Course Module Description

<table>
<tr><th colspan="7">ENVIRONMENTAL SIMULATION AND MODELING</th></tr>
<tr><td colspan="2">Module code
ESC 801</td><td>Student workload
2 hours</td><td>Credits (according to ECTS)
1.125 ECTS</td><td>Semester
1st. Sem.</td><td>Frequency
Every First Semester</td><td>Duration
1 Semester</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
a) Class Work
b) Seminars
c) Students' Presentation
d) Field Work</td><td>Contact hours
18 hours</td><td>Independent study
6 hours</td><td colspan="2">Class size
10 students</td></tr>
<tr><td>2</td><td colspan="6">Prerequisites for participation:
Good First Degree in Environmental background.</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes
After completing the module, students will be able to:
(i) understand the criteria for the use of data in modeling;
(ii) Understand the classification of models; (iii)
(iii) know flood routing models,]
(iv) Understand environmental forecasting;
(v) Know forecast methods: short-term forecast, on-line systems, updating of parameters; long-term forecast for seasonal runoff, off-line systems.</td></tr>
<tr><td>4</td><td colspan="6">Subject Aim: The aim of the subject is to expose the students to environmental simulation and modeling.</td></tr>
<tr><td>5</td><td colspan="6">Teaching methods: The teaching methods will include:
(i) Lectures (ii) Practical Demonstrations (iii) You Tube (iv) Field Trip (v) Project work (vi) Sharing of materials via learning tools, case studies, group work, individual presentations, and discussions</td></tr>
<tr><td>6</td><td colspan="6">Assessment methods
Continuous Assessment, Take Home Assignments, Field Trip Reports and End of the semester examination</td></tr>
<tr><td>7</td><td colspan="6">This module is used in the following degree programmes as well
PhD Environmental Systems and Climate Change</td></tr>
<tr><td>8</td><td colspan="6">Responsibility for module
Prof. O. D. Akinyemi</td></tr>
<tr><td>9</td><td colspan="6">Other information
This course is a 2-unit course which translates to 24 hours contact in a 12-week semester</td></tr>
<tr><td>10</td><td colspan="6">Recommended Materials
1. Hydrolgy for Engineers and Planners; Allen T. Hjelmfelt, Jr., John J. Cassidy
2. Guide to Hydrological Practices 5th edition 1994, Data acquisition and processing, analysis, forecasting and other applications; WMO-No 168.</td></tr>
</table>

ESA 802 Course Description

Module/Course Title:	**Resource and Environmental Economics**				
Module/ Course code	**Student work-load**	**Credits** (ECTS)	**Semester**	**Frequency**	**Duration**
ESC 802	30 hours	2	2nd Semester	Every 2nd semester with 2hours lecture every week	1 semester

1	**Types of courses** Theory with Field Practical and Class Presentations	**Contact hours** 2hours/week	**Independent study** 2 hours	**Class size** 5 - 10 students (up to 30)

2	**Prerequisites for participation** Good knowledge of microeconomics, calculus, statistics and research methods evidenced by at least Grade C level passes of these or related courses at undergraduate levels. Ability to read, speak and write in English Language evidenced by at least O level Credit Pass in English Language.
3	**Learning outcomes** Upon a successful completion of this course, students should be able to: a) Understand causes of market failure, and the link to environmental degradation and/or unsustainable use of ecosystems and natural resources; b) Be familiar with the main types of policy tools that governments can use to correct "market failures" related to the environment and natural resources; and c) Understand the use of non-market valuation techniques, including hedonic pricing, contingent valuation and choice experiments, among others, in support of Social Benefit-Cost Analysis to address ecosystems and natural resource uses problems.
4	**Subject aims/Content** This course exposes students to the economic principles underlying the design of efficient environmental policies and the optimal management of natural resources. It identifies conditions under which market failures lead to unsustainable use of ecosystems and natural resources, and discusses economic policies that can counteract such market failures. It exposes students to non-market valuation techniques including hedonic pricing, contingent valuation and choice experiments as tools of economic valuation in support of Social Benefit-Cost Analysis.
5	**Teaching methods** Class lectures, case studies, group work, assigned readings and discussions.
6	**Assessment methods** Graded assignments (10marks), mid-semester test (15 marks), course project report and presentations based on group work (15 marks) and final examination (60 marks)
8	**This module/course is used in the following degree programme as well** M. Agric. Agricultural Economics (Environmental and Resource Economics Option)
10	**Responsibility for module/course**
	Course lecturer organizes all class sessions, moderate students' contributions to various class sessions including case studies and presentations, and maintain class discipline. He/she also

