Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Microbial Genetics **Semester : VI**

Program: Int. BSc.MSc. Microbiology **Duration : 3 hours**

Course Code: HSMB 3017 **Max. Marks: 100**

Instructions:

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	Cos
Q 1	Generalized transduction only transfers: a) Random DNA b) Phage DNA c) Adjacent host genes d) Entire chromosome	**1.5**	**CO2**
Q 2	Identify which gene controls competence in *B. subtilis*. a) com b) lexA c) comp d) araC	**1.5**	**CO2**
Q 3	Identify filamentous phage from the following. a) T4 b) T7 c) M13 d) Lambda	**1.5**	**CO2**
Q 4	Recall, which of these is a chemical mutagen. a) UV radiation b) X-rays c) EMS d) Heat	**1.5**	**CO1**
Q 5	Transduction requires: a) Pilus b) Bacteriophage c) Plasmid d) Sigma factor	**1.5**	**CO1**
Q 6	Two-factor crosses in phages are used to: a) Determine operons b) Create lysogens c) Map genes d) Observe transformation	**1.5**	**CO1**
Q 7	The main function of antitermination in T4 phage is:	**1.5**	**CO2**

	a) Prevent replication b) Promote recombination c) Continue transcription d) Halt translation		
Q 8	Pick the correct answer. Which of the following follows a lytic life cycle? a) Lambda phage b) T4 phage c) P2 phage d) P4 phage	**1.5**	**CO2**
Q 9	OriT refers to: a) Operator site b) Origin of transcription c) Origin of transfer d) Outer region	**1.5**	**CO2**
Q 10	Recombination tests help identify: a) Gene expression levels b) Regulatory proteins c) Genetic linkage d) DNA replication errors	**1.5**	**CO1**
Q11	Spot, which mutation type is caused by tautomeric shifts. a) Frameshift b) Transition c) Deletion d) Insertion	**1.5**	**CO2**
Q12	Identify, which organism is naturally competent. a) *E. coli* b) *B. subtilis* c) *Salmonella typhi* d) *Mycobacterium leprae*	**1.5**	**CO2**
Q13	The lac operon is regulated by: a) Only lactose b) Only glucose c) Both positive and negative mechanisms d) Phage integration	**1.5**	**CO2**
Q14	Plasmid integration into the chromosome forms: a) Hfr strain b) F− cell c) Prime factor d) Transposon	**1.5**	**CO2**
Q15	The ‘jumping genes’ discovered by Barbara McClintock are known as: a) Operons b) Episomes c) Transposons d) Plasmids	**1.5**	**CO1**
Q16	Marker rescue is a technique used for: a) Mutant enrichment	**1.5**	**CO1**

	b) Gene mapping c) Cloning based on functional restoration d) Complementation testing		
Q17	Suppressor mutations are classified as: a) Reversions b) Intragenic or intergenic c) Dominant d) Recessive only	**1.5**	**CO1**
Q18	T4 phage performs: a) Generalized transduction b) Specialized transduction c) Transformation d) Lysis only	**1.5**	**CO1**
Q19	Identify, which method allows mapping of bacterial genes based on time of entry during conjugation. a) Transformation b) Generalized transduction c) Hfr conjugation d) Site-specific recombination	**1.5**	**CO1**
Q20	Spot which system is an example of site-specific recombination commonly used in genetic engineering. a) lac operon b) T4 phage lytic system c) loxP-Cre system d) SOS repair system	**1.5**	**CO2**
Section B (4Qx5M=20 Marks)			
Q 1	Explain the role of base analogues in mutagenesis with example of one agent.	**5**	**CO2**
Q 2	Distinguish between base excision repair and mismatch repair.	**5**	**CO1**
Q 3	Differentiate between positive and negative selection of mutants in microbial genetics.	**5**	**CO2**
Q 4	In case of lac operon the levels of structural proteins differs in ratio of 1:0.5:2 as you move from beginning to end of operon. Reason why.	**5**	**CO1**
Section C (2Qx15M=30 Marks)			
Q 1	Experiments using rII mutants of T4 phage were instrumental in deciphering the genetic code. In one such experiment, a double mutant was used to study intragenic recombination. a) Name the scientist who worked on rII locus? (1) b) Spot the significance of rII mutants in phage genetics? (3) c) Describe how complementation and recombination tests were used in this context. (6) d) Describe how complementation groups are created using the example below where zero means no complementation while _ means complementation. (5)	**15**	**CO2**

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Q 2	A cancer arose in a healthy person with no genetic or environmental history. The doctor diagnosed a jumping gene which integrated into a tumor suppressor gene to be responsible for it. With your knowledge of microbial genetics and molecular biology, answer the following: a. Define jumping genes. (1) b. Name the scientist who discovered jumping genes and in which organism? (2) c. Elaborate if there are different kinds/types of these jumping genes. Classify them. (5) d. Explain, how do these genes cause mutations? (3) e. Discuss the role of jumping genes in mapping. (4)	**15**	**CO2**
Section D **(2Qx10M=20 Marks)**			
Q 1	A student performs an interrupted mating experiment using an Hfr strain and a recipient F– strain. The order of gene transfer observed is: leu → thr → his → lac → gal. a) Explain the principle of interrupted mating and how it is used to map bacterial genes. (5) b) Name the scientists who used it first? (1) c) Based on the gene transfer order, construct a partial map of the donor chromosome. (4)	**10**	**CO1**
Q 2	a. Elaborate the life cycle of lambda phage with transcriptional regulation and choice of lysis and lysogeny highlighted. (7) b. Illustrate the uses of lambda phage in gene mapping. (3)	**10**	**CO1**