GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 7
Subject Name: Marine Microbiology
Subject Code: 1370414

Prerequisite:
Basic knowledge of microbiology, molecular biology, and marine science is required. Understanding microbial structure, function, and ecological roles will help students explore marine microbial diversity, biogeochemical cycles, and biotechnological applications in marine environments.

Rationale:
Marine Microbiology focuses on microbial diversity, ecology, and their roles in oceanic processes. It equips students with skills to analyze marine microbes, their industrial and environmental applications, and their significance in climate regulation, biotechnology, and bioremediation for sustainable marine resource management.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
4	0	0	4	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	Ecology of coastal, shallow and deep sea microorganism - importance and their significance. Diversity of microorganism - Archaea, bacteria, cyanobacteria, algae, fungi, viruses and actinomycetes in the mangroves and coral environs.	12	20
2	Importance of taxonomy conventional and modern methods. General microbial techniques. Unculturable forms. 16S rRNA genomic similarity - content of guanine (G) + cytosine (C) (%GC)., DNA-DNA homology, Fatty acid analysis and genomic sequencing using Microbial identification system (GCFAME), DNA hybridization, polyphasic taxonomy.	12	20
3	Nutrient cycles- Role of microorganisms in carbon, nitrogen, phosphorous and sulphur cycles in the sea under different environments including mangroves.	12	20
4	Food Microbiology- pathogenic microorganisms, distribution, indicator organisms prevention and control of water pollution, quality standards, International and National standards. Microbiology of processed finfish and shellfish products. Microbial diseases diagnosis and control.	12	20

5	Microbial biodegradation - natural and synthetic material in the marine environment pesticide, cellulose degradation, hydrocarbon production. Bioremediation of xenobiotic oil, heavy metals, pesticides, plastics, etc. Mining and metal biotechnology.	12	20
	Total Hours:	60	100

Textbook:

1. Austin. B, and D.A Austin 1999. Bacterial Fish pathogens- Diseases of Farmed and Wild Fish. Springer Publisher.
2. John Paul 1999. Marine Microbiology, Elsevier.
3. Munn and Munn 1996. Marine Microbiology: Ecology and Applications. BIOS Scientific publisher.
4. Atlas, R.M 1988. Microbiology, Fundamentals and applications Maxwell McMillan International Editions

Reference Books:

1. Rheinheimer, G., 1980 Aquatic Microbiology-an Ecological Approach. Blackwell Scientific Publications
2. Kirchman, L Microbial Ecology of the Oceans 2000 John Wiley and Sons. Hans G. Truper et. al 1991.
3. The Prokaryotes: 1992 A Handbook on the biology of Bacteria. Vol. 1-4 Springer & Verlag New York

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	Describe the diversity, classification, and ecological roles of marine microorganisms.	RM, UN
2	Explain the significance of marine microbes in biogeochemical cycles and oceanic food webs.	UN, AP
3	Analyze microbial interactions in marine environments and their impact on ecosystem stability.	AN, EL
4	Evaluate the applications of marine microorganisms in biotechnology, bioremediation, and pharmaceutical industries.	EL, CR
5	Apply microbiological techniques to study, isolate, and characterize marine microbes for industrial and research applications.	AP, CR

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

1. Preparation of bacterial media- culture- nutrient broth, agar medium, agar slants.
2. Methods of sample collection form marine environments; estimation of bacterial, fungal and actinomycte population.
3. Isolation of pathogenic organisms from seafood water and sediment..
4. Identification of unknown bacteria- separation of mixed cultures.
5. Isolation, maintenance and preservation of pure cultures
6. Characterization- biochemical tests-. staining of bacteria, cell morphology.

List of Laboratory/Learning Resources Required:

1. Equipment & Instruments
   - Autoclave for media and sample sterilization
   - Laminar airflow chamber for aseptic work
   - Incubators for microbial culture growth
   - Colony counter for microbial enumeration
   - Microscopes (light and phase contrast) for bacterial and fungal identification
   - Refrigerators and deep freezers for microbial culture storage
   - Spectrophotometer for bacterial growth analysis
   - Bunsen burners and inoculation loops for aseptic transfer
2. Glassware & Consumables
   - Petri dishes, test tubes, culture flasks
   - Micropipettes and sterile pipette tips
   - Glass slides and coverslips for staining
   - Cotton swabs and filter papers
   - Sterile sample collection bottles
3. Media & Reagents
   - Nutrient agar, Mueller-Hinton agar, MacConkey agar, Sabouraud dextrose agar
   - Selective media: TCBS, XLD, EMB, and Mannitol Salt Agar
   - Biochemical test reagents (catalase, oxidase, IMViC, urease, carbohydrate fermentation media)
   - Gram stain kit, endospore stain, capsule stain reagents
   - Glycerol and cryoprotectants for culture preservation
4. Field & Laboratory Facilities
   - Marine/coastal field stations for sample collection
   - Dedicated microbiology laboratory with biosafety protocols
5. Reference Manuals & Learning Resources
   - Bergey's Manual of Systematic Bacteriology
   - Benson's Microbiological Applications: Laboratory Manual
   - Prescott's Microbiology
   - APHA Standard Methods for Water and Wastewater Examination
   - Microbiological Methods for the Examination of Foods (ICMSF)
   - Manual of Environmental Microbiology (ASM)

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