Question Paper

Exam Date & Time: 08-Jan-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

MAKEUP EXAM

Introduction to Biomedical Nanotechnology [BME 4053]

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

MAKEUP EXAM

Answer all the questions. Section Duration: 180 mins

1A)	A research scholar prepared 3 samples of gold nanoparticles. Suggest a method to confirm the formation of nanoparticles without using any characterization technique. Explain the theory.	(2)
1B)	"As size reduces, surface energy increases." Justify the statement.	(3)
1C)	A researcher has zinc nitrate and sodium hydroxide, which are soluble in polar solvents and react to form ZnO. He also has a nonpolar solvent (cyclohexane), a polar solvent (distilled water), and a surfactant. Can you develop a procedure for efficient synthesis of ZnO QDs using all the reagents with justification.	(5)
2A)	Compare hydrothermal and precipitation methods for nanomaterial synthesis.	(2)
2B)	Summarize the sol-gel preparation method for nanomaterial synthesis and decide the drying condition to get xerogels.	(3)
2C)	Formulate a synthesis method to make a porous 3D scaffold for tissue engineering. Suggest the changes in the experimental parameters to make nano/microporous structures to control cell adhesion and proliferation	(5)
3A)	Suggest the modification need to do in the characterization procedure to image the folic acid receptors on a cell using AFM.	(2)
3B)	Suggest a characterization technique to determine the nanomaterial's colloidal stability and explain the instrument's working principle.	(3)
3C)	In an experiment, titanium dioxide nanoparticles were supposed to be attached over a macrophage surface. Suggest an imaging method to understand the titanium dioxide nanoparticle attachment over the macrophage surface. Explain the imaging process in detail.	(5)
4A)	Explain the procedure to obtain the emission spectra of zinc sulphide doped with manganese quantum dots.	(2)
4B)	The students were synthesizing zinc oxide quantum dots functionalized with oleic acid. Suggest a characterization technique to confirm the functionalization of quantum dots with oleic acid. Explain the working principle of the instrument.	(3)
4C)	Develop a nanomaterial system that delivers a chemotherapeutic drug doxorubicin. The drug delivery needs to be controlled by the changes in the pH.	(5)
5A)	Explain the working principle of FET (field effect transistor) based nano biosensor for glucose detection.	(5)
5B)	Design a nanoparticle system for photothermal therapy and deliver a chemotherapeutic drug to the tumor tissues. Justify the design and working principle.	(3)
5C)	Design a nanoparticle contrast agent (a single nanosystem) for CT and MRI multimodal imaging. Justify the design.	(2)

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