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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2026

B.Tech-VI Semester (BT)

Course Code (Credits):18B1WBT633 (3) Max. Marks: 35

Course Name: NanoBiotechnology

Course Instructor: Dr. Abhishek Chaudhary Max. Time:2.0 Hour

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculators is not allowed

Q.No	Question	CO	Marks
Q1	Passive drug delivery systems leverage natural physiological processes and transport therapeutic agents to target sites without active targeting ligands and play a crucial role in targeted therapy." a. Discuss the principles of passive drug targeting in drug delivery systems b. Explain the Enhanced Permeability and Retention (EPR) effect and the role of the Reticulo-endothelial System (RES) in influencing drug distribution, efficacy, and clearance c. Also discuss the advantages and limitations of passive targeting in drug delivery systems.	CO-4	2+4+2
Q2	Fluorescence spectroscopy is a highly sensitive and widely used analytical technique for studying molecular interactions, biomolecular structure, drug analysis, environmental monitoring, and nanomaterial characterization. 1. Discuss the principle and applications of fluorescence spectroscopy as an analytical tool. 2. Discuss important concepts such as Stokes shift, quantum yield, quenching, and fluorescence lifetime. 3. Comment on the effect of polar and non polar solvent on emission spectra of a fluorophore.	CO-3	3+2 +2
Q3	Heavy metal contamination by toxic ions such as Pb, Hg, and As poses a major threat to environmental sustainability and human health due to their persistence, bioaccumulation, and toxicity. Among various nanotechnology-based analytical approaches, colloidal gold nanoparticles (AuNPs) have emerged as highly sensitive and selective colorimetric sensors for the rapid detection of mercury ions (Hg^{2+}). 1. Explain the mechanism of Hg^{2+} detection, including nanoparticle aggregation/disaggregation or Au–Hg interaction. 2. Describe the role of surface functionalization and selectivity toward Hg^{2+} ions. 3. Illustrate the sensing mechanism with a neat, well-labeled diagram.	CO-5	2+2+3

	4. Highlight the advantages, limitations, and environmental significance of AuNP-based colorimetric detection systems.		
Q4	Nanotechnology is an excellent example of an emerging technology, offering engineered nanomaterials with the great potential for producing products with substantially improved performances. There are various methods (PVD, Chemical reduction, Laser ablation, Biogenic etc.) to develop nanomaterial of different size and shape. a. Which methods you will prefer to synthesize biocompatible colloidal nanoparticles for targeted drug delivery application and why? Explain the synthesis mechanism in detail b. Identify the key requirements for nanoparticles used in targeted drug delivery	CO-2	5+2
Q5	The properties of materials at nanoscale ranging from 1 to 100 nanometers are significantly influenced by their large surface area relative to their volume. Suppose a spherical nanoparticles has a diameter of 20 nm. • Calculate the surface area to volume ratio of above sphere. • Compare the surface area to volume ratio of 20 nm nanoparticles with a microparticle of diameter 2 μm. • Comment on how this difference influences reactivity.	CO-1	2+2+2