U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

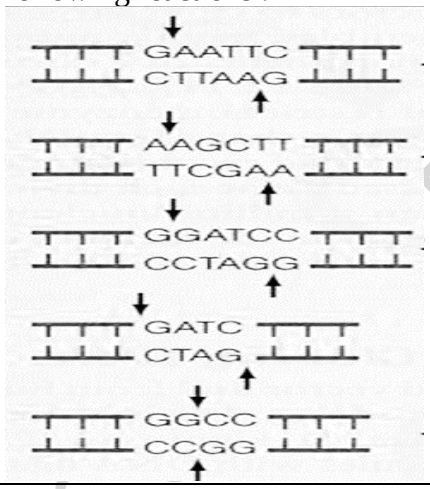
Programme: B.E. **Semester: IV**

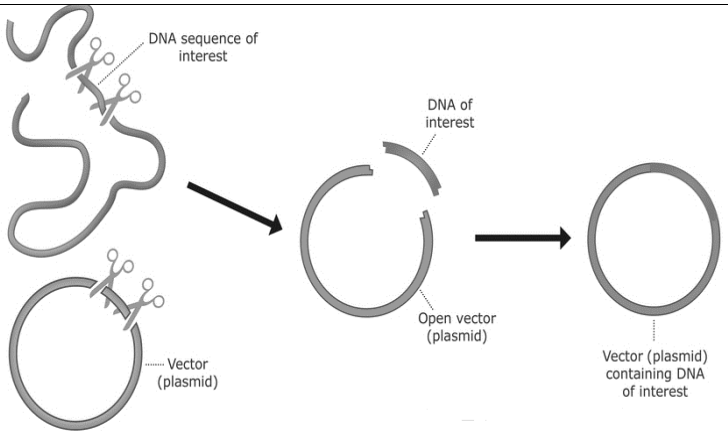
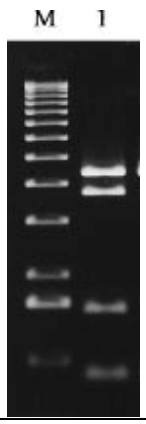
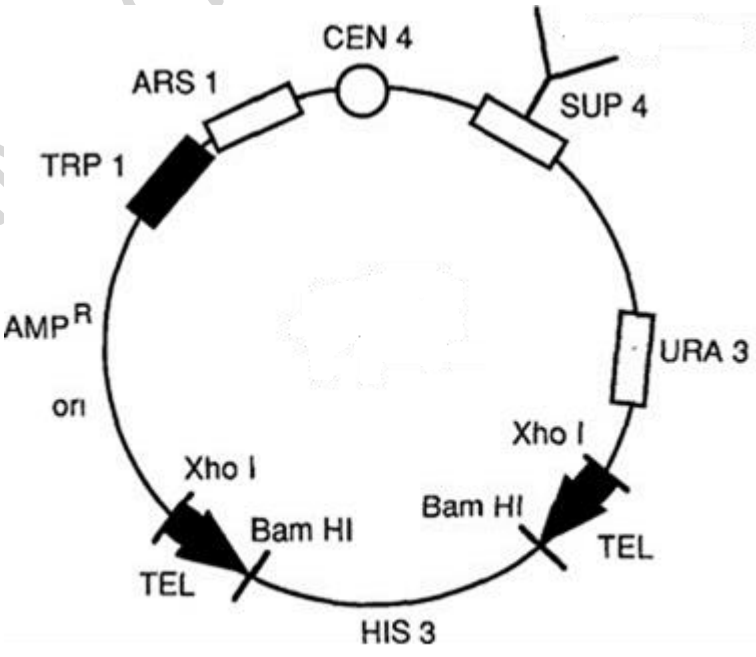
Branch: Biotechnology **Duration: 3 hrs.**

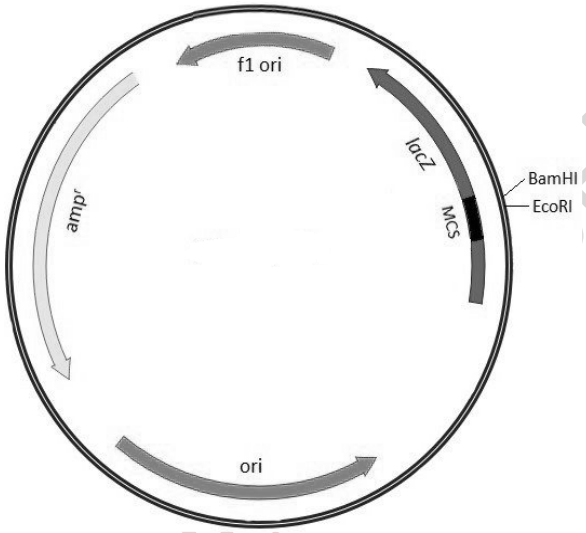
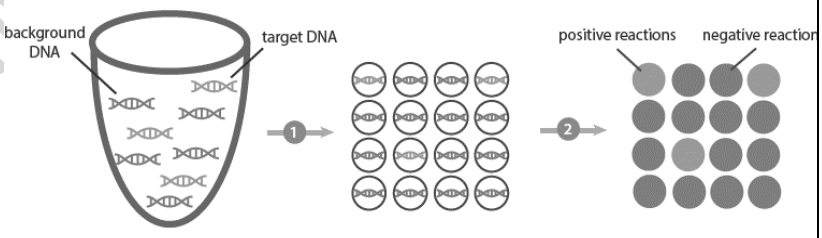
Course Code: 23BT4PCGEN / 22BT4PCGEN **Max Marks: 100**

