

B.E. PRINTING ENGINEERING EXAMINATION 2023

(SECOND YEAR FIRST SEMESTER 2023)

SUBJECT: MATERIALS SCIENCE

Time: Three Hours

Full Marks: 100

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

- Q1. Answer any 5 (five) questions. 5x4=20
- (a) Explain briefly Crystalline and amorphous material? [4]
 - (b) What is intrinsic silicon crystal? How you can make an extrinsic semiconductor? [4]
 - (c) Explain briefly Carburizing and Nitriding. [4]
 - (d) What are the various properties of Emulsions? [4]
 - (e) Explain briefly that with increase of temperature why viscosity of liquid decreases and in case gas viscosity increases? [4]
 - (f) What is the difference between Dyes and Pigments? [4]
- Q2.(a) Describe briefly Fick's first law of steady state diffusion with a simple sketch. [8]
- (b) 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. Consider Avogadro's number as 6.023×10^{23} atoms/mol. [6]
- (c) The diffusion coefficients for copper in aluminium at 500°C and 600°C are 4.8×10^{-14} and 5.3×10^{-13} m²/s, respectively. Determine the approximate time at 500°C that will produce the same diffusion result (in terms of concentration of Cu at some specific point in Al) as a 10-hour heat treatment at 600°C. [6]
- Q3.(a) Explain briefly Thermoplastic polymer and Thermosetting polymer. [6]
- (b) Describe how Fibers are fabricated from bulk polymers? [6]
- (c) Why additives are included in polymer products? Discuss briefly various types of additives for polymer products. [8]
- Q4.(a) What are the differences between Colloid and Suspension? [6]
- (b) The velocity distribution for flow over a flat plate is given by $u=3y/4 - y^2$ in which u is the velocity in meter per second at a distance y meter above the plate. Determine the shear stress at $y=0.15$ m. Take dynamic viscosity of fluid as 8.6 poise. [6]
- (c) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in (i) water, and (ii) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130°. Take density of water at 20°C as equal to 998 kg/m³. Specific gravity of mercury is 13.6 [8]

- Q5.(a) What is composites? Why Glass is popular as a fiber reinforcement material for Glass Fiber-Reinforced Polymer (GFRP) Composites? [6]
- (b) Discuss briefly Medium Carbon steel [6]
- (c) Discuss briefly Aluminium and its alloys [8]
- Q6.(a) Discuss briefly Methanol. [6]
- (b) What do you understand by Adhesives? Discuss briefly Synthetic adhesives [6]
- (c) What is Polymerization? Discuss briefly addition and condensation polymerization. [8]
- Q7. Write short note on any four 4x5=20
- (a) Amines and Amides [5]
- (b) Photopolymers [5]
- (c) Surfactants [5]
- (d) Copper and its alloys [5]
- (e) Injection molding. [5]