Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, MAY/JUNE 2023

COURSE: **Nanoscience and Technology [CHE5009]**

Date: 31/05/2023 (Forenoon) Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Give neat sketches wherever required.

1A	Explain the key differences in properties between nanomaterials and bulk materials. Discuss how factors such as size, surface area, quantum confinement, and surface effects contribute to these differences.	05
1B	Discuss the synthesis methods used to produce buckyballs and CNTs. Explain the potential applications of buckyballs and CNTs in various fields.	05
2A	Describe the concept of biological synthesis of nanomaterials and its advantages over conventional chemical synthesis methods. Discuss the role of biological agents, such as microorganisms, enzymes, and plant extracts, in the synthesis of nanomaterials.	05
2B	Define super paramagnetism in nanomaterials and explain how it differs from other types of magnetism, such as ferromagnetism and paramagnetism. Discuss the critical size range for achieving superparamagnetic behavior in nanomaterials. Describe the origin and underlying principles of super paramagnetism in nanomaterials.	05
3A	Explain the concept of core-shell nanomaterials and their unique structural features. Discuss the advantages and potential applications of core-shell structures in various fields, such as pollution control and drug delivery.	05
3B	Elucidate the factors that can influence the toxicity of nanomaterials Discuss the potential toxicity of nanomaterials and the importance of assessing their safety before widespread use. Explain why nanomaterials may exhibit different toxicological properties compared to bulk materials.	05
4A	Explain the unique properties of nanofluids that make them different from conventional fluids. Discuss the role of nanoparticles in enhancing the heat transfer characteristics of nanofluids. Describe the preparation methods for nanofluids and the factors that affect their stability.	05
4B	Discuss the potential environmental applications of nanomaterials. Provide examples of how nanomaterials can be utilized to address environmental challenges such as pollution remediation, water treatment, and energy sustainability.	05

5A	Explain the working principle of a Scanning Electron Microscope (SEM). Describe the role of key components such as the electron source, electromagnetic lenses, and detectors in the imaging process. Explain the different imaging modes available in SEM, such as secondary electron imaging and backscattered electron imaging. Discuss the information each mode provides and their respective applications.	4
5B	Briefly explain the principle behind zeta potential analysis and its importance in the characterization of colloidal systems. Discuss how zeta potential relates to the stability and behavior of nanoparticles and other dispersed particles in solution. Explain the significance of zeta potential values and their interpretation.	3
5C	Discuss specific applications and advancements in the use of nanomaterials for batteries and fuel cells. Provide examples of how nanomaterials have been employed to improve the performance of energy storage and conversion devices.	3

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