TOTAL PAGES : 2

22BCP208N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2025
(Second Semester)

Branch - **BIOCHEMISTRY**

MOLECULAR GENETICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which of the following is true about the C-value paradox? a) The DNA content of an organism is directly proportional to its complexity b) Organisms with similar levels of complexity can have widely different amounts of DNA c) The C-value paradox explains the function of all non-coding DNA in eukaryotes d) The C-value paradox is resolved by the presence of repetitive sequences	K1	CO1
	2	In the maize transposon system, the 'Ac' element's transposition role is? a) It excises itself from one location and integrates into another b) It causes the deletion of coding genes c) It requires an external transposase enzyme to move d) It remains fixed in its position and inhibits gene expression	K2	CO2
2	3	Which of the following organelles contain their own genome? a) Lysosome and Nucleus b) Endoplasmic Reticulum and Golgi Apparatus c) Mitochondria and Plastids d) Peroxisomes and Ribosomes	K1	CO1
	4	Endosymbiont theory suggests that mitochondria and plastids originated from a) Prokaryotic cells engulfing other eukaryotic cells b) Eukaryotic cells engulfing prokaryotic cells c) The fusion of eukaryotic and prokaryotic cells d) Internal evolution of organelles from the eukaryotic cell membrane	K2	CO2
3	5	Which of the following is a characteristic feature of zinc finger motifs in proteins? a) They are involved in carbohydrate binding b) They form a structure stabilized by a zinc ion c) They are exclusively found in viral proteins d) They bind to membrane phospholipids	K1	CO1
	6	Cysteine-Histidine zinc finger motifs typically bind to: a) RNA polymerase complex b) DNA major groove c) Ribosomal RNA d) Transmembrane proteins	K2	CO2
4	7	Which of the following proteins plays a role in heat-shock regulation of steroid receptor function? a) Serum Response Factor (SRF) b) c-Jun c) Heat-Shock Protein 90 (HSP90) d) NF-Kb	K1	CO1
	8	Steroid hormones regulate gene expression by: a) Directly binding to DNA and modifying histones b) Interacting with membrane receptors and initiating cytoplasmic signal cascades c) Binding to nuclear receptors that then act as transcription factors d) Phosphorylating transcription factors within the nucleus	K2	CO2
5	9	Which of the following Mendelian principles explains the separation of alleles during gamete formation? a) Principle of Dominance b) Principle of Segregation c) Principle of Independent Assortment d) Principle of Codominance	K1	CO1
	10	In gene mapping, what is the primary use of molecular markers? a) To determine the phenotype of an organism b) To locate genes on a chromosome based on linkage c) To initiate transcription of a specific gene d) To detect mutations in non-coding regions	K2	CO2

Cont..

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Describe the different types of repetitive sequences in eukaryotic genomes and explain their significance.	K2	CO2
		(OR)		
	11.b.	What are transposons? Explain their mechanism and provide examples from both bacterial and eukaryotic systems.		
2	12.a.	Explain how cytoplasmic inheritance is observed in plants, particularly focusing on plastid inheritance patterns in variegated plants.	K3	CO3
		(OR)		
	12.b.	Discuss the mechanism of homologous recombination in mitochondria and how this process differs from recombination in nuclear DNA.		
3	13.a.	Explain how zinc finger proteins recognize specific DNA sequences and how mutations in these motifs could affect DNA binding specificity.	K3	CO3
		(OR)		
	13.b.	Describe the molecular mechanisms by which HIV enters a host cell and discuss the role of viral receptors and co-receptors in this process.		
4	14.a.	Critically evaluate the role of glucocorticoids in the regulation of gene expression. Discuss how their regulatory mechanism differs from that of prolactin.	K4	CO5
		(OR)		
	14.b.	Analyze the role of transcription factors like NF-kB and c-Jun in brain development and function. How do they contribute to the transcriptional control of the central nervous system (CNS)?		
5	15.a.	Evaluate the usefulness of pedigree analysis in identifying patterns of inheritance in genetic disorders like Hutchinson-Gilford Progeria Syndrome and Thalassemia.	K4	CO5
		(OR)		
	15.b.	Analyze the role of Quantitative Trait Loci (QTL) mapping in understanding polygenic inheritance. How has this technique advanced our knowledge in plant breeding or disease resistance?		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Explain the concept of multigene families and their evolutionary significance. How do transposons contribute to the generation of multigene families? Provide examples to support your explanation.	K4	CO5
2	17	State the significance of mitochondrial DNA mutations in human disease and how potential therapies like mitochondrial replacement therapy (MRT) offer solutions. Discuss both the ethical and scientific challenges associated with MRT.	K4	CO5
3	18	Discuss the current strategies for HIV drug discovery, focusing on the development of antiretroviral therapies targeting different stages of the viral life cycle. Discuss the challenges in overcoming drug resistance and the prospects for developing a complete cure for HIV/AIDS.	K4	CO5
4	19	Outline the molecular mechanism of action of steroid and nuclear receptors, focusing on ligand binding and DNA binding domains. Discuss how mutations in these domains can affect gene regulation and lead to disease.	K4	CO5
5	20	Paraphrase the impact of Next Generation Sequencing (NGS) in the diagnosis of antibiotic resistance genes, with a specific focus on XDR Mycobacterium tuberculosis.	K4	CO5

Z-Z-Z END