

**UNIVERSITY OF NIGERIA, NSUKKA**  
**DEPARTMENT OF SOIL SCIENCE**

**POSTGRADUATE (PGD, MSc AND PhD) PROGRAMMES IN SOIL SCIENCE**

Postgraduate studies and research in the Department of Soil Science aim at deepening the students' understanding and knowledge of the specific areas within the discipline; equipping the students with professional competences required to serve in agricultural institution, government industry, research institution, university etc.; and developing research skills in students, and teaching them to apply the acquired skills in a multi-disciplinary approach towards finding solution to agricultural soil and environment-related problems. In Nigeria, many of the agricultural production problems are related to soil condition. The postgraduate programmes of the Department are designed to increase the candidate's knowledge of soil and thus develop the intellectual and professional competences necessary for the student to make a career in research, teaching, industry and agriculture.

The Department of Soil Science (in conjunction with the Departments of Agricultural Economics and Agricultural & Bioresources engineering) offers regular or long vacation postgraduate diploma (PGD) programme in Land and Water Resources Management. The course is based in the Department of Soil Science and is designed for university graduates and others with equivalent qualification who wish to obtain professional training in broad areas of soil fertility management, soil and water conservation and pollution control, land capability evaluation and irrigation management. The course aims at producing well-qualified professionals who have the competence to identify (in the field) soil-related constraints to various uses to which land can be put. The PGD students are required to take taught courses and conduct research to be embodied in a project report.

The Master of Science (MSc) and Doctor of Philosophy (PhD) degree programmes train professionally qualified individuals who can assume leadership position in government, non-governmental organizations, related international organizations, research institutions, and tertiary educational establishments. The MSc and PhD programmes are prosecuted by coursework and project report and by coursework and thesis, respectively. Students may be awarded higher degrees in any of the following areas: soil genesis, survey and classification, remote sensing; environmental impact assessment and land evaluation; soil chemistry and mineralogy; soil biology and biochemistry; soil fertility and management; soil physics and conservation; and environmental pollution management.

## **PHILOSOPHY**

The Department of Soil Science offers a one-year (regular) and two long vacations (sandwich) Postgraduate Diploma (PGD) in Land and Water Resources Management. This course programme which is to be based in the Department of Soil Science is designed for graduates (or equivalents) who wish to obtain professional training in the broad areas of soil fertility management, soil and water conservation and pollution control, land capability evaluation and irrigation water management.

The MSc and PhD degree programmes of the Department of Soil Science are intended to prepare professionally qualified individuals who can assume leadership positions in government, non-governmental organizations, related international organizations, research institutions and tertiary educational establishments. Agricultural land use is one of the many competitive uses of Nigeria's land resources. There is a lack of in-depth knowledge of our soil resources and many of the agricultural production problems are related to soil condition.

## **OBJECTIVES**

The main objective of the three programmes is to produce well qualified who have the competence to identify (in the field) soil-related constraints to the various uses to which land can be put. Emphasis of the course is (but not exclusively) on practical field training. Specific objectives include to (i) help students deepen their understanding and knowledge of specific areas within the discipline with a view to specialized research without losing contact with other areas, (ii) equip students with progression competencies that will enable them serve the nation in agriculture, industry, research, university, etc., and (iii) develop research skills in students and teach them to apply such skills in a multi-disciplinary approach in the solution of agricultural soil and environmental related problem.

## **SCOPE**

Because of the interdisciplinary nature of the programmes, experts to handle some courses and material resources are often drawn from such other departments as Department of Crop Science, Department of Agricultural Economics and Department of Agricultural & Bioresources Engineering. This is to ensure viability and reduce demands on funding.

The postgraduate programmes are designed to increase the candidate's knowledge of soils and thus develop intellectual and professional competencies necessary for the scientist to have a career in research, teaching, industry and agriculture.

