRM 0524: Fieldwork

This course is intended to expose the students to practical field exercise. The students will undertake a field trip to disaster prone areas and do a practical assessment of disaster cases. A report of the fieldwork will be submitted and graded accordingly.

# DRM 0525: Disaster and Public Health Management

Introduction to public health; Scope and role of public health in DRR; Health intervention in disaster; Health aspects of disasters/major emergencies: post-disaster phase public health, disease surveillance during and after disaster; Health Education; Behavior Change communication; Hospital Casualty Management; Control of communicable disease, immunization and rehabilitation; Role of the Health department, Major public health challenges in disaster management in Nigeria.

**DRM 0526: Environmental Planning &Disaster Management Laws in Nigeria**

Planning principles and design for disaster risk reduction; Use of development control for disaster risk reduction; Land use and environmental bye laws for DRR; National building code; Principles and processes of Environmental Impact Assessment (EIA) and disaster risk reduction; Disaster management legislations – NEMA’s Act, NESREA Decree, National Oil Spill Detection and Response Agency Act of 2006, National Security and Civil Defense Corps Act, EIA Decree etc.; Roles of various laws in DRR and implementationproblems. Strategies for disaster law enforcement; Constraints and challenges of enforcing disaster related laws; Role of Human Rights/ Civil liberty organizations in Disaster Management, Humanitarian Laws, DRR Laws, International Laws etc.

# DRM 0527: Community Based Approaches to Disaster Risk Management

Perception and attitude of community to disasters; Community based approaches to disaster risk management and hazard mitigation; Community involvement towards prevention of disasters; Development of community based disaster risk management plans; Consideration of elements of social vulnerability parameters such as health, education, gender etc. in disaster risk management; Barriers to development of disaster risk management and adaptation plan- such as lack of information, community participation, and linkages between local actions and national strategies, proper balance of trust in traditional knowledge and appropriate technology; Community based disaster relief systems; Involvement of communities in development of long termrecoveryandrehabilitationplans,theirimplementationandmonitoring;The roles of

NGOs\CBOs in Disaster Management Case studies.

# DRM 0528: Institutional and Policy Frameworks for Disaster Risk Management in Nigeria

Existing institutional and policy framework for disaster management ; Mechanisms for emergency relief and crisis management in Nigeria; Evacuation, rehabilitation and recovery procedures; Preparation of recovery plan and its implementation; Key players in disaster management – NEMA, SEMAs, LEMAs, communities, media, NGOs, international development partners; National Disaster Management Policy: National disaster management framework; Disaster management coordination, collaboration and networking; Role of cognate agencies – National Space Development Agency, National Centre for Remote Sensing, Fire services, FRSC, etc .

# DRM 0591: Project work6 Credit Unit

Each student will be required to write a terminal project on a topic of choice under the supervision of a competent expert before graduation. The outcome of the project will be presented before internal examiners for assessment. All students must pass the oral examination as a condition forgraduating.

***M.Sc. PROGRAMME IN ENVIRONMENTAL MANAGEMENT***

*Students specializing in environmental pollution control must take EMC 661 and 663 whereas students specializing in environmental management must take 2 courses from the electives other than EMC 663.*

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 611 | Overview of Environmental Systems and Environmental Management System | 2 |
| EMC 621 | Pollution Control and Soil Conservation Methods | 2 |
| EMC 641 | Principles of Environmental Management, Monitoring and Control Technique  | 2 |
| EMC 615 | Environmental Chemistry, Air and Water Quality Management | 2 |
| PGC 601 | Research Methodology and Application of ICT in Research | 3 |
| EMC 619 | Waste Management | 2 |
| EMC 661 | Statistics and mathematics for Environmental Studies | 2 |
|  | 2 Electives | 4 |
|  | **Semester Total** | **19** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 653 | Climate Change and Management Options  | 2 |
| EMC 627 | Environmental Psychology and Policy Studies | 2 |
| EMC 651 | Environmental Impact Assessment and Sustainability Studies | 2 |
| EMC 652 | Environmental epidemiology and Ecological Risk Management | 2 |
|  | 2 Electives | 4 |
| EMC 662 | Seminar | 2 |
| EMC 692 | Project Report | 6 |
|  |  **Semester Total**  | **20** |
|  | **SESSION TOTAL**  | **39** |

**ELECTIVES**

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE**  | **COURSE TITLE** | **UNIT LOAD** |
| EMC 631 | Environmental Law | 2 |
| EMC 613 | Land Use, Rural and Urban Planning  | 2 |
| EMC 645 | Geographic Information Systems | 2 |

**ELECTIVES**

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| EMC 663 | Environmental Risk Assessment and Remediation | 2 |
| EMC 636 | Occupational Health and Safety  | 2 |
| EMC 633 | Environmental Economics | 2 |

**Course Descriptions**

**EMC 611: *Overview of Environmental Systems and Environmental Management System***

Overview of environmental systems; concept of environmental systems; habitat and food chain as systems; man’s relationship with the ecosystem; aquatic system; terrestrial systems: the planet as a system; urban environmental system – physical, social, economic; the rural environment,; environment/development imbalance; factors that influence changes in the environmental systems; natural environmental systems; geographical systems; atmospheric systems; hydrological systems.; Approaches to environmental management; management of geographical, atmospheric and hydrological systems. Economics and management of environmental qualities. Environmental ethics, the role of government in environmental management systems; the public and environmental management systems, cultural management approaches to environmental systems; Introduction toair, soil and water pollution – types, sources and impacts. Preventive systems. Control systems at source; collection, transportation and processing strategies. End of pipe versus proactive systems. Processes and kinetics of waste treatment technologies. Residue processing and disposal systems. On-site and off-site systems. Design of elementary engineering systems.

**EMC 613: *Land Use, Rural and Urban Planning***

The nature of land use; land use change; urban, rural, land use planning; land use, analysis and plan preparations; land use regulations; types and procedures. endowment and resources: natural, technological and human; problems and constraints to development; resource inventories, resource management techniques; public control over land use, policies and issues; urbanization and land use; the city as an integrated system of human environment; urban land resource allocation problems; urban growth management problems; management of new and expanding towns; issues on rural settlement; rural land use studies; rural settlement: forms, structure and growth patterns; migration and rural population dynamics.

**EMC 615: Environmental Chemistry, *Air and Water Quality Management***

Environmental pollution associated with crude oil prospecting, drilling, transportation, storage and refining; pollution associated with coal mining: combustion, carbonization and processing;pollution associated with the manufacture and use of agrochemicals; land, water and air pollution emanating from chemical industries *such as* cement, beer and beverages, tanning and leather, dyes and pigments, pulp and paper, plastics, iron and steel, etc.; composition of the atmosphere; atmospheric structure; chemical and photochemical reactions in the atmosphere; types of air pollution, effects, monitoring and control; greenhouse effects/global warming; depletion of ozone layer; climate change; air quality management and air quality index (AQI); water quality management; water pollutants, their sources and effects; water chemistry and analysis; design of water treatment plant; design of waste water treatment plant; water quality parameters and standards; water quality index (WQI) employed in the assessment of water quality and its limitations.

**EMC 619: *Waste Management***

Classification of wastes; chemical assessment of wastes; Management of hazardous wastes; urban solid waste management. Contamination of land and water resources through pollutants from waste materials; E-waste and emerging pollutants; improvement of waste management and disposal. Water and sanitation; management of degradable and non- degradable wastes; sewage and sludge management; waste management facilities. Waste management financing. Private Sector Participation (PSP) and public sector agencies. National policy and framework on waste management. Solid waste management projects and carbon market: concepts of carbon credit and carbon-offset; the role of clean development mechanisms.

**EMC 621: *Pollution Control and soil Conservation Methods***

Physical and natural environment; relationship between development and environment. Environmental degradation: causes, type and processes. Rural and natural environmental degradation; urban environmental degradation. Pollution control approach: the concepts of assimilative capacity and control; modern pollution control technologies. The concept of monitoring, its processes and techniques. Legal frameworks for environmental pollution control. Processes of pollution assessment, procedure of pollution monitoring. Case studies in global concerns – treaties, agenda, monitoring constraints; evaluation techniques and processes. Trends in monitoring and evaluation of soil conservation structures and processes. Methods of soil erosion control, predicting amount of soil loss using the universal soil loss equation. Revised universal soil loss equation, Water Erosion Prediction Package (WEPP), applicable in Nigeria. Relationships between soil loss and land productivity. Preparation and presentation of detailed soil loss map of an area as a mini project.

**EMC 627: *Environmental Psychology and Policy Studies***

Behaviour, health and environmental stress; human behaviour and environment; children within environment; community mental health and behavioural ecology; disaster policy implementation; rural psychology; human behaviour and traffic safety; victims of the environment; losses from natural hazards; risk analysis; advances in environment behaviour and design. Environmental risk perception-subjective risk judgments, values, morality & ethics and emotional reactions to environmental risks; uniqueness of climate change; effects of environmental stress-noise, crowding, poor housing quality, poor neighborhood quality, traffic congestion; nature and its health benefits-air quality, physical activity, social cohesion, stress reduction; children and the natural environments; built environment and the promotion of healthy behavior and well-being; urban environmental quality and the source of stress; environment and quality of life; effect of cues on normative behavior; measurement of environmental behavior; values and environmental behavior; theories that explain environmental behavior- theory of planned behavior, protection motivation theory, the norm activation model; the value-belief-norm theory of environmentalism and goal framing theory; influence of automaticity on environmental behaviour; Strategies for promoting good environmental behavior-changing knowledge, awareness and attitudes*.*Concepts, processes and methods of planning for environmental quality. Quality of life concepts and decision making practices. Environmental policy analysis and management including an overview of systems theory and information requirement; application of research methodology to planning problems and formation of research designs. Policy application to areas such as environmental planning theory; urban and regional planning; land use analysis; growth management techniques; carrying capacity analysis; political processes in environmental planning; public sector participation; population analysis; future analysis techniques.

