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17ME32

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 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 Atomic Packing Factor. Calculate APF for BCC systems. (04 Marks)
- b. Classify different types of crystal – imperfections. Explain in detail line imperfections. (06 Marks)
- c. With neat sketch, explain BCC and FCC crystal structures. (10 Marks)

**OR**

- 2 a. With a help of neat schematic stress – strain diagram for mild steel, explain the behavior of the material till fracture. (10 Marks)
- b. Differentiate between Slip and Twinning deformations in materials. (05 Marks)
- c. Define the various fatigue properties and loads. (05 Marks)

### Module-2

- 3 a. Draw Fe – C equilibrium diagram. Mark on it all salient temperature , composition and phases. (10 Marks)
- b. What is a Solid solution? List the Hume – Rothery’s rule governing formation of substitutional solid solution. (05 Marks)
- c. Sketch and explain Eutectoid Binary Phase - diagram. (05 Marks)

**OR**

- 4 a. State Gibb’s phase rule and explain each term. (08 Marks)
- b. With neat sketches, explain forms of nucleation. (12 Marks)

### Module-3

- 5 a. What is meant by heat treatment? With relevant sketch, explain Annealing. (05 Marks)
- b. Draw a schematic TTT diagram. (05 Marks)
- c. What is Carburizing? Explain different types of Carburizing process. (10 Marks)

**OR**

- 6 a. Explain composition , properties and uses of Grey Cast Iron. (10 Marks)
- b. Define Hardenability. With a neat sketch, explain Jominy hardenability. (10 Marks)

### Module-4

- 7 a. State and explain the properties of Ceramics. (10 Marks)
- b. Write a short note on : i) Glass ii) Refractories. (10 Marks)

**OR**

- 8 a. Differentiate between Thermoplastic and Thermosetting polymers. (05 Marks)
- b. What is Processing of polymers? Explain Injection Molding methods of processing. (10 Marks)
- c. Briefly explain Shape Memory Alloys. (05 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.



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**Module-5**

- 9 a. What is the role of matrix and reinforcement in a composite? (05 Marks)  
b. Explain the following :  
i) Pultrusion process      ii) Hand – layup process. (15 Marks)

**OR**

- 10 a. Calculate the 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.  
 $E_{\text{Carbon fibers}} = 3.86 \times 10^4 \text{ kg f / mm}^2$  and  $E_{\text{epoxy}} = 4.28 \times 10^2 \text{ kg f / mm}^2$ . (08 Marks)  
b. Write a short note on :  
i) CMC      ii) PMC      iii) MMC. (12 Marks)

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