<b>STRESS AREAS</b>	<b>Code</b>
General Department-based Faculty Courses	0
General Departmental Introductory Courses	1
Soil Genesis and Classification, Pedology	2
Soil Survey, Remote Sensing, Land Use Planning	3
Soil Physics, Meteorology, Environmental Studies	4
Soil Conservation, Land Reclamation, Environmental Pollution Manage.	5
Soil Chemistry and Mineralogy, Soil Fertility Manage, Soil/Plant Analysis	6
Soil Biology and Biochemistry, Microbial Ecology	7
Seminar	8
Project Report/Thesis	9

### **LIST OF APPROVED SUPERVISORS**

#### **PROFESSORS**

C.L.A. Asadu; Soil Resources Management; Soil Agronomy  
B. Agric., M.Sc., Ph.D. (Nig.)

C.A. Igwe; Pedology, Soil Conversation  
B. Agric., M.Sc. (Nig.),  
PGD (As. Norway), Ph.D. (Nig.)

#### **NON-PROFESSORS**

P.I. Ezeaku; Soil Survey & Land Use Planning  
M.Sc., Ph.D. (Nig.)

I.M. Uzoh; Soil Microbiology & Fertility  
B. Agric., M.Sc., Ph.D. (Nig.)

S.E. Obalum; Soil Physics & Hydrology;  
Soil & Water Conservation/Management  
B. Agric., M.Sc. (Nig.),  
Ph.D. (Kindai-Japan)

C.B. Obika; Soil Chemistry & Conservation;  
Soil Fertility  
B. Agric., M.Sc. (Nig.),  
Ph.D. (KNUST-Ghana)

## POSTGRADUATE DIPLOMA (PGD) PROGRAMME

### 1. ENTRY REQUIREMENTS

A bachelor's degree or HND (minimum of upper credit) in agriculture or in natural, physical and biological sciences.

### 2. MODE OF STUDY

The programme's mode of study is by course work and writing a project report.

### 3. AREA OF SPECIALIZATION

There is no specialization in this programme. Every successful participant obtains a PGD certificate in Land and Water Resources Management.

### 4. DURATION OF PROGRAMME

The minimum duration of the programme is two semesters (i.e., one calendar year).

### 5. COURSES TO BE OFFERED

Postgraduate Diploma (PGD) students are required to register for all the courses listed below including seminar and project report.

#### COURSE CONTENTS

##### First Semester

<u>Course No.</u>	<u>Title</u>	<u>Units</u>
<b>Course work/Taught courses</b>		
SSC 0611	Introductory Soil Science	3
SSC 0621	Soil Genesis and Classification	2
SSC 0671	Principles of Soil Microbiology	2
CSC 511	Field Experimentation	2
AGE 501	Agricultural Land Clearing and Development	2
<b>Project Seminar</b>		
SSC 0681	PGD Proposal Seminar	1
	Total	12 units

##### Second Semester

<b>Course work/Taught courses</b>		
SSC 0632	Soil Survey and Land Use Planning	2
SSC 0652	Soil and Water Conservation & Management	3
SSC 0662	Soil Fertility Assessment and Management	2
SSC 0664	Soil and Plant Analysis	2
<b>Project Seminar/Report</b>		
SSC 0682	PGD Final Seminar	2
SSC 0692	Project Report	4
	Total	15 units

## **6. COURSE DESCRIPTIONS**

### **SSC 0611 Introductory Soil Science**

Chemical, physical and biology properties of soils used in land productivity ratings and multipurpose classification. (3 units)

### **SSC 0621 Soil Genesis and Classification**

Processes and factors of soil formation; relationships among morphology, genesis and geomorphology, genesis and geomorphology soil classification system; field description of soil profiles. (2 units)

### **SSC 0671 Principles of Soil Microbiology**

Survey of important soil organisms; their characteristics, distribution, abundance, and contributions to soil fertility. Effect of environmental factors on the soil microflora. Interactions amongst microbial groups. Soil microflora plant relationships; the rhizosphere effect and mycorrhizal association. Microbial transformations of organic matter, nitrogen, phosphorus, sulphur and other minerals. (2 units)

