

PG (CBCS)
M.Sc. Semester-III Examination, 2021
CHEMISTRY
PAPER: CEM 303
(PHYSICAL SPL.)

Full Marks: 40**Time: 2 Hours****Answer any FOUR questions of the following:****4×10=40**

1. (a) Obtain the expression for electrical conductivity based on quantum free electron theory.
 (b) What are the drawbacks in classical free electron theory and explain how does quantum free electron theory overcomes the drawbacks? 5+5
2. Define Lattice vibration. Explain how Optical Phonons and Acoustic Phonons are generated? 2+4+4
3. (a) Define Hall Effect in metals.
 (b) Why the conductivity of a semiconductor increases with temperature?
 (c) Explain the working principle of an n-p junction semiconductor. 2+3+5
4. Obtain the equilibrium concentration of Schottky defect and Frenkel defect in a crystal. 5+5
5. Define geometrical structure factor of a crystal. Distinguish between body centered cubic (BCC) lattice and face centered cubic lattice with the help of Geometrical Structure Factor. 2+8
6. (a) Define the terms
 (i) Ensemble average and
 (ii) Time average for the square of coordinate of an ensemble.
 (b) Obtain the Gibbs Canonical Distribution. 1+1+1+7
7. (a) Assuming, without derivation, the expressions for Hamilton's equations of motion; derive Liouville's equation.
 (b) Write without derivation, the expression for molar translation partition function in terms of thermal de Broglie wavelength, and hence derive the Sackur-Tetrode equation. 5+5
8. Define the grand partition function Z, obtain the expression for ln Z for fermions and hence derive Fermi-Dirac distribution Law. 10
9. What is meant by the Bose-Einstein condensation? Obtain the expression for the temperature at which such a phenomenon occurs. 10
10. (a) State the principle of microscopic reversibility.
 (b) What are oscillatory chemical reactions? Discuss any one model to explain the mechanism of such reactions. 4+2+4