



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Science College
Semester-3 (B.Sc.)

Subject: Microbial Ecology of Soil and Water - BSCMB13306

Type of course: Major

Prerequisite: Student must have comprehensive understanding of soil and water microbiology

Rationale: It helps in understanding of organisms present in soil and techniques and method used in water microbiology.

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; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voice; CCE-Continuous and Comprehensive Evaluation; 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 Microbial population associated with soil and plants <ul style="list-style-type: none"> • Types of soil and pedogenesis. • Physicochemical characteristics of soil. • Types of microorganisms in soil. • Methods of studying soil microflora: Direct microscopic method, agar plate technique, Enrichment culture technique & buried slide method. • Construction and significance of Winogradsky column. • Microbial interactions in soil- Positive and negative associations. • Microbe-microbe interaction (Lichen), microbe-plant (Mycorrhiza) and microbe-animal interaction. 	15	25%
2	Chapter:2 Microbial activities in soil <ul style="list-style-type: none"> • Cyclic changes of elements – I: Carbon, Hydrogen and Oxygen. • Cyclic changes of elements – II: Phosphorus, Sulfur and Iron. • Nitrogen cycle: Nitrogen fixation (symbiotic & asymbiotic), ammonification, nitrification, • ammonification, nitrification, denitrification. 	10	25%
3	Chapter:3 Drinking Water Microbiology <ul style="list-style-type: none"> • Types of water and sources of contamination. • Microbial indicators of fecal pollution <ul style="list-style-type: none"> ○ Methods of differentiation: IMViC ○ Microbial indicators other than coliforms. • Water borne diseases: <ul style="list-style-type: none"> ○ Bacterial: Cholera, Gastroenteritis ○ Protozoal: Amoebic dysentery, Giardiasis ○ Viral: Hepatitis, Stomach flu • Bacteriological examination of drinking water: <ul style="list-style-type: none"> ○ Sampling. ○ Quantitative analysis (SPC). ○ Qualitative analysis: Detection of fecal contaminants (Presumptive, confirmed & completed test), membrane filter technique. • Purification of drinking water: Sedimentation, filtration & disinfection. 	10	25%

4	Chapter:4 Waste water Microbiology <ul style="list-style-type: none"> • Types of waste water. • BOD, COD & TOD as indicators of strength of waste water. • Methods of waste water treatment <ul style="list-style-type: none"> ○ Primary & secondary treatments: Principles & role of microorganisms in septic tank, in-hoff tank, trickling filters, activated sludge process, oxidation ponds & anaerobic sludge digestion. 	10	25%
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Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	Listing out organisms Students have to list out specific soil organisms involved in specific activity of soil and upload it on GMIU web portal.	10
2	Economic Application of any one soil organisms Students have to mention economic application of any 2 soil organisms and upload it on GMIU web portal.	10
3	Soil Activity Students have to observe mutualism and capture photo using leguminous plants and upload it on GMIU web portal.	10
4	Waste water treatment Students will have to set a waste water treatment model and upload a photo on GMIU web portal.	10
5	Attendance	10
Total		50



Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	40%	30%	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	Apply the principles and methods of strain enhancement, separation, and screening.
CO2	Understand the cyclic changes in environment.
CO3	Analyze the water quality and its causes.
CO4	Elucidate the treatment for waste water.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1	To study of microbial Diversity in soil by using Winogradsky Column.	1	2
2	Enumeration of organisms from soil(SPC from soil)	1	2
3	Direct observation of soil flora by buried slide method.	1	2
4	Isolation of <i>Rhizobium</i> sp. from root nodules.	1	2
5	Isolation of <i>Azetobacter</i> sp. from soil.	1	2



6	Isolation of actinomycetes from soil.	1	2
7	Microbiological analysis of drinking water (SPC).	1	2
8	Detection of fecal pollution of water by performing presumptive test: MPN method.	3	4
9	Detection of fecal pollution of water by performing confirmed test using EMB agar.	3	4
10	Detection of fecal pollution of water by performing completed test by IMViC tests.	3	4
11	Differentiation between typical and atypical coliforms by Eijkman's test.	3	4
12	To determine potability ratio of drinking water.	3	2
13	To determine Dissolved Oxygen of water sample.	4	2
Total			34

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.



Reference Books:

- [1] Microbiology: Pelczar MJ, Chan ECS and Kreig NR, Tata Mc Grow Hill.
- [2] General Microbiology: Stanier RY, Adelberg EA and Ingraham JL, Mac Millan Press Inc.
- [3] General Microbiology Vol I & II: Powar & Daginawala, Himalaya Publishing House.
- [4] Introduction to Microbiology: Ingraham JL and Ingraham CA, Thomson Brooks/Cole.
- [5] Principles of Microbiology: Atlas RM, Wm C brown Publishers.
- [6] Brock's biology of Microorganisms Madigan MT and Martinko JM, Pearson Education Inc.
- [7] Microbiology: An introduction: Tortora GJ, Funke BR and Case CL, Pearson Education Inc.
- [8] Elementary Microbiology: Modi HA, volume- I & II.
- [9] General Microbiology: Dubey RC.
- [10] Practical Microbiology: Patel RJ, Aditya Publications.
- [11] Practical Microbiology: Dubey RC and Maheshwari DK, S Chand Publication.

