ADVANCED CELL BIOLOGY AND IMMUNOTECHNOLOGY
(BIOT 5231)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   Major lipid components of membrane are
             (a) Phospholipids and fatty acids   (b) Phospholipids and triacylglycerol
             (c) Phospholipids and cholesterol   (d) Cholesterol and isoprenoids.

    (ii)   FGF propagates signal transduction through
             (a) Second messenger   (b) Enzyme linked receptors
             (c) Cytosolic receptors   (d) All of the above.

    (iii)   NO is synthesized by
             (a) NO synthetase from arginine and oxygen
             (b) NO dehydratase from arginine and water
             (c) NO synthetase from arginine and water
             (d) Monooxygenase from arginine and oxygen.

    (iv)   Protein kinase C is activated by
             (a) Calcium   (b) Both calcium and DAG
             (c) Cyclic AMP   (d) Steroids.

    (v)   MAP kinase pathway is activated by
             (a) Receptor tyrosine kinases   (b) JaK-STAT
             (c) Calcium   (d) Cyclic AMP.

    (vi)   _____ is concerned with the intrinsic pathway of apoptosis.
             (a) Cytochrome A   (b) Cytochrome B
             (c) Cytochrome C   (d) Cytochrome D

    (vii)   In order to enter the cell cycle a cell must be stimulated from outside. What type of molecule provides this stimulation?
             (a) Cyclins   (b) Cyclin-dependent kinases
             (c) Cytokines and growth factors   (d) Tyorise kinases.

(viii) Consider the following two statements:
I. During G_1 phase the cell is metabolically active and continuously grows but does not replicate its DNA.
II. During G_2 phase, proteins are synthesized in preparation for mitosis while the cell growth continues.
(a) Only I is correct
(b) Only II is correct
(c) Both I and II are correct
(d) Both I and II are incorrect.

(ix) Which of the following proteins is a death receptor which triggers the extrinsic apoptotic pathway?
(a) Caspase 8
(b) FADD
(c) Fas ligand
(d) Fas.

(x) The hybridomas are made by
(a) Fusing T cells with myeloma cells
(b) Fusing B cells with myeloma cells
(c) Fusing T helper cells with myeloma cells
(d) Fusing B memory cells with myeloma cells.

Group- B

2. (a) How ion channels of a cell can be distinguished from pores?
[(CO1)(Distinguish/HOCQ)]
(b) Why do need a transport system for macromolecules between nucleus and cytoplasm? *[(CO1)(Understand/IOCQ)]*
(c) Describe the structure of the transport system that is responsible for transport between nucleus and cytoplasm. *[(CO1)(Remember/LOCQ)]*
4 + 2 + 6 = 12

3. (a) Describe the signal sequence of proteins that are transported to mitochondria.
[(CO2)(Remember/LOCQ)]
(b) Discuss the roles of TOM and TIM23 complexes for transport of proteins to mitochondria. *[(CO2)(Understand/IOCQ)]*
(c) Discuss the source of energy for mitochondrial transport using cross-bridge rachet model. *[(CO2)(Understand/IOCQ)]*
3 + (3 + 3) + 3 = 12

Group - C

4. (a) What are hormone response elements? Discuss the sequence of hormone response elements for steroid hormones. How do they differ from those of thyroxine? *[(CO2)(Remember/LOCQ)]*
(b) Retenoids and isoprenoids are derived from vitamin A. Can they be considered signal molecules so far signal transduction is concerned? Justify you answer.
[(CO2)(Justify/HOCQ)]
(c) State two functions of thyroxine. *[(CO2)(Remember/LOCQ)]*
(2 + 2 + 2) + 4 + 2 =12

5. (a) What do you mean by classical and non-classical PKCs? *[(CO2)(Remember/LOCQ)]*
    (b) How calcium-calmodulin complex is generated by IP3? *[(CO3)(Understand/IOCQ)]*
    (c) Signal transduction using cAMP and Ca2+ as second messengers are sometimes interrelated. Explain the statement. *[(CO3)(Explain/IOCQ)]*
    4 + 4 + 4 = 12

Group - D

6. (a) Explain why apoptosis is called as 'Programmed cell death'.
    [(CO3)(Remember/LOCQ)]
    (b) Explain the origin of term 'Caspase'. Describe the extrinsic apoptotic pathway by caspase activation. *[(CO3)(Remember/LOCQ)]*
    (c) Analyze the apoptotic pathway by formation of apoptosome.
    [(CO4)(Analyze/IOCQ)]
    4 + (1 + 3) + 4 = 12

7. (a) Elucidate the function of Plasmodesmata with a diagram.
    [(CO4)(Remember/LOCQ)]
    (b) Analyze how cadherins mediate cell-cell interactions. *[(CO4)(Analyze/IOCQ)]*
    (c) Discuss the structure and function of the extra-cellular matrix.
    [(CO4)(Understand/LOCQ)]
    4 + 4 + 4 = 12

Group - E

8. (a) Discuss with examples how you can treat a human disease using customized monoclonal antibodies. *[(CO5)(Discuss/IOCQ)]*
    (b) Analyze with an example the use cytokines in cancer immunotherapy.
    [(CO5)(Analyze/IOCQ)]
    (c) What do you mean by Multiple Antigen Delivery System (MAPS)?
    [(CO5)(Understand/LOCQ)]
    4 + 4 + 4 = 12

9. (a) Discuss the cutting edge techniques in the domain of cellular imaging.
    [(CO5)(Understand/IOCQ)]
    (b) What are the applications of phage display technique? *[(CO5)(Understand/IOCQ)]*
    (c) Compare between Pleuripotent, Multipotent, Unipotent and Totipotent stem cells. *[(CO5)(Compare/HOCQ)]*
    4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	42.7	44.8	12.5

Course Outcome (CO):

After completing this course, students should be able to
1. Understand the mechanisms of cellular transport & trafficking.
2. Analyze the different channels of cell signaling and their interaction with different molecules.
3. Describe the mechanism of cell cycle and its components.
4. Analyze the mechanism of programmed cell death and its applications in human therpaeutics.
5. Apply the knowledge of different bioassays and vaccinology in disease diagnosis and human healthcare.

LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.