



NATIONAL BOARD FOR TECHNICAL EDUCATION

PLOT B BIDA ROAD, P.M.B. 2239, KADUNA, NIGERIA

HIGHER NATIONAL DIPLOMA

IN

**SOIL SCIENCE AND LAND RESOURCES MANAGEMENT
TECHNOLOGY**

CURRICULUM AND COURSE SPECIFICATIONS

JUNE, 2026

PREFACE

The transformation of Nigeria's agricultural sector remains central to the nation's aspirations for sustainable economic growth, food security, job creation, industrial development, and poverty reduction. As agriculture continues to evolve in response to technological advancements, climate change, emerging global market demands, and the need for increased productivity across agricultural value chains, it has become imperative to ensure that curricula in Nigerian tertiary institutions remain relevant, responsive, and aligned with contemporary industry requirements. It is against this backdrop that we embarked on the comprehensive review and modernization of Agricultural curricula for Nigerian tertiary institutions. The review process was designed to address identified skills gaps, integrate emerging technologies and innovations, strengthen entrepreneurship and employability competencies, promote climate-smart agriculture, and align training programmes with the industry expectations and global best practices. The successful execution of this important project was made possible through the invaluable support and commitment of key stakeholders. I wish to express profound appreciation to the Honourable Minister of Education for providing the policy direction and leadership that facilitated this initiative. I also extend sincere gratitude to the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their unwavering support, technical contributions, and commitment to strengthening agricultural education and workforce development in Nigeria. Special appreciation goes to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that enabled the conduct of nationwide skills gap analyses and supported the series of national curriculum review and development workshops. The findings from the skills gap studies provided critical evidence and industry insights that guided the review process and ensured that the curricula reflect current and future workforce requirements within the agricultural sector.

I also acknowledge with gratitude the immense contributions of the Sector Skills Council for Agriculture, whose expertise and industry perspectives greatly enriched the curriculum development process. Equally commendable are the efforts of members of the Implementation Committee, resource persons, industry experts, professional bodies, French Embassy in Nigeria, regulatory agencies, academic institutions, employers, development partners, and other stakeholders who devoted their time, knowledge, and experience to the various workshops and technical sessions. The revised curricula represent a collective national effort to produce graduates equipped with relevant knowledge, practical skills, digital competencies, entrepreneurial capabilities, and professional attitudes required to drive innovation and productivity across Nigeria's agronomy, forestry, fisheries and livestock sectors. It is my expectation that Institutions offering these programmes will faithfully implement the curricula and continue to collaborate with industry to ensure sustained relevance and quality. I commend all stakeholders for their dedication and contributions to this landmark achievement and look forward to the successful implementation of these curricula for the benefit of our dear nation.

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee
EXECUTIVE SECRETARY
National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

The National Board for Technical Education (NBTE) expresses its profound appreciation to all individuals and organizations whose invaluable support, expertise, and commitment made the successful review and modernization of the Agricultural Education curricula for Nigerian tertiary institutions possible. Our sincere gratitude goes to the Honourable Minister of Education for providing the policy direction and leadership that made this national initiative possible. We also appreciate the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their technical guidance, collaboration, and unwavering commitment to strengthening agricultural education and workforce development in Nigeria. The Board is particularly grateful to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that funded the nationwide skills gap analyses, stakeholder engagements, curriculum review exercises, validation meetings, and development workshops. The evidence generated through these studies provided a solid foundation for developing curricula that are relevant, industry-driven, and responsive to national and global agricultural priorities.

Special appreciation is extended to the curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated actively in the skills gap studies, technical sessions, validation exercises, and curriculum development workshops. Their diverse expertise and practical insights greatly enriched the quality and relevance of the curricula. We further appreciate the support of the French Embassy in Nigeria and other development partners for their collaboration in promoting excellence and innovation in technical and vocational education within the agricultural sector. Finally, NBTE expresses its gratitude to all tertiary institutions, researchers, facilitators, rapporteurs, technical staff, and administrative personnel whose commitment and hard work contributed to the successful completion of this important national assignment. The Board acknowledges that this achievement is the result of a collective effort and remains confident that the effective implementation of these curricula will contribute significantly to producing competent, innovative, and entrepreneurial graduates capable of advancing sustainable agricultural development, food security, and economic prosperity in Nigeria.

TABLE OF CONTENTS

PREFACE	ii
ACKNOWLEDGEMENT	iii
GENERAL INFORMATION	vi
CURRICULUM TABLES	xi
HND I - SEMESTER I	1
SOIL BIOLOGY	2
SOIL FERTILITY AND PLANT NUTRITION	12
LAND SURVEYING AND LAND USE PRINCIPLES	20
GIS AND DIGITAL SOIL MAPPING	24
HND I - SEMESTER II	32
REMOTE SENSING FOR SOIL AND LAND RESOURCES	33
SOIL GENESIS AND MORPHOLOGY	41
FIELD PRACTICAL I (SOIL SURVEY AND SAMPLING TECHNIQUES)	52
SOIL CHEMISTRY AND NUTRIENT DYNAMICS	56
SOIL AND ENVIRONMENTAL PHYSICS	61
HND II - SEMESTER I	70
SOIL CONSERVATION	71
LAND DEGRADATION ASSESSMENT AND RESTORATION	79
SOIL SURVEY AND CLASSIFICATION	85
FIELD PRACTICAL II (GIS, SOIL MAPPING AND LAND EVALUATION)	93
CLIMATE CHANGE AND SOIL QUALITY	96
HND II - SEMESTER II	107
SOIL POLLUTION AND REMEDIATION	108
AI AND MACHINE LEARNING IN SOIL SCIENCE	114
SOIL, WATER AND PLANT ANALYSIS	118

SOIL MINERALOGY	124
LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT	128
LIST OF MINIMUM RESORCES/ PHYSICAL FACILITIES.....	132
LIST OF WORKSHOP PARTICIPANTS	152



GENERAL INFORMATION

1.0 PROGRAMME NOMENCLATURE

Higher National Diploma in Soil Science and Land Resources Management Technology

2.0 PROGRAMME GOAL

The HND in Soil Science and Land Resources Management Technology is designed to train technologists with practical skills in soil survey, classification, fertility management, conservation, land evaluation, digital soil mapping, GIS, remote sensing, and climate-smart land management for sustainable land use. The programme is aligned with current occupational standards and addresses key skill gaps in digital soil mapping, climate-smart soil management, and inclusive land governance.

3.0 OBJECTIVES OF THE PROGRAMME

On completion of the programme, the diplomats should be able to:

- i. Conduct soil sampling, classification, and detailed soil survey fieldwork using appropriate sampling and mapping techniques.
- ii. Perform laboratory analyses of soil physical, chemical, biological, and mineralogical properties.
- iii. Carryout soil fertility assessment, soil test interpretation, and integrated nutrient management for crop production.
- iv. Know soil conservation, erosion control, and watershed management practices for sustainable land use.
- v. Carryout land evaluation, land capability classification, and land suitability assessment using recognized frameworks.
- vi. Know digital soil mapping techniques using GIS, remote sensing, drone surveys, and geospatial technologies.
- vii. Understand remote sensing image processing, vegetation indices, soil moisture assessment, and land-use change detection.
- viii. Know geostatistical methods used in soil survey, spatial analysis, and digital soil mapping.
- ix. Carryout climate-smart soil management practices, including soil carbon measurement, carbon sequestration, and land restoration.
- x. Know irrigation, drainage, environmental impact assessment, land valuation, gender-inclusive land governance, entrepreneurship, and professional communication in soil and land resources management.

4.0 ENTRY REQUIREMENTS

The general entry requirements for the HND Soil Science and Land Resources Management Technology Programme include:

- a. All the requirements for admission into the ND programme in Agricultural Technology, Horticultural Technology, Irrigation Agronomy, Wildlife and Eco-Tourism Management Technology and Forestry Technology with a minimum of lower credit pass* (CGPA) of 2.50) in ND with a minimum of lower credit pass in any of the agricultural programmes, SLT and Food Technology and of one year post - ND cognate work experience.

- b. In exceptional cases, the ND diplomates with a pass grade (CGPA of 2.00 - 2.49) in the ND examination, that had with two or more years of cognate work experience may be considered for admission into the HND programme. However, the number of students should not be more than 10% of the total student intake in each class.
- c. Completion of a minimum of one (1) year post-ND Industrial Training (IT) attachment in a relevant soil / land-resource institution (Ministry of Agriculture, Agricultural Development Programme (ADP), soil-testing laboratory, fertiliser company, NIMET, land-survey firm, GIS / remote-sensing firm, NGO, research institute) verified by a logbook and supervisor's report.
- d. Five (5) credit-level passes in the Senior Secondary Certificate Examination (SSCE) — WAEC, NECO or NABTEB — including English Language, Mathematics, Physics, Chemistry and any one of: Geography, Biology, Agricultural Science, Economics or Technical Drawing.

5.0 STRUCTURE/DURATION OF THE PROGRAMME

The Programme is structured to last for two (2) academic years (four semesters) of classroom instruction, laboratory work, and field practicals. Each semester shall consist of:

- i) 15 contact weeks of teaching (lectures, practicals, fieldwork);
- ii) 2 weeks for tests, registration, and examinations.

6.0 CURRICULUM

The curriculum of the HND Soil Science and Land Resources Management Technology Programme consists of three (3) main components:

- i. **General Studies Courses:** Courses that develop students' general knowledge, communication skills, values, and personal development outside their main field of study.
- ii. **Foundation Courses:** Basic introductory courses that provide the fundamental knowledge and principles needed for advanced learning in a Programme.
- iii. **Professional Courses:** Specialized courses that equip students with practical and technical skills related to their chosen profession or career field.

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum number of four (4) qualified lecturers and must be from the rank of (lecturer I to above) in: Soil Science ; Crop Production; Agronomy; Agricultural Engineering and Related disciplines

7.2 Head of Department (HOD)

The Head of Department shall have at least master's degree in soil science and related field. He or she must not be below the rank of a Senior Lecturer and registered with relevant professional bodies. He or she must have cognate experience in both academic and industry

7.3 Technical Staff

There should be technical staff:

i) Technologist

A technologist is a highly skilled professional trained at the Higher National Diploma (HND) level. They possess advanced technical and practical knowledge in their field and are capable of supervising operations, managing projects, operating modern equipment, and applying technology to solve practical problems. In agriculture, technologists help in farm management, research support, and the application of improved technologies.

ii) Technician

A technician is a middle-level manpower trained at the National Diploma (ND) level. Technicians are responsible for carrying out technical tasks, operating tools and equipment, and assisting technologists and professionals in practical activities. In agriculture, they assist in crop production, livestock management, farm maintenance, and data collection.

iii) Farm Assistants

Farm assistants are support workers who help in daily farm operations under supervision. They perform basic practical activities such as planting, weeding, feeding animals, harvesting, cleaning farm tools, and maintaining farm records. They contribute to the smooth running of farm activities and help improve productivity.

8.0 CERTIFICATION

A diplomate of this Programme shall be awarded the Higher National Diploma (HND) in Soil Science and Land Resources Management Technology by the authority of the Academic Board of the awarding institution.

9.0 ACCREDITATION OF PROGRAMME

The Higher National Diploma (HND) in Soil Science and Land Resources Management Technology Programme shall be accredited by the National Board for Technical Education (NBTE) before the diplomats can be awarded. Details about the process of accrediting a Programme are available from the Board's website or through correspondence to:

The Executive Secretary

National Board for Technical Education (NBTE)
Plot 'B' Bida Road,
P.M.B 2239, Kaduna, Nigeria.

10.0 CONDITIONS FOR THE AWARD OF HND INCLUDE:

Successful completion of all prescribed coursework, assignments, practicals, and fieldwork:

- i Passing all semester examinations;
- ii Completion and defense of project work;
- iii Completion of the required minimum credit units.

10.1 Classification of Diploma

Distinction	– CGPA 3.50 – 4.00
Upper Credit	– CGPA 3.00 – 3.49
Lower Credit	– CGPA 2.50 – 2.99
Pass	– CGPA 2.00 – 2.49

11.0 LOG BOOK

Students shall maintain a personal log book to record all practical activities carried out during: Field practicals; Laboratory work; Farm operations. The log book shall be checked regularly, marked appropriately and endorsed by lecturers.

12.0 FINAL YEAR PROJECT

Students shall undertake a project work in the final year. The project may be individual or group-based (maximum of two students per group). The project must be relevant to Soil Science and Land Resources Management Technology. The project shall be supervised and formally presented.

13.0 AWARD OF HIGHER NATIONAL DIPLOMA

The Higher National Diploma in Soil Science and Land Resources Management Technology shall be awarded by the authority of the Academic Board of the institution.

13.1 Grading of Courses

MARKS RANGE	LETTER GRADE	GRADE POINT
75% and above	A	4.00
70–74%	AB	3.50
65–69%	B	3.25
60–64%	BC	3.00
55–59%	C	2.75
50–54%	CD	2.50
45–49%	D	2.25
40–44%	E	2.00

14.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME:

14.1 The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stresses the need to introduce the semester credit units which will enable a student, who so wishes, to transfer the units already completed in an institution of similar standard from which he/she is transferring.

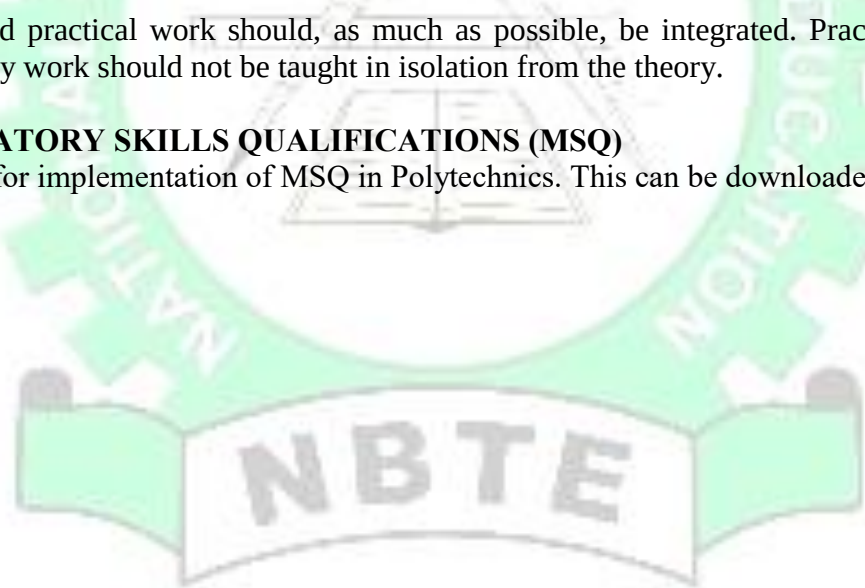
14.2 In designing the units, the principle of the modular system by product has been adopted, thus making each of the professional modules, when completed provides the student with technician operative skills, which can be used for employment purposes.

14.3 As the success of the credit unit system depends on the articulation of programmes between the institution and industry, the Curriculum content has been written in behavioural objectives, so that the expected performance of the student is clear to all students who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance-based curriculum which requires the conditions under which the performance is expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal Evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

14.4 The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory.

15.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, refer to NBTE guidelines for implementation of MSQ in Polytechnics. This can be downloaded from NBTE website (web.nbte.gov.ng)



CURRICULUM TABLE

YEAR I - SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	GNS 301	Use of English III	2	0	0	2	2
2.	AED 313	Principles and Methods of Agricultural Extension	1	0	2	3	3
3.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
4.	GLT 311	Laboratory Management	1	0	1	2	2
5.	GLT 312	Instrumentation (General)	1	0	2	3	3
6.	CPT 311	Crop Production I (Roots, Tuber, Fibers and Others)	1	0	2	3	3
7.	CPT 314	Cropping Systems and Sustainable Intensification	1	0	2	3	3
8.	SST 311	Soil Biology	1	0	3	4	4
9.	SST 312	Soil Fertility and Plant Nutrition	1	0	3	4	4
10.	SST 313	Land Surveying and Land Use Principles	1	0	3	4	4
11.	SST 314	GIS and Digital Soil Mapping	1	0	3	4	4
Total			12	0	22	34	34

YEAR I - SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
3.	AGR 302	Field Experimentation and Data Analysis	1	0	1	2	2
4.	MSQ 321	Practice of Quality Assurance Assessment	1	0	1	2	2
5.	GLT 321	Biological and Chemical Instrumentation	1	0	2	3	3
6.	CPT 323	Crop Production II (Cereals, Legumes, and Oil Crops)	1	0	3	4	4
7.	SST 321	Remote Sensing for Soil and Land Resources	1	0	3	4	4
8.	SST 322	Soil Genesis and Morphology	1	0	3	4	4
9.	SST 323	Field Practical I (Soil Survey and Sampling Techniques)	0	0	4	4	4
10.	SST 324	Soil Chemistry and Nutrient Dynamics	1	0	2	3	3
11.	SST 325	Soil and Environmental Physics	1	0	2	3	3
Total			12	0	23	35	35

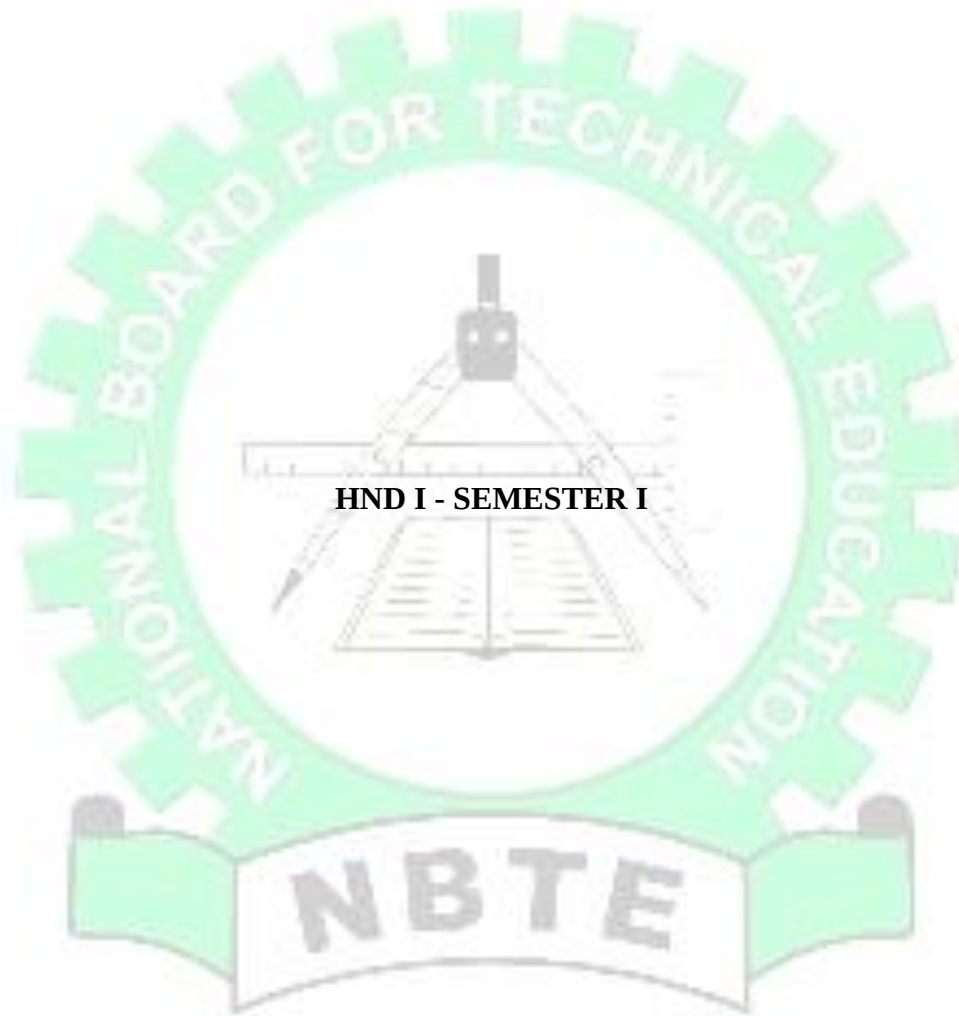
YEAR II - SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
2.	AGR 401	Research Methodology and Scientific Writing	1	0	1	2	2
3.	CPT 415	Irrigation Technology and Water Use Efficiency	1	0	2	3	3
4.	CPT 417	Drainage Technology and Waterlogging Management	1	0	3	4	4
5.	AED 414	Extension Administration, Personnel Management and Leadership	1	0	2	3	3
6.	SST 411	Soil Conservation	1	0	2	3	3
7.	SST 412	Land Degradation Assessment and Restoration	1	0	2	3	3
8.	SST 413	Soil Survey and Classification	1	0	2	3	3
9.	SST 414	Field Practical II (GIS, Soil Mapping and Land Evaluation)	0	0	4	4	4
10.	SST 415	Climate Change and Soil Quality	1	0	2	3	3
Total			10	0	22	32	32

YEAR II - SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CH	CU
1.	AED 424	Rural Sociology	1	0	1	2	2
2.	SST 421	Soil Pollution and Remediation	1	0	3	4	4
3.	SST 422	AI and Machine Learning in Soil Science	1	0	3	4	4
4.	SST 423	Soil, Water and Plant Analysis	1	0	3	4	4
5.	SST 424	Soil Mineralogy	1	0	2	3	3
6.	SST 425	Land Use Planning and Environmental Impact Assessment	1	0	3	4	4
7.	SST 426	Project	0	0	4	4	4
Total			6	0	19	25	25

L = Lectures (hours/week) P = Practical (hours/week) T = Tutorial (hours/week) CH = Contact Hour (Hours/week) CU = Credit Unit



SOIL BIOLOGY

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL BIOLOGY	COURSE CODE: SST 311	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
Goal: This course is designed to provide the students with the knowledge and skills in soil organisms, their classification and their roles in soil development and fertility		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the basic definition of soil organisms 2.0 Understand the general classification of soil organisms 3.0 Know the roles of soil fauna in soil development and fertility 4.0 Know the roles of soil flora in soil development and fertility 5.0 Know primary, secondary and tertiary consumers in the soil 6.0 Know the role of micro fauna in the soil 7.0 Know the activities of micro flora in the soil 8.0 Know the roles of organisms in soil remediation		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL BIOLOGY			COURSE CODE: SST 311		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
Goal: This course is designed to provide the students with the knowledge and skills in soil organisms, their classification and their roles in soil development and fertility						
General Objective 1.0 : Know the nature of soil components						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Define the term soil organisms 1.2 Discuss the differences between micro and macro organisms 1.3 Describe the soil samples collection 1.4 Describe soil fauna organism 1.5 Describe soil flora organism	• Explain the term soil organisms • Explain the differences between micro and macro organisms • Discuss soil samples collection • Discuss soil fauna organism • Explain soil flora organism	LCD, Projector, Pictorials, Internet, Chats	• Collect soil sample • Identify soil fauna • Identify soil flora • Record and report observation	Guide students to; • Collect soil sample • Identify soil fauna • Identify soil flora • Record and report observation	Soil auger; Soil bag; Culture media, Chloroform, Petri-dish, Beaker, etc.
General Objectives 2.0: Understand the general classification of soil organisms						
2-3	2.1 Define the term soil organisms 2.2 Differentiate between micro and macro organisms	• Explain the term soil organisms • Differentiate between micro and	LCD, Projector, Pictorials, Internet, Chats	• Culture soil samples • Incubate soil samples • Count soil organism	Guide students to; • Culture soil samples • Incubate soil	Soil bag; Culture media, Chloroform, Incubator, Microscope,

	2.3 Describe the soil samples collection 2.4 Describe soil fauna organisms 2.5 Describe soil flora organisms	macro organisms • Explain soil samples collection • Discuss soil fauna organisms • Explain soil flora organisms		in the samples	samples • Count soil organism in the samples	Colony counter, Laminar flow hood, Petri-dish, Soil samples Beaker, etc.
General objective 3.0: Know the roles of soil fauna in soil development and fertility						
4-5	3.1 Explain the term soil fauna 3.2 Distinguish between macro and micro soil fauna 3.3 Explain the role of micro soil fauna in soil development 3.4 Explain the role of macro soil fauna in soil development 3.5 Describe field observations of the activities of soil fauna in soil development such as earthworms, termites and other burrowing animals 3.6 Explain the roles of macro soil fauna in soil fertility 3.7 Explain the roles of micro soil fauna	• Discuss the term soil fauna • State the difference between macro and micro soil fauna • Discuss the role of micro soil fauna in soil development • Explain the role of macro soil fauna in soil development • Discuss field observations of the activities of soil fauna in soil development such as earthworms, termites and other burrowing animals • Discuss the importance of soil micro fauna in the carbon cycle	LCD, Projector, Pictorials, Internet, Chats	• Carryout field observations of the activities of soil fauna in soil development such as earth worms, termites and other burrowing animals • Conduct a Field trip to earthworm, termites, etc infested sites	Guide students to; • Carryout field observations of the activities of soil fauna in soil development such as earth worms, termites and other burrowing animals • Conduct a Field trip to earthworm, termites, etc infested sites	Spade; Wire mesh; Chloroform Funnel; Lighting bulb; Spatula etc.

