

2021

BIOCHEMISTRY — HONOURS

**Paper : DSE-A-3
(Advanced Cell Biology)**

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* questions: 2×5
- (a) What is the function of RanGAP in relation to nuclear import and export?
 - (b) How does the cytoskeleton structure change during anaphase?
 - (c) What is the significance of Pachytene?
 - (d) What is the function of tight junctions in epithelial cells?
 - (e) How and why does the number of nuclear pore complexes change during the cell cycle?
 - (f) Are blood and bone have extracellular matrices? Briefly justify your answer.
 - (g) What are the major components of extracellular matrix?
 - (h) What is chiasma? Mention its significance.
 - (i) What is exportin? Mention its major function?
 - (j) What is the importance of haematopoiesis?
2. Answer *any two* questions:
- (a) What is peripheral protein? How can you prove that membrane proteins are mobile? What is the hydrophathy index? 1+3+1
 - (b) (i) Which genetic disorder is associated with dysfunction of gap junction?
(ii) How can malignant tumours or cancer be classified? 2+3
 - (c) What is the nuclear localisation sequence? What will happen if you fuse NLS with a cytosolic protein? How does cholesterol affect membrane fluidity? 2+1+2
 - (d) (i) What is the difference between the nuclear envelope and the cell membrane in terms of structure and function?
(ii) State the principle of ultracentrifugation. 3+2
3. (a) Mention the role of centriole during cell division. 2
- (b) With neat labelled diagram distinguish between zygotene and pachytene of prophase 1. 2

Please Turn Over

- (c) A scientist has discovered a mutation that prevents cells from passing anaphase of mitosis. Of the following options, which is the most likely target of the mutation? — Explain.
- (i) Actin synthesis
 - (ii) Myosin
 - (iii) Microtubule formation
 - (iv) Proteins involved in chromosome condensation 3
- (d) What initiates apoptosis? What type of enzyme is caspase? How can it be activated? 1+1+1

Or,

4. (a) The Rb gene is one example of a category of antiproliferative genes in humans. Typically, when both copies of such genes are lost, cancers develop. Do you suppose that cancer could be eradicated if tumour suppressor genes such as Rb could be expressed at high levels in all human cells? What would be the effect on the human? Explain your answer. 1+2
- (b) What is stem cell? How can stem cells be maintained in cell culture? 2+2
- (c) What is therapeutic cloning? What is its utility? 2+1
5. (a) How is confocal microscopy different from fluorescence microscopy? Briefly explain with appropriate examples. 2+1
- (b) What is membrane asymmetry? 3
- (c) (i) 'Gap junctions prevent molecules and ions from traveling between cells in the extracellular space'. State true or false with reason.
- (ii) Comment on the statement "Meiosis enables the conservation of specific chromosome number of each species even though the process actually results in reduction of chromosome number. 2+2

Or,

6. (a) Schematically describe the export of a protein from the nucleus. 3
- (b) Define cell line. How can you detect cancer by *in vitro* cell growth? 2+2
- (c) State some of the differences between immunotherapy and chemotherapy. 3
7. (a) What is FACS? How does it work? 2+2
- (b) The most basic function of the cell cycle is to duplicate accurately the DNA in the chromosomes and then distribute the copies precisely to the daughter cells; why is there a gap between S phase and M phase? 3
- (c) Why are fixatives used in immunohistochemistry? Name two. 2+1

Or,

8. (a) State two differences each between immunotherapy and chemotherapy. 2+2
- (b) What is the role of collagen in the extracellular matrix? 3

(c) Which type of microscope is especially useful for viewing thick structures such as biofilms?— Justify. 3

- (i) transmission electron microscope
 - (ii) scanning electron microscope
 - (iii) phase-contrast microscope
 - (iv) confocal scanning laser microscope
 - (v) atomic force microscope
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