

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION- 2023
M.Tech-II Semester (BT)

Course Code (Credits):11B1WBT840 (3)

Max. Marks: 35

Course Name: NanoBiotechnology

Course Instructors: Dr. Abhishek Chaudhary

Max. Time: 2 Hours

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

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

1. Environmental pollution derivatives from toxic metals and organic toxins is becoming a serious issue worldwide because of their harmful effects on the ecosystem and human health. How you will develop extremely selective and cost-effective colorimetric sensor which can be used for simultaneous recognition of Hg^{2+} and Pb^{2+} . You may use green synthesized gold nanoparticles for the development of above sensor. Describe all the steps in details [6]
2. A chromophore is used as contrast agent to diagnose a tumor in a patient. After injecting, chromophore form a layer around tumor cell of thickness 10 nm and cover an area of 500 cm^2 . Calculate the minimum volume of chromophore required to stain all the cells of tumor. [3]
3. Regenerative medicine deals with the "process of replacing, engineering or regenerating human or animal cells, tissues or organs to restore or establish normal function. It has been observed that the regenerative construct should contain appropriate components to mimic the functions of the native tissue. [6]
 - a. Related to Regenerative medicine concept, discuss how you will develop an artificial tissue to repaired damage organ. Illustrate with neat and clean diagram.
 - b. Explain the mechanisms in which biomaterials might affect adaptive immune responses such as to tissue-engineered constructs.
4. AFM is ideally suited for characterizing NPs and NMs. It offers both qualitative and quantitative information on many physical properties including size, morphology, surface texture and roughness. Detail out the working principle of AFM with neat and clean diagram and explain various mode of operation used in AFM [5]
5. The first electronic absorption band maximum of a polar and relatively rigid aromatic molecule appears at 310 nm but its fluorescence maximum in acetonitrile solution appears with a large Stokes shift at 450 nm. What are the most likely reason for the Stokes shift, justify the your answer. Also calculate the spin multiplicity of singlet excited and triplet excited state.[3]

6. Cancer remains the one of the most common causes of mortality in humans; thus, cancer treatment is currently a major focus of investigation. Recent advances in cancer nanotechnology have raised exciting opportunities for specific drug delivery by an emerging class of nanotherapeutics that may be targeted to neoplastic cells, thereby offering a major advantage over conventional chemotherapeutic agents. There are two ways by which targeting of nanoparticles may be achieved, namely passive and active targeting. Detail out passive drug targeting and the significance of RES and EPR system in Passive Targeting. Also write the name of carrier you may use in passive targeting. How passive targeting differ from active targeting? [6]
7. A variety of environmental factors affect fluorescence emission, including interactions between the fluorophore and surrounding solvent molecules (dictated by solvent polarity). The effects of polarity vary widely from one fluorophore to another, but emission spectra, as well as quantum yields, can be heavily influenced by environmental variables. Detail out the mechanism of solvent effect on emission spectra and quantum yields. In the same line, explain the impact of solvent polarity on fluorescence emission spectra using hexane as nonpolar solvent and water as polar solvent. [6]