Ref. No. : Ex/PG/BME/T/113A/2025

MASTER OF BIO-MEDICAL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025

FUNDAMENTALS OF BIOMATERIALS AND IMPLANTS

Time: 3h Full Marks: 100

1. Answer Any Ten Questions : 10 X 10 = 100

i. Define biomaterial. Classify biomaterials with examples alongwith comparative advantage and disadvantage of each type. Discuss mechanical property of each type with graphical representation. 2+5+3

ii. Write a short note on contact angle, critical surface tension and their implication in Biomedical Engineering.

iii. Find atomic packing factor for BCC crystal structure. Write the Co-ordination number of HCP crystal structure. Draw [021], (111). 5+1+4

iv. Classify polymers based on origin and thermal response with example. Differentiate between graft and branch co-polymer. What is the Glass transition temperature of polymer and what is its implication? 5+2+(2+1)

v. Using a TGA graph indicate how a. filler and moisture content b. Compositional analysis and Lifetime prediction; could be calculated. 10

vi. Difference between Optical microscopy, SEM and TEM with diagram. Graphically represent how rupture lifetime is related to creep stress.

vii. Differentiate between graft and branch co-polymer. Write a Short note on coating. What is zeta potential? What is its application in biomedical engineering? 3+4+(2+1)

viii. Write a short note on Extrusion. Name the processing through which fibers are made from polymer. All rubber, plastic and fiber are polymers-what are their major differences?

ix. Define a. Single Crystal, b. Frenkel defect, c. Ductility. Define and classify twin boundary.

x. By which technique mechanical property of ceramic material could be recorded. Explain effect of temperature on PMMA with respect to its mechanical property. Name the spectroscopic technique used to detect functional groups? Write a short note on its mechanism of detection. How unknown concentration of a solution of could be detected. Write the law involve in this detection.

xi. For UV light of wavelength 200nm. Calculate a. frequency, b. amount of energy absorbed by one molecule, c. amount of energy absorbed by one mole. Define stern theory. What is conjugation system (chemistry) and by which technique it is detected. 6+2+2

xii. What is Viscocity average molecular weight? A PVC sample has 50 mol% molecular weight 10,000 and 50 mol% molecular weight 20,000. Find M_w and M_n and polydispersity index, number average degree of polymerization, weight average degree of polymerization.