Module/Course Title:			Resource and Environmental Economics		
Module/ Course code	**Student work-load**	**Credits** (ECTS)	**Semester**	**Frequency**	**Duration**
ESC 802	30 hours	2	2nd Semester	Every 2nd semester with 2hours lecture every week	1 semester
	conducts and assesses students' submissions on assignments, class projects, tests and examination. *Students* have the responsibility to attend/participate in at least 70% of course activities, present themselves for tests/examinations, and submit assignment and class project reports within specified deadlines. Late submissions may attract penalties.				
11	**Other information –** ***Recommended Text*** Baker, R. and Ruting, B. (2014). *Environmental Policy Analysis: A Guide to Non-Market Valuation*, Productivity Commission Staff Working Paper, Canberra Dasgupta, P. (2010). The Place of Nature in Economic Development, Chapter 74 in Rodrik D and Rosenzweig, M. (Eds), *Handbook of Development Economics*, 5: 4977-5046. Kahn, J.R. (2005). The Economic Approach to Environmental and Natural Resources. Third Edition, Thomson South-Western Perman R., Ma, Y., Common, M., Maddison, D., and McGilvray, J. (2011). Natural Resource and Environmental Economics. Fourth Edition, Pearson-Addison Wesley ***Course Lecturer:*** Professor Adebayo M. Shittu				

CLIMATE CHANGE PROCESSES, HISTORY AND CONTEMPORARY					
module/ course code	**Student work-load**	**Credits**	**Semester**	**Frequency**	**Duration**
ESC 803	2 hours	2	First Semester	Every First semester	1 semester

1	**Types of courses** a) Lecture b) Tutorial c) Field work	**Contact Hours** 2 hours	**Independent study** 4 hours / week	**Class size** 3 students
2	**Prerequisites for participation** English Language skill			
3	**Learning outcomes** After studying this course, students will be able to: • understand climate change; • identify causes of climate change;			

	• describe impact of climate change on agricultural production, food security and ecosystem; • discuss vulnerability assessment and strategies for climate change impacts; • describe adaptive management for climate change impacts.
4	**Subject aims/Content** **Subject aim** The aim of the subject is to expose the students to climate change impact, vulnerability and adaptive management Subject content - Climate change and disaster / hazards consequences (erosion, floods, storms, acids rain, heat waves, resource depletion etc) - Challenges on agricultural production and food security – soils, cropping / farming systems, food and animal production, distribution and accessibility - Impacts on livestock, fisheries, forestry, post harvest and farm produce storage, water resources - Land use, savanna and forest fires and implications for ecosystem structure, food chain and biodiversity loss - Climate change, ecosystem degradation and food security situation in sub-Sahara Africa - Vulnerability assessment and strategies for ecosystem management in a changing climate (adaptation, mitigation, resilience etc) - Adaptive management of ecosystems for sustainable development - Principles and concept of sustainability and carrying capacity - Climate change and sustainability of environmental resources (soil, vegetation and forest resources, water resources and aquatic organisms, agriculture and crop biodiversity) - Climate change – human activities nexus and concept of ecological rehabilitation
5	**Teaching methods** Lectures, discussions, project work and case studies
6	**Assessment methods** i. Term paper 30% ii. Examination 70%
7	**This module/course is used in the following degree programme/s as well** ...
8	**Responsibility for module/course** Professor O. D. Akinyemi
9	**Other information** References 1. Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: Impacts, Adaptation and Vulnerability. Contribution of working Group II to the Third Assessment Report of the IPCC. 2. Sombroek, W. G. and Gommes, R. 1996. The climate change Agricultural Conundrum.

