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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2026

MSc-II Semester (BT)

Course Code (Credits): 20MSWBT231 (2) Max. Marks: 25

Course Name: Nanobiotechnology

Course Instructor: Dr. Abhishek Chaudhary Max. Time: 1.5 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	A research scholar attempted to observe binary fission under an optical microscope using an illumination source of wavelength 800 nm. Even after proper adjustment and focusing of the slide, the stages of division could not be observed clearly. Later, the scholar replaced the light source with one of wavelength 200 nm and was then able to observe the dividing cells. Explain the reason for this observation. Also calculate and compare the resolving power of the microscope in both cases. If the magnifying powers of the objective lens and eyepiece are 15× and 2.5×, respectively, determine the total magnifying power of the microscope.	5
Q2	Electron microscopy (EM) is an advanced imaging technique used to obtain high-resolution images of biological and non-biological specimens. It is widely employed in biomedical research to examine the ultrastructure of tissues, cells, organelles, and macromolecular complexes. 3+1+2 a. Describe the working principle of a transmission electron microscope (TEM) with a neat, well-labelled diagram. b. Explain the significance of the goniometer and elastically scattered electron in TEM microscopy. c. Describe the various types of electron sources used in electron microscopy and explain the emission processes by which electrons are generated.	3+1+2
Q3	The atomic force microscope (AFM) is widely used in materials science and has found many applications in biological sciences including topography analysis of soft biological materials in their native environments. 3+2+2 a. Discuss how Atomic Force Microscopy (AFM) can be utilized for the size and morphological characterization of nanomaterial and biological molecules. b. Explain various AFM modes in terms of their working mechanism. c. Also enlist the advantages, limitations, and applications of AFM microscopy.	3+2+2

Q4	What do you understand by DLS, explain its principle, instrumentation, and data analysis? Discuss the Stokes–Einstein equation and its application in calculating the hydrodynamic diameter of nanoparticles suspended in a fluid. Also elaborate its advantages, limitations, and applications	5
Q5	Discuss the major approaches used for the preparation of nanoparticles, and explain the factors that influence their size, shape, and stability.	2