BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – M.Sc.(BT)-2024
Course Name – Genetic Engineering
Course Code - MBT40115
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) A sequence is having two ends, 5' and 3'. Which of the following statements is correct regarding the nature of the ends?

a) The 5' end is having hydroxyl group
b) The 5' end is having phosphate group
c) The 3' end is having phosphate group
d) Any group can be present at any end

(ii) The recognition sequence for BamHI is 5' G|GATCC 3'. The '|' represents the cutting site. What can be inferred about the ends from it?

a) The ends created are double stranded
b) The single stranded end is 5' in nature
c) The single stranded end is 3' in nature
d) To decide about the nature of the ends more information is needed

(iii) 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) 0.015625
c) 0.125
d) 0.25

(iv) Both strands during replication in E. coli are elongated by _____.

a) DNA Polymerase I
b) DNA Polymerase II
c) DNA Polymerase III
d) RNA Polymerase

(v) RNA primers on the lagging strand are replaced by DNA with the help of _____.

a) DNA Polymerase I
b) DNA Polymerase II
c) DNA Polymerase III
d) Topoisomerase I

(vi) Multiple cloning site (MCS) is defined as _____

a) site within the plasmid which contains a site for many restriction enzymes
b) site within the plasmid which contains a site for many restriction enzymes and they are not present anywhere else in the plasmid

c) as the site containing many sites for only one restriction enzyme
d) cloning many inserts together

(vii) Probe is used for

a) Hybridisation with similar DNA
b) Hybridisation with complementary DNA
c) RACE
d) Sequence data is not available in any case

(viii) The technique used to detect the presence of DNA or RNA in a non-fractionated DNA sample is

a) Dot blot technique
b) Western blotting
c) Colony hybridization
d) In situ hybridization

(ix) Ligase joins the nicks by creating

a) Covalent bond
b) Phosphodiester bond
c) Hydrogen bond
d) Ionic bond

(x) The structural gene z in lac operon codes for

a) β-galactosidase
b) lactose permease
c) transacetylase
d) None of the these

(xi) One of the most significant discoveries which allowed the development of recombinant DNA technology was:

a) the discovery of antibiotics used for selecting transformed bacteria
b) the identification and isolation of restriction endonucleases permitting specific DNA cutting
c) the discovery of DNA and RNA polymerase allowing workers to synthesize any DNA sequence
d) the development of the polymerase chain reaction

(xii) TALEN specificity is determined by:

a) Zinc ion concentration
b) Repeat-variable di-residues (RVDs)
c) Guide RNA length
d) Cas proteins

(xiii) CRISPR-Cas9 creates double-strand breaks using:

a) Restriction enzymes
b) Endonuclease activity of Cas9
c) RNA polymerase
d) Topoisomerase

(xiv) The PAM sequence is essential in CRISPR because it:

a) Activates transcription
b) Prevents self-targeting of bacterial DNA
c) Enhances translation
d) Stabilizes guide RNA

(xv) Which DNA repair pathway often leads to gene knockouts after CRISPR editing?

a) HDR
b) NHEJ
c) BER
d) NER

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Analyze the advantages of baculovirus expression systems over bacterial systems. (3)
3. Describe the basic mechanism of baculovirus-mediated protein expression. (3)
4. Summarize the features of a plasmid vector. (3)
5. Develop a PCR strategy to confirm orientation-specific cloning in an expression vector. (3)
6. Discuss the basic requirements PCR reaction. (3)

OR

Explain how does fluorescence-based DNA sequencing detection improve accuracy and throughput. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Design a PCR optimization strategy for amplifying a GC-rich gene. (5)
8. Design a cloning-oriented PCR strategy for inserting a gene into a bacterial expression vector. (5)
9. Analyze the role of denaturant in the recovery of over-expressed misfolded protein in prokaryotic system. (5)
10. Classify real time PCR on the basis of chemistry used to detect the PCR product (5)
11. Explain the importance of synthesis of restriction enzyme in bacterial cell? How does bacterial Genomic DNA is protected from restriction digestion. (5)
12. Analyze how miRNA-mediated silencing differs from siRNA-mediated knockdown. (5)

OR

Analyze the working principles of Zinc Finger Nucleases and TALENs in genome editing. (5)

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