	3. Watson, D. J. 1983. Climate, weather and plant yield in environmental control of plant growth, London, Academic Press

ESA 804: ENVIRONMENTAL SAFETY AND PROTECTION						
module/ course code ESA 804	**Student work-load** 24 hours	**Credits** (ECTS) 2	**Semester** 2nd Sem.	**Frequency** Every Second Sem.,	**Duration** 1 semester(s)	
1	**Types of courses** a) Teaching b) Presentations	**Contact hours** 24 hours		**Independent study** 5 hours/Week	**Class size** 10 students	
5	**Prerequisites for participation** e.g. The candidates must have had their undergraduate study in environment related disciplines e.g. The candidates must be familiar with peculiar terminologies in the field of environmental sciences. English language proficiency is required					
2	**Learning outcomes** At the completion of this course, the candidates must be have a good mastery of the following: (i) Identification of pollution sources (ii) Characterisation of materials that are capable of polluting the environment (iii) identification of the roles of Government policies in environment protection (iv) Appreciation of sundry constraints to effectiveness of environmental policies (v) Understanding of the relationship between federal and State policies on environment (vi) Knowledge of policies that govern the management of hazardous and other solid wastes (vii) Awareness of the rule governing solid waste management in agric. sector (viii) Knowledge of remediation requirements for livestock waste sites (ix) Identification of appropriate PPE for different work/activities including agric. Industry (x) Preparation of Health risk assessment in different work scenario					
3	Subject aims/Content ▪ Major issues and public policy on environmental protection ▪ Managerial problem associated with the prevention, mitigation and clean-up of environmental problems ▪ Governmental involvement and regulation and emerging trends as they influence decision-making in the public and private sector ▪ Physical, political, legal, economic and technological factors that help shape and constrain environmental policy ▪ Sources and substances that pollute the environment ▪ Rules that govern the management of hazardous and other solid wastes, including industrial, household and livestock wastes ▪ Requirements governing solid waste generation, storage, transportation, processing, treatment and disposal as well as closure and remediation requirements for livestock waste sites ▪ The relationship between Federal and State rules as they apply to the management of waste and enforcement issues to waste management					

	▪ Safety of the human component of the environment – Risk, Exposure, Outcome ▪ Use of PPE in the Agric. Industry
4	**Teaching methods** (i) Lectures (ii) Group discussions (iii) Individual assignment (iv) Case studies
6	**Assessment methods** (i) Continuous Assessment 30% (ii) Examination 70%
8	**This module/course is used in the following degree programme/s as well** ▪ ESA 804 is used in Environmental Systems and Climate change programme of CEADESE
10	**Responsibility for module/course** (i) Prof. T. A. Arowolo - Lecturer (ii) Dr. O. Oguntoke - Lecturer
11	**Other information** e.g. bibliographical references ▪ Environmental Science by S. C. Santra (2013) ▪ Making Policies Work: Between Environmental Policies and Environmental Protection ▪ Federal Environmental Protection Agency Act ▪ Other several Online materials provided in the course of the Programme

RESEARCH METHODOLOGY						
Module code ESC 805		Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work		**Contact hours** 18 hours	**Independent study** 6 hours		**Class size** 10 students
2	**Prerequisites for participation** Good First Degree					
3	***Learning outcomes***					

	Students would be able to • know different sampling techniques; • different ways of data representation; and • different experimental design.
4	**Subject aims** The aim of the module is to 1. Make students appreciate the importance of research methodology; 2. Equip students with necessary sampling technique, experimental designs and data representation; 3. Develop students' problem-solving skills to propose appropriate experimental design to environmental problems
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change
8	**Responsibility for module** Professor M. Shittu
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** • Applied Statistics for Scientific Studies Published by Afrika-Link Books, 1999 • Prctical Statistics for Analytical Chemists by Robert L. Anderson, Published by Van Nostrand Reinhold, New York

SOIL PROCESSES, ASSESSMENT AND MANAGEMENT						
module/ course code ESC 806		**Student work-load** 2 hours	**Credits** 2	**Semester** Second Semester	**Frequency** Every Second semester	**Duration** Second semester
1	**Types of courses** d) Lecture e) Tutorial f) Field work		**Contact Hours** 2 hours		**Independent study** 4 hours / week	**Class size** 3 students

