LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

THIRD SEMESTER – **APRIL 2025**

PCH 3301 – MATERIALS SCIENCE

Date: 05-05-2025 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION – A

Answer ANY FOUR Questions. **(4 x 10 = 40)**

1. Explain the procedure to obtain Miller indices of a crystalline plane. In a crystal, a plane cuts intercept of 2a, 3b and 6c along the three crystallographic axes. Determine the Miller indices of the plane.
2. Explain the construction and working principle of CO_2 laser with suitable energy level diagram.
3. a) Give a comprehensive overview of the Bardeen-Cooper-Schrieffer (BCS) theory of superconductors and its limitations. (5+5)
   b) Discuss the various types of dielectric breakdown.
4. What are the differences between soft magnets and hard magnets in terms of their characteristics, applications and magnetic properties?
5. Describe the properties Ferro, Piezo, and pyro electric materials in detail.
6. a) Explain the synthesis of polyethylene by using mono-metallic Ziegler-Natta catalyst. (5+5)
   b) How would you synthesize silica nanoparticles by sol-gel method?
7. a) Illustrate the mechanism of free radical polymerization. (5+5)
   b) Discuss the working principle of inert gas condensation with neat diagram.
8. a) What are conducting polymers? Explain with the mechanism of p-doping of polyacetylene. (5+5)
   b) Outline the degradation of polyvinyl chloride with the mechanism.

SECTION – B

Answer ANY THREE Questions. **(3 x 20 = 60)**

9. a) How does the Bridgman-Stockbarger method enable controlled crystal growth and defect-free crystals? (10+10)
   b) Describe the neutron diffraction method in crystal structure analysis.
10. What is the mechanism behind superconductivity? Explain the difference between Type-I and Type-II superconductors.
11. Explain the relationship between polarization, electronic and ionic orientation, and space charge in materials.
12. a) Explain the construction and operation of SEM with a suitable diagram. (10+10)
    b) Outline the process of photo degradation of polymers.
13. a) Illustrate the mechanism of rubber oxidation. (10+5+5)
    b) Discuss the synthesis polyisobutylene by cationic addition polymerization.
    c) Describe the calendaring and die casting methods of polymer processing techniques.
14. a) Explain the synthesis of gold nanoparticles by colloidal method. (5+10+5)
    b) Describe the classification of core – shell nanoparticles based on shell property.
    c) Briefly explain the laser ablation method of PVD.
