Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - VII EXAMINATION - WINTER 2025

Subject Code: 3170418 **Date: 28-11-2025**

Subject Name: Biomaterials

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Describe the characteristics of the nanofibrils on the outer surface of the abalone foot tissue, and how do they contribute to adhesion?	**03**
	(b)	Describe the structure of the chameleon skin, including the layers involved.	**04**
	(c)	What are the key structural components of myosin motor proteins, and how do they vary among different isoforms? Describe the formation and function of higher-order assemblies of Myosin II, emphasizing its role in cellular processes.	**07**
Q.2	**(a)**	What are the applications of DNA nanotechnology, and how can it be utilized in smart therapeutics and drug delivery?	**03**
	(b)	What is the significance of Lab-on-a-chip (LOC) devices, and how do they contribute to the miniaturization and automation of assay functions?	**04**
	(c)	Can you provide examples of LOC devices used for the detection of malaria, and how do they operate?	**07**
		OR	
	(c)	Explain the significance of scaffolds in tissue engineering and the purposes they serve. Why is a three-dimensional scaffold preferred over two-dimensional structures in tissue engineering?	**07**
Q.3	**(a)**	How do bacterial (Escherichia coli) flagellar motors function in terms of propulsion, and what role does the rotation of helical filaments play in their movement?	**03**
	(b)	Explain the microstructure of spider dragline silk and how it contributes to its mechanical behavior.	**04**
	(c)	How does tissue engineering contribute to addressing ethical concerns in the meat industry, particularly in avoiding traditional slaughterhouses and minimizing animal killing?	**07**
		OR	
	(a)	What is bio ink, and how is it used in the organ printing process?	**03**
	(b)	Describe the cutting mechanism and hierarchical tooth structure of the piranha	**04**

	(c)	What are the three approaches to synthesize carbon nanotubes, and how do they differ?	**07**
Q.4	**(a)**	Describe the process of making nanofiber-based scaffolds using peptides, and what are the advantages of these scaffolds?	**03**
	(b)	What are the advantages and disadvantages of bottom-up and top-down approaches to nanomaterial production?	**04**
	(c)	What is the role of green synthesis in nanomaterial production, and how do plants and microbes act as bio-nanofactories?	**07**

OR

	(a)	Why is the biological method preferred for synthesizing nanoparticles?	**03**
	(b)	How can viral capsids be utilized in nanoparticle synthesis, and what is their resemblance to a nano container?	**04**
	(c)	How can microscopy be used as a means of characterization of nanoparticles?	**07**
Q.5	**(a)**	What are the two primary strategies extensively utilized for the production of nanoparticles (NMs) through bacterial involvement?	**03**
	(b)	Describe the process of electrospinning and its advantages in producing nano fibers for tissue engineering.	**04**
	(c)	Describe the structure, properties, and degradation behavior of Polycaprolactone	**07**

OR

	(a)	How do microalgae, both unicellular and multicellular, contribute to the biological synthesis of nanoparticles, and what applications are associated with the synthesized nanoparticles?	**03**
	(b)	Why is hydrophilicity important in materials used for nano scaffolds in tissue engineering, and how can it be measured?	**04**
	(c)	Explain the biosynthesis and degradation pathways of Hyaluronic Acid in the body.	**07**

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