CBCS SCHEME

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18ME34

Third Semester B.E. Degree Examination, Aug./Sept.2020
Material Science

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define APF. Calculate APF for HCP cell. **(08 Marks)**

b. Differentiate edge dislocation and screw dislocation. **(06 Marks)**

c. State and explain Fick's I and II law of diffusion. **(06 Marks)**

OR

2 a. Define: (i) Ductility (ii) Tensile strength (iii) Hardness (iv) Toughness (v) Resilliance **(10 Marks)**

b. A cylindrical specimen of steel having an original diameter of 12.5 mm is tensile tested to fracture, and the fracture strength is 450 MPa, if the cross sectional diameter at fracture is 10.5 mm, determine:

(i) Ductility in term of percentage reduction in area

(ii) True stress at fractures **(10 Marks)**

Module-2

3 a. Differentiate between ductile and brittle fractures with sketches. **(06 Marks)**

b. What is fatigue? What are the factors affecting the fatigue life? **(08 Marks)**

c. What is creep? Explain creep curve. **(06 Marks)**

OR

4 a. Draw Fe-Fe_3C diagram and indicate the phase temperatures and also write the invariant reaction. **(12 Marks)**

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

Module-3

5 a. What is Heat treatment? What are the purpose of Heat treatment? **(06 Marks)**

b. Differentiate between annealing and normalizing. **(06 Marks)**

c. Explain Austempering and Martempering with neat sketch. **(08 Marks)**

OR

6 a. With a neat sketch explain Nitriding process and applications. **(08 Marks)**

b. Discuss the precipitation hardening of AC 4 percentage weight copper alloy. **(06 Marks)**

c. Give the compositions and applications of Grey Cast Iron. **(06 Marks)**

Module-4

7 a. What are composite materials? What are advantages, limitations and application of composite materials? **(08 Marks)**

b. What is the role of (i) matrix (ii) reinforcement (iii) interface in a composite **(12 Marks)**

OR

8 a. Derive the rule of mixtures for the modulus of elasticity of a fiber reinforced composite when a stress (σ) is applied along the axis of fibers. **(08 Marks)**

b. With a neat sketch explain injuction moulding. **(06 Marks)**

c. Calculate the tensile modulus of elasticity of unidirectional carbon fiber-reinforced composite material which contains 62% by volume of carbon fibers in iso-strain and iso-stress condition. Take $E_{carbonfibres} = 3.86 \times 10^4$ kgf/mm^2 and $E_{epoxy} = 4.28 \times 10^2$ kgf/mm^2. **(06 Marks)**

Module-5

9 a. Define ceramic. Explain briefly the types of ceramics. **(06 Marks)**

b. Differentiate the thermo plastics and thermo setting plastics. **(06 Marks)**

c. Define smart material. Explain briefly the types of smart material. **(08 Marks)**

OR

10 a. Explain briefly shape memory alloys – Nitinol. **(06 Marks)**

b. Write a note on piezoelectrical material. **(06 Marks)**

c. Explain use of Non-Destructive Testing (NDT) for residual life assessment. **(08 Marks)**

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