	in soil fertility 3.8 Explain the importance of soil micro fauna in the carbon cycle					
General Objectives 4.0: Know the roles of soil flora in soil development and fertility						
6-7	4.1 Explain the term soil flora 4.2 Differentiate between micro and macro flora 4.3 Describe the role of macro soil flora in soil development 4.4 Describe the role of soil micro flora in soil development 4.5 Describe the collection of soil samples and identification of soil flora organisms 4.6 Explain the role of soil macro flora in soil fertility 4.7 Explain the role of soil micro flora in soil fertility 4.8 Explain the	• Explain the term soil flora • Differentiate between micro and macro flora • Explain the role of macro soil flora in soil development • Discuss the role of soil micro flora in soil development • Discuss the collection of soil samples and identification of soil flora organisms • Explain the role of soil macro flora in soil fertility • Explain the role of soil micro flora in soil fertility • Explain the importance of soil micro flora in the nitrogen cycle • Explain the	LCD, Projector, Pictorials, Internet, Chats	• Identify micro flora organisms in nodules, galls of legumes, etc. • Collect soil samples and identify soil flora organisms	Guide students to; • Identify micro flora organisms in nodules, galls of legumes, etc. • Collect soil samples and identify soil flora organisms	Root samples of leguminous plant, microscope, slides, e.tc

	importance of soil micro flora in the nitrogen cycle 4.9 Explain the activities of micro flora organisms in nodules, galls of legumes, etc. 4.10 Describe the importance of soil micro flora in biodegradable waste management	activities of micro flora organisms in nodules, galls of legumes, etc. • Explain the importance of soil micro flora in biodegradable waste management				
General Objectives 5.0: Know primary, secondary and tertiary consumers in the soil						
8-9	5.1 Explain 5 major groups of micro-organisms, found in the soil, give their relative sizes, numbers and biomass 5.2 Describe the characteristics of each group of soil microorganisms and their nutritional patterns 5.3 Discuss soil microorganisms to food chains and to the decomposition of organic matters 5.4 Describe the	• Explain 5 major groups of micro-organisms, found in the soil, give their relative sizes, numbers and biomass • Discuss the characteristics of each group of soil microorganisms and their nutritional patterns • Discuss soil microorganisms to food chains and to the decomposition of organic matters • Explain the environmental factors	LCD, Projector, Pictorials, Internet, Chats	• Identify five major groups of micro-organisms, found in the soil with • their relative sizes, numbers and biomass	Guide students to; • Identify organisms, found in the soil, with their relative sizes, numbers and biomass	Soil samples Root samples Microscope e.tc.

	environmental factors that influence decomposition of organic matters 5.5 Explain the nitrogen cycle 5.6 Explain the carbon cycle	that influence decomposition of organic matters • Explain the nitrogen cycle • Explain the carbon cycle				
General Objective: 6.0: Know the role of micro fauna in the soil						
10-11	6.1 Explain two groups of micro fauna in the soil 6.2 Describe nematodes 6.3 Classify nematodes 6.4 Describe the activities of nematodes in the soils 6.5 Explain the symptoms of nematodes infection of the soil 6.6 Describe various methods of control of nematode attack 6.7 Describe the life cycle of nematodes 6.8 Describe the role of earthworms in tropical soils 6.9 Explain factors affecting earthworm	• Explain two groups of micro fauna in the soil • Explain nematodes • Discuss classification of nematodes • Explain the activities of nematodes in the soils • Explain the symptoms of nematodes infection of the soil • Explain various methods of control of nematode attack • Discuss the life cycle of nematodes • Explain the role of earthworms in tropical soils • Explain factors affecting earthworm	LCD, Projector, Pictorials, Internet, Chats	• Identify two groups of microscopic animals in the soil • Identify the symptoms of nematodes infection of the soil • Apply various methods of control of nematode attack	Guide students to; • Identify two groups of microscopic animals in the soil • Identify the symptoms of nematodes infection of the soil • Apply various methods of control of nematode attack	Infected soil and plant roots samples, Microscope, Hand lens, Slides, Nematicides, Knapsack sprayer.

	activity	activity				
General Objective 7. 0: Know the general activities of micro-flora in the soil						
12-13	7.1 Describe major microflora in the soil. a) Algae b) Fungi c) Bacteria etc. 7.2 Describe the characteristics of the above listed microflora 7.3 Describe the functional categories of microflora viz: i. Autotrophs ii. Heterotrophs iii. Photoheterotrophs iv. Chemoheterotrophs v. Aerobes vi. Anaerobes 7.4 Describe microorganisms as part of the soil ecosystems: their relation to mineral and organic components of the	• Discuss major microflora in the soil. • Algae • Fungi • Bacteria etc. • Explain the characteristics of the above listed microflora • Explain the functional categories of microflora viz: • Autotrophs • Heterotrophs • Photoheterotrophs • Chemoheterotrophs • Aerobes • Anaerobes • Explain microorganisms as part of the soil ecosystems: • Their relation to mineral and organic components of the soil; • Their relation to soil moisture, soil	LCD, Projector, Pictorials, Internet, Chats	• Identify major microflora in the soil. • Algae • Fungi • Bacteria	Guide students to; • Identify major microflora in the soil. Algae • Fungi • Bacteria	Contaminated site, .Samples of phytoremediation plants e.g sunflower, Indian mustard, willow plant, poplar tree, Indian grass, etc.

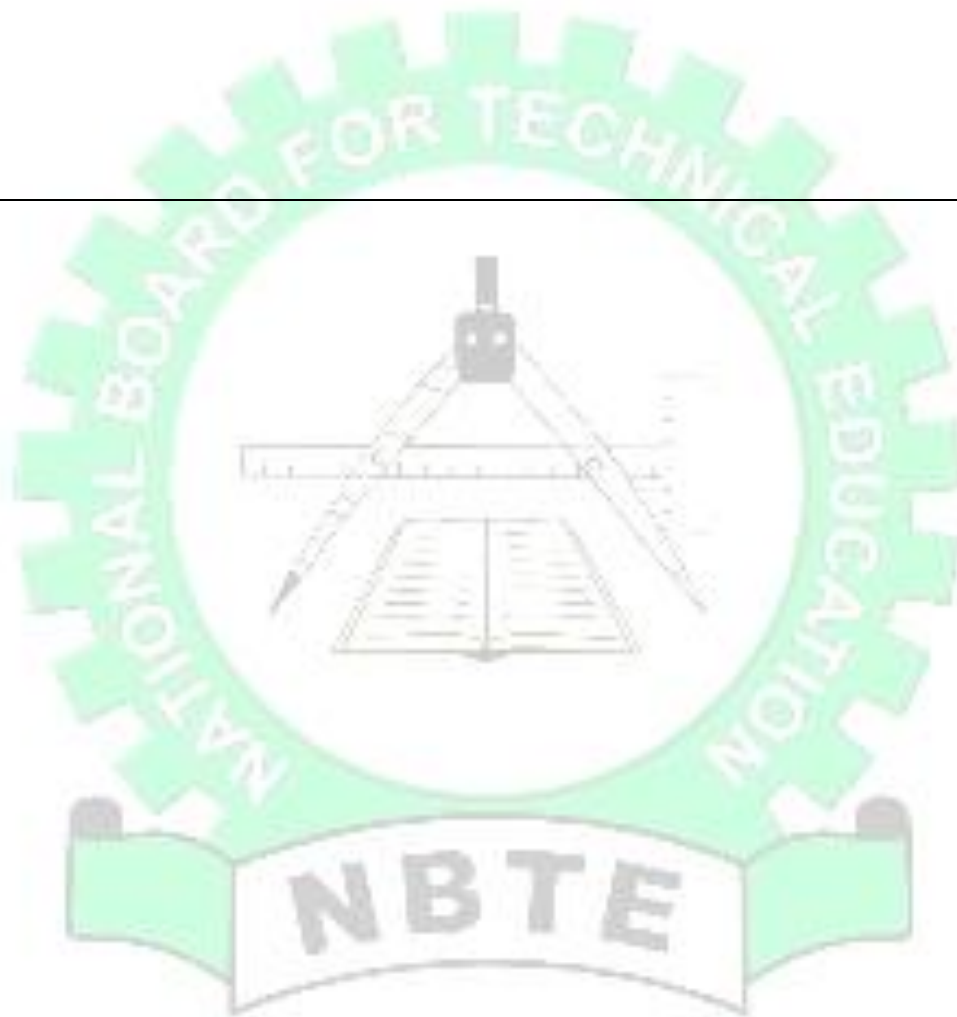
	soil; their relation to soil moisture, soil gas, soil profile and plant. The carbon cycle with particular attention to its importance. The nitrogen cycle with emphasis on nitrogen mineralization. The mineral cycles of the most importance elements – phosphorus, calcium, sulphur, iron and manganese 7.5 Explain the conditions affecting the growth of microflora in the soil – include carbon – nitrogen ratio. 7.6 Describe the effects of agricultural practices on soil microorganisms 7.7 Describe the activities of soil	gas, soil profile and plant. • The carbon cycle with particular attention to its importance. • The nitrogen cycle with emphasis on nitrogen mineralization. • The mineral cycles of the most importance elements – phosphorus, calcium, sulphur, iron and manganese • Explain the conditions affecting the growth of microflora in the soil – include carbon – nitrogen ratio. • Discuss the effects of agricultural practices on soil microorganisms • Explain the activities of soil organisms beneficial to higher plants • Discuss the activities				
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	organisms beneficial to higher plants 7.8 Describe the activities of soil organisms beneficial to agriculture: Decomposition of organic residues Formation of soil humus Improvement of soil physical properties Plant nutrient release, etc.	of soil organisms beneficial to agriculture: • Decomposition of organic residues • Formation of soil humus • Improvement of soil physical properties • Plant nutrient release, etc.				
General Objectives: 8.0: Know the roles of organisms in soil remediation						
14-5	8.1 Describe the concept of soil remediation 8.2 Describe different types of soil remediation 8.3 Describe the role of micro flora in soil bioremediation 8.4 Describe the role of macro flora in soil bioremediation 8.5 Describe the role of micro fauna in soil bioremediation	• Discuss the concept of soil remediation • Explain different types of soil remediation • Discuss the role of micro flora in soil bioremediation • Explain the role of macro flora in soil bioremediation • Discuss the role of micro fauna in soil bioremediation	LCD, Projector, Pictorials, Internet, Chats	• Identify different contaminated sites. • Identify different types of phytoremediating plants • Carry out observation on the importance of soil micro flora in biodegradable waste management	Guide students to; • Identify different contaminated sites. • Identify different types of phytoremediating plants • Carry out observation on the importance of soil micro flora in biodegradable waste management	Contaminated site, Samples of phytoremediation on plants e.g. sunflower, Indian mustard, willow plant, poplar tree, Indian grass, etc. Soil sample, agricultural wastes, petri dish, growth

						media refrigerator, etc
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COURSE ASSESSMENT:

Coursework: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
Total: 100%



SOIL FERTILITY AND PLANT NUTRITION

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL FERTILITY AND PLANT NUTRITION	COURSE CODE: SST 312	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with fundamental knowledge and practical skills in soil fertility principles, essential plant nutrient functions, soil fertility evaluation, fertilizer technology, and crop-specific nutrient management practices for sustainable agricultural productivity and environmental management.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the fundamental principles of soil fertility and plant nutrition. 2.0 Know the relationship between soil properties and nutrient availability to plants. 3.0 Know the functions of macro and micronutrients. 4.0 Understand fertilizer technology principles in the management of soil fertility and plant nutrition. 5.0 Know integrated nutrient management		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL FERTILITY AND PLANT NUTRITION			COURSE CODE: SST 312		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: Nil		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with fundamental knowledge and practical skills in soil fertility principles, essential plant nutrient functions, soil fertility evaluation, fertilizer technology, and crop-specific nutrient management practices for sustainable agricultural productivity and environmental management.						
GENERAL OBJECTIVE 1.0: Understand the fundamental principles of soil fertility and plant nutrition.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Describe the principles and concepts of soil fertility and plant nutrition. 1.2 Explain essential plant nutrients required for crop growth and development 1.3 Describe soil fertility status using appropriate soil-testing methods. 1.4 Explain nutrient deficiency symptoms and	• Explain the principles and concepts of soil fertility and plant nutrition. • Discuss essential plant nutrients required for crop growth and development • Discuss soil fertility status using appropriate soil-testing methods. • Discuss nutrient deficiency symptoms and their effects on crop	LCD, Projector, Slides, Internet, Chats, Computer White board, Marker	• Collect soil samples from the field . • Analyses them using standard laboratory methods to • Determine soil fertility index, including; soil pH, textural class, organic matter, CEC, etc.	Guide students to; • Collect soil samples from the field. • Analyse collected soil samples using standard laboratory methods • Determine soil fertility index, including; soil pH, textural class, organic matter, CEC, etc.	Soil auger, Labelled soil bags, Spectrophotometer, pH meter, Flame photometer; AAS, Computer, Internet, Practical manual

	their effects on crop performance.	performance.				
General objective 2.0: Know the relationship between soil properties and nutrient availability to plants.						
4-6	2.1 Explain the relationship between soil texture, nutrient retention and availability to plants. 2.2 Describe how soil pH affects the solubility and availability of essential plant nutrients. 2.3 Describe the contribution of soil biological properties (microorganisms, organic matter, and soil fauna) to nutrient cycling and release. 2.4 Explain the role of soil moisture on nutrient mobility and plant absorption	• Explain the relationship between soil texture, nutrient retention and availability to plants. • Explain how soil pH affects the solubility and availability of essential plant nutrients. • Discuss the contribution of soil biological properties (microorganisms, organic matter, and soil fauna) to nutrient cycling and release. • Explain the role of soil moisture on nutrient mobility and plant absorption	LCD, Projector, Slides, Internet, Chats, Computer White board, Marker	• Determine soil texture using the hydrometer method or feel method. • Classify soil samples into sand, silt, and clay proportions and relate results to nutrient retention capacity. • Interpret laboratory results to explain how clay-rich soils retain more nutrients than sandy soils. • Observe soil microorganisms and fauna (e.g., earthworms, fungi, bacteria) using soil samples. • Carry out decomposition of organic matter using litter bag or	Guide students to; • Determine soil texture using the hydrometer method or feel method. • Classify soil samples into sand, silt, and clay proportions and relate results to nutrient retention capacity. • Interpret laboratory results to explain how clay-rich soils retain more nutrients than sandy soils. • Identify and observe soil microorganisms and fauna (e.g., earthworms, fungi, bacteria) using soil samples. • Carryout decomposition of organic matter using litter bag or incubation methods. • Measure microbial activity through	Hydrometer, Sieves, Plunger, textural triangle, spade/trowel, soft forceps. Computer, Internet, Practical manual

				incubation methods. • Measure microbial activity through respiration (CO₂ release) or simple incubation tests. • Create poster to Relate biological activity results to nutrient mineralization and release into the soil solution.	respiration (CO ₂ release) or simple incubation tests. • Relate biological activity results to nutrient mineralization and release into the soil solution.	
General Objective 3.0: Know the functions of macro and micronutrients						
7-9	3.1 Describe the functions of primary macronutrients; N, P, K in soil fertility and plant nutrition. 3.2 Explain the roles of secondary macronutrients (Ca, Mg, S) in maintaining soil fertility and plant nutrition. 3.3 Explain the functions of micronutrients (Fe, Mn, Zn, Cu, B, Mo,	• Discuss the functions of primary macronutrients; N, P, K in soil fertility and plant nutrition. • Explain the roles of secondary macronutrients (Ca, Mg, S) in maintaining soil fertility and plant nutrition. • Discuss the functions of micronutrients (Fe, Mn, Zn, Cu, B, Mo, Cl, Ni) in plant physiological	LCD, Projector, Slides, Internet, Chats, Computer White board, Marker	• Determine Nitrogen (N), Phosphorus (P), and Potassium (K) as primary macronutrients essential for plant growth. • Examine the function of Phosphorus in root development, energy transfer (ATP), flowering, and seed formation. • Determine the	Guide students to; • Determine Nitrogen (N), Phosphorus (P), and Potassium (K) as primary macronutrients essential for plant growth. • Examine the function of Phosphorus in root development, energy transfer (ATP), flowering, and seed formation. • Determine the role of Iron (Fe) in chlorophyll synthesis,	Kjeldahl apparatus, Spectrophotometer, Flame photometer, AAS for macro and micronutrients, Computer, Internet, Practical manual

	Cl, Ni) in plant physiological processes. 3.4 Explain nutrient availability in soil to plant growth, crop yield, and nutrient-use efficiency.	processes. • Explain nutrient availability in soil to plant growth, crop yield, and nutrient-use efficiency.		role of Iron (Fe) in chlorophyll synthesis, electron transport, and enzyme activation in plants. • Demonstrate the importance of Boron (B) in cell wall formation, sugar transport, and pollen germination.	electron transport, and enzyme activation in plants. • Demonstrate the importance of Boron (B) in cell wall formation, sugar transport, and pollen germination.	
General objective 4.0: Understand fertilizer technology principles in the management of soil fertility and plant nutrition.						
10-12	4.1 Describe the concept and importance of fertilizer technology in soil fertility management. 4.2 Classify fertilizers into organic, inorganic (mineral), and biofertilizers based on composition and function. 4.3 Compare slow-release, controlled-release, and soluble fertilizers in relation to nutrient	• Explain the concept and importance of fertilizer technology in soil fertility management. • Discuss fertilizers classification into organic, inorganic (mineral), and biofertilizers based on composition and function. • Compare slow-release, controlled-release, and soluble fertilizers in relation to nutrient availability.	LCD, Projector, Slides, Internet, Chats, Computer White board, Marker	• Classify fertilizer samples into organic, inorganic (mineral), and biofertilizers based on physical appearance, labelling, and composition. • Examine fertilizer labels and interpret nutrient content (NPK ratios and nutrient forms). • Differentiate fertilizer types through	Guide students to: • Identify and classify fertilizer samples into organic, inorganic (mineral), and biofertilizers based on physical appearance, labelling, and composition. • Examine fertilizer labels and interpret nutrient content (NPK ratios and nutrient forms). • Differentiate fertilizer types through laboratory and field observation based on	4:1 Justify the use of: Kjeldahl apparatus, Spectrophotometer, Flame photometer, AAS, Computer, Internet, Practical manual

	availability. 4.4 Explain fertilizer reaction in soil and its effect on soil pH and nutrient dynamics. 4.5 Explain appropriate fertilizer types based on soil test results and crop nutrient requirements	• Explain fertilizer reaction in soil and its effect on soil pH and nutrient dynamics. • Discuss appropriate fertilizer types based on soil test results and crop nutrient requirements		laboratory and field observation based on solubility, texture, and origin. • Investigate the effect of fertilizers on soil pH using incubation or soil treatment experiments. • Measure changes in soil chemical properties (pH and EC) after fertilizer application. • Analyse fertilizer-soil reactions and explain effects such as acidification, alkalization, nutrient fixation, or loss. • Interpret laboratory results to determine how fertilizer application influences nutrient dynamics in soil.	solubility, texture, and origin. • Investigate the effect of fertilizers on soil pH using incubation or soil treatment experiments. • Measure changes in soil chemical properties (pH and EC) after fertilizer application. • Analyse fertilizer-soil reactions and explain effects such as acidification, alkalization, nutrient fixation, or loss. • Interpret laboratory results to determine how fertilizer application influences nutrient dynamics in soil.	
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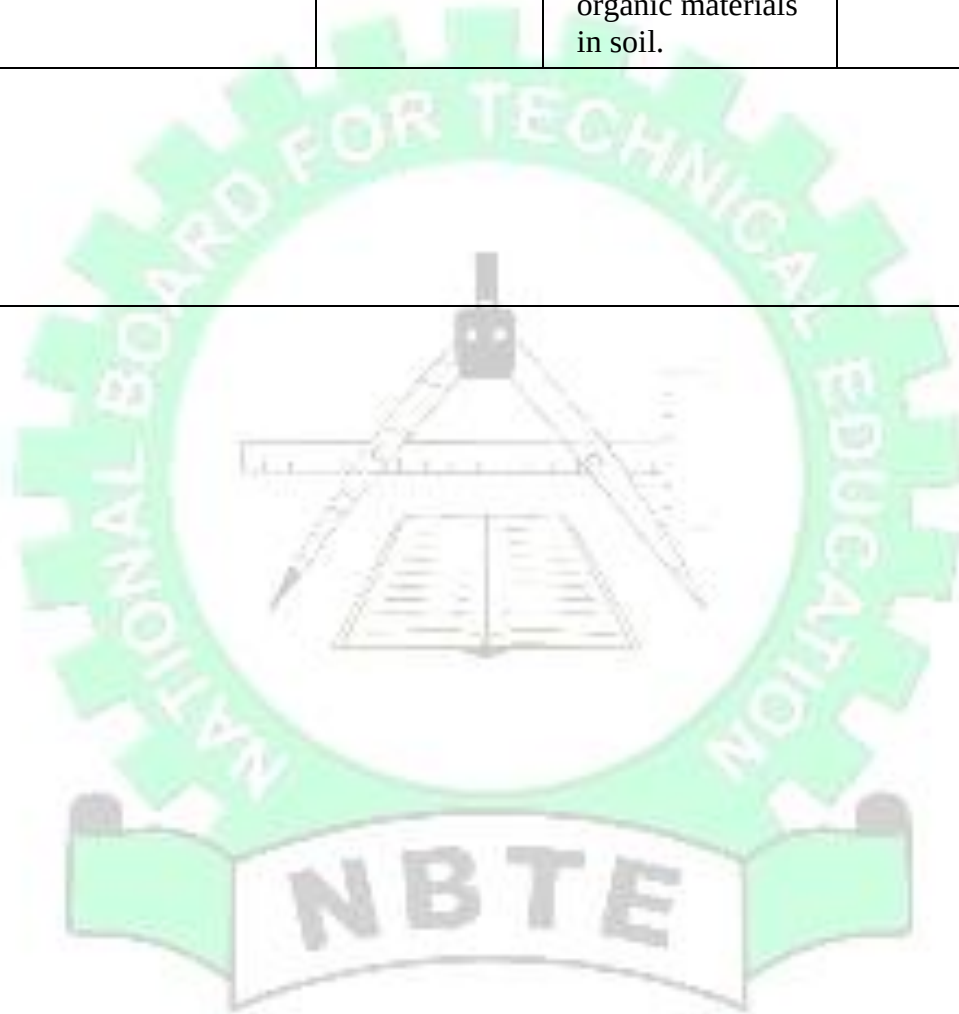
General Objective 5.0: Know integrated nutrient management

13-15	5.1 Describe the concept and principles of Integrated Nutrient Management (INM) in soil fertility and plant nutrition. 5.2 Describe the roles of organic, inorganic, and biological nutrient sources in INM systems. 5.3 Discuss the different nutrient sources used in integrated nutrient management (fertilizers, manure, compost, biofertilizers, and crop residues). 5.4 Describe INM principles in field or laboratory demonstrations to improve soil fertility and plant nutrition.	• Explain the concept and principles of Integrated Nutrient Management (INM) in soil fertility and plant nutrition. • Discuss the roles of organic, inorganic, and biological nutrient sources in INM systems. • Discuss the different nutrient sources used in integrated nutrient management (fertilizers, manure, compost, biofertilizers, and crop residues). • Explain INM principles in field or laboratory demonstrations to improve soil fertility and plant nutrition.	LCD, Projector, Slides, Internet, Chats, Computer White board, Marker	• Collect and prepare organic materials (e.g., crop residues and manure) for use in soil fertility improvement. • Set up field or pot experiments comparing sole fertilizer use, sole organic manure, and integrated nutrient application. • Apply different nutrient combinations (organic + inorganic + biofertilizer) following INM principles. • Observe and record plant growth responses under different nutrient management treatments. • Demonstrate nutrient cycling	Guide students to; • Collect and prepare organic materials (e.g., crop residues and manure) for use in soil fertility improvement. • Set up field or pot experiments comparing sole fertilizer use, sole organic manure, and integrated nutrient application. • Apply different nutrient combinations (organic + inorganic + biofertilizer) following INM principles. • Observe and record plant growth responses under different nutrient management treatments. • Demonstrate nutrient cycling processes through decomposition and mineralization of organic materials in	Experimental field plot or greenhouse space Pots, polybags, or planting in integrated nutrient management, Computer, Internet, Practical manual
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				processes through decomposition and mineralization of organic materials in soil.	soil.	
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COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



LAND SURVEYING AND LAND USE PRINCIPLES

PROGRAMME: HND IN SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: LAND SURVEYING AND LAND USE PRINCIPLES	COURSE CODE: SST 313	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: The course is designed to equip students with the knowledge and technical skills required for the measurement, mapping, evaluation, planning, and sustainable utilization of land resources		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand land-surveying foundations. 2.0 Understand leveling and contouring. 3.0 Know geographical positioning system and modern surveying. 4.0 Understand land-use principles. 5.0 Know cadastral and land-administration basics.		

