LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **NOVEMBER 2013**

PH 4806 - SOLID STATE PHYSICS - II

Date : 04/11/2013 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

PART - A

Answer **ALL** questions: (10 x 2 = 20)

1. Mention any four characteristic properties of a semiconductor.
2. What is the effect of doping on the Fermi level?
3. What is pyro-electric property?
4. Define polarisation and polarisability.
5. What is photoluminescence?
6. What are colour centres and name the various types of colour centres?
7. Establish the relation between magnetic susceptibility and permeability for a linear medium.
8. Mention any three contributions to the magnetic energy of a material.
9. What is a cooper pair? Is it a boson or fermion?
10. What is isotope effect in superconductors?

PART - B

Answer any **FOUR** questions: (4 x 7.5 = 30)

11. Derive an expression for hole concentration in an intrinsic semiconductor.
12. Derive Clausius-Mossotti equation for a dielectric.
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 classical theory of diamagnetism.
15. Derive an expression for London's penetration depth.

PART - C

Answer any **FOUR** questions: (4 x 12.5 = 50)

16. (a) Explain with suitable diagrams the rectifying metal-semiconducting contact. (8)

    (b) The Hall coefficient of certain silicon specimen was found to be - $7.35 \times 10^{5} m^{3} C^{-1}$ from 100 to 400K. Determine the nature of the semiconductor. Further the electrical conductivity was found to be $200 \Omega^{-1} m^{-1}$. Calculate the density and mobility of charge carriers. (4.5)

17. Derive an expression for temperature dependence of dielectric constant (Curie-Wiess law) for a ferroelectric crystal.

18. Explain in detail the principle, construction and working of a three level laser?

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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