Bachelor of Printing Engineering Examination, 2017
(2nd Year- 2nd Semester)
Printing Material Science II

Time: Three hours   Full Marks: 100

Answer any five questions.

1. (a) Derive the relationship between unit cell edge length and atomic radius for face centered cubic crystal structure. Derive the atomic packing factor for the same.   7
   (b) Write difference between vacancy and interstitial diffusion.   4
   (c) Write short notes on Injection molding.   4
   (d) A plate of iron is exposed to a carburizing atmosphere on one side and a decarburizing atmosphere on the other side at 700 ^{0}C. If a condition of steady state is achieved, calculate the diffusion flux of carbon through the plate if the concentrations of carbon at positions of 5 ad 10 mm beneath the carburizing surface are 1.2 and 0.8 kg/m^3, respectively. Assume a diffusion coefficient of 3 X 10^{-11} m^2/s at this temperature.   5

2. (a) How fiber lengths influence the strength properties of fiber-reinforced composites?   5
   (b) Briefly describe laminar composites. What is the prime reason fabricating these materials?   5
   (c) Write down the differences between Addition and Condensation polymerization techniques   5
   (d) For BCC iron, compute (a) the interplanar spacing, and (b) the diffraction angle for the (220) set of planes. The lattice parameter for Fe is 0.2866 nm. Also, assume that monochromatic radiation having a wavelength of 0.1790 nm is used, and the order of reflection is 1.   5

3. (a) Derive the modulus of elasticity of a continuous and aligned fiber-reinforced composite in the transverse direction of the alignment.   6
   (b) What is allotropy? Explain with one example.   4
   (c) Derive planar density expressions for FCC (100) and (111) planes in terms of the atomic radius R.   6
   (d) Write short notes on Purple plague.   4

4. (a) Define Bragg's law for diffraction of X-rays by crystals and derive the equation.   8
   (b) Write short notes on Diffusion coefficient and Concentration Gradient.   6
   (c) 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?   6

5. (a) What is activation energy for diffusion? Why is it more for vacancy diffusion than Interstitial diffusion?   5
   (b) Write down the difference between injection and extrusion molding process.   5
   (c) State the Fick's second law of diffusion. Draw the concentration profile of non steady state diffusion.   5
   (d) Copper has an atomic radius of 0.128 nm, an FCC crystal structure, and an atomic weight of 63.5 g/mol. Compute its theoretical density.   5

6. (a) What is surface hardening? Write down its applications.   5
   (b) What do you mean by cathodic protection in electrochemical corrosion? Explain with proper example.   5
   (c) Determine the density of BCC iron, which has a lattice parameter of $2.866 A^0$ and atomic weight of 55.85 g/g.mole.   5
   (d) For the unit cell shown in the accompanying sketch, locate the point having coordinates (1/4) 1 (1/2).   5
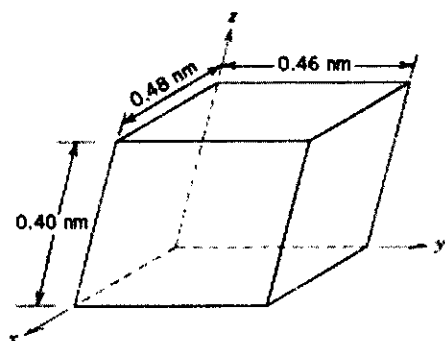
7. (a) What are the different types of polymer additives used? Explain briefly.   8
   (b) Construct a (011) plane within a cubic unit cell.   5
   (c) Consider a copper-zinc corrosion couple. If the current density at the copper cathode is 0.05 A/cm^2, Calculate the weight loss of zinc per hour if (a) the copper cathode area is 100 cm^2 and the zinc anode area is 1 cm^2 and (b) the copper cathode area is 1 cm^2 and the zinc anode area is 100cm^2.   7

8. Write short notes on: (any five)   5 X 4

   (a) Carburizing.
   (b) Compression molding.
   (c) Antistatic agent
   (d) Dispersion strengthened composite
   (e) Hexagonal closed-packed crystal structure
   (f) Crevice corrosion
   (g) Azo dye
   (h) Triarylmethane dye