TISSUE ENGINEERING
(BIOT 4242)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Protein kinases and phosphatases act by altering _____ of the signalling proteins.
(a) basicity (b) conformation
(c) acidity (d) size

(ii) The response of a material due to the function of heat is known as _____.
(a) mechanical property (b) electrical property
(c) chemical property (d) thermal property.

(iii) Why are decellularized membranes used for tissue engineering?
(a) Decellularized membranes act as scaffolds with extracellular matrix where cells can be seeded
(b) Decellularized membranes are used in cell culture expansion protocols
(c) Decellularized membranes have cells that can help in regeneration of a tissue
(d) Decellularized membranes can be used as explants culture.

(iv) Alumina is a/an
(a) inert ceramics (b) bioactive ceramics
(c) bioresorbable ceramics (d) none of these

(v) Which of the following role is played by agitation in bioreactor?
(a) Increase oxygen rate transfer by diminishing size of air bubbles
(b) Prevention of sedimentation
(c) Proper distribution of nutrients to cell
(d) All of these

(vi) Dimethyl sulfoxide (DMSO) is used as cryopreservant for mammalian cell culture because_____.
(a) it is an organic solvent
(b) it easily penetrates cells
(c) it is also utilized as a nutrient
(d) it protects cells by preventing crystallization of water

(vii) The biomaterials are expected to mimic the functions of _____
(a) Extracellular Matrix (ECM) (b) Transmembrane proteins
(c) Cytoplasm (d) Cell Organelles

(viii) _____ is a network of polymer chains that are hydrophilic.
(a) Hydrogel (b) Alginate
(c) Starch (d) Amylose

(ix) The epidermis is considered the outermost component of the skin and primarily comprised of _____ a specific type of epithelial cells.
(a) Kertinocytes (b) Collagen
(c) Stem cells (d) Chondrocytes

(x) Which of the following is an example of Synthetic polymer?
(a) Polylactic acid (b) Dextran
(c) Chitin (d) Amylose

Fill in the blanks with the correct word

(xi) The largest family of cell surface receptor is _____.

(xii) The Inner Cell Mass of the embryo is rich in _____ stem cells.

(xiii) _____ is the physiological process through which new blood vessels form from pre-existing vessels.

(xiv) Batch culture is a _____ culture system.

(xv) Computational fluid dynamics (CFD) models are useful tools to analyse the bioreactor performance, e.g., predicting shear stress, turbulence, _____ for better bioreactors design so that cell growth can be optimized.

Group - B

2. (a) Highlight the major molecular events involved in a hypothetical signal transduction. *[(CO2)(Analyse/HOCQ)]*
(b) Give an overview of the different phases of skin wound healing. *[(CO2)(Remember/LOCQ)]*
(c) Justify with reasons why ECM bioscaffolds are preferred choice for constructive tissue remodelling. *[(CO2)(Justify/HOCQ)]*

4 + 4 + 4 = 12

3. (a) Elucidate the formation of different organs from ectoderm, endoderm and mesoderm. *[(CO1)(Understand /LOCQ)]*
(b) Analyze with a diagram the formation of a four-chambered beating heart from a single tube. *[(CO1)(Analyze/IOCQ)]*
(c) What do you mean by 'Lines of Blaschko'? Give a critical appreciation of the significance of this discovery. *[(CO1)(Criticize/HOCQ)]*

4 + 4 + 4 = 12

Group - C

4. (a) What is silk fibroin? Describe the steps of extraction of silk from *Bombyx mori.* *[(CO3)(Analyse/HOCQ)]*

   (b) What is 3D-bioprinting? Write names of three types of 3D-printers. Explain principle of anyone type of bioprinter that you have mentioned with a labelled diagram. *[(CO3)(Remember/LOCQ)]*

(1 + 5) + (1 + 5) = 12

5. (a) Write names of three synthetic biodegradable polymer and three natural biodegradable polymer. *[(CO3)(Remember/IOCQ)]*

   (b) Write about the properties and application of PLA and PLGA in tissue engineering? *[(CO3)(Remember/LOCQ)]*

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

Group - D

6. (a) (i) Write the names of three different techniques for preservation of cells or tissue. (ii) Describe any one of the cell preservation techniques that you mentioned. *[(CO4)(Analyse/HOCQ)]*

   (b) (i) Explain the Monod model for mammalian cell growth. (ii) Explain the kinetic model for contact inhibition of mammalian cells. *[(CO4)(Remember/LOCQ)]*

(2 + 4) + (3 + 3) = 12

7. (a) Explain the steps of isolation of adult stem cells. *[(CO4)(Analyse/IOCQ)]*

   (b) Write three examples of cell migrations in human body? *[(CO4)(Remember/LOCQ)]*

   (c) Explain the phases of cell motions with a labelled diagram. *[(CO4)(Apply/IOCQ)]*

4 + 3 + 5 = 12

Group - E

8. (a) Discuss the role of various growth factors involved in bone repair. *[(CO6)(Remember/LOCQ)]*

   (b) Comment on the usage of different growth factors in bone tissue engineering. *[(CO6)(Justify/IOCQ)]*

   (c) Give a critical appreciation of various type of scaffolds used in cartilage tissue engineering. *[(CO6)(Criticize/IOCQ)]*

4 + 4 + 4 = 12

9. (a) Discuss the use of hydrogel matrices for entrapment of bioactive molecules. *[(CO4)(Analyse/IOCQ)]*

   (b) How are tissue engineering scaffolds used for immunomodulation? *[(CO4)(Apply/HOCQ)]*

   (c) Cite an example of any one successful commercial use of bioscaffold in tissue engineering. *[(CO4)(Describe/LOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	40.63	30.21	29.16