2	**Prerequisites for participation** English Language skill			
3	**Learning outcomes** After studying this course, students will be able to: • understand soil genesis, classification and mapping; • identify physical and chemical properties of soils; • describe soil reactions; • discuss soil degradation and management; • describe soil carbon sequestration; • understand soil conservation measures			
4	**Subject aims/Content** **Subject aim** The aim of the subject is to expose the students to soil genesis, classification, mapping and soil fertility management. Subject content - Soils in the ecosystem, soil genesis and factors of soil formation; - Soil resources inventories - Soil morphology and characterization - Physical and morphological properties of soils - Main soil process; - Physical and chemical properties of soils: colour, texture, structure, consistency, porosity, permeability, drainage; - Soil reaction, soil clays, Cations Exchange Capacity, Anion absorption and exchange, soil buffering, organic colloids; - Soil classification and mapping; - Soil data interpretations and multi-criteria evaluations; - Soil fertility assessment and management; - Soil organic matter management (continuation) and soil carbon and carbon sequestration, soil erosion and soil conservation measures; - Soil conservation measure; - Soil toxicity and soil contamination: land degradation assessment -			
5	**Teaching methods** Lectures, discussions, project work and case studies			
6	**Assessment methods** iii. Term paper 30% iv. Examination 70%			
7	**This module/course is used in the following degree programme/s as well** ...			

8	**Responsibility for module/course** Dr B. S. Bada and Dr G. A. Ajiboye
9	**Other information** References 1. White R. E. 2006. Principle and practice of soil science: The soil as a natural resource. 4th Edition, Blackwell Publishing. 2. FAO. 1972. Effects of intensive fertilizer use on the human environment. Report of the consultation convened at Rome 20-25 February, 1972

ESC 813: Remote Sensing, GIS and Land Management

Example of a module/course description

Module/Course Title: ESC 811: Remote Sensing, GIS and Land Management					
module/ ESC 813 course code (if used)	**Student work-load** 3	**Credits** (ECTS) 3	**Semester** First Semester	**Frequency** Every First Semester,	**Duration** X semester(s)

1	**Types of courses** g) Lecture h) Tutorial i) Demonstration j) Practical	**Contact hours** 3 hours	**Independent study** 6 hours/week	**Class size** X students
5	**Prerequisites for participation** Not applicable Requires English language skills			
2	**Learning outcomes** After completing the module, students will be able to: (vi) Explain what a map is. (vii) Describe the characteristics of a map. (viii) List the types of maps. (ix) Explain the concept of projection in map making. (x) Describe the types of projection and their uses; (xi) Discuss the concept of scale in maps; (xii) Evaluate the different ways of showing scale vis-à-vis types of scale; (xiii) Describe the presentation of variables in space as maps; (xiv) Analyse the characterization of variables in space and time; (xv) Evaluate 3-Dimentional mapping and uses thereof; (xvi) Examine the concept of modeling in mapping;			

	(xvii) explain the concept of Hydrologic mapping; (xviii) list and describe the morphometric properties of streams and their uses in land management ; (xix) explain the concept of Remote Sensing Application (xx) Describe its importance in land management; (xxi) Use the tools of Remote Sensing Application in mapping and land analysis (xxii) GIS
3	**Subject aims/Content** **Subject Aim:** The aim of the subject is to expose the students to mapping, measurements and analysis of variables in space and time. **Subject Content:** (i) Introduction to Carthography. (ii) Principles of Projection. (iii) Introduction to mapping- Parts, Characteristics and types of. (iv) Presentation of three dimensional problems in maps.. (v) Presentation of variables in space. (vi) Hydrological mapping-Surface water maps, water quality maps,groundwater maps, Hydro-geological maps. (vii) Landuse mapping. (viii) Remote Sensing Application. (ix) Interpretation of aerial photograph and space Imagery. (x) Global Positioning System. (xi) Geographical Information System
4	**Teaching methods** The teaching methods will include: (ii) Lectures (iii) Project work
6	**Assessment methods** (i) Continuous Assessment 30% (ii) Examination 70%
8	**This module/course is used in the following degree programme/s as well** ...
10	**Responsibility for module/course** (i) Prof. G. C. Ufoegbune (2) Dr John Oyedepo
11	**Other information** 3. Lillesand, T.M. and R.W. Kiefer, 1994: *Remote Sensing and Image Interpretation*. Third edition. New York, John Wiley and Sons 4. Richards, J. A., 1986. Remote Sensing Digital Image Analysis: An Introduction Springer-Verlag, Berlin. Introductory to Hydrology; Warren Viessman, Jr, John

W. Knapp, Gary L.Lewis
5. Richards, J. A., 1986. Remote Sensing Digital Image Analysis: An Introduction . Springer-Verlag, Berlin.