### **CSC 511 Field Experimentation**

Study of different methods of analyzing field data (e.g. Completely Randomized Design, Randomized Complete Block Design Split Block Design, etc. (2 units)

### **AGE 501 Agricultural Land Clearing and Development**

Land resources and land use regulations for agricultural production in Nigeria. Land clearing methods. Types, economics and management of land clearing equipment. Disposal of vegetation after initial operation. Principles and benefits of land grading. Land grading equipment. Earthmoving machinery. (2 units)

### **SSC 0632 Soil Survey and Land Use Planning**

Survey and cartography of soils; land capability classification systems; technical groupings of soils; methods of land evaluation; planning the uses of land; farm survey practicals. (2 units)

### **SSC 0652 Soil and Water Conservation**

Soil erosion - types, causes and effects on agricultural lands; soils erosions and water pollution - sources and control; soil erosion control by crop management; agricultural water management. (2 units)

### **SSC 0662 Soil Fertility Assessment and Management**

Methods of assessing soil fertility and nutrient deficiency in crops, nutrient dynamics in soils; interpretation of soil test results; fundamentals of liming and fertilizer use; practical methods of improving soil fertility. (2 units)

**SSC 0664 Soil and Plant Analysis**

Methods of soil analysis and plant tissue analysis; expression and interpretation of soil and plant test results. (2 units)

**SSC 0682 Seminar**

This is the seminar on the research project presented after the project has been carried out. (1 unit)

**SSC 0692 Project Report**

Group or independent research project to be chosen from one of the five main areas of the programme. (2 units)

**7. EMPLOYMENT OPPORTUNITIES**

- i. **Private Consultancies:** to serve banks, insurance companies, large-scales farmers and government ministries and parastatals in areas dealing with site selection for on-site disposals of household wastes, sanitary landfills, effluent disposals, insurance claims arising from pollution damages, etc.
- ii. **Bank/Financial Institutions:** for advice on the feasibility of proposals for loans for agricultural development.
- iii. **Agrochemical Industrial:** to evaluate effects and persistence of agrochemicals on soils and plants before recommendation for production in commercial quantities.
- iv. River basin authorities, large and small-scale irrigation projects, and land reclamation specialists and in research institutes.
- v. Public health divisions, ministries of environmental planning, works, urban planning etc., as environmental consultant to tackle waste management and refuse disposal problems.
- vi. Ministries of Agriculture, Federal Department of Agricultural Land Resources as Soil Conservation Specialist.
- vii. Teachers in Secondary Schools and Schools of Agriculture.

## **MASTER OF SCIENCE (MSc) AND DOCTOR OF PHILOSOPHY (PhD) DEGREE PROGRAMMES**

### **1. ENTRY REQUIREMENTS**

The following categories of students may be admitted on application:

#### **i. Master of Science (MSc)**

- a) Graduates of the University of Nigeria, Nsukka or of other recognized universities who have obtained at least a Second Class Bachelor's degree or its equivalent in Agriculture, Soil Science or related science.
- b) Graduates with a pass degree in related disciplines plus a credit (minimum of 3.50 GPA on a 5-point scale) pass in the Postgraduate Diploma (PGD) in Soil and Water Resource Management, University of Nigeria, Nsukka.
- c) Other graduates of the University of Nigeria, Nsukka or of any other recognized institutions whose detailed academic records are considered satisfactory by the Senate of the University of Nigeria, Nsukka.

#### **ii. Doctor of Philosophy (PhD)**

- a) Graduates of the University of Nigeria, Nsukka or other recognized universities who have obtained a Master's Degree in Soil Science or any appropriate discipline related to Soil Science with a minimum grade point average (GPA) of 3.50 on a 5-point scale (or 3.00 on a 4-point scale) provided that satisfactory research formed part of the degree.
- b) Candidates who hold other qualifications may be admitted into the Doctor of Philosophy programme if their detailed academic records are satisfactory to the Senate of the University of Nigeria, Nsukka.

