

SOS 1206 SOIL SCIENCE FOR ENGINEERS LECTURER/INSTRUCTOR: SESSANGA SAM M. (MR).

ACADEMIC QUALIFICATIONS:

1. Msc. (Soil Science) University of Nairobi, Kenya.
2. Bsc. (Agriculture) Hons. Makerere University, Kampala, Uganda

COURSE TYPE: Core for BSc. Agricultural Engineering J (Age I).

COURSE DURATION: 3CU, 45CH (30LH, 30 PH)

SCHEDULED DURATION (WKS): 15 Teaching weeks

2 Examination weeks (at end of the Semester II)

COURSE DESCRIPTION

General concept of soils as complex living systems. Soil genesis (formation); Factors and processes of soil formation. Basic soil physical and chemical properties; (soil texture, soil structure, clay mineralogy soil consistency, soil density, porosity, soil colour, soil temperature) and how these relate to/influence agricultural engineering works. Principles and practices of soil site characterization. Field water cycle and energy relationships in the Soil – Plant – Atmospheric continuum(SPAC). Soil Water Management Principles and Practices in the SPAC. Soil Tillage: Principles, Practices and Management. Soil Compression, Compaction and Consolidation. Soil Degradation: Causes and processes. Soil Conservation; Principles and Practices.

OVERALL COURSE OBJECTIVE

To have qualitative as well as quantitative knowledge and related skills availed to agricultural engineering students for soils' identification, utilization and conservation for sustainable productivity.

SPECIFIC COURSE OBJECTIVES

For agricultural engineering students to:

- Be able to identify and evaluate various soil types and their potential (s)
- Apply appropriate soil management/and conservation practices for sustainable utilization.
- Identify soil/land related research problems through case studies and field attachments.

COURSE REFERENCES;

1. Hillel D. (1980) Fundamentals of Soil Physics, Academic Press Inc. London Ltd. PP. 3-4, 6-17, 21-36, 55-68, 71-90, 93-117, 123-162, 166-190, 265-283, 287-313, 355-382.
2. Hillel D. (1980) Applications for Soil physics, Academic Press Inc. London Ltd. PP. 1-4, 5-46, 50-72, 147-150, 197-213, 234-281
3. Brady N.C (1990) The Nature and Properties of Soils, Macmillan Publishing Company New York PP 1-20, 23-33, 47-60, 91-122, 123-148, 153-164, 165-175, 177-193, 254-278, 431-469)
4. Urio A.P et al (1983) Introduction to Soil Science, Tanzania Publishing House , Dar-es-Salaam PP. 1-4, 5-12, 13-34, 35-53, 205-215.
5. Barnes K.K et al (1971) Compaction of Agricultural Soils , ASAE Monograph by American Society of Agricultural Engineers, Michigan USA PP 3-46, 47-106, 106-124, 125-213, 225-306, 315-366, 367-456.
6. Fitz Patrick E.A (1986) An Introduction Soil Science PP. 1-120
7. Singer M.J. and D.N. Munns (1996) Soils – An Introduction (3rd Edition) Prentice Hall Inc. USA PP. 1-14, 19-44, 55-65, 79-90, 97-113, 300-318, 391-422, 423-443
8. Hillel D. (1998) Environmental Soil Physics Academic Press London PP. 3-26, 75-100, 101-123, 129-169, 173-199, 545-550
9. Pierzynski G.A. et al (2000) Soil and Environmental Quality (2nd Ed) CRC-Press-New York. PP. 1-19, 57- 96, 339-376

Course Unit Coverage/Scheduling Details

	Topic/sub-topics Content	Method of instruction	Tools/aids equipment	
1.	<p>Concept of soil as living complex system.</p> <ul style="list-style-type: none"> • Land and soil distinctions. • The pedosphere. • Living and dynamic nature of the pedosphere. 	1 Interactive Lecture (1CH)	Power point/Chalk.	
2.	<p>Soil Genesis (Soil formation)</p> <ul style="list-style-type: none"> ✓ Factors of soil genesis. ✓ Physical and chemical weathering 	<ul style="list-style-type: none"> • Definition and examples of parent rock(s)/materials. • Parent materials/rocks/Climate / Organisms / Topography Human Activities and Time. • Definitions and processes during chemical and physical weathering, e.g. exfoliation/frost action, biotic action, abrasion (by wind) 	<p>1 Interactive Lecture (1 CH)</p> <p>1 Interactive Lecturer (1CH)</p>	<p>Power Point/Chalk</p> <p>Power Point/Chalk + Plates or Photos.</p>
3.	Functions of soils	<ul style="list-style-type: none"> • Technical and functional definitions of soils. • Practical aspects of the functional definitions of soils e.g. Terra firma 	1 Interactive Lecture (1 CH)	Power Point/Chalk
4.	<p>Basic chemical and physical properties of soils.</p> <p>Soil Profile characteristics</p>	<ul style="list-style-type: none"> • Chemical properties e.g. PH, Clay mineralogy, laterisation processes • Physical properties e.g. <ul style="list-style-type: none"> - soil texture, - Soil structure - Soil porosity/ pore - Soil Consistence. - Soil Colour - Soil temperature - Workability • Influence on tillage/or soil utilization <ul style="list-style-type: none"> - Horizons variations - Laterisation - Plough layer • Characteristics <ul style="list-style-type: none"> - Influence on soil tillage aspects. 	<p>2 Interactive Lectures (2 CH)</p> <p>1, 3PH Practical to determine soil texture (2 CH)</p> <p>1 Interactive Lecture (1 CH)</p>	<p>Power Point/Chalk</p> <p>Power Point/Chalk</p>
5.	Soil Density	<ul style="list-style-type: none"> • Definition of soil densities; <ul style="list-style-type: none"> - Bulk density - Particle density - Determination of these, - Influence on soil tillage & management aspects. 	1CH 1, 3PH Practical on Bulk density determination (2CH)	Core Samplers Density bottles.
6.	Soil Site Characterization	<ul style="list-style-type: none"> • Definition of terms • Land and Soil distinctions, (revisited) • Basic principles of land/soil potential 	1CH 1, 3PH Practical on soil site	Soil Site characteristic Kits.

