LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **PHYSICS**

FOURTH SEMESTER – **APRIL 2013**

PH 4806 - SOLID STATE PHYSICS - II

Date : 25/04/2013 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

SECTION- A

Answer **all** the questions. 10 x 2 = 20

1. Distinguish between direct and indirect band gap semiconductors.
2. What is Peltier effect?
3. **W**hat are polar and non-polar molecules? Give examples for each.
4. Explain Piezo electric effect. What is its relation to ferroelectricity?
5. State any two laws of photoelectric effect.
6. What are colour centres and name the various types of colour centres?
7. Define magnetic susceptibility and relate it to the permeability.
8. Relate magnetic moment and angular momentum of an electron in an atom.
9. What is a cooper pair? Is it a boson or fermion?
10. What is isotope effect in superconductors?

SECTION- B

Answer any **four** questions. 4 x 7.5 = 30

11. Derive an expression for electron concentration in an intrinsic semiconductor.
12. Outline the classical theory of electronic polarizability.
13. What is photoconductivity? Based on a simple model without impurities, arrive at an expression for rate of generation of charge carriers per unit volume?
14. Describe the Langevin's classical theory of paramagnetism.
15. Derive an expression for London's penetration depth.

SECTION- C

Answer any **four** questions. 4 x 12.5 = 50

16. (a) Derive an expression for Hall coefficient in a semiconductor. (8)
    (b) The intrinsic carrier density at 300K in silicon is $1.5 \times 10^{16} m^{-3}$. If the electron and hole mobilities are 0.13 and 0.05 $m^2V^{-1}s^{-1}$ respectively, calculate the conductivity of (i) intrinsic silicon
    (ii) silicon containing 1 donor impurity per 10^8 silicon atoms. (4.5)
17. Derive an expression for the frequency dependence of dielectric constant and hence discuss the complex nature of the refractive index of a dielectric material.
18. Explain the principle, construction and working of an ammonia maser?
19. (a) Derive expression for the temperature dependence of susceptibility for ferromagnetic materials. (8)
    (b) Write a note on ferrites. (4.5)
20. Explain with necessary theory (i)flux quantisation, (ii) AC and (iii) DC Josephson effect. (6+4+2.5)

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