

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

Course Code (Credits):20MSWBT231 (2)

Max. Marks: 35

Course Name: Nano-Biotechnology

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. Extreme loss of skin function and structure due to injury and illness will result in substantial physiological imbalance and may ultimately lead to major disability or even death. As much as it is claimed that tissue-engineered skin is now a reality to treat severe and extensive burns, then how will you produce skin through tissue engineering. Also mention the basic clinical goals and fundamental challenges of tissue engineering. [5]
2. Rapid and high precision detection of toxic metal ions is one of the chief requirements today to combat environment pollution. Metal nanoparticles play a key role in this by assisting the development of smart sensors and detection agents. Their high surface to volume ratio and unique optical property facilitates the development of high sensitive analytical nanoparticles based bio-sensing tools. How will you design a sensor for heavy metal detection using nanoparticles, give detail mechanism with suitable example? [5]
3. A transmission electron microscope operated at 350KV using ZrO as electron source to generate a electron beam of wavelength 50 Å but unable to give good image of sample due to low resolution. To get high resolution image CFE filament is used instead of ZrO which generate electron beam of 0.5 Å. Compare the resolving power of microscope in both cases (in presence of ZrO and CFE filament). Also write down the difference between optical microscope and transmission microscope [3].
4. In recent years, the development of nanoparticles has expanded into a broad range of clinical applications. Nanoparticles have been developed to overcome the limitations of free therapeutics and navigate biological barriers systemic, microenvironmental and cellular those are heterogeneous across patient populations and diseases. Based on the above advantages of nanodrug delivery system, how you will design a targeted drug delivery system for the treatment of Breast Cancer, give detail explanation with all steps. You may use Daunorubicine as a model drug. In the same line write the name of any two FDA approved nanodrug available for clinical uses. [6]

5. One of the most important steps in nanomaterial development is to characterize nanomaterial with different analytical and microscopic technique to know the size, shape and stability of nanomaterial. There are multiple technique available to characterize nanomaterial (TEM, SEM, AFM, DLS, Zeta Potential etc) which technique you will use to get the 3D image of your sample and why? Also write down the working principle of dynamic light scattering and its advantages and disadvantages. [5]
6. Electron microscopy is a technique that allows obtaining high-resolution images of biological and non-biological specimens. It can be used in biomedical research to examine the detailed structure of tissues, cells, organelles and macromolecular complexes. Illustrate the working mechanism of transmission electron microscope and limitations associated with it. [4]
7. A benign tumor having spherical tissue mass is isolated from the patient using biopsy. The diameter of isolated tumor mass was observed around 8.0cm. If the radiuses of single cells of tumor are equal to 100 nm then calculate the total number of cells present in tumor. [2]
8. Nanoparticles are rapidly being developed and trialed to overcome several limitations of traditional drug delivery systems and are coming up as a distinct therapeutics for cancer treatment. Conventional chemotherapeutics possess some serious side effects including damage of the immune system and other organs with rapidly proliferating cells due to nonspecific targeting. Conventional system also has some limitations in term of lack of solubility, and inability to enter the core of the tumors resulting in impaired treatment with reduced dose and with low survival rate. Using nanomedicine concept you can overcome most of the limitations associated with conventional system, explain how? Also explain the significance of EPR system in the development of drug delivery system. [5]