

J.S. University, Shikohabad

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VALUE ADDED COURSE

Soil Microbiology and Biochemistry:
Understanding Soil Organisms and their
Functions

Faculty of Agricultural Sciences



J.S. University, Shikohabad
Faculty of Agricultural Sciences

Value Added Course

AGVAC-27

Soil Microbiology and Biochemistry: **Understanding Soil Organisms and their** **Functions**


Learning Objectives:

This value-added course on Soil Microbiology and Biochemistry is designed to provide participants with a comprehensive understanding of the diverse and dynamic world of soil organisms and their functions in soil ecosystems. Participants will learn about the role of microorganisms in soil fertility, nutrient cycling, organic matter decomposition, and plant-microbe interactions. The course will also cover the biochemistry of soil processes, including enzyme activities, metabolic pathways, and interactions between soil organisms and their environment. Practical applications of soil microbiology and biochemistry for sustainable agriculture will be emphasized throughout the course.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the diversity, abundance, and ecological roles of soil microorganisms and their functions in soil ecosystems.
2. Describe the processes of nutrient cycling and the interactions between microorganisms and plants in soil.
3. Analyze the biochemistry of soil processes, including enzyme activities, metabolic pathways, and their influence on soil health.
4. Apply the knowledge of soil microbiology and biochemistry in practical applications for sustainable agriculture, such as composting, biofertilizers, and biopesticides.
5. Implement strategies to enhance soil microbiome and promote beneficial microbial activities in agricultural systems.

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Duration: 8-10 weeks (depending on the pace of the student)

Intake: 60 students

Course Modules (Syllabus):

Module-1

Introduction to Soil Microbiology

- Overview of soil microorganisms: bacteria, fungi, protozoa, nematodes, and other microorganisms
- Microbial diversity in soil: abundance, distribution, and ecological roles
- Techniques for studying soil microorganisms: culture-dependent and culture-independent methods

Module-2

Soil Organisms and Nutrient Cycling

- Role of microorganisms in nutrient cycling: nitrogen, phosphorus, sulfur, and other essential elements
- Microbial processes in nutrient transformations: nitrogen fixation, nitrification, denitrification, and mineralization
- Plant-microbe interactions: mycorrhizae, rhizobia, and other symbiotic associations

Module-3


Soil Biochemistry and Enzyme Activities

- Biochemical processes in soils: decomposition, humification, and mineralization
- Enzyme activities as indicators of soil health and fertility
- Factors influencing enzyme activities in soil: temperature, moisture, pH, and substrate available

Module-4

Organic Matter Decomposition and Soil Health

- Decomposition of organic matter by microorganisms: microbial biomass, extracellular enzymes, and metabolic pathways

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- Influence of organic matter on soil properties: structure, fertility, water holding capacity, and nutrient availability
- Role of microorganisms in enhancing soil health and resilience

Module-5

Applied Soil Microbiology and Biochemistry

- Practical applications of soil microbiology and biochemistry for sustainable agriculture: composting, biofertilizers, and biopesticides
- Management of soil-borne diseases and pests using microbial agents
- Strategies for enhancing soil microbiome and promoting beneficial microbial activities in agricultural systems

Assessment:

- Weekly quizzes and assignments
- Final project on designing and implementing a soil microbiology plan.

Reference books:-

1. "Soil Microbiology, Ecology, and Biochemistry" by Eldor A. Paul
2. "Soil Microorganisms and Plant Growth" by N.K. Pareek
3. "Soil Biochemistry" by Kamala V. Krishnaswamy

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