Name:

Enrolment No:

UPES

End Semester Examination, May 2024

Course: Introduction to Biomedical Engineering

Semester: 2

Program: BT- Biomedical Engineering

Duration: 3 Hours

Course Code: HSBE1001 **Max. Marks: 100**

Instructions: Attempt all the questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	What is ECG?	1.5	CO2
Q 2	What is Computed Tomography (CT)?	1.5	CO1
Q 3	What are non-ionizing radiations?	1.5	CO1
Q 4	Define Nucleic acids.	1.5	CO4
Q 5	What are essential and non-essential amino acids?	1.5	CO2
Q 6	What are Cardiac pacemakers?	1.5	CO2
Q 7	What are the applications of "Implantable cardioverter-defibrillators"?	1.5	CO3
Q 8	Define "Cardiac resynchronization therapy (CRT)".	1.5	CO3
Q 9	Define basic principle of Hemodialysis.	1.5	CO3
Q 10	What is Vascular access surgery?	1.5	CO4
Q 11	Define "AV graft".	1.5	CO4
Q 12	What is the clinical application of Artificial Kidney Dialyzers?	1.5	CO3
Q 13	Draw the structure of adenine and guanine.	1.5	CO2
Q 14	What are Phosphodiester Bonds?	1.5	CO2
Q 15	What is the difference in the DNA Packaging in Cells Of Eukaryote and prokaryote?	1.5	CO1
Q 16	What is the difference between DNA and RNA?	1.5	CO1
Q 17	Name two techniques for detection of nucleic acids.	1.5	CO2
Q 18	What are primers?	1.5	CO1
Q 19	Define "point-of-care".	1.5	CO3
Q 20	Define Protein engineering.	1.5	CO4

Section B

(4Qx5M=20 Marks)

Q 1	How do medical x-rays work?	**5**	**CO2**
Q 2	Explain the working of Single-frame x-ray tomosynthesis (SFXT)?	**5**	**CO3**
Q 3	How are RNA aptamers selected from random libraries, such as plasmid DNA, and what are the advantages of using aptamers in biomedical applications?	**5**	**CO4**
Q 4	Explain the structural features of DNA and RNA molecules and how they contribute to their diverse functions in cellular processes?	**5**	**CO3**
Section C (2Qx15M=30 Marks)			
Q 1	Case Study: Cell & Protein Engineering in Biopharmaceuticals Introduction: In the biopharmaceutical industry, advancements in cell and protein engineering have revolutionized drug development and production. This case study examines a fictional biotech company, BioGenix, which specializes in developing novel therapies using cutting-edge cell and protein engineering techniques. Company Overview: BioGenix focuses on developing therapies for rare genetic diseases and oncology. Their flagship product is a recombinant protein therapy for a rare metabolic disorder. The company is committed to advancing precision medicine through innovative cell and protein engineering approaches. Case Study Scenario: BioGenix is developing a new therapy for a rare type of cancer that currently lacks effective treatment options. The therapy involves engineering patient-derived immune cells to recognize and target cancer cells specifically. Additionally, they are designing a novel protein-based drug to enhance the immune response against cancer cells. 1. What are the key challenges in developing personalized cell therapies for cancer treatment? (2) 2. Discuss the role of protein engineering in enhancing the efficacy and specificity of cancer therapies. (2) 3. How can BioGenix ensure the safety and efficacy of their engineered cell therapy? (2) 4. Explain the process of engineering immune cells for cancer immunotherapy. What are the critical steps involved? (2) 5. What are the potential ethical considerations associated with personalized cell therapies, and how can BioGenix address them? (2) 6. Describe the importance of optimizing protein stability and pharmacokinetics in drug development. How can	**15**	**CO2**

	protein engineering techniques be employed for this purpose? (2) 7. What are the regulatory challenges faced by companies like BioGenix in bringing novel cell and protein-based therapies to market? (2)		
Q 2	Explain RNA aptamer and their applications.	**15**	**CO2**
Section D (2Qx10M=20 Marks)			
Q 1	Describe the process of SELEX (Systematic Evolution of Ligands by Exponential Enrichment) and its significance in identifying aptamers with high affinity and specificity for target molecules.	**10**	**CO3**
Q 2	How do advances in cell and protein engineering contribute to the development of innovative therapies, such as gene editing, cell-based immunotherapies, and enzyme replacement therapies?	**10**	**CO4**