Example of a module/course description

Module/Course Title						
module/ course code ESC 808	**Student work-load** 2 hours	**Credits** 2	**Semester** First Semester	**Frequency** Every First semester	**Duration** 1 semester	
1	**Types of courses** k) Lecture l) Tutorial m) Field work	**Contact Hours** 2 hours	**Independent study** 4 hours / week	**Class size** 8 students		
2	**Prerequisites for participation** English Language skill					
3	**Learning outcomes** After studying this course, students will be able to: • understand paleo-climatology and tropospheric photo-chemistry; • identify ozone depleting substances; • describe factors influencing climate change; • discuss greenhouse effects and remediation techniques; • describe global warming, acid rain and acidification.					
4	**Subject aims/Content** **Subject aim** The aim of the subject is to expose the students to paleo-climatology, tropospheric photo-chemistry, ozone depletion and remediation techniques. Subject content - An overview of Paleo-climatology - Atmospheric components, structure and the general circulation of the atmosphere - History of climate, natural and anthropogenic greenhouse gases. Global warming, climate variability and change - Formation of ozone and interaction with UV radiation - Tropospheric photo-chemistry (NO_x, VOCs, formation of tropospheric ozone and					

	impacts on radiation balance / budget quantities on the earth and atmosphere systems) - Causes of climate change (Natural and anthropogenic / human activities) - Factors influencing climate change including interactions within the atmosphere, ocean, solid earth and biosphere - Stability and sensitivity of climate system, global warming, ozone depletion and other human influences - Green house effects, remediation techniques, air pollution consequences of global warming, acid rain and acidification - Evidences of climate change
5	**Teaching methods** Lectures, discussions, project work and case studies
6	**Assessment methods** v. Term paper 30% vi. Examination 70%
7	**This module/course is used in the following degree programme/s as well** ...
8	**Responsibility for module/course** Professor O. D. Akinyemi
9	**Other information** References 4. Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: Impacts, Adaptation and Vulnerability. Contribution of working Group II to the Third Assessment Report of the IPCC. 5. Sombroek, W. G. and Gommes, R. 1996. The climate change Agricultural Conundrum. 6. Watson, D. J. 1983. Climate, weather and plant yield in environmental control of plant growth, London, Academic Press

ENVIRONMENTAL GEOPHYSICS

Module code ESC 814	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students
2	**Prerequisites for participation** Good First Degree in Physics, Geophysics or Geology			

3	***Learning outcomes*** Students would be able to • Synthesise results from different geophysical methods in order to describe the Earth's properties in terms of density, resistivity, susceptibility, elasticity and rheology. • Apply basic physical equations to the solution of general geophysical problems.
4	**Subject aims** The aim of the module is to 1. Make students appreciate the importance of geophysics in environmental investigations **2.** Equip students with necessary skills to address environmental issues with geophysical method**s** **3.** Develop students' problem-solving skills to propose appropriate response strategies to environmental processes
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change (Environmental Geophysics)
8	**Responsibility for module** Prof. Olukayode D, Akinyemi
9	**Other information** This course is a 2 unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** • **Reynolds, J. M., An Introduction to Applied and Environmental Geophysics, Wiley, 2011** • Kearey, Ph., Brooks, M., and Hill, I., An introduction to geophysical exploration, Wiley-Blackwell, 2002. • http://www.learninggeoscience.net/free/00001/index.htm • http://www-ig.unil.ch/cours/geophysa/c_resa.htm

HYDROLOGICAL MEASUREMENTS					
Module code ESC 817	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students