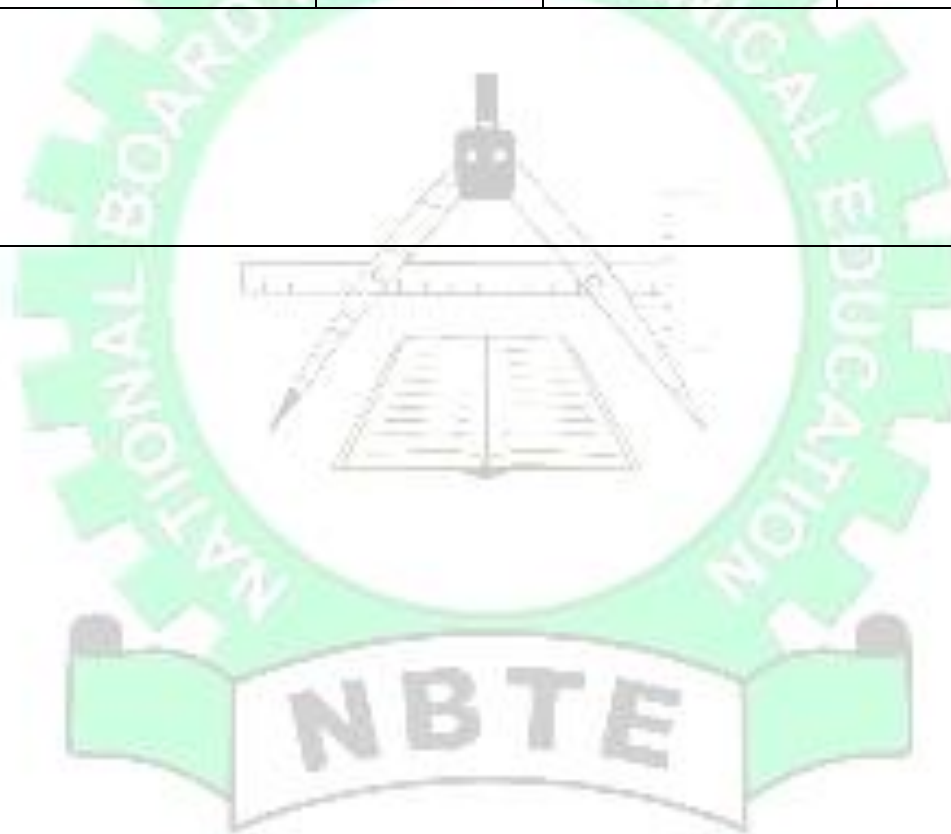
PROGRAMME: HND IN SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: LAND SURVEYING AND LAND USE PRINCIPLES			COURSE CODE: SST 313		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: T The course is designed to equip students with the knowledge and skills required for the measurement, mapping, evaluation, planning, and sustainable utilization of land resources.						
GENERAL OBJECTIVE 1.0: Understand land-surveying foundations						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define Land survey 1.2 Describe surveying principles and concepts 1.3 Describe linear and angular measurement 1.4 Explain chain / tape surveying 1.5 Explain compass / theodolite surveying	• Explain Land survey • Discuss surveying principles and concepts • Explain linear and angular measurement • Explain chain / tape surveying • Discuss compass / theodolite surveying	LCD Projector Pictorials, Internet Chats	• Measure linear and angular dimensions • Conduct chain / tape survey • Conduct compass / theodolite survey	Guide students to: • Measure linear and angular dimensions • Conduct chain / tape survey • Conduct compass / theodolite survey	Chain Tape; Compass Theodolite; Ranging pole; Rods, Computer, Internet, Practical manual etc.
GENERAL OBJECTIVE 2.0: Understand leveling and contouring.						
4-6	2.1 Define soil leveling principles 2.2 Describe differential and	• Explain soil leveling principles • Discuss differential and profile leveling	LCD Projector	• Conduct differential leveling • Conduct profile	Guide students to: • Conduct differential leveling • Conduct profile	Auto-level; digital level, and tripod, Computer,

	profile leveling 2.3 Explain reduced-level computations 2.4 Describe contouring methods	• Explain reduced-level computations • Explain contouring methods	Pictorials, Internet Chats, Computer,	leveling • Compute reduced levels • Generate contour map	leveling • Compute reduced levels • Generate contour map	Internet, Practical manual
GENERAL OBJECTIVE 3.0: Know geographical positioning system and modern surveying						
7-9	3.1 Explain GPS / GNSS principles 3.2 Describe hand-held GPS 3.3 Describe RTK GPS positioning 3.4 Describe total-station surveying	• Explain GPS / GNSS principles • Describe hand-held GPS • Explain RTK GPS • Discuss total-station surveying	LCD Projector Pictorials, Internet Chats	• Identify 20 position points using hand-held GPS • Conduct RTK GPS survey • Conduct total-station survey	Guide students to: • Identify 20 position points using hand-held GPS • Conduct RTK GPS survey • Conduct total-station survey	GPS, RTK Processing Software. Computer, Internet, Practical manual
GENERAL OBJECTIVE 4.0: Understand land-use principles						
10-12	4.1 Define land-use classification systems 4.2 Describe land-use change drivers 4.3 Explain land-use mapping 4.4 Describe land-use conflicts	• Explain land-use classification systems • Discuss land-use change drivers • Explain land-use mapping • Discuss land-use conflicts	LCD Projector Pictorials, Internet Chats	• Conduct land-use change over time • Conduct land-use mapping • Identify and resolve land-use conflicts	Guide students to: • Conduct land-use change over time • Conduct land-use mapping • Identify and resolve land-use conflicts	EM maps, Computer, Internet, Practical manual
GENERAL OBJECTIVE 5.0: Know cadastral and land-administration basics.						
12-15	5.1 Define cadastral principles	• Explain cadastral principles	LCD	• Conduct cadastral survey	Guide students to: • Conduct cadastral	Cadastral maps, Tenure docs,

5.2 Explain land-tenure systems in Nigeria 5.3 Describe land-titling and registration 5.4 Describe Land-Use Act of Nigeria	- Discuss land-tenure systems in Nigeria - Explain land-titling and registration - Discuss Land-Use Act of Nigeria	Projector Pictorials, Internet Chats	- Profile Nigerian tenure systems - Conduct land-titling exercise	survey - Profile Nigerian tenure systems - Conduct land-titling exercise	Land-Use Act , Computer, Internet, Practical manual
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COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



GIS AND DIGITAL SOIL MAPPING

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: GIS AND DIGITAL SOIL MAPPING	COURSE CODE: SST 314	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in Geographic Information Systems (GIS), Global Positioning Systems (GPS), Remote Sensing, spatial data management, digital soil mapping (DSM), and the application of geospatial technologies in soil survey, land evaluation, precision agriculture, and natural resource management.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the concepts, scope, and applications of GIS in soil science and land resources management 2.0 Know the components of GIS and spatial data models 3.0 Understand coordinate systems, map projections, and georeferencing 4.0 Know spatial data acquisition, data processing and editing techniques 5.0 Understand the principles of Global Positioning System (GPS) and field data collection 6.0 Know how to create and manage a GIS database 7.0 Understand the principles of remote sensing for soil and land resource studies 8.0 Know how to perform image classification and land use/land cover mapping 9.0 Know how to perform spatial interpolation and predictive soil mapping techniques 10.0 Know how to perform soil suitability evaluation using GIS 11.0 Know map production, visualization, accuracy assessment, and report generation		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: GIS AND DIGITAL SOIL MAPPING			COURSE CODE: SST 314		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: Nil		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills in Geographic Information Systems (GIS), Global Positioning Systems (GPS), Remote Sensing, spatial data management, digital soil mapping (DSM), and the application of geospatial technologies in soil survey, land evaluation, precision agriculture, and natural resource management.						
General Objective 1.0: Know the concepts, scope, and applications of GIS in soil science and land resources management						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Explain the concepts of GIS Soil Science and Land resources management 1.2 Discuss the scope and limitations of GIS in Soil Science and Land Resources Management 1.3 Explain the applications of GIS in Soil Science and Land Resources Management	- Explain the concepts of GIS Soil Science and Land resources management - Discuss the scope and limitations of GIS in Soil Science and Land Resources Management - Discuss the applications of GIS in Soil Science and Land Resources Management	LCD, Projector, GIS Software, Internet	Identify GIS laboratory facilities and software interfaces	Guide the students to: Identify GIS laboratory facilities and software interfaces	Computer laboratory, QGIS, ArcGIS Computer, Internet, Practical manual

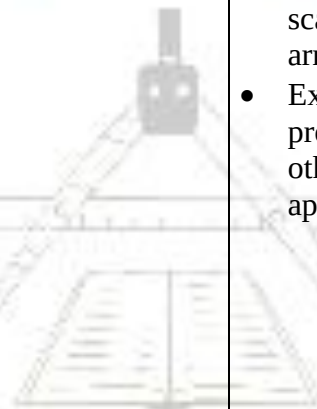
General Objective 2.0: Know the components of GIS and spatial data models justify						
2	2.1 Discuss the components of GIS and spatial data models 2.2 Explain the difference between hardware, software, data, personnel, and methods requirements for GIS and spatial data models 2.3 Describe the types of software and their limitations in carrying out GIS work 2.4 Explain raster and vector models	- Discuss the components of GIS and spatial data models - Explain the difference between hardware, software, data, personnel, and methods requirements for GIS and spatial data models - Discuss the types of software and their limitations in carrying out GIS work - Discuss raster and vector models	LCD, Projector, GIS software, charts, multimedia presentations, Internet	- Inspect the facilities in a GIS laboratory - Install and navigate GIS software - Nviside GIS Software	Guide the students to: - Inspect the facilities in a GIS laboratory - Install and navigate GIS software	Computer, QGIS, ArcGIS, Computer, Internet, Practical manual
General Objective 3.0: Understand coordinate systems, map projections, and georeferencing						
3	3.1 Explain the concept of coordinate systems, map projections, and georeferencing 3.2 Describe how to use different coordinate systems and their	- Explain the concept of coordinate systems, map projections, and georeferencing - Describe how to use different coordinate systems	LCD, Projector, Maps, GIS software, GPS receiver, Internet	- Study maps produced using different projection systems - Carry out georeferencing of printed maps	Guide the students to: - Study maps produced using different projection systems - Carry out georeferencing of printed maps	Scanned maps, GIS software, Computer, Internet, Practical manual

	conversions 3.3 Describe how to project maps using different coordinate systems 3.4 Describe how to georeference maps	and their conversions - Describe how to project maps using different coordinate systems - Describe how to georeference maps				
General Objective 4.0: Know spatial data acquisition, data processing and editing techniques						
4	4.1 Explain the concept of spatial data acquisition 4.2 Discuss the types of spatial data acquisition techniques 4.3 Describe how to use different types of spatial data acquisition techniques	- Explain the concept of spatial data acquisition - Discuss the types of spatial data acquisition techniques (GPS, remote sensing, soil surveys, DEMs, and existing maps) - Explain how to use different types of spatial data acquisition techniques	GPS units, satellite imagery, topographic maps, Internet	- Use waypoint for the collection and navigation - Acquire data using GPS and satellite images	Guide the students to: - Use waypoint for the collection and navigation - Acquire data using GPS and satellite images	Handheld GPS device, Smart phones, GIS software, Computer, Internet, Practical manual
General Objective 5.0: Understand the principles of Global Positioning System (GPS) and field data collection						
5	5.1 Explain the working principles of the Global Positioning System (GPS) and field data collection	Explain the working principles of the Global Positioning System (GPS) and field data collection	Handheld GPS devices, smartphones Computer, Internet,	Carry out navigation using a GPS device	Guide the students to: Carry out navigation using a GPS device	:Handheld GPS device, Smart phones, Computer, Internet,

	5.2 Explain the importance of accurate field data collection 5.3 Describe how to use GPS device to collect data from the field	• Discuss the operations and accuracy of GPS and the importance of accurate field data collection • Explain how to use GPS device to collect data from the field				Practical manual
General Objective 6.0: Know how to create and manage a GIS database						
6	6.1 Explain the concept of GIS database creation and management 6.2 Describe how to create GIS a database 6.3 Describe how to modify attribute tables, database structures, and data storage methods	• Explain the concept of GIS database creation and management • Describe how to create GIS a database • Explain how to modify attribute tables, database structures, and data storage methods	Computers, GIS software (QGIS/ArcGIS)	• Create a database using any GIS software and practice data entry • Edit entries in a database create using any GIS software	Guide the students to: • Create a database using any GIS software and practice data entry • Edit entries in a database created using any GIS software	Computer, GIS software, spreadsheets, Computer, Internet, Practical manual
General Objective 7.0: Understand the principles of remote sensing for soil and land resource studies						
7-8	7.1 Explain the concept of Remote Sensing in soil and land resource studies 7.2 List the resources used to obtain data remotely	• Explain the concept of Remote Sensing in soil and land resource studies • Discuss the different resources used to obtain data	Satellite images, remote sensing manuals, Internet	• Download satellite images for analyses • Download Digital Elevation Models (DEMs) and terrain maps	Guide the students to: • undertake the download of satellite data for analyses • Download Digital Elevation Models (DEMs)	Computer, GIS software, Internet, Computer, Practical manual

	7.3 Describe how to obtain data remotely	- remotely - Discuss electromagnetic spectrum, image acquisition, and interpretation			and terrain maps	
General Objective 8.0: Know how to perform image classification and land use/land cover mapping						
9-10	8.1 Explain the concept and principles of image classification and land use/land cover mapping in soil and land resource studies 8.2 List the different methods of image classification and land use/land cover mapping 8.3 Describe how to perform supervised and unsupervised classification	- Explain the concept and principles of image classification and land use/land cover mapping in soil and land resource studies - Discuss the different methods of image classification and land use/land cover mapping - Explain how to perform supervised and unsupervised classification	Computers, GIS and remote sensing software	Carry out the supervised and unsupervised classification of satellite images	Guide the students to: Carry out the supervised and unsupervised classification of satellite images	Computer, GIS software, Internet, Computer, Practical manual
General Objective 9.0: Know how to perform spatial interpolation and predictive soil mapping techniques						
11-12	9.1 Explain the concept of spatial interpolation and predictive soil mapping techniques	Explain the concept of spatial interpolation and predictive soil mapping techniques	Computer, GIS software, statistical packages	Perform interpolation and other spatial analyses using different GIS software (IDW)	Guide the students to: Perform interpolation and other spatial analyses using different GIS software	Computer, GIS software, Internet, Computer, Internet,

	9.2 Discuss the different approaches to spatial interpolation 9.3 Describe how to use different approaches to carry out interpolation	- Discuss the different approaches to spatial interpolation (IDW, Kriging, Regression Models, and Machine Learning approaches) - Explain how to use IDW, Kriging, Regression Models, and Machine Learning approaches to carry out interpolation		and kriging analysis)		Practical manual
General Objective 10.0: Know how to perform soil suitability evaluation using GIS						
13-14	10.1 Explain the concept of soil suitability evaluation using GIS 10.2 List the criteria to be followed in carrying out soil suitability evaluation 10.3 Describe the procedure to perform soil suitability	- Explain the concept of soil suitability evaluation using GIS - Discuss the criteria to be followed in carrying out soil suitability evaluation (Interpolation, AHP, Weighted overlay analysis) - Explain the	Land evaluation guides, GIS software	Carry out land suitability assessment through weighted overlay analysis on interpolated maps in the GIS environment	Guide the students to: Perform AHP, weighted overlay analysis and land suitability assessment on interpolated maps	Computer, GIS software, Internet, Computer, Practical manual

	evaluation	procedure to perform soil suitability evaluation				
General Objective 11.0: Know map production, visualization, accuracy assessment, and report generation						
15	11.1 Explain the concept of map production and visualization 11.2 Explain the importance of accuracy assessment, and report generation 11.3 Describe how to produce accurate maps 11.4 Describe how to produce reports using produced maps	- Explain the concept of map production and visualization - Explain the importance of accuracy assessment, and report generation - Discuss how to produce accurate maps - Explain how to produce reports with maps	Printers, plotters, GIS software 	- Produce digital soil maps with good layout design, legends, scale bars, north arrow - Export maps produced to other applications	Guide the students to: - Produce digital soil maps with good layout design, legends, scale bars, north arrow - Export maps produced to other applications	Computer, GIS software, Internet, Computer, Practical manual
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



REMOTE SENSING FOR SOIL AND LAND RESOURCES

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: REMOTE SENSING FOR SOIL AND LAND RESOURCES	COURSE CODE: SST 321	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to provide students with the knowledge and practical skills needed to utilize remote sensing technologies and geospatial data for the inventory, assessment, monitoring, mapping, and sustainable management of soil and land resources.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the fundamental principles, concepts, and applications of remote sensing 2.0 Know the various types of remote sensing platforms, sensors, and data acquisition systems used in environmental and land resource studies. 3.0 Understand aerial photographs, satellite imagery, and other remotely sensed data for soil and land resource assessment 4.0 Know how to utilize remote sensing data for soil survey, land evaluation, land capability assessment, and land suitability classification 5.0 Understand land degradation processes such as erosion, desertification, salinization, flooding, and deforestation using remote sensing techniques 6.0 Know remote sensing technologies in precision agriculture, crop monitoring, soil fertility assessment, and sustainable land management 7.0 Understand modern geospatial technologies to support agricultural development, environmental sustainability, and land-use planning		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: REMOTE SENSING FOR SOIL AND LAND RESOURCES			COURSE CODE: SST 321		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with the knowledge and practical skills needed to utilize remote sensing technologies and geospatial data for the inventory, assessment, monitoring, mapping, and sustainable management of soil and land resources.						
GENERAL OBJECTIVE 1.0: Understand the fundamental principles, concepts, and applications of remote sensing						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Define remote sensing 1.2 explain its principles, scope, and applications in soil and land resource management 1.3 Describe the historical development and evolution of remote sensing technologies 1.4 Differentiate between active and passive remote sensing systems	• Explain remote sensing • Discuss its principles, scope, and applications in soil and land resource management • Explain the historical development and evolution of remote sensing technologies • Explain differences between active and passive remote sensing systems	LCD, Projector, Pictorials, Internet, Chats	• Acquire and interpret aerial photograph	Guide students to; • Acquire and interpret aerial photograph	Aerial photo maps Contour maps, Computer, Internet, Practical manual

	1.5 Explain the advantages and limitations of remote sensing in natural resource assessment.	Explain the advantages and limitations of remote sensing in natural resource assessment.				
General Objective 2.0: Know the various types of remote sensing platforms, sensors, and data acquisition systems used in environmental and land resource studies						
3-4	2.1 Explain various remote sensing platforms, including ground-based, airborne, and satellite systems 2.2 Classify remote sensing sensors based on their operational principles and applications. 2.3 Differentiate between spatial, spectral, radiometric, and temporal resolutions. 2.4 Select appropriate sensors and imagery for specific soil and land resource	- Discuss various remote sensing platforms, including ground-based, airborne, and satellite systems - Classify remote sensing sensors based on their operational principles and applications. - Explain differences between spatial, spectral, radiometric, and temporal resolutions. - Select appropriate sensors and imagery for specific soil and land resource	LCD, Projector, Pictorials, Internet, Chats	- Collect various remote sensing platforms - Compare resolutions - Classify sensors based on their operational principles - Download Landsat/Sentinel images for Nigeria	Guide the students to: - Collect various remote sensing platforms - Compare resolutions - Classify sensors based on their operational principles - Download Landsat/Sentinel images for Nigeria	Satellite image/aerial photo maps, Computer, Practical manual

	investigations	investigations				
General Objective 3.0 Understand aerial photographs, satellite imagery, and other remotely sensed data for soil and land resource assessment						
5-6	3.1 Explain land features using visual image interpretation elements such as tone, texture, shape, pattern, size, and association. 3.2 Describe aerial photographs and satellite imagery for soil and land resource studies. 3.3 Discuss landforms, soil boundaries, vegetation types, and drainage patterns from remotely sensed imagery.	- Explain land features using visual image interpretation elements such as tone, texture, shape, pattern, size, and association. - Explain aerial photographs and satellite imagery for soil and land resource studies. - Discuss landforms, soil boundaries, vegetation types, and drainage patterns from remotely sensed imagery.	LCD, Projector, Pictorials, Internet, Chats	- Assemble satellite imagery /maps to identify soil data studies/properties - Delineate landforms, soil boundaries, vegetation types, drainage patterns etc. - Generate thematic maps from image interpretation results - Generate thematic maps from image interpretation results.	Guide students to: - Assemble satellite imagery /maps to identify soil data studies/properties - Delineate landforms, soil boundaries, vegetation types, drainage patterns etc. - Observe/generate thematic maps from image interpretation results - Generate thematic maps from image interpretation results.	Computer software Images, Computer, Internet, Practical manual
General Objective 4.0: Understand remote sensing data for soil survey, land evaluation, land capability assessment, and land suitability classification						
7-8	4.1 Classify land use and land cover categories from satellite imagery 4.2 Explain the	- Discuss land use and land cover categories from satellite imagery - Explain the	LCD Projector Pictorials Internet Chats,	- Conduct land use and land cover using satellite imagery - Conduct soil	Guide students to: - Conduct land use and land cover using satellite imagery - Conduct soil	Aerial photo maps Computer software, Computer,

	relationship between Remote Sensing and GIS 4.3 Explain remote sensing data to identify and map soil types and soil variability 4.4 Describe land capability and land suitability assessments using remotely sensed data 4.5 Explain soil moisture distribution using remote sensing techniques 4.6 Explain land degradation and environmental changes using temporal imagery	relationship between Remote Sensing and GIS • Explain remote sensing data to identify and map soil types and soil variability • Discuss land capability and land suitability assessments using remotely sensed data • Explain soil moisture distribution using remote sensing techniques • Explain land degradation and environmental changes using temporal imagery	Computer, Internet,	moisture distribution using remote sensing techniques • Identify land degradation and environmental changes using temporal imagery	moisture distribution using remote sensing techniques • Identify land degradation and environmental changes using temporal imagery	Internet, Practical manual
General Objective 5.0: Understand land degradation processes such as erosion, desertification, salinization, flooding, and deforestation using remote sensing techniques						
9-10	5.1 Explain how to use remote sensing data to map soil types and soil variability.	• Explain how to use remote sensing data to explain maps soil types and soil variability.	LCD Projector Pictorials Internet Chats	• Identify various soil types using maps • Observe soil degradation	Guide students to: • Identify various soil types using maps • Observe soil degradation	Computer, relevant software, Images Practical

	5.2 Describe soil degradation indicators such as erosion, salinity, compaction, and nutrient depletion. 5.3 Describe soil moisture distribution using remote sensing techniques. 5.4 Explain remotely sensed data in soil survey and soil fertility management.	• Discuss soil degradation indicators such as erosion, salinity, compaction, and nutrient depletion. • Discuss soil moisture distribution using remote sensing techniques. • Explain remotely sensed data in soil survey and soil fertility management.	Marker Marker board Computer	indicators such as erosion, compaction, nutrient depletion • Conduct soil moisture distribution using remote sensing techniques • Determine remotely sensed data in soil survey and soil fertility management	indicators such as erosion, compaction, nutrient depletion • Conduct soil moisture distribution using remote sensing techniques • Determine remotely sensed data in soil survey and soil fertility management	manual,
General Objective 6.0: Know remote sensing technologies in precision agriculture, crop monitoring, soil fertility assessment, and sustainable land management						
11-12	6.1 Classify land use and land cover categories from satellite imagery. 6.2 Explain land capability and land suitability assessments using remotely sensed data. 6.3 Explain land-use and land-cover changes over time. 6.4 Discuss land	• Classify land use and land cover categories from satellite imagery. • Explain land capability and land suitability assessments using remotely sensed data. • Discuss land-use and land-cover changes over time. • Discuss land	LCD Projector Pictorials Internet Charts, Computer, Marker, Marker board,	• Collect soil data to conduct land capability and land suitability classifications • Identify land degradation and environmental changes using temporal imagery etc.	Guide students to: • Collect soil data to conduct land capability and land suitability classifications • Identify land degradation and environmental changes using temporal imagery etc.	Aerial photo maps Computer, QGIS / SNAP, images Practical manual Charts,

	degradation and environmental changes using temporal imagery.	degradation and environmental changes using temporal imagery.				
General Objective 7.0: Understand modern geospatial technologies to support agricultural development, environmental sustainability, and land-use planning						
13-15	7.1 Explain remote sensing techniques in crop monitoring and precision agriculture 7.2 Explain drought, flooding, desertification, and other environmental hazards using remote sensing data. 7.3 Evaluate the impacts of climate variability and climate change on land resources using geospatial technologies. 7.4 Discuss appropriate land management interventions based on remotely sensed information.	• Explain remote sensing techniques in crop monitoring and precision agriculture • Discuss drought, flooding, desertification, and other environmental hazards using remote sensing data. • Explain the impacts of climate variability and climate change on land resources using geospatial technologies. • Explain appropriate land management interventions based on remotely sensed information	LCD Projector, Pictorials Internet Charts Computer, Marker, Marker board, Charts,	• Apply remote sensing techniques in crop monitoring and precision agriculture • Collect aerial photo maps to observe drought, flooding, desertification etc. easily • Identify impacts of climate change on land resources using geospatial technologies • Interpret remotely sensed information in land management	Guide students to: • Apply remote sensing techniques in crop monitoring and precision agriculture • Collect aerial photo maps to observe drought, flooding, desertification etc. areas • Identify impacts of climate change on land resources using geospatial technologies • Interpret remotely sensed information in land management	Aerial photo maps Computer, GIS software images Internet, Computer, Practical manual,

COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



SOIL GENESIS AND MORPHOLOGY

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL GENESIS AND MORPHOLOGY	COURSE CODE: SST 322	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip the student with the practical knowledge of soil genesis and morphology.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the units of the soil study 2.0 Understand the weathering processes 3.0 Understand the Pedogenic processes 4.0 Understand the external factors of soil formation 5.0 Understand the important morphological properties of the soil 6.0 Understand soil horizons and their designation 7.0 Understand soil particle and bulk density		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL GENESIS AND MORPHOLOGY			COURSE CODE: SST 322		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip the student with the practical knowledge of soil genesis and morphology.						
GENERAL OBJECTIVE 1.0: Know the units of the soil study						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Define Pedon 1.2 Define Polypedon 1.3 Define soil profile 1.4 Distinguish between the pedon and soil profile as units of soil study	• Explain Pedon • Explain Polypedon • Explain soil profile • Distinguish between the pedon and soi profile as units of soil study	Whiteboard Marker Projector Computer, Internet, Charts, etc	• Conduct a practical on soil profile • Draw a soil profile, the pedon and the polypedon	Guide the students to: • Dig a pit to identify soil depth • Identify soil colour • Identify soil horizons Soil texture etc.	Knife, Shovel Auger, digger, soil tape, shovel, Munsell color chart, practical manual, computer, internet,
General Objective 2.0: Understand the weathering processes						
2-3	2.1 Define soil genesis 2.2 Explain the history of soil genesis 2.3 Explain rocks and their modes of formation: igneous rocks; sedimentary;	• Explain soil genesis • Discuss the history of soil genesis • Discuss rocks and their modes of formation: igneous	Marker Charts, slides, Whiteboard Projector, Computer, Internet,	• Identify igneous, sedimentary, metamorphic rocks and their mode of formation	Guide the students to; • Identify Igneous, sedimentary, metamorphic rocks	Charts, slides, Projector, camera, mallet, hammer, identification tag,

	metamorphic rocks 2.4 Define weathering 2.5 Describe types of weathering: physical/mechanical; chemical; biological 2.6 Explain factors influencing rate of weathering	rocks; sedimentary; metamorphic rocks • Explain the term weathering • Discuss the different forms of weathering with their examples • Discuss the factors influencing rate of weathering.				masking tape
General Objective 3.0: Understand the Pedogenic processes						
4-5	3.1 Explain the general nature of the pedogenic processes 3.2 Describe specific pedogenic processes: desilication; calcification and decalcification; clay migration and deposition; other pedogenic processes 3.3 Define Soil composition 3.4 Explain the determination of the content of soil composition in an ideal soil.	• Discuss the general nature of the pedogenic processes • Explain specific pedogenic processes: desilication; calcification and decalcification; clay migration and deposition; other pedogenic processes • Explain Soil composition • Explain the determination of the content of soil	Chart, Projector Marker board, mathematical set, polythene bags, computer, internet, marker	• Determine the content of soil composition in an ideal soil.	Guide the students to; • Determine the content of soil composition in an ideal soil in the laboratory	Charts, Projector mathematical set,, polythene bag Soil samples, water, weighing balance, oven, spatula, practical manual,

	3.5 Describe the Importance of soil composition	composition in an ideal soil. • Explain the importance of soil composition • Discuss the composition of an ideal soil using a pie-chart • Explain the major functions of soil composition.				
General Objective 4.0: Understand the factors of soil formation						
6-7	4.1 Define factors of soil formation 4.2 State the equation of soil formation 4.3 Describe the role of parent material in soil formation 4.4 Explain the influences of rock types on soil properties 4.5 Explain the role of relief and landscape factors 4.6 Explain the relation between relief and other factors of soil formation 4.7 Describe topo-sequence and soil	• Explain factors of soil formation • State the equation of soil formation • Explain the role of parent material in soil formation • Explain the influences of rocks types on soil properties • Explain the role of relief and landscape factors • Explain the relation between relief and other factors of soil formation	Markerboard, Marker, Projector, Computer, Internet, Charts,	• Identify topo-sequence and soil catenas	Guide the students to; • Identify topo-sequence and soil catenas	Camera, mallet, hammer, Auger, identification label, GPS, Practical manual, Practical report booklet, etc

	catena 4.8 Explain: climate – soil property relationships. Rainfall – soil property relationships; temperature – soil property relationships 4.9 Explain the influence of microclimate on soil genesis 4.10 Describe the role of micro and macro flora and fauna in soil formation 4.11 Explain rate of soil formation 4.12 Explain the concept of mature soil and the time factor	• Discuss topo-sequence and soil catenas • Explain: climate – soil property relationships. Rainfall – soil property relationships; temperature soil property relationships • Explain the influence of microclimate on soil genesis • Discuss the role of micro and macro flora and fauna in soil formation • Explain rate of soil formation • Explain the concept of mature soil and the time factor				
General Objective 5.0: Understand the important morphological properties of the soil						
8-11	5.1 Define the three variables of colour viz: hue; value; chroma 5.2 Describe the	• Explain the role of three variable colours viz: hue; value; chroma in soil colour	Markerboard, Projector, Computer, Internet, Marker,	• Identify mottles using the three characteristics: abundance; size; contrast	Guide students to; • Identify mottles • Determine soil texture • Identify soil structure	Munsell soil, colour charts, Computer, Internet, Practical

	differences in the colour of the soil samples of different soil drainage classes 5.3 Define mottling 5.4 Explain the conditions under which mottling occurs in soils 5.5 Describe mottles using the three characteristics: abundance; size; contrast 5.6 Define soil texture 5.7 Describe methods of soil texture: field method; laboratory method 5.8 Define soil structure 5.9 Describe the two types of structureless conditions viz: single grain; massive grain 5.10 Describe the three features of soil structure viz: grade; class; type 5.11 Describe the primary types of	variation • Explain the differences in the colour of the soil samples of different soil drainage classes with examples • Explain mottles and mottling process • Discuss the conditions under which mottling occurs in soils • Explain mottles using the three characteristics: abundance; size; contrast • Explain soil texture • Explain methods of soil texture: field method; laboratory method • Explain the determination of soil texture on the field and in the laboratory by the use of the textual triangle • Explain soil	Charts, etc	• Determine soil texture on the field and in the laboratory by the use of the textual triangle • Determine soil consistency under different moisture conditions in the fields • Determine soil PH • Classify soil reaction using PH values	• Identify soil consistencies	manual
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	structure viz: platy; prismatic; spheroidal etc 5.12 Explain the importance of soil structure in agriculture 5.13 Describe soil structural classes in the field 5.14 Define soil consistency 5.15 Describe soil consistence at the three moisture conditions in the soil: wet, moist and dry 5.16 Define soil pH 5.17 Describe the determination of soil pH 5.18 Explain why the pedologist determines soil pH during soil description in the field 5.19 Explain classification of soil reaction using pH values 5.20 Explain how horizons	structure • Explain the two types of structureless conditions viz: single grain, massive grain, etc • Explain the three features of soil structure viz: grade; class; type • Explain the primary types of structure viz: platy; prismatic; spheroidal etc • Discuss the importance of soil structure in agriculture • Explain soil structural classes in the field • Explain soil consistency • Explain soil consistence at the three moisture conditions in the soil • Explain the determination of soil consistency under different				
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	boundaries are described 5.21 Define boundary width 5.22 Define boundary topography 5.23 Explain soil voids and their relationship to the soil	moisture conditions in the fields • Explain soil pH determination • State the reason pedologist determines soil pH during soil description in the field • Discuss the classification • Explain horizon boundaries • Explain boundary width • Explain boundary topography • Discuss soil voids and their relationship to the soil.				
General Objective 6.0: Understand soil horizons and their designation						
12-13	6.1 Define soil horizon 6.2 Explain soil horizon designation 6.3 Define the O, A, E, B, C and R horizon 6.4 Explain the processes of soil horizon development	• Explain the term soil horizon • Describe soil horizon designation • Explain the O, A, E, B, C and R horizon	Markerboard, Projector, Computer, Internet, Marker, Charts, etc	• Identify different soil horizons in a profile pit • Identify stoneliness • Identify concretions	Guide students to; • Identify different soil horizons in a profile pit • Identify stoneliness • Identify concretions	Digger, shovel, camera, GPS, hand trowel, core sampler, labels, practical manual, computer,

6.5 Define subordinate horizons	6.6 Describe different soil horizons in a profile pit	6.7 Define lithologic discontinuities	6.8 Define stoneliness	6.9 Explain the formation of stoneliness	6.10 Explain stoneliness	6.11 Relate stoneliness to lithologic discontinuities	6.12 Define concretions and nodules	6.13 Explain how concretions and nodules are formed	6.14 Define cutan	6.15 Describe the various types of cutans and distinguish between them	6.16 Explain the occurrence of hard pans in soils	6.17 Explain the various types of hard pans and their agricultural	- Describe the processes of soil horizon development - Explain subordinate horizons - Explain the term lithologic discontinuities - Explain the term stoneliness - Describe the formation of stoneliness - Distinguish between stoneliness and lithologic discontinuities - Explain concretions and/or nodules - Describe how concretions and nodules are formed - Explain the term Cutan - Explain the various types of cutans - Describe the	and/or nodules - Identify the various types of cutans - Identify the various types of hard pans	and/or nodules - Identify the various types of cutans and - Identify the various types of hard pans	internet, etc
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	importance	occurrence of hard pans in soils • Explain the various types of hard pans and their agricultural importance				
General Objective 7.0: Understand soil particle and bulk density						
14-15	7.1 Define the term particle density 7.2 Describe the method of particle density determination 7.3 Explain the term bulk density 7.4 Explain the importance of particle and bulk densities in soil classification 7.5 Describe the various methods of determination of bulk density 7.6 Explain the term porosity 7.7 Explain the calculation of soil porosity	• Discuss the term particle density • Explain the methods of determination of particle density • Discuss the term bulk density • State the importance of particle and bulk densities in soil classification • Explain the various methods of determination of bulk density • Discuss the term porosity • Explain the methods of calculating soil porosity	Markerboard, Projector, Computer, Internet, Marker, Charts, etc	• Determine bulk density using different methods • Determine particle density.	Guide students to; • Determine bulk density in the laboratory using different methods. • Determine particle density.	Core sampler Hammer Oven, pycnometer Wood, Computer, Internet, Practical manual, etc

COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



FIELD PRACTICAL I (SOIL SURVEY AND SAMPLING TECHNIQUES)

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: FIELD PRACTICAL I (SOIL SURVEY AND SAMPLING TECHNIQUES)	COURSE CODE: SST 323	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 0
YEAR: I SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 4 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills to deliver integrated soil-survey, sampling and field-mapping practice across multiple agro-ecological sites		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand pre-fieldwork preparation. 2.0 Know field-survey execution. 3.0 Understand data compilation and lab handover. 4.0 Understand mapping and analysis. 5.0 Understand reporting and presentation of data collected		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: FIELD PRACTICAL I (SOIL SURVEY AND SAMPLING TECHNIQUES)			COURSE CODE: SST 323		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 0	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 4 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills to deliver integrated soil-survey, sampling and field-mapping practice across multiple agro-ecological sites						
GENERAL OBJECTIVE 1.0: Understand pre-fieldwork preparation.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3				- Plan field-survey logistics (sites, transport, materials) - Prepare topo and base maps - Calibrate equipment (GPS, kits) - Conduct safety briefing	Guide students to: - Undertake field planning processes - Prepare topo and base maps - Calibrate equipment (GPS, kits) - Conduct safety briefing	Maps GPS Kits, Internet, Computer, Practical manual
General Objective 2.0: Know field-survey execution.						
4-6				- Conduct reconnaissance and traverse survey - Dig 3 profile	Guide students to: - Conduct reconnaissance and traverse survey - Dig and describe 3	Field sites, tools, samples, GPS, Computer, Internet,

				pits • Take auger samples on grid (30+ points) • Use field kit for rapid testing	profile pits • Take auger samples on grid (30+ points) • Use field kit for rapid testing	Practical manual, etc
General Objective 3.0: Understand data compilation and lab handover.						
7-9				• Carryout Geo-referencing samples • Labeled • transport samples to lab • Compile field-data sheets • Handover to lab for analysis	Guide students to: • Carryout Geo-referencing samples • Label and transport samples to lab • Compile field-data sheets • Handover to lab for analysis	Soil sample, Sample bags, Labels, Laboratory, Computer, Internet, Practical manual,
General Objective 4.0: Understand mapping and analysis.						
10-12				• Map sample distribution • Interpolate field-test results • Build draft soil-unit map • Cross-check with imagery	Guide students to: • Map sample distribution • Interpolate field-test results • Build draft soil-unit map • Cross-check with imagery	Computers Software, Imagery, Computer, Internet, Practical manual, etc
General Objective 5.0: Understand reporting and presentation of data collected						
13-15				• Write 15-page	Guide students to:	Report templates,

				field-practical report • Prepare -slide presentation • Defend report to panel • Submit corrected report	• Write 15-page field-practical report • Prepare-slide presentation • Defend report to panels • Submit corrected report	Panel, Computer, Internet, Practical manual,
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COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



SOIL CHEMISTRY AND NUTRIENT DYNAMICS

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL CHEMISTRY AND NUTRIENT DYNAMICS	COURSE CODE: SST 324	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with principles and knowledge of soil chemistry, with emphasis on soil-solution interactions, nutrient dynamics, ion exchange mechanisms, and soil chemical reactions governing plant nutrient availability and environmental quality.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand soil-chemistry foundations; 2.0 Understand cation-exchange capacity (CEC) and base saturation; 3.0 Understand the chemistry of soil-acidity and salinity; 4.0 Know nutrient dynamics (N, P, K, S); 5.0 Know soil-organic matter and environmental chemistry;		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL CHEMISTRY AND NUTRIENT DYNAMICS			COURSE CODE: SST 324		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course focuses on principles of soil chemistry, with emphasis on soil-solution interactions, nutrient dynamics, ion exchange mechanisms, and soil chemical reactions governing plant nutrient availability and environmental quality.						
GENERAL OBJECTIVE 1.0: Understand soil-chemistry foundations.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define soil-solid phase (mineral, organic, biological) 1.2 Discuss soil-solution composition and nutrient availability 1.3 Describe soil gas-phase chemistry principles in relation to soil processes. 1.4 Describe soil redox chemistry processes affecting soil fertility and environmental quality.	• Explain soil-solid phase (mineral, organic, biological) • Evaluate soil-solution composition and nutrient availability • Describe soil gas-phase chemistry principles in relation to soil processes. • Explain the soil redox chemistry processes affecting soil fertility and environmental quality.	LCD, Projector, Slides, Internet, Chats, Computer	• Identify soil mineral fractions • Extract • Analyse soil solution • Measure soil carbon dioxide and oxygen • Measure soil redox potential (Eh) and pH • Record findings • Interpret results	Guide students to; • Identify soil mineral fractions • Extract • Analyse soil solution • Measure soil carbon dioxide and oxygen • Measure soil pH and Eh • Record and interpret results	Soil samples, Eh/pH meter

General Objective 2.0: Understand cation-exchange capacity (CEC) and base saturation.						
4-6	2.1 Explain soil CEC 2.2 Discuss exchangeable bases (Ca, Mg, K, Na) in soil 2.3 Calculate base saturation percentage	• Explain CEC • Determine exchangeable bases (Ca, Mg, K, Na) • Calculate base saturation percentage	LCD, Projector, Slides, Internet, Chats, Computer	• Determine CEC • Extract • analyse exchangeable Ca, Mg, K, Na • Calculate base saturation • Interpret soil fertility status from CEC and base saturation results	Guide students to; • Determine CEC • Extract and analyse exchangeable Ca, Mg, K, Na • Calculate base saturation • Interpret soil fertility status from CEC and base saturation results	Soil samples, Flame photometer, AAS
General Objective 3.0: Understand the chemistry of soil-acidity and salinity.						
7-9	3.1 Explain soil acidity (active, exchangeable, residual) 3.2 Describe lime-requirement for acidic soil 3.3 Describe soil salinity, sodicity and alkalinity 3.4 Determine Electrical Conductivity (EC), Exchangeable Sodium Percentage (ESP) and Sodium Adsorption Ratio	• Discuss soil acidity (active, exchangeable, residual) • Discuss lime-requirement for acidic soil • Explain soil salinity, sodicity and alkalinity • Explain EC, ESP, SAR of soil samples.	LCD, Projector, Slides, Internet, Charts, Computer	• Determine soil pH (water, KCl, CaCl₂) • Determine lime requirement (SMP buffer) • Determine EC, ESP, SAR of soil samples. • Calculate EC, ESP, SAR on saline samples • Recommend amendments	Guide students to; • Determine soil pH (water, KCl, CaCl₂) • Determine lime requirement (SMP buffer) • Determine EC, ESP, SAR of soil samples. • Calculate EC, ESP, SAR on saline samples • Recommend amendments	pH/EC meter

	(SAR) of soil samples.					
General Objective 4.0: Know nutrient dynamics (N, P, K, S).						
10-12	4.1 Describe nitrogen dynamics (mineralisation, nitrification, denitrification, leaching) 4.2 Describe phosphorus dynamics (fixation, availability) 4.3 Discuss potassium dynamics 4.4 Discuss sulphur and micronutrient dynamics	• Explain nitrogen dynamics (mineralisation, nitrification, denitrification, leaching) • Describe phosphorus dynamics (fixation, availability) • Explain potassium dynamics • Explain sulphur and micronutrient dynamics	LCD, Projector, Slides, Internet, Charts	• Determine NO_3^-, NH_4^+ in soil samples • Determine soil-available Phosphorus (Bray 1 or Olsen) method • Determine exchangeable Potassium • Determine Sulphur and one micronutrient (Zn / Fe / Cu / Mn)	Guide students to; • Determine the forms of Nitrogen • Determine fixed/available Phosphorus • Determine exchangeable potassium • Determine Sulphur and any micronutrient	Spectrophotometer, Flame photometer, AAS,
General Objective 5.0: Know soil-organic matter and environmental chemistry.						
13-15	5.1 Discuss soil organic matter (SOM) composition 5.2 Explain SOM mineralisation processes 5.3 Describe heavy-metals in soil samples 5.4 Describe the role of soil organic matter in	• Explain soil organic matter composition and quantify SOM content • Describe SOM mineralisation processes • Determine heavy-metals in soil • Describe the role of soil organic matter in	LCD, Projector, Slides, Internet, Charts	• Determine SOM (Walkley-Black / dry combustion) • Conduct incubation for mineralisation rate • Determine Pb, Cd, Zn, Cu in soil samples	Guide students to; • Determine SOM (Walkley-Black / dry combustion) • Conduct incubation for mineralisation rate • Determine Pb, Cd, Zn, Cu in soil samples	Soil samples, AAS,

	adsorption, complexation, and immobilization of pollutants	adsorption, complexation, and immobilization of pollutants.				
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COURSE ASSESSMENT:

Coursework: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%

SOIL AND ENVIRONMENTAL PHYSICS

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL AND ENVIRONMENTAL PHYSICS	COURSE CODE: SST 325	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide the students with the knowledge and skills in soil-physics principles including soil-water relations, soil-temperature regime, aeration, soil structure dynamics and environmental properties relevant to crop production and land use		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the soil-physical properties 2.0 Understand soil the structure and its agricultural significance 3.0 Understand the dynamic properties of soil 4.0 Understand the soil temperature and aeration 5.0 Understand the soil-water retention 6.0 Understand the soil-water movement and transport 7.0 Understand soil water plants relations 8.0 Understand the environmental soil properties		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL AND ENVIRONMENTAL PHYSICS			COURSE CODE: SST 325		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: Nil		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide the students with the knowledge and skills in soil-physics principles including soil-water relations, soil-temperature regime, aeration, soil structure dynamics and environmental properties relevant to crop production and land use						
GENERAL OBJECTIVE 1.0: Understand the soil-physical properties						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Define soil texture 1.2 Describe the determination of particle size distribution in soil samples 1.3 Determine particle size distribution in soil samples 1.4 Classify the various textural separates on the basis of their diameters. 1.5 Define Stokes' law and use it as a basis for particle size distribution 1.6 Define soil bulk	• Explain soil texture • Explain the determination of particle size distribution in soil samples • Explain particle size distribution in soil samples • Classify the various textural separates on the basis of their diameters. • Explain Stokes' law and use it as a basis for particle size distribution • Explain soil bulk	LCD projector Slide Chart Computer	• Collect soil sample from the field for particle size analysis and bulk density determination	Guide students to: • Collect soil sample from the field for particle size analysis and bulk density determination	Soil auger Soil bag Hydrometer, Sieves Weighing balance Calgon Cylinder Water bath Core sampler Oven

	density, particle density, porosity 1.7 Discuss soil bulk density, particle density, porosity	density, particle density, porosity • Explain the determination of soil bulk density, particle density, porosity using core sampler				
General Objective 2.0: Understand soil the structure and its agricultural significance						
3-4	2.1 Define soil structure 2.2 Classify soil structure based on types, classes and grade 2.3 Explain the genesis of soil structure 2.4 Describe how the soil structure is evaluated using aggregate stability 2.5 Explain the agricultural significance of soil structure under; cultural changes affecting soil structures; seedbed-rootbed preparation; cultivation 2.6 Explain the factors that cause	• Explain soil structure • Classify soil structure • Explain the genesis of soil structure • Describe how the soil structure is evaluated using aggregate stability • Explain the agricultural significance of soil structure under; cultural changes affecting soil structures; seedbed-rootbed preparation; cultivation • Explain the factors that cause degradation of soil structure • Explain how soil	LCD projector Slide Chart Computer	• Collect soil sample from the field for soil structure identification. • Perform Aggregate stability test on the soil sample.	Guide students to: • Collect soil sample from the field for soil structure identification and Aggregate stability test	Shovel Soil bag Sieves Aggregates stability machine

	degradation of soil structure 2.7 Explain how soil structure can be restored 2.8 Explain the relationship between soil pores and structure 2.9 Describe the various pore types involved in soil aeration	structure can be restored • Explain the relationship between soil pores and structure • Explain the various pore types involved in soil aeration				
General Objective 3.0: Understand the dynamic properties of soil						
5-6	3.1 Define soil consistency 3.2 Describe soil consistency under wet, moist and dry soil conditions 3.3 Define soil plasticity 3.4 Describe how soil plasticity is determined 3.5 Describe the method of determining soil plasticity 3.6 Explain the Atterberg concepts 3.7 Discuss the basic principles of shear	• Explain soil consistency • Discuss soil consistency under wet, moist and dry soil conditions • Explain soil plasticity • Explain how soil plasticity is determined • Discuss the method of determining soil plasticity • Explain the Atterberg concepts • Explain the basic principles of shear strength of soils	LCD projector Slide Chart Computer	• Collect soil sample from the field. • Carry out Shear strength and Plasticity determination	Guide students to: • Collect soil sample from the field and carry out shear strength and plasticity determination	Soil samples Water Mould Atterberg machine

	strength of soils 3.8 Describe the methods of determining shear strength 3.9 Discuss the concepts of compression and compaction of soil. 3.10 Discuss the dynamic properties of soils involved in tillage practice	• Explain the methods of determining shear strength • Explain the concepts of compression and compaction of soil. • Explain the dynamic properties of soils involved in tillage practice				
General Objective 4.0: Understand the soil temperature and aeration						
7-8	4.1 Discuss solar radiation as the source of heat to the soil 4.2 Explain soil temperature regime and measurement 4.3 Discuss the physical factors affecting radiation distribution 4.5 Define heat capacity 4.6 Explain the flow of heat through the soil 4.7 identify factors that cause variations in soil temperature.	• Explain solar radiation as the source of heat to the soil • Explain soil temperature regime and measurement • Explain the physical factors affecting radiation distribution • Explain heat capacity Explain the flow of heat through the soil • Discuss the factors that cause variations in soil temperature • Explain soil aeration and gas exchange	LCD projector Slide Chart Computer	• Measure soil temperature at different depths in the field over 24 hours. • Measure soil bulk-air composition • Determine O₂-diffusion rate in the field	Guide students to: • Measure soil temperature at different depths in the field over 24 hours. • Measure soil bulk-air composition • Determine O₂-diffusion rate in the field	Soil thermometers Gas-sampling kit Laboratory analysis equipment

