DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT
FACULTY OF PHYSICAL SCIENCES
AHMADU BELLO UNIVERSITY ZARIA, NIGERIA

M.Phil. PRGRAMME IN CLIMATE CHANGE ECONOMIC, POLICY AND INNOVATION

1.0 Introduction

In the last three decades that Climate Change has become an issue of concern, the concentration of several greenhouse gases have been increasing since the Industrial Revolution. Several of these Green House Gasses (GHGs) have long atmospheric lifespan of decades to centuries.

The programme is aimed at responding to the need for research, training and understanding of Climate Change impacts, mitigation and adaptation. It will lead to a creation of knowledge based evidence, as well as inculcating trans-disciplinary research methods and approaches on climate issues /challenges.

2.0 Justification

The implication is that these gases respond slowly to emission control strategies. Occasional benefits of the phenomenon, notwithstanding, Climate Change affects the poor, developing countries, rural areas, the women and children mostly. While developing countries contribute the least to Climate Change they are, however, the most seriously affected, destroying homes, basis of people's livelihoods and set in motion a stream of migration and refugees with a number of consequences. This led to the Intergovernmental Panel on Climate Change (IPCC) to raise an alarm in 1990, since then, conferences and workshops have been held, books written and Climate Change courses introduced in the programmes of schools. This document is an effort at setting standards and procedures in the design, teaching and evaluation of Climate Change programmes in

Nigerian Universities. Mainstreaming the programme Climate Change Economics, Policy and Innovation as a programme of study in Nigeria University System has become mandatory as a viable response by tertiary education institutions.

3.0 Objectives

The objectives of the programme are to:

Build Climate Change Economics Policy and Innovation (CCEPI) awareness at all levels within Schools, Ministries, Parastatals, Organizations and Communities.

- Sensitize the society to effectively weigh the evidence regarding global Climate Change as it confronts the challenges;
- Equip students with a higher level of thinking such toward understanding of climate science, climate impacts, climate politics, climate economics, climate policies and laws, climate ethics and equity;
- Create a platform for trans—disciplinary studies of Climate Change issues, develop policy approaches and assess vulnerability
- To explore the nature of important relationship between Climate Change Economics and sustainable Development Process and its Challenges.

4. 0 Admission Requirements

The criteria for admission into the M.Phil**.** in Climate Change Economics, Policy and Innovation (CCEPI) are as follows:

- Candidates must have at least five "0" level credits pass including English and Mathematics;
- Candidates with the M.Sc degree in any other course with a CGPA of at least 3.5, with Subjects Relevant from an NUC Approved University;

- Candidate with Masters in CCPEI with a CGPA of at least 3.5 from an NUC Approved University
- Any other relevant Requirement binding on the Post Graduate Programme of ABU Zaria
- A brief proposal of intended area of research

5.0 Duration of the Programme

A **M.Phil.** Programme shall run for a minimum of eighteen (18) months and a maximum of thirty six (36) months.

6.0 Requirements for Graduation

A candidate must have fulfilled the following conditions to be awarded the

M.Phil. in Climate Change Economics, Policy and Innovation:

M.Phil. programme should primarily be by research. In addition, the Departmental Postgraduate Committee may prescribe some courses of not more than 12 credit units to be taken by the candidate.

A **M.Phil.** Thesis of 24 credit units must be defended before a panel of examiners.

The research Theses should be relevant to the candidate's area of interest on an approved topic by the Department.

A candidate must acquire a minimum of 30 credit unites before graduation (Including Seminar 3 Credit units Project 6 Credit Units)

7.0 List of Courses for the Programme in form of First and Second Semesters:

First Semester Courses (Core)			
S/No	**Course Code**	**Course Titles**	**Credit unites**
2	MPLCC 901	Philosophy and Methodology of CCPEI	3
3	MPHCC 921	Tropical Climatology	3
4	MPLCC 925	Basic metrology	3
5	MPLCC 923	Seminar	3
First Semester Courses (Electives)			
S/No	**Course Code**	**MCourse Titles**	**Credit unites**
1	MPLCC 907	Climate Change Risk Management	**3**
2	MPLCC 909	Climate Change and Gender Development	**3**
3	MPLCC 911	Agricultural Projects in a Changing Climate	**3**
4	MPLCC 913	Sustainable Rural Development in a Changing Climate	**3**
5	MPLCC915	Climate Change and Human/ Animal/ Crop Diseases	**3**
6	MPLCC 917	Principles and Technics of Ecosystem Management	**3**
Second Semester Courses (Core)			
1	MPLCC 900	Project	**6**
2	MPLCC 902	Systems of Innovations and Emerging Technology	**3**
3	MPLCC 904	Climate Change Law Policy and Politics	**3**
Second Semester courses (Elective)			
1	MPLCC 906	Climate Change Prediction and Engineering Infrastructure	3

