



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Science College
Semester-5 (B.Sc.)

Subject: Agriculture and Marine Microbiology-BSCMB15318

Type of course: Minor

Prerequisite: Basic knowledge of Agriculture, general biology, and ideally, some familiarity with ecology and chemistry.

Rationale: Agricultural and Marine Microbiology explores the diverse roles of microbes in these vital ecosystems, impacting nutrient cycles, plant/animal health, and global biogeochemical processes.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	SEE		CCE			
				Theory	Practical	MSE	LWA/V	ALA	
3	0	2	4	75	25	30	20	50	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

3 Credits * 25 Marks = 75 Marks (each credit carries 25 Marks) Theory

1 Credits * 25 Marks = 25 Marks (each credit carries 25 Marks) Practical

SEE 100 Marks will be converted in to 50 Marks

CCE 100 Marks will be converted in to 50 Marks

It is compulsory to pass in each individual component.



Course Content:

Unit No	Course content	Hrs	% Weightage
1	Chapter: - 1 Agricultural Microbiology – Soil and Rhizosphere Microbiology <ul style="list-style-type: none"> • Introduction to Agricultural Microbiology <ul style="list-style-type: none"> o Historical developments and scope • Soil Microbial Diversity <ul style="list-style-type: none"> o Types of microorganisms in soil: bacteria, fungi, actinomycetes, protozoa o Factors affecting soil microbial populations • Soil-Plant-Microbe Interactions <ul style="list-style-type: none"> o Rhizosphere and phyllosphere microorganisms o Mycorrhizae (Ectomycorrhiza and Endomycorrhiza) o Plant growth-promoting rhizobacteria (PGPR) • Biogeochemical Cycles <ul style="list-style-type: none"> o Role of microbes in nitrogen, phosphorus, sulfur, and carbon cycles 	15	25
2	Chapter: - 2 Agricultural Microbiology – Biofertilizers and Biocontrol <ul style="list-style-type: none"> • Biofertilizers <ul style="list-style-type: none"> o Types: Nitrogen-fixers (Rhizobium, Azotobacter, Azospirillum, Frankia), phosphate-solubilizing microorganisms (PSM), cyanobacteria o Production, formulation, and application methods • Biological Nitrogen Fixation <ul style="list-style-type: none"> o Symbiotic and non-symbiotic nitrogen fixation o Mechanism and regulation of nitrogenase enzyme • Biopesticides and Biocontrol Agents <ul style="list-style-type: none"> o Microbial control of plant pathogens and pests o Examples: Bacillus thuringiensis, Trichoderma, Pseudomonas fluorescens • Genetically Modified Microorganisms (GMOs) in Agriculture <ul style="list-style-type: none"> o Role in crop protection and nutrient enhancement 	10	25



3	Microbes to the Rescue: Protecting Our Farms Students (in group of five) must design bioremediation strategies, choose biocontrol agents, and diagnose plant diseases prepare report and upload the report on GMIU web portal.	10
4	Ocean's Hidden Kingdoms: Exploring Marine Microbe Students (in group of five) have to identify Diversity of microbes presented, accuracy of ecological role descriptions, and thorough explanation of the microbial interaction scenario, prepare characteristic table upload it to GMIU web Portal.	10
5	Attendance	10
Total		50

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	40%	20%	10%	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the importance of microorganisms in agriculture with their distribution and interaction with plants.
CO2	Apply microorganisms in Biofertilizers, biopesticides and biocontrol agents
CO3	Diversify marine microorganisms, their ecological roles in nutrient cycling and interactions, and the adaptations of extremophiles to harsh marine environments.
CO4	Apply marine microbiology for aquaculture health and exploring the marine microbiome in a changing climate.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1	Set up a microcosm experiment to assess the bioremediation potential of a microbial consortium for a specific pollutant (e.g., pesticide, heavy metal) in soil. Measure pollutant levels over time.	1	2
2	Prepare a simple biofertilizer using a carrier material and a nitrogen-fixing bacterium	2	2
3	Collect and process marine water samples for microbiological analysis.	2	4
4	Observe diverse marine microorganisms (bacteria, phytoplankton, zooplankton) using microscopy.	3	2
5	Demonstrate the process of collecting soil samples from different depths to create a soil profile.	3	4
6	Isolate and identify phosphate-solubilizing microorganisms from a soil sample using a selective medium.	4	4
7	Isolate and characterize plant growth-promoting rhizobacteria (PGPR) from the rhizosphere of a specific plant.	4	4
8	Isolate and identify potential biocontrol agents (e.g., bacteria, fungi) from soil or plant samples.	4	4
9	Monitor the microbial changes during composting of organic waste by analyzing temperature, pH, and microbial populations.	4	4
10	Diagnose common plant diseases based on observed symptoms and identify the causal microbial agent	4	2
Total			32

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.



3	Chapter: - 3 Marine Microbiology – Marine Microbial Ecology and Biodiversity <ul style="list-style-type: none"> • Introduction to Marine Microbiology <ul style="list-style-type: none"> o Marine habitats: estuaries, deep sea, hydrothermal vents, coral reefs • Types of Marine Microorganisms <ul style="list-style-type: none"> o Marine bacteria, archaea, fungi, viruses, microalgae • Marine Microbial Ecology <ul style="list-style-type: none"> o Role in nutrient cycling (carbon, nitrogen, sulfur) o Interactions with marine flora and fauna • Extremophiles and Adaptations <ul style="list-style-type: none"> o Psychrophiles, halophiles, barophiles: adaptations to extreme marine conditions 	10	25
4	Chapter: - 4 Marine Microbiology – Applications and Recent Advances <ul style="list-style-type: none"> • Marine Biotechnology <ul style="list-style-type: none"> o Bioactive compounds from marine microbes (antibiotics, enzymes, pigments) o Marine-derived pharmaceuticals and nutraceuticals • Bioremediation in Marine Environments <ul style="list-style-type: none"> o Oil spill degradation, heavy metal detoxification o Role of marine microbes in pollution control • Aquaculture and Marine Microbial Health <ul style="list-style-type: none"> o Probiotics and disease management in aquaculture • Current Trends and Research <ul style="list-style-type: none"> o Metagenomics and marine microbiome studies o Climate change impact on marine microbial ecology 	10	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	Biogeochemical Cycle Architects Faculty will provide problem statement; Students (in group of five) need to identify type of cycle and draw the diagram of Biogeochemical Cycle Architects. Student will upload the photo on to the GMIU web Portal.	10
2	The Microbe-Powered Farm Faculty will provide different types of soil to the students (in group of five) have to find out Diversity of microbes listed, relevance to the assigned soil type, and clarity of explanations, prepare chart of microorganisms and upload it to GMIU web portal	10



Reference Books:

- [1] PRINZIPIEN DER BIOCHEMIETextbook by Albert L. Lehninger, David L. Nelson, and Michael M. Cox
- [2] Prescott L, Harley J P, and Klein D A, (2008). Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.
- [3] Agricultural Microbiology" by D. K. Arora
- [4] "Agricultural Microbiology" by Henry J. du Bruyn and James W. Lorch
- [5] "Soil Microbiology and Sustainable Crop Production" by D. K. Arora
- [6] "Marine Microbiology" by D. K. Arora
- [7] "Microbial Ecology of the Oceans" by David Kirchman

