

B. SC. DEGREE (C.B.C.S.S) EXAMINATION, MARCH 2018**(2015 Admission Regular)****SEMESTER VI – CORE (PHYSICS)****PH6B11TB - CONDENSED MATTER PHYSICS****Time : 3 Hours****Maximum Marks : 60****Part A****I. Answer all questions. Each question carries 1 marks****(5x1=5)**

1. State Bragg's law of x-ray diffraction
2. What is the value of c/a ratio for hcp unit cell?
3. What is Fermi energy?
4. What are the different classes of amorphous semiconductors ?
5. Define local electric field.

Part B**II. Answer any Five questions. Each question carries 2 marks****(5x2=10)**

6. Define packing fraction. What is the value of packing fraction for a bcc crystal structure?
7. Obtain an expression for inter planar spacing for a set of parallel planes with indices (hkl).
8. Distinguish between crystalline and amorphous solids. Give examples.
9. What are the major drawbacks of the free electron theory?
10. What are donor and acceptor impurities? Why are they called so?
11. Plot the density of states vs energy diagram for a crystalline semiconductor and an amorphous semiconductor.
12. What is ferroelectricity? Give an example of a ferroelectric crystal.
13. Distinguish between Type I and Type II superconductors.

Part C**III. Answer any Five questions. Each question carries 5 marks****(5x5=25)**

14. The first order spectrum of a beam of X-rays diffracted from a crystal corresponds to an angle 6.833° and the distance between the Bragg planes is 2.81 \AA . Calculate the wavelength of x-rays used.
15. Electrons are accelerated by 8.54 V and are reflected by a crystal. The first reflection maximum occurs when the glancing angle is 56° . Estimate the spacing of the crystal.
16. The lattice constant of a cubic crystal is 4.12 \AA . Find the inter-planar spacing between a) (111) plane b) (322) plane.
17. Obtain an expression for the energy eigen values of an electron using Sommerfeld's free electron theory in one dimension.
18. The electron and hole mobilities in a Si sample are 0.135 and $0.048 \text{ m}^2/\text{V-s}$ respectively. Determine the conductivity of intrinsic Si at 300K if the intrinsic carrier concentration is $1.5 \times 10^{16} \text{ atoms/m}^3$. If the sample is doped with 10^{23} phosphorous atoms/ m^3 , determine the equilibrium hole concentration and conductivity.
19. Explain the working of an LCD device
20. A paramagnetic substance has $10^{28} \text{ atoms/m}^3$. The magnetic moment of each atom is $2 \times 10^{-23} \text{ Am}^2$. Determine the paramagnetic susceptibility at 300K.
21. The transition temperature of a superconducting material with an average mass of 200amu is 4K. Determine the transition temperature of its isotope having an atomic mass 206 amu.

Part D**IV. Answer any Two questions. Each question carries 10 marks****(2x10=20)**

22. What are Miller indices? Draw (100),(101) and (111) planes in a cubic unit cell. Also obtain an expression for inter planar spacing for a set of parallel planes with indices (hkl).

23. Explain what is meant by an extrinsic semiconductor. Discuss the variation of the Fermi level with temperature for n type and p type materials.
24. What do you mean by the term polarizability of a molecule? Discuss the different sources of polarizability comparing their contributions in different types of materials.
25. Describe the factors that led to the development of London equations and derive the equations. Explain how these equations could explain the flux penetration observed in thin film superconductors.