Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Stem Cell technology — **Semester : VIII**

Program: B. Tech Biotechnology — **Duration : 3 Hours**

Course Code: HSBT4006 — **Max. Marks: 100**

Instructions:

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Identify the totipotent cell among the following options: a) Inner cell mass cell b) Zygote c) Hematopoietic stem cell d) Epidermal stem cell	**1.5**	**CO1**
Q 2	Select the transcription factor responsible for maintaining pluripotency in ESCs: a) p53 b) CD34 c) Oct3/4 d) FGF	**1.5**	**CO1**
Q 3	Multipotent stem cells can differentiate into: a) All cell types including placenta b) Limited lineages within a tissue c) Only one specific lineage d) All three germ layers	**1.5**	**CO1**
Q 4	Identify the stem cell type located in the bulge region of hair follicles? a) Neural stem cell b) Epithelial stem cell c) iPSC d) Mesenchymal stem cell	**1.5**	**CO1**
Q 5	Choose the characteristic that is common to all stem cells: a) Ability to form tumors b) Asymmetric cell division	**1.5**	**CO1**

	c) Fixed differentiation pathway d) No surface markers		
Q 6	Define the term totipotency.	**1.5**	**CO1**
Q 7	Provide the definition of the term *stem cell niche*.	**1.5**	**CO1**
Q 8	Differentiate between multipotent and unipotent stem cells.	**1.5**	**CO1**
Q 9	Explain the role of intrinsic and extrinsic factors in determining cell fate.	**1.5**	**CO1**
Q 10	Describe the properties of embryonic stem cells that make them ideal for regenerative medicine.	**1.5**	**CO1**
Q 11	Identify the technique used to isolate the inner cell mass from a blastocyst: a) Immunosurgery b) Flow cytometry c) Electroporation d) PCR	**1.5**	**CO2**
Q 12	The marker commonly associated with hematopoietic stem cells is: a) CD4 b) CD34 c) CD3 d) CD8	**1.5**	**CO2**
Q 13	Choose the culture method that eliminates the use of animal-derived components: a) MEF feeder cells b) Xeno-free feeder-free system c) Fetal bovine serum culture d) Fibroblast co-culture	**1.5**	**CO2**
Q 14	Identify the signaling pathway in intestinal stem cells that promotes differentiation by opposing Wnt activity: a) BMP b) Notch c) Hedgehog d) EGF	**1.5**	**CO2**
Q 15	Determine the function of bFGF in stem cell culture: a) Induce differentiation b) Maintain pluripotency c) Activate apoptosis d) Promote senescence	**1.5**	**CO2**
Q 16	The _____ signaling maintains satellite cells in a dormant state until activation.	**1.5**	**CO2**

Q 17	Oct3/4 and Sox2 are essential transcription factors that maintain stemness by regulating genes involved in self-renewal and pluripotency. **(True/False)**	**1.5**	**CO2**
Q 18	Name one techniques used to isolate stem cells.	**1.5**	**CO3**
Q 19	Choose the correct description of the CFU assay used in hematopoietic stem cell research: b) A test for the ability of stem cells to form tumors in vivo c) An assay that evaluates proliferation and differentiation potential in semisolid media d) A technique to sequence hematopoietic genes in stem cells	**1.5**	**CO3**
Q 20	Describe the method applied by Shinya Yamanaka to generate iPSCs from adult fibroblasts: a) By exposing cells to chemical mutagens and growth factors b) By culturing cells on MEF feeder layers with fetal bovine serum c) By introducing key pluripotency genes using viral vectors d) By fusing fibroblasts with embryonic stem cells	**1.5**	**CO3**
Section B (4Qx5M=20 Marks)			
Q 1	Explain the classification of stem cells based on potency with suitable examples.	**5**	**CO1**
Q 2	Describe the culturing methods of human embryonic stem cells using feeder and feeder-free systems.	**5**	**CO2**
Q 3	Discuss the role of iPSCs as a replacement for ESCs in regenerative medicine.	**5**	**CO2**
Q 4	Analyze the ethical issues associated with stem cell tourism.	**5**	**CO3**
Section C (2Qx15M=30 Marks)			
Q 1	Outline the main considerations involved in selecting patients for stem cell transplantation. **(10 marks)** Include a discussion on disease status, age, comorbidities, and psychosocial aspects. **(5 marks)**	**15**	**CO2**
Q 2	Explain the role of signaling pathways in regulating stem cell maintenance and differentiation in the shoot apical meristem. **(10 marks)** Discuss the potential applications of this knowledge in the fields of plant tissue engineering and crop improvement. **(5 marks)**	**15**	**CO3**

Section D (2Qx10M=20 Marks)			
Q 1	Describe the structural features, anatomical location, and biological properties of skeletal muscle stem cells (satellite cells). **(5 marks)** Explain their involvement in muscle upkeep and regeneration under normal physiological conditions. **(5 marks)**	**10**	**CO1**
Q 2	Discuss the key features of cancer stem cells and the methods used for their isolation and study. **(5 marks)** Describe the ways in which this understanding contributes to the development of targeted cancer treatments. **(5 marks)**	**10**	**CO2**