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END SEMESTER EXAMINATION-2015

B.Tech, VI Semester

COURSE CODE: 10B11PH611 MAX. MARKS: 45

COURSE NAME: MATERIALS SCIENCE

COURSE CREDITS: 04 MAX. TIME: 3 HRS

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Please attempt the questions sectionwise.

Section A **(6 ×1.5 = 9)**

1. What is Meissner effect? Give its physical significance.
2. What is Weiss field? How it is related with the effective magnetic field?
3. How magnetic susceptibility is related with Neel temperature in an antiferromagnetic material?
4. Give difference between step index and graded index optical fibre.
5. What is optical dielectric constant for an electronic material considering electron as a classical particle bound harmonically in an atom? Give graphically the variation of dielectric constant with frequency.
6. Differentiate between step growth and additional polymerization.

Section B **(4 × 3 = 12)**

7. Determine the transition temperature and critical field at 4.2 K for a given specimen of a superconductor if critical fields are 1.41×10^5 A/m and 4.205×10^5 A/m at 14.1 K and 12.9 K respectively.
8. The molecular weight and density of a paramagnetic substance are 168.5 and 4370 kg/m^3 respectively at room temperature. Considering the contribution to paramagnetism as 2 Bohr magnetons per molecule, calculate the susceptibility and magnetization produced in it in a field of 2×10^5 A/m.
9. The velocity of light in core of silica fibre is 2×10^8 m/s and critical angle at the core cladding interface is 60°. Determine the refractive index of the core and cladding, and the numerical aperture for fibre. Assume velocity of light in free space as 3×10^8 m/s.

10. The atomic weight and density of sulphur are 32 and 2.08 g/cc respectively. The electronic polarizability of the atom is 3.28×10^{-40} Fm^2. If sulphur solid has cubic symmetry, what will be its relative permittivity and refractive index?

Section C **(4 × 6 = 24)**

11. Derive an expression for London penetration depth and analyse its temperature dependence. Also discuss graphically the superelectron density as function of temperature.

12. Derive classical Langevin equation for diamagnetism and discuss its physical significance.

13. Discuss the propagation of light through optical fibre using the concept of acceptance angle. Give two advantages of an optical fibre.

14. If x is the relative displacement of nucleus and electron cloud under the influence of an externally applied electric field E, show that

$x = (4\pi\varepsilon_o R^3)/Ze$

where R is the radius of atom and Ze is the charge of nucleus.