JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
Test -3 Examinations -2022
M.Sc-II Semester (BT)

Course Code (Credits): 20MSWBT231 (2) Max. Marks: 35
Course Name: NanoBiotechnology
Course Instructors: Dr. Abhishek Max. Time: 2 Hours

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. Tissue engineered constructs have been developed or are under development for a number of tissues (skin, cartilage, bone) and organs (heart, liver, kidney). It has been stated that the construct should contain appropriate components to mimic the functions of the native tissue. [5]

a) Related to tissue engineering of skin and the design components, discuss which models have been used and how these can lead to a construct which can mimic the function of native skin tissue.
b) Explain the mechanisms in which biomaterials might affect adaptive immune responses such as to tissue-engineered constructs.

Q2. You are employed by a company who has recently discovered a novel colloidal nano-system that seems to have excellent optical properties. Your company is currently in the process of patenting this nano-system as they see significant potential for using it in biosensing applications. One of the scientists has suggested that the patent be targeted to a specific application and after lengthy discussions, it has been decided that the glucose will be the target analyte. You have been placed on a team to research the issues surrounding the development of glucose biosensor using the above nano-system. How will you lead the team to developed highly efficient and selective glucose biosensor which can be efficiently utilized by diabetic patient? [5]

Q3. An electron microscope operated at 300KV using W as a filament generate a electron beam of wavelength 100 À but unable to give high resolution image. To get high resolution image LaB6 filament is used instead of W which generate electron beam of 0.1 À. Compare the resolving power of microscope in the presence of W and LaB6 filament. Also write down the significance of backscattered electron in SEM imaging [3].

Q4. A spherical tissue mass is isolated from the body of a patient using biopsy. The diameter of isolated tissue mass was observed around 16.0cm. If the radius of each cells of tissue is equal to 200 nm then calculate the total number of cells present in isolated tissue mass. [2.5]

Q5. A dye is used as contrast agent to diagnose a tumor in a patient. After injecting, dye form a layer around tumor cell of thickness 10 nm and cover an area of 500 cm2. Calculate the minimum volume of dye required to stain all the cells of tumor. [2.5]

Q6. A large number of researchers working on the development of various drug delivery approaches so that we can get maximum therapeutic efficacy and minimum side effect. To achieve desired therapeutic effect using Passive Drug Delivery system detail out the importance of EPR effect and also explains the significance of RES system in inverse drug delivery system [5]

Q7. Targeted drug delivery approaches can be used to maximize therapeutic efficacy and minimize side effects. To achieve desired targeted therapy of Doxorubicin drug against breast cancer, detail out the selection criteria of ideal drug delivery carrier for doxorubicin delivery. Also detail out the vesicular and microparticulate nano-carriers system for targeted drug delivery system. In the same line write the name of any two FDA approved nanodrug available for clinical uses. [6]

Q8. Higher reactivity levels of nanomaterials make them attractive for introduction into products and production processes but this reactivity also applies to biological processes and we know that nanomaterials can travel further into the body via inhalation, absorption, ingestion and causes toxicity like cancer, cardiovascular toxicity and environmental problems. [6]

a) What properties affect the transport and toxicity of nanomaterials?
b) How do nanoparticles accumulate in the body?
c) How do nanoparticles behave in the natural environment? and their impact on human health.