

U.G. 4th Semester Examination-2026**ZOOLOGY****[MAJOR-IV]****Course Code : ZOO-MJ-T-401****(Cell Biology)****[NEP-2020]**

Full Marks : 40

Time : 2½ Hours

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

1. Answer any five of the following: $2 \times 5 = 10$
- a) Why are viruses classified as obligate intracellular parasites rather than living cells?
 - b) Why phospholipids are called amphipathic?
 - c) What are IP3 and DAG (diacylglycerol)?
 - d) Distinguish between primary active transport and facilitated diffusion.
 - e) What is the significance of the KDEL sequence?
 - f) What is the role of the mannose-6-phosphate (M6P) receptor in protein sorting?

[Turn Over]

- g) Describe the structural composition of a core nucleosome particle.
- h) State the functional role of Janus Kinases (JAK) in the JAK- STAT signaling pathway.

2. Answer any **two** of the following: $5 \times 2 = 10$

- a) Differentiate between Adherens junctions and Desmosomes based on their transmembrane proteins, intracellular cytoskeletal attachment, and primary tissue location. How hemidesmosome differs from desmosome? $3+2$
- b) Explain the molecular mechanism of protein sorting to lysosomes, focusing on the synthesis, tagging, and receptor-mediated transport of acid hydrolases.
- c) Give a comparative account of the three major types of cytoskeletal elements (microtubules, microfilaments, and intermediate filaments) based on their structural subunits, polymerization kinetics, and cellular functions.
- d) What are the tumor suppressor genes? Discuss the regulatory role of the Retinoblastoma (Rb) protein and the p53 pathway in preventing aberrant cell proliferation. $2+3$

3. Answer any **two** of the following: $10 \times 2 = 20$

- a) Describe the structure of Golgi apparatus. Distinguish between the forming and maturing face of Golgi. Mention the main reason why Golgi apparatus is known as the 'post office' of the cell. Discuss on the role of COP I and COP II protein in trafficking of molecules between ER and Golgi apparatus. $3+2+3+2$
- b) Provide a detailed mechanistic account of the mitochondrial electron transport chain (ETC), specifying the composition and functional roles of Complexes I through IV. Explain Peter Mitchell's Chemiosmotic Hypothesis and details how the proton motive force drives ATP synthesis via the F_0F_1 -ATPase motor. $5+5$
- c) Discuss the molecular mechanisms regulating the eukaryotic cell cycle. Explain the role of specific Cyclin-CDK complexes during the G_1 , S, G_2 , and M phases. Describe how the spindle assembly checkpoint (SAC) and DNA damage checkpoints ensure genomic fidelity. $3+3+4$

- d) Compare and contrast the molecular, morphological, and biochemical pathways of Apoptosis (Programmed Cell Death) and Necrosis (Accidental Cell Death). Explain the intrinsic (mitochondrial) and extrinsic (death receptor) caspase cascades pathway regulating apoptosis. Explain why necrosis triggers an inflammatory response while apoptosis does not.
- 4+4+2
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