**EMC 631: *Environmental Law***

Legal mechanisms for protection of the environment: water bodies, air pollution, noise control, waste management, hazardous material and waste. Enforcement of environmental laws: the executive, statutory agencies and authorities, the judiciary and NGOs. Types of environmental liabilities: criminal liabilities, civil liabilities, compensating environmental damages, mechanism used, who shall be compensated, who compensates; environmental litigation problems; issues of jurisdiction, *locus standi,* expert witness, pre-litigation notice, un-due delays, cost of litigation.

Sources of international environmental law; customary international law, international conventions, general principles of international law or soft laws, judicial decisions, academic commentary. Development of international environmental law: 1869-1945 (Bilateral Fisheries Conventions- creation of the UN), 1945-1972 (from creation of the UN – Stockholm conference), 1972-1992 (from Rio- present day). Principles of state co-operation, pre-cautionary principle, polluter-pay principle, no harm rule, principle of common but differentiated responsibility, sustainable development, human right to environmental health. Contemporary issues in international environmental law: ozone layer depletion, global warming, climate change, biodiversity, trans-boundary movement of waste. Relevant international institutions in environmental protection: United Nations, the International Court of Justice, the Organization for Economic Co-operation and Development, the World Bank, the World Trade Organization.

**EMC 633: *Environmental Economics***

Introduction and Evolution of Thinking on Resource and Environmental Economics; Environmental and Resource Economics – An Overview of Key Concepts and Tools;

Principles of Sustainable Development; Environmental Policy Instruments – Theory; Nigeria Environmental Problems and Environmental Policies, Institutions, Legislations and Regulations including Pollution Control Legislation, Environmental Laws and Practice in Nigeria – Policy Instrument Practical; Types of Economic and Social Costs of Environmental Pollution in Agriculture; Macroeconomics and the Environment - Trade and the Environment; Environmental Taxation and Fiscal Reform; Economics of Non-Renewable Resources; Case study on Mining especially Oil and Gas in Niger Delta: Depletion and Mechanisms for Rent appropriation; Managing the Global Commons – Climate Change – Mitigation and Adaptation especially in Agriculture focusing on Nigeria; Managing the Commons: Parks Management; Introduction to Valuation and Cost-Benefit Analysis; Measuring Environmental Health Effects; Valuing Health Benefits – How Valuation can be Used to Help Set Environmental Priorities; Contingent Valuation, Hedonic Price Method, Travel Cost Method, Choice Experiments, Replacement Cost and Benefit Transfer Approach; Valuing Productivity Impacts; Environmental Accounting; Managing the Global Commons: The Role of Carbon Markets; Consideration and priorities in Environmental management including sustainable financing mechanisms for Environmental Management e.g. Payment for Ecosystem Services (PES).

**EMC 636: Occupational Health and Safety**

Introduction to Health Safety and Environment (HSE) in organisational policies; Formulation, implementation and evaluation of environmental policy initiatives within organisational environment; Risk assessment: Identification of hazards and exposures; Accident investigation and reporting; Role of Hygiene in environmental and occupational safety; Emergency Procedures (Safety signs and evacuation plans); Fire safety; Personal Protective Equipment (PPE); the role of HSE in the work environment**.**

**EMC 641:  *Principles of Environmental Management, Monitoring and Control Techniques***

Environment/development linkages; environment network analysis; environmental management principles; environmental management steps, tools/techniques; environmental policy instruments; economic evaluation and analysis of environmental damages; cost estimation, cost/ benefits analysis; preventive measures and processes; social measure for environmental management; environmental ethics; constraints to environmental management; management of urban environment- urban land use management; management of rural environment; the role of government agencies in environmental management.Introduction to environmental management systems; components of environmental management systems; environmental management systems standards – ISO-14001, Eco-Management and Audit Scheme (EMSA); pollution abatement and control – command and control measures, market-based initiatives, end-of-pipe solution, etc.; hazardous waste techniques - hazardous waste management technologies, stabilization/solidification, biological treatment techniques, chemical treatment methods, thermal treatment of hazardous waste; EIA as an environmental management tool. Policy making; Environmental Information System; Life Cycle Assessment (LCA); Renewable resources; Corporate Social Responsibility; Supply Chain Links.

**EMC 645: *Geographic Information Systems***

Concepts of spatial information; introduction to information processing; concepts of space and time; real world: its models and representation. Spatial information theory; geographic information system (GIS); history of GIS, GIS software architecture, data types and data structures; data storage, data entry and handling; data quality; query, maintenance and data analysis; visualization; spatial data transfer and its standard. GIS models and modeling; GIS applications in environmental management and control.

**EMC 651: Environmental Impact Assessmentand Sustainability Studies**

Environmental components and indicators;Definition and history of environmental impact assessment (EIA); Relationship between sustainable development and EIA; the costs and benefits of undertaking EIA; EIA as decision making tool; EIA in Global Affairs; Law, Policy and Institutional Arrangements/Legal Requirements for EIA-the EIA act 1992; EIA Process; EIA review meetings. EIA Draft and Final Reports;Current methodologies for the analysis of environmental impacts; Mitigation of environmental impacts and environmental management plan (EMP), Monitoring, Management and Auditing process post environmental impact assessmentImplementation. Case studies and field trip which may include attending EIA public review meetings. Overview of sustainability concepts and practices and how they are applied in real-world contexts/situations; The three-bottom line; Sustainability economics- Cost Benefit Analysis (CBA), Physical dimension of sustainability management (connection between environmental inputs i.e natural resources and outputs i.e energy and their effects on the natural environment); Public policy environment of sustainability management; General and financial management.

**EMC 652: *Environmental Epidemiology and Ecological Risk Management***

Microbiological aspects of soil and water resources; fresh water and marine microhabitats. Sources and types of water pollution: natural and man-made, Nitrates, pesticides and organic micro- pollutants, odour and taste, iron and manganese etc. Hardness, pathogens alga and algal toseins. Fadon and radioactivity and problems arising from water treatment, distribution and home plumbing systems, monitoring and removal of pathogens. Basic principles of epidemiology; epidemiology of communicable diseases; basic concepts and principles of control of communicable diseases; investigation and management of communicable diseases and epidemics; surveillance of communicable diseases.

Definitions and components of natural and man-made environments; air, water and land pollution; causes, consequences and remedies; the problems of waste disposal; soil erosion; floods and other natural catastrophes; renewable and non-renewable resources; deforestation and desertification; environmental control and land use policy in Nigeria. Quantification of ecological risks using risk indices;Known human carcinogens and incidents leading to their exposure and ways of quantifying carcinogenic and non-carcinogenic risks

**EMC 653: Climate Change and Management Options**-

Definition and Components of Climate, Climate change, Causes of climate change, Impact/effect of climate change. Management option of Climate change: Adaptation Techniques as management option, Tree planting culture etc. The Intergovernmental Panel on Climate Change(IPCC), United Nations Framework Convention on Climate Change. Components and Place of Ozone Layer in Climate Change, Causes of Ozone Layer Depletion. El Niño Southern Oscillation and Global Warming. Theory and Concepts of climate change: Paleclimatology and climate change, *abrupt climate change,* Ewing and Donn hypothesis, and Some argument to be noted concerning the theory. Pollution; Global Warming; Overpopulation; Natural Resource Depletion;Waste Disposal; Climate Change; Loss of Biodiversity; Deforestation; Ocean Acidification; Ozone Layer Depletion;Acid Rain; Water Pollution; Urban Sprawl; Public Health Issues; Genetic Engineering; [Nuclear issues](https://en.wikipedia.org/wiki/Nuclear_power_debate) ([Nuclear fallout](https://en.wikipedia.org/wiki/Nuclear_fallout), [Nuclear meltdown](https://en.wikipedia.org/wiki/Nuclear_meltdown), [Nuclear power](https://en.wikipedia.org/wiki/Nuclear_power), [Nuclear weapons](https://en.wikipedia.org/wiki/Nuclear_weapons), [Nuclear and radiation accidents](https://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents), [Nuclear safety](https://en.wikipedia.org/wiki/Nuclear_safety), [High-level radioactive waste management](https://en.wikipedia.org/wiki/High-level_radioactive_waste_management)). ***Priority Issues:*** Curbing Global warming; Creating the clean energy future; Reviving the world’s Oceans; Defending endangered wildlife and wild places; Protecting our health by preventing pollution; Ensuring safe & sufficient water; Fostering sustainable communities.

**EMC 661 Statistics and mathematics for Environmental Studies**

Introduction (descriptive and Inferential statistics); collecting data and survey design; (types of data and sampling methods); interpreting data sets (graphical techniques, measures of central tendencies, measures of dispersion/variability); probability and sampling distributions (normal distribution, chi-square distributions, F-distributions, T-distributions); hypothesis testing and confidence intervals (sample confidence intervals, null and alternate hypothesis, one and two-sided hypothesis), correlation and regressions (scatterplots, simple linear regression analysis, analysis of variance, etc.), principal component analysis, cluster analysis; introduction to statistical packages (e.g. SPSS); Introduction to Vectors analysis; matrices (addition, multiplication, types of matrices, etc.), inverse and determinants of matrices, solutions to systems of linear equations using matrix method, functions, limits and continuity, calculus of one variables: differentiation (first principle, derivatives, types of differentiation, chain rules, Implicit differentiation, higher derivatives), anti-derivatives, integration (Integrals, methods of integration) applications of differentiation and integration, partial differentiation. Statistical and mathematical modeling techniques in environmental science

**EMC 663: ENVIRONMENTAL RISK ASSESSMENT AND REMEDIATION**

Priority Pollutants including persistent organic pollutants (POPs) and emerging pollutants; common sources of pollutants; transport and fate of pollutants in the environment; investigation of hydrocarbons and heavy metals polluted sites and site assessment reports; conceptual site models; risk based corrective action (RBCA)-determination of risk based screening levels (RBSL) using human health and toxicological standard methods; quantification of uncertainties using deterministic and stochastic approaches; tiered risk approach for enhanced environmental risk management; Several remediation technologies; techniques for selecting appropriate remedial options; post remediation assessment; close out and site restoration. Site visits of hydrocarbon contaminated sites and submission of site assessment reports; field trips to sites undergoing remediation.

