St. Philomena's College(Autonomous), Mysore

Question Bank

Programme: M.Sc. Physics

IV Semester

Course Title: Condensed Matter Physics -2

Course Type: Soft Core

Q.P Code : 58305

Q.No.	Question	Marks
1	Write a note on systematic absences.	4
2	What is the significance of Fourier analysis in X-ray crystallography.	4
3	Define elastic stress and strain in a solid.	4
4	Give an account on types of magnetic interaction.	4
5	Explain the scattering of X-rays by an atom.	6
6	What is a line imperfection? Explain edge and screw dislocation with neat diagram.	6
7	Obtain an expression for an energy per unit length of screw dislocation.	6
8	Describe briefly the line imperfections and the importance of the concept of Burger's vector to describe these line imperfections.	6
9	What is diffusion? State and explain Fick's first law of diffusion.	6
10	State and explain Fick's second law of diffusion.	6
11	Explain the Kirkendall effect in alloys.	6
12	Give an elementary explanation of the BCS theory of superconductors.	6
13	Explain Meissner effect in superconductors.	6
14	Describe flux quantization in superconductors.	6
15	Write a note on Gudden-Pohl effect.	6
16	Mention the applications of high temperature superconductors.	6
17	Using Franck-Condon principle describe the excitation and emission process in luminescent crystals.	6
18	Explain the temperature independent decay mechanism in	6

	luminescence solids.	
19	Obtain an expression for magnetic susceptibility in terms of Helmholtz free energy F.	6
20	What is Van Vleckparamagnetism ? Explain.	6
21	Explain the cyclic Fourier refinement.	7
22	What are point imperfections? With neat diagram explain the interstitial atom and vacancy defects.	7
23	Discuss the experimental technique to determine the elastic waves in a crystal.	7
24	Explain the scattering of X-rays by an electron.	8
25	Explain the direct method of determining the phase for the structural analysis of a single crystal.	8
26	What are crystal imperfections? Explain the classification of imperfections according to their dimensions.	8
27	Explain the propagation of elastic waves in (110) plane of a cubic crystal.	8
28	Show that there are only three independent elastic constants in a cubic crystal.	8
29	Explain the propagation of elastic waves in a cubic crystal.	8
30	Explain the propagation of elastic waves in (100) plane of a cubic crystal.	8
31	Discuss the theory of DC Josephson effect.	8
32	On the basis of Hund's rule calculate L, S and J for 3d shells.	8
33	On the basis of Hund's rule calculate L, S and J for 4f shells.	8
34	Discuss the variation of magnetic susceptibility of an ion placed in uniform magnetic field at high and low magnetic fields.	8
35	Construct a spin Hamiltonian for a two-electron system using Heisenberg model.	8
36	Obtain an expression for the atomic scattering factor and its variation with the wavelength of incident X-rays.	9
37	Obtain an expression for the structure factor.	9
38	Obtain an expression for concentration of Frenkel imperfections in monoatomic solid.	9
39	Obtain an expression for concentration of Schottky imperfections (Ionic solid) in monoatomic solid.	9
40	Obtain an expression for diffusion coefficient in case of alkali halides.	9

41	Explain the ionic conductivity in alkali halide crystal.	9
42	In detail explain the diffusion mechanism in metals.	9
43	Obtain an expression for diffusion co-efficient in case of interstitial diffusion in metals.	9
44	Explain the temperature dependent decay mechanism in luminescence solids.	9
45	What are colorcenters? Explain the generation and types of colorcenters.	9
46	Explain in detail the construction of anEwald sphere and its significance in understanding the diffraction of X-rays from a crystal.	10
47	Obtain an expression for concentration of point imperfections (vacancies) in monoatomic solid.	10
48	What is Josephson tunneling? Discuss the theory of AC Josephson effect.	10
49	Explain the quantum theory of paramagnetism for a solid/ion placed in an external uniform magnetic field.	10
50	What are spin waves? Obtain the dispersion relation for one dimensional antiferromagnetic spin waves.	10
51	Derive Bloch's $T^{3/2}$ law for magnetization in ferromagnets.	10
52	Explain the decay mechanism in luminescence solids.	12
53	Set up a Hamiltonian field for a solid kept in an external magnetic field and hence discuss the application of the same to describe the diamagnetic susceptibility.	12
54	Set up a Hamiltonian for a solid kept in an external uniform magnetic field and thus arrive at an expression for energy correction.	12
55	What are magnons? Derive the magnon dispersion relation for one dimensional ferromagnetic spin waves.	12

56	Explain qualitatively the relaxation mechanism in paramagnetic solids.	12
57	Discuss the theory of Casimir-Durpe for spin-lattice relaxation and obtain the expression for the real and imaginary parts of the complex magnetic susceptibility.	12
58	Set up Bloch equations and explain its role in interpretation of nuclear resonance experiments.	12
59	Explain spin-spin relaxation and spin-lattice relaxation mechanism for paramagnetic solids.	08
60	Explain the phenomena of Nuclear Magnetic Resonance.	06
61	Explain paramagnetic relaxation.	06