

U.G. 4th Semester Examination - 2022
Molecular Biology & Biotechnology
[HONOURS]

Course Code : MBBT-H-401-T-CCR-8

Full Marks : 40 Time : 2½ Hours

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own words as far as practicable

Answer all the questions.

1. Answer any **five** of the following: 2×5=10
- a) What is Hogsteen pairing in DNA? What is its significance? 1+1
 - b) A strand of a double helical DNA has sequence 5'GCGCAATATTTCTCAAAATATT3'. Write the base sequence of the complementary strand. What special type of sequence is contained in this DNA segment? 1+1
 - c) In samples of double stranded DNA isolated from two unidentified species of bacteria, A and B, adenine makes up 35% and 19% respectively, of the total bases. What relative

proportions of adenine, guanine, thymine and cytosine would you expect to find in two DNA samples? One of these species was isolated from a hot spring (64°C). Which species is most likely the thermophilic bacteria and why?

1+1

- d) Homologous recombination does not change the linear array of genes. Justify.
 - e) How RecA filament forms on a single stranded DNA and on duplex DNA?
 - f) What are abortive transcripts? Why do they form?
 - g) How would you determine that peptidyl transferase activity is shown by rRNAs and not by proteins?
 - h) Although there are many AUG codons in an mRNA, but ribosome binds before the initiation codon, why?
2. Answer any **two** of the following: 5×2=10
- a) Describe Nirenberg and Leder experiment for deciphering genetic code. What is the physiological significance of mutation in 1st genetic code and error in 2nd genetic code?

3+2

- b) What is the role of cyclin CDK complexes in regulation of DNA replication? What is the significance of minichromosome maintenance proteins in DNA replication? 3+2
- c) Write the significance of human UNG, hSMUG1, TDG and MBD4 DNA glycosylases in BER. How the DNA mismatch repair system discriminate between template and new DNA strands. That is how the system will recognize which strand is mutated? 3+2
- d) Explain with diagram the mechanism of splicing of pre-mRNA in human. 5
3. Answer any **two** of the following: 10×2=20
- a) What is hybrid dysgenesis in *Drosophila*? Why infertile progeny is produced only from a cross between P cytotype father and M cytotype mother? With a diagram explain how alternative splicing gives rise to both repressor and transposase from the P element. 2+4+4
- b) Explain the mechanism of correct base selection and proofreading during DNA replication. Explain with diagram how DNA synthesis is regulated together on both leading and lagging strands. 5+5
- c) Explain the ABC excinuclease activity in NER. The recombinase enzyme is a site specific endonuclease and a ligase in one package. Explain. Explain the mechanism of direct repair with diagram. 3+3+4
- d) In diauxic growth curve of *E.coli* glucose is consumed first, followed by the consumption of lactose. How this physiological process is manifested at the molecular level by lac operon? What will be the expression state of the operon $I^S-O_C-Z^+-Y^+-A^+$ in presence and absence of inducer? Explain. Describe the regulation of tryptophan operon by attenuation mechanism. 4+2+4