



**B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023**

(Regulation 2018)

Fifth Semester

**BIOTECHNOLOGY**

U18BTI5201: Genetic Engineering and Genomics

**COURSE OUTCOMES**

- CO1:** Comprehend and choose cloning steps for recombinant DNA construction.
- CO2:** Analyze the features of various types of gene cloning vectors and design a suitable vector for recombinant protein expression.
- CO3:** Interpret various types of gene isolation and screening methods.
- CO4:** Apply suitable modern molecular techniques to solve real life problems.
- CO5:** Evaluate regulatory issues of GMOs and their environmental and societal impact.

**Time: Three Hours**

Analyze and interpret various genome analysis methods

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

- |   |     |                   |
|---|-----|-------------------|
| 1. Justify why promoters are called gene switches.  | CO1 | [K <sub>3</sub> ] |
| 2. What is insertional inactivation? Explain its uses in selection of recombinants.               | CO1 | [K <sub>3</sub> ] |
| 3. Draw the vector map of an expression vector and indicate the various genetic elements needed.  | CO2 | [K <sub>3</sub> ] |
| 4. Distinguish between Endpoint PCR and RT-PCR techniques.  | CO2 | [K <sub>3</sub> ] |
| 5. What is cDNA library? Provide illustration of immunochemical screening method of cDNA library. | CO3 | [K <sub>5</sub> ] |
| 6. What are SINES and LINES of genome?  | CO3 | [K <sub>3</sub> ] |
| 7. Construct a cosmid vector highlighting the key genetic elements.                               | CO4 | [K <sub>5</sub> ] |
| 8. Distinguish between contigs and supercontigs?  | CO4 | [K <sub>4</sub> ] |
| 9. Justify why dATP $\alpha$ S is used in pyrosequencing.   | CO5 | [K <sub>3</sub> ] |
| 10. Evaluate various types of Biosafety levels involved in handling GMOs.                         | CO5 | [K <sub>5</sub> ] |

**Answer any FIVE Questions:-**

**PART B (5 x 16 = 80 Marks)**

**(Answer not more than 400 words)**

- |  |   |     |                   |
|--|---|-----|-------------------|
| 11. a) Construct a plasmid map of Ti Vector that can enable the formation of crown gall disease in plants and elaborate the role of vir genes in plant transformation. | 8 | CO1 | [K <sub>3</sub> ] |
|--|---|-----|-------------------|

- b) Critically evaluate the HDR and NHEJ mechanism that can be adopted in genome wide deletion or insertion of a gene of interest using CRISPR-cas9 based gene editing methods. 8 CO1 [K<sub>4</sub>]
12. a) What is RNA interference (RNAi)? Critically evaluate how RNAi can be performed in *Caenorhabditis elegans* by highlighting key genetic elements involved in RNAi technique. 10 CO2 [K<sub>3</sub>]
- b) Following datasets represents the restriction digestion results. 6 CO2 [K<sub>4</sub>]
- | Digest performed  | Size of fragment (kb) |
|-------------------|-----------------------|
| EcoR I            | 25,25                 |
| Hind III          | 50                    |
| Sal I             | 25,25                 |
| Hind III + Sal I  | 25,16,9               |
| EcoR I+ Sal I     | 8,17,8,17             |
| EcoR I + Hind III | 8,25,17               |
- Create a restriction digestion map assuming that the template is plasmid DNA.
13. a) The following datasets represent the restriction digestion results. 8 CO3 [K<sub>4</sub>]
- |                  |                      |
|------------------|----------------------|
| Hind III         | 5.0 kb and 10.0 kb   |
| Sma I            | 4.0 kb and 11 kb     |
| Sma I + Hind III | 5 kb, 6.0 kb, 4.0 kb |
- Create a restriction digestion map and gel image assuming that the template is linear DNA.
- b) What is TALENs? Justify the specificity of TALE proteins in deleting or inserting a gene of interest in prokaryotic genome. 8 CO3 [K<sub>4</sub>]
14. a) What is gene chip? Design an experiment to analyze the gene expression levels during various stages of embryonic development using gene chip. 8 CO4 [K<sub>3</sub>]
- b) Design an experiment to identify the sequence of unknown genes using chemical degradation method. 8 CO4 [K<sub>6</sub>]
15. a) What are pyrophosphates? Elaborate on how pyrophosphates can be used to sequence an unknown gene? 8 CO5 [K<sub>3</sub>]
- b) Design an experiment to sequence an unknown gene using chain termination method of DNA sequencing. 8 CO5 [K<sub>3</sub>]
16. a) List the merits and demerits of Genetically Modified Organisms (GMO). Elaborate with neat sketch on various types of gene transfer techniques used for production of transgenic animals. 8 CO4 [K<sub>5</sub>]
- b) Elaborate the importance of Cartagena protocols on biosafety pertaining to the use of Living Modified Organisms (LMO). 8 CO5 [K<sub>3</sub>]

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