# **Question Paper**

Exam Date & Time: 10-May-2024 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

### VI SEM B. Tech (BME) DEGREE END SEMESTER EXAMINATIONS, APRIL-MAY-2024

#### INTRODUCTION TO NANOTECHNOLOGY AND CHARACTERIZATION TECHNIQUES [BME 4305]

#### Marks: 50

Duration: 180 mins.

MAIN

#### Answer all the questions.

1)	Select the sample with the highest surface energy among the three sets of cadmium selenide nanoparticles prepared by a researcher. Justify the selection.	(2)
	Sample 1: 20nm, shape: spherical Sample 2: 5nm, shape: spherical Sample 3: 10nm, shape: cubic	
2)	The Lycurgus cup, a Roman glass cage cup dating back to the 4th century, exhibits varying colors depending on the direction of transmitted light. Comment on the type of nanomaterials potentially employed in creating such glasses. Substantiate your speculation with theoretical rationale.	(3)
3)	Apprise the theory behind the formation of monodispersed ZnO nanoparticles based on LaMer's nucleation model. (Zinc acetate and sodium hydroxide reacts to form Zinc oxide)	(5)
4)	Explain precipitation reaction for synthesis of nanomaterials.	(2)
5)	Propose a synthesis method to prepare aerogels and explain the procedure in detail.	(3)
6)	A student intends to synthesize zinc oxide nanorods via the hydrothermal method, utilizing zinc nitrate hexahydrate and sodium hydroxide as reactants. Develop the experimental setup and procedure for conducting the synthesis. Recommend key experimental parameters to be adjusted to optimize the synthesis protocol.	(5)
7)	Explain the basic difference in the instrumentation of DLS and Zeta potential analyzer.	(2)
8)	Discuss the instrumentation and working principle of Transmission Electron Microscopy.	(3)
9)	Explain the Chemical Vapour Deposition method to synthesize nanostructures in detail.	(5)
10)	Describe elastic and inelastic interactions of electrons with matter.	(2)
11)	Discuss the noncontact imaging mode of Atomic Force Microscope	(3)
12)	A student prepared ZnS nanoparticles using Zinc nitrate and sodium sulphide as reactants and functionalized with oleic acid molecules. Suggest a characterization technique to understand the nature of this surface functionalization.	(5)
	Justify your suggestion with a detailed explanation of the characterization technique.	
13)	Compare the working of reverse phase and normal phase HPLC.	(2)
14)	Explain the working principle of Raman spectroscopy with diagram.	(3)
15)	A student wants to study the thermal degradation of a polymer nanocomposite to change in temperature from 30°C to 700°C. Suggest a characterization technique. Explain the suggested	(5)

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