		evaluation in the field prior to laboratory testing.	characterization (2CH)	
7.	Field Water cycle and energy relationships in the SPAC (Soil Plant Atmospheric Continuum)	<ul style="list-style-type: none"> ● Definition of the hydrological cycle ● Processes and phases of soil water infiltration ● Soil water Potential ● Soil water Retention ● Soil water Release ● Available Water concepts 	1 Interactive Lecture (1CH) 1, 3PH Practical on Infiltration test (2CH) 2 Interactive Lectures (2CH)	Power Point/chalk Double Rings (4 sets)
	Basic Soil Water Management Principles and practices in the SPAC.	<ul style="list-style-type: none"> ✓ Soil water conservation principles ✓ Evapo-transpiration ✓ Soil drainage aspects - - camber beds - Tile drainage ✓ Leaching requirement ✓ Climate change aspects of soil water management ✓ Cover cropping ✓ Agro forestry 	2 Interactive Lectures (2CH)	Power Point/Chalk
8.	Continuous Assessment		Test 1 (1CH)	
9.	Soil Tillage; Principles, Practices and Management	<ul style="list-style-type: none"> ✓ Definition of land tillage; primary, secondary ✓ Soil tilth ✓ Soil compression ✓ Soil compaction ✓ Soil consolidation ✓ Variances in tillage – e.g. Zero tillage, minimum tillage, primary and secondary, special tillages. 	2 Interactive Lectures (2CH)	Power Point/Chalk
10.	Soil Tillage Management (STM)	<ul style="list-style-type: none"> ✓ Definition of the Soil Tillage Management Package (STMP) ✓ Considerations of the package namely, Soil tilth, Planting material, Soil moisture Soil Consistency, Selection of tillage equipment/tools, frequency of tillage, special operations, Terrain/topographic aspects and influence on tillage. 	2 Interactive Lectures (2CH) 1, 3PH Practical on Tillage equipments review in operations in the field (2CH)	Power Point Facilitation to the University Field Station and Namalere Agricultural Equipment testing unit.
11.	Soil Degradation; Principles and Processes	<ul style="list-style-type: none"> ✓ Definition of Soil Degradation ✓ Phases and processes during soil degradation ✓ Types of soil degradation e.g. soil erosion, compaction Siltation, land slides, mass movement, salinization, dispersion 	3 Interactive Lectures (3 CH)	Power Point/Chalk

		✓ Implications on soil tillage/utilization.		
	Qualitative & Quantitative assessment of soil degradation	<ul style="list-style-type: none"> ✓ Field evaluations e.g. visual observation of erosional features e.g. pedestals, rills, gulleys, penetrometer tests ✓ Laboratory /chemical assessments ✓ Use of bulk density evaluations and Infiltration rate tests in soil degradation evaluations. ✓ Runoff plots /Pegs method. (briefly) 	2 Interactive lectures (2CH) 1,3PH Practical on field Assessment of soil degradation (2CH)	Power point/ Use of plates and photos relevant to soil degradation.
12.	Soil Conservation; Principles and Practices.	<ul style="list-style-type: none"> ✓ Definition of Soil Conservation ✓ Preservation and Conservation contrasted ✓ Mitigation Principles as regards soil conservation practices. 	3 Interactive Lectures (3 CH)	Power point/chalk
	Prevention/Remedial measures.	<ul style="list-style-type: none"> ✓ Bunding ✓ Grass strips ✓ Stone lines ✓ Terracing/basins ✓ Cover cropping ✓ Agro Forestry ✓ Crop rotation ✓ Hydro mulch ✓ Use of Gabions ✓ Cut-off drains 	1, 3PH Field Excursion to a selected areas with soil conservation structures (2CH)	Transport facilitation to the soil conservation sites.
	Remedial	<ul style="list-style-type: none"> ✓ Leaching ✓ Sub Soiling ✓ Wind breaks ✓ Tillage aspects (revisited) 		
13.	Continuous Assessment Test 2 (1CH)			

SUMMARY OF COURSE COVERAGES

Theory		
✓ Interactive Lectures	(29 HRS)	29 CH
✓ Field-Based Practicals	(4x 3HRS)	8 CH
✓ Field Excursions	(1x 3HRS)	2 CH
✓ Laboratory Practicals	(2x 3HRS)	4 CH
✓ Continuous Assessment Tests	(2 x 1HR)	2 CH
Total CH		45 CH
Evaluation Allocations (Weighted %s)		
✓ Continuous Assessment Tests (2) CATs		20%
✓ Practicals (Field + Laboratory)		20%
✓ Final Examination		60%
Overall Total		100%

SUMMARY OF COURSE COVERAGES

Evaluation allocations (Weighted % s)

Overall Total = 100%