2	MPLCC 908	Ecosystem Management and Sustainability	3
3	MPLCC 910	Climate Change and Wild life Management	3
4	MPLCC 912	Climate Change and Animal Biodiversity	3
5	MPLCC 914	Energy Management Principle	3
6	MPLCC 916	Integrated Water Resources Management and Climate Change Adaptation	3
7	MPLCC 920	Climate Change and Rural Entrepreneurship	3

8.0 COURSE DESCRIPTIONS FOR DOCTORATE (Ph.D.) PROGRAMME IN CLIMATE CHANGE ECONOMICS POLICY AND INNOVATION (CCEPI):

7.1 Core Courses

MPLCC 900: Project (3 Credit Units)

MPLCC 901: Philosophy and Methodology of Climate Change (3 Credit Units)

Origin, composition, structure and dynamics of the atmosphere. Fhe global climate system. Factors influencing climate change including interactions within the atmosphere, oceans, solid earth, and biosphere; Stability and sensitivity of climate system.; global warning, ozone depletion and other human influences. Greenhouse effects, atmospheric radiation, Elj.o. Scientific evidence of Climate Change. Methods of observation and measurement of Climate Change. Tests of validity and reliability. Quantitative and qualitative data gathering techniques.

MPLCC 921: Tropical Climatology 3 Credit Units

Delimiting the tropical Climate regions, Radiation and Tempreture condition in the tropics, General circulation of the Tropical Atmosphere. Inter Tropical Convergens Zones.

MPLCC 925: Basic Metrology 3 Credit Units

PHCC 903: Economics of Climate Change (3 Credit Units)

Economic impact of Climate Change. Costs of adaptation in various sectors (water, agriculture, forestry and fisheries; natural ecosystems arid health. Theory and practice of economic analysis of environmental problems (efficiency, externalities, and public goods). Environmental policy instruments (carbon trading, tax incentives; revenue recycling). Management of depletable and non-renewable resources. Rational decision making techniques: Analysis of risk and uncertainty. Cost benelit analysis. Discounting of future and distant effects choices made on climate

PHCC 904: Climate Change Law, Policy and Politics (3 Credit Units)

Background to the law, policy and politics on Climate Change; Applicable International Environmental Law Principles on Climate Change; precautionary principle, principle of prevention, inter-generational principle, sustainable development, etc.; Establishment of the Intergovernmental Panel on Climate Change (IPCC); Critical theories in Climate Change law, policy and politics; the globalization theory, political economy of Climate Change; Problems of delimitation, identification and global perception o issues of global commons, trans-boundary nature of adverse consequences of Climate Change; Local cumulative problem of Climate Change and problem of inter-linkages between Climate Change and other global environmental concerns such as Depletion of the Ozone layer,

Biodiversity Loss, Desertification, Deforestation, etc.; Negotiation and implementation of multilateral agreements/treaties on Climate

Change: Politics of conflict and compromise; International/National legal instruments for Climate Change mitigation and control: the Vienna Convention for the Protection of the Ozone Layer, 1985, the Montreal Protocol on Substances That Deplete the Ozone Layer, 1987 and its Amendments, 1992, the Convention on Biological Diversity, 1992, the United Nations Framework Convention on Climate Change, 1.992 and the Kyoto Protocol, 1997, the United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, 1994; the National Environmental Impact Assessment Act, 1994; the National Environmental Standards, Regulations and Enforcement Agency (Establishment) Act 2007; Nigeria

Gas Flaring/Economic Development and Climate Change: National Response...Statutory Options, Policy Options, and Approved Industry Options; Public Private Partnership (PPP) for 'Alternative Climate Change Preventive Plan'; International/National Action Programs/Mechanisms to reduce the impact of Climate Change: joint implementation, the development mechanism, emission trading system, reducing Emission from Deforestation and forest Degradation (REDD) programme; the Berlin Mandate, 1995; intractable disputes between the industrial and nonindustrial countries on the binding effect/enforcement of Climate Change treaties

Climate Change Systems of Innovations and Emerging Technologies (3 Units)

The state of science and technology in the climate innovation system in Nigeria and Africa. Concept of innovation and innovation system, national system of innovation. Identifying key actors in the Climate Change innovation systems. The role and

characteristics of actors in the Climate Change innovation system. Technological capability of actors in the Climate Change innovation system, investment, production, linkage, marketing and learning. Production technologies for heat, electricity, food and transportation. Solar energy, wind energy, hydropower, biomass energy, geothermal energy, tidal/wave energy. The role of different energy technologies in generating and reducing greenhouse emissions. Energy efficient systems

PHCC 905 Climate Change Agricultural Production (3 Credit Units)