Course: Genetic Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			UNIT - I	CO	PO	Marks
1	a)		Identify the product formed with the type of overhangs produced due to cleavage by typeII enzymes in the following sequences. Name the enzymes involved in atleast 3 of the following reactions .  	*1*	*1*	**10**
	b)		Deliberate on the different ligases that are available for the ligation of gene of interest in vectors.	*1*	*1*	**5**
	c)		A molecular archaeologist attempts to isolate DNA from a sample buried in ancient stones for understanding its sequences. Suggest an enzyme that could help him have a Biomolecule sufficient in amount for his/her studies.	*1*	*1*	**5**
			OR			
2	a)		Researcher isolates RNA for the synthesizing cDNA in laboratory. Discuss the precautions she/he needs to take in order to prevent the RNA from degradation	*1*	*1*	**5**
	b)		The image given below depicts the complete process of cloning. Discuss the various enzymes used in each step to obtain the final vector with gene of interest.	*1*	*1*	**10**

						
		c)	Differentiate between prokaryotic and eukaryotic methylases with examples.	*1*	*1*	**5**
			UNIT - II			
	3	a)	Below given image depicts a gel electrophoresis results post - isolation of plasmid from *E.coli*. Label the band and interpret the results . 	*1*	*1*	**5**
		b)	Identify the vector given in the image and the functions of genes, vector is carrying. Discuss the cloning and selection strategy for the gene of interest cloned at Sup4. 	*4*	*3*	**10**

		c)	Draw a structure of plasmid found naturally in *Agrobacterium tumefaciens*.	*4*	*3*	**5**
			OR			
	4	a)	Suggest a method of converting low copy number plasmids such as p BR322 to medium copy number palsmids with the number of copies given in the table below. Category | Typical number of copies per bacterial cell Low copy (e.g. pBR22 and derivatives) | 15–20 copies per cell Medium copy | 20–100 copies per cell	*1*	*1*	**5**
		b)	Differentiate between Adeno and retroviral vectors on the basis of their efficiency and helper system.	*1*	*1*	**5**
		c)	Identify the given vector based on the genes it is harbouring and write its features. Elaborate on role of f1 ori in the vector. Discuss the strategy of selection when a gene of ineterst is cloned at MCS . 	*4*	*3*	**10**
			UNIT - III			
	5	a)	The following image depicts one of the vaiants of PCR. Complete the reaction/flowchart and discuss the requirement, protcol and application. 	*3*	*5*	**10**
		b)	Differentiate between the protocols and types of various fluorescently labeled probe preparation that can be used for library screening. Write a note on their advantage over radiolabeled probes.	*4*	*3*	**10**
			OR			

<table>
<tr><td></td><td>6</td><td>a)</td><td>Design a pair of primers for creating and introducing a mutation in the desired target gene and write the outcome and results of the PCR carried out using such primers.</td><td>3</td><td>5</td><td>7</td></tr>
<tr><td></td><td></td><td>b)</td><td>Draw a suitable diagram that shows the setup created for blotting of DNA sample.</td><td>3</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td>c)</td><td>How can a researcher construct and screen a library prepared using mRNA?</td><td>4</td><td>3</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Discuss any 3 types of chemical means of transferring the gene of interest into targets systems. Add a note on limitations of the methods.</td><td>2</td><td>5</td><td>12</td></tr>
<tr><td></td><td></td><td>b)</td><td>A technique that uses ultrasound to temporarily create pores in cell membranes, allowing for the delivery of drugs, genes, or other molecules into cells has its own limitations. Enumerate on technique and justify the statement.</td><td>2</td><td>5</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Design suitable vectors with gene of interest and selection markers that are used for chloroplast transformation.</td><td>2</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td>b)</td><td>Setup an experiment and write the steps involved in delivery gene to target cells using optimum voltage.</td><td>2</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td>c)</td><td>High velocity projectiles can deliver gene of interest into any phenotypes, efficiently. Justify the statement with suitable figure and methodology.</td><td>2</td><td>5</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>a)</td><td>The table below provides the list of herbicides used in crops for better yield. But the non-selective nature of these chemicals kills main crops too. Thus, developing crops resistance against these would aid in preventing crops from damage and increasing yield. Fill in the table with appropriate answers and justifications.
<table>
<tr><th>S.No</th><th>Herbicide</th><th>Mode of action</th><th>Gene for resistance</th><th>Crops expressed</th></tr>
<tr><td>1</td><td>Glufisinate/Phosphoinothricin</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Glyphosate</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Bromoxynil</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Triazine</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Sulfonyl urea</td><td></td><td></td><td></td></tr>
</table></td><td>5</td><td>6,7,12</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Discuss Ex- Vivo gene therapy that can be applied in providing solution to ADA associated SCID?</td><td>5</td><td>6,7,12</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>10</td><td>a)</td><td>Though Plant-based foods offer an assortment of nutrients that are essential for adequate nutrition, the majority of widely consumed crops are deficient in some of these nutrients. Apply the knowledge of Gene manipulation to combat at least two nutritionally important biomolecules in the system.</td><td>5</td><td>6,7,12</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Discuss at least three important strategies of Gene therapy that could aid in the treatment of pancreatic cancer.</td><td>5</td><td>6,7,12</td><td>10</td></tr>
</table>

****