JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2025

MSc (Micro) - Semester III

COURSE CODE (CREDITS): 24MS1MB311 (3-0-0) MAX. MARKS: 35

COURSE NAME: Microbial Genetics and Physiology

COURSE INSTRUCTORS: Dr Ashok Nadda /Dr Tyson MAX. TIME: 2 Hours

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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
Q1	Temperate bacteriophages make a developmental decision between immediate viral replication and integration into the host genome. Discuss the regulatory roles of key proteins controlling the lytic–lysogenic switch.	4
Q2	DNA from a Bacillus strain with genotype trp^+ tyr^+ is used to transform a recipient strain with genotype trp^- tyr^-. The following numbers of transformants are obtained: $trp^+ tyr^-$: 154 $trp^- tyr^+$: 312 $trp^+ tyr^+$: 354 What will be the co-transformation frequency of the trp and tyr genes? Explain how co-transformation frequency reflects physical proximity of genes.	3
Q3	The trp operon in bacteria ensures efficient control of tryptophan biosynthesis at the transcriptional and translational levels. a) Explain how the trp repressor regulates transcription in response to tryptophan levels. b) Describe how attenuation fine-tunes gene expression under moderate tryptophan conditions.	3+3
Q4	Bacterial plasmids show wide diversity in structure and function, and some play specialized roles in host–microbe interactions. a) What are the general features of different bacterial plasmids and write in detailed about the significance and functioning of the Ti plasmid. b) Explain the major plasmid replication strategies, for plasmid maintenance?	3+3
Q5	Consider a large-scale fermentation where maintenance energy becomes substantial due to long culture times. How can the Pirt model guide strategies like fed-batch feeding, temperature reduction, or oxygen modulation?	4

Q6	Monod kinetics assumes that substrate is the sole limiting factor. How would Monod predictions deviate from actual growth curves when cells experience oxidative stress, pH shock, or membrane damage even when substrate concentrations are non-limiting?	4
Q7	Psychrophilic enzymes are highly flexible than thermolabile. Discuss why flexibility is more important than stability for catalysis at low temperatures	4
Q8	How do ATP, NADH/NAD^+ ratios, and phosphoenolpyruvate (PEP) levels change during the transition between carbon sources, and how do these shifts influence gene regulation and growth rate?	4