.Basic concepts and definitions of food security, nutrition security and gender. Conceptual framework of food security, gender and Climate Cha ngc. Poverty and food security situations in Africa. Changing Climate on (‘ and food production, distribution, and accessibility. Methods of ameliorating Climate Changes impacts on soils, crop farming, livestock, fisheries, forestry. Farm housing design in relation to Climate Change. Aquatic, land flora and fauna in a changing climate and food security. Climate Change, social conflict and food security. The institutional settings for addressing food security. Concepts, tools and frameworks in gender analysis; Gender- Climate Change link;

MPLCC 923: Seminar (3 **Credit Unites)**

8.2 Elective Courses

MPLCC 906: Climate Change Prediction and Engineering Infrastructure (3 CreditUnits)

Climate Change assessment, monitoring and prediction. Vulnerability, response capability and adaptation to Climate Change. Climate Change prediction models. Concept of natural disasters and hazards. Disasters, hazards and early warning systems. Early warning methodologies and analyses. Intervention phases of early warning systems. Early warning programmes of different countries. The costs of adapting engineering

infrastructure to Climate Change. Impacts of Climate Change on durabUity and safety of engineering infrastructure. Design factors of safety as adaptation mechanism. Materials, construction methods, operational and maintenance considerations required to adapt to Climate Change.

MPLCC 909: Climate Change and Gender Development (3 Credit Units)

Gender inequality in the context of Climate Change. Gender agriculture, health , food security and Climate Change. Gendered impacts of Climate Change on wage labour; migration; and conflict. Gendered perspective of Climate Change adaptation strategies; International Climate Change framework and policy; linking gender analysis with policy and framework in Climate Change adaptation:

Typology of policy and analytical approaches to address women's needs and interests in Climate Change adaptation; Typology of projects to address women's needs and interests in Climate Change adaptation.

MPLCC 907: Climate Change Risk Management - (3 Credit Units)

Basic concepts and terminologies of Climate Change risk management risk, probability, hazards, Consequence, vulnerability, disaster, risk assessment, risk estimation, risk evaluation, risk reduction, option analysis and risk management; Climate Change risk reduction planning, early warning, mitigation of hydro-metrological hazards, mitigation of geological hazards. Risk Assessment- Elements of hazard, risk and vulnerability assessment. Types and methods of risk assessment, evaluation and management. Information for Risk Reduction Planning, Risk monitoring, Preparedness measures and

response, community ba'd Climate Change management, The Role of community and local authorities in risk reduction and management (RRM). Methods of managing risk.

MPLCC 908: Ecosystem Management and Sustainability- (3 Credit Units)

Concept of ecosystems management. Ecosystem structure and functional mechanisms. Ecosystem biodiversity goods and services and role in moderating Climate Change. Ecological knowledge, indicators, ecosystem and health. Climate Change and ecosystem degradation. Strategies for ecosystem management in Climate Change adaptation . Socio-economic and environmental benefits of adopting an ecosystems management approach. Adaptive management of ecosystem for sustainable development. Sustainability, principles, concepts and poverty. Consumption, population, technology and carrying capacity.

MPLCC 919: Principles and Technic of Ecosystem Management- (3 Credit Units)

Baseline audits: water, food, energy, waste and transportation. Concepts of carbon and ecological footprint. Ecology and nature, population and resources, carbon cycle, green house gases (GHGs) and biodiversity. Water:

portable, shortage and conservation. Sustainable resources; forestry; fishing, agriculture, and mining. Social security, peace, justice. Human relation to nature and human settlements. Sustainable designs and transportation-building, urban planning, and waste management.

MPLCC 911: Agricultural Projects in a Changing Climate - (3 Credit Units)

Concepts, analysis and design of agricultural projects. Life cycle of agricultural projects. Integrating agricultural development with Climate Change. Project appraisal and valuation. Agricultural project appraisal methods under Climate Change scenarios.

Appraisal of Climate Chanqn insurance options. Matrix for evaluating project appraisal options undnr changing climate, low-carbon agriculture. Climate Change and agricultural policy. Methods of assessing Climate Change risks in agricultural projects. Case studies on Climate Change threats to agricultural projects in Nigeria.

MPLCC 912: Climate Change, Animal Biodiversity - (3 Credit Units)

Concepts and definitions in wildlife and animal biodiversity. Terrestrial and aquatic wildlife. Effect of Climate Change on wildlife diseases including history of species extinctions. Climate Change and ecological perturbations; flood, famine, hyperthermia, impacts on wildlife and biodiversity. Climate Change and ecological adaptation of species, breeding and general genetic resources.

MPLCC 910: Climate Change and Wildlife Management- (3 Credit Units)

Climate Change, wildlife conservation and park management. Wildlife farming, development and preservation of coastal wet lands, establishment of zoological gardens and preservation of endangered species. Climate Change and threat', to natural populations, and communities, introduction of exotic species and ecological portfolios. Climate Change, public education and legislation in wildlife, conservation and park management.

