Ref. No.: Ex/PG/BME/PE/T/123A/2025

MASTER OF BIO-MEDICAL ENGINEERING FIRST YEAR SECOND SEMESTER - 2025

ADVANCED BIOMATERIALS & TISSUE ENGINEERING

Time: 3h Full Marks: 100

Answer any **TEN** questions 10X10=100

1. Write True(T) or False(F) as applicable (Any ten) 10X1=10
   i. Primary human cell doubling in cell culture depend on donar age.
   ii. Tissue engineering organs always need external power supply.
   iii. ECM cannot bind with other ECM molecule.
   iv. Nutrition transport is an important parameter in scaffold fabrication.
   v. A normal human adult have approx. 100 trilion of cells.
   vi. ECM is a stable part and cannot grow.
   vii. A normal human adult have 200 different types of mature cells.
   viii. Pore size range required to grow osteoblast are far less than fibroblast.
   ix. All cells have a small population of stem cells.
   x. Cytochrome c release from the mitochondria is a hallmark event in the extrinsic pathway of apoptosis.
   xi. DISC is formed by caspase 8 binding to FADD with the help of Cytochrome c.
   xii. Mammalian cells that don't have cytochrome c are resistant to apoptosis induced by DNA damage.

2. What are the kinds of progency present in stem cells? Define them. What are the applications of stem cells? How could you isolate hematopoietic stem cells? What do you mean by 'opportunistic' stem cell?Name one organic & inorganic material finds application in drug delivery system. 3+1.5+1.5+2+2 C1

3. Write a short note on telomers and self renewal. What is cell line? Name one cryoprotectant of cell. What is subculture? Why& when it is required? How instability of cell line could be overcome? 4+1+1+2.5+1.5 C1

4. Write a short note on
   a. Bone marrow transplantation b. Cartilage repair using tissue culture technique
   c. Cardinal sign 5+3+2 C2

5. Why it is difficult to prevent implant infection by conventional antibiotic therapy? What are the strategies present to prevent implant infection?Explain with proper reasoning. Classify different types of implant infection. Define each of them. 3+3+4 C5

6. Name the different biocompatibility testing's required as per latest ISO standard.Write three basic assay principles of cytotoxicity testing including the name of tests where these principles applied. Write any one of these tests procedure in detail (mention the name of dyes whenever required). 4+3+3 C4

7. Write short note on scaffold. Write the sequential events observed in blood cells and related, surrounding tissue as a response to the introduction of biomaterials within the human system. 5+5 C2

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8. Give an account on sequential events leading to wound healing in details. How can a normal cell and an apoptotic cell be differentiated in a laboratory setup? Explain your answer. 8+2 C2

9. Write short notes on: (i) Cell cycle control checkpoints; (ii) Cyclin-dependent kinases (Cdks); (iii) Interphase. What is Anaphasic Movement? (3+3+3+1) C2

10. What are the differences between Apoptosis and Necrosis? What is the significance of Apoptosis as a biological process? What is DISC, and how is it involved in Apoptosis? How do survival factors control apoptosis? Explain "Caspase-Cascade". (2+2+2+2+2) C2

11. Explain the concept of surface plasmon resonance (SPR) in metallic nanoparticles. Discuss the physical, optical, and chemical properties of carbon dots and explain their advantages in biomedical fields. Write different Biomedical applications of nanomaterials. Which nanoparticle property primarily influences its zeta potential? (3+3+3+1) C3

12. Answer Any **FIVE** 5X2=10 C1,5

i. Which cell is termed as mother of all cells? ECM is degraded by _____enzyme?
ii. Calculate the ionic strength of 0.05 M Na_2SO_4 and 0.02 M NaCl solution.
iii. What is the doubling time of normal hepatocytes and hematopoietic progenitors?
iv. What is angiogenesis? Name the class of receptors ECM bind during cellular fate process.
v. What do you mean by 'Stealth Liposome'?
vi. Presence of which groups enhance rate of degradation.