B.TECH/ BT/8TH SEM/ BIOT 4242/2018

TISSUE ENGINEERING
(BIOT 4242)

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) Bone is a/an
(a) elastic material (b) viscous material
(c) isoelastic material (d) hard material.

(ii) Albuminised surface is used to improve
(a) tissue compatibility (b) mechanical properties
(c) blood compatibility (d) contour.

(iii) Which of the following tissue has a high regeneration capacity?
(a) Skin (b) Bone (c) Cartilage (d) Brain.

(iv) In perfusion chamber of 6 mm diameter, fluid flows at a superficial velocity of 1 mm/sec. What is the flow rate in the system ?
(a) Around 28 µl/sec (b) Around 35 µl/sec
(c) 10 µl/sec (d) Cannot be determined.

(v) Bone Morphogenic Protein (BMP) is a
(a) cell surface marker (b) growth factor
(c) hormone (d) neurotransmitter.

(vi) Solid Free Forming is a scaffold fabrication technique for
(a) 2D scaffold (b) 3D scaffold
(c) microscaffold (d) nano-patterned scaffold.

(vii) Bleeding, inflammation, proliferation, remodelling are phases of
(a) wound healing (b) clotting
(c) cell differentiation (d) cell maturation.

(viii) Which statement is true?
(a) G-protein coupled receptors are activated by tyrosine phosphorylation.
(b) G-protein consist of three subunits and each subunits is having a specific role in signal transduction.
(c) G-protein coupled receptors have seven-transmembrane domains and always signal by increasing intracellular cAMP concentrations.
(d) G-protein coupled receptors have five-transmembrane domains and always signal by increasing intracellular Ca^{+2} concentrations.

(ix) Bioreactor culture improves the nutrient supply by
(a) decreasing the diffusion distance.
(b) decreasing the convection.
(c) decreasing the mass transfer.
(d) decreasing the convection and mass transfer.

(x) Which is possible contribution of computational fluid dynamic modelling to the development of a bioreactor system?
(a) Prediction of patterns of shear stress
(b) Prediction of local profiles of oxygen consumption
(c) Prediction of efficiency of glucose utilization.
(d) Both (a) and (c).

Group – B

2. (a) What is cell signalling? What are the different types of signals?

(b) Describe the posttranslational modification of protein required for Hedgehog activation.

(c) Describe the Hedgehog signalling for proliferation of chondrocytes to formation of bone.

(1 + 2) +3 + 6 = 12

3.(a) What do you understand by extracellular matrix (ECM)? Mention names of three components of ECM other than collagen.

(b) Describe the molecular mechanism of vascularization.

(c) Describe the detailed mechanism of stem cell division with a ladled diagram.

(2 + 2) + 4 + 4= 12

Group – C

4. (a) How cellulose can be applied in vascular tissue engineering? What is the most important disadvantage of cellulose and how it can be controlled?

   (b) Describe the role of alginate in wound healing and cartilage repair? How can we promote cell adhesion property on scaffolds?

(6 +2) +(2 + 2) = 12

5. (a) What are the advantages of porogen leaching technique for scaffold fabrication? How self-assembly of molecule can be used for scaffold fabrication?

   (b) What is the principle of electrospinning? How electrospinning is used in Tissue engineering?

   (c) What is Rapid Prototyping? What are the advantages of Rapid Prototyping technique over the other scaffold fabrication techniques?

(2+2)+(2+2)+(1+3) = 12

Group – D

6. (a) Mention the names of three different techniques for the preservation of cell or tissue. Describe any one of the technique.

   (b) Differentiate between fixed bed and fluidized bed bioreactors.

   (c) With the help of a diagram explain the functioning and set-up of a flow chamber-bioreactor system.

(1+3) + 3+5 = 12

7. (a) Describe the kinetic Model for contact inhibition and Cell proliferation in vivo.

   (b) Write the difference between the following:
   (i) ESC and ASC.
   (ii) Tissue Engineering (TE) and regenerative medicine.
   (iii) Growth factor receptor and integrin.

   (c) Mention two ethical problems in relation to Tissue Engineering (TE).

(2 + 2) +(2 × 3) +2 = 12

Group – E

8. (a) Describe one approach to change the release kinetics for scaffold based delivery system?

   (b) How gene therapy can be used as an alternative means to achieve controlled delivery of protein. Mention the advantage of this process over protein therapy.

   (c) What are the different vehicles which can be used for controlled protein delivery?

4+ 3 + 5 = 12

9.(a) What are the different problems of commercially available skin substitutes?

   (b) How scaffold-free cartilage tissue construct can be used for cartilage regeneration?

   (c) What are the advantages of scaffold free cartilage tissue engineering?

5+ 5 + 2 = 12