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22BCU414N

PSG COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026

(Fourth Semester)

Branch - **BIOCHEMISTRY**

RECOMBINANT DNA TECHNOLOGY

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which of the following enzymes is primarily used to join DNA fragments during gene cloning? a. DNA polymerase, b. DNA ligase c. Restriction Endonuclease, d. RNA Polymerase	K1	CO1
	2	Show the function of restriction enzymes in genetic engineering. a. They synthesize new DNA strands during replication b. They join DNA fragments together c. They cut DNA at specific sequences to generate fragments d. They facilitate the movement of plasmids between bacteria	K2	CO1
2	3	What is the function of the p^{UC18} plasmid in E.coli cloning experiments? a. It carries yeast replication genes b. It serves as a shuttle vector between yeast and bacteria c. It acts as a cloning vector with a lacZ selection marker d. It integrates into the yeast genome	K1	CO1
	4	Classify the following vectors based on their host organisms: P^{BR322}, YAC and M13. Which grouping is correct? a. P^{BR322} – Yeast, YAC – Bacteria,M13-Virus b. P^{BR322} – Bacteria, YAC– Yeast, M13- Bacteriophage c. P^{BR322} – Virus, YAC– Yeast, M13- Bacteria d. P^{BR322} – Virus, YAC– Bacteria, M13- Yeast	K2	CO1
3	5	Choose the correct definition of a cDNA library a. A collection of DNA fragments representing the entire genome b. A collection of DNA sequences copied from mRNA transcripts c. A collection of proteins expressed in a cell d. A collection of RNA molecules extracted from cells	K1	CO2
	6	Outline the primary application of Restriction Fragment Length Polymorphism (RFLP) a. Measuring protein concentrations b. Detecting variations in DNA sequences for genetic mapping and disease diagnosis c. Synthesizing new genes d. Amplifying DNA fragments	K2	CO2
4	7	Define PCR (Polymerase Chain Reaction) a. A technique to cut DNA at specific sites b. A method to amplify specific DNA sequences c. A process to sequence DNA d. A technique to insert genes into bacteria	K1	CO2
	8	Relate how genetic finger printing helps in forensic applications a. By identifying bacterial species b. By comparing DNA profiles to match individuals c. By sequencing RNA viruses d. By cloning genes for protein production	K2	CO2
5	9	When was recombinant human insulin first approved for medical use? a. 1972 b.1982 c.1992 d.2002	K1	CO2
	10	Summarize the main constituents of an expression vector for E.coli. Which of the following components is NOT typically part of an expression vector? a. Promotor b. Origin of replication c.Transfer of RNA gene d. Selectable marker	K2	CO2

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the basic steps involved in the process of gene cloning. Why is each step important in achieving successful cloning?	K2	CO1
		(OR)		
	11.b.	Illustrate the process of DNA ligation with the help of a simple diagram and description.		
2	12.a.	Construct a step by step protocol for transforming E.coli with a recombinant plasmid and identifying recombinant colonies using blue white screening.	K3	CO1
		(OR)		
	12.b.	Build a workflow to introduce foreign DNA into E.coli using the p^{BR322} vector. Include antibiotic selection and the identification of transformed colonies.		
3	13.a.	Analyze the differences between the construction of a genomic library and a cDNA library.	K4	CO2
		(OR)		
	13.b.	Examine the role of fluorescent in situ hybridization (FISH) and in situ hybridization in gene localization studies. How do they differ in methodology and application?		
4	14.a.	Evaluate the role of genetic finger printing in forensic science and medical diagnostics.	K5	CO2
		(OR)		
	14.b.	Assess the basic PCR technique and its role in molecular biology.		
5	15.a.	Create a detailed plan for the production of recombinant human insulin using bacterial expression systems.	K6	CO3
		(OR)		
	15.b.	Plan a biosafety regulatory framework for the release of a genetically modified organism (GMO) intended for agricultural use.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Compare and analyze Lambda DNA and M13 DNA as Bacteriophage cloning vectors. How does their structure influence their suitability for different cloning strategies?	K4	CO1
2	17	Distinguish between binary vectors and SV40 viral vectors in term of hot range, structure and role in gene delivery.	K4	CO1
3	18	Categorize the steps involved in southern, northern and western blotting techniques and their applications	K4	CO2
4	19	Evaluate the advantages and limitations of Maxam–Gilbert sequencing compared to Sanger – Nicolson sequencing. Which method is more suitable for modern DNA sequencing and why?	K5	CO2
5	20	Construct a yeast expression system for the production of Hepatitis B surface antigen (HBsAg).	K6	CO3

Z-Z-Z END