Name: Enrolment No:	

UPES

End Semester Examination, May 2025

Course: Biotechnology
Program: Int BMSc (Microbiology)
Course Code: HSBT3001

Semester: VI
Time : 03 hrs.
Max. Marks: 100

Instructions: Read carefully and answer all the 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.	Which of the following is the correct nomenclature of a restriction enzyme obtained from the first activity of strain R of Escherichia coli? a) EcoR1 b) EscRI c) EcorI d) EcoRI	1.5	CO1
2.	The ends created by use of DNase have unique single stranded sequences. a) True b) False	1.5	CO1
3.	Phosphatases refer to _____ a) the enzymes which add phosphate group at the end of the DNA molecule in the place of hydroxyl group b) the enzymes which hydrolytically remove phosphate group from the DNA molecules and replace them with hydroxyl group c) the enzymes responsible for removal of phosphate group from the DNA molecules and replace them with hydrogen d) the enzymes responsible for replacing hydrogen in the DNA molecules with the phosphate group	1.5	CO2
4.	Which of the following activity is not possible in the case of DNA polymerase I? a) 3'-5' exonuclease b) 5'-3' exonuclease c) 5'-3' DNA synthesis d) 3'-5' DNA synthesis	1.5	CO1
5.	Thermostable DNA polymerases are very important in PCR. How are they obtained? a) They are obtained by heating the bacteria manually over 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

6.	Polyacrylamide gels are the other types of gels which are commonly used. Which of the following statement is not correct with respect to these types of gels? a) They are obtained via polymerization between acrylamide and bis-acrylamide b) The components added for initiating polymerization are ammonium persulphate and TEMED c) It is casted in horizontal and flat trays d) TEMED catalyses the formation of free radicals from persulphate ions which leads to initiation of cross-linking	1.5	CO3
7.	Primers and polymerases are added again during the PCR because they get consumed as the reaction proceeds. a) True b) False	1.5	CO2
8.	Molecules having new combination of sequences that were not present before are called as _____ a) intermolecular ligants b) recombinants c) couple d) intramolecular ligants	1.5	CO2
9.	Insertion of DNA into lacZ gene may lead to disruption of the gene function. a) True b) False	1.5	CO3
10.	After carrying out the cloning experiment, the cells are plated on agar. Along with agar, it also contains antibiotic-resistant genes, X-gal and an inducer of lacZ gene. Which of the following would grow? a) Cells that have taken up plasmid DNA b) Cells that have taken up genomic DNA c) Cells having no insert d) Cells either having no insert or having genomic DNA	1.5	CO3
11.	Often PCR can be performed in order to confirm whether an insert is present in the plasmid. Cells are taken directly and PCR is performed, this type of PCR is known as _____ a) direct PCR b) colony PCR c) quantitative PCR d) in-situ PCR	1.5	CO2
12.	It is required to distinguish between the cells that have taken up the vector and that have not. It is done by using _____ a) multiple cloning site b) origin of replication c) high copy number d) selectable marker	1.5	CO3
13.	If a plasmid has two antibiotic-resistant genes, say ampicillin resistant and chloramphenicol resistance. If the plasmid grows in ampicillin-containing medium but not in chloramphenicol, what can be concluded? a) The insert is not present in any of the genes b) The insert is present in the ampicillin gene but not in the chloramphenicol gene c) The insert is present in the choramphenicol gene but not in	1.5	CO2

	ampicillin gene d) The insert is present between both of the genes		
14.	The cell in which the recombinant molecules are propagated is termed as _____ a) host b) vector c) plasmid d) carrier	1.5	CO3
15.	Disablement is also done in plasmids. Choose the correct statement. a) The strains carrying out the recombinant plasmids should not escape outside b) Preferred strains are having mutations which allow their growth in wild c) Mutations confer prototrophy d) If the recombinants escape outside, there is no such harm	1.5	CO3
16.	Compare linkers and adaptors?	1.5	CO2
17.	What is the disadvantage of amplification of using PCR over natural cloning? a) In PCR, there is no proof reading activity b) In PCR, small fragments can't be amplified c) There is an A incorporated in PCR products, which makes cloning difficult d) PCR takes more time as compared to natural cloning	1.5	CO3
18.	For a convenient transformation system, _____ can be used for gene silencing. a) antisense RNA b) transposon insertion c) either antisense RNA or transposon insertion d) transposon insertion followed by antisense RNA	1.5	CO4
19.	A mixture containing DNA fragments, a, b, c and d, with molecular weights of a+b = c, a > b and d>c, was subjected to agarose gel electrophoresis. The positions of these fragments from anode to cathode sides of the gel would be a) b, a, c, d b) a, b, c, d c) c, b, a, d d) b, a, d, c	1.5	CO4
20.	Give the temperatures ranges of the following steps in a PCR? a) Denaturation b) Annealing c) Extension	1.5	CO3
	Section B	(4x5=20 Marks)	CO
Q	Statement of question (each question carries 5 marks)		

1.	Give the restriction map and later analyze the advantages and limitations of using pUC8 over traditional plasmids like pBR322 for molecular cloning.	5	CO1
2.	Differentiate between insertion and substitution lambda phage vectors. Analyze how their DNA-carrying capacities influence their application in molecular cloning.	5	CO2
3.	Describe the basic structure of a YAC and its components that are important for cloning. Draw a flowchart highlighting how YACs are used for cloning large DNA inserts	5	CO2
4.	Analyze the role of the T-DNA region and virulence (vir) genes in the Ti plasmid during the genetic transformation of plants. How do these components contribute to successful gene integration?	5	CO3
	Section C	(2x15=30 Marks)	
Q	Statement of question (Case studies) (Each question carries 15 marks)		CO
1.	With relevance to cloning in insects, answer the following questions: a). What are P-insertion elements? Draw a well-labeled diagram highlighting different components of a P-element. b). Explain the mechanism of P-element insertion in *Drosophila melanogaster* and how it is used for gene cloning in insects. c). Discuss the advantages and limitations of using P-element mediated transformation for cloning genes in insects.	15 (5+5+5)	CO3
2.	In relevance to Pyrosequencing, answer the following questions: a). Explain the principle of pyrosequencing and the role of enzymes involved in the detection of nucleotide incorporation. b). Design a basic experimental approach using pyrosequencing to detect a single-nucleotide polymorphism (SNP) in a gene of interest. c). Compare pyrosequencing with Sanger sequencing in terms of methodology, read length, accuracy, and suitable applications.	15 (4+2+2+2+2+2+1)	CO4
	Section D	(2x10=20 Marks)	
Q	Statement of question (each question carries 10 marks)		CO
1.	a) Compare the structural features of bacterial and yeast expression vectors. Highlight at least two differences relevant to their respective host systems.	5+5	CO2

	b) Analyze the advantages and limitations of using yeast expression systems over bacterial systems for the production of recombinant therapeutic proteins.		
2.	a) Describe the role of following reagents while running an SDS-PAGE (i) Ammonium persulphate (ii) TEMED (iii) SDS (iv) B-Mercaptoethanol (v) Coomassie Brilliant Blue b) Discuss the application of Recombinant DNA technology in production of following products of human therapeutic interest: (i) Insulin (ii) Vaccines	5+5	CO4