MPLCC 915: Climate Change and Human/Animal/Crop Diseases- (3 Credit Units)

Concept and definitions of diseases, types and causative agents and predisposing factors. Impact of Climate Change on global disease prevalence. Emerging infectious diseases of man animals, and crops. 1 heir epidemiology and influence of climate . Pathogen, vector prevalence and environmental temperature. Common zoonoses and their relationship to changes in weather. Climate, disease and ecology interactions. Adaptation and control

mechanism to emerging and re-emerging diseases of man, animal, and crops. Biosecurity measures. Impact of Climate Change and emerging crop diseases. Ecology and ecological distribution of crops, and biomes. Climate and distribution of crop types and pathogens. Epidemiology of common crop disease and their relation to Climate Change. Drivers of emerging crop diseases. Climate Change as predisposing factor in emerging infectious diseases (EIDS) of plants. Surveillance of emerging crop diseases. Stress factors in changing climate and crop health, pollution, nutrient deprivation, exposure to toxic substances. Adaptation mechanisms to Climate Change induced emerging infectious and non infectious diseases of crops.

MPLCC 914: Energy Management Principles - (3 Credit Units)

Carbon footprint of energy production and consumption, fossil fuels global warming potential and Climate Change. Elements of heat transfer- conduction, convection and radiation. Sources of energy waste in buildings and industrial systems. Energy efficiency and security- indicators in the main energy use sectors. Measurement of energy loss (energy analysis and sustainability). Energy conversion measures. Insulation used for waste heat and cold. Temperature control-the thermostat in heating and cooling applications. Scaling up production and utilization of low carbon and climate resilient energy technologies- hydrogen energy, cogeneration, Photovoltaic, Biomass, fuel cells, etc.

MPLCC 917: Environmental Economics - (3 Credit Units)

Concept, scope and limitations of environmental economics. Fundamental Issues in the economic approach to environmental issues. Economy- environment interdependence; The drivers of environmental impact. Pollution Control and modeling mechanisms;

Efficiency level of pollution; static model of efficient pollution; modified efficiency targets; Efficient levels of emissions of stock pollutants. Inter-temporal analysis of stock pollution; variable decay; Estimating the cost of abating pollution. Pollution control Instruments. A comparison of the relative advantages of command and control, emissions tax, emission ‘abatement subsidy and marketable permit instruments. International trade and the environment.

Valuing the environment; dimensions of value; the theory of environmental valuation; and environmental valuation techniques. The efficient and optimal use of natural resources; a simple model of resources depletion and the theory of optimal resource extraction.

MPLCC 916: IWRM and Climate Change Adaptation (3 Credit Units)

Concepts and techniques of Integrated Water Resources Management IWRM. Climate Change impacts on the hydrological cycle water resources, weather variability and environmental conditions. Adaptation options and alternatives in the IWRM tool kit. Climate Change and weather variability as forces in models for predicting impacts and selection of best coping strategies and practices.

MPLCC 913: Sustainable Rural Development in a changing climate - (3 Credit Units)

Concept of growth, development and sustainability. Concept of sustainable rural’ development. Communicating Climate Change: Understanding the Issues. Impacts of Climate Change on society and the environment. Sustainability issues in rural agricultural development. Politics of Climate Change in Development. Sustaining rural communities

under Climate Change. Evaluating current research in Climate Change and rural development. Case studies.

MPLCC 902: Climate Change Innovations in the Arts and Humanities- (3 Credit Units)

Introduction to Climate Change and contemporary developments in the Arts, Impacts of Climate Change in sound and creative resources. Environmental effects on Ensemble, theatre performance and its exhibition. Innovative approaches to Climate Change adaptation in the arts. Social, cultural approaches and enlightenment on Climate Change knowledge and adaptation in the arts. Dissemination of Climate Change issues in rural and urban centers in creative forms.

9.0 Minimum Facilities and Staff Required for Doctorate (Ph.D) Post Graduate Studies in Climate Change Economics, Policy and Innovation

The facilities required for running/teaching Post Graduate Programme in Climate Change Economic, Policy and Innovation are available. They include;

i. A functional meteorological Station with up-to-date weather facilities in Institute of Agricultural Research (IAR).
ii. A GIS Laboratory with computers and GIS software in Geography Department
iii. Faculty of Science Multi-User Laboratory
iv. Physical Laboratories in Geography, Biological Sciences, Geology and IAR
v. Class Rooms, incudes RM 309, 311, theater AB/BC, Z 1.1/1.2 and Faculty of Science Theaters 1and 2
vi. Ahmadu Bello University Botanical Garden
vii. Kasim Ibrahim Library
viii. A. B. U. Dam
ix. NAPRI