



BRAINWARE UNIVERSITY

Term End Examination 2024-2025

Programme – M.Sc.(MB)-2024

Course Name – Biology for Macromolecules

Course Code - MMB10105

(Semester I)

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) Which of the following is not an example of post-translational modification?
 - a) Myristoylation
 - b) Polyadenylation
 - c) Ubiquitination
 - d) Alkylation
- (ii) Choose the factor, that contributes to a decrease in gene density.
 - a) Intergenic sequence
 - b) Cell size
 - c) Exon sequence
 - d) Operon
- (iii) Identify from the following that is not a crucial requirement during DNA Cloning.
 - a) Protein expression
 - b) Vector
 - c) Molecular cutter
 - d) DNA insert
- (iv) The process of RNA inactivation by siRNAs is termed as _____.
 - a) RNA silencing
 - b) RNA interference
 - c) Short RNA inactivation
 - d) RNA disfunction
- (v) If a DNA sample is composed of 30% adenine, what is the percentage of guanine in this sample?
 - a) 0.2
 - b) 0.3
 - c) 0.4
 - d) 0.5
- (vi) A student is conducting an experiment on DNA replication and finds that replication is proceeding normally, but the DNA strands are highly coiled ahead of the replication fork. Which enzyme is most likely defective?
 - a) DNA polymerase
 - b) Helicase
 - c) Topoisomerase
 - d) primase
- (vii) If DNA polymerase III in prokaryotes encounters a mismatched base during replication, what mechanism allows it to correct the error?
 - a) Priming
 - b) Exonuclease activity
 - c) Telomere extension
 - d) Okazaki fragment repair

- (viii) A researcher finds that a cell line has an increased mutation rate and a tendency to develop cancer. Defects in which DNA repair pathway could lead to this phenotype?

 - Mismatch repair
 - BER
 - NER
 - None of these

(ix) A mutation causes a cell to lose its ability to repair DNA breaks during mitosis. Which repair mechanism is most likely affected?

 - NHEJ
 - BER
 - NER
 - Mismatch repair

(x) Analyze how transcription factors can act as both activators and repressors depending on their binding sites. Which of the following is an accurate explanation?

 - Transcription factors activate transcription when bound to enhancers but repress when bound to silencers
 - The outcome depends on the cofactors they recruit at different binding sites.
 - Transcription factors are always either activators or repressors, depending on their structure
 - Transcription factors do not influence transcription directly but only through mediator complexes.

(xi) How does the presence of small interfering RNAs (siRNAs) affect transcriptional regulation?

 - siRNAs promote transcription by stabilizing mRNA
 - siRNAs lead to degradation of target mRNA, reducing gene expression
 - siRNAs enhance the translation of mRNA into protein
 - siRNAs modify histones to increase transcription

(xii) In eukaryotic cells, the binding of a transcriptional activator to a promoter region increases transcription. How would the deletion of the corresponding co-activator affect gene expression?

 - The transcriptional activator would compensate by directly recruiting RNA polymerase
 - Gene expression would decrease, as the co-activator is necessary for transcriptional activation
 - There would be no effect, as co-activators are non-essential for transcription
 - The gene would become constitutively expressed due to loss of co-activator repression

(xiii) Analyze the potential outcome if DNA methylation in a promoter region is blocked. What would be the likely effect on gene transcription?

 - Transcription would be repressed.
 - Transcription would increase due to the lack of repressive methylation marks.
 - RNA polymerase binding would be impaired.
 - The gene would undergo alternative splicing.

(xiv) In post-transcriptional gene silencing (PTGS), how does the stability of the mRNA impact the level of gene expression?

 - Increased stability of mRNA leads to gene silencing.
 - Decreased stability of mRNA through degradation leads to gene silencing.
 - mRNA stability does not affect gene expression
 - The stability of mRNA promotes histone acetylation

(xv) Which post-translational modification is crucial for bacterial chemotaxis?

 - Glycosylation of flagella proteins
 - Acetylation of pili proteins
 - Methylation of chemotaxis receptors
 - Ubiquitination of surface proteins

Group-B

(Short Answer Type Questions)

$$3 \times 5 = 15$$

2. Evaluate the role of phosphorylation as a post-translational modification in molecular signaling pathways. (3)

3. Explain the significance of RNA transcription in the context of gene expression regulation. (3)
4. How does the cell detect DNA damage? (3)
5. Describe general properties of Genetic code. (3)
6. Analyze the function of Dicer in gene regulation. (3)

OR

Analyze how changes in RNA transport pathways can impact the regulation of gene expression and its broader aspect on cellular functions. (3)

Group-C
(Long Answer Type Questions)

5 x 6=30

7. Compare the process of transcription between prokaryotes and eukaryotes. (5)
8. Explain the process of RNA splicing and its significance in gene expression regulation. (5)
9. Briefly describe the experimental proof of Semiconservative model of DNA replication. (5)
10. Analyse the roles of different inhibitors in Bacterial DNA replication. (5)
11. Analyze the errors occurred due to the malfunctioning of aminoacyl-tRNA synthetases during bacterial translation. (5)
12. Compare between the termination of transcription between prokaryotes and eukaryotes. (5)

OR

Outline the process of spliceosome mediated intron removal of mRNA. (5)

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