CBCS Scheme

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15ME/MA32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Material Science

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define APF. Calculate APF for HCP cell. **(06 Marks)**

b. With neat sketches explain surface defects briefly. **(05 Marks)**

c. Explain briefly the mechanical properties of a material in plastic range. **(05 Marks)**

OR

2 a. With neat sketches, explain cup and cone fracture. **(05 Marks)**

b. What is stress relation? Obtain an expression for stress relaxation. **(06 Marks)**

c. With S-N diagram explain fatigue behaviour of a material. **(05 Marks)**

Module-2

3 a. Explain different types of solid solution with sketches. **(04 Marks)**

b. State lever rule and Gibbs phase rule. Also explain Hume-Rothary rules for formation of solid solution. **(06 Marks)**

c. Two metals A and B have their melting points at 900°C and 800°C respectively. The alloy pair forms eutectic at 600°C at 60% B and 40% A. Both A and B have unlimited solubilities in liquid state. The solid state solubilities are 10% B in A at 600°C and 5% B in A at 0°C, and 8% A in B at 600°C and 4% A in B at 0°C. Assume solidus, liquidus and solvus lines are to be straight. No intermediate phase change occurs. Draw phase diagram and label at temperatures, phases and fields. Also find the room temp structure of an alloy of composition 60% A and 40% B, with respect to the number, type, extent and composition of the phases. **(06 Marks)**

OR

4 a. Draw Fe – Fe_3C diagram. Label all phases, temperatures. Explain solidification process for any one alloy. **(08 Marks)**

b. Define Homogeneous and Heterogeneous nucleation. Obtain an expression for critical radius of nucleation. **(08 Marks)**

Module-3

5 a. Draw TTT diagram for eutectoid steel and explain briefly. **(06 Marks)**

b. Distinguish between Austempering and martempering. **(05 Marks)**

c. Explain Flame hardening with neat sketch. **(05 Marks)**

OR

6 a. Explain composition, properties and uses of Gray cast Iron, white cast iron and S. G Iron. **(06 Marks)**

b. Explain solution hardening of Al – 4%C alloy. **(05 Marks)**

c. Write a note on Austenitic and Martensitic stainless steel. **(05 Marks)**

Module-4

7 a. What are ceramics? Briefly explain the types of ceramics. **(05 Marks)**

b. Write a note on mechanical properties of ceramics. **(05 Marks)**

c. Define smart material. Explain briefly the types of smart materials. **(06 Marks)**

OR

8 a. Give classification of polymers. List the characteristics of polymers. **(05 Marks)**

b. With a neat sketch explain the processing of plastic by injection moulding method. **(05 Marks)**

c. Write a note on piezo-electric material and shape memory alloys. **(06 Marks)**

Module-5

9 a. Define composite. Give its classification. **(05 Marks)**

b. With a neat sketch, explain filament winding process. List the applications of filament winding process. **(06 Marks)**

c. What is the role of matrix and reinforcement in composite materials? **(05 Marks)**

OR

10 a. Under Iso stress condition, obtain an expression for Young's modulus of a fibre reinforced composites. **(06 Marks)**

b. List the advantages and applications of composite material. **(05 Marks)**

c. Calculate the tensile modulus of elasticity of unidirectional carbon-fibre reinforced composite containing 62% of carbon fibres by volume in ISO-stress and ISO – strain condition. Take $E_{carbon\ fibre} = 37.86 \times 10^4$ N/mm^2, $E_{epoxy} = 41.98 \times 10^2$ N/mm^2. **(05 Marks)**

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