Q. Code: 786653

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

B.E / B.TECH. DEGREE EXAM1INATIONS, MAY 2023

Sixth Semester

BT18022 -TISSUE ENGINEERING

(Biotechnology)

(Regulation 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 Gain knowledge and get expertise in the field of tissue engineering.
CO 2 Discuss the basic concepts of tissue engineering.
CO 3 Design and develop reactors for specific tissue engineering application.
CO 4 Apply the knowledge of professional and ethical responsibility in use of stem cells in creating tissue engineered therapies.
CO 5 Design and develop different biomaterial in tissue engineering application.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Mention the design factors of engineered porous templates that ease the wound healing.	**1**	**2**
2.	Identify the molecules which play a major role in controlling the cellular fate processes.	**1**	**2**
3.	Define Angiogenesis and the role of VEGF in the angiogenesis process.	**2**	**3**
4.	Illustrate the role of matrix metalloproteins in tissue remodeling process.	**2**	**3**
5.	Mention the genes which are responsible for the induction of pluripotency.	**3**	**4**
6.	Diagrammatically show the cultivation of adult stem cells from bone marrow and their differentiation into various types of specialized cells.	**3**	**4**
7.	Are the biomaterials that replace body parts as effective as the original materials with reference to their properties and function.	**4**	**4**
8.	How the porosity and interconnectivity of the scaffolds influences the regeneration of the tissues.	**4**	**4**
9.	Appraise the necessary steps needs to undertake for the proceeding towards commercialization of his product?	**5**	**3**
10.	Comment on how the tissue engineering strategies is promising to get rid of and heal the myocardial damage caused by COVID -19.	**5**	**3**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	**(i)**	It is a process in which the movement of cells occurs in response to chemical/ mechanical signals. It occurs throughout life and it is considered as a major driving force for the various morphogenic events starting from embryonic development until cell death. Outline the process patterns using soluble signal mechanisms.	**(7)**	**1**	**2**
	(ii)	Explain how do you calculate the persistence time and the gradient based taxis behaviors.	**(7)**	**1**	**2**
		(OR)			
(b)	**(i)**	All tissues have their characteristic replacement and production rates. However, the time scale of the tissue varies with the type and the cell turnover rate also varies. Explain this concept with suitable examples.	**(7)**	**1**	**2**
	(ii)	Outline the role of cytokines and chemokines and how much concentrations needed to achieve effective signaling process.	**(7)**	**1**	**2**
12. (a)	**(i)**	Biological and chemical reactions in living cells are dramatically reduced at low temperature. Give a detailed description of the technique through which you can preserve cell culture and its characteristic features from the risk of genetic drift and cross-contamination with other cell lines.	**(10)**	**2**	**3**
	(ii)	Summarize the agents which helps to alter the freezing behavior of cells.	**(4)**	**2**	**3**
		(OR)			
(b)	**(i)**	Most tissue-engineered structures are meant to eventually find their way into humans to be used as a treatment or replacement. Give an outline about the design requirements of the system for attaining uniform cell distribution.	**(10)**	**2**	**3**
	(ii)	Describe such systems which might you use to engineer construct to improve its performance in terms of regeneration.	**(4)**	**2**	**3**
13. (a)	**(i)**	A constellation of intrinsic and extrinsic cellular mechanisms regulates the balance of self-renewal and differentiation in all stem cells. Categorize the above-mentioned cells based on their microenvironment.	**(10)**	**3**	**4**
	(ii)	Illustrate the technique which has been used to re-program these cells under in-vitro conditions.	**(4)**	**3**	**4**
		(OR)			
(b)	**(i)**	Explain the natural differentiating phenomenon through which the terminally differentiating cell to less differentiated from its own lineage.	**(10)**	**3**	**4**
	(ii)	Illustrate the process with any one type of cells to justify the full potential of these processes for regenerative medicine.	**(4)**	**3**	**4**

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			Marks	CO	RBT LEVEL
14. (a)	**(i)**	You have been hired by Health Canada as a consultant to assess tissue-engineered scaffolds and to suggest what products would fall under this designation and identify the major safety issues the must be considered when Health Canada is deciding whether to approve these constructs. Discuss the methods for the synthesis of a new class of devices.	**(10)**	**4**	**4**
	(ii)	Propose how porosity and other characteristics can be controlled and measured in scaffolds.	**(4)**	**4**	**4**
		(OR)			
(b)	**(i)**	Implantable 3D scaffolds are used for restoration and reconstruction of different anatomical defects of complex organs and functional tissues. Explain the types and properties of a biopolymers employed in preparation of scaffolds.	**(10)**	**4**	**4**
	(ii)	Discuss the pros and cons of using stem cells as the cell source in your tissue-engineered scaffold.	**(4)**	**4**	**4**
15. (a)	**(i)**	The outbreak of COVID -19 caused by SARS – CoV 2 affects the whole world and is likely to damage many organs and systems especially the cardiovascular system. Myocardial injury is one of the major symptoms and systemic inflammation increases the risk of prothrombic conditions. Also, the use of drugs used to treat COVID -19 has caused negative effects on the cardiovascular system. Comment how the tissue engineering strategies are promising to get rid of and heal the myocardial damage caused by COVID -19.	**(14)**	**5**	**4**
		(OR)			
(b)	**(i)**	Provide a report for the regulatory agency in which you detail with examples, the biological safety issues that should be considered before the approval of a Tissue engineering and Regenerative medicine product for clinical use. As a part of your report, consider the goals of tissue engineering and the need to reach an equitable balance between the benefit and risk of harm.	**(14)**	**5**	**4**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A medical device company that is in the business of commercializing biomaterials to be used for total hip replacement procedures. The femoral component of hip prostheses is generally fabricated from cobalt -based metal alloy. Discuss the concept with focus on how metal materials are impacted by a physiological environment, expected and potential immune system responses to the metal associated with an implant, as well as subsequent clinical manifestations.	**(10)**	**5**	**5**

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