	c) Students' Presentation d) Field Work			
2	**Prerequisites for participation:** Good First Degree in Agriculture, Engineering and Science Graduates, Physics, Geophysics or Geology.			
3	***Learning outcomes*** After completing the module, students will be able to: (xxiii) Carry out measurement of rainfall using rain gauges. (xxiv) Determine infiltration capacity of soil. (xxv) Determine permeability of soil. (xxvi) Carry out evaporation measurements. (xxvii) Have developed a knowledge of hydrometric data, why it is needed, what to collect and how to process it; (xxviii) Know how to construct a rating curve from river level and flow data; (xxix) Be aware of the different methods for estimating flood peaks, and know where and when to use them;			
4	**Subject Aim:** The aim of the subject is to expose the students to hydrological measurements and analysis. **Subject Content:** (i) Hydrometric Networks: Gauging networks; design considerations; precipitation networks; evaporation networks; surface water networks and groundwater networks. (ii) Precipitation: Storage gauges; rainfall recorders; sitting the rain gauge; international practice and recent developments. (iii) Evaporation: Factors affecting evaporation, measurement of evaporation from an open water surface and measurement of evaporation loss from transpiration from vegetation (evapotranspiration) and measurement of potential evaporation. (iv) Soil moisture: Soil structure and composition; soil properties; water in soil; soil water retention and methods of measurement. (v) River flow: River gauging; stage-discharge relationship; flumes and weirs; dilution gauging and modern gauging techniques. (vi) Groundwater: Infiltration; groundwater flow equations; flow nets; groundwater measurement and groundwater exploration.			
5	**Teaching methods:** The teaching methods will include: (iv) Lectures (ii) Practical Demonstrations (iii) You Tube (iv) Field Trip (v) Project work (vi) Sharing of materials via learning tools, case studies, group work, individual presentations, and discussions			
6	**Assessment methods** Continuous Assessment, Take Home Assignments, Field Trip Reports and End of the semester examination			
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change (Hydrology and Climate Change)			
8	**Responsibility for module** Prof. O.S. Awokola			
9	**Other information** This course is a 2 unit course which translates to 24 hours contact in a 12-week semester			
10	**Recommended Materials** 6. Hydrology in Practice; Elizabeth M. Shaw 7. Engineering Hydrology; E.M. Wilson 8. Hydrolgy for Engineers and Planners; Allen T. Hjelmfelt, Jr., John J. Cassidy 9. Introductory to Hydrology; Warren Viessman, Jr, John W. Knapp, Gary L.Lewis 10. Guide to Hydrological Practices 5th edition 1994, Data acquisition and processing, analysis, forecasting and other applications; WMO-No 168.			

HYDROLOGICAL ANALYSIS

Module code ESC 811	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	Frequency Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students

2 **Prerequisites for participation:**
Good First Degree in Agriculture, Engineering and Science Graduates, Physics, Geophysics or Geology.

3

Learning outcomes

After completing the module, students will be able to:

(xxx) understand the concepts used in flood risk analysis;
(xxxi) understand the purpose of flood risk analysis and management within the context of development planning;
(xxxii) know what a flood risk assessment should contain and how to undertake such an assessment;
(xxxiii) have an up-to-date knowledge of how to take climate change into consideration;
(xxxiv) explain the difference between porosity and permeability;
(xxxv) list and describe the properties of aquifers that control the movement and storage of groundwater;
(xxxvi) explain the role of fractures in determining the transmission properties of aquifers;

4 **Subject Aim:** The aim of the subject is to expose the students to hydrological measurements and analysis.
Subject Content:

(vii) Precipitation Analysis: Determination of areal rainfall; depth-area analysis; depth-area-duration; rainfall frequency; intensity-duration-frequency analysis and extreme values of precipitation.
(viii) Evaporation Calculations: Calculation of E_o; Calculation of E_t; Calculation of PE and Soil moisture deficit.
(ix) River Flow Analysis: River regimes; peak discharges; flow frequency; flood frequency; flood probabilities; analysis of an annual maximum series; flood prediction; droughts and frequency of low flows.
(x) Rainfall-Runoff Relationships: Rational Method; Time-area method; hydrograph analysis.
(xi) Catchment modeling and Stochastic hydrology

5 **Teaching methods:** The teaching methods will include:
(v) Lectures (ii) Practical Demonstrations (iii) You Tube (iv) Field Trip (v) Project work (vi) Sharing of materials via learning tools, case studies, group work, individual presentations, and discussions

6 **Assessment methods**
Continuous Assessment, Take Home Assignments, Field Trip Reports and End of the semester examination

7 **This module is used in the following degree programmes as well**
PhD Environmental Systems and Climate Change (Hydrology and Climate Change)

8 **Responsibility for module**
Prof. O.S. Awokola

9 **Other information**
This course is a 2 unit course which translates to 24 hours contact in a 12-week semester

10 **Recommended Materials**

11. Hydrology in Practice; Elizabeth M. Shaw
12. Engineering Hydrology; E.M. Wilson
13. Hydrolgy for Engineers and Planners; Allen T. Hjelmfelt, Jr., John J. Cassidy
14. Introductory to Hydrology; Warren Viessman, Jr, John W. Knapp,

	Gary L.Lewis 15. Guide to Hydrological Practices 5th edition 1994, Data acquisition and processing, analysis, forecasting and other applications; WMO-No 168.

