Question Paper

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

MANIPAL ACADEMY OF HIGHER EDUCATION

7TH SEMESTER B.TECH MAKEUP EXAMINATIONS, DEC 22

Introduction to Biomedical Nanotechnology [BME 4053]

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

A

Answer all the questions.

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

1)		Mr. X is preparing ZnO nanoparticles using Zinc nitrate and NaOH as reactants. Explain multiple steps in the growth process of ZnO nuclei? Recommend a method to limit the growth of ZnO nanoparticles to form monosized ZnO nanoparticles	(3)
	A)		
	B)	Ms. X have prepared 3 samples of Quantum dots. Sample details are given below: Sample 1 :- contains Quantum dots with diameter 2 nm Sample 2 :- contains Quantum dots with diameter 5 nm Sample 3 :- contains Quantum dots with diameter 10 nm Speculate the change in the band gap of the quantum dots with respect to size. Justify your answer with appropriate reasons	(2)
	C)	Ms. X have prepared gold nanoparticles diameter 2 nm, diameter 5 nm, and diameter 10 nm Which one of these samples will have maximum surface energy? Justify your answer with appropriate reasons.	(5)
2)		Describe physical vapor deposition method (PVD) for nanomaterial synthesis	(3)
	A)		
	B)	Explain the synthesis of ZnO nanorods using Zinc nitrate and NaOH as reactants by hydrothermal method.	(2)
	C)	Design a synthesis strategy (combining different synthesis methods) to prepare Poly vinyl alcohol (PVA) - Zinc Oxide quantum dot (ZnO QD) nanofiber composite film. You have zinc nitrate hexahydrate and sodium hydroxide as reactants both will dissolve in polar solvents (water). à ZnO + 2NaNO3 + H2OZinc nitrate: - Zn(NO3)2, Sodium hydroxide: - NaOH, Sodium nitrate: - 2NaNO3 Zinc oxide: - ZnO. Poly vinyl alcohol (PVA) is a polymer which is soluble in water.	(5)
3)		Mr. X have prepared zinc oxide nanoparticles (ZnO)	(3)
	A)	Suggest a characterization technique to find the crystallite size of the nanoparticles. Justify your suggestion with detailed explanation on the characterization technique.	
	B)	Explain the characterization technique which can be used to measure luminescence of the	(2)

nanoparticles.

C) Ms. Y have prepared doxorubicin entrapped porous silica nanoparticles for targeted drug delivery. She is not sure about the stability of this nanoparticles in aqueous solutions. Suggest a characterization technique. (5)

Justify your suggestion with detailed explanation on the characterization technique.

4) Design a specific drug delivery system for ultrasound induced drug delivery (3)

A)

B) Design a nano-system which can act as a PET and CT imaging contrast agent. Justify your design concepts. (2)

C) Design a strategy for drug delivery in which release of the drug will be activated by Fluorescence Resonance Energy Transfer (FRET). (5)

5) Develop a design strategy to develop magnetic field induced drug delivery systems (3)

A)

B) Explain the concept of photothermal therapy and detail the application of nanotechnology in photothermal therapy. (2)

C) Develop a strategy to develop FET (Field Effect Transistor) based glucose sensor (5)

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