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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2016

B.Tech. (ECE, CSE & IT) 6th Semester

COURSE CODE: 10B11PH611   MAX. MARKS : 25

COURSE NAME: MATERIALS SCIENCE

COURSE CREDITS: 04   MAX. TIME: 1 Hr 30.Min

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Scientific calculator allowed.

Q1. a) Sketch the variation of the total polarizability of an atom as a function of the frequency listing the various contributions and the relevant frequency ranges.   [2]

b) A dielectric material has dielectric constant 5 and square of refractive index is 2.50. Calculate the ratio of electronic to ionic polarizability for this material.   [2]

c) Write short notes on: **i)** Conducting polymer **ii)** Strain hardening   [2]

Q2. a) What are cooper pairs and how cooper pairs are formed?   [1]

b) Explain BCS theory of superconductivity and discuss the energy gap based on this theory.   [2]

b) A superconductor has critical fields 1.4×10^5 and 4.2×10^5 A/m at 14 K and 13 K respectively. Calculate its transition temperature. Also calculate the critical current that will flow through a long thin wire (diameter 10^{-4} m) of this superconductor at 4.2 K.   [2]

Q3. a) Derive London's equations and explain how its solution explains Meissner effect.   [3]

b) Density and atomic number of niobium are 8.57×10^3 kg/m^3 and 93 respectively. It has one conduction electron per atom. Calculate the London penetration depth of niobium.   [2]

c) A polymer has polydispersity index 1.236 and number average molecular weight 9166 g/mol. If the weight average degree of polymerization is 269, what is the monomer?   [2]

Q4. a) Discuss average molecular weights of polymers and analyze the impact of molecular weight on the crystallinity of polymers.   [3]

b) The density and associated percent crystallinity for two samples of a polymer material are 2.144 g/cc & 2.215 g/cc, and 51.3% & 74.2% respectively. Determine the densities of totally crystalline and totally amorphous materials. Also determine the percent crystallinity of a specimen having a density of 2.26 g/cc.   [2]

c) Classify and discuss the polymers on the basis of their thermal response.   [2]

Constants: $\mu_o = 4\pi \times 10^{-7}$ *SI units,* $m_e = 9.1 \times 10^{-31}$ *SI units,* $e = 1.6 \times 10^{-19}$ *SI units*