

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 ?

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Contd.

- (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, ferri-magnetic 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 = $9.27 \times 10^{-24} \text{ A.m}^2$ and Avogadro's number = $6.023 \times 10^{23} \text{ atoms / mole}$. 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 $2.7 \times 10^{25} \text{ m}^{-3}$. 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