**PGC 601:Research Methodology and Application of ICT in Research**

In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of the study area from African and Western perspectives. Research design: sample frame, sampling techniques, surveys for quantitative and qualitative data sets in environmental management research. Multivariate statistics analysis: analysis of variance, multiple linear regression, canonical correlation, factor analysis, discriminant analysis, etc. Dissertation and thesis proposals.

Major steps in research: Selection of problem, Literature review, Design, Data collection, analysis and interpretation, Conclusions. Study of various research designs, Historical, Case studies, Surveys, Descriptive, Cross sectional, Experimental, etc. Analysis, surveys, and synthesis of conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix). Data analysis and result presentation in different disciplines using appropriate analytical tools. Methods of project/dissertation writing. Application of appropriate advanced ICT tools relevant in every discipline for data gathering, analysis and result presentation. Essentials of Spreadsheets, Internet technology, and Internet search engines. All registered Masters Degree students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

**EMC 692: *Project Report - 6 units***

***M.Sc. PROGRAMME IN DISASTER RISK MANAGEMENT (MDRM)***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **Course Code** | **Name Of Course** | **Credit Unit** |
| DRM 610DRM 611DRM 612DRM 613DRM 614DRM 615DRM 616DRM 625 | **Core Courses**Fundamentals of Disaster Risk ManagementDisaster Risk Management Principles and PracticeDisaster Vulnerability Assessment and MonitoringDisaster Risk Policy & AdvocacySeminarPublic Health in Disaster ManagementRemote Sensing and GIS ApplicationsCommunity Conflict ResolutionElective**Total** | 222222222**18** |
| DRM 617DRM 618DRM 619DRM 631 | **Elective Courses**Information and Communication Technology in Disaster Management.Environmental Risk and Impact Assessment.Climate Change Adaptation and Disaster Risk ManagementDisaster Types & Mitigation Strategy | 2222 |

**Second Semester**

|  |  |  |
| --- | --- | --- |
| **Course Code** | **Name Of Course** | **Credit Unit** |
| DRM 620DRM 621DRM 622DRM 623PGC 601DRM 626DRM 627DRM 692 | **Core Courses**Disaster Logistic ManagementSociology of DisastersEarly Warning Response and RecoveryDisaster and Environmental Management LawResearch Methodology and Application of ICT in ResearchAccounting for Disaster Loss & DRR FrameworkField WorkProject ReportElective**Total** | 222232262**23** |
| DRM 628DRM 629DRM 630DRM 641 | **Elective Courses**Inclusive Planning in Disaster Risk ReductionStrategic Disaster Management.Trauma and Mass Causality Management in DisasterUrban and Regional Planning Strategy for Disaster RiskReduction. | 2222 |

**Course Descriptions**

**DRM 610: Fundamentals of Disaster Risk Management**

The course is designed to provide the basic conceptual background of disaster management to the students. The contents include: Basic concepts of hazards, risks, disasters, resilience and vulnerability; Types of disaster/ hazards; Emergency and Disaster; Hazards and RiskManagement; Various theories and models of Hazards; Physical, Social and economicdeterminants of vulnerability; Causes of Geophysical, Biological, Hydro-Metrological andtechnological hazards and disasters. Case studies dealing with (i) Earthquakes (ii) Floods (iii)Droughts (iv) Landslides (v) storms and other natural hazards.

Interplay between hazard and vulnerability factors; The human dimensions of Environmentalchange; Geologic, climate and Environmental hazards; Disease Epidemics; MitigatingEnvironmental Degradation; Environmental management; Chemical and industrial accidents; Oilspill and pollution control.

**DRM 611: Disaster RiskManagement Principles and Practice**

This course introduces the students to the basics of disaster management. It covers the issues of concepts and definitions; Elements of disaster management; Principles and practice of disaster management; Disaster management implementation; Disaster Mitigation: Hazards Assessment, Vulnerability Assessment, Risk assessment, Protective measures and public information;

Disaster preparedness; Disaster management plan; Disaster forecasting, early warning and information dissemination; Legislations, principles and ethics considered in the effective planning, controlling, coordinating, monitoring and implementing Disaster Management.

**DRM 612: Disaster Vulnerability Assessment and Monitoring**

The thrust of this course is to teach the students the basic methods of hazards and risks

identification; methods of determining vulnerability to risks; Tools for assessing and

monitoring disaster; Determinants of community vulnerability to disaster; Qualitative and

quantitative methods of vulnerability assessment; Risk actuary probability theory; Geoinformationin risk pattern and condition; vulnerability mitigation and prevention strategies;vulnerability and capability analysis, etc.

**DRM 613: Disaster Risk Policy and Advocacy**

The aim of this course is to explain the requirements and the challenges of policy formulation for disaster management. It will examine: the Nigerian National Policy on Disaster Risk management and disaster Risk Reduction (DRR); Policy formation and implementation strategies; Institutional structure for DRR; Integration of Disaster Risk Reduction programmesinto institutional processes; Good governance in disaster management; Fundamentals ofvolunteerism and advocacy; Civil society and disaster management advocacy; Budgetaryrequirements and allocation for DRR; Examination of disaster risk policy from both legal andgovernance perspectives; Development of risk reduction plans, projects and programmes

**DRM 614: ResearchSeminar**

The seminar is designed to enable students prepare their intents for the terminal research.

Students will be encouraged to read a lot of literature materials on disasters occurrence in

Nigeria and they will be guided in the selection of seminar topics close to their everyday

experiences or schedules at work. Each student will present a seminar on the selected topic to ajury. The presentation of a thesis (DRM 730) proposal will depend upon the fulfillment of the requirements of seminar

**DRM 615**: **Public Health in Disaster Management**

Disaster occurrence has huge implications for public health. The course is designed to teach the students the basic concepts of public health with regards to: Biological and community health;Epidemiology and biostatistics presentation and summarizing of data; Measures of disease frequency and association; Planning, obstacles to planning and conduct of investigation in disaster situation; Health care planning, priorities and objectives for disaster victims; EconomicEvaluation of health care programmes; Health and Development; Impact of disasters on thehealth of victims; Types of disaster related health problems; Public health management indisaster situation. i.e. Water Sanitation and Hygiene WASH

**DRM 616: Remote Sensing and GIS Application in Disaster Management**

This course is by teaching and laboratory work and it is designed to inculcate the knowledge of Remote Sensing and its applications to disaster management. The contents include: Various types and sources of geographic (RS/GIS) data; Data requirements for disaster management;

Information generation for decision-making; Remote sensing applications to disaster

management; Use of geo-information techniques to visualize geographic data; Remote sensingdata application to hazard analysis and mapping; Risk and vulnerability assessment using GIStool.

**DRM 617: Information and Communications Technology in Disaster Management**

This course is designed to expose students to: The Nexus between information and decisionmaking; information management concepts and principles; Uses of information technologies indisaster management; Strategies for public awareness generation and civil society engagement;Information for social mobilization and targets group advocacy;Information monitoring and evaluation of feedbacks for disaster management; Roles of theMedia in disaster information management and public education; Risk communication and thepractice of releasing information to the community; Early warning system and informationdissemination

**DRM 618: Environmental Risk and Impact Assessment**

This course designed to expose students to issues of: Environmental damage assessment; Postdisaster damage assessment on human lives, farm and rangelands etc.; Assessment of economicimpacts of disaster; Biological and bio-physical aspects of environmental degradation; postdamage degradation remedies, impacts of drought and flood on food production and supply; Policy dimensions to environmental disaster; Disaster cost-benefit analysis; Environmental impact assessment for Disaster Risk Reduction, Post Disaster Needs Assessment (PDNA) etc.

**DRM 619: Climate Change Adaptation and Disaster Risk Management**

Climate change is a global phenomenon with severe implications for hazard and disaster risk. This course is designed to introduce the students to the issues of climate change as it affects disaster occurrence and management. The contents include: Meaning and theory of climate change; Factors of climate change; Global debate on climate change; Adaptation and mitigation measures for climate variability and change; Risks associated with climatic and environmental changes; Climate change impact on natural hazards and underlying risk factors; Polices and measures for reducing the impact of climate change; Integrative framework for risk management;

Challenges to the coordination of climate change and disaster risk management; World

Conferences on climate and relevance to disaster risk reduction.

**DRM 620: Disaster Logistics Management**

Introduction to disaster and logistics responses, integrated logistics approach to warehouse management including the role of warehousing within the supply chain, performance metrics applicable, leadership basics, how to interact with others, logistics managers to optimize overallactivity, as well as principles of warehouse location, design, layout, operating functions, andcustomer service, techniques (transportation model, Assignment model and Linear programing)needed for scheduling, planning and controlling inventories, acquisition, positioning, and management of materials, services and equipment that organizations need to attain their goals.

Transportation and distribution in supply chain, basic transport systems, distribution networkdecisions. Integrated logistics and supply chain of all-mode: maritime logistics, aviationlogistics, global ports and logistics facilitation: contemporary issues and challenges, information technology in logistics and supply chain management and environmental logistics.

