

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

**M.Sc. IN CLIMATE CHANGE ECONOMICS, 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 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**

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 Economy, Policy and Innovation awareness at all levels within Schools, Ministries, Parastatals, Organisations and Communities.
- equip students with a higher level of thinking towards understanding of climate science, climate impacts, climate politics, climate economics, climate policies and laws, climate ethics and equity;
- equip students with the skill to analyze, evaluate and model the various climate change impact ranging from global to local levels to solve societal problems;
- establish a multi-disciplinary research team to conduct Climate Change Economy, Policy and Innovation research in Nigeria and beyond;
- lead to exposition of broad approaches to research opportunities in global issues of Climate Change mitigation and adaptation
- explore the relationship between Climate Change Economy, Policy and Innovation and Sustainable development processes and its challenges

### **4.0 Admission Requirements**

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

- Candidates must have at least five “O” level credits pass including English and Mathematics;

- Candidates with Bachelors degree in Physical, Natural, Applied, Environmental, Agricultural Sciences and Education with a minimum of second class (lower) from an NUC approved University;
- Candidates with a Post Graduate Diploma in Climate Change economics, Policy and Innovation awarded by a recognized institution with not less than an upper credit.
- Any other relevant requirement binding the Post Graduate programme in ABU Zaria

### **5.0 Duration of the Programme**

A Masters 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 an M.Sc in Climate Change Economics, Policy and Innovation:

- i. registered and passed a minimum of 36 credit units of both core and elective courses as follows:
  - Core courses — (27 Units)
  - Electives – (9 Units)
  - Dissertation – (6 Units)
  - Total – (36 Units)

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

<b>First Semester Courses (Core)</b>		
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDIT UNITS</b>
<b>MSCCC 801</b>	Philosophy and Methodology of Climate Change	<b>3</b>
<b>MSCCC 803</b>	Economics of Climate Change	<b>3</b>
<b>MSCCC 805</b>	Climate Change and Agricultural Production	<b>3</b>
<b>MSCCC 823</b>	Seminar	<b>3</b>
<b>MSCCC 825</b>	Research Methods	<b>3</b>
<b>MSCCC 809</b>	Agro- Climatology	<b>3</b>
<b>First Semester Courses (Electives)</b>		
<b>MSCCC 807</b>	Climate Change Risk Management	<b>3</b>
<b>MSCCC 811</b>	Agricultural Projects in a Changing Climate	<b>3</b>
<b>MSCCC 813</b>	Sustainable Rural Development in a Changing Climate	<b>3</b>
<b>MSCCC 815</b>	Climate Change and Human/Animal/Crop Diseases	<b>3</b>
<b>MSCCC 817</b>	Environmental Economics	<b>3</b>

<b>Second Semester Courses (Core)</b>		
<b>MSCCC 800</b>	Dissertation	<b>6</b>
<b>MSCCC 802</b>	Climate Change, Systems of Innovations and Emerging Technologies	<b>3</b>
<b>MSCCC 804</b>	Climate Change Law, Policy and Politics	<b>3</b>
<b>MSCCC 812</b>	Basic Statistics and Computer Application	<b>3</b>
<b>Second Semester Courses (Electives)</b>		
<b>MSCCC 806</b>	Climate Change Prediction and Engineering Infrastructure	<b>3</b>
<b>MSCCC 808</b>	Ecosystem Management and Sustainability	<b>3</b>
<b>MSCCC 810</b>	Climate Change and Wildlife Management	<b>3</b>
<b>MSCCC 814</b>	Energy Management Principles	<b>3</b>
<b>MSCCC 816</b>	Integrated Water Resources Management (IWRM) and Climate Change Adaptation	<b>3</b>

**8.0 Course Descriptions for M.Sc. in Climate Change Economics, Policy and Innovation (CCEPI):**

**MSCCC 801 Philosophy and Methodology of Climate Change (3 Units)**

Origin, composition, structure and dynamics of the atmosphere. The global climate system. Factors influencing climate change including interactions within the atmosphere, oceans, solid earth, and biosphere; Stability and sensitivity of climate system.; global warming, ozone depletion and other human influences. Greenhouse effects, atmospheric radiation, El-Nino, Scientific evidence of Climate Change, Methods of observation and

measurement of Climate Change. Tests of validity and reliability, Quantitative and qualitative data gathering techniques.

### **MSCCC 802 Climate Change Law, Policy and Politics (3 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, 1992 and the Kyoto Protocol, 1997, the United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/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

### **MSCCC 803 Economics of Climate Change (3 Units)**

Economic impact of Climate Change. Costs of adaptation in various sectors (water, agriculture, forestry and fisheries; natural ecosystems and 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 benefit analysis. Discounting of future and distant effects choices made on climate

### **MSCCC 804 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

### **MSCCC 805 Climate Change and Agricultural Production (3 Units)**

Basic concepts and definitions of food security, nutrition, security and gender. Conceptual framework of food security, gender and Climate Change. Poverty and food security situations in Africa. Changing climate and food production, distribution and accessibility. Methods of ameliorating Climate Change 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.

### **MSCCC 806 Climate Change Prediction and Engineering Infrastructure - (3Units)**

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 durability 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.

### **MSCCC 807 Climate Change Risk Management - (3 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 bad Climate Change management, The Role of community and local authorities in risk reduction and management (RRM) and Methods of managing risk.

### **MSCCC 808 Ecosystem Management and Sustainability- (3 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. 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.

**MSCCC 809 Agro- Climatology- (3 units)**

Climate change and Agriculture, Concept and nature of radiation, evapotranspiration and potential evapotranspiration, Precipitation and Agriculture in relation to climate change.

**MSCCC 810 Climate Change and Wildlife Management- (3 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. 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.

**MSCCC 811 Agricultural Projects in a Changing Climate - (3 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 Change insurance options. Matrix for evaluating project appraisal options under 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.

**MSCCC 812 Basic Statistics and Computer Application – (3 Units)**

Functions of statistics, Review of algebraic operations, Subscript and summations, Data description and characteristics, Probability and sampling distributions, Non parametric tests of association and measures of correlation.

**MSCCC 813 Sustainable Rural Development in a changing climate - (3 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.

**MSCCC 814 Energy Management Principles - (3 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.

### **MSCCC 815 Climate Change and Human/Animal/Crop Diseases- (3 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. Their 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.

### **MSCCC 816 Integrated Water Resources Management (IWRM) and Climate Change Adaptation (3 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.

### **MSCCC 817 Environmental Economics - (3 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 resource depletion and the theory of optimal resource extraction.

### **MSCCC 825 Research Methods – (3 Units)**

Relevant issues in climate change, Problem definition, Hypothesis formulation and testing, Sampling and quantification, Use of primary and secondary data, Role of literature review in climate change related research, presentation of results.

### **MSCCC 800 Dissertation (6 Units)**

### **MSCCC 823 Seminar (3 Units)**

## **9.0 Facilities and Staffing**

The Facilities required for running/teaching Postgraduate 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 for 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 Departments and Institute for Agricultural Research (IAR).
- v. Classrooms include: Room 309,311, Theater AB/BC, Z1.1/1.2 and FSLT 1/2
- vi. Kashim Ibrahim Library (KIL)
- vii. Libraries in Geography, Biological Sciences, Geology Departments and Institute for Agricultural Research (IAR).
- viii. Ahmadu Bello University Botanical Garden and practical farms in Institute for Agricultural Research (IAR).
- ix. Ahmadu Bello University Dam
- x. National Animal Production Research Institute (NAPRI)