JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2025

M. Tech. -Ist Semester (BT)

COURSE CODE (CREDITS): 18M1WBT134 (3) MAX. MARKS: 35

COURSE NAME: MICROBIAL ECOLOGY

COURSE INSTRUCTORS: AKN MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	Marks
	Section I	
Q1	Why is DNase treatment often required before RT-PCR? What type of nucleic acid serves as the starting template for RT-PCR?	0.5+0.5= (1)
	b) Which enzyme's inhibition forms the basis of certain SO_2-detecting biosensors? Name one limitation of enzyme-based SO_2 biosensors in polluted air environments.	0.5+0.5= (1)
	What is the main purpose of FISH in microbial ecology? What cellular component is typically targeted by FISH probes in bacteria?	0.5+0.5= (1)
	Name one algal group commonly used in water quality assessment. What does excessive algal bloom formation indicate about water quality?	0.5+0.5= (1)
	Why estuaries are considered highly productive ecosystems? Name a common marine bioindicator species.	0.5+0.5= (1)
	Section II	
Q 2	How does pyrosequencing enable quantitative analysis of mixed microbial communities? Discuss one major advantage and one limitation of pyrosequencing compared to Sanger sequencing.	3
Q 3	Contrast the electron-transfer mechanisms in *Acidithiobacillus ferrooxidans* during sulfide ore bioleaching with those in archaea-based high-temperature bioleaching systems. What governs efficiency of bioleaching? Explain diagrammatically.	3
Q 4	Why does the turbidometric method only reliably estimate cell number	3

	during mid-log phase but not in stationary or lag phase? Why does a hemocytometer may overestimate or underestimate true microbial density. Discuss at least two sources of error.	
Q 5	Describe the principle behind using lux-reporter gene–based biosensors for detecting aromatic hydrocarbons. What makes them highly specific?	3
Q 6	Analyze how soil microbial diversity influences carbon sequestration in forest and grassland ecosystems. Explain the role of mycorrhizal fungi in plant adaptation to nutrient-poor soils and drought conditions.	3
	Section III	
Q 7	Critically analyze the different stages of a microbial biofilm formation in relation to microbial colonization and various signal molecules produced by Gram positive and Gram negative bacteria. How do the interspecies interactions, quorum sensing, and extracellular polymeric substances regulate the process of biofilm formation?	5
Q 8	Analyze how abiotic stressors (temperature, pH, salinity, pollutants) or biotic stressors (pathogens, invasive species) affect microbial succession, colonization, and interspecies interactions. Provide examples of adaptive strategies microbes use to deal with stress while maintaining community functionality.	5
Q 9	Draw a schematic diagram showing how various bioindicators can be used to monitor air quality in the forest or grassland and water quality in rivers or pond ecosystem. Include indicator species, pollutants detected, and potential ecosystem impacts.	5
	Total	**35**