**DRM 621: Sociology of Disasters**

The course on sociology of disaster is designed to cover the issues of: Ethnography of

urbanization; Nature and development of human settlement; Ethic and cultural influences on human settlement’ Anthropology of poverty; Poverty reduction strategies and disaster risk reduction; Evaluating economic importance of disasters; Theoretical perspectives, research and policy issues in the sociological study of disaster; Cultural, social, economic and political aspects of natural and man-made disasters. Building back better

**DRM 622: Early Warning, Response and Recovery**

This course aims at exposing the students to theoretical and practical issues in disaster response and recovery. Students will be taught: Organizing search and rescue operations; Evacuation types (emergency, forced & voluntary); Simultaneous and stage evacuation strategies; Evacuations decision making strategies; Evacuation need assessment; Determinants of field clearance time; Effectiveness of evacuation strategies; Recovery action and operation; Shelter requirements and strategies; Rehabilitation and reconstruction - Rehabilitation, Restoration of basic services and functions; Damage inspection, repair and recovery procedures; Building back better Recovery agencies;

**DRM 623: Humanitarian Disaster Risk & Environmental Laws**

This course is designed to expose the students to the legal aspects of disaster management. It will advance the student’s knowledge of : Legal basis and requirements for disaster management; National Emergency Management Agency (NEMA) Act; Environmental protection laws in Nigeria – Environmental Impact Assessment Decree, NESREA Act; National Oil Spill Regulatory Agency, etc; Disaster insurance laws and regulations; Global case studies of disaster management legislations; Global treaties on disaster risk reduction (HyogoFramework of Action); Strategies for disaster law enforcement; Constraints and challenges of enforcing disaster related laws; Role of Human Rights/ Civil liberty organizations in Disaster Management, Humanitarian Laws, DRR Laws, International Laws etc.

**PGC 601: Research Methodology and Application of ICT in Research**

In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of the study area from African and Western perspectives. Research design: sample frame, sampling techniques, surveys for quantitative and qualitative data sets in environmental management research. Multivariate statistic analysis: analysis of variance, multiple linear regression, canonical correlation, factor analysis, discriminant analysis, etc. Dissertation and thesis proposals.

Major steps in research: Selection of problem, Literature review, Design, Data collection, analysis and interpretation, Conclusions. Study of various research designs, Historical, Case studies, Surveys, Descriptive, Cross sectional, Experimental, etc. Analysis, surveys, and synthesis of conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix). Data analysis and result presentation in different disciplines using appropriate analytical tools. Methods of project/dissertation writing. Application of appropriate advanced ICT tools relevant in every discipline for data gathering, analysis and result presentation. Essentials of Spreadsheets, Internet technology, and Internet search engines. All registered Masters Degree students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

**DRM 625: Community Conflict Resolution**

What is conflict resolution? the impact of community conflict on disasters; disaster risk governance and conflict; political and personal power in disasters; human rights, conflict prevention and peace building; separation of conflict management from disaster risk reduction programmes; actors and activities in conflict management during disasters; important strategies in resolving community conflicts during disasters.

**DRM 626: Accounting for Disaster Loss & DRR Framework**

Definition of DesInventar, DesInventar as a disaster information management system (benefits ofDesInventar), DesInventar and Sendai Framework, DesInventar methodology, disaster hazardclassification (as it affects various forms of Hazards; Hydro meteorological, Biological:Technological etc); definition of basic events in DesInventar; Challenges of disaster informationsources; migrating DesInventar to Sendai Framework Format; Practical exercise on theapplication of DesInventar

**DRM 627: Field Work**

The course is designed to expose students to field- based exercises in DRM. The components include a study trip to a chosen location, field survey, data collection, analysis and report writing on locally identified environmental hazard, risks and disasters. Students will be exposed practical field exercises in order to sharpen their skills in DRM.

**DRM 628: Planning and Development in Disaster Risk Reduction**

The course will define the theory of inclusive planning; explore community-based risk reduction principles and strategies. The course contents include: The roles of local institutions in facilitating risk reduction; The use of traditional/indigenous knowledge in hazard and risks identification and management; Community Disaster Action Plan; Community based techniques in search and rescue; Disaster volunteer corps and their modes of operation; Assessment of the roles of communities in all phases of disaster management; International Best Practice, from Africa, Asia, Latin America, Europe and America.

**DRM 629**: **Strategic Disaster Management Systems**

The course focuses on the concept, philosophy of management systems. It also covers institutional arrangement, international and National coordination architecture, organizational structures, issues and problems in the formulation of efficient national disaster risk management systems. Also covers environmental management systems standardization and the reviews of natural disaster risk management systems of selected countries. Additional emphasis is on Humanitarian Principles & Values to on-going participatory10development; Disaster fundraising, appeals and the utilization of funding resources; Legal status of refugees; refugee registration, repatriation and reintegration; The United Nations High Commissionfor Refugee.

**DRM 630: Trauma and Mass Causality Management in Disasters**

This course will explore crisis and trauma management in support victims of disasters. The course will consider: General management of crisis; Basic concepts of crisis intermediation and trauma management; Emotional distress of victims of trauma; Management of post-traumatic stress; Action strategies for crisis workers; Coping strategies and management of victims of natural disasters, human made disaster, family and sexual violence etc.

**DRM 631: Disaster Types and Mitigation Strategy**

Fire disaster is a universal problem of global concern as it affects all nations of the world. This course is designed to expose the students to problems of fire disaster and management strategies.

The contents include: The definition and concept of fire; Types of fire disaster (domestic, forest and rangeland fires); Causes of fire disaster; Fire safety and prevention methods in buildings andresidential areas and the general environment Firefighting and control strategies; Fire damage evaluation and assessment; National fire safety code; Fire prevention laws in Nigeria; Challenges in the enforcement of fire codes and laws etc.

**DRM 641: Urban and Regional Planning Strategies for Disaster Risk Reduction (DRR)**

This course is designed to teach the students Urban and Regional Planning measures for disaster management and risk reduction. The course contents include: Physical development activities and land use; Roles of Urban Planning in community security and DRR; Planning principles and design for DRR; Classification of disaster risk areas; Land use and development control forDRR; Related Town planning laws, regulations and Enforcements for DRR (EIA law, building codes; zoning ordinance; land use standards etc.); Proper Waste management problems in urban areas; Hazards associated with poor waste management; Waste management strategies for DRR.

**DRM 692 Project Report - - - - - - 6 units**

.***M.SC. DEGREE IN CHEMICAL SECURITY MANAGEMENT***

**First Semester**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| CSM 610 | Hazardous Chemicals | 2 |
| CSM 611 | Fundamentals of Chemical Safety & Security Management | 2 |
| CSM 624 | Personal Reliability & Physical Security | 2 |
| CSM 628 | Regulations and Enforcement for Chemical Security | 2 |
| CSM 631 | Chemical Security Management & LaboratoryPractices | 2 |
| CSM 632 | Reduction and Mitigation Techniques of Chemical Security | 2 |
| CSM 634 | CSM 634: Basics of Information Security | 2 |
| CSM 636 | Chemical Waste Management | 2 |
| CSM 640 | Field Work | 2 |
|  | **Total** | **18** |

**Second Semester**

|  |  |  |
| --- | --- | --- |
| **COURSE****CODE** | **COURSE TITLE** | **UNITS** |
| CSM 615 | Chemical Safety Risk & Vulnerability Assessment | 2 |
| CSM 617 | Fundamentals of Chemical Inventory ManagementSystem | 2 |
| PGC 601 | Research Methods and Applications of ICT | 3 |
| CSM 620 | Chemical Emergency Response Strategies | 2 |
| CSM 645 | Geographic Information System | 2 |
| EMC 661 | Introduction to statistics and mathematics | 2 |
| CSM 680 | Seminar | 2 |
| CSM 692 | Project | 6 |
|  | **Total** | **21** |

**Course Descriptions**

***CSM 610: Hazardous Chemicals***

Chemical compounds; properties of hazardous substances; handling hazardous chemicals; transportation and storage of hazardous chemicals; material safety data sheet of hazardous chemicals; chemical risk assessment; hazardous uses of chemicals for deliberately causing mayhem; chemical wastes and their management

## CSM 611: Fundamentals of Chemical Safety &Security

Concept of chemical safety and security; Relationship between chemical safety and security; Conflicts between chemical safety and security; Dual-use chemicals e.g. (Cyanide, pseudoephedrine, pesticides, arsenictrichloride, etc) and international controls, UN security Council Resolution(1540), Chemical Weapon Convention(CWC), Organisationfor the Prohibition of Chemical Weapons (OPCW), OPCW schedule of chemicals (schedule1,2,3 and unscheduled district organic chemicals); Chemical symbols and signs;

## CSM 613 Chemical Security Management and Laboratory Practices

Chemical distribution and supply chain; Diversion of industrial laboratory chemicals eg.Sodiumazidewidely used in older automobile airbags (1980s -1990s) is poisonous and reacts explosively with metals and has been found in possession of terrorists; What might motivate adversaries for the use of these chemical?Concepts,fundamentals and best practices for chemical security management (eg.Inventory, procurement, access control, etc; Social engineering; Concept of cybersecurity; Cybersecurity surveillance, chemical storage concepts and principles; Chemical storage best practices; Laboratory use of chemicals (Labeling, GHS, SDS, SOP); Principles of good laboratory practices; occupational safety & health for laboratory workers; Laboratory documentations.

## CSM 615: Chemical Safety Risk & Vulnerability Assessment

General safety rules; Risk assessment; Risk management; Risk Mitigation; Risk communication; Security vulnerability assessment - Hypothetical security vulnerability assessment; Fundamentals of chemical laboratory safety; Laboratory emergency planning; Response and Management; Chemical disaster emergency management; Accident and incident investigation; Selecting the best PPE for a given laboratory experiment; emergency spill response procedure (for major and minor spills); international cooperation in peaceful use of chemicals; Target identification; determinethepossibletargetsforthefollowingactions:**.**Sabotage(identify vital areas to protect), theft of chemicals**, t**heft of information (identify location of materials to protect); chemical wastemanagement.

