9. (a) What are the applications of cord blood stem cells in human therapeutics.

(b) Write a brief note on sub-unit vaccines.

(c) Mention the principle of FACS and its applications in clinical diagnostics.

4 + 4 + 4 = 12

ADVANCED CELL BIOLOGY & 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
any 5 (five) from Group B to E, taking at least one 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) State which of the following statements is true
(a) Ion channels are ion selective and fluctuate between closed and open state
(b) Ion channels are ion selective and remain in open state
(c) Ion channels are not ion selective and fluctuate between closed and open state
(d) Ion channels are not ion selective and remain in open state.

(ii) Na^+K^+ pumps
(a) use ATP to transfer Na^+ outside the cell and K^+ inside the cell
(b) use ATP to transfer Na^+ inside the cell and K^+ outside the cell
(c) maintain membrane potential with a positive charge inside
(d) is a tetrameric membrane protein.

(iii) Transport through carrier protein will follow
(a) Michelis Menten kinetics   (b) first order kinetics
(c) zero order kinetics   (d) no specific model.

(iv) The hormone adrenalin acts through
(a) tyrosine kinase receptor   (b) cyclic AMP
(c) protein kinase C   (d) IP3 and DG.

(v) KDEL sequence is present in the
(a) golgi proteins   (b) ER proteins
(c) plasma membrane proteins   (d) secretory proteins.

(vi)   In cell cycle, DNA synthesis takes place in
(a) G_1 phase   (b) G_2 phase
(c) G_0 phase   (d) S phase.

(vii)   What is responsible for the equal distribution of replicated chromosomes into each of two daughter cells?
(a) mitotic spindle   (b) random motion
(c) centromeres   (d) chromatids.

(viii) In hybridoma technology, which of the following cells are made deficient of HGPRT enzyme?
(a) B cells   (b) hybrid cells
(c) myeloma cells   (d) none of these.

(ix)   A cell divides every one minute. At this rate of division, it can fill a 100 ml beaker in one hour. How much will it take to fill a 50 ml beaker?
(a) 30 minutes   (b) 60 minutes
(c) 59 minutes   (d) 1 minute.

(x)   DNA vaccines
(a) are relatively poor at stimulating cytotoxic T lymphocyte responses in mice
(b) must be administered on gold particles if they are to be effective
(c) are only effective if followed by a protein boost
(d) may have distinct advantages when preparing subunit vaccines against viruses which frequently alter their antigens.

Group - B

2. (a)   Discuss the mechanism by which membrane proteins are anchored with the membrane.

    (b)   Discuss the role of Na+ and K+ channels in generation of action potential and restoration of normal membrane potential in nerve cells.

$$4 + (4 + 4) = 12$$

3. Describe the role of the following proteins in protein transport to mitochondria: (i) TOM complex (ii) TIM23 complex (iii) OXA complex and (iv) mitochondrial hsp 70.

$$(4 + 4 + 2 + 2) = 12$$

Group - C

4. (a)   For activation of a tyrosine kinase receptor, a ligand must bind simultaneously at least two adjacent receptor chains. Demonstrate the above statement with binding mechanisms of PDGF, EFG, and FGF.

    (b)   Discuss the importance of SH2 domains in signal transduction through tyrosine kinase receptors and down regulation of the same.

$$6 + 6 = 12$$

5. Discuss the role of the following proteins in signal transduction process.
(i)   G protein
(ii)   adenylate cyclase
(iii)   protein kinase A
(iv)   phospholipase C.

$$(3 \times 4) = 12$$

Group - D

6. (a)   Explain how cdk and cyclin act in progression of cell cycle through the checkpoints.

    (b)   Discuss the transmission of death signals by TNF receptors.

    (c)   Illustrate the extrinsic apoptotic pathway with the help of a diagram.

$$4 + 4 + 4 = 12$$

7. (a)   Explain how excessive apoptosis leads to T cell depletion in HIV patients.

    (b)   Discuss the role of ras proteins in stimulation of mitogenic signals.

    (c)   Describe the transmission of cell growth signals by PI3-kinase.

$$4 + 4 + 4 = 12$$

Group - E

8. (a)   Discuss the rationale for using HAT medium in hybridoma technology.

    (b)   Mention the applications of phage display technique.

    (c)   Describe the technique of immunophenotyping and its applications in diagnostics.

$$4 + 4 + 4 = 12$$