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GLOBAL ISSUES NEGOTIATION PROCESS 1						
Module code ESC 812		Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work		**Contact hours** 18 hours	**Independent study** 6 hours		**Class size** 10 students
2	**Prerequisites for participation** Good First Degree					
3	***Learning outcomes*** Students would be able to • Understand the concept of ozone layer depletion and the International Legal Framework for the protection. • Understand the concept of Climate Change, United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and adoption of the Paris Agreement in 2015.					
4	**Subject aims** The aim of the module is to 1. Make students understand ozone layer and legal framework for the protection **2.** Equip students with necessary skills to address issue of climate change for sustainable agricultural production.t					
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions					
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination					
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change					
8	**Responsibility for module** Dr B. S. Bada and Dr Z. O. Ojekunle					

9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** • Margaret T. Okorodudu-Fubara. 1998. Law of Environmental Protection

PUBLIC HEALTH AND ENVIRONMENTAL SYSTEMS						
Module code ESC 814		Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester Second	**Frequency** Each Second Semester	Duration 1 Semester
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work		**Contact hours** 18 hours	**Independent study** 6 hours		**Class size** 10 students
2	**Prerequisites for participation** Good First Degree					
3	***Learning outcomes*** Students would be able to					

	• Understand the distinction between community and public health. • Know the Hippocrates viewpoint of community / public health. • Understand the methods for investigating public health problems • Know the sources of public health problems in rural and urban areas in LDCs
4	**Subject aims** The aim of the module is to 1. Make the students appreciate the importance of clean environment in the control of public health problems **2.** Equip students with different methods for investigating public health problems **3.** Develop students' problem-solving skills to public health problems in rural and urban areas in LDCs.
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change
8	**Responsibility for module** Dr O. Oguntoke and Dr A. M. Taiwo
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** Brooker, S., Clements, A.C. A. and Bundy , D. A. P. (2006).Global epidemiology, ecology and control of soil transmitted helminth infections. Advanced Parasitology: 62: 221 – 261 • Karagiannis-Voules, D. A., Odermatt, P., Biedermann, P., Khieu, V., Schar, F., Muth, S., Utzinger, J., Vounatsou, P. (2014). Geostatistical modelling of soil-transmitted helminth infection in Cambodia: Do sociaoeconomic factors improve predictions. Acta Tropica 141(b): 2014-2021.

Module/Course Title: Wastewater Management and Pollution Control					
Module/ Course Code ESA 815	**Student work-Load** 2 hours	**Credits** (2)	**Semester** (First Semester)	**Frequency** (Every First Semester)	**Duration** (15 Weeks)
1	**Types of courses**	**Contact hours**		**Independent study**	**Class size**

	a) e.g. seminar b) …	(2 hours)	(2 hours)	(Three (3) students)
2	**Prerequisites for participation** English Language Skills (Reading = 5; Listening = 5; Speaking = 5; Writing = 6)			
3	**Learning outcomes** Student should be able to describe the different sources of water and their characteristics. On completion of the course, should be able to do sampling and characterization of water as good to use by analyzing for the physical, chemical and biological parameters. Students should be able to analyze water samples and compare with local and international standards for policy formulation and implementation. Students should be able to differentiate between water quality assessment and water monitoring and identify the main reasons for water quality assessment.			
4	**Subject aims/Content** The general aim of this subject is to identify the sources water, characterize water, differentiate between water quality assessment and water monitoring. Understand the stages involve in portable water purification.			
5	**Teaching methods** e.g. project work, case studies, group work, lectures, discussions, etc.			
6	**Assessment methods** Minor test: 20% Assignments: 10% Major test: 70%			
7	**This module/course is used in the following degree programme/s as well** ...			
8	**Responsibility for module/course**			
9	**Other information** e.g. bibliographical references			

ADVANCE RESEARCH METHODOLOGY					
Module code ESC 901	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students
2	**Prerequisites for participation:** Good First Degree			