## CSM 617: Fundamentals of Chemical Inventory Management Systems(CIMS)

CIMS software walkthrough; inventory setup; searches; audits; changes; application of CIMS in tracking chemicals; CIMS exercise. Label requirements; requirements in transportation of chemicals, Role of chemical suppliers in chemical safety and security – supplier information on Safety Data Sheet (SDS), employee information & training; Employer responsibility. Covers topics on procurement, logistics, and supply chain management of chemicals of concern.

## CSM 620: Chemical Emergency Response Strategies

Emergency response management is aimed at protecting infrastructure and ensuring the public safety in the event of chemical accident and/or chemical terrorism. There is need to develop contingency plans and emergency preparedness for different scenarios that may arise. Part of this effort also include coordinating the different emergency response agencies such as the government, non-governmental agencies, nonprofit organizations, and first responders such as the fire, police, andmilitary.

NEMA, law enforcement agencies, public health officials, and security agencies may likely be involved and they need to be coordinated and managed to assure cohesiveness in both decision making and the information that is disseminated to the general public. Emergency response management also delves into issues on how to coordinate relief efforts.

## CSM 624: Personal Reliability &PhysicalSecurity

Physical security of site**;** Personnel management**;** Information security**;** Management of chemical security activities**;** Allocation of chemical security responsibilities**;** Development of emergency plans**;** Professional behaviors; Chemical security training; Awareness and campaign; Characterization of chemical facility in terms of: Site boundary, Buildings (construction and HVACsystems), Roomlocations; Accesspoints, processes within the facility, Existing protection systems ,operating conditions (workinghours, off-hours, potential emergencies), safety consideration, types and numbers of employees, Legal and regulatory issues; Chemical security anti-terrorism standards; Good practices for both chemical security and safety.

## CSM 628: Regulations and Enforcements for Chemical Security

International regulations–UN Security Council Resolution of 1540; Chemical Weapons Convention (CWC)-which Nigeria is signatory to; Organisationfor the Prohibition of Chemical Weapons. Local/National Regulations and enforcement–Nigeria’s Bill on Chemical security (May21,2014) and the effect of the bill; The role of federal, state, local and tribal governments in reducing hazardous chemicals through health and environmental regulations (role of Custom services, NAFDAC, ONSA etc); The authority of NAFDAC and ONSA. Which agency has the authority to check for chemical security in Nigeria? Responsible Care.

## PGC 601: Research Methodology and Application of ICT

In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of the study area from African and Western perspectives. Research design: sample frame, sampling techniques, surveys for quantitative and qualitative data sets in environmental management research. Multivariate statistical analysis: analysis of variance, multiple linear regression, canonical correlation, factor analysis, discriminant analysis, etc. Dissertation and thesis proposals. Major steps in research: Selection of problem, Literature review, Design, Data collection, analysis and interpretation, Conclusions. Study of various research designs, Historical, Case studies, Surveys, Descriptive, Cross sectional, Experimental, etc. Analysis, surveys, and synthesis of conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix). Data analysis and result presentation in different disciplines using appropriate analytical tools. Methods of project/dissertation writing. Application of appropriate advanced ICT toolsrelevant in every discipline for data gathering, analysis and result presentation. Essentials of Spreadsheets, Internet technology, and Internet search engines. Research Ethics…

***Note:*** All registered M.Sc.degree students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

## CSM 632: Reduction and Mitigation Techniques of Chemical Security

Border security; counterterrorism; Counter-improvised Explosive Device (IED) and risk mitigation; Cyber security; Immigration statistics; Preparedness, response and recovery; Strategic planning; overview of terrorist attack cycle; Homemade explosives and precursor awareness for public safety; protective measures and awareness; Awareness and safety procedures; Bombing prevention awareness, Emergency notification system; Surveillance detection for Law Enforcement and Security Professionals; Bombing treat management planning, Response to suspicious behaviours& items.

## CSM 634: Basics of Information Security

Overviewandterminologiesincybersecurity(information security), General concepts, Transmission Control Protocol (TCP)/internet protocol networking, Network security, Cryptography, Securing both clean and corrupted systems, protecting personal data, securing simple computer networks, using the internet safely, cyber-attack incident management, incident preparation, incident detection and analysis, containment, eradication, and recovery, proactive and incident cyber services.

## CSM 636: Chemical Waste Management

The focus is on identifying hazardous or toxic chemicals and the pollution they create to the environment. Specifically, the emphasis will be on how to dispose of expired and waste chemicals by following a cradle-to-grave approach. The course will insist on product stewardship. The waste disposal of “chemicals of concern” is discussed especially from the view point of controlling spread and exposure to toxic wastes. Emphasis will also be placed on cleanup of chemical wastes and following best practices to protect the integrity of the environment, infrastructure, and personal security.

Managing wastes from PCB (Polychlorinated Biphenyl) /POPs (Persistent Organic Pollutants) will also be an integral part of the course.

## CSM 640:Fieldwork

Interaction with agencies such as the Nigerian Customs, Nigerian Police force, the Army, the Red Cross Society, Federal Road Safety Corps, NAFDAC, SON, ONSA, Export Promotion Council.

**CSM 645: Geographic Information Systems**

Concepts of spatial information; introduction to information processing; concepts of space and time; real world: its models and representation. Spatial information theory; geographic information system (GIS); history of GIS, GIS software architecture, data types and data structures; data storage, data entry and handling; data quality; query, maintenance and data analysis; visualization; spatial data transfer and its standard. GIS models and modeling; GIS applications in environmental management and control.

**EMC 661 Statistics and mathematics for Environmental Studies**

Introduction (descriptive and Inferential statistics); collecting data and survey design; (types of data and sampling methods); interpreting data sets (graphical techniques, measures of central tendencies, measures of dispersion/variability); probability and sampling distributions (normal distribution, chi-square distributions, F-distributions, T-distributions); hypothesis testing and confidence intervals (sample confidence intervals, null and alternate hypothesis, one and two-sided hypothesis), correlation and regressions (scatterplots, simple linear regression analysis, analysis of variance, etc.), principal component analysis, cluster analysis; introduction to statistical packages (e.g. SPSS); Introduction to Vectors analysis; matrices (addition, multiplication, types of matrices, etc.), inverse and determinants of matrices, solutions to systems of linear equations using matrix method, functions, limits and continuity, calculus of one variables: differentiation (first principle, derivatives, types of differentiation, chain rules, Implicit differentiation, higher derivatives), anti-derivatives, integration (Integrals, methods of integration) applications of differentiation and integration, partial differentiation. Statistical and mathematical modeling techniques in environmental science

## CSM 680: Research Seminar in Chemical Security Management

Review of related literature in chemical security management. Selection of feasible research topic. Seminar presentation and discussions. The seminar should clearly show the goals, objectives and detailed procedure for carrying out original research.

**CSM 692 Project Report - - - - - - - 6 units**

***M.Sc. DEGREE PROGRAMME IN GREEN ENERGY***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| GES 611  | Introduction to Alternative Energy and Energy Mix | 2 |
| GES 612 | Energy Transition and Innovation | 2 |
| GES 613 | Green Energy Management and Finance | 2 |
| GES 614 | Wind Power | 2 |
| PGC 601 | Research Methodology and Application of ICT in Research | 2 |
| GES 615 | Geothermal Energy, Wave and Hydro Power | 2 |
| GES 616 | Solar Photovoltaic | 2 |
| GES 617 | Biomass | 2 |
| EMC 661 | Statistics and mathematics for Environmental Studies | 2 |
|  | **Semester Total** | **18** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| GES 621 | Hydrogen Energy | 2 |
| GES 622 | Green Energy Solutions | 2 |
| GES 623 | Energy Audit and Efficiency in Buildings | 2 |
| GES 624 | Energy Storage | 2 |
| GES 625 | Transition to De-carbonized Energy of Tomorrow | 2 |
|  | 1 Elective | 2 |
| GES 662 | Seminar | 2 |
| GES 692 | Project Report | 6 |
|  |  **Semester Total**  | **20** |
|  | **SESSION TOTAL**  | **38** |

**ELECTIVES**

|  |  |  |
| --- | --- | --- |
| EMC 636 | Occupational Health and Safety  | 2 |
| EMC 633 | Environmental Economics | 2 |
| EMC 631 | Environmental Law | 2 |

**Course Descriptions**

**GES 611: Introduction to Alternative Energy and Energy Mix**

Understanding energy and its generation; Energy measurement; Unconventional Resources and Management; Unconventional energy resources in Nigeria and their distribution: Coal bed Methane (CBM), Shale gas, Tight gas reservoirs, wind energy, solar energy); Problems with fossil fuels and other energy sources: Pricing; Distribution of unconventional reservoirs in Nigeria’s sedimentary basins and their potentials; Economics of unconventional projects; Energy conservation techniques and storage; Energy usage; Energy conversion; Policy formulation and development

**GES612: Energy Transition and Innovation**

Understanding energy demand determinants;

* Overview of Measures of Profitability

Petroleum Exploration Risk Analysis Methods

Stochastic Modeling of Petroleum E&P Outcomes

Decision Analysis Using Simulation in E&P

 Become familiar with energy sources both traditional and future (Oil, Natural Gas, Coal, and Electricity); Energy Market Efficiency; Energy Efficiency in Industry, Environment, and Transportation; Strategy of Fuel Transition; Renewable Sources of Energy; Block chain, Micro grids, and Artificial Intelligence; Digital Twin of Energy System; Design of the Energy Efficient City; Sustainable Economics of Energy

**GES 613: Green Energy Management and Finance**

Introduction to Green Energy Finance and Sustainable Design; Methods of Financing: FiT/ RHI / ROCs / CfD / PPA / ESCO /EPC; Project Risk and Financial Management; Basic Project Finance & Technical calculations – e.g. energy, economics, emissions, NPV, IRR; Life Cycle Assessment (LCA) and approach; Incentives and barriers to Investment; Government Policy and Support Schemes – Nigeria, UN, EU, UK , US; Project Finance examples; Practical International Case Studies

