

BACHELOR OF PRINTING ENGINEERING EXAMINATION, 2009

(2nd Year-2nd Semester)

PRINTING MATERIAL SCIENCE-II**Answer any five questions.**

1. (a) What is atomic packing factor? Show that the atomic packing factor for the FCC crystal structure is 0.74. 5
 (b) Calculate the volume of a BCC unit cell. 2
 (c) What is meant by co-ordination number in crystal structure? How many grams are there in 1 amu of a material? 3
 (d) Describe the difference between atomic structure and crystal structure? 3
 (e) Copper has an atomic radius of 0.128nm, an FCC crystal structure, and an atomic weight of 63.5gm/mol. Compute its density. 3
 (f) What is Miller indices? Construct a $(\bar{0}11)$ plane within a cubic unit cell. 4

2. (a) Define Bragg's law for diffraction of X-rays by crystals and derive the equation. 10
 (b) Write down the limitations of Bragg's law for crystal structure determination. 2
 (c) What is short range repulsion in case of ionic bonding? 3
 (d) Make a comparison of primary and secondary bonds. 3
 (e) State Pauli's exclusion principle. 2

3. (a) What is polymerization? Classify Polymerization. 3
 (b) Cite differences between Addition and Condensation polymerization techniques. 4
 (c) What is Polydispersity Index? What does it indicate? 3
 (d) Write down the application of polymers. 5
 (e) One gram of hydrogen peroxide is added to 10,000 gm of ethylene to serve as the initiator and terminator. Calculate the average molecular weight of the polymer if all the hydrogen peroxide is consumed? 5

4. (a) Describe the difference between thermoplastic and thermosetting Polymers. 4
 (b) Cite differences between Injection and Extrusion molding technique? 4
 (c) Explain why molding is more time consuming for thermoplasts than for thermosets. 2
 (d) A sample of poly vinyl chloride is composed according to the following fractional distribution

Wt. fraction	0.04	0.23	0.31	0.25	0.13	0.04
Mean mol. Wt. $\times 10^{-3}$	7	11	16	23	31	39

 - i. Compute \bar{M}_n , \bar{M}_w , \bar{DP}_n and \bar{DP}_w .
 - ii. How many molecules per gram are there in the polymer? 10

5. (a) Compare interstitial and vacancy atomic mechanisms for diffusion. 3
 (b) Explain the concept of steady state diffusion. 5
 (c) What is diffusion flux? What is the driving force for steady-state diffusion? 5
 (d) The purification of hydrogen gas is done by diffusion through a palladium sheet. Compute the number of kilograms of hydrogen that pass per hour through a 5mm thick sheet of palladium having an area of 0.2 m² at 500^o C. Assume a diffusion coefficient of 1.0X10⁻⁸ m²/s, that the concentrations at the high and low-pressure sides of the plate are 2.4 and 0.6 kg of hydrogen per cubic meter of palladium, and that steady-state conditions have been attained. 7

6. (a) What is surface hardening? Describe the Carburizing process used for surface hardening of material. 5
 (b) Write down the applications of surface hardening. 3

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- (c) What is a dye? How are dyes classified on the basis of application? 4
- (d) Describe Triarylmethane dyes with example. 3
- (f) What are intrinsic and extrinsic semiconductors? 3
- (g) What are the differences between p-type and n-type semiconductors? 2
7. (a) Prove that the modulus of elasticity of a continuous and aligned fiber-reinforced composite in the direction of alignment is equal to the volume fraction weighted average of the modulus of elasticity of the fiber and matrix phases. 8
- (b) What is critical length of fiber? Cite differences between continuous and discontinuous fiber? 4
- (c) Cite the general difference between large particle and dispersion-strengthened particle reinforced composites. 2
- (d) What is the distinction between matrix and dispersed phase in composite material? 3
- (e) Briefly describe sandwich panel structural composites. 2
- (f) Give an example of ceramic-metal composite. 1
8. Write short notes on: (any five) 5x4
- (a) Copolymerization.
- (b) Emulsion.
- (c) Vat dyes.
- (d) Blow molding.
- (e) Covalent Bond.
- (c) Azo dyes
- (d) Laminar composites.
- (e) Disperse dyes
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