Total number of printed pages – 6 **B. Tech**

BSCC 2202

Fourth Semester Examination – 2008

MATERIAL SCIENCE

(Chemical)

Full Marks – 70

Time : 3 Hours

Answer Question No. ***1*** *which is compulsory and any* ***five*** *from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following in brief and to the point. 2×10

   (a) What do you mean by weighted index in material selection methods ?

   (b) Calculate the critical current density at 0k for a wire of lead which has a circular cross section of radius 5 mm. The critical magnetic field for Pb at 0K is 803×10^{-4} T.

   (c) What is the value of Lorentz number in SI system according to quantum theory of free electrons in metals ?

   (d) Distinguish between dielectric strength and dielectric constant.

   (e) What are the different processes that may occur when visible radiation is incident on a material ?

   (f) What is the difference between thermo-setting and thermoplastic polymers ?

   (g) Why does thermal spalling occur in ceramics during service ?

   (h) What are ceramics ?

(i) Why is stainless steel corrosion resistance ?

(j) Why are aluminum alloys used for construction of aircrafts but not steel ?

2. (a) Calculate the density of energy states per unit volume with energies between 0eV to 1.5eV. 3

(b) Explain with necessary theory how you can design a device to measure power in a plane polarized electromagnetic wave by using the concepts of Hall effect. 4

(c) Distinguish between ferromagnetic, ferrimagnetic and antiferromagnetic materials. 3

3. (a) Write the mechanism of polymerization of styrene using potassium amide as initiator. What is Ziegler-Natta catalyst ? Mention its importance in polymerization. 4+1+1

(b) Discuss injection moulding for fabrication of plastics. Mention two important uses of butyl rubber. 4

4. (a) Calculate the saturation magnetization for nickel which has a density of 8.90 cm^{-3}. Given Bohr magneton = 9.27×10^{-24} $A.m^2$ and Avogadro's number = 6.023×10^{23} *atoms / mole.* 3

(b) The band gap energies of silicon and germanium are 1.11eV and 0.67ev respectively. Over what range of wavelengths of electromagnetic spectrum they are opaque ? 4

(c) Explain why magnesium is a conductor even though the outer most valence shell of Mg is completely filled. 3

5. (a) Explain briefly pitting corrosion and stress corrosion. 2+3

(b) How is corrosion prevented by cathodic protection ? Explain how rusting of iron is prevented by galvanization. 2+3

6. (a) Briefly explain the BCS theory of superconductivity. 4

(b) Ammonium chloride gas has dielectric constant 1.0083 at 0 °C and dielectric constant 1.0049 at 100 °C. The concentration of Ammonium chloride molecule at 0 °C is 2.7×10^{25} m^{-3}. Calculate the permanent dipole moment of ammonium chloride. 4

(c) What are the advantages of photonic communication over electronic communication ? 2

7. (a) What are different classes of composites ? What is Whisker ? 3+2

(b) Discuss about R.C.C. with regard to composition, strength and its protection. 5

8. (a) What are different types of composites ? What are the factors that control the strength of ceramics ? 3+2

(b) Mention the composition of clay. What are fire clay and china clay ? Give important applications of ceramics. 1+2+2

———————