**GES 614: Wind Power**

Small and micro wind power plants; Scenery adaptation; The environmental impact; Hybrid systems; Incentives for wind power adoption; Economical aspects; Policies and procedures; Running and maintenance of plants; Design criteria; Tuning the plants; Technologies of machines; The wind market; Classification and types of plants; Concepts of aerodynamics and aeraulic machines; Offshore Wind Projects

**GES 615: Geothermal Energy, Wave and Hydro Power**

Geothermal energy resources in Nigeria; Geothermal energy systems for energy generation; Geothermal energy capture, economics and tradeoffs; Combined heat and power; Wave/Tidal power; Hydro power; Market, resources and targets overview; The physics principles (energy content, types of technologies); Design guidance (types, sizing, selecting, manufacturers); Environmental impact and analysis; Finance, regulation and incentives (MCS, RHI, CCL, ECA); Case studies, best practice analysis; Simulation tools; Standards, References and further reading

**GES 616: Solar Photovoltaic**

Composition of light; Photovoltaic effect; Photovoltaic cells; Materials; Daily/annual energy; Positioning of the modules; Photovoltaic energy; Photovoltaic illumination; Planning and designing a photovoltaic installation; The electric load; Costs and evaluation of the economical solutions; Maintenance and reliability; Practical solutions; Typologies and modality of installation; Integration of the photovoltaic modules in the building structure; Payback time; Economical perspectives

**GES 617: Biomass**

What is biomass?; Market, resources and targets overview; The physics principles; How biomass works (energy content, types of technologies, PCI, humidity content); Design guidance (sizing, selecting, autonomy, storage, manufacturers); Types of technologies: anaerobic digestion (bio-methane), gasification, pyrolysis, dual fuel, heating and power efficiencies; Environmental impact and analysis; Finance, regulation and incentives (RHI, MCS, ROCs, DECC); Case studies, best practice analysis, manufacturers; Simulation tools; Standards; References and further reading; Trade bodies and support

***EMC 631, EMC 633, EMC 636, EMC 661 & PGC 601 course contents have been described in the MSc Programme in Environmental Management & Control*.**

**GES 621: HYDROGEN ENERGY**

Environmentally Sustainable Hydrogen; Hydrogen as Part of a Climate Neutral Strategy; Hydrogen Production and Conversion; Fuel Cells; Hydrogen for Mobility Applications & Vehicles; Hydrogen Technologies; Modelling and Simulation; Hydrogen Economy & Financial Market Opportunities; Storage & Carbon Capture; LCSA, Recycling and Eco-design; Distribution & Grid Infrastructure; Government Legislation & Policies – UK, EU (including European Green Deal), Worldwide; Case Studies

**GES 622: GREEN ENERGY SOLUTIONS**

Overview of the different renewable technologies; Government incentive, climate change, energy, assessment (LEED, BREEAM, EPC); Choosing the best renewable energy options; Benefits, applications and case studies for each technology; Renewable Energy Technologies: Solar Geometry, Solar Chimneys, Solar Wall, Natural Ventilation, Passive Solar Heating House/ Design, Solar Water Heating, Photovoltaic, Wind Technology, Biomass Heating; Other Energy Saving Technologies: GSHP, UTES, Geometry, CHP, Tri Generation, Rainwater Harvesting, Fuel Cell, Earth duct: Canadian/Provencal Wheel, Light pipe; Review of each technology; Payback time considerations; Combining renewable energy technologies; Software available; Energy Storage

**GES 623: ENERGY AUDIT AND EFFICIENCY IN BUILDINGS**

Energy context; Physical principles; Building envelope; Building services; Energy Performance Certificate; Simulation tools – Energy modelling software; Building design best practice

**GES 624: ENERGY STORAGE**

Types of electrical energy storage and key characteristics; Parameters for electrical energy storage; Operational characteristics of electrical storage; Costs and pricing; Integration of energy storage into electrical grids; Off-grid systems, architecture and sizing; Small scale battery storage systems; Types and applications of thermal energy storage; Future developments in energy storage.

**GES 625: TRANSITION TO DE-CARBONIZED ENERGY OF TOMORROW**

The impact of the energy transition on energy markets, including the introduction of renewable energy sources and storage technologies; The business case for renewable energy technologies; support schemes for renewable energy sources; Methods of carbon pricing; origin and the implementation of the emission trading scheme; The goals and appearance of the European energy system and energy market of 2050; steps necessary to achieve these goals; The impact of variable renewable energy sources (VRES) and smart energy demand on electrical power grids; Tools and approaches to design a smart grid; Application of optimal power flow (OPF) solutions for the evaluation of performance of an electrical power system with integrated renewable energy sources; Analysis of intelligent electrical power system dynamics (frequency stability) to achieve active power balance, and Control-room technologies for system-wide remote monitoring, protection and risk management of smart grid cyber security.

**GES 692: Project Report** - - - - - - - 6 units

***Ph. D. PROGRAMME IN ENVIRONMENTAL MANAGEMENT AND CONTROL***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 711 | Advanced Environmental Impact Assessment  | 2 |
| EMC 721 | Advanced Environmental Quality Management Systems | 2 |
| EMC 741 | Advanced Research Methods  | 2 |
| EMC 781 | Special Topics in Disaster Risk Reduction and Management | 3 |
|  | **Total**  | **9** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| EMC 752 | Environmental Politics and Policy | 2 |
| EMC 791 | Global Environmental Challenges | 2 |
| EMC 784 | Environmental Modeling | 2 |
| PGC 701 | Synopsis and Grant Writing | 3 |
| EMC 792 | Thesis | 12 |
|  | **Total** | **21** |

**EMC 711: *Advanced Environmental Impact Assessment***

Overview of EIA-Sustainable development, evolution of EIA and its benefits, ethical requirement for EIA process; statutory requirements; Strategic Environmental Assessment (SEA), Legislations on EIA. Environmental protection and impact assessment policies in the developing and developed countries. Local and international standards on EIA. Critical Habitat Assessment: Definition and criteria for critical habitat assessment; International Finance Corporation Performance Standard 6 (IFC PS6). Details of IFC PS6 (biodiversity conservation and sustainable management of living natural resources). Explanation on the use of IFC PS6 methodology for identifying critical habitat (CH) under the criteria outlined in IFC PS 6 (2019) at species, ecosystems and landscape levels. Explain why this method is used. Environmental impact indicators; case studies in oil sector, industries and transport; Environmental components and sensitivities; the standard EIA process and public involvement; Various levels of public involvement; methods and techniques for consultation required in EIA studies; dispute resolution; impact analysis using current and widely accepted methods; mitigation and impact management; writing EIA reports; public review meetings; expert review of EIA reports on consultancy basis for regulatory bodies; environmental impact statement and how to formulate it. Several field trips in form of trips to public review meetings within the Southeast geopolitical zone and participation in the Centre’s EIA consultancy engagements.

**EMC 721: *Advanced Environmental Quality Management Systems***

Nigerian environmental laws; Nigerian Environmental Protection Agency (EPA) and Standards Organization of Nigeria (SON) approved analytical methods; quality assurance programme; quality assurance manual; overview of ISO17025 management systems; auditing analytical services laboratory; introduction to ISO 14001; elements of ISO 14001; implementing ISO 14001; ISO 14001 auditing research laboratories; introduction to ISO 9001/2000; elements of ISO 9001/2; implementing and integrating ISO 9001/2 and ISO 14001. Student industrial field trip and report.

**EMC 741: *Advanced Research Methods***

**Note:** This course is an advanced form of EMC 643 – Research Methodology in Environmental Management (or its equivalent) and which is a pre-requisite for

EMC 741. Statistical models in environmental research; environmental systems indicators; advanced analytical tools; discriminant analysis; canonical correlations; advanced logit models; data analysis and presentations; experimental test research; simulation models.

**EMC 752: Environmental Politics and Policy**

Environmental policy process , important policy concepts (e.g., risk, regulation, sustainability, environmental justice), Nature and scope of environmental, energy, and natural resource problems; contrasting perspectives on their severity and policy implications; the goals and strategies of the environmental community and its opponents; public opinion on the environment; scientific, economic, political, and institutional forces that shape policymaking and implementation; approaches to environmental policy analysis; and selected issues in environmental policy both within the Nigeria and globally, fate and future of Climate Change treaties, Rethinking environmental institutions; and Commodity chains and Environmental changes.

**EMC 781: Special Topics in Disaster Risk Reduction and Management**

Sendai Framework for Disaster Risk Reduction (SFDRR); Hyogo Framework for Action (HFA); the role of International Strategy for Disaster Reduction; Disaster Risk Reduction, Mitigation and Adaptation Strategies for Flooding; Erosion; Deforestation and other natural disasters; Management of relief efforts; Disaster Insurance; Climate Change and Disaster Risk; Intergovernmental Panel on Climate Change (IPCC); UN Framework Convention on Climate Change.

**EMC 784: Environmental Modeling**

Statistics; Environmental Project management; Model building; Computer modeling – simulation, Data collection and Design processes; Multi-criteria model;Data Analysis and Interpretation; Research Colloquia.

