

Model Question Paper - I (CBCS) with effect from 2015-16

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15ME32

Third Semester B.E. Degree (CBCS) Examination, Dec.2016/Jan.2017

Material Science & Metallurgy

Time: 3 hrs.

Max. Marks: 80

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

Module I

- 1 a. What are Imperfections? Explain how imperfections are helpful in engineering materials? (6 Marks)
- b. Discuss the different types of stress cycles which can cause fatigue failure with the help of neat sketch. (4 Marks)
- C Illustrate the phenomenon and mechanisms of Diffusion. (6 Marks)

OR

- 2 a. Compare the engineering stress and strain with the true stress and strain for the tensile test of a low carbon steel that has the following test values:
Load applied to specimen: 75kN
Initial diameter of specimen: 12.5mm
Diameter of specimen under 75kN load: 12mm. Assume no change in volume. (6 Marks)
- b. List the various types of fractures in materials. (4 Marks)
- c. Define creep. Explain the differences in various stages of creep with a neat figure. (6 Marks)

Module II

- 3 a. Two metals 'A' & 'B' are used to form an alloy containing 70%A & 30%B. 'A' melts at 610°C and 'B' at 410°C. When alloyed together, these metals form no compound or solid solution but forms eutectic at 40%A & 60%B. The eutectic solidifies at 260°C. Find (10 Marks)
 - i. The temperature at which the alloy will begin to crystallize from the melt and at which the melt will be completely solid.
 - ii. The percentage of eutectic in the alloy at room temperature and 300°C.
- b. Define Nucleation. Explain heterogeneous nucleation with neat sketch. (6 Marks)

OR

- 4 a. Draw the Iron -carbon equilibrium diagram and label various phases present. Write the invariant reactions occurring in the diagram, indicating the temperature and compositions. (10 Marks)
- b. Discuss the effect of alloying elements in steel. (6 Marks)

Module III

- 5 a. Describe the methods of Hardening & Tempering heat-treatments with a neat sketch? Infer why hardening should be always followed by tempering process. (8 Marks)
 - b. Differentiate between Annealing & Normalizing. (4 Marks)
 - c. Discuss the properties, microstructure and composition of grey cast-iron. (4 Marks)
- 6 a. Explain various phases of T-T-T diagram for 0.8% C steel superimposing at least one cooling curve on it. (8 Marks)
 - b. Discuss any two surface hardening methods with suitable applications. (8 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 e.g. 38+2 = 40, will be treated as malpractice.

Module IV

- 7 a. List the properties of Ceramics. (4 Marks)
b. Explain the slip casting method of processing Ceramics. (6 Marks)
c. Differentiate between thermoplastic plastics & thermosetting plastics. (6 Marks)

OR

- 8 a. List the applications of Shape Memory Alloys. (5 Marks)
b. Explain the working of a Optical fiber. (5 Marks)
c. Write short notes on smart materials used as implants in human body. (6 Marks)

Module V

- 9 a. Classify composites based on the matrix and fiber reinforcement with specific applications of each. (10 Marks)
b. Explain the Sheet-Moulding Compound (SMC) process of producing composites. (6 Marks)

OR

- 10 a. Determine the young's modulus of a fiber-reinforced composite in
i. Iso-stress (10 Marks)
ii. Iso-strain conditions
b. What are hybrid composites? List their applications. (6 Marks)