Question Paper

Exam Date & Time: 02-Dec-2023 (02:30 PM - 05:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

VII SEM B. Tech (BME) DEGREE END SEMESTER EXAMINATIONS, INTRODUCTION TO BIOMEDICAL NANOTECHNOLOGY (BME 4053)

Introduction to Biomedical Nanotechnology [BME 4053]

Marks: 50

Duration: 180 mins.

Descriptive

Section Duration: 180 mins

Answer all the questions. Answer all the questions

1A)	A research scholar prepared 3 samples of cadmium selenide nanoparticles without any surface functionalization. She found out that the nanoparticles in sample 1 had a diameter of 10nm, sample 2 had a 50 nm diameter, and set 3 had a 70nm diameter. Choose the sample that contains nanoparticles with maximum surface energy. Justify the selection.	(2)
1B)	The 4th-century Roman glass cage cup called the Lycurgus cup shows different colours depending on whether the light passes through it. Speculate the type of nanomaterials used to develop these types of glasses. Justify your answer with a detailed theoretical explanation.	(3)
1C)	Apprise the theory behind the formation of Cadmium Selenide quantum dots by 2023 Nobel prize winner Dr. Moungi Bawendi based on Lamer's mechanism.	(5)
2A)	Compare sonochemical and microwave synthesis methods for nanomaterial synthesis.	(2)
2B)	Summarize the sol-gel preparation method for nanomaterial synthesis and decide the drying condition to get aerogels.	(3)
2C)	A student wants to prepare zinc oxide nanorods in hydrothermal method. The reactants are zinc nitrate hexahydrate and sodium hydroxide. Design the experimental apparatus and experiment method for the synthesis. Suggest the major experimental conditions to vary for optimizing the synthesis procedure.	(5)
3A)	Suggest the method to find out the crystallite size of a nanomaterial and explain the equation for the same.	(2)
3B)	A student prepared ZnO nanoparticles using Zinc nitrate and NaOH as reactants and functionalized it with oleic acid molecules.	(3)
	Suggest a characterization technique to understand the nature of this surface functionalization.	
	Justify your suggestion with detailed explanation on the characterization technique.	
3C)	The band gap of bulk zinc oxide particles is 3.36ev. Predict the changes in the optical absorption and luminescence spectra if particle size reduces to nanoscale and defects are formed in the crystal lattice. Justify the prediction.	(5)
4A)	Explain the procedure to obtain the excitation spectra of the cadmium selenide quantum dots.	(2)
4B)	Suggest a characterization technique to understand the hydrodynamic diameter of the nanoparticles. Explain the working principle of the instrument.	(3)
4C)	Develop a nanodrug delivery system in which FRET triggers drug delivery.	(5)
5A)	Explain the enhanced permeability and retention (EPR) effect.	(2)
5B)	Comment on the application of nanoparticles as therapeutic agents based on the details below.	(3)

Hydrophilicity and hydrophobicity of nanoparticlesNanoparticles with a hydrodynamic diameter of 3nm, 30nm, and 300nm

5C) Design a nanoparticle contrast agent (a single nanosystem) for optical and MRI multimodal imaging. (5) Justify the design.