

M.Sc. (Biotechnology) Supplementary Examination, 2023
(1st Year, 2nd Semester)
SUBJECT: MOLECULAR BIOLOGY-II AND GENETICS
MSBT 231
Full Marks – 40

Time 2 hours

Answer *Question Number 1* and *any seven* questions from the rest

1. Answer any five questions

1 X 5 = 5

- (a) Mention two technical advantages that are offered by baker's yeast as a model eukaryote.
- (b) What is the difference between general recombination and site-specific recombination?
- (c) What is the function of 'Chi' sites?
- (d) How many different types of plasmids are routinely used for carrying out genetic analysis of *S. cerevisiae*?
- (e) What do mean by the term "tetrad"?
- (f) Where heteroduplex DNA is found in the cell?
- (g) What is telomere?
- (h) How thymine dimers are repaired in cells?

2. State if the following statements are true or false:

1X5 = 5

- (a) Proof reading reaction that removes the wrongly added nucleotides during de novo DNA chain elongation relies on 3' → 5' exonuclease activity of the polymerase.
- (b) Yeast integrative plasmids are used to overexpress specific genes in yeast cells.
- (c) Yeast genetic screening starts with the cloning of the genes by complementation.
- (d) Chi sites provides resistance to *E. coli* from bacteriophage.
- (e) Holliday model of recombination involves new DNA synthesis.

3. (a) What is Ames Test? For which purpose this test is used

3

(b) What is the function of DNA helicase in the DNA replication?

2

4. (a) Is DNA replication bi-directional or unidirectional in eukaryotic cells? Does DNA replication in eukaryotic cells occur throughout the cell cycle?

3

(b) What is the function of RecA in homologous recombination?

2

5. (a) What is Okazaki fragments? How these fragments are originated during DNA replication?

(b) What is SOS repair? Which DNA polymerases are newly synthesized during SOS repair?

2

6. (a) Which proteins/enzymes play crucial roles in the nucleotide excision repair? Describe the function of one of them.

3

(b) How many families of recombinases are involved in the site-specific recombination of prokaryotic system? Mention one major difference between them.

2

[Turn over

7. Regarding gene expression in eukaryotes, mention whether the following statements is true or false
5 x1 = 5

- (a) mRNA and DNA are collinear.
- (b) RNA polymerase I transcribes the protein coding genes.
- (c) mRNA and protein synthesis can occur simultaneously in eukaryotes.
- (d) Splicing of pre-mRNA yields mRNA.
- (e) Circularization of mRNA is necessary for translation in eukaryotes.

8. (a) Which of the following processes is necessary for transport of mRNA from nucleus? **2**
 (i) Splicing, (ii) 3'-capping, (iii) Secondary structure, (iv) 5'-capping.

(b) What is the difference between siRNAs and miRNAs. Mention one protein which are required for their processing

(c) What is RISC complex? How it is related to the function of miRNA? **3**

9. (a) How DNA methylation in the surrounding regions of a given gene in the mammalian cells impacts the levels of its expression? **2**

(b) Describe the process of stepwise assembly of eukaryotic transcription initiation complex with labelled diagram. **3**

10. (a) What is the function of CTD of the largest subunit of RNA polymerase II in the transcription and mRNA processing events in eukaryotic cells? **3**

(b) Mention the functions of the following enzymes in splicing: U2AF 65/35 and SR proteins. **2**

11. (a) "Eukaryotic genes are split in nature" – explain. How it is different from prokaryotes? **2+1**

(b) List the names of four proteins that are involved in eukaryotic translation. **2**

12. Write Short Notes on any two of the following: **2.5 X2=5**

- (a) Epigenetic regulation
- (b) Histone acetylation
- (c) mRNA capping reaction
- (d) Post-transcriptional Modification
- (e) Initiation of eukaryotic translation.