	4.8 Define soil aeration and gas exchange 4.9 Discuss oxygen-diffusion measurement	• Explain the method of oxygen-diffusion measurement				
General Objective 5.0: Understand soil-water retention						
9-10	5.1 Define soil water 5.2 Explain soil water contents and the factors influencing it 5.3 Define matric potential of soil water 5.4 Explain how matric potential can be measured 5.5 Define gravitational potential 5.6 Define pressure potential 5.7 Define osmotic potential 5.8 Explain the relationship between soil moisture content and soil water potential 5.9 Explain soil water in the vapour phase 5.10 Explain the	• Explain soil water • Explain soil water contents of and the factors influencing it • Explain matric potential of soil water • Explain how matric potential can be measured • Explain gravitational potential • Explain pressure potential • Explain the relationship between soil moisture content and soil water potential • Explain osmotic potential • Explain soil water in the vapour phase • Explain the relationships between vapour	LCD projector Slide Chart Computer	• Determine components of soil water potential Such as Matric, pressure, gravitational and osmotic	Guide students to • Determine components of soil water potential Such as Matric, pressure, gravitational and osmotic	Pressure plate apparatus Tensionmeter Soil sample Core sampler Piezometer Tape etc

	relationships between vapour pressure and relative humidity	pressure and relative humidity				
General Objective 6.0: Understand the soil-water movement and transport						
11-12	6.1 Describe the various forms of water movement – saturated flow – unsaturated flow; - flow in stratified soils 6.2 Define hydraulic conductivity 6.3 Explain how hydraulic conductivity can be measured 6.4 State Darcy's law and saturated hydraulic conductivity 6.5 Describe the capillary rise of waters in soil 6.6 Define infiltration 6.7 Describe infiltration through a non-homogenous soil profile 6.8 Define field moisture capacity 6.9 Explain the	• Explain the various forms of water movement – saturated flow – unsaturated flow; - flow in stratified soils • Explain hydraulic conductivity • Explain the hydraulic conductivity can be measured • Explain State Darcy's law and and saturated hydraulic conductivity • Explain the capillary rise of waters in soil • Explain infiltration • Explain infiltration through a non-homogenous soil profile • Explain field moisture capacity • Explain the	LCD projector Slide Chart Computer	• Determine Field Capacity and Permanent Wilting Point in the field. Conduct double-ring infiltration test on sites. • Conduct saturated hydraulic conductivity test	Guide students to: • Determine FC and PWP AWC in the field. Conduct double-ring infiltration test on sites. • Conduct saturated hydraulic conductivity test	Permeameters Psychrometric Manometer Core sampler Undisturbed soil samples Retort stand Water etc Double-ring infiltrometer Water Meter rule Stop watch

	agricultural importance of field capacity 6.10 Explain evaporation	agricultural importance of field capacity • Discuss evaporation				
General Objective 7.0: Understand soil water plant relations						
13-14	7.1 Discuss the internal water relations of plants and factors influencing it 7.2 Explain the effects of leaf-water deficits 7.3 Explain leaf-water potential to soil water content 7.4 Define transpiration 7.5 Describe how transpiration takes place in plants 7.6 Explain the growth of plants to soil water 7.7 Define irrigation 7.8 State reasons for irrigation 7.9 Describe the two forms of irrigations – surface; - subsurface 7.10 Describe the methods used in	• Explain the internal water relations of plants and factors influencing it • Explain the effects of leaf-water deficits • Relate leaf-water potential to soil water content • Explain transpiration • Explain how transpiration takes place in plants • Explain the growth of plants to soil water • Explain irrigation • Explain reasons for irrigation • Explain the two forms of irrigations – surface; - subsurface • Explain the methods used in carrying out surface and	LCD projector Slide Chart Computer	• Demonstrate how plant draw water from the soil and transmit to plant	Guide students to: • Demonstrate how plant draw water from the soil and transmit to plant	Photometer Beaker Water Stop watch Petroleum jelly

	carrying out surface and subsurface irrigation	subsurface irrigation				
General Objective 8.0 Understand the environmental soil properties						
15	8.1 Discuss soil colour and reflectance 8.2 Define soil sealing, crusting, compaction 8.3 Explain soil-physics in climate-smart practice	• Explain soil colour and reflectance • Explain soil sealing, crusting, compaction • Explain soil-physics in climate-smart practice	LCD projector Slide Chart Computer	• Determine soil colour in the field • Measure soil compaction.	Guide students to: • Determine soil colour in the field • Measure soil compaction.	Munsell colour chart Soil penetrometer
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



SOIL CONSERVATION

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL CONSERVATION	COURSE CODE: SST 411	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to provide the students with the knowledge and skills in soil conservation and its importance in food production		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the importance of soil conservation in increasing food production ; 2.0 Understand soil erosion by wind and water ; 3.0 Understand various method of soil erosion control; 4.0 Understand the basic principles and practices of erosion control ; 5.0 Understand the factors that causes land degradation; 6.0 Understand the management of land conservation and reclamation using various methods;		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL CONSERVATION			COURSE CODE: SST 411		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide the students with the knowledge and skills in soil conservation and its importance in food production						
General Objective 1.0: Understand the importance of soil conservation in increasing food production						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Define soil conservation 1.2 Explain the effect of man and animal activities on the earth's surface 1.3 Explain the ways by which crop production could be increased through soil conservation practices 1.4 Describe the process of soil erosion – detachment and removal 1.5 Explain the effects of soil erosion on	• Explain the term soil conservation • Discuss the effect of man and animal activities on the earth's surface • Discuss the ways through which crop production could be increased through soil conservation practices • Explain the process of soil erosion – detachment and removal • Explain the effects of soil erosion on	LCD, Projector, Pictorials, Internet, Charts	• Identify the effects of soil erosion on farmlands	Guide the students to; • farmland to identify the effects of erosion on the soil	camera, GPS, Tape

	crop production	crop production				
General Objective 2.0: Understand soil erosion by wind and water						
3-4	2.1 Define soil erosion 2.2 Describe the specialized forms of soil erosion 2.3 Differentiate between the specialized forms of soil erosion 2.4 Explain the causes of soil erosion by water 2.5 Identify various forms of soil erosion by water 2.6 State acceptable limits of soil erosion and basis for determining the limits 2.7 List the factors affecting soil erosion, such as rainfall, soil erodibility, erosivity, slope length, slope gradient, crop management, erosion control practice 2.8 Describe how each	• Explain the term soil erosion • Explain the specialized forms of soil erosion Geological & Accelerated erosion • Compare between the specialized forms of soil erosion • Discuss the causes of soil erosion by water • Explain the various forms of water erosion: sheet, rill, gully and stream bank erosion • Explain acceptable limits of soil erosion and basis for determining the limits • Discuss the factors affecting soil erosion, such as rainfall, soil erodibility, erosivity, slope length, slope gradient, crop management,	Projector, Projector Screen,	• Identify the specialized forms of soil erosion • Identify various forms of erosion by water: sheet, rill, gully and stream bank erosion • Identify some physical factors affecting soil erosion by water • Identify erosion features by wind	Guide students to: • Identify the specialized forms of soil erosion • Identify various forms of erosion by water: sheet, rill, gully and stream bank erosion • Identify some physical factors affecting soil erosion by water • Identify erosion features by wind	Camera, GPS, Tape

	factor listed in 2.7 affects soil erosion 2.9 Explain the universal soil loss equation 2.10 Explain the significance of universal soil loss equation to erosion control 2.11 explain the mode of soil movement by wind 2.12 describe soil erosion features by wind 2.13 Explain the factors facilitating soil erosion by wind 2.14 explain losses of plant food and organic matter 2.15 Calculate amount of loss by wind	erosion control practice • Explain how each factor listed in 2.7 affects soil erosion • Outline the universal soil loss equation • Discuss the significance of universal soil loss equation to erosion control • Describe the mode of soil movement by wind: Suspension, saltation, surface creep • Explain soil erosion features by wind • Describe the factors facilitating soil erosion by wind • Explain losses of plant food and organic matter • Determine the amount of loss by wind • Explain the calculation				
General Objective 3.0: Understand various methods of soil erosion control						
5-7	3.1 Explain the principle involved	• Discuss the principle	LCD, Projector, Pictorials,	• Identify wind	Guide student to;	Camera, GPS, Tape

	in the control of erosion on agricultural land 3.2 Describe the methods used in the control of soil erosion by wind 3.3 Describe the various soil tillage practices, employed to control soil erosion by water 3.4 Explain the tillage practices to the various forms of soil erosion by water 3.5 Describe the conditions for the establishment of terraces, bunds and water courses 3.6 Explain the principles of determining specifications for terrace, bunds and water courses design	involved in the control of erosion on agricultural land Explain the methods used in the control of soil erosion by wind • Discuss the various soil tillage practices, employed to control soil erosion by water • Compare the tillage practices to the various forms of soil erosion by water • Explain the conditions for the establishment of terraces, bunds and water courses • Describe the principles of determining specifications for terrace, bunds and water courses design	Internet, Charts	erosion site and examine various forms of wind erosion control • Identify water erosion site and examine various forms of water erosion control • Examine various tillage practices, employed to control soil erosion by water • Identify terraced site (if available)	• Identify wind erosion site and examine various forms of wind erosion control • Identify water erosion site and examine various forms of water erosion control • examine various tillage practices, employed to control soil erosion by water • identify terraced site (if available)	
General Objective 4.0: Understand the basic principles and practices of erosion control						
8-9	4.1 Explain sheet erosion control	• Explain sheet erosion control	LCD, Projector, Pictorials,	• Carryout topographic	Guide students to; • Carryout topographic	Camera, GPS, Tape

	measure 4.2 Describe rill erosion control measure 4.3 Describe gully erosion control measures 4.4 Describe the process of topographic survey of erosion affected area 4.5 Describe the process of gully survey of gully affected area 4.6 Describe erosion control measures such as contour bunding, terracing, grassed waterways, check dams, strips cropping, windbreak etc. 4.7 Describe various tillage practices to control erosion by water 4.8 Explain the importance of soil conservation and control measures in relation to desertification	measure • Describe rill erosion control measure • Describe gully erosion control measures • Describe the process of topographic survey of erosion affected area • Describe the process of gully survey of gully affected area • Describe erosion control measures such as contour bunding, terracing, grassed waterways, check dams, strips cropping, windbreak etc. Describe various tillage practices to control erosion by water • Explain the importance of soil conservation and control measures in relation to desertification	Internet, Charts	survey of erosion affected area • Conduct survey of gully affected area • Construct simple erosion control devices to check rill, sheet and gully erosion • Carryout design of simple erosion control measures such as contour bunding, terracing, grassed waterways, check dams, strips cropping, wind break, etc	survey of erosion affected area • Conduct survey of gully affected area • Construct simple erosion control devices to check rill, sheet and gully erosion • Carryout design of simple erosion control measures such as contour bunding, terracing, grassed waterways, check dams, strips cropping, wind break, etc	
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General Objective 5.0: Understand the factors that causes land degradation

10-12	5.1 Define Land Degradation 5.2 Explain the ways by which land degradation process could lead to reduction in crop productivity such as Overgrazing, burning, erosion, excessive lumbering, continuous cropping etc 5.3 Describe the specific effects of each of 5.2 above on the ecosystem (e.g. overgrazing 5.4 Identify possible land degraded areas	• Explain the term land degradation • Describe the ways by which land degradation process could lead to reduction in crop productivity such as; Overgrazing, burning, erosion excessive lumbering, over cropping etc. • Outline the specific effects of each of 5.3 on the ecosystem	LCD, Projector, Pictorials, Internet, Charts	• Identify and visit possible land degraded areas	Guide students to; • Identify and visit possible land degraded areas	Vehicle, camera, soil auger, labelling kit
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General Objective 6.0: Understand the management of land conservation and reclamation using various methods

13-15	6.1 Define Land Management 6.2 Explain the effect of agricultural activities on the environment. 6.3 List management practices of the activities	• Explain the term Land Management • Discuss the effect of agricultural activities on the environment. • Explain management practices of the activities mentioned	LCD, Projector, Pictorials, Internet, Charts	• Determine the effects sitted agricultural activities in 6.2 on soil nutrients • Identify various methods of soil conservation/recla	Guide students to: • Accompany the students to an established farm to observe the practices • Accompany the students to some established farms or	Various methods of soil samples
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	mentioned in 6.2 above. 6.4 Determine the effects of some of the agricultural activities in 6.2 on soil nutrients 6.5 Define environmental conservation 6.6 Explain the need for environmental conservation. 6.7 List the names of organizations involved in environmental conservation and their functions. 6.8 Describe and identify various methods of soil conservation/reclamation.	in 6.2 above. • Explain environmental conservation • Discuss the need for environmental conservation. • Explain organizations involved in environmental conservation and their functions. • Discuss various methods of soil conservation/reclamation.		mation such as strip cropping, crop rotation, reforestation, manuring, contour farming, and terracing, careful addition of fertilizer and planting of trees.	Research stations show them identify various methods of soil conservation/reclamation such as strip cropping, crop rotation, reforestation, manuring, contour farming, terracing, careful addition of fertilizer and planting of trees.	
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

LAND DEGRADATION ASSESSMENT AND RESTORATION

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: LAND DEGRADATION ASSESSMENT AND RESTORATION	COURSE CODE: SST 412	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: The goal of this course is to equip students with the knowledge and practical skills required to assess and restore degraded lands through the application of field and laboratory techniques for enhanced soil productivity and environmental sustainability.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1. Understand the concepts, causes, types, and impacts of land degradation on agricultural production and environmental quality; 2. Understand characterization of various forms of land degradation; 3. Understand conducting of field assessments of degraded lands; 4. Understand laboratory methods to determine physical, chemical, and biological indicators of land degradation; 5. Understand analyses and interpretation of land degradation data using appropriate indices, models, and decision-support tools; 6. Understand design and implementation of land restoration strategies; 7. Understand the development of sustainable land management plans; 8. Understand the preparation of technical reports and communicate findings from land degradation assessment and restoration projects.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: LAND DEGRADATION ASSESSMENT AND RESTORATION			COURSE CODE: SST 412		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The goal of this course is to equip students with the knowledge and practical skills required to assess and restore degraded lands through the application of field and laboratory techniques for enhanced soil productivity and environmental sustainability.						
General objective 1.0: Understand the concepts, causes, types, and impacts of land degradation on agricultural production and environmental quality.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Define land degradation 1.2 Explain concepts of land degradation and restoration 1.3 Explain causes of land degradation 1.4 Explain the impacts of soil degradation	• Explain land degradation and restoration • Explain the causes and types of land degradation • Discuss the impacts of soil degradation	LCD Multimedia projector	• Identify visible indicators of degraded land • Identify different types of land degradation in the field and lab.	Guide students to: • Identify visible indicators of degraded land • Identify different types of land degradation in the field and lab.	Photographs, Field maps
General objective 2.0: Understand identification and characterization of various forms of land degradation						
3-4	2.1 Describe ways of identifying land degradation 2.2 Explain how to characterize land degradation	• Explain ways of identifying land degradation • Outline different ways of characterizing land	Lecture slides, videos, maps	• Conduct preliminary land degradation assessment in field plots. • Perform soil	Guide students to: • Conduct preliminary land degradation assessment in field plots. • Perform soil profile	Soil augers, measuring tapes, GPS

	2.3 Describe various forms of land degradation	degradation Describe various forms of land degradation		profile description, take basic field measurements (slope, vegetation cover), record observations.	description, take basic field measurements (slope, vegetation cover), record observations.	
General objective 3.0: Understand conducting of field assessments of degraded lands						
5-6	3.1 Explain field techniques for assessing degraded lands 3.2 Describe type, extent and severity of degradation 3.3 Explain soil survey techniques for assessing degraded lands 3.4 Describe land evaluation techniques	- Discuss field techniques for assessing degraded lands - Explain type, extent and severity of degradation - Discuss soil survey techniques for assessing degraded lands - Explain land evaluation techniques	LCD Multimedia projector Maps	- Collect soil samples - Process them for analyses - Identify the various land degradation indicators - Identify different land degradation types using standard techniques.	Guide students to: - Collect soil samples - Process them for analyses - Identify the various land degradation indicators - Identify different land degradation types using standard techniques.	Maps GPS Measuring tapes Soil auger Sampling bags
General objective 4.0: Understand laboratory methods used to determine physical, chemical, and biological indicators of land degradation.						
7-8	4.1 Describe standard methods for determining physical, chemical and biological indicators 4.2 Describe physical degradation	- Discuss standard methods for determining physical, chemical and biological indicators - Explain soil chemical	LCD Multimedia projector	- Perform soil physical, chemical and biological tests and - Interpret results. - Collect soil samples from	Guide students to: - Perform soil physical, chemical and biological tests and - Interpret results. - Collect soil samples from plots, conduct insitu and nutrient	Soil samples Vials Sample containers GPS Field sampling kits

	(compaction, structure decline). 4.3 Explain soil chemical degradation 4.4 Explain biological degradation indicators 4.5 Explain standard quality assurance and quality control in sample collection, handling and analysis of samples	degradation (salinity, acidity, nutrient depletion). - Explain indicators of biological degradation - Discuss standard quality assurance and quality control in sample collection, handling and analyses of samples		plots, conduct insitu and nutrient assays, Record findings.	assays, Record findings.	
General objective 5.0: Understand analyses and interpretation of land degradation data using appropriate indices, models, and decision-support tools.						
9-10	5.1 Explain how data from field and laboratory data are acquired 5.2 Describe the tabulation of field and laboratory data using relevant devices 5.3 Explain how the acquired data can be processed using relevant computer software	- Explain how data from field and laboratory data are acquired - Explain the tabulation of field and laboratory data using relevant devices - Explain how the acquired data can be processed using relevant computer software	Sample datasets, Excel/SPSS, calculation templates	- Input data to their computers, laptops or Tablets - Learn the use of relevant analytical software like SAS, SPSS, Genstat etc - Compute degradation indices and - Interpret soil health status.	Guide students to: - Input data to their computers, laptops or Tablets - Learn the use of relevant analytical software like SAS, SPSS, Genstat etc - Compute degradation indices and - Interpret soil health status.	Computers, software, field/lab data
General objective 6.0: Understand design and implementation of land restoration strategies						

	6.1 Describe how results from field and laboratory data are utilized 6.2 Explain Biological approaches 6.3 Explain mechanical approaches 6.4 Explain agronomic approaches.	• Explain the results from field and laboratory data • Explain biological approaches • Explain mechanical approaches • Explain agronomic approaches.	Case studies, videos, practical demonstration sites	• Design restoration plans for degraded land plots using different approaches	Guide student to: • Propose and justify restoration techniques, prepare practical implementation plans.	Field plots, case study data, plant seedlings, organic amendments
General objective 7.0: Understand the development of sustainable land management plans						
	7.1 Define sustainable land management plan 7.2 Explain how to develop a sustainable land management plan 7.3 Describe land degradation assessment 7.4 Discuss integrated land management planning.	• Discuss sustainable land management plan • Describe how to develop a sustainable land management plan • Explain land degradation assessment • Explain integrated land management planning.	LCD Multimedia projector	• Develop a sustainable land management plan incorporating restoration measures.	Guide students to: • Prepare and present management plans for assigned plots, receive feedback.	Maps Planning templates, Previous field data
General objective 8.0: Understand the preparation of technical reports and communicate findings from land degradation assessment and restoration projects						
13-15	8.1 Explain practical field assessment and reporting 8.2 Describe necessary tools for report	• Discuss practical field assessment and reporting • Explain necessary tools for report	LCD Multimedia projector	• Identify present land degradation assessment and restoration reports • Prepare	Guide students to: • Identify present land degradation assessment and restoration reports	PowerPoint, poster boards, maps

	presentation 8.3 Explain project presentation and discussion. 8.4 Describe qualities of a technical report 8.5 Explain use of pictures and graphs etc in presentations	presentation • Discuss project presentation and discussion. • Explain qualities of a technical report • Discuss use of pictures and graphs etc in presentations		presentations, defend findings.	• Prepare presentations, defend findings.	
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

SOIL SURVEY AND CLASSIFICATION

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL SURVEY AND CLASSIFICATION	COURSE CODE: SST 413	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE: Nil	PRACTICAL: 2 HOURS/WEEK
GOAL: To provide students with the theoretical knowledge and practical skills necessary for soil identification, characterization, classification, mapping, interpretation, and evaluation for sustainable land resource management and agricultural development.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the fundamental principles, concepts, and objectives of soil survey and soil classification; 2.0 Know characterization of soils based on their physical, chemical, morphological, and biological properties; 3.0 Know differences between various soil survey methods, approaches, and levels of survey intensity; 4.0 Understand field investigations and soil profile studies using standard soil survey procedures; 5.0 Understand soil classification using recognized soil classification systems such as the United States Department of Agriculture Soil; Taxonomy and the Food and Agriculture Organization / International Union of Soil Sciences World Reference Base (WRB); 6.0 Understand land capability and land suitability based on soil survey information; 7.0 Understand Modern Tools in Soil Survey; 8.0 8.0 Know Soil Survey and Classification data in Land-use Planning and Sustainable Land Management.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL SURVEY AND CLASSIFICATION			COURSE CODE: SST 413		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: To provide students with the theoretical knowledge and practical skills necessary for soil identification, characterization, classification, mapping, interpretation, and evaluation for sustainable land resource management and agricultural development.						
GENERAL OBJECTIVE 1.0: Understand the fundamental principles, concepts, and objectives of soil survey and soil classification						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Define soil survey and soil classification and 1.2 Explain importance of soil survey and classification in land resource management. 1.3 Describe the objectives, scope, and applications of soil survey and classification. 1.4 Explain the relationship between soil survey, soil mapping, land	• Explain soil survey and soil classification and • Explain importance of soil survey and classification in land resource management. • Discuss the objectives, scope, and applications of soil survey and classification. • Explain the relationship between soil survey, soil mapping, land evaluation, and land-use planning.	LCD, Projector, Pictorials, Internet, Chats	• Conduct a reconnaissance soil survey • Identify methods of soil survey	Guide students to: • Conduct a reconnaissance soil survey • I methods of soil survey	GPS Note pad, practical mineral etc

	evaluation, and land-use planning. 1.5 Explain the historical development of soil survey and classification systems	• Discuss the historical development of soil survey and classification systems				
General Objective 2.0: Know characterization of soils based on their physical, chemical, morphological, and biological properties						
2-3	2.1 Explain the factors and processes of soil formation and their influence on soil characteristics. 2.2 Describe soil-forming materials and parent materials 2.3 Describe soil morphological properties including colour, texture, structure, consistence, porosity, mottling, and rooting patterns. 2.4 Describe soil profile characteristics for soil identification and classification.	• Discuss the factors and processes of soil formation and their influence on soil characteristics. • Explain soil-forming materials and parent materials • Discuss soil morphological properties including colour, texture, structure, consistence, porosity, mottling, and rooting patterns. • Explain soil profile characteristics for soil identification and classification.	LCD, Projector, Pictorials, Internet, Chats	• Undertake field trip to a site on soil forming factors and processes • Excavate a profile pit for soil description	Guide students to: • Undertake field trip to a site on soil forming factors and processes • Excavate a profile pits for soil description	GPS Digger Munsell color chart Hand trowel Core samplers Measuring tape Hammer Wood
General Objective 3.0: Know differences between various soil survey methods, approaches, and levels of survey intensity						
6-7	3.1 Explain the differences between	• Explain difference between	LCD, Projector, Pictorials,	• Conduct soil survey	Guide students to: • Conduct soil survey	Soil samples Auger

	reconnaissance, semi-detailed, detailed, and intensive soil surveys 3.2 Explain the procedures involved in planning and conducting a soil survey 3.3 Describe appropriate survey methods for different land resource assessment objectives 3.4 Conduct field traverses and soil observations using standard survey techniques 3.5 Collect representative soil samples for laboratory analysis and classification.	reconnaissance, semi-detailed, detailed, and intensive soil surveys • Explain the procedures involved in planning and conducting a soil survey • Describe appropriate survey methods for different land resource assessment objectives • Explain field traverses and soil observations using standard survey techniques • Describe representative soil samples for laboratory analysis and classification.	Internet, Chats	• Conduct traverses/grid line, • Perform Soil sampling	using different methods • Conduct traverses/grid line, • Perform Soil sampling	Spade shovel Chain Theodolite Compass GPS Base map
General Objective 4.0: Understand field investigations and soil profile studies using standard soil survey procedures						
10-12	4.1 Excavate soil profile pits according to standard guidelines 4.2 Record soil profile characteristics	• Describe soil profile pits according to standard guidelines • Explain soil profile characteristics accurately in field	LCD, Projector, Pictorials, Internet, Chats	• Excavate soil profile pit for description	Guide students to: • Excavate soil profile pit for description	GPS Digger Spade Hand trowel Munsell color charts

	accurately in field data sheets. 4.3 Describe soil depth, drainage condition, slope, erosion status, and stoniness. 4.4 Describe site characteristics including topography, vegetation, land use, and parent material. 4.5 Describe field observations for soil characterization and mapping.	data sheets. • Discuss soil depth, drainage condition, slope, erosion status, and stoniness. • Explain site characteristics including topography, vegetation, land use, and parent material. • Discuss field observations for soil characterization and mapping.				
General Objective 5.0: Understand soil classification using recognized soil classification systems						
8-9	5.1 Define soil classification 5.2 Explain the principles and objectives of soil classification 5.3 Describe the hierarchical structure of USDA Soil Taxonomy 5.4 Discuss major soil Orders and their diagnostic characteristics 5.5 Explain the	• Explain soil classification • Discuss the principles and objectives of soil classification • Explain the hierarchical structure of USDA Soil Taxonomy • Discuss major soil Orders and their diagnostic characteristics • Explain the	LCD, Projector, Pictorials, Internet, Chats	• Collect soil sample for analysis • Use the data for soil classification	Guide students to: • Collect soil sample for analysis • Use the data for soil classification	USDA Soil Taxonomy System WRB guidelines

