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Third Semester B.E. Degree Examination, Dec.2019/Jan.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 the APF for BCC Unit cell. (07 Marks)
- b. Explain edge dislocation and screw dislocation. (08 Marks)
- c. State and explain Fick's 1st law of diffusion. (05 Marks)

OR

- 2 a. Define Stiffness, Yield strength, Toughness and Ultimate tensile strength. (08 Marks)
- b. Explain Plastic deformation by Slip and twinning. (06 Marks)
- c. Explain strain hardening and solid state hardening process of strengthening of metals. (06 Marks)

Module-2

- 3 a. Draw and explain the S – N curve. (04 Marks)
- b. Derive an expression for stress relaxation. (04 Marks)
- c. Draw the Iron carbon diagram indicating the phase temperatures. Explain the different phases in Iron carbon diagram. (12 Marks)

OR

- 4 a. State and explain Hume Rothery Rules. (06 Marks)
- b. Explain the effect of any 4 alloying elements in steel. (06 Marks)
- c. Two metals A & B are alloyed in the proportion of 60% A and 40% B. The melting temperature of A & B are 650°C and 450°C. When they are alloyed together they do not form any compound or intermediate phase, but form an Eutectic of composition 40% A and 60% B which solidifies at 300°C. The maximum and minimum solid solubilities of B in A and A in B are 10% at 300°C and remains constant till 0°C. Assume solidus, liquidus and solvus lines to be straight.
 - i) Draw the equilibrium diagram and label all the fields.
 - ii) The temperature at which solidification starts and completes.
 - iii) Percentage of Eutectic at room temperature. (08 Marks)

Module-3

- 5 a. Define Heat treatment and give its classification. (06 Marks)
- b. Explain how a TTT diagram is drawn. (08 Marks)
- c. Explain Austempering and Martempering. (06 Marks)

OR

- 6 a. Draw the TTT diagram for Eutectoid steel and explain it. (07 Marks)
- b. With neat sketch, explain induction hardening process. (05 Marks)
- c. Explain the composition, properties and uses of Gray Cast Iron, White Cast Iron and SG Iron and Malleable Iron. (08 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.

Module-4

- 7 a. Define Composite. Give its classification. (06 Marks)
 b. Explain metal matrix composites and ceramic matrix composites. (06 Marks)
 c. List the advantages, disadvantages and applications of composite materials. (08 Marks)

OR

- 8 a. Derive an expression for Young's modulus for ISO stress and ISO strain condition. (12 Marks)
 b. With neat sketch, explain Pultrusion process. (08 Marks)

Module-5

- 9 a. Define Ceramic. Explain the types of ceramics. (05 Marks)
 b. Differentiate between Thermoplastic and Thermosetting plastics. (05 Marks)
 c. With neat sketch, explain Processing of plastic by Injection Moulding method. (10 Marks)

OR

- 10 a. Explain the different Non – destructive testing methods used for accessing residual life. (10 Marks)
 b. Define Smart Material. Explain the types of smart materials. (10 Marks)