**ST JOSEPH’S UNIVERSITY, BENGALURU -27**

**M.Sc. Biotechnology- II SEMESTER**

**SEMESTER EXAMINATION: APRIL 2024**

**(Examination conducted in May/June 2024)**

**BTDE 8622: NANOBIOTECHNOLOGY**

**(For current batch students only)**

Registration Number:

Date & Session:

**Time: 2 hours Max Marks: 50**

**This paper contains TWO printed pages and THREE parts.**

**INSTRUCTIONS: Draw diagrams wherever necessary using black or blue ballpoint pen.**

**PART A**

**Answer any SEVEN of the following 2m x 7 = 14 marks**

1. What are integrins? How are they relevant in nanobiotechnology?
2. How is the behavior of charges relevant in understanding behavior of materials?
3. Comment on the statement: Degree of polarizability of a material is dependent on its dielectric permittivity.
4. Which among the two processes of self-assembly and self-organization require energy? How is this energy spent in this process?
5. What is DNA origami? How is it useful in DNA computing?
6. Mention any two precursor materials that can be used for preparing gold nanoparticles from plant extracts.
7. What are the means through which hyperthermia can be achieved using nanosystems?
8. Why is surface modification of nanoparticles important for cancer therapy?
9. Explain any one testing method to quantitatively study nanoparticle-induced toxicity in cells.

**PART B**

**Answer any FOUR of the following: 5m x 4 = 20 marks**

1. How does Langmuir-Blodgett technique assist in the arrangement of molecules at air-water interface? State any two scenarios where such a method can be employed. (3+2)
2. What are Nano-barcodes? How does the super-paramagnetic effect of nanoparticles assist magnetotactic bacteria? Mention two applications of bacteriorhodopsin. (1+3+1)
3. What is a nano-biosensor? Mention two advantages of using nanomaterials in biosensors. Explain any two characteristics of a nano-biosensor. (1+2+2)
4. Explain how nano-mechanobiology is relevant for modern cell biology? Give two examples of materials used in preparing the microfluidic devices required for the same. (3+2)
5. Design a flowchart showing the steps required to fabricate a solar energy device using nano-chitosan.
6. What are the biosafety concerns associated with production of nanomaterials? How would one address such issues?

**PART C**

**Answer any TWO of the following: 8 x 2 = 16 marks**

1. How is polarization of a material different from magnetization? How does drift velocity impact conductivity in a material? Explain mechanical milling and laser ablation approaches of nanomaterial synthesis. (2+2+4)
2. A scientist is planning to develop a silver nanoparticle based optical detection system to effectively screen and differentiate between healthy cells that produce surface protein A from tumor cells that produce protein B on their surface. Silver nanoparticles produce a surface plasmon resonance peak at 400-450 nm in the UV-VIS spectrum. Protein A absorbs at 500 nm and protein B at 650 nm. Using the information given, illustrate the steps from synthesizing this nanoparticle to its application in screening different cells, so that the scientist will be successful in deploying this device to the market.
3. Outline nanocellulose synthesis. State any two specific applications of this material in biology. (6+2)