

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2026

MSc-II Semester (BT)

Course Code (Credits): 20MSWBT231 (2)

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	Marks
Q1	Targeted drug delivery systems represent a significant advancement in cancer therapeutics by enhancing drug accumulation at the tumor site while minimizing systemic toxicity. Critically discuss the design and application of targeted drug delivery systems with reference to Breast Cancer. In your answer, address the following aspects in a well-structured manner: - Explain the limitations of conventional chemotherapy and justify the need for targeted drug delivery. - Describe the molecular basis of ligand-mediated targeting, highlighting the over-expression of folate receptors in breast cancer cells. - Design a folic acid-functionalized drug delivery system (e.g., liposomes, polymeric nanoparticles, or dendrimers), explaining drug loading, surface modification, and targeting efficiency. - Highlight recent advances and potential future directions in targeted nanomedicine for cancer treatment	2+2 +3+2
Q2	A benign tumor was surgically removed from a patient, and medical examination revealed that the tumor had a diameter of 20.0 cm. Assuming that the tumor is perfectly spherical and composed entirely of closely packed spherical tumor cells, each having a radius of 100 nm, estimate the total number of cells presents in the isolated tumor. Assume that there is no empty space between the cells.	4
Q3	A biotechnology company has recently developed a novel colloidal nano-system exhibiting exceptional optical properties with strong potential for biosensing applications. As the company is preparing to patent this nano-system, the research team has decided to focus on the development of a glucose biosensor for diabetic monitoring applications. You have been appointed as the lead scientist of a multidisciplinary research team tasked with designing a highly efficient, selective, and patient-friendly glucose biosensor based on this nano-system. Discuss the scientific strategies you would adopt for the successful development of this glucose biosensor.	4+2

	b. Also discuss the selection and functionalization criteria of the nano-system for glucose recognition	
Q4	A patient suffering from minor burn injuries requires rapid and effective skin regeneration to restore the damaged tissue and prevent infection. As a biomedical engineer, you have been assigned to design a tissue-engineered skin substitute for wound healing applications. 1. Discuss the principles and approaches involved in the development of engineered skin tissue for minor burn treatment. 2. Selection criteria of suitable biomaterials and scaffold design 3. Role of cells (fibroblasts, keratinocytes, stem cells) in skin regeneration 4. Importance of growth factors and extracellular matrix components 5. Clinical applications and future prospects of tissue-engineered skin substitutes in burn therapy	3+1+ 1+1+2
Q5	As a nanobiotechnology researcher, design a detailed experimental strategy for the synthesis and characterization of nanoparticles. In your answer, discuss the following aspects: 1. Criteria for the selection of suitable synthesis approaches (top-down and bottom-up methods) 2. Role of reducing agents, stabilizers, and reaction conditions in nanoparticle formation 3. Comparison of physical, chemical, and biological methods of nanoparticle synthesis 4. Techniques used for nanoparticle characterization, including particle size, morphology, surface charge, crystalline, and optical properties	2+2+ 2+2