Name: Enrolment No:	

UPES

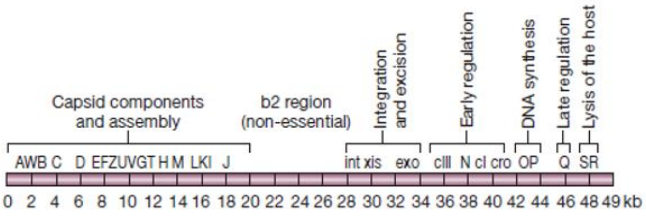
End Semester Examination, December 2023

Course: Biotechnology **Semester:** IIIrd
Program: M. Sc (Microbiology and Nutrition & Dietetics) **Time :** 03 hrs.
Course Code: HSMB 8003/ 8004 **Max. Marks:** 100

Instructions: Answer all questions

Q.No	**Section A** MCQs/Short answer questions/True &False	(20x1.5= 30 Marks)	COs
Q	Statement of question (each question carries 1.5 marks)		CO
1.	Fill in the blanks: The trio of scientists who re-discovered Mendel's work were: ……, …….. and ……..	1.5	CO1
2.	Fill in the blanks: Morgan and his colleagues developed a techniques for ……., and produced a comprehensive analysis of the relative positions of over ……..genes on the ……. chromosomes of *Drosophila melanogaster.*	1.5	CO1
3.	What are the two strains of bacteria involved in Griffith's experiment, and what are their characteristics?	1.5	CO1
4.	What is the purpose of the CRISPR-Cas9 system in biotechnology? a) Gene sequencing b) Gene mapping c) Gene editing d) Gene silencing	1.5	CO2
5.	Which of the following statements about restriction enzymes is true? a) They randomly cut DNA molecules. b) They are involved in DNA replication. c) They recognize specific DNA sequences and cut at or near those sequences. d) They only cut RNA molecules.	1.5	CO2
6.	In their experiments based on transformation, what did Avery, MacLeod, and McCarty isolate and purify from the heat-killed virulent bacteria to test its transforming ability?	1.5	CO3
7.	Name the bacteriophage used in transduction experiment carried out by Hershey and Chase?	1.5	CO2
8.	State True or False: Chargaff's rule states that A+T= G+C.	1.5	CO2

9.	Klenow fragment is derived from a) DNA Ligase b) DNA Pol-I c) DNA Pol-II d) d) Reverse Transcriptase	1.5	CO3
10.	Briefly explain the role of following reagents in PCR: a) Taq Polymerase, b) Primers	1.5	CO3
11.	Name three different DNA modifying enzymes. State their functions.	1.5	CO2
12.	Northern Blotting is a) Attachment of probes to RNA fragments b) Transfer of RNA fragments from electrophoretic gel to a nitrocellulose sheet c) Comparison of RNA fragments to two sources d) Transfer of RNA fragments to electrophoretic gel from cellulose membrane	1.5	CO3
13.	Plasmids are used as cloning vectors for which of the following reasons? a) Can be multiplied in culture b) Self-replication in bacterial cells c) Can be multiplied in laboratories with the help of enzymes d) Replicate freely outside bacterial cells	1.5	CO2
14.	Give an example of Restriction Endonuclease enzyme that produces: a) Cohesive ends b) Blunt ends	1.5	CO3
15.	State True or False: Restriction enzymes act on “Phosphodiester bonds” in a DNA molecule.	1.5	CO4
16.	Compare between linkers and homo-polymer tails?	1.5	CO4
17.	Draw a well labelled restriction map of PBR322.	1.5	CO3
18.	Give the significance of COS site in a phage genome.	1.5	CO4
19.	Compare between F- and R-plasmids	1.5	CO4
20.	The melting temperature of a primer pair, Tm is 55° C. What would happen if the extension step of a PCR was set at 50° C.	1.5	CO3
	Section B	(4x5=20 Marks)	CO

Q	Statement of question (each question carries 5 marks)		
1.	(a) Draw a well labelled diagram of DNA backbone. Highlight salient features of a DNA molecule. (b) Which of the two nucleic acids, DNA and RNA is more stable and why?	3+2	CO1
2.	(a) State two important features of a DNA molecule to be able to act as a vector? (b) Discuss the advantages and disadvantages of using pBR322 as a vector	2+3	CO2
3.	(a) What is the potential drawback of using linkers for the generation of sticky ends in a vector molecule? (b) How do adaptors overcome this drawback? Explain with the help of a well labelled diagram.	2+3	CO3
4.	What is a cosmid? Explain how is it used to clone long DNA fragments?	5	CO4
	Section C	(2x15=30 Marks)	
Q	Statement of question (Case studies) (each question carries 15 marks)		CO
1.	A gene of interest (G1) was cloned in a cloning vector pUC8 series vector, after digestion of the plasmids backbone by a restriction endonuclease, EcoR1. After the process of transformation bacterial cells were plated on a media. a) Give a diagram (or restriction map) of pUC8 series vector. Highlight the advantages that pUC8 series vectors have over pBR322 b) Name the selectable marker and reporter gene in pUC8 series vector. c) What does Lac Z gene code for? What is the function of that product? d) What is the role of IPTG in blue-white screening e) Which gene would show insertional inactivation? f) What do you understand by MCS? Where is it located? g) What would happen: i) If you forgot to add the Substrate (X-Gal) in the media prior to plating the transformed cells? ii) If all the colonies obtained were blue. What would you interpret from this observation?	15 (4+2+2+2+1+2+2)	CO3
2.	 In reference to the given figure, answer the following questions. a) Name the bacteriophage whose genetic map is this?	15 (1+2+2+4+3+3)	CO4

	b) Describe two drawbacks that are met while designing–based vectors? c) Explain how these drawbacks are resolved to develop lambda-based vectors? d) Differentiate between lamda-based insertion and replacement vectors, with one example for each? e) Describe two strategies for identification of recombinant phages? f) What is Genome sequencing? Describe one method employed to sequence a gene?		
Cure	**Section D**	(2x10=20 Marks)	
Q	Statement of question (each question carries 10 marks)		CO
1.	a) Which vectors were used in Human Genome project? How these vectors were efficient over the conventional plasmids or phage based vectors? b) Differentiate between the infection cycle of lambda and M13 phages?	5+5	CO2
2.	a) Differentiate between Reverse Transcriptase-PCR and Real Time-PCR? b) Describe what happens in the following steps of a PCR: i. Denaturation ii. Annealing , and iii. Extension c) Discuss the application of Recombinant DNA technology in production of following products of human therapeutic interests: (i) Insulin (ii) Vaccines	5+5	CO4