Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Molecular Biology
Program: M. Sc Microbiology
Course Code: HSMB7037

Semester: II
Time : 03 hrs
Max. Marks: 100

Instructions: Read carefully and answer the following questions

Q.No	**Section A** **MCQs/Short answer questions/True &False**	**(20x1.5=30 Marks)**	**COs**
Q	Statement of question (each question carries 1.5 marks)		CO
1.	With respect to nucleosides which of the following is paired correctly? a) Purine – Adenosine, Thymidine b) Purine – Guanosine, Thymidine c) Pyrimidine – Uridine, Cytidine d) Pyrimidine – Uridine, Adenosine	1.5	CO1
2.	In one strand of a double stranded DNA the rate of occurrence of A is 3 times C in consecutive 10 bases. So how many G will be there in 100 base pairs of a DNA duplex?[Consider G=T in one strand]. a) 30 b) 20 c) 40 d) 60	1.5	CO2
3.	Which of the following statement is false about DNA? a) Located in chromosomes b) Carries genetic information from parent to offspring c) Abundantly found in cytoplasm d) There is a precise correlation between the amount of DNA and number of sets of chromosome per cell	1.5	CO1
4.	Which of the following combinations is a correct observation for the transformation experiment performed by Griffith? a) Type IIIS (living) + mouse = dead b) Type IIIS (heat killed) + mouse = dead c) Type IIR (living) + mouse = dead d) Type IIIS (heat killed) + type IIR (living) + mouse = living	1.5	CO3
5.	What were the main criteria taken under consideration for the experiment by Hershey and Chase? a) DNA contains phosphorus, protein contains sulfur b) Protein contains phosphorus, DNA contains sulfur c) Both DNA and protein contains phosphorus and not sulphur d) Both DNA and protein contains sulfur and not phosphorus	1.5	CO2
6.	What stores the genetic information in DNA? a) Sugar b) Phosphate c) Nitrogenous base	1.5	CO2

	d) Polymerase		
7.	Which of the following is used in prokaryotic replication? a) DNA polymerase I b) DNA polymerase II c) DNA polymerase III d) DNA polymerase δ	1.5	CO1
8.	The RNA polymerase core enzyme converts into a holoenzyme on the addition of the _____ subunit. a) α b) β c) β' d) σ	1.5	CO1
9.	Amino acids prior to their incorporation into polypeptide must be attached to a special adaptor molecule. Who proved this and when? a) Francis H. Crick in 1955 b) Paul C. Zamecnic and Maholon B. Hoagland in 1957 c) James Watson and Francis H. Crick in 1953 d) Linus Pauling in 1950	1.5	CO2
10.	The codon is a _____ a) Singlet b) Duplet c) Triplet d) Quadruplet	1.5	CO2
11.	Which component of the rRNA binds to the mRNA? a) 16S b) 5S c) 28S d) 23S	1.5	CO3
12.	Which of the following RNA polymerases are responsible for the production of 5S rRNA? a) RNA polymerase I b) RNA polymerase II c) RNA polymerase III d) RNA polymerase IV	1.5	CO2
13.	The α subunits of polymerase has a function of _____ a) Promoter binding b) Initiation c) Elongation d) Termination	1.5	CO2
14.	The first RNA processing event is _____ a) Capping b) Tailing c) Splicing d) Editing	1.5	CO3

15.	The initiation codon is a) AUG b) UAA c) UAG d) UGA	1.5	CO1
16.	Four types of σ factors are known of them which one is heat stable? a) σ70 b) σ32 c) σ54 d) σ28	1.5	CO3
17.	Who came up with the idea of "adapter molecule"? a) James Watson b) Francis Crick c) Gregor Mendel d) Charles Darwin	1.5	CO2
18.	Which of the following is an adapter molecule? a) mRNA b) rRNA c) cRNA d) tRNA	1.5	CO2
19.	Which of the following enzyme has a unique ability to introduce positive and negative supercoiling of the DNA and it is the target for antibacterial agents such as ciprofloxacin/quinolones? a) Dna A protein b) DNA helicase c) DNA gyrase d) DNA polymerase	1.5	CO2
20.	In case of prokaryotes the first tRNA enters the ribosome in the _____ a) A site b) P site c) E site d) Already attached to the mRNA before ribosome association	1.5	CO3
	Section B	**(4x5=20 Marks)**	CO
Q	Statement of question (each question carries 5 marks)		
1.	Compare and contrast the structural differences between A-DNA, B-DNA, and Z-DNA. How do these variations influence the biological functions and stability of DNA in different cellular conditions?	5	CO2
2.	Analyze the initiation of DNA replication at the OriC site in *E. coli*. Describe the coordinated roles of DnaA, helicase, primase, and DNA polymerase III in establishing and elongating the replication fork.	5	CO3

3.	Evaluate the functional importance of the promoter sequences and phosphorylation state of the CTD of RNA polymerase II during transcription.	5	CO4
4.	Discuss the role of initiation and elongation factors in protein translation in eukaryotes.	5	CO2
	Section C	**(2x15=30 Marks)**	
Q	Statement of question (Case studies: each question carries 15 marks)		CO
1.	In reference to the splicing events of the primary transcript, answer the following questions: a). Discuss how small nuclear RNAs (snRNAs) contribute to splice site recognition and catalysis in spliceosome-mediated removal of introns in pre-mRNA. b). With the help of a well-labelled diagram, give an outline of how precursor rRNAs are processed and spliced in eukaryotic cells? c). Analyze the splicing and maturation process of tRNA in eukaryotic cells. How does it differ from the processing of mRNA and rRNA?	15 (5+5+5)	CO3
2.	In reference to genetic code answer the following questions: a). List and briefly explain the characteristic traits of a genetic code. Evaluate the relationship of codon and anticodon. a). Analyze the role of the Wobble Hypothesis in explaining the degeneracy of the genetic code. b). Give a detailed and well-labelled diagram of t-RNA. Explain how the various arms facilitate the events of protein translation.	15 (5+5+5)	CO4
	Section D	**(2x10=20 Marks)**	
Q	Statement of question (each question carries 10 marks)		CO
1.	a). Describe the mechanism by which self-splicing introns are excised from the primary RNA transcript. Illustrate the splicing process with a well-labelled diagram to demonstrate the molecular events involved. b). Compare RNA-based and protein-based mechanisms of transcription termination.	5+5	CO4
2.	Discuss the key events involved in prokaryotic translation, including: i) Activation of aminoacyl-tRNA, ii) Initiation, iii) Elongation, and iv) Termination. For each process, provide a well-labelled diagram to illustrate the molecular events.	10	CO2