### **2. MODE OF STUDY**

#### **a) Master's Programme**

The MSc degree programme will be prosecuted through course work and research work. The course work will be examined in written papers while the research work will be presented in a project report. The research work to be assessed by special seminars & project report usually constitutes about 1/3 of the total credit load. The MSc degree will be awarded to a candidate only after a successful oral defence of their project report before a panel of examiners including an external examiner.

## **b) Doctoral Programme**

The PhD degree programme will be prosecuted through coursework and a comprehensive research work. The coursework will be examined in written papers whereas the research work will be presented in a thesis. The comprehensive research work to be assessed by special seminars & thesis usually constitutes about 2/3 of the total credit load. The PhD degree will be awarded to a candidate only after a successful oral defence of their thesis before a panel of examiners including an external examiner.

## **3. AREAS OF SPECIALIZATION**

Available staff and laboratory facilities permit for specialization in the following areas, at both MSc and PhD levels. There are seven areas:

1. Soil Genesis, Survey and Classification
2. Remote Sensing, Environmental Impact Assessment and Land Evaluation
3. Soil Chemistry and Mineralogy
4. Soil Biology and Biochemistry
5. Soil Fertility Management
6. Soil Physics and Conservation
7. Environmental Pollution Management

## **4. DURATION OF THE PROGRAMMES**

The minimum and maximum duration of the MSc and PhD programmes shall be:

### **a) Master of Science (MSc) Programme**

**Full-Time:** 3 semesters minimum; 6 semesters maximum

**Part-Time:** 4 semesters minimum; 8 semesters maximum

### **b) Doctor of Philosophy (PhD) Programme**

**Full-Time:** 6 semesters minimum; 10 semesters maximum

**Part-Time:** 8 semesters minimum; 12 semesters maximum

Students who successfully complete the postgraduate programmes of the Department of Soil Science are well equipped for careers in industry, ministries, tertiary and research institutions, consultancies and agriculture. They have self-employment opportunities.

## **5. COURSES TO BE OFFERED (DEPARTMENTAL MSc AND PhD COURSES)**

### **I. MASTER OF SCIENCE (MSc) COURSES**

Master of Science (MSc) students are required to register for five (5) taught courses (PGC 601, CSC 611 and any other three) as well as for MSc proposal seminar in the first



semester. They are required to register for any three (3) from among the taught courses as well as for MSc final seminar and project report in the second semester.

### **First Semester**

<b>Course No.</b>	<b>Title</b>	<b>Units</b>
<b>Taught courses</b>		
SSC 621	Advanced Soil Gen. & Classification	3
SSC 641	Advanced Soil Physics and Hydrology	3
SSC 651	Soil and Water Management and Conservation	3
SSC 661	Advanced Soil Chemistry and Mineralogy	3
CSC 611	Design of Experiments	3
PGC 601	Research Methodology & Application of ICT in Research	3
(5 courses from the above)		
<i>Semester total</i>		<i>15 units</i>

### **Second Semester**

<b>Taught courses</b>		
SSC 632	Advanced Soil Survey and Land Use Planning	3
SSC 652	Land Reclamation (including Waste Management)	3
SSC 662	Advanced Soil Fertility	3
SSC 672	Microbial Ecology in Soils	3
(Any 3 courses from the above)		
<b>Special Seminar/Project Report</b>		
SSC 682	MSc Seminar <sup>†</sup>	3
SSC 692	Project Report	9
<i>Semester total</i>		<i>21 units</i>
<b><i>Programme total</i></b>		<b><i>36 units</i></b>

<sup>†</sup>This seminar is the research findings seminar to be presented before the oral defence.

## **II. DOCTOR OF PHILOSOPHY (PhD) COURSES**

The courses recommended for doctoral (PhD) candidates are listed below. The candidates are required to register for eight (8) courses in all; any two (2) SSC-coded taught courses, PGC 701, and PhD Proposal Seminar in the first semester, and two (2) SSC-coded taught courses, PhD Final Seminar and thesis in the second semester.