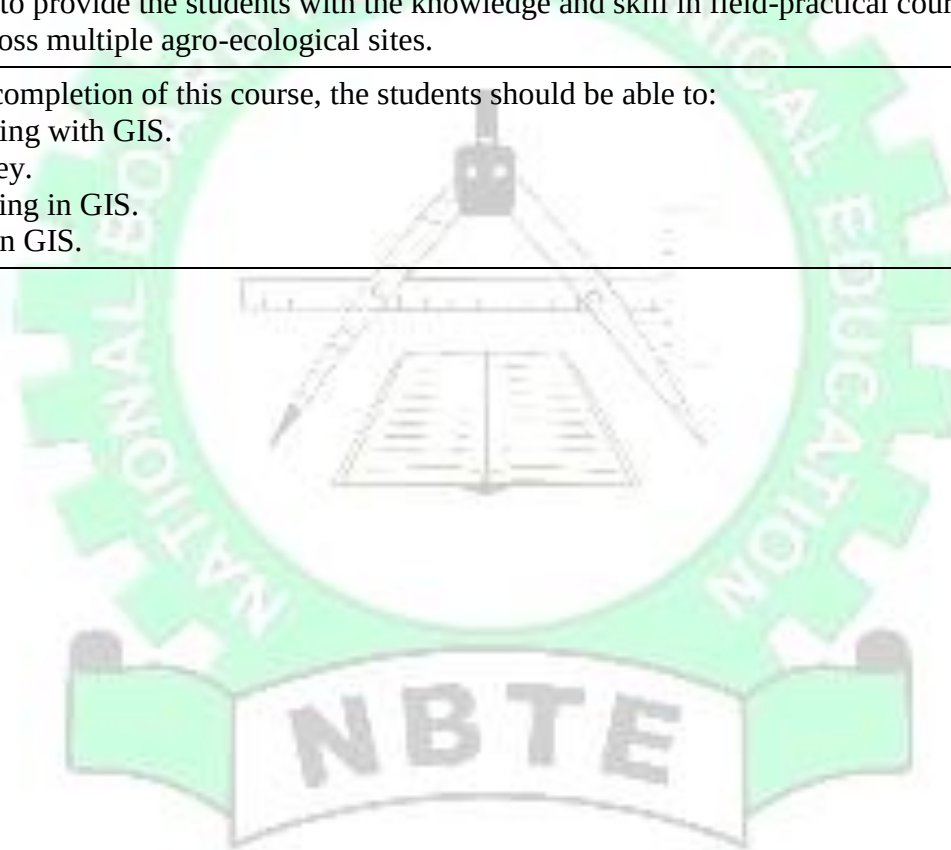
	principles of the World Reference Base (WRB) system	principles of the World Reference Base (WRB) system				
	5.6 Describe soils using appropriate diagnostic horizons, properties, and materials	• Explain soils using appropriate diagnostic horizons, properties, and materials				
General Objective 6.0: Understand land capability and land suitability based on soil survey information						
10-11	6.1 Define land capability and land suitability concepts. 6.2 Describe soil limitations affecting agricultural production and land use 6.3 Classify land capability classes using soil survey information 6.4 Determine land suitability for selected crops and land-use types 6.5 Explain appropriate management practices based on	• Discuss land capability and land suitability concepts. • Explain soil limitations affecting agricultural production and land use • Discuss land capability classes using soil survey information • Explain land suitability for selected crops and land-use types • Explain appropriate management practices based on land evaluation results	LCD, Projector, Pictorials, Internet, Chats Computers	• Conduct land capability and suitability classification	Guide students to: • Conduct land capability and suitability classification	Soil samples Data

	land evaluation results					
General Objective 7.0: Understand Modern Tools in Soil Survey						
12-13	7.1 Explain the role of GPS, GIS, and remote sensing in soil survey and classification 7.2 Explain spatial data using GPS devices 7.3 Explain Integration of soil survey information into GIS databases 7.4 Discuss digital soil maps and thematic maps 7.5 Discuss geospatial technologies in soil inventory and land resource assessment	• Discuss the role of GPS, GIS, and remote sensing in soil survey and classification • Explain spatial data using GPS devices • Explain soil survey information into GIS databases • Explain digital soil maps and thematic maps • Explain geospatial technologies in soil inventory and land resource assessment	LCD, Projector, Pictorials, Internet, Chats	• Conduct spatial works using GIS/GPS • Conduct field trip to acquire geospatial data	Guide students to: • Conduct spatial works using GIS/GPS • Conduct field trip to acquire geospatial data	GPS Soil samples
General objective 8.0: Know Soil Survey and Classification data in Land-use Planning and Sustainable Land Management						
14-15	8.1 Explain soil survey information for agricultural land-use planning 8.2 Describe soil data for irrigation, drainage, and soil fertility	• Explain soil survey information for agricultural land-use planning • Describe soil data for irrigation, drainage, and soil fertility management	LCD, Projector, Pictorials, Internet, Chats	• Undertake suitability and capability classification using the acquired soil data for different uses	Guide students to: • Undertake suitability and capability classification using the acquired soil data for different uses	Soil data Reference guidelines

	management				
	8.3 Explain soil suitability for engineering, forestry, and environmental purposes	• Discuss soil suitability for engineering, forestry, and environmental purposes			
	8.4 Explain soil survey data in watershed management and conservation planning	• Discuss soil survey data in watershed management and conservation planning			
	8.5 Explain the role of soil classification in sustainable land management.	• Explain the role of soil classification in sustainable land management.			
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%					

FIELD PRACTICAL II (GIS, SOIL MAPPING AND LAND EVALUATION)

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: FIELD PRACTICAL II (GIS, SOIL MAPPING AND LAND EVALUATION)	COURSE CODE: SST 414	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 0
YEAR: II SEMESTER: I	PRE-REQUISITE: Nil	PRACTICAL: 4 HOURS/WEEK
GOAL: This course is designed to provide the students with the knowledge and skill in field-practical course integrates GIS-based soil mapping and land evaluation across multiple agro-ecological sites.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand pre-survey planning with GIS. 2.0 Understand digital field survey. 3.0 Understand digital soil mapping in GIS. 4.0 Understand land-evaluation in GIS.		



PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: FIELD PRACTICAL II (GIS, SOIL MAPPING AND LAND EVALUATION)			COURSE CODE: SST 414		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 0	
YEAR: II SEMESTER: I			PRE-REQUISITE: Nil		PRACTICAL: 4 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide the students with the knowledge and skill in field-practical course integrates GIS-based soil mapping and land evaluation across multiple agro-ecological sites						
GENERAL OBJECTIVE 1.0: Understand pre-survey planning with GIS						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3				• Compile environmental covariates (DEM, climate, NDVI) • Design sample design (cLHS) in GIS • Prepare digital field sheets • Calibrate GPS / drone / mobile-GIS	• Guide students to: Compile environmental covariates (DEM, climate, NDVI) • Design sample design (cLHS) in GIS • Prepare digital field sheets Calibrate GPS / drone / mobile-GIS	computer, GIS, covariates, sampling tools, Drones
General Objective 2.0: Understand digital field survey						
4-7				• Identify the different types of digital field survey use in the field survey eg	Guide students to: • Identify the different types of digital field survey use in the field survey eg GNSS/GPS	Handheld GPS ODK collect Drones

				GNSS/GPS Survey, Mobile GIS survey etc.	Survey, Mobile GIS survey etc.	
General Objective 3.0: Understand digital soil mapping in GIS						
8-9				• Process samples in laboratory • Build covariate stack • Use regression-kriging in R • Generate soil-property maps	Guide students to: • Process samples in laboratory • Build covariate stack • Use regression-kriging in R • Generate soil-property maps	Computer, R Soft ware GIS soft wares
General Objective 4.0: Understand land-evaluation in GIS.						
12-15				• Identify the existing land evaluation such as FAO suitability framework in GIS • USDA capability classification in GIS • Build land-evaluation maps • Cross-validate maps	Guide students to: • Identify the existing land evaluation such as FAO suitability framework in GIS • USDA capability classification in GIS • Build land-evaluation maps • Cross-validate maps	Computer, GIS Evaluation tools. Evaluation forms
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

CLIMATE CHANGE AND SOIL QUALITY

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: CLIMATE CHANGE AND SOIL QUALITY	COURSE CODE: SST 415	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
Goal: This course is designed to provide students with the knowledge of climate change as it affects agricultural productivity, food security and sustainability of the environment		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand Climate, Climatic elements, Climate Change and Soil Quality; 2.0 Understand the concepts of Green House Gases, Global Warming and their Effects; 3.0 Know the relationship between Green House Gases and Climate Change on Soil Quality; 4.0 Understand Climatic Change, flooding and Soil Degradation; 5.0 Know the relationship between Climate Change and Agricultural Food Security; 6.0 Understand Salinity and Sodidity in soils; 7.0 Understand wetland, watershed and Management; 8.0 Understand the measures used to mitigate and adapt Climate Change Effects on soils and Agricultural Productivity; 9.0 Understand the concepts and methods in carbon sequestration.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY							
COURSE TITLE: CLIMATE CHANGE AND SOIL QUALITY			COURSE CODE: SST 415		CONTACT HOURS: 4 HOURS/WEEK		
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK		
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL							
General Objective 1.0 : Understand Climate, Climatic elements, Climate Change and Soil Quality.							
GENERAL OBJECTIVE 1.0: Apply soil-data analysis foundations							
THEORETICAL CONTENT				PRACTICAL CONTENT			
Week	Specific Learning Outcome		Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1	Define the following terms i. Climate ii. -Climate elements (temp, pressure, relative humidity, sunshine, etc) iii. Climate Change iv. Soil Quality	• Explain the terms listed in 1.1 • Explain the means and mode of measuring climatic elements and soil quality • Discuss the units of measuring the quantities in 1.3 • Explain the terms listed in 1.4	Pictorials, Charts and Internet	• Identify climatic elements and means and modes of measuring climatic element and soil quality	Guide students to: • Identify the climatic elements, their roles in climate change and soil quality	Maps Study guides Meteorological station
	1.2	Describe the means, mode of measuring Climatic elements and Soil Quality					
	1.3	Describe the different units of measuring Climatic elements and Soil Quality					
	1.4	Discuss Climatic					

	elements such as - Rainfall - Temperature - Wind Speed - Atmospheric pressure - Sunshine (Solar radiation) - Evaporation - Transpiration - Evapotranspiration 1.5 Discuss Soil Quality such as - Soil reaction - Soil-redox reaction (status) - Phosphate concentration - Nitrate concentration - Organic carbon - Biological-Oxygen demand (BOD) (vii) Chemical Oxygen Demand (COD)					
General Objective 2.0: Understand the concepts of Green House Gases, Global Warming and their Effects						
4-6	2.1 Define the terms: - Greenhouse gas - Global warming 2.2 List the different greenhouse gases 2.3 Describe the	- Explain the terms in 2.1 - Discuss the different greenhouse gases - Explain the	Pictorials, Charts and Internet	Identify gases that are classified as greenhouse gases and their effects on global warming	Guide students to identify the different greenhouse gases causing global warming	Maps Study guides

	relationship between greenhouse gases and global warming	relationship between greenhouse gases and global warming				
General Objectives 3.0: Know the relationship between, Green House Gases and Climate Change on Soil Quality						
7-9	3.1 Enumerate anthropogenic (human) and natural causes of greenhouse gases and global warming 3.2 Discuss the effects of: i. Greenhouse gases ii. Global warming	- Discuss anthropogenic (human) and natural causes of greenhouse gases and global warming - Explain the effects of greenhouse gases as a result of the factors.	Textbooks, Pictorials, Charts and Internet	Identify anthropogenic activities causing climate change	Guide students to identify the different anthropogenic activities causing global warming	Maps Study guides
General Objectives 4.0: Understand climate change, flooding and soil degradation						
10-12	4.1 Relate Climate Change to: i. Increase in temperature ii. Increase in evapotranspiration iii. excessive moisture loss and drought conditions iv. Rising sea levels v. Impeded drainage (surface and intra profile)	- Correlate climate change with the factors in 4.1 - Link Climate change and its effects on soils to the listed factors in 4.2	Pictorials, Charts and Internet	Identify the visible effects of climate change	Guide Students to; Identify the visible effects of climate change	Maps as a Study guide

	vi. vi flooding 4.2 Explain Climate Change and its effects on soils in terms of i. Increased runoff ii. Soil erosion iii. Water logging iv. Flooding and inundation					
General Objective 5.0: Know the relationship between climate change and agricultural food security						
13-15	5.1 Describe the effect of increase in temperature as it relates to food security 5.2 Describe the effects of increase in temperature as it relates food security and agricultural crops in relates to growth and development maturity viability adaptation 5.3 Highlight the effects of pests and diseases resulting from Climate Change on Agricultural crops and animals	• State the effects of increase in temperature as it affects food security • Explain temperature increase with food security of Agricultural crops as it pertains the factors in 5.2 • Explain the effects of pests and diseases on Agricultural crops and animals due to Climate Change	Pictorials, Charts and Internet	• Identify the increase in temperature on climate change and agricultural food security	Guide students to: • Identify the effect of increase in temperature on agricultural food security	Maps Study guides
General Objective 6.0: Understand salinity and sodicity in soils						

	6.1 Define the terms: i. Salinity ii. Sodicty 6.2 Non-Saline and non-Sodic soils 6.3 Distinguish between the three in 6.1 above in terms of reaction. 6.4 Describe the different methods of reclamation	• Explain the terms in 6.1 • Differentiate between the three types of soils • Write out the different methods of reclamation	Pictorials, Charts and Internet	• Identify saline, sodic and non-saline, non-sodic soils	Guide students to: • Identify saline, sodic and non-saline, non-sodic soils	various Study guides
General Objective 7.0: Understand wetland, watershed and management						
	7.1 Define the following terms: i. Wetland ii. Watershed 7.2 Discuss the following: i. Wetland environment ii. Watershed environment 7.3 Discuss the deterioration of wetland and watershed to include: i. over abstraction of ground water ii. Drought iii. Urbanization iv. Agricultural	• Explain the terms in 7.1 • Explain the terms in 7.2 • Describe deterioration of wetland and watershed in terms of the listed factors in 7.3 • Discuss the effects of deterioration on the factors in 7.4 • Explain conventional practices in the management of wetland and	Pictorials, Charts and Internet Wetland and watershed locations, Field trips and excursions	• Identify Wetland and Watershed environments	Guide students to: • Visit Wetland and Watershed environments within their catchment	Previous reports Manuals GPS

	activities v. Overgrazing vi. Poor planning and development control	watershed according to the control and administrative levels in 7.5				
7.4	Explain the effects of deterioration on i. sedimentation ii. silting iii. biodiversity losses iv. water scarcity v. Competition between animals and plants including livestock vi. increased risks vii. inter-communal conflicts in some countries viii. Downstream livelihood disruption and social unrest					
7.5	Outline the practices used in the Management of i. Wetland environment ii. Watershed environment					
7.6	Explain: i. Statutory control					

	ii. Enacting enabling laws to protect the watershed and wetlands. iii. Administrative control iv. Policies to augment enacted statutes v. Enforce host communities' interests. vi. Enforce downstream community interests in case of water courses vii. Policies against loss of livelihood, displacement without compensation and loss of cultural and social assets viii. Encourage communities to undertake sub catchment management plans					
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General Objectives: 8.0: Understand the measures used to mitigate and adapt climate change effects on soils and agricultural

productivity						
	8.1 Discuss measures against greenhouse gases - Statutory control - International conventions and agreement e.g. Kyoto 1997, Copenhagen 2009, Paris 2015, Brazil, 2025 - Strategic Development Goals (SDGs 6 and 13) - Afforestation programmes - Solar radiation - laws banning gas flaring, bush fires, CFCs and accumulation of solid wastes. 8.2 Explain measures in the adaptation of greenhouse gases - alternative refrigerants - alternate household energy (LNG, biogas etc) - Research and Development	- Describe the measures against greenhouse gases - Discuss the importance of global conventions on the management of global warming - Explain measures in the adaptation of greenhouse gases - Describe the measures used in mitigating against Climate Change as captured in 8.1 above - Outline adaptive measures against Climate Change as captured in 8.2 above	Pictorials, Charts, projectors and Internet	- Identify gases emitted from green houses - Carry out research in the area of adaptation of greenhouse gases	Guide students to: - Carry out identification of gases from green houses - Identify basic adaptation measures of greenhouse gases	Logbook Reports of International conventions, treaties and agreements

	(R&D) into more efficient means of adaptation 8.3 Explain the measures used in mitigating against Climate Change as captured in 8.1 above 8.4 Explain adaptive measures against Climate Change as captured in 8.2 above.					
General Objectives: 9.0: Understand the concepts and methods in carbon sequestration						
	9.1 Define Carbon sequestration 9.2 Sketch the carbon cycle 9.3 Explain the following terms: i. Carbon sink ii. Carbon tanks iii. Carbon credit iv. Carbon dating 9.4 Explain the different ways of: i. Accumulation of Carbon in the universe ii. loss of Carbon in the universe iii. Carbon	• Explain the term Carbon Sequestration • Explain the Carbon Cycle • Describe the terms in 9.3 • Discuss the different paths for accumulation of Carbon in the universe • loss of Carbon in the universe • Carbon remediation as a result of (i) and (ii) above to	Pictorials, Charts, projectors and Internet Chemical Laboratories , Carbon sinks Carbon tanks Abandoned mining and excavation sites	• Practice a mock carbon sequestration on a school field trial plot or key into any R&D scheme on carbon sequestration • Identify sites mentioned in 9.3 • Identify spaces for Carbon Capture • Carbon Storage within a given locality	Guide students to: • Familiarize with activities that affect carbon sequestration • Identify and record in logbooks the sites mentioned in 9.3 • Visit facilities involved with Carbon Capture • Carbon Storage within a given locality and ask them to record in logbooks	Notes Markers Manuals Reports from International Conventions

	remediation as a result of (i) and (ii) above to mitigate against global warming	mitigate against global warming Outline the processes involved in				
	9.5 Describe the processes involved in i. Carbon Capture ii. Carbon Storage	(i) Carbon Capture (ii) Carbon storage				
	9.6 Distinguish between the different carbon accumulations in Environmental Components as i. atmospheric environment ii. Sea iii. Soils	Describe the levels of concentrations in the stated media in 9.6				
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



SOIL POLLUTION AND REMEDIATION

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL POLLUTION AND REMEDIATION	COURSE CODE: SST 421	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is design equip students with the knowledge and skills required to assess soil pollution arising from agricultural, industrial, municipal, mining, petroleum, and other anthropogenic activities using contemporary and sustainable remediation approaches.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1. Understand the concepts, sources, types, and significance of soil pollution; 2. Know the major soil pollutants and their characteristics; 3. Know the sources, fate and effect of pollutants on soil, plant, man and the environment; 4. Understand and assess heavy metal contamination in soils; 5. Understand contamination arising from petroleum hydrocarbons, mining, municipal and industrial wastes; 6. Understand pollution resulting from agricultural chemicals, fertilizers, pesticides, and herbicides; 7. Understand soil sampling and laboratory analyses for pollutant determination; 8. Understand the principles of soil remediation and techniques for managing polluted soils.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL POLLUTION AND REMEDIATION			COURSE CODE: SST 421		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: Nil		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is design equip students with the knowledge and skills required to assess soil pollution arising from agricultural, industrial, municipal, mining, petroleum, and other anthropogenic activities using contemporary and sustainable remediation approaches.						
General objective 1.0: Understand the concepts, sources, types, and significance of soil pollution						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Describe concepts of soil pollution 1.2 Explain the sources of soil pollution 1.3 Discuss the significance of soil pollution. 1.4 Define pollutants and contaminants 1.5 Differentiate between soil pollution and contamination	• Explain concepts of soil pollution • Discuss the sources of soil pollution • Explain the significance of soil pollution. • Explain pollutants and contaminants • Differentiate between soil pollution and contamination	Lecture notes, multimedia projector, charts.	• Identify different sources of soil pollution in the environment. • Identify the different soil pollutants and contaminants	Guide students to: • Identify different sources of soil pollution • Identify the different soil pollutants and contaminants	Camera, GPS.
General objective 2.0: Know the major soil pollutants and their characteristics						
2-3	2.1 Define soil pollution and contamination	• Explain soil Pollution and contamination	Charts, videos.	• Identify soil pollutants using various	Guide students to: • Identify soil pollutants using various	Sample containers, reference

	2.2 Explain the classification of soil pollutants into organic, inorganic, biological and radioactive pollutants. 2.3 Describe the characteristics of soil pollutants	• Discuss soil pollutants into organic, inorganic, biological and radioactive pollutants. • Explain the characteristics of soil pollutants.		techniques. • Differentiate pollutants based on observable characteristics.	techniques. • Differentiate pollutants based on observable characteristics.	materials. pollutant samples,
General objectives 3.0: Know the sources, fate and effect of pollutants on soil, plant, man and the environment						
4-5	3.1 Describe sources, pathways and fate of pollutants in soils 3.2 Explain effects of soil pollution on soil properties and plants 3.3 Explain the effect of soil pollution on animals and humans	• Explain pollutant transport mechanisms • Explain the sources and fate of pollutants in soil ecosystems • Discuss the effect of soil pollution on animals and humans	Flow charts, case studies.	• Identify polluted sites for in-situ studies • Observe trace pollution pathways in selected sites.	Guide students to: • Conduct field investigation exercise. • Visit polluted sites for in-situ assessment	GPS maps field sheets pen
General objective 4.0: Understand and assess heavy metal contamination in soils						
6-7	4.1 Describe heavy metal contamination in the soil 4.2 Explain how heavy metals can be assessed in the	• Explain heavy metals, toxicity and accumulation processes. • Discuss how heavy metals can be assessed in the soil	Videos, scientific reports.	• Identify visible impacts of soil contamination on vegetation and soil.	Guide students to: • Collect soil samples from polluted sites, process and analyze them	Observation sheets Cameras Soil samples AAS

	soil 4.3 Discuss the environmental implications of heavy metals	Discuss the environmental implications of heavy metals				
General objective 5.0: Understand contamination arising from petroleum hydrocarbons, mining, municipal and industrial wastes.						
8-9	5.1 Explain petroleum hydrocarbon pollution 5.2 Explain the sources of petroleum hydrocarbon pollution 5.3 Discuss the impact of hydrocarbon pollution on the environment 5.4 Explain the types and sources of industrial wastes 5.5 Describe mining pollution and their environmental impacts 5.6 Explain municipal wastes and their effect on environment 5.7 Describe types and sources of industrial wastes.	- Discuss crude oil spills refinery wastes and industrial pollutants - Explain how petroleum hydrocarbon contamination can affect soil, water and air - Describe the types and sources of industrial wastes - Explain pollution caused by mining activities - Describe municipal wastes and their effect on environment - Explain the various types and sources of industrial wastes	Videos, case studies, reports	- Collect soil samples for heavy metal analysis. - Identify contaminated sites and collect samples. - Observe types of industrial wastes - Identify sources of industrial wastes - Identify mining sites and assess pollution types - Observe municipal wastes at urban centres and their menace in the environment - Identify different sources of wastes generated by industries	- Guide student to; Collect soil samples for heavy metal analysis. - Identify contaminated sites and collect samples. - Observe types of industrial wastes - Identify sources of industrial wastes - Identify mining sites and assess pollution types - Observe municipal wastes at urban centres and their menace in the environment - Identify different sources of wastes generated by industries	Soil augers, sample bags, labels, AAS Sampling kits, PPE, GPS. Soil samples Water samples Air samples Laboratory equipment

General objective 6.0: Understand pollution resulting from agricultural chemicals						
10-11	6.1 Explain pollution from fertilizers 6.2 Discuss pollution from use of pesticides 6.3 Explain pollution from use of herbicides	• Discuss fertilizer pollution and residue accumulation • Explain how agrochemicals pollute the environment	Agrochemical samples, manuals	• Determine potential agricultural pollution sources in farms.	Guide students to: • Conduct farm surveys for collection of soil samples	Survey forms PPE GPS AAS Soil sampling equipment
General objective 7.0: Understand soil sampling and laboratory analyses for pollutant determination						
12-13	7.1 Explain soil sampling methods for pollutants 7.2 Explain laboratory methods for soil pollutant analysis 7.3 Describe the procedures for soil sampling and laboratory analyses of pollutants	• Describe methods of soil sampling for pollutants • Discuss analytical techniques and quality control • Explain the procedures for soil sampling and laboratory analyses of pollutants	Laboratory manuals,	• Analyze soil samples for selected contaminants	Guide student to; • undertake practical sessions on pollution	Spectrophotometer pH meter Soil samples
General objective 8: Understand the principles of soil remediation and techniques for managing polluted soils.						
14-15	8.1 Explain principles of soil remediation and restoration 8.2 Describe physical and engineering remediation technologies 8.3 Explain chemical remediation	• Discuss remediation objectives and site characterization • Explain excavation, soil washing, containment, capping and land farming techniques • Discuss stabilization,	Remediation manuals. Models, videos, engineering diagrams Chemical samples, manuals. Plant samples,	• Conduct site assessment for remediation planning. • Demonstrate simple soil washing and containment methods. • Perform	• Guide students to; Conduct site assessment for remediation planning. • Demonstrate simple soil washing and containment methods. • Perform stabilization and neutralization	Assessment forms, GPS. Soil washing apparatus, containers Chemicals, PPE, laboratory equipment. Seedlings

	techniques. 8.4 Explain biological remediation techniques.	immobilization and chemical extraction methods. • Discuss bioremediation,	microbial cultures, videos.	stabilization and neutralization experiments. • Establish phytoremediation and compost-based remediation trials.	experiments. • Establish phytoremediation and compost-based remediation trials.	Compost Sample containers.
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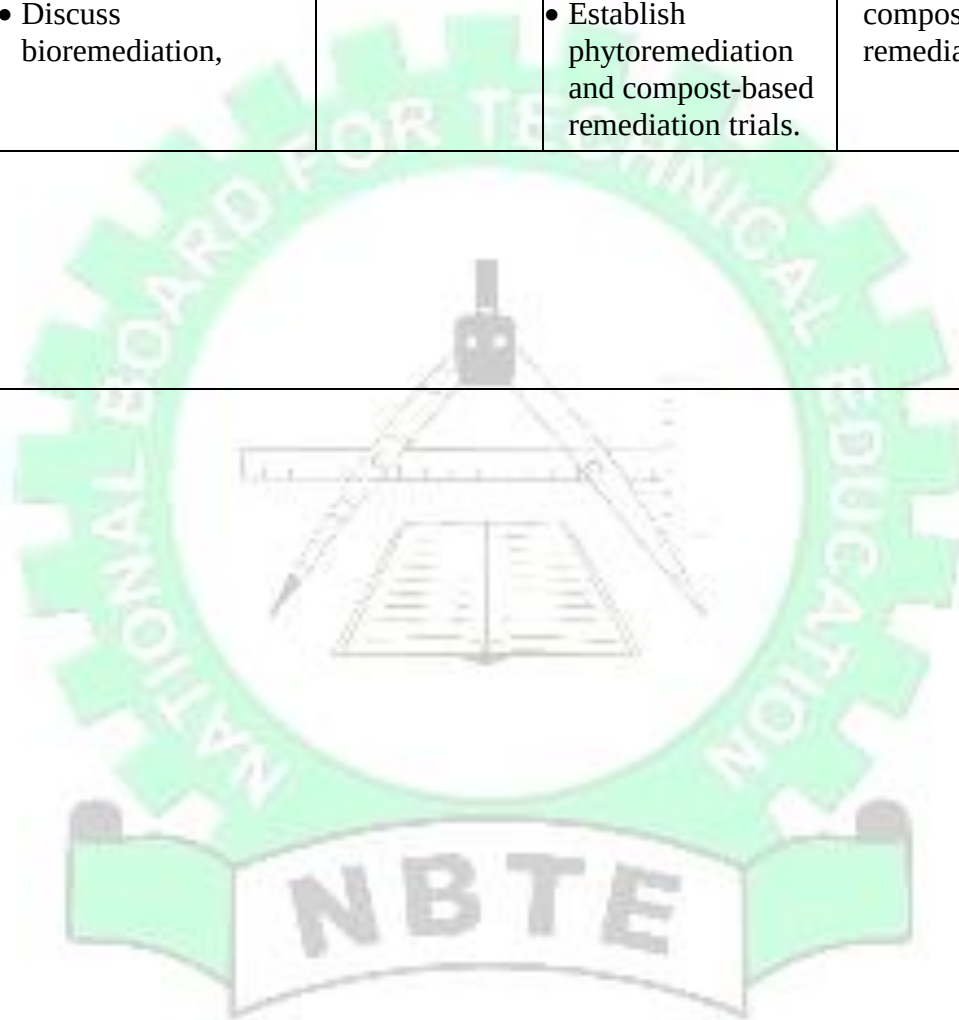
COURSE ASSESSMENT:

Coursework: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%

AI AND MACHINE LEARNING IN SOIL SCIENCE

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: AI AND MACHINE LEARNING IN SOIL SCIENCE	COURSE CODE: SST 422	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in artificial intelligence and machine learning in soil science for improved soil analysis, prediction and sustainable land management.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and applications of Artificial Intelligence (AI) and Machine Learning (ML) in soil science; 2.0 Apply AI and ML techniques to collect, manage, analyse, and interpret soil data; 3.0 Develop AI-based models for soil property prediction, soil classification, and digital soil mapping; 4.0 Use AI tools for precision soil fertility management, land suitability evaluation, and decision-making; 5.0 Carry out practical competence in applying AI and ML technologies for sustainable soil and land resource management.		

