**SOS 1207 SOIL BIOLOGY I**

**COURSE INSTRUCTORS:** Dr. John Baptist Tumuhairwe (BSc. Agric, M.Sc, PhD) Fulltime staff

Mr. Charles Nkwiine (BSc. Agric, M.Sc, PhD Student) Full time staff

**Credit Units: 2 CU**

**Course Duration**: 30 contact hours (15 LH and 30 PH).

**Course type: Core course for B.Sc Agric I and B.Sc LUM I**

**COURSE DESCRIPTION**

**Biology I (2 CU)**

In this course students will cover the definition of soil biology and its relevance of other disciplines and its importance in sustainable agriculture and environment. Emphasis in this course will on soil organisms. Soil as a habitat for soil organisms. Diversity of soil organisms and their interactions. Socio-economic benefits of soil organisms. Classification of soil organisms. Methods, types and taxonomy. Methods, techniques and advances of studying soil macroorganisms. Trophic groups of soil macro organisms and their interactions. Ecology of soil macro flora and fauna. Activities and roles of soil macroorganisms and their effects of ecosystem functions. Copping strategies for soil organisms against biotic and abiotic stress. Effects of management practices on soil macroorganisms. Conservation and management of the soil macro organisms.

Overall object

The **overall objective** is enable students acquire knowledge on the living component of soil and its relevance to agricultural production and it is a foundation course for further studies in soil organisms.

Specific object

1. Students will acquire knowledge and skill on how to identify various soil organisms
2. The course will provide student knowledge about the living component of soil, its significance in soil ecosystem and relevance to soil productivity and environmental integrity.

**COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Topics** | **Content** | **Method of instruction** | **Duration (hours)** | **Tools/equipment needed** |
| Topic 1  Introduction | **-** Definitions soil biology,  -Relevance to other disciplines: Soil Science, Biology, Biochemistry, Ecology, Sustainable Agriculture and Environment (in line with current national and international relevant conventions/ treaties). | Interactive lectures | 1 | - LCD projector, chalk and blackboard, duster |
| Topic 2  Types of soil organisms | **-** Major soil organisms : Classification-size (micro- meso- and macro-organisms), function groups(ecosystem engineers, decomposers, symbionts, phytopathogens | Interactive Lecture  Explorative field practical, sample for macrofauna, observe their activities, assess impact on soil & plants from 2 distinct land use systems | 1  3 | - LCD projector, chalk and blackboard.  Transport for field scouting  Transport for taking students and instructors  Tools- hoes, shovels, magnifying lenses, trays/ basins. Printing paper & photocopying services |
| Topic 3  Taxonomy of soil organisms | * Trends in taxonomy and nomenclature of soil organisms- Linneaus, Whithaker, Woese, Cavelier Smith and molecular technique. Major taxonomic: Orders, Families, Genera and species of different groups. * Trophic groups: heterotrophs, autotrophs,chemolithotrophs, chemorganotrophs. Photolithitrophs and photo-organotrophs. | Lecture  Lecture | 1  1 | - LCD projector, chalk and blackboard. |
| Topic 4  Distribution of soil organisms | - Soil as a habitat for flora  and fauna.  -Occurrence of soil organisms in relation to soil factors (depth, moisture, aeration, pH, temperatures, salinity, nutrients, and availability of carbon, energy and electron sources, and pollutants.  -Geographical influence: regional distribution, climatic and soil types effects  - Influence of soil/land management practices on soil organisms.  **-** Rhizophere ( unique niche)  - Copping strategies of soil organisms | Interactive lectures  Lab practical (demonstrate pH and temperature influence on microbial growth)  Interactive lectures | 2  1.5  2 | - LCD projector chalk and blackboard  **-** Nutrient agar, incubators preferably with thermal controls, rotary shakers, 250ml volumetric preferably with side arms, spectrophoto-meter. Printing paper and photocopying services  - LCD projector chalk and blackboard,  duster. |
| Topic 5  Field and laboratory techniques for studying soil organisms | - Direct and indirect methods for studying soil organisms | Interactive lectures  Practical 1-  Sampling macroorganisms by monoliths  technique.  Practical 2- comparison between soil under rhizophere effect and non-rhizophere soil- by dilution plate technique. | 2  1.5  1.5 | -LCD projector, chalk and blackboard,  duster.  - Monolith and 5kg iron hammer, hardwood pieces , 95%ethanol alcohol, sample bottles, trays/ basins .  - Growth rooms, incubator with thermostat mechanism  petri-dishes, colony counters,  soil samples and seeds and  autoclave. Printing paper & photocopying services |
| **Test** | On above 5 topics | Two written tests | 2 | Answer sheets |
| Topic 6  Growth media | -Types of media: solid/agar and broth; defined; enriched; selective; differential; anaerobic and reduced.  - Media preparations: proportions/ constitution, sterilization and preservation/storage. | Interactive lecture  Laboratory practical – Differentiate gram positive and gram negative bacteria by eosin methylene blue (EMB) - examine specimens under microscopes | 2  1.5 | - LCD projector, chalk and blackboard  Petri dishes, Media, eosin Methylene blue (EMB), distilled water, autoclave, refrigerators, Light microscopes, least a fluorescent microscope, slides and stains. Printing paper & photocopying services |
| Topic 7  Microbial growth | - Reproduction and multiplication, incubation, growth phases: (Lag, log, stationary and decline) and concept of generation time. | Interactive Lectures | 1 | - LCD projector, chalk and blackboard |
| Topic 8  Enumeration & identification techniques | -Staining procedures: Why stain? Types of stains and their importance; Gram, acid fast, Fluorescein diacetate( FDA),  -Molecular and serological techniques | Interactive lecture | 1 | - LCD projector, chalk and blackboard  Gram stain, acid-fast, Fluorescein diacetate , Microscopes, Slides and Specimens. |
| Topic 9  Interactions of soil organisms | Predation, symbiosis, Neutralism, competition, synergism, inhibition, and stimulation. | Interactive lectures | 1 | - LCD projector, chalk and blackboard |
| Topic 10  Effects of soil organisms to higher plants and animals | Beneficial attributes: organic matter decomposition, inorganic transformation, nutrient cycling, soil structure modification and bio-control.  Harmful attributes: injury to plants and animals, soil –borne pathogens and pests. | Interactive lectures | 1 | - LCD projector, chalk and blackboard |

**RECOMMENDED REFERENCES FOR READING**

1. Gobat J. m., Aragno, M., Matthey, W. and Sarma V.,A.,K. 2004. The Living Soil. Fundamentals of Soil Science and Soil Biology. Science Publisher, Inc. Plymouth, UK.
2. Moreira, F.M.S., Huising, F. J. and Bignell, D. E. 2008. A handbook of Tropical Soil Biology. Sampling & Characterisation of Below –ground Biodiversity. Earthscan, UK and USA.
3. Paul E. A. and F. E. Clark 1996 ( Eds.) Soil Microbiology and Biochemistry Second. Edition. Academic Press.
4. Hatifield J. L. and B.A.. Stewart 1994 (Eds.) Soil Biology : Effects On Soil Quality. Lewis Publishers.
5. Bardgett, R. D. 2005. The Biology of Soil. OxfordUniversity Press, Oxford.

**SUMMARY OF TIME NEEDED**

Interactive lectures covering theory 15 hrs

Field and laboratory practicals 15 hrs

Test 02 hrs

**OVERALL COURSE EVALUATION**

Continuous Assessment Test 20%

Practical reports 20%

Final examination 60%