Exam. Code: 1015
Sub. Code: 35218

2055

M.E. (Mechanical Engineering)-Second Semester

MME-203: Advances in Engineering Materials

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, selecting atleast two questions from each Part.

x-x-x

PART-A

Q1(a)	How do the unique surface-to-volume ratios of nanomaterials enhance their mechanical or electrical properties in applications like sensors or batteries?	5
(b)	How does the interface between matrix and reinforcement affect the overall performance of a composite material?	5
Q2(a)	Why would you choose XRD over TEM for phase identification?	5
(b)	How can XRD be used to estimate the size of nanoparticles?	5
Q3 (a)	If you need both elemental and structural information, which combination of techniques would you choose and why?	5
(b)	How can SEM, EDS, and XRD complement each other in a failure analysis investigation?	5
Q4 (a)	Explain the working principle of Scanning Electron Microscopy (SEM). Discuss its applications, advantages, and limitations in the characterization of nano materials.	5
(b)	Describe the principle of Transmission Electron Microscopy (TEM). How does it differ from SEM? Highlight its role in determining the crystallographic structure of materials.	5
	PART-B	
Q5(a)	What are synthetic materials, and how are they different from natural materials? Write some common examples of synthetic materials?	5
(b)	What is the difference between thermoplastics, thermosets, and elastomers?	5
Q6(a)	Explain how fiber-reinforced polymer composites contribute to weight reduction, fuel efficiency, crash resistance, and design flexibility, while also addressing their processing challenges for aerospace and automobile applications.	5
(b)	Describe how materials like graphene and carbon nanotubes are transforming electronic device design in terms of flexibility, conductivity, and miniaturization.	5
Q7(a)	Explain how nanostructured materials improve the performance of batteries and supercapacitors, including their effect on charge/discharge rates, energy density, and lifecycle.	5
(b)	Describe the design considerations for developing a biodegradable polymer for drug delivery.	5
Q8(a)	What properties make titanium alloys suitable for load-bearing implants?	5
(b)	Explain the working principles and real-world applications of shape memory alloys (SMAs).	5

x-x-x