3	***Learning outcomes*** After completing the module, students will be able to: 1. Design an experiment 2. Design sample surveys 3. Collect and prepare data 4. Use descriptive and inferential statistics for data analysis.
4	**Subject Aim:** The aim of the subject is to expose the students to advance research methodology.
5	**Teaching methods:** The teaching methods will include: Lectures, Practical Demonstrations, Field Trip, Project work, Sharing of materials via learning tools, case studies, group work, individual presentations, and discussions
6	**Assessment methods** Continuous Assessment, Take Home Assignments, Field Trip Reports and End of the semester examination
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change
8	**Responsibility for module** Professor M. Shittu
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** **1.** Research Methodology, Methods and Techniques 3rd Edition by Kothari, C. R. and Garg G. 2. Applied Statistics for Scientific Studies Published by Afrika-Link Books, 1999 3. Prctical Statistics for Analytical Chemists by Robert L. Anderson, Published by Van Nostrand Reinhold, New York

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GLOBAL ISSUES NEGOTIATION PROCESS II					
Module code ESC 902	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students
2	**Prerequisites for participation** Good First Degree			
3	***Learning outcomes***			

	Students would be able to • Understand the concept of ozone layer depletion and the International Legal Framework for the protection. • Understand the concept of Climate Change, United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and adoption of the Paris Agreement in 2015. • Know the origin and history of Convention on Biological Diversity • Know the measures to control transboundary movement of toxic waste using convention
4	**Subject aims** The aim of the module is to 1. Make students understand the origin and history of global issues affecting the environment and human health. 2. Make students aware of the convention available for the control of global issues.
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change
8	**Responsibility for module** Dr B. S. Bada and Dr Z. O. Ojekunle
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester
10	**Recommended Materials** • Margaret T. Okorodudu-Fubara. 1998. Law of Environmental Protection

ENVIRONMENTAL POLICY AND GOVERNANCE					
Module code ESC 903	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students

	b) Seminars c) Students' Presentation d) Field Work			
2	**Prerequisites for participation** Good First Degree			
3	***Learning outcomes*** Students would be able to • Know the institutional structures for decision-making on the environment. • Aware of the nature of policy mechanisms used by different countries and modes of implementation. • Know the Water Pollution Control Ordinance, Waste Disposal Ordinance and Noise Control Ordinance.			
4	**Subject aims** The aim of the module is to 1. Make students know the origin, history and understanding of environmental policy and governance in Nigeria and the world in general.			
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, field work, individual presentations, and discussions			
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination			
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change			
8	**Responsibility for module** Dr B. S. Bada			
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester			
10	**Recommended Materials** • Margaret T. Okorodudu-Fubara. 1998. Law of Environmental Protection			

ESC 904: Advanced Biostatistics (2 units)

Basic concepts, empirical frequency distribution, binominal and normal distributions, introduction to statistical inference, principles of scientific experimentation, major experimental designs and treatment comparisms, linear regression and correlation.

ADVANCE ENVIRONMENTAL STATISTICS

Module code ESC 904	Student workload 2 hours	Credits (according to ECTS) 1.125 ECTS	Semester 1st. Sem.	**Frequency** Each Second Semester	Duration 1 Semester

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation d) Field Work	**Contact hours** 18 hours	**Independent study** 6 hours	**Class size** 10 students
2	**Prerequisites for participation:** Good First Degree			
3	***Learning outcomes*** After completing the module, students will be able to: 1. Design an experiment 2. Design sample size 3. Collect and prepare data 4. Principal Component Analysis.			
4	**Subject Aim:** The aim of the subject is to expose the students to advanced biostatistics.			
5	**Teaching methods:** The teaching methods will include: Lectures, Practical Demonstrations, Field Trip, Project work, Sharing of materials via learning tools, case studies, group work, individual presentations, and discussions			
6	**Assessment methods** Continuous Assessment, Take Home Assignments, Field Trip Reports and End of the semester examination			
7	**This module is used in the following degree programmes as well** PhD Environmental Systems and Climate Change			
8	**Responsibility for module** Dr B. S. Bada			
9	**Other information** This course is a 2-unit course which translates to 24 hours contact in a 12-week semester			
10	**Recommended Materials** 1. Applied Statistics for Scientific Studies Published by Afrika-Link Books, 1999 2. Prctical Statistics for Analytical Chemists by Robert L. Anderson, Published by Van Nostrand Reinhold, New York			