BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc./MSc./Pre PhD **SEMESTER : IX/III/I**
BRANCH: PHYSICS **SESSION : MO/2025**

SUBJECT: PH539 INTRODUCTION TO BIOPHYSICS AND BIOMATERIALS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	What is an electromagnetic wave? What are the different regions of the electromagnetic spectrum, and how are these regions used for various biomaterial characterisation techniques?	[5]	1,4	
Q.1(b)	What are the different types of chemical bonding and forces that exist in materials? How does the strength depend on bonding? Define: diffusion, viscosity and thermal conduction.	[5]	1,2	
Q.2(a)	Draw the structure of a eukaryotic cell, label its different organelles, and describe the function of each organelle.	[5]	1,2	
Q.2(b)	Discuss the physics of the Bio-membrane, cell membrane, Plasma membrane and its functions. Discuss the structure of lipid molecules.	[5]	2	
Q.3(a)	What are molecular machines? Discuss linear translatory motors, such as myosin and RNA polymerase.	[5]	2	
Q.3(b)	Describe the fundamentals of zeta potential and Debye length and calculate the Debye length for the blood.	[5]	2,3	
Q.4(a)	What are the basic principles of STM, AFM, CT scan and MRI? Discuss the construction and working of CT scan.	[5]	2	
Q.4(b)	Discuss the basic principles of FTIR and Raman Spectroscopy. What are the differences between them? Explain with the help of the spectra of each.	[5]	2,3	
Q.5(a)	Describe how UV-Visible spectroscopy can be used to find the band gap of hydroxyapatite.	[5]	2,4	
Q.5(b)	Discuss the true and engineering stress-strain curve. What can be a different mechanical failure in biomaterials? How can you strengthen the materials through heat treatment?	[5]	2	

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