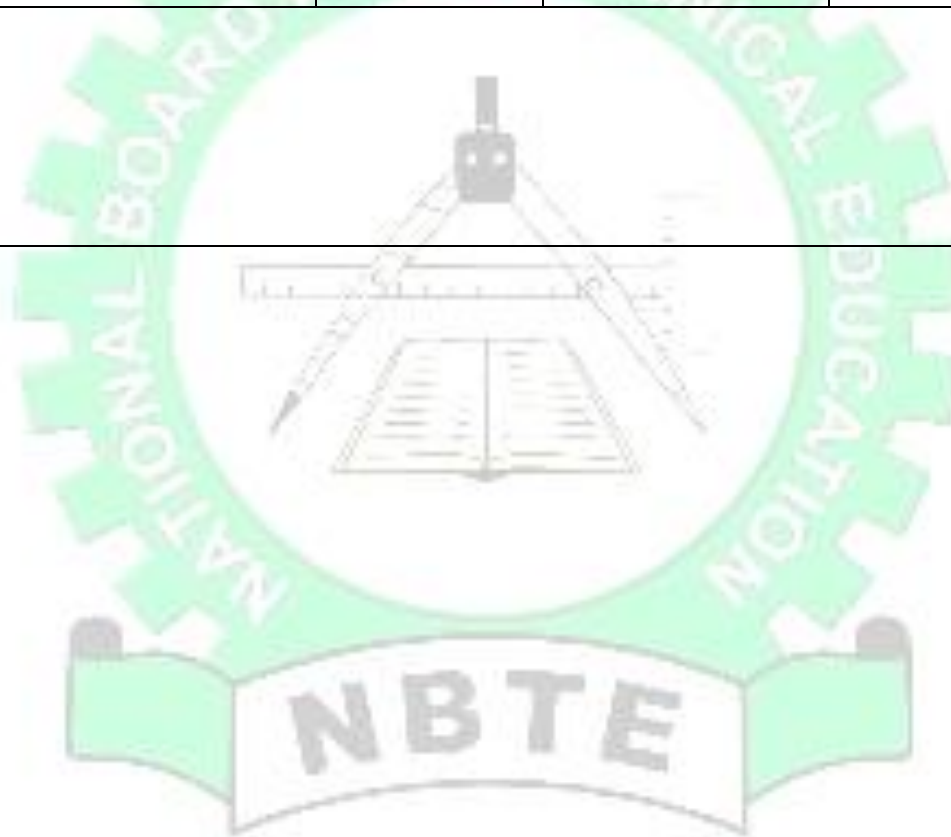
PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: AI AND MACHINE LEARNING IN SOIL SCIENCE			COURSE CODE: SST 422		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: I SEMESTER: I			PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in artificial intelligence and machine learning in soil science for improved soil analysis, prediction and sustainable land management.						
GENERAL OBJECTIVE 1.0: Understand the principles and applications of Artificial Intelligence (AI) and Machine Learning (ML) in Soil Science						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain the concepts of AI and Machine Learning. 1.2 Describe the types and applications of AI in soil science. 1.3 Describe the benefits and limitations of AI in soil management.	• Explain the concepts of AI and Machine Learning. • Discuss the types and applications of AI in soil science. • Explain the benefits and limitations of AI in soil management.	LCD projector Slide Chart Computer	• Explore AI software platforms. • Identify AI applications in soil science. • Present findings from selected case studies.	Guide students to: • Explore AI software platforms. • Identify AI applications in soil science. • Present findings from selected case studies.	Computer, AI software, Internet access, Projector.
General Objective 2.0: Apply AI and ML techniques to collect, manage, analyse and interpret soil data						
4-6	2.1 Explain soil data sources for AI applications. 2.2 Describe soil data preprocessing	• Explain soil data sources for AI applications. • Explain soil data preprocessing	LCD projector Slide Chart Computer	• Import soil datasets into AI software.2. • Clean and	Guide students: • Import soil datasets into AI software.2. • Cleaning and perform	Computer, Python, Jupyter Notebook, Excel, Soil datasets.

	techniques. 2.3 Explain methods of soil data interpretation.	techniques. • Explain methods of soil data interpretation.		preprocess soil data.3. • Analyse and interpret soil datasets. •	preprocessing soil of data.3. • Analyse and interpret soil datasets.	
General Objective 3.0: Develop AI-based models for soil property prediction, soil classification and digital soil mapping						
7-9	3.1 Explain machine learning algorithms used in soil science. 3.2 Describe digital soil mapping techniques. 3.3 Explain model evaluation methods.	• Explain machine learning algorithms used in soil science. • Discuss digital soil mapping techniques. • Explain model evaluation methods.	LCD projector Slide Chart Computer	• Execute an AI-based soil management project. • Prepare a technical report. • Present project findings and recommendations.	Guide students to: • Execute an AI-based soil management project. • Prepare a technical report. • Present project findings and recommendations.	Computer, AI software, GIS software, projector, Soil datasets, Internet access.
General Objective 4.0: Use AI tools for precision soil fertility management, land suitability evaluation and decision-making						
10-12	4.1 Explain AI applications in soil fertility management. 4.2 Describe land suitability evaluation methods. 4.3 Explain AI-based decision support systems.	• Explain AI applications in soil fertility management. • Discuss land suitability evaluation methods. • Explain AI-based decision support systems.	LCD projector Slide Chart Computer	• Generate fertilizer recommendations using AI. • Conduct land suitability analysis. • Apply AI tools for decision-making.	Guide students to: • Generate fertilizer recommendations using AI. • Conduct land suitability analysis. • Apply AI tools for decision-making.	GIS software, Soil analysis reports, Satellite imagery, Computer.
General Objective 5.0: Carry out practical competence in applying AI and ML technologies for sustainable soil and land resource management						
13-15	5.1 Explain sustainable	• Explain sustainable	LCD projector	• Execute an AI-	Guide students to:	Computer,

	AI applications in soil management. 5.2 Describe ethical issues in AI. 5.3 Explain project planning and reporting procedures.	AI applications in soil management. • Describe ethical issues in AI. • Explain project planning and reporting procedures.	Slide Chart Computer	based soil management project. • Prepare a technical report. • Present project findings and recommendations.	• Execute an AI-based soil management project. • Prepare a technical report. • Present project findings and recommendations.	AI software, GIS software, projector, Soil datasets, Internet access.
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COURSE ASSESSMENT:

Coursework:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



SOIL, WATER AND PLANT ANALYSIS

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL, WATER AND PLANT ANALYSIS	COURSE CODE: SST 423	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE: Nil	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and practical skills in the collection, preparation, analysis, interpretation, and reporting of soil, water, and plant samples for agricultural production, environmental monitoring, irrigation management, and land resource assessment.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles and importance of soil, water, and plant analysis in agricultural production, environmental monitoring, and land resource management; 2.0 Know standard procedures for the collection, handling, storage, and preparation of soil, water, and plant samples for laboratory analysis; 3.0 Understand the physical, chemical, and biological properties of soils using standard laboratory methods; 4.0 Understand irrigation and environmental water samples for important physical and chemical quality parameters. 5.0 Know nutrient concentrations and other relevant constituents in plant tissues using appropriate analytical techniques; 6.0 Understand operation, calibration, and maintenance of basic laboratory equipment and analytical instruments used in soil, water, and plant analysis; 7.0 Understand how to Interpret soil, water, and plant analytical data for agricultural, environmental, and land-use decision-making.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL, WATER AND PLANT ANALYSIS			COURSE CODE: SST 423		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 2		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE: Nil		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and practical skills in the collection, preparation, analysis, interpretation, and reporting of soil, water, and plant samples for agricultural production, environmental monitoring, irrigation management, and land resource assessment.						
General Objectives 1.0: Understand the principles and importance of soil, water, and plant analysis in agricultural production, environmental monitoring, and land resource management.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Explain the meaning of soil, water, and plant analysis 1.2 Explain the importance of soil, water, and plant analysis in agriculture and environmental management. 1.3 Explain principles of laboratory safety, quality assurance, and quality control.	• Discuss the meaning of soil, water, and plant analysis • Discuss the importance of soil, water, and plant analysis in agriculture and environmental management. • Discuss applications of laboratory analysis in crop production and land management • Discuss laboratory regulations, safety	LCD, multimedia projector, Internet, charts	• Identify laboratory equipment and observe safety procedures	Guide the students to: • Identify laboratory instruments and safety practices.	Safety manuals,

		precautions, SOPs, and QA/QC procedures				
General Objective 2.0: Know standard procedures for the collection, handling, storage, and preparation of soil, water, and plant samples for laboratory analysis.						
3-4	2.1 Describe procedures for soil sampling, handling, and preparation. 2.2 Explain procedures for water sampling, preservation, and storage. 2.3 Describe plant tissue sampling and sample preparation methods.	• Explain sampling strategies, drying, grinding, and storage procedures • Discuss procedures for water sampling, preservation, and storage. • Describe plant tissue sampling and sample preparation methods.	LCD, Laboratory safety manuals, multimedia projector, Internet, charts	• Collect representative soil samples from the field • Prepare soil samples for laboratory analysis • Collect and preserve water samples for analysis • Collect and prepare plant tissue samples	Guide students to: • Collect representative soil samples from the field • Prepare soil samples for laboratory analysis • Collect and preserve water samples for analysis • Collect and prepare plant tissue samples	Soil augers, sample bags, sieves, Drying trays, Water sampling bottles, field guides, GPS, Plant samples, drying oven, grinder.
General Objective 3.0: Understand the physical, chemical, and biological properties of soils using standard laboratory methods.						
5-6	3.1 Explain soil physical analyses and their significance 3.2 Explain methods for determination of soil pH, electrical conductivity (EC), and salinity. 3.3 Describe methods for determining soil	• Explain soil physical analyses and their significance • Explain methods for determination of soil pH, electrical conductivity (EC), and salinity. • Describe methods for determining soil organic matter and	LCD, multimedia projector, Internet, charts, Laboratory manuals, nutrient rating charts	• Determine soil texture, moisture content, and bulk density. • Measure soil pH, EC, and salinity • Determine soil organic carbon and organic matter content • Determine	Guide the students to: • Carry out extraction of soil nutrients from soil samples • Use standard laboratory methods to carry out soil analysis • Carry out calculations	Soil Textural triangle, Core sampler, Pycnometer, Digestion blocks, Mechanical shakers, Muffle furnace,

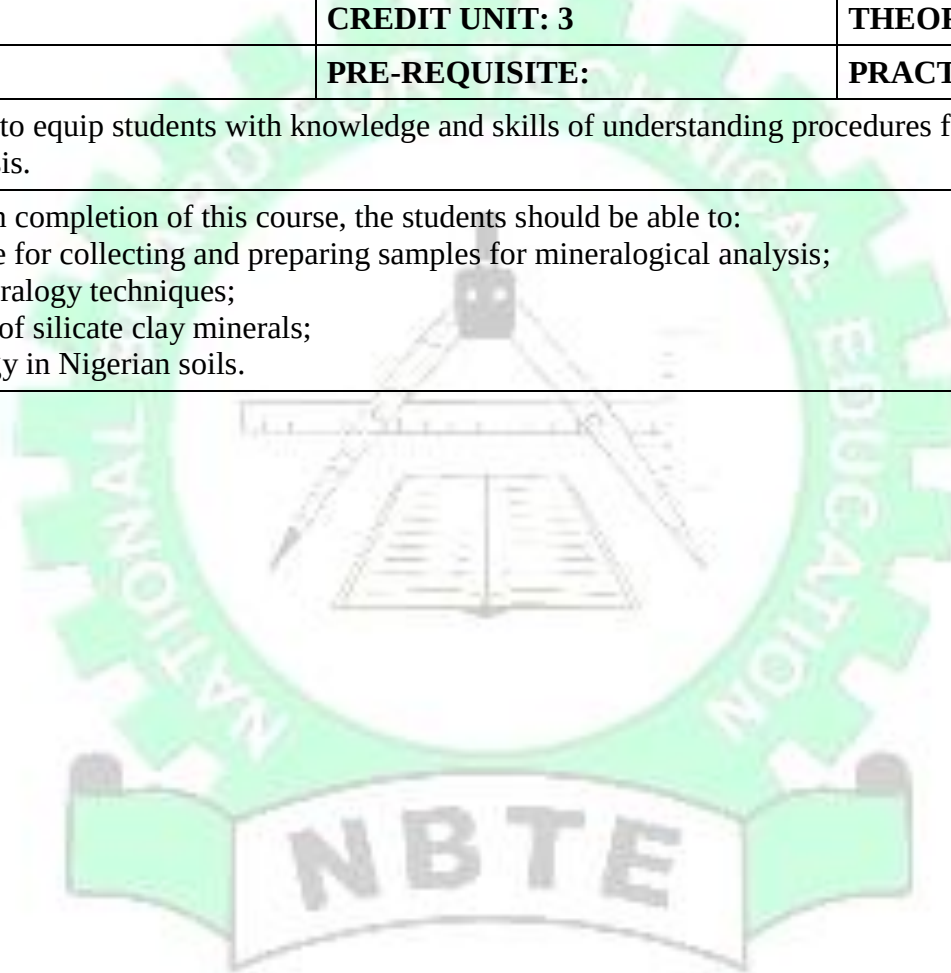
	organic matter and soil organic carbon. 3.4 Explain determination of essential nutrients in soil	soil organic carbon. • Explain determination of essential nutrients in soil		available phosphorus and exchangeable potassium in soils		
General Objective 4.0: Understand water samples for important physical and chemical quality parameters.						
7-8	4.1 Explain physical analyses of water samples 4.2 Explain chemical analyses of water samples 4.3 Explain biochemical analyses of water samples	- Describe analyses of TDS, TSS, Total Hardness, Turbidity, Water temperature, etc in irrigation water - Discuss the analyses of pH, EC, SAR, Nitrates, Carbonates, Bicarbonates, Sulphates, Phosphates, Chlorides, Boron, Heavy metals, etc in irrigation water - Explain biochemical analyses of water samples	LCD, multimedia projector, Internet, charts, Water quality manuals, analytical standards,	Analyze water samples quality parameters	Guide the students to: Determine pH, EC, TDS, hardness, and major ions from water samples	Water sampling bottles, Labels, Markers, Water distillation unit, pH meter, EC meter, conductivity standards, Spectrophotometer, flame photometer
General Objective 5.0: Know nutrient concentrations and other relevant constituents in plant tissues using appropriate analytical techniques.						
9-10	5.1 Explain plant tissue analysis 5.2 Explain the procedure in plant tissue analysis	- Explain plant tissue analysis - Explain the procedure in plant tissue analysis	LCD, multimedia projector, Internet, charts	- Digest plant samples for the determination of nutrient contents - Determine	Guide the students to: - Carry out digestion of plant samples for analysis - Carry out nutrient	Digestion block, Kjeldahl apparatus, Spectrophotometer, flame

	5.3 Describe methods for determination of nutrients in plant tissues.	Explain methods for determination of nutrients in plant tissues.		nitrogen, phosphorus, and potassium in plant tissues	analysis on plant samples	photometer, laboratory manuals
General Objective 6.0: Understand Operation, calibration, and maintenance of basic laboratory equipment and analytical instruments used in soil, water, and plant analysis						
11-12	6.1 Discuss major laboratory analytical instruments 6.2 Explain the operations of major analytical instruments 6.3 Discuss the maintenance of major analytical instruments	- Discuss major laboratory analytical instruments - Explain the operations of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc - Discuss the maintenance of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc	LCD, multimedia projector, Internet, charts	- Identify major laboratory analytical instruments - Demonstrate the operations of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc - Demonstrate the maintenance of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc	Guide the students to: - Identify major laboratory analytical instruments - Demonstrate the operations of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc - Demonstrate the maintenance of flame photometer, calorimeter, spectrophotometer, photometers, pH meters, etc	Digestion block, Kjeldahl apparatus, Spectrophotometer, flame photometer, pH meter, EC meter, Permeameter, etc
General Objective 7.0: Understand how to Interpret soil, water, and plant analytical data for agricultural, environmental, and land-use decision-making.						
13-15	7.1 Explain interpretation of soil analytical results. 7.2 Explain interpretation of	- Discuss interpretation of soil analytical results - Discuss interpretation of	LCD, Nutrient critical limits charts, Standard water quality	- Interpret soil analytical data - Interpret water analytical data - Interpret plant	Guide the students to: - compare results with standard ratings and critical limits - make appropriate	Analytical reports, interpretation guides

	water analytical results. 7.3 Explain interpretation of plant analytical results. 7.4 Discuss soil fertility status, nutrient deficiencies, toxicities, and imbalances affecting crop production. 7.5 Explain fertilizer recommendation and nutrient management based on analytical results.	plant analytical results • Discuss interpretation of water analysis for agricultural purposes • Discuss the use of soil and plant analytical results for fertilizer recommendation and nutrient management	assessment charts, Fertilizer recommendation charts	samples analytical data	recommendations based on soil, water and plant samples analytical results	
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

SOIL MINERALOGY

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: SOIL MINERALOGY	COURSE CODE: SST 424	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of understanding procedures for collecting and preparing samples for mineralogical analysis.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the procedure for collecting and preparing samples for mineralogical analysis; 2.0 Understanding clay-mineralogy techniques; 3.0 Understand the structure of silicate clay minerals; 4.0 Understanding mineralogy in Nigerian soils.		



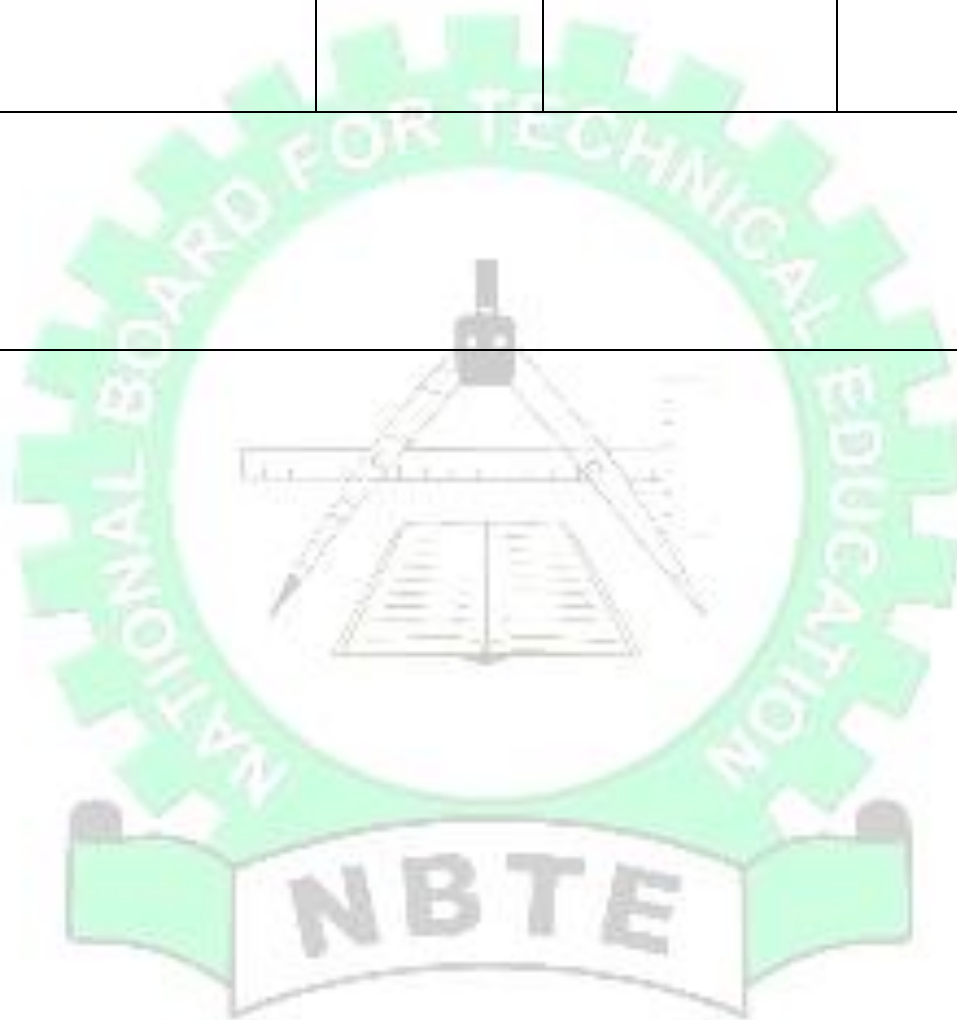
PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: SOIL MINERALOGY			COURSE CODE: SST 414		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills of understanding procedures for collecting and preparing samples for mineralogical analysis.						
GENERAL OBJECTIVE 1.0: Understand the procedure for collecting and preparing samples for mineralogical analysis						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define primary minerals (quartz, feldspar, mica) secondary clay minerals (kaolinite, smectite, illite, chlorite) 1.2 Define oxide and hydroxide minerals (Fe, Al, Mn) 1.3 Explain carbonate and salt minerals	• Explain primary minerals (quartz, feldspar, mica) secondary clay minerals (kaolinite, smectite, illite, chlorite) • Explain oxide and hydroxide minerals (Fe, Al, Mn) • Discuss carbonate and salt minerals	LCD Projector Microscope	• Identify primary minerals using microscope • Identify clay minerals using X-Ray Diffraction • Identify oxides / hydroxides • Identify carbonates / salts	Guide students to; • Collect soil sample • Identify primary minerals	LCD Projector Microscope
GENERAL OBJECTIVE 2.0: Understanding clay-mineralogy techniques						
4-7	2.1 Describe XRD principles for clay Identification 2.2 Explain thermal analysis (DTA,	• Discuss XRD principles for clay Identification • Explain thermal analysis (DTA,	LCD projector Clay-mineralogy Microscope	• Identify XRD for clay Identification • Conduct DTA / TGA	Guide students to; • Demonstrate how to remove free iron oxides from sands • Demonstrate how to	LCD projector Clay-mineralogy Microscope

	TGA) 2.3 Define IR spectroscopy 2.4 Explain clay-fraction separation	TGA) • Explain IR spectroscopy • Explain clay-fraction separation		• Identify FTIR • Fractionate clay fraction	separate sand, silt and clay • Demonstrate soil dispersion applying the processes in 2.1	
GENERAL OBJECTIVE 3.0: Understand the structure of silicate clay minerals						
8-11	3.1 Define crystal chemistry 3.2 Explain the term polymorphism in minerals 3.3 Describe the tetrahedron unit of silicate clays 3.4 Describe the octahedral unit. 3.5 Explain the derivation of the formulae of the silicate clays 3.6 Explain the classification of silicate clays	• Explain crystal chemistry • Explain the term polymorphism in minerals • Describe the tetrahedron unit of silicate clays • Explain the derivation of the formulae of the silicate clays • Explain the classification of silicate clays	LCD Projector Pictorials,	• Identify the classification of silicate clay	Guide student to; • Identify the classification of silicate clay	LCD Projector Pictorials
GENERAL OBJECTIVE 4.0: Understanding mineralogy in Nigerian soils						
12-15	4.1 Describe mineralogy of major Nigerian soils 4.2 Define weathering / mineralogical sequences 4.3 Explain	• Discuss mineralogy of major Nigerian soils • Explain weathering / mineralogical sequences • Explain mineralogy-fertility relationships	LCD Projector	• Identify mineralogy of 3 Nigerian soils • Identify trace weathering sequences • Determine mineralogy to	Guide students to; • Identify mineralogy of Nigerian soils	LCD Projector Maps

	mineralogy-fertility relationships 4.4 Explain implications for soil management	Discuss implications for soil management		fertility		
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COURSE ASSESSMENT:

Coursework: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
Total: 100%



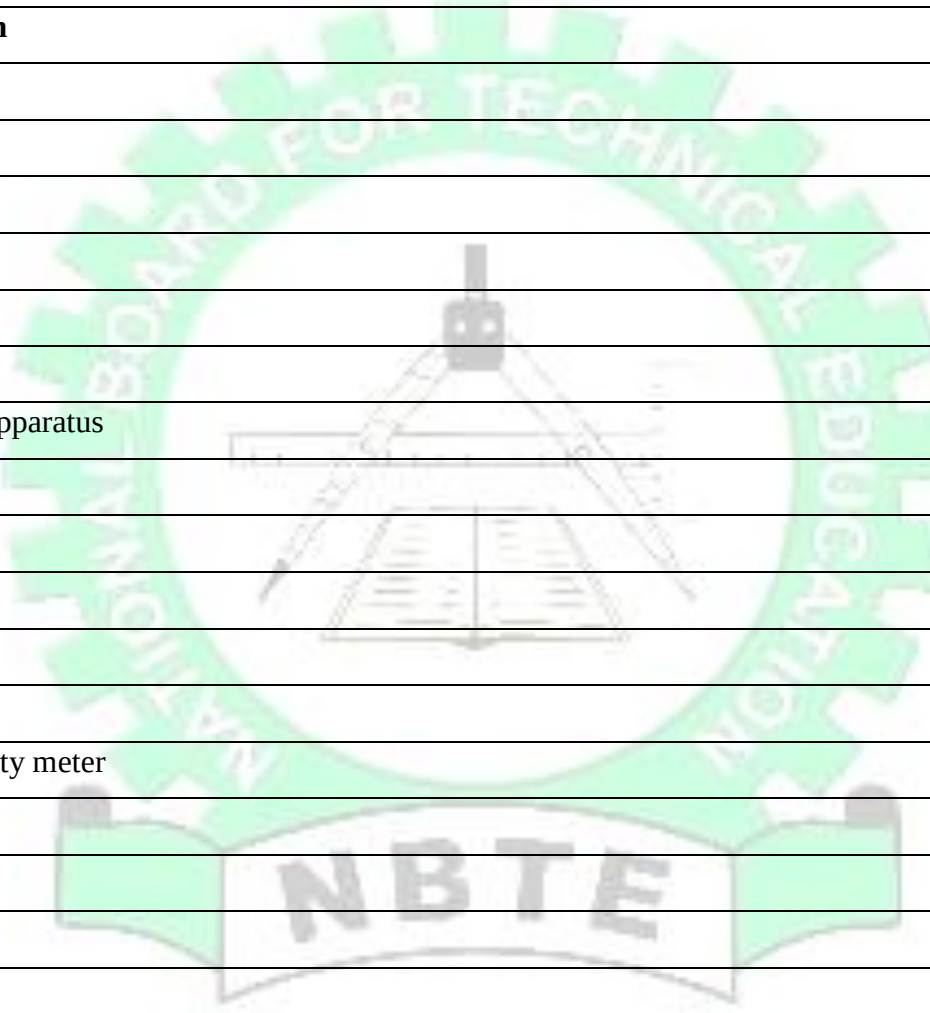
LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY		
COURSE TITLE: LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT	COURSE CODE: SST 425	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: The course is designed to equip the students with practical knowledge of land-use planning principles, planning processes and Environmental-Impact Assessment (EIA).		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand land-use-planning foundations. 2.0 Know participatory land-use planning. 3.0 Understand Environmental Impact Assessment foundations. 4.0 Know Environmental-Impact Assessment, identification and mitigation. 5.0 Understand Environmental-Impact Assessment reporting and management plans.		

PROGRAMME: HND SOIL SCIENCE AND LAND RESOURCES MANAGEMENT TECHNOLOGY						
COURSE TITLE: LAND USE PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT			COURSE CODE: SST 425		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to equip the students with practical knowledge of land-use planning principles, planning processes and Environmental-Impact Assessment (EIA).						
GENERAL OBJECTIVE 1.0: Understand land-use-planning foundations						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Define land-use planning concepts 1.2 Explain planning levels (national, regional, local) 1.3 Explain planning processes 1.4 Define Nigerian land-use planning legislation	• Explain land-use planning concepts • Explain planning levels (national, regional, local) • Discuss planning processes • Explain Nigerian land-use planning legislation	LCD, Projector	• Conduct field investigation exercise • Identify planning concepts • Carryout planning levels • Determine planning process to one site • Identify Nigerian planning laws	Guide students to; • Conduct field investigation exercise • Identify planning concepts • Carryout planning levels • Determine planning process to one site • Identify Nigerian planning laws	LCD, Projector Planning templates
GENERAL OBJECTIVE 2.0: Know participatory land-use planning						
4-6	2.1 Explain stakeholder identification and analysis 2.2 Define participatory mapping	• Discuss stakeholder identification and analysis • Explain participatory	LCD, Projector	• Collect map stakeholders for one project • Conduct	Guide students to; • Collect map stakeholders for one project	LCD, Projector Maps

	2.3 Explain consensus-building tools 2.4 Explain gender /youth inclusion in planning	mapping • Explain consensus-building tools • Discuss gender / youth inclusion in planning		participatory mapping • Carry out consensus tools	• Conduct participatory mapping • Carry out consensus tools	
GENERAL OBJECTIVE 3.0: Understand Environmental-Impact Assessment foundations						
7-9	3.1 Explain EIA concepts and history 3.2 Explain EIA process (screening, scoping, assessment, review) 3.3 Explain EIA Act of Nigeria 1992 3.4 Explain environmental laws and NESREA	• Discuss EIA concepts and history • Explain EIA process (screening, scoping, assessment, review) • Discuss EIA Act of Nigeria 1992 • Explain environmental laws and NESREA	LCD, Projector	• Carryout EIA • Identify EIA Act 1992 • Identify NESREA mandate	Guide students to; • Undertake EIA • Acquire EIA 1992 Act • Identify NESREA mandate	LCD, Projectors
GENERAL OBJECTIVE 4.0: Know Environmental-Impact Assessment, identification and mitigation						
10-12	4.1 Explain impact-identification methods (matrix, checklist, network) 4.2 Describe impact-prediction techniques 4.3 Explain impact-significance assessment 4.4 Define mitigation hierarchy (avoid, minimise, restore,	• Explain impact-identification methods (matrix, checklist, network) • Discuss impact-prediction techniques • Explain impact-significance assessment • Discuss mitigation hierarchy (avoid, minimise, restore,	LCD, Projector	• Identify impact-identification methods • Investigate significance • Design mitigation measures	Guide students to; • Identify impact-identification methods • Investigate significance • Identify mitigation measures	LCD, Projector

	offset)	offset)				
GENERAL OBJECTIVE 5.0: Understand Environmental-Impact Assessment reporting and management plans						
13-15	5.1 Explain EIS / EIA report writing 5.2 Explain Environmental Management Plan (EMP) 5.3 Define public consultation in EIA 5.4 Explain EIA monitoring and audit	• Discuss EIS / EIA report writing • Explain Environmental Management Plan (EMP) • Discuss public consultation in EIA • Explain EIA monitoring and audit	LCD, Projector	• Draft 20-page EIA report • Conduct mock public consultation • Build monitoring plan	Guide students to; • Complete EIA project • Conduct public consultation • Identify monitoring plan steps.	LCD, Projector
COURSE ASSESSMENT: Coursework: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

LIST OF MINIMUM RESOURCES/ PHYSICAL FACILITIES.**1.0 SOIL SCIENCE LABORATORY**


S/N	Description of Item	Quantity
1	Drying oven (soil)	2
2	pH meter	3
3	Electric furnace	1
4	Electronic balance	4
5	Beam balance	2
6	Set of soil sieve	20
7	Soil sedimentation apparatus	2
8	Soil moisture meter	2
9	Soil testing outfit	3
10	Soil augers	30
11	Humidity cabinet	1
12	Tensiometer	2
13	Electrical conductivity meter	2
14	Flame photometer	1
15	Spectrophotometer	1
16	Kjeldahl apparatus	1
17	Nodule counter	1
18	Micro-digester for N	2
19	Colorimeter	2

20	Water quality test kit	1
21	Drying oven (plants)	1
22	Vacuum pumps	1
23	Sieve shaker (small)	3
24	Bottle shaker	3
25	Water bath	3
26	Atomic Absorption Spectrophotometer (AAS)	1
27	Piezometer	1
28	Nematode detector	1
29	Incubator	2
30	Centrifuge	1
31	Aggregate stability machine	1
32	Water distillation apparatus	1
33	Sand box	2
34	Büchner funnel	1
35	Permeameter	1
36	Fume cupboard	1
37	Pycnometer	20
38	Soil hydrometer	4
39	Drip irrigation tubes	1,000 m
40	Emitters	1,000
41	Double-ring infiltrometer	1

42	Sledge hammer	5
43	Drying trays	20
44	Digital camera	2
45	Munsell colour chart	As required
46	Axe	As required
47	Shovel / spade	As required
48	Cutlass	As required
49	Knife	As required
50	Pestle and mortar	As required
51	Thermometer	As required
52	Electric stirrer	As required
53	Desiccator chamber	As required
54	Wash bottles	As required
55	Vernier caliper	As required
56	Spatula	As required
57	Tin cans (perforated)	As required
58	Class A Pan	As required

2.0 CARTOGRAPHIC STUDIO

S/N	Item	Quantity
1	Draughting table	3
2	Light tables	3
3	Coordinatograph	1
4	Diazo printer	1
5	Trimmer	1
6	Pantograph	5 sets
7	Leroy lettering stencils	5
8	Uno lettering stencils	3
9	Opisometer (map measures)	5
10	Scribing tool sets and cutters	2 sets
11	Radiographs	5
12	Steel straight edges	1
13	Line testers	1
14	Contact box / frame	1
15	Process camera	1
16	Plate maker / printing-down box	1
17	Type composing machine	5 sets
18	French curves	1 set
19	Railway curves	1 set
20	Planimeter	2

3.0 SURVEYING EQUIPMENT

S/N	Item	Quantity
1	Prismatic compass	3
2	Ranging poles	8
3	Chain	2
4	Drawing set	5
5	Metric tape	2
6	Drawing boards	10
7	Protractors	10
8	Theodolite and staff	1
9	Scan rules	15
10	Set square	1 of 10
11	Set of arrows	30
12	Field book	5
13	Levels	4
14	T-square	10
15	Pantograph	10
16	Stereoscope (pocket)	4
17	Handheld GPS	2
18	GNSS / GPS AI-lite	2
19	Base maps	Many
20	Description sheets	Many

4.0 AUDIO-VISUAL STUDIO / FACILITIES

S/N	Item	Quantity
1	Video recorder	2
2	Slide projector	2
3	Overhead projector	2
4	Film projector	2
5	Magnetic board	2
6	Public address system	1
7	Television set	2
8	Cameras	5
9	Enlarger	1
10	Photo dryer	1
11	Photo cutter	1
12	Tables for drawing	5
13	Water colours	As required
14	Drawing pencils	As required
15	Drawing pens	As required
16	Display cabinets and boards	As required

5.0 WORKSHOP — MACHINERY SHED

S/N	Item	Quantity
1	Tractors	4
2	Disc plough	4
3	Disc harrows	4
4	Disc ridgers	4
5	4-wheel trailer	2
6	Stump jumper	1
7	Earth scoop	1
8	Rotovators	1
9	Versatile cultivators	2
10	Mouldboard ridge	2
11	Tractor winch	2
12	Tractor pulley	2
13	Versatile seed loader	2
14	Seed drill	2
15	Combine harvester	2
16	Seed cleaner	1
17	Seed grader	2
18	Hay baler	1
19	Cutter-bar mower	1
20	Rotary slasher	1

21	Fertilizer spreader	1
22	Cereal thresher	1
23	Forage shredder with cut hood	1
24	Sub-soiler	2
25	Versatile mouldboard plough	3
26	Manual maize planter	2
27	Spike-tooth harrow	1
28	Rice planter	2
29	Root cutter	1
30	Inter-row weeder	1
31	Manure spreader	1

6.0 MAINTENANCE / BUILDING SERVICES WORKSHOP

S/N	Item	Quantity
WOODWORK SECTION		
1	Working benches with vice	10
2	Band saw	2
3	Surface planer	2
4	Thickness planer	2
5	Drilling machine	1
HAND TOOLS		

6	Saws, chisels, try square, gauges, rulers, screwdrivers, set of drill bits, hammers, pincers, oil stones, planers, etc.	15 sets
METAL WORK SECTION		
7	Lathe machine	1
8	Pipe benders	3
9	Anvils	3
10	Micrometer screw gauge (inside, outside)	1
11	Stock and die set	5
12	Drill sets	5
13	Electrical hand drills	2
14	Hydraulic jack (12 and 15 tonnes)	1 each
15	Tool boxes	5
16	Box of drills	4
17	Battery charger	1
18	Grease gun	2
19	Pipe cutters	1
20	Scribers	1
21	Steel ruler	5
22	Mallet sets	2
23	Pipe screwing / threading set	2
24	Arc-welding equipment	8
25	Working benches	4

26	Arc welder	2
27	Electric grinder	2
28	Welding gloves	15
29	Welding helmet	15
30	Wire brush	5
31	Welding boots and screens / soldering equipment	15
32	Blow torch	4
33	Tin snips	4
34	Soldering flux	4
35	Sheet-metal shear	4
36	Mallet hammer	4
37	Hacksaw	4
38	Oxygen and acetylene bottles	2
39	Oxygen and acetylene regulator	2
40	Cylinder wrenches	3
41	Spark lighter	5
MAINTENANCE WORKSHOP		
42	Tool boxes	5
43	Hydraulic jack	2
44	Service pit	1
45	Teaching models or scraps of tractor engines	5
46	Trailers	As required

47	Ploughs	As required
48	Other farm implements	As required

7.0 FIELD FACILITIES — METEOROLOGICAL STATION

S/N	Item	Quantity
1	Automatic weather station	1
2	Stevenson screen	1
3	Thermohydrograph	1
4	Maximum and minimum thermometer	2
5	Rain gauge	2
6	Measuring glasses	2
7	Wind vane	1
8	Anemometers	2
9	Evaporimeters	2
10	Hygrometers	2
11	Barometers	2
12	Sunshine recorder / Solarimeter	1

8.0 IRRIGATION EQUIPMENT

S/N	Item	Quantity
1	Sprinkler irrigation kit (2,000 sq. m)	15
2	Hoses	20
3	Rotating sprinkler for 5 acres	10
4	Big-boss irrigation gun for 20 acres	3
5	Centre-pivot irrigation system for 20 acres	1
6	Current meter	2
7	Irrigation water tester	2
8	Electric motor pump	1

8.0 TABLE OF ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used throughout this curriculum document.

ACRONYM / ABBREVIATION	MEANING
4R	Right Source, Right Rate, Right Time, Right Place (nutrient stewardship)
AAS	Atomic Absorption Spectroscopy
ADP	Agricultural Development Programme (Nigerian state-level)
ANOVA	Analysis of Variance
ArcGIS	Esri Geographic Information System Software
AWS	Automatic Weather Station

BCR	Benefit-Cost Ratio
BET	Brunauer-Emmett-Teller (surface-area analysis)
BMC	Business Model Canvas
BNF	Biological Nitrogen Fixation
BRT	Boosted Regression Trees
CA	Conservation Agriculture / Continuous Assessment
CAC	Corporate Affairs Commission (Nigeria)
CBA	Cost-Benefit Analysis
CBN	Central Bank of Nigeria
CEC	Cation Exchange Capacity
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CGPA	Cumulative Grade Point Average
CH	Contact Hours per Week
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
cLHS	Conditioned Latin Hypercube Sampling
CN	Carbon-to-Nitrogen Ratio
COREN	Council of Registered Engineers of Nigeria
CPD	Continuing Professional Development
CRD	Completely Randomised Design
CROPWAT	FAO Crop Water Requirement Software
CSA	Climate-Smart Agriculture
CU	Credit Unit

CV	Coefficient of Variation
CWR	Crop Water Requirement
DEM	Digital Elevation Model
DMRT	Duncan's Multiple Range Test
DSM	Digital Soil Mapping
DTA	Differential Thermal Analysis
EC	Electrical Conductivity
ECe	Electrical Conductivity of the Saturation Extract
EDA	Exploratory Data Analysis
EGME	Ethylene Glycol Monoethyl Ether (surface-area method)
Eh	Soil Redox Potential
EIA	Environmental Impact Assessment
EM	Electromagnetic (Induction Survey)
EMP	Environmental Management Plan
ENSO	El Niño Southern Oscillation
ENT	Entrepreneurship Course Prefix
ERA5	ECMWF Reanalysis (5th generation) Climate Dataset
ESG	Environmental, Social and Governance
ESP	Exchangeable Sodium Percentage
ET	Evapotranspiration
FAO	Food and Agriculture Organization (of the United Nations)
FC	Field Capacity

FGD	Focus Group Discussion
FMENV	Federal Ministry of Environment (Nigeria)
FTIR	Fourier-Transform Infrared Spectroscopy
GCP	Ground Control Point
GEE	Google Earth Engine
GHG	Greenhouse Gas
GIS	Geographic Information System
GGW	Great Green Wall (initiative)
GLASOD	Global Assessment of Soil Degradation
GNS	General Studies Course Prefix
GNSS	Global Navigation Satellite System
GO	General Objective
GPS	Global Positioning System
GRI	Global Reporting Initiative
HND	Higher National Diploma
HSC	Higher School Certificate
IAR	Institute of Agricultural Research (Nigeria)
IITA	International Institute of Tropical Agriculture
IJMB	Interim Joint Matriculation Board
IMRaD	Introduction, Methods, Results and Discussion (report format)
INM	Integrated Nutrient Management
IoT	Internet of Things

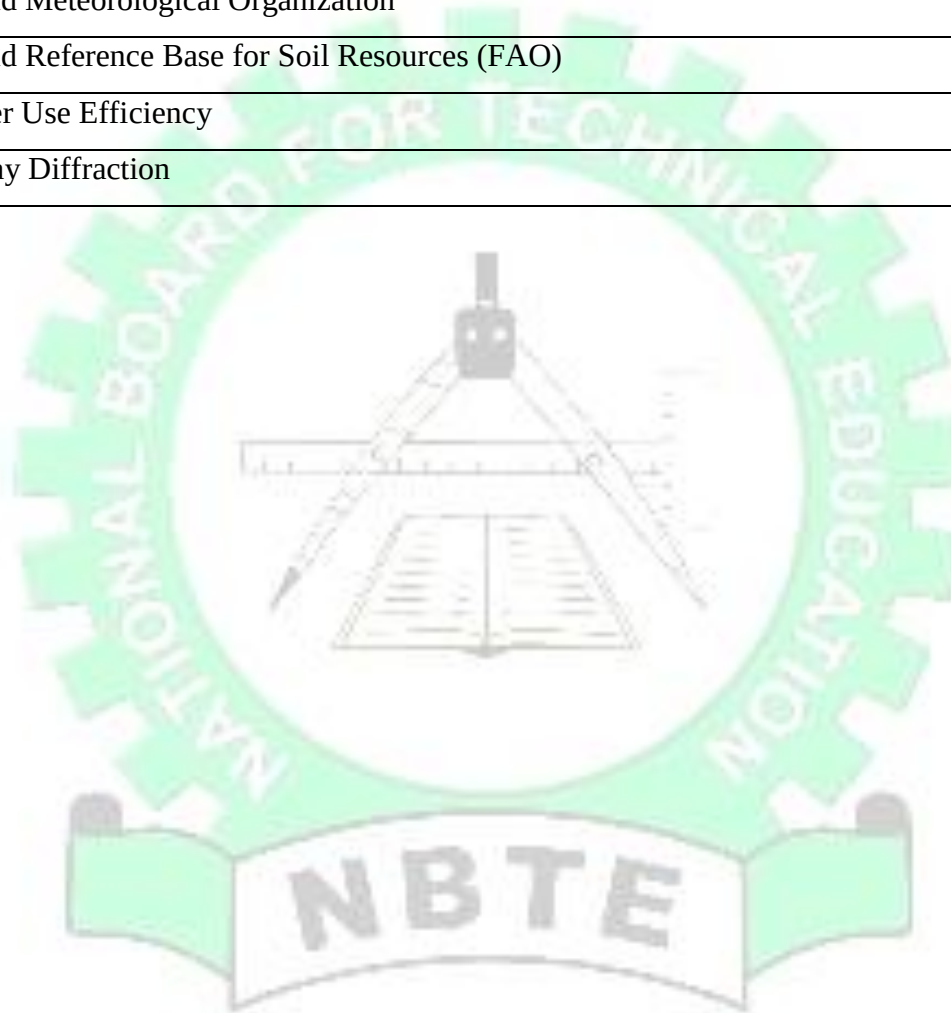
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
IRGA	Infra-Red Gas Analyser
ISFM	Integrated Soil Fertility Management
ISO	International Organization for Standardization
Ksat	Saturated Hydraulic Conductivity
KPI	Key Performance Indicator
L	Lecture Hours per Week
LADA	Land Degradation Assessment in Drylands (FAO)
LDN	Land Degradation Neutrality
LiDAR	Light Detection and Ranging
LOI	Loss on Ignition
LP	Linear Programming
LSD	Least Significant Difference (statistical test)
LULC	Land-Use / Land-Cover
M&E	Monitoring and Evaluation
MLC	Maximum Likelihood Classification
MRV	Measurement, Reporting and Verification
MVP	Minimum Viable Product
NABTEB	National Business and Technical Examinations Board
NAFDAC	National Agency for Food and Drug Administration and Control
NALDA	National Agricultural Land Development Authority

NBTE	National Board for Technical Education
NCAM	National Centre for Agricultural Mechanization (Nigeria)
NCE	Nigeria Certificate in Education
ND	National Diploma
NDC	Nationally Determined Contribution (climate)
NDVI	Normalized Difference Vegetation Index
NECO	National Examinations Council
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGO	Non-Governmental Organisation
NIHORT	National Horticultural Research Institute (Nigeria)
NIMET	Nigerian Meteorological Agency
NIS	Nigerian Institution of Surveyors
NOS	National Occupational Standards
NPK	Nitrogen-Phosphorus-Potassium (fertiliser)
NPV	Net Present Value
NSE	Nigerian Society of Engineers
OLS	Ordinary Least Squares (regression)
OM	Organic Matter
P	Practical Hours per Week
PDSI	Palmer Drought Severity Index
PES	Payment for Ecosystem Services
PGPR	Plant Growth-Promoting Rhizobacteria

pH	Potential of Hydrogen (acidity / alkalinity measure)
PPE	Personal Protective Equipment
PRA	Participatory Rural Appraisal
PWD	Persons With Disability
PWP	Permanent Wilting Point
PZC	Point of Zero Charge
QGIS	Quantum GIS (open-source Geographic Information System)
R	R Statistical Computing Language
RCBD	Randomised Complete Block Design
RF	Random Forest (machine-learning algorithm)
RS	Remote Sensing
RTK	Real-Time Kinematic (GNSS positioning)
RUSLE	Revised Universal Soil Loss Equation
RWH	Rainwater Harvesting
SAGA	System for Automated Geoscientific Analyses (GIS)
SAR	Sodium Adsorption Ratio / Synthetic Aperture Radar
SCORPAN	Soil = f(Soil, Climate, Organisms, Relief, Parent material, Age, Network) — DSM model
SD	Standard Deviation
SDG	Sustainable Development Goal
SER	Society for Ecological Restoration
SIWES	Students' Industrial Work Experience Scheme
SLT	Science Laboratory Technology

SMAP	Soil Moisture Active Passive (NASA satellite mission)
SOC	Soil Organic Carbon
SOM	Soil Organic Matter
SPAC	Soil-Plant-Atmosphere Continuum
SRTM	Shuttle Radar Topography Mission (DEM)
SSCE	Senior Secondary Certificate Examination
SST	Soil Science and Land Technology Course Prefix
SSNM	Site-Specific Nutrient Management
SSSN	Soil Science Society of Nigeria
SST	Soil Science and Technology (legacy NBTE prefix)
SVM	Support Vector Machine
SWAT	Soil and Water Assessment Tool
T	Theoretical / Lecture Hours per Week
TDR	Time-Domain Reflectometry
TGA	Thermogravimetric Analysis
Trends.Earth	UNCCD Land-Degradation Monitoring Tool (QGIS plug-in)
UAV	Unmanned Aerial Vehicle (drone)
UNCCD	United Nations Convention to Combat Desertification
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
VRT	Variable Rate Technology (precision agriculture)

WAEC	West African Examinations Council
WHO	World Health Organization
WMO	World Meteorological Organization
WRB	World Reference Base for Soil Resources (FAO)
WUE	Water Use Efficiency
XRD	X-Ray Diffraction



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