**EMC 791: Global Environmental Challenges**

Analysis of global environmental issues using case studies in Pollution; Global Warming; Overpopulation; Natural Resource Depletion; Waste Disposal; Climate Change; Loss of Biodiversity; Deforestation; Ocean Acidification; Ozone Layer Depletion; Acid Rain; Water Pollution; Urban Sprawl; Public Health Issues; Genetic Engineering; [Nuclear issues](https://en.wikipedia.org/wiki/Nuclear_power_debate) ([Nuclear fallout](https://en.wikipedia.org/wiki/Nuclear_fallout), [Nuclear meltdown](https://en.wikipedia.org/wiki/Nuclear_meltdown), [Nuclear power](https://en.wikipedia.org/wiki/Nuclear_power), [Nuclear weapons](https://en.wikipedia.org/wiki/Nuclear_weapons), [Nuclear and radiation accidents](https://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents), [Nuclear safety](https://en.wikipedia.org/wiki/Nuclear_safety), [High-level radioactive waste management](https://en.wikipedia.org/wiki/High-level_radioactive_waste_management)). Analysis of global environmental issues using case studies in Pollution; Global Warming; Overpopulation; Natural Resource Depletion; Waste Disposal; Climate Change; Loss of Biodiversity; Deforestation; Ocean Acidification; Ozone Layer Depletion; Acid Rain; Water Pollution; Urban Sprawl; Public Health Issues; Genetic Engineering; [Nuclear issues](https://en.wikipedia.org/wiki/Nuclear_power_debate) ([Nuclear fallout](https://en.wikipedia.org/wiki/Nuclear_fallout), [Nuclear meltdown](https://en.wikipedia.org/wiki/Nuclear_meltdown), [Nuclear power](https://en.wikipedia.org/wiki/Nuclear_power), [Nuclear weapons](https://en.wikipedia.org/wiki/Nuclear_weapons), [Nuclear and radiation accidents](https://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents), [Nuclear safety](https://en.wikipedia.org/wiki/Nuclear_safety), [High-level radioactive waste management](https://en.wikipedia.org/wiki/High-level_radioactive_waste_management)).

**PGC 701: SYNOPSIS AND GRANT WRITING**

Identification of types and nature of grant writing; mining of grants application calls on the internet. Determining appropriate strategy for each grant application. Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Study of sample grant writings in various forms and writing of mock research and other grants. Identification of University of Nigeria synopsis structure and requirements, (Introduction, Methodology and Results). Determining the content of each sub-unit of the synopsis. Steps in writing of synopsis from the Dissertation/Thesis document. Structural and language issues. Common errors in synopsis writing and strategies for avoiding them. The roles of the student and the supervisor in the production of a synopsis. Writing of mock synopsis. All registered Ph.D. students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

**EMC 792: Thesis - 12 units**

***Ph.D. PROGRAMME IN DISASTER RISK MANAGEMENT***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| DRM 710 | Fundamentals, Philosophy and Principles of Disaster Risk Management | 2 |
| EMC 711 | Advanced Environmental Impact Assessment  | 2 |
| EMC 741 | Advanced Research Methods  | 2 |
| EMC 781 | Special Topics in Disaster Risk Reduction and Management | 3 |
|  | **Total**  | **9** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| DRM 751 | Disaster Risk Economics and Loss Accounting | 2 |
| DRM 752 | Flood and Climate Related Disaster Risk Management | 2 |
| EMC 784 | Environmental Modeling | 2 |
| PGC 701 | Synopsis and Grant Writing | 3 |
| DRM 792 | Thesis | 12 |
|  | **Total** | **21** |

***DRM 710 Fundamentals, Philosophy and Principles of Disaster Risk Management***

The course shall begin with a background of disaster management and then advance to philosophy and principles of disaster risk management. The contents include: Basic concepts of hazards, risks, disasters, resilience and vulnerability; Types of disaster/ hazards; Emergency and Disaster; Hazards and Risk Management; Various theories and models of Hazards; Physical, Social and economic determinants of vulnerability; philosophical foundation of disaster; schools of geographical thought; critical evaluation of the paradigms of determinism, possibilism, probabilism and human ecology in examining sustainable and unsustainable human-ecosystem interaction; theories, laws and models in disaster management.

***DRM 751 Disaster Risk Economics and Loss Accounting***

The course will evaluate concepts like Economics and costs of Risks and Disasters; Auditing and Disaster Management Systems; Damage and loss accounting/estimation in recovery planning; Insurance in DRM; Disaster recovery and reconstruction as well as concepts, practice, and guidelines. The course will also cover DesInventar as a disaster information management system; DesInventar basic events, methodology, benefits and challenges; migrating from DesInventar to Sendai Framework Format and practical exercises on the application of DesInventar. The basics and purpose of Business Continuity Planning (BCP) will also be examined.

***DRM 752 Flood and Climate Related Disaster Risk Management***

The course will bring to the fore the complexities of natural hazards including floods, earthquakes, volcanoes, droughts and the impact on livelihoods. Students will also learn to evaluate the management issues and challenges associated with such hazards, and how these can be applied to major incident management, risk reduction and recovery and national planning. Perception and attitude of community to disasters; Community based approaches to disaster risk management and hazard mitigation; Introduction to Community Participatory Approaches (CPA); Cross-cutting issues in CPA, tools & techniques; Community involvement in the development of community based disaster risk management plans; Consideration of elements of social vulnerability parameters such as health, education, gender etc. in disaster risk management; Barriers to development of disaster risk management and adaptation plan- such as lack of information, community participation, and linkages between local actions and national strategies, proper balance of trust in traditional knowledge and appropriate technology; Community based disaster relief systems; Involvement of communities in development of long term recovery and rehabilitation plans, their implementation and monitoring; Drafting a Community Action Plan; Practicing the tools; Community Based Risk Assessment (CBRA); preparation of Risk assessment and CBRA report; The roles of NGOs\FBOs\CBOs in Disaster Management Case studies

***EMC 711: Advanced Environmental Impact Assessment***

Strategic Environmental Assessment (SEA), Legislations on EIA. Environmental protection and impact assessment policies in the developing and developed countries. Local and international standards on EIA. Environmental impact indicators; case studies in oil sector, industries and transport; Overview of EIA-Sustainable development, evolution of EIA and its benefits, ethical requirement for EIA process; statutory requirements; Environmental components and sensitivities; the standard EIA process and public involvement; Various levels of public involvement; methods and techniques for consultation required in EIA studies; dispute resolution; impact analysis using current and widely accepted methods; mitigation and impact management; writing EIA reports; public review meetings; expert review of EIA reports on consultancy basis for regulatory bodies; environmental impact statement and how to formulate it. Several field trips in form of trips to public review meetings within the Southeast geopolitical zone and participation in the Centre’s EIA consultancy engagements.

***EMC 741: Advanced Research Methods***

**Note:** This course is an advanced form of EMC 643 – Research Methodology in Environmental Management (or its equivalent) and which is a pre-requisite for

EMC 741. Statistical models in environmental research; environmental systems indicators; advanced analytical tools; discriminant analysis; canonical correlations; advanced logit models; data analysis and presentations; experimental test research; simulation models.

***EMC 781: Special Topics in Disaster Risk Reduction and Management***

Sendai Framework for Disaster Risk Reduction (SFDRR); Hyogo Framework for Action (HFA); the role of International Strategy for Disaster Reduction; Disaster Risk Reduction, Mitigation and Adaptation Strategies for Flooding; Erosion; Deforestation and other natural disasters; Management of relief efforts; Disaster Insurance; Climate Change and Disaster Risk; Intergovernmental Panel on Climate Change (IPCC); UN Framework Convention on Climate Change.

***EMC 784: ENVIRONMENTAL MODELING***

Statistics; Environmental Project management; Model building; Computer modeling – simulation, Data collection and Design processes; Multi-criteria model;Data Analysis and Interpretation; Research Colloquia.

***PGC 701: SYNOPSIS AND GRANT WRITING***

Identification of types and nature of grant writing; mining of grants application calls on the internet. Determining appropriate strategy for each grant application. Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Study of sample grant writings in various forms and writing of mock research and other grants. Identification of University of Nigeria synopsis structure and requirements, (Introduction, Methodology and Results). Determining the content of each sub-unit of the synopsis. Steps in writing of synopsis from the Dissertation/Thesis document. Structural and language issues. Common errors in synopsis writing and strategies for avoiding them. The roles of the student and the supervisor in the production of a synopsis. Writing of mock synopsis. All registered Ph.D. students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

***DRM 792: Thesis -* 12 units**

***Ph.D. PROGRAMME IN GREEN ENERGY***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| GES 711 | Biomass and Solid Biofuel Production  | 2 |
| EMC 712 | Advanced Environmental Impact Assessment  | 2 |
| EMC 741 | Advanced Research Methods  | 2 |
| GES 713 | Advanced Solar, Hydro and Wind Energy Technology | 3 |
|  | **Total**  | **9** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| GES 714 | Bioenergy and Microbial Technology for Biofuel Production | 2 |
| GES 715 | Landscape Level Carbon Sequestration | 2 |
| EMC 784 | Environmental Modeling | 2 |
| PGC 701 | Synopsis and Grant Writing | 3 |
| GES 792 | Thesis | 12 |
|  | **Total** | **21** |

***GES 711 Biomass and Solid Biofuel Production***

Biomass resources; classification and characteristics; Techniques for biomass assessment; Biomass feedstock potential in Nigeria. Physical properties of biomass: Moisture, bulk density, size, grindability, crushability. Chemical composition of biomass- estimation of volatile matter, cellulose, hemicellulose and lignin content. Properties of municipal solid waste – Segregation of paper and plastic waste – refuse derived fuels; Solid Biofuel Production Processes**:**Pelleting and briquetting of solid biomass–Process flow–factors influencing heat values. Pretreatment of biomass for energy enhancement – Torrefaction, fuel characteristics of solid biofuels - co-firing of solid biofuels in thermal power plants – application in industrial units, industrial production of pellets and briquettes – integrated process flow -feedstock and product portfolios–Securing feedstock supply chain. Energy economy of solid biofuel: Roll of biomass energy in energy security - energy economy of solid biofuel - regional biomass utilization- Entrepreneurships potential- International and national energy policies on solid biofuels – Integrated economy model in solid biofuel Production – Case studies.

