

B.E. PRINTING ENGINEERING

(SECOND YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2023)

SUBJECT: MATERIALSCIENCE

Time: Three Hours

Full Marks: 100

Question 1 is compulsory. Answer any **four(4)** from remaining questions.

- Q1 10x2=20
- (i) Draw a BCC crystal structure. [2]
 - (ii) What is atomic packing factor (APF) [2]
 - (iii) What is surface hardening? [2]
 - (iv) Define Emulsion. [2]
 - (v) What do you understand by Non-Newtonian fluid? [2]
 - (vi) What is Newton's law of viscosity? [2]
 - (vii) Define Surface Tension. [2]
 - (viii) What is doping in a semiconductor? [2]
 - (ix) What is composite material? [2]
 - (x) What are the differences between Cast iron and Steel? [2]
- Q2(a) Describe briefly Fick's second law of diffusion with a simple sketch. [10]
- (b) Compute Atomic Packing Factor for FCC crystal structure. [5]
 - (c) Aluminium has an atomic radius of 0.143 nm, an FCC crystal structure, and an atomic weight of 26.93 g/mol. Compute its theoretical density. Consider Avogadro's number as 6.023×10^{23} atoms/mol. [5]
- Q3(a) Explain briefly the following with brief sketches: 4x4=16
- (i) Linear Polymer
 - (ii) Branched Polymer
 - (iii) Crosslinked Polymer
 - (iv) Network Polymer
- (b) Discuss briefly Thermoplastic and Thermosetting polymers. [4]
- Q4(a) Explain briefly Colloid and Suspension? [6]
- (b) Find the kinematic viscosity of an oil having density 981 kg/m^3 . The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second. [6]
 - (c) Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tensions $\sigma = 0.0725 \text{ N/m}$ for water and $\sigma = 0.52 \text{ N/m}$ for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact = 130° . [8]

- Q5(a) Discuss briefly Stainless steel. [6]
(b) Discuss Copper and its alloys. [6]
(c) Give reasons why Carbon is used as a fiber reinforcement material in Carbon Fiber Reinforced Polymer (CFRP) Composites? [8]
- Q6(a) What do you understand by Primary Alcohol, Secondary Alcohol and Tertiary Alcohol? [6]
(b) Discuss Ethanol. [6]
(c) Discuss briefly various additives used in polymer products. [8]
- Q7 Write short note on any two 2x10=20
(a) Dyes and Pigments [10]
(b) Surfactants and its various applications. [10]
(c) Pultrusion process of Fiber-Reinforced Composites. [10]