(Pages : 3) T – 5638

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree Examination, July 2024

Physics

Special Paper II

PH 243 M : MATERIALS SCIENCE II

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Briefly explain the polarisation mechanism in materials.
2. What is photoluminescence?
3. Explain the Seebeck effect.
4. Describe the properties of carbon-based nano-materials.
5. Define nanoshells.
6. Explain the plasma arc discharge technique.
7. Describe the concept of single-electron tunnelling.
8. Classify magnetic materials based on their properties.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **three** questions. Each question carries **15** marks.

9. Compare and contrast the electrical conductivity of metals and alloys. Discuss the factors that influence their conductivity and the implications for various applications.

OR

10. Discuss the concepts of luminescence and phosphorescence. Explain these phenomena' excitation, emission and absorption processes with a proper diagram.

11. Explain the size effects observed in nanomaterials and how they relate to potential wells. Discuss the implications of partial confinement effects on the electronic properties of nanomaterials.

OR

12. Describe FTIR spectroscopy with the necessary theory and diagram.

13. Define magneto resistance and differentiate between ordinary magneto resistance, giant magneto resistance and colossal magneto resistance.

OR

14. Describe the mechanisms of spin relaxation. Explain spin relaxation specifically in quantum dots, its implications and potential applications.

(3 × 15 = 45 Marks)

PART – C

Answer any **three** questions. Each question carries **5** marks.

15. Describe the conduction mechanisms in ionic materials, semiconductors and insulators.

16. At room temperature, the resistivity of copper is 2.01×10^{-6} ohm-cm with a temperature resisitivity coefficient of $0.0051^{\circ}\ C^{-1}$. Determine the electrical conductivity of copper at

    (a) 350° C and

    (b) –50° C.

17. Briefly explain the electrical, mechanical and thermodynamical properties of nanomaterials.

18. Describe the role of X-ray diffraction in nanomaterial analysis.

19. Discuss the concept of density of states and how it influences various properties of materials.

20. Describe the working principle behind Micro-Electro Mechanical Systems (MEMS).

(3 × 5 = 15 Marks)