**GES 713 Advanced Solar, Hydro and Wind Energy Technology**

Solar Radiation Geometry; Solar Collectors and Thermal Analysis; Solar Thermal Energy Storage; Solar thermal energy systems; Economic analysis for solar thermal engineering projects

Fundamentals of Wind Energy; Conceptual and Component Design of Wind Turbines;

Mechanics and Dynamics: Review of Fluid Flow Concepts, Airfoil terminology, Blade element theory, Blade design, General Principles Primer (stress, strain, vibrations), Rotor Dynamics, Sources of loads, Types of loads, Aero Servo Elasticity in Wind Turbines. Primer on Fatigue, Fatigue in Wind Systems; Wind Turbine Performance; Layout design of civil components of MHP system; Design and Selection of mechanical components of MHP system; Selection of electrical components of MHP scheme; Selection of Transmission and Distribution Lines

***GES 714 Bioenergy and Microbial Technology for Biofuel Production***

## Bioenergy conversion systems; biomass to energy conversion systems - direct combustion,

## incineration, pyrolysis, gasification and liquefaction. Hydrolysis & hydrogenation; solvolysis of wood; biocrude; biodiesel production via chemical process; catalytic distillation; trans-esterification methods; Fischer-Tropsch diesel: chemicals from biomass. Biodegradation & Microbial conversion; Biodegradability of substrate; biochemistry and process parameters of biomethanation; chemical kinetics and modeling of biomethanation process, bioconversion of substrates into alcohol: methanol & ethanol production, organic acids, solvents, amino acids, antibiotics etc. Microbial resource Significance of microbes, Microbes from different source: soil, water, air, food, waste, degraded materials, heterotrophic, autotrophic, characterization of microbes, classification, identification of microorganisms: morphology, biochemical, molecular, cultivation, reproduction and growth, pure culture, contamination, bacteria, fungi, actinomycetes, algae, etc.Value added products from Microbes; Enzyme production, Microbes for enzymatic deconstruction of biomass: cellulase, β-glucosidase, xylanase, ligninolytic enzymes, Microbial fermentation to biofuels: ethanol, butanol, hydrogen, methane, biooil.; Microbial Engineering Technology: Generation of biofuels production, Microbial genetics, synthetic microbiology, development of industrial strain, tools in microbial engineering, Genetically Modified microbes for biofuel production.Fermentation Technology for Biofuel; Fermentation process, fermentor, types of fermentor, hybrid fermentor, sterilization, fermentation media, precursor and inhibitors, buffers, types of fermentation, upstream process, downstream process, troubleshooting mechanism.

***GES 715 Landscape Level Carbon Sequestration***

Climate change and International agreements: The green-house effect. The United Nations Framework Convention on Climate Change (UNFCCC); The Intergovernmental Panel on climate change (IPCC), the Kyoto Protocol, the Clean Development Mechanism (CDM). Afforestation and Reforestation projects, Reduced Emissions from Deforestation and Degradation (REDD). CDM projects, finance, project development. Conservation of natural carbon sinks; Primary productivity: mechanisms and assessment; Photosynthesis, absorption and yield. C3, C4 and CAM pathways. Laboratory measurement of primary productivity: cell, plant, ecosystem. Direct field measurements of biomass and primary productivity: allometric models, harvest methods for forests, grass lands and ocean.Indirect measurements of biomass andprimary productivity: remote sensing and other methods. The CDM methodologies for measurement of stocks and fluxes. Role of soil in the carbon balance: decomposition and sequestration in soils. The carbon cycle: plant, soil and atmosphere. Impact of soil degradation. Conditions for the formation of fossil stocks of carbon. Carbon balance of ecosystems: forests, grasslands and oceans. Impact on the global carbonbalance. Soil Organic Carbon (SOC) and biodiversity and climate change. SOC global stock –hot spots and bright spots. Measurement, reporting and verification of SOC. SOC for sustainable development. Sensors. Reflectance of vegetation. Measuring biomass with remotely sensed data. Measuring primary productivity with remotely sensed data. High resolution satellites, use and limitations to measure biomass and primary productivity. Low resolution satellites use and limitations to measure biomass and primary productivity. Regional and global assessments of biomass and primary productivity. Introduction to Geographic Information Systems(GIS). Land-use and land- use changes assessment. The Clean Development Mechanism(CDM) methodologies for measurement of stocks and fluxes at the landscape level. Carbon Sequestration Technologies: Post, Pre and Oxy combustion capture– Sequestration in geological formation: Oil-Gas, Deep sea and unmineable coal seams. CCS programmes, issues and challenges. Clean Technology Scenario and CCS. CCS an international policy strategy and legal perspective.

***EMC 711: Advanced Environmental Impact Assessment***

Strategic Environmental Assessment (SEA), Legislations on EIA. Environmental protection and impact assessment policies in the developing and developed countries. Local and international standards on EIA. Environmental impact indicators; case studies in oil sector, industries and transport; Overview of EIA-Sustainable development, evolution of EIA and its benefits, ethical requirement for EIA process; statutory requirements; Environmental components and sensitivities; the standard EIA process and public involvement; Various levels of public involvement; methods and techniques for consultation required in EIA studies; dispute resolution; impact analysis using current and widely accepted methods; mitigation and impact management; writing EIA reports; public review meetings; expert review of EIA reports on consultancy basis for regulatory bodies; environmental impact statement and how to formulate it. Several field trips in form of trips to public review meetings within the Southeast geopolitical zone and participation in the Centre’s EIA consultancy engagements.

***EMC 741: Advanced Research Methods***

**Note:** This course is an advanced form of EMC 643 – Research Methodology in Environmental Management (or its equivalent) and which is a pre-requisite for

EMC 741. Statistical models in environmental research; environmental systems indicators; advanced analytical tools; discriminant analysis; canonical correlations; advanced logit models; data analysis and presentations; experimental test research; simulation models.

***EMC 784: Environmental Modeling***

Statistics; Environmental Project management; Model building; Computer modeling – simulation, Data collection and Design processes; Multi-criteria model;Data Analysis and Interpretation; Research Colloquia.

***PGC 701: SYNOPSIS AND GRANT WRITING***

Identification of types and nature of grant writing; mining of grants application calls on the internet. Determining appropriate strategy for each grant application. Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Study of sample grant writings in various forms and writing of mock research and other grants. Identification of University of Nigeria synopsis structure and requirements, (Introduction, Methodology and Results). Determining the content of each sub-unit of the synopsis. Steps in writing of synopsis from the Dissertation/Thesis document. Structural and language issues. Common errors in synopsis writing and strategies for avoiding them. The roles of the student and the supervisor in the production of a synopsis. Writing of mock synopsis. All registered Ph.D students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

***GES 792: Thesis -* 12 units**

***Ph.D. PROGRAMME IN CHEMICAL SECURITY MANAGEMENT***

**FIRST SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| CSM 710 | Advanced Hazardous Chemicals | 2 |
| EMC 712 | Advanced Environmental Impact Assessment  | 2 |
| EMC 741 | Advanced Research Methods  | 2 |
| CSM 711 | Advanced Chemical Safety &Security  | 3 |
|  | **Total**  | **9** |

**SECOND SEMESTER**

|  |  |  |
| --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **UNITS** |
| CSM 713 | Advanced Chemical Security Management and Laboratory Practices | 2 |
| CSM 715 | Chemical disaster management and loss accounting | 2 |
| EMC 784 | Environmental Modeling | 2 |
| PGC 701 | Synopsis and Grant Writing | 3 |
| GES 792 | Thesis | 12 |
|  | **Total** | **21** |

***CSM 710: Advanced Hazardous Chemicals***

Properties of hazardous chemicals and Materials Safety Data Sheet (MSDS); P-List & U-List Chemical Wastes; Advanced chemical risk assessment; Hazardous chemicals commonly used to unleash mayhem; Hazardous chemical waste management.

## *CSM 711: Advanced Chemical Safety &Security*

Chemical safety and security as a global concern; Multiple uses of chemicals; Chemistry in conflict vis-à-vis dual use chemicals; Chemical Weapon Convention(CWC) and articles I-XXIV; Roles of the Organisationfor the Prohibition of Chemical Weapons (OPCW) in the implementation of the CWC; OPCW schedule of chemicals; innovative technologies for chemical security

## *CSM 713 Advanced Chemical Security Management and Laboratory Practices*

Industrial and institutional laboratory chemicals and their diversion to reach terrorists or drug abusers; best practices for chemical security; Cyber security surveillance; Principles of good laboratory practices; occupational safety & health for laboratory workers; Laboratory documentations.

## *CSM 715: Chemical disaster management and loss accounting*

Chemical security vulnerability assessment; Chemical disaster emergency management; Accident and incident investigation; Contingency plans and emergency preparedness for different scenarios that may arise; DesInventar as a disaster information management system; Economics and costs of chemical risks and chemical disasters; Damage and loss accounting/estimation in recovery planning

***EMC 711: Advanced Environmental Impact Assessment***

Strategic Environmental Assessment (SEA), Legislations on EIA. Environmental protection and impact assessment policies in the developing and developed countries. Local and international standards on EIA. Environmental impact indicators; case studies in oil sector, industries and transport; Overview of EIA-Sustainable development, evolution of EIA and its benefits, ethical requirement for EIA process; statutory requirements; Environmental components and sensitivities; the standard EIA process and public involvement; Various levels of public involvement; methods and techniques for consultation required in EIA studies; dispute resolution; impact analysis using current and widely accepted methods; mitigation and impact management; writing EIA reports; public review meetings; expert review of EIA reports on consultancy basis for regulatory bodies; environmental impact statement and how to formulate it. Several field trips in form of trips to public review meetings within the Southeast geopolitical zone and participation in the Centre’s EIA consultancy engagements.

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***CSM 792: Thesis -* 12 units**