Exam Date & Time: 18-Jul-2022 (09:00 AM - 12:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIX SEMESTER B.TECH END SEMESTER MAE UP EXAMINATIONS, 2022

INTRODUCTION TO NANOTECHNOLOGY AND CHARACTERIZATION TECHNIQUES [BME 4305]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		"When size of a nanoparticle reduces, agglomeration increases" Justify the statement with appropriate reasons	(2)
	A)		
	B)	Discuss in detail the process of Ostwald ripening	(3)
	C)	Explain from La Mer's mechanism of nanoparticle growth with an example	(5)
2)		Explain microwave method of nanoparticle synthesis	(2)
	A)		
	B)	Compare physical vapor deposition method (PVD) and Atomic Layer Deposition (ALD) for nanomaterial synthesis	(3)
	C)	Design "Two-Microemulsion" nanomaterial synthesis method for the following reaction? $Zn(NO3)2 + 2NaOH$ à $ZnO + 2NaNO3 + H2O$ Zinc nitrate: - $Zn(NO3)2$, Sodium hydroxide: - NaOH, Sodium nitrate: - $2NaNO3$, Zinc oxide: - ZnO	(5)
3)		Describe the principle behind and operation modes of Atomic Force Microscopy	(2)
	A)		
	B)	Discuss the instrumentation of spectrophotometer	(3)
	C)	Propose and explain a synthesis method to prepare Nano fiber mesh of polymer polyvinyl alcohol (PVA) and ZnO nanoparticles	(5)
4)		Explain different sensing strategies using the principle of Surface enhanced Raman spectroscopy	(2)

A)

B) Explain the working principle of (Matrix-Assisted Laser Desorption/ionization-Time Of Flight Mass Spectrometry) MALD-TOF MS (3)

C) You have gold nanoparticles dispersed in water (colloidal solution of gold nanoparticles). Propose a characterization technique (other than microscopies) to find out the shape of the nanoparticles. Explain in detail the working principle of the characterization technique. (5)

5) Explain the working principle of Auger Electron Spectroscope. (2)

A)

B) The polymer polymethyl methacrylate (PMMA) thermally degrades in 3 steps. Research group wants to understand the changes in thermal degradation of the polymer when nanoparticles are added to it as filler material. Suggest an analysis method to study the thermal stability of the material. Explain the analysis method in detail. (3)

C) Explain the working principle of Gas Chromatography (5)

-----End-----