## First Semester

Course No.	Title	Units
<b>Taught courses</b>		
SSC 721	Specialized Soil Genesis & Classification	3
SSC 741	Specialized Soil Physics and Hydrology	3
SSC 751	Specialized Soil and Water Management and Conservation	3
SSC 761	Specialized Soil Chemistry and Mineralogy	3
PGC 701	Synopsis and Grant Writing	3
(3 courses from the above)		
<b>Special Seminar</b>		
SSC 781	PhD Proposal Seminar	3
<i>Semester total</i>		<i>12 units</i>

## Second Semester

<b>Taught courses</b>		
SSC 732	Specialized Soil Survey and Land Use Planning	3
SSC 752	Specialized Land Reclamation (including Waste Management)	3
SSC 762	Specialized Soil Fertility	3
SSC 772	Specialized Microbial Ecology in Soils	3
(2 courses from the above)		
<b>Special Seminar/Thesis</b>		
SSC 782	PhD Final Seminar	3
SSC 792	Thesis	24
<i>Semester total</i>		<i>33 units</i>
<b><i>Programme total</i></b>		<b><i>45 units</i></b>

## 6. COURSE DESCRIPTIONS

### I. MASTER OF SCIENCE (MSc)

#### SSC 621 Advanced Soil Genesis and Classification

Concepts and theories of origin and development of soils. Nature of soil-forming processes; modelling soil forming processes; factors in soil formation. Historical development of soil classification systems; Soil Taxonomy. Process-oriented study showing the relationship between class criteria employed for soil Taxonomy and pedogenic process responsible for the morphological markers observed. The soil orders. Other systems in use and the FAO/UNESCO legend. (3 units)

### **SSC 641 Advanced Soil Physics and Hydrology**

Phenology – flow, deformation and stress-strain relations of matter relating to such practical problems as compaction, tillage, trafficability, and bearing capacity of soils. Transport phenomena – flow and retention to such practical problems as water infiltration, and drainage, soil temperature, soil aeration. (3 units)

### **SSC 651 Soil and Water Management and Conservation**

Management practices (other than fertilization) for improving crop production and conserving soil and water with minimum pollution of surface and ground waters. Field surveying for land and water management. (3 units)

### **SSC 661 Advanced Soil Chemistry and Mineralogy**

A study of the interactions of solid, liquid and gaseous phases of the soil. Weathering and soil development, solid-solute interaction including cation exchange and retention of anions. (3 units)

### **PGC 601 Research Methodology & 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. 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 problem 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/project report writing. Application of appropriate advanced ICT tools relevant in every discipline for data gathering, analysis and result presentation. Essentials of spreadsheet, internet technology and internet search engines. All registered Master's 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. (3 units)

### **SSC 632 Advanced Soil Survey and Land Use Planning**

Methods of soil survey and interpretation of soil survey reports. Land evaluation techniques and the allocation of land to different uses. Preparation of Legends. Use of remote sensing in resource survey and land use planning. (3 units)

### **SSC 652 Land Reclamation (including Waste Management)**

Reclamation of lands which have been disturbed as a result of mining, construction, stone quarrying, etc. Techniques and materials used for reclamation. Wastes - their classification. Chemistry and biology of waste materials. Land application of wastes. Soil and site characteristics for waste disposal systems. Ground water protection. Role of soils in waste management. (3 units)

### **SSC 662 Advanced Soil Fertility**

Soil conditions affecting availability of plant nutrients. Methods of determining soil fertility and insufficiency of plant nutrients in soils. Fertilizers & micronutrient crop response curves. Soil testing and interpretation of test results. Nutrients movement - contact exchange theory, mass flow, diffusion, ion uptake and translocation in roots, lineweaver-Burke plot.(3 units)

### **SSC 672 Microbial Ecology in Soils**

Survey of macro and micro organisms occurring in soils; carbon, nitrogen, P, mineral cycles and the effects of micro-organisms on soil properties. Soil enzymes and enzyme kinetics. Microbial transformations, mycorrhiza, nitrogen fixation, soil-microflora-plant relationships. (3 units)

### **SSC 682 MSc Seminar**

This comprises proposal and final sections. The proposal section is on brief discuss of the need, objectives and methods for carrying out the MSc research work, whereas the final section is on the detailed review of the research carried out including introduction, literature review, materials and methods, results, discussions and conclusions from the study. (3 units)

## **II. PhD COURSE DESCRIPTIONS**

### **SSC 721 Specialized Soil Genesis and Classification**

More detailed studies of the concepts and theories of origin and development of soils. Nature and modeling of specific soil-forming processes; Correlations of soil classification systems; Soil Taxonomy. Field appreciation of process-oriented relationships between class criteria

employed for soil Taxonomy. Field appreciation of pedogenic process responsible for the morphological markers observed. Detailed study of selected soil orders. Other systems in use and the FAO/UNESCO legend. (3 units)

#### **SSC 741 Specialized Soil Physics and Hydrology**

More detailed studies of phenology – flow, deformation and stress-strain relations of matter relating to such practical problems as compaction, tillage, trafficability, and bearing capacity of soils. Field observation of hydrological processes. Significance of transport phenomena – flow and retention to such practical problems as water infiltration, and drainage, soil temperature, soil aeration. (3 units)

#### **SSC 751 Specialized Soil and Water Management and Conservation**

More detailed study of water management practices for improving crop production. Field appreciation of conservation of soil and water with minimum pollution of surface and ground waters. Field surveying for land and water management. (3 units)

#### **SSC 761 Specialized Soil Chemistry and Mineralogy**

More detailed study of the interactions of solid, liquid and gaseous phases of the soil. Field appreciation of weathering and its significance in soil development, solid-solute interaction including cation exchange and retention of anions. (3 units).

#### **SSC 781 PhD Proposal Seminar**

A detailed discuss of the need, objectives and methods for carrying out the Ph.D. research work including introduction, literature review, materials and methods, and expected results. (3 units)

#### **PGC 701 Synopsis and Grant Writing**

Identification of types and nature of grant and 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 defence. 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 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 PhD 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. (3 units).

### **SSC 732 Specialized Soil Survey and Land Use Planning**

More detailed study of the methods of soil survey and interpretation of soil survey reports. Comparison of land evaluation techniques, allocation of land to different uses. Preparation of Legends. Use of remote sensing in resource survey and land use planning. (3 units)

### **SSC 752 Specialized Land Reclamation (including Waste Management)**

More detailed study of reclamation of lands which have been disturbed as a result of mining, construction, stone quarrying, etc. Field appreciation of techniques and materials used for reclamation. Land application of wastes. Soil and site characteristics for waste disposal systems. Ground water protection. Role of soils in waste management. (3 units)

### **SSC 762 Specialized Soil Fertility**

More detailed study of soil conditions affecting availability of plant nutrients. Field appreciation of insufficiency of selected plant nutrients in soils. Fertilizers and micronutrient crop response curves. Practical significance of soil test results. Nutrients movement - contact exchange theory, mass flow, and diffusion, ion uptake and translocation in roots, lineweaver - Burke plot. (3 units)

### **SSC 772 Specialized Microbial Ecology in Soils**

More detailed study of survey of macro and microorganisms occurring in soils; carbon, nitrogen, P, mineral cycles and the effects of micro-organisms on soil properties. Study of selected enzymes and their kinetics in greater detail. Microbial transformations, mycorrhiza, nitrogen fixation, soil-microflora-plant relationships. (3 units)

### **SSC 782 PhD Final Seminar**

A detailed presentation and discuss of the research carried out including introduction, literature review, materials and methods, results, discussions and conclusions from the study. (3 units)