ST. JOESPH COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

PPH910 – CONDENSED MATTER PHYSICS

Dept.of physics

SECTION –A

1. Differentiate primitive cell and unit cell ?
2. Write a note on debye – waller factor ?
3. what are the various types of crystallographic in imperfections ?
4 . compare schottky defect and frenkel defect ?
5 .write a note on phonons ?
6 .what are brillouin zones ? * * *
7 . mention some of the application of high temperature super conducting materials ?
8 .differentiate type 1 and type 2 super conductors ? * *
9 .what are ferromagnetic spin waves ?
10 .define curie temperature of ferroelectric material ?
11.what is known as bravais lattice ?
12.what are the applications of reciprocal lattice ?
13.what is known as colour centres ? *
14.what is known as grain boundaries ?
15.define bloch theorem ? * *
16.how will you differentiate semi conductor from insulator ?
17.define Meissner effect ? *
18. Give examples for high temperature super conducting materials ?
19.Explain the term polarisation ?
20.What are spin waves ? * *
21.What are miller indices ? * *
22.write a short note on reciprocal lattice ? *
23.what is a colour centre ? mention some of the ways by which crystals gets coloured ?
24.how crystal growth is affected by crystal defects ?
25.what is a fermi surface ?
26.what do you understand by the term penetration depth ?
27.define dielectric susceptibility ?
28.what are magnons ?
29.mention few geometrical properties of reciprocal lattice ?
30.give the nucleation process in crystal growth ?
31.what is de has-van alphen effect ?
32.what is super conductivity ?
33.how cooper pairs are formed in super conductors ? *
34.define electric dipole and its moment ?
35.F centre - explain ?
36.give the principle of electron microscope ?
37.define magnetic resistance?
38.what is intermediate or vortex state ?
39.write a note on ionic polarization ?
40.Explain two and three dimensional bravais lattices ?
41.write down the procedure for finding miller indices ?
42.what is point defect ? mention its types ?
43.what do you mean by grain boundaries ?
44.state curie Weiss law ?

45.define dielectric constant ?

SECTION –B (5 MARKS)

1. A certain orthorhombic crystal has axial units a: b: c of 0.424: 1 :0.367 find the miller indices of crystal faces intercepts are 0.212 : 1: 0.183 .?
2.The bragg angle corresponding to the first order reflection from (111) planes in a crystal is 30◦ when x rays of wave length 1.75 amp are used . calculate interatomic spacing ?
3.discuss how the electrical conductivity in ionic crystals like alkyl halides is influenced by lattice vacancies ?
4. Explain how dis location promote growth of crystals ?
5. State and prove Bloch theorem. how it is useful in the analysis of electron motion through crystal lattice.
6.explain briefly the application De Hass-van Alphen effect in the study of fermi surface.
7.what is copper pair ? Discuss qualitatively the BCS theory of super conductor.
8.Explain how entropy ,specific heat and thermal conductivity are affected in the superconducting phase?
9.Define piezo electricity .explain the piezo electric behaviour of materials with suitable examples.
10.What are ferromagnetic materials? Explain the ferromagnetic characteristics using the domain model.
11.The distance between (110) plane in a BCC structure is 0.203 nm. What is the size of the unit cell? What is the radius of the atom?
12.An x-ray diffraction analysis of a crystal is made with x-rays of wavelength 0.58nm. reflections are observed at angles of a) 6.45◦ b)9.15◦ and 13◦. Calculate the interplanar spacings of the crystal.
13.write a note an F-centres by giving examples.
14.write brief note on the schottky compositional and electronic defects in crystals.
15.what are the drawbacks of free electron model? State and explain bloch theorem.
16.explain how band theory of solids leads to the classification into metals ,insulators and semiconductors.
17.explain the meissner effect in superconductors.
18.explain type 1 and type 2 super conductors.
19.write a note an ferroelectric domain.
20.write a note an ferromagnetic domains?
21.enumerate the seven crystal systems with neat diagrams and pointing out their characteristic features.
22.how will you determine the miller indices for a crystal.
23.write a face centres by giving examples.
24.explain how electron microscopy is helpful in crystal imperfection studies.
25.what are brillouin zones. How they are related to the energy level of an electron in a metal.
26.explain how the band theory of solids leads to the classification into metals, insulators and semiconductors.
27.explain what are type 1 and type 2 semiconductors by giving examples.
28.write note an high temperature superconducting materials.
29.write a note an piezoelectricity.
30.discuss the curie- Weiss law for ferromagnetic materials. what are its drawbacks?
31.explain laue theory of x-ray diffraction.

