

CBCS Scheme

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15ME32

Third Semester B.E. Degree Examination, June/July 2017 Material Science

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. With the help of Stress – strain diagrams, briefly explain the ductile and brittle behaviour of Engineering Materials. (08 Marks)
- b. A 0.2% e steel component is to be carburized at 920°C. Calculate the time required to increase the carbon content at 0.5mm below the surface to 0.4%.
 $D_{920^{\circ}\text{C}} = 1.28 \times 10^{-11} \text{ m}^2