

M.SC.(Physics) Semester - 2 (CBCS) Examination

May/June-2022 (NEW COURSE)

Solid State Physics

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Q.1 Answer in brief any seven: 14
- (a) Define unit cell.
 - (b) What are symmetry elements?
 - (c) What are color centers?
 - (d) What are Brillouin zones?
 - (e) Define persistent current.
 - (f) Write applications of superconductors.
 - (g) Draw the spin arrangements for diamagnetic, paramagnetic and ferromagnetic materials.
 - (h) What are the limitations of Langevin's classical theory of paramagnetism?
 - (i) Define phonon and polaron.
 - (j) Draw a spin arrangement for helical spin array and canted antiferromagnetic state.
- Q.2 Answer any two of following questions: 14
- (a) Describe in detail the X-ray, neutron and electron diffraction techniques.
 - (b) Define crystal planes and miller indices. Draw the crystal planes for (100) , (110) , (111) , (120) and (202) miller indices.
 - (c) Discuss in detail the atomic scattering factor and geometric structure factor.
- Q.3 (a) Write a note on vacancy defects. Derive the expression for number of vacancies in solids. 07
- (b) Write a note on self interstitial defects in elemental solids. 07
- OR
- (a) Discuss in detail the effective mass. 07
- (b) Write a detailed note on tight binding approximation. 07
- Q.4 Answer any two of following questions: 14
- (a) Discuss in detail the two types of superconductors.
 - (b) Write a detailed note on BCS theory and its outcomes.
 - (c) Write a note on Josephson tunneling.
- Q.5 Answer any two of following questions: 14
- (a) Discuss the Langevin's theory of diamagnetism.
 - (b) Write a note on quantum theory of paramagnetism.
 - (c) Discuss the Heisenberg exchange integral and Slater's criteria.
 - (d) Draw the plots of $1/\chi$ versus temperature for different five types of magnetic materials.