32.obtain bragg's equation for x-rays. the bragg's angle for reflection from the planes for which sum of square of h,k and l =8 is 20.2∘ for an x-ray wavelength of 1.54 amp, find the indices of the reflection.
33. explain about the phonon defect in crystal.
34.explain one of the crystal growth techniques with neat diagram.
35.give an account on the construction of fermi surfaces.
36.how will you classify the solids. Explain?
37.give an account on high temperature superconducting materials.
38.write down the josephson theory of superconductors.
39.discuss about the spin waves.
40. what are ferromagnetic crystals explain the some examples?
41. what is bravais lattice? Draw the diagrams for 14 bravais lattices?
42.explain the rotating crystal method of x-ray diffraction ?
43. write a note an point defects?
44.discuss any one method of growing the crystals?
45. explain Meissner effect ?
46.write a note BCS theory of superconductivity?
47. discuss piezoelectricity ?
48.calculate the internal field acting in a dielectric material?
49.explain bloch theorem?
50.obtain an expression for effective mass of an electron?
51. find the miller indices of a set of parallel planes which make intercepts in the ration 3a and 4b on the X and Y axes area parallel to Z axis .calculate the interplanar distance of the plane taking the lattice constant of a cube as 2 amp.
52.the spacing between successive (1 0 0) planes in NaCl is 2.820 A∘. X-ray incident upon the surface of this crystal is found to give rise to first order bragg reflection at a grazing angle of 8∘35' . calculate the wavelength of x-ray and the angle at which the second order bragg reflection would occur .
53. explain how lattice defect responsible for the ionic conductivity.
54.write a note an colour centres .
55.how does the band theory of solid lead to the classification solids?
56.explain the construction of fermi surfaces?
57.distinguish between type 1 and type 2 super conductors.
58.write a note an A.C josephson effect.
59.what do you mean by ferroelectric domains? explain?
60.write a note on spin waves?

SECTION –C

1.write the basic principle behind X-ray diffraction ? explain the method pf crystal structure investigation using rotating crystal method ?
2.what is colour centre ? how experimental facts on F-centres are explained? Discuss the formation on F' centres?
3.what is cyclotron resonance ? explain how it is used to study the fermi surface of metals ?
4.what is quantum tunneling ?discuss the theory behind the DC josephson effect?

5.discuess the ferroelectric behaviour with suitable examples. Deduce the curie – Weiss law of ferro electricity ?
6.derive the general structure factor equation and hence find it for the B C C and F C C lattice ?
7.write a detailed note on the various line imperfections in crystals with suitable figures ?
8.derive the expression for effective mass of an electron and explain ?
9.discuss the A C josephoson effect in detail?
10.describe the domain theory of ferromagnetism . how the existence of domains was proved experimentally ?
11.discuss the 1) laue and 2) rotating crystal methods of determining the crystal structure ?
12.write a detailed note on the various surface imperfections in crystals with suitable diagrams ?
13.state and prove bloch theorem in solids ?
14.what do you understand by josephson tunneling ? discuss the DC josephson effect in detail ?
15.describe the domain theory of ferromagnetism . how the existence of domains was prove experimentally ?
16.discuss about the elastic scattering from a perfect lattice ?
17.write an essay on crystal imperfections ?
18.discuss the theory of cyclotron resonance with neat diagram ?
19.discuss the theory aspects of London's theory ?
20.explain the theory of ferromagnetic domains ?
21.a) Explain the diffraction of neutrons by crystals ?
b)Discuss Debye waller factor ?
22.write notes on
a)Dislocation and its types .
b)Grain boundaries and its types .
c)Scanning electron microscope .
23.explain the kronig – penny model for the motion of an electron in a periodic potential ?
24.discuss the theory of antiferromagnetism with reference to neel temperature ?
25.discuss D.C and A.C josephson effect ?
26.a)explain how the interplanar spacing is determined by powder X-ray diffraction method ?
b)how Debye – waller factor of a diffraction line decreases with an increase in the magnitude of the reciprocal lattice factor ? explain ?
27.a)state three aspects of crystal growth .
b)what is the importance of XRD in crystal growth ?
c)explain the instrumentation techniques and applications of SEM .

THANK YOU