

CBCS SCHEME

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15ME/MA32

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019 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. Draw FCC lattice and calculate its atomic packing factor. (04 Marks)
b. Classify crystal imperfection, explain point defect in detail. (06 Marks)
c. The surface of steel gear made of 1020 steel (0.2%C) is to be gas carburized at 927°C. calculate the time required to increase the carbon content to 0.4% at 1 mm below the surface if the carbon potential at surface is 1.2 wt%. $\text{erf}(0.9) \approx 0.8$ (06 Marks)

OR

- 2 a. Define creep, with a typical creep curve, explain three stages of creep. (08 Marks)
b. With the help of a neat conventional stress-strain diagram, explain behavior of mild steel, under tension till fracture. (06 Marks)
c. Draw S-N curve for steel. (02 Marks)

Module-2

- 3 a. Explain Hume Rothery rules for the formation of solid solution. (06 Marks)
b. Draw and explain the Iron-Carbon equilibrium diagram and label all the points and fields. (10 Marks)

OR

- 4 a. Explain the following with example:
i) Gibb's phase rule
ii) Lever rule (10 Marks)
b. Explain any four types of stainless steel based on their crystal structure. (06 Marks)

Module-3

- 5 a. What is TTT diagram? Explain with a neat diagram the martensitic transformation of austenite. (08 Marks)
b. Write notes on the following:
i) Annealing
ii) Carburizing (08 Marks)

OR

- 6 a. What is hardening? Explain with a neat sketch induction hardening. (08 Marks)
b. Briefly explain the composition, properties and applications of grey cast iron. (08 Marks)

Module-4

- 7 a. What are properties of ceramic materials? (04 Marks)
b. With a neat sketch, explain tape casting. (06 Marks)
c. Explain with a neat diagram, the processing of plastic by injection molding. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Explain working principle of optical fiber. (06 Marks)
b. What are the applications of shape memory alloys? (06 Marks)
c. Explain any two methods of NDT. (04 Marks)

Module-5

- 9 a. With a neat sketch, explain filaments winding. (08 Marks)
b. Explain production of composite materials by spray-up process. (08 Marks)

OR

- 10 a. A tensile load of 500 N is applied to a epoxy-glass fiber composite. If the cross section of the composite is 1 mm^2 and the volume of the fiber is 30% calculate the stress in the glass fiber when:
i) The load axis is parallel to the fiber
ii) The load axis is perpendicular to the fiber.
Take the values of Young's modulus for the glass fiber as 86 GN/m^2 and for matrix as 3.38 GN/m^2 . (06 Marks)
- b. Explain the following:
i) Production of MMC's by stir casting
ii) Pultrusion process. (10 Marks)
