Name: Enrolment No:	

UPES

End Semester Examination, May 2025

Course: Genetic Engineering and Omics — Semester: VI

Program: B. Tech Biotechnology — Time: 03 hrs

Course Code: HSMB 3027 — Max. Marks: 100

Instructions: Answer all questions

Q.No	Section A MCQs/True &False	(20x1.5= 30 Marks)	COs
Q	Statement of question (each question carries 1.5 marks)		CO
1.	Type II Restriction enzyme cuts the sequence in the following way: _____ a) Within the recognition sequence b) At 100-1000 nucleotides away from the recognition sequence c) At 27-30 nucleotides away from the recognition sequence d) It cuts randomly	1.5	CO1
2.	A sequence has two ends, 5' and 3'. Which of the following statements is correct regarding the nature of the ends? a) The 5' end has a hydroxyl group b) The 5' end has a phosphate group c) The 3' end has a phosphate group d) Any group can be present at any end	1.5	CO1
3.	If all the nucleotides are present with equal frequencies and at random, what are the chances of having a particular four-nucleotide-long motif? a) 1/256 b) 1/64 c) 1/16 d) 1/8	1.5	CO2
4.	Which of the following statements is correct regarding S1 nuclease? a) It acts on double-stranded DNA b) It acts on single-stranded DNA c) It acts on both types of strands d) It is obtained from E. coli	1.5	CO1
5.	What is the function of methylase? a) Addition of methyl groups to DNA b) Removal of methyl groups from DNA c) Both in removal and addition of methyl groups from DNA d) It is used in production of methane gas	1.5	CO2
6.	Polymerase can be defined as _____ a) an enzyme used to synthesize a new DNA or RNA strand on the basis of pre-existing strand or at times without a pre-existing strand b) an enzyme used for removal of nucleotides from the DNA or RNA strand c) an enzyme which can synthesize only a new DNA strand, not an RNA strand d) an enzyme which can synthesize either a new DNA or an RNA strand but only when a strand is there	1.5	CO3

7.	Thermostable DNA polymerases are very important in PCR. How are they obtained? a) They are obtained by heating the bacteria manually at high temperatures b) They are isolated from extremely stable thermophilic bacteria, which are often found growing in oceanic vents c) They are found everywhere in nature d) They are obtained by genetically modifying the E. coli bacteria with thermal stability property	1.5	CO2
8.	Which of the following enzyme is said as reverse transcriptase? a) DNA dependent DNA polymerase b) RNA dependent RNA polymerase c) RNA dependent DNA polymerase d) DNA dependent RNA polymerase	1.5	CO2
9.	The process of amplification of specific DNA sequences by an enzymatic process is termed as _____ a) amplification b) polymerase chain reaction (PCR) c) translation d) microarrays	1.5	CO3
10.	Which of the following is not a condition for PCR? a) Initial melting carried out for 5 minutes at 94 degrees b) Initial melting followed by 30 cycles each consisting of melting for 1 minute at 94 degrees c) Renaturation for 5 minutes at 60 degrees d) DNA synthesis at 72 degrees for 1.5 minutes	1.5	CO3
11.	Introduction of DNA molecules into the recipient organism is termed as _____ a) transformation b) translation c) transduction d) transcription	1.5	CO2
12.	F plasmid is often used in conjugation. The correct statement is? a) The F plasmid encodes the factor that is transferred from one cell to another b) The factor encoded by the F plasmid is called as Filamentous (F) factor c) It is transferred from one cell to another by filament d) The bacteria must belong to the same species to carry out the conjugation	1.5	CO3
13.	Electroporation is also used for taking up the DNA by the cells. It consists of _____ a) inserting the DNA into the cells via an electric shock b) increased efficiency compared to both natural and chemical methods c) causing the least amount of damage in comparison to other methods d) decreased efficiency than both natural and chemical methods	1.5	CO2
14.	The various steps for the construction of libraries are _____ i) Fragmentation of DNA ii) Isolation of genomic DNA iii) Amplification iv) Ligation and introduction to the host v) Vector preparation The correct order of construction of libraries is (In the order of starting to ending). a) i)-ii)-iii)-iv)-v)	1.5	CO3

	b) ii)-i)-v)-iv)-iii) c) ii)-v)-i)-iv)-iii) d) v)-ii)-i)-iii)-iv)		
15.	Insertional and replacement vectors are types of _____ vector. a) Lambda b) M13 c) Yeast d) BAC	1.5	CO2
16.	For getting a large amount of proteins to crystallize, which of the following should be used as an expression system? a) Bacterial system b) Yeast systems c) Eukaryotic systems d) Both eukaryotic and bacterial systems can be used	1.5	CO4
17.	What is a "stuffer fragment" in cloning jargon? a) A replaceable fragment b) Promoter region c) Ribosomal binding site d) Clustered with restriction sites	1.5	CO1
18.	The Klenow fragment is a _____ a) DNA hybrid b) DNA polymerase c) RNA polymerase d) Promoter	1.5	CO1
19.	Genomic library construction is concerned with _____ a) Gene isolation b) Protein production c) Antibiotics d) Regeneration	1.5	CO2
20.	In screening for Puc8 recombinants, which color colonies will be the non-recombinants? a) Blue b) Colorless c) White d) Yellowish	1.5	CO3
	Section B	(4x5=20 Marks)	CO
Q	Statement of question (each question carries 5 marks)		
1.	Compare the pBR322 and pUC series of plasmid vectors in terms of size, selection markers, and multiple cloning site (MCS).	5	CO2
2.	Describe how lambda phage vectors are used for gene cloning. What are the advantages and limitations of using phage vectors?	5	CO2
3.	Compare "Linkers" and "Adaptors". Discuss the challenges that might arise when using homopolymer tailing for gene cloning compared to restriction enzyme-based methods.	5	CO3
4.	Illustrate different strategies (Transfection and *in-vitro* packaging) for the introduction of phage DNA into bacterial cells.	5	CO4
	Section C	(2x15=30 Marks)	

Q	Statement of question (Case studies) (each question carries 15 marks)		CO
1.	In relevance to Sanger Sequencing, answer the following questions: a) Elaborate on the function of ddNTPs in Sanger sequencing. b) List the key enzymes used in the Sanger sequencing method. c) Construct a flowchart showing the steps in the Sanger sequencing method from template preparation to data analysis. d) Briefly discuss the application of PAGE in Sanger Sequencing.	15 (3+3+6+3)	CO2
2.	In relevance to the expression vector system and insulin production, answer the following questions: a) Explain the relevance of strong promoter in an expression vector. Give an example. b) Describe how recombinant DNA technology is used to produce human insulin in bacteria. Draw a well-labelled flowchart for the same. c) Analyze potential problems of using bacterial systems to produce functional human insulin and suggest how these can be overcome. d) Examine the key components of a typical expression vector and discuss their roles.	15 (3+5+3+4)	CO3
	Section D	(2x10=20 Marks)	
Q	Statement of question (each question carries 10 marks)		CO
1.	Briefly outline the application, principle, and steps involved in any **two** OMICs techniques.	5+5	CO3
2.	Discuss the application of genetic engineering in the production of recombinant vaccines.	10	CO4