

M.Sc. (Physics) (CBCS Pattern) Semester-IV
PSCPHYT14 - Core-12 Paper-XIV - Solid State Physics

P. Pages : 1

Time : Three Hours



GUG/S/25/11413

Max. Marks : 80

Either:

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| 1. | a) | State and prove Bloch theorem. | 8 |
| | b) | Explain the quantum theory of paramagnetic materials. | 8 |

OR

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| e) | Discuss briefly Kroning-Penny model for energy band structure of solids. | 8 |
| f) | Obtain an expression for paramagnetic susceptibility of free electrons on the basis of classical law. Discuss its inadequacy and show how Pauli modified it. | 8 |

Either:

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| 2. | a) | Explain Dulong and Petti's Law. | 8 |
| | b) | Explain Einstein and Debye models. | 8 |

OR

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| e) | What is Brillouin zone, explain in details. | 8 |
| f) | Give the theory of one dimensional monoatomic linear lattice vibrations & obtain expression for angular frequency of vibration. | 8 |

Either:

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| 3. | a) | What is Hall effect? State the importance of Hall effect? Derive the expression for hall coefficient and mobility of charge carriers. | 8 |
| | b) | What is an extrinsic semiconductor? Discuss the variation of the fermi level with temperature for an n-type semiconductor? | 8 |

OR

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| e) | Explain in detail about electrical conductivity of semiconductor. | 8 |
| f) | Obtain an expression for energy of an electron moving in three dimensional potential well. | 8 |

Either:

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| 4. | a) | Discuss BCS theory of superconductor. | 8 |
| | b) | Discuss DC and AC Josephson effect. | 8 |

OR

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| e) | Explain type I & II superconductors. | 8 |
| f) | What is Isotope effect? Describe superconducting coherence length? | 8 |

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| 5. | Attempt all the following questions. | | |
| | a) | Derive an expression for the effective mass of the electron in a crystal and explain the physical basis of it. | 4 |
| | b) | What are acoustic and optical phonons? | 4 |
| | c) | Explain Seebeck effect. | 4 |
| | d) | State any four applications of superconductivity. | 4 |
