

## FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025

(Regular/Improvement/Supplementary)

## CHEMISTRY

## FCHE4E07- MATERIAL SCIENCE

Time: 3 Hours

Maximum Weightage: 30

**Section A: Short answer questions. Answer any *eight* questions. Each carries *one* weightage.**

1. What are nanomaterials, and how are they classified?
2. Explain the concept of quantum confinement in nanomaterials.
3. What are nanoelectronics, and how do nanomaterials contribute to this field?
4. Describe the application of nanomaterials in targeted drug delivery.
5. What is phase transfer catalysis, and how does it facilitate reactions between reactants in different phases?
6. Provide examples of nano-catalytic reactions and their applications.
7. What is the role of initiators, monomers, and chain transfer agents in free radical polymerization?
8. Explain ring opening polymerization with one example.
9. What is gelation, and how does it occur in polymerization reactions?
10. Provide examples of polymeric substrates and their applications.
11. Explain the deposition techniques used for metallic matrix composites.
12. Why is fracture mechanics important in understanding material failure?

**(8 × 1 = 8 weightage)****Section B: Short essay questions. Answer any *four* questions. Each carries *three* weightage.**

13. Describe the bottom-up and top-down approach to synthesizing nanostructures.
14. Explain the principle of XPS and its application in characterizing nanomaterials.
15. How does XRD help in understanding the crystal structure and phase composition of nanomaterials?
16. What are liquid crystalline polymers, and how are they classified?
17. Explain the role of heterogeneous catalysts in the water gas shift reaction.
18. Derive the Mayo-Walling equation for the steady-state kinetics of free radical polymerization.
19. Explain the application of composite materials.

**(4 × 3 = 12 weightage)****(P.T.O.)**

**Section C: Essay questions. Answer any *two* questions. Each carries *five* weightage.**

20. a) What are conducting polymers? Discuss the preparation and application of poly aniline and poly thiophene.  
b) Describe the processing techniques for composites with metallic matrices, including solid and liquid state processing.
21. a) Explain the role of flaws, pores, and grain boundaries in ceramic and glass fracture.  
b) Discuss the role of heterogeneous catalysts in catalytic cracking.
22. Describe the mechanisms of cationic and anionic polymerization. Provide examples of polymers synthesized using cationic and anionic polymerization.
23. a) Explain the mechanism of group transfer polymerization.  
b) Discuss photoresponsive and photorefractive polymers.

**(2 × 5 = 10 weightage)**