| Reg. No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

# MANIPAL INSTITUTE OF TECHNOLOGY

**(A constituent unit of MAHE, Manipal 576104)**

**II SEM M.Tech.(BME) DEGREE END SEMESTER EXAMINATIONS APR/MAY 2019**
**SUBJECT: TISSUE ENGINEERING (BME 5239)**
**Elective III**
**(REVISED CREDIT SYSTEM)**
**Saturday, 4th May 2019: 9 am to 12 noon**

**TIME: 3 HOURS** **MAX. MARKS: 50**

**Instructions to Candidates:**

1. **Answer all the questions.**
2. **Draw labeled diagrams wherever necessary.**

| | | | |
|---|---|---|---|
| 1. | (a) | Classify different types of cells by their source. Explain the basic components of connective tissues. | 04 |
| | (b) | Explain the strategies you would adopt to sterilize the following items:<br>(i) heat sensitive soluble culture medium, (ii) vaccines, (iii) collagen scaffold,<br>(iv) A "portion of exposed arm" for vaccination | 02 |
| | (c) | (i) Justify the roles of polycomb group proteins and G1 phase regulators for regulating the self- renewal of mesenchymal stem cells.<br>(ii) How does embryonic stem cell violate Hayflick's limit. | 04 |
| 2. | (a) | Following are the cells involved in cellular signaling in bones:<br>(i) Osteocyte, (ii) lining cell, (iii) osteoblast, and (iv) osteoclast.<br>Establish the interdependence among these cells with the factors regulating the signaling paradigm. Map the BMP regulated cell signaling pathways for bone formation (state clearly the role of each component). | 05 |
| | (b) | How would you evaluate the regenerative potentials of both the isolated human embryonic stem cells and human hematopoietic stem cells (isolated from placenta) by *in vivo* process? | 05 |
| 3. | (a) | You are asked to make a porous scaffold using collagen (biopolymer). How would you proceed to make the interconnected porous scaffold? | 03 |
| | (b) | A bioengineer is asked to extract collagen for the fabrication of a composite matrix (for designing a femoral prosthesis).<br>(i) Compare the steps involved in the isolation of soluble and insoluble collagens.<br>(ii) After isolation, which one would be suitable for the fabrication of the composite matrix? | 04 |

(c) How would you determine porosity in scaffold? 03

4. (a) You have harvested chondrocyte, hepatocyte and osteocytes from a human subject (primary culture). How would you: 07
(i) Select specifically chondrocyte from the heterogenous population
(ii) convert them to cell line
(iii) Comment on whether FACS study could be appropriate for selecting the above cells. After selection, how would you maintain and preserve these cells? In this context, analyze the roles of dimethyl sulfoxide and polyethylene glycol for cell preservation.

(b) In the superficial and trans-zonal region of an articular cartilage, collagen fibers are horizontally oriented. Indicate the significance of such orientation. 03

5. (a) Highlight the significance of using growth factors in scaffolds for tissue engineering application. Mention the ligands and receptors involved in the PDGF signaling network 03

(b) Mention the major components of tissue culture medium with purpose. 04

(c) Explain the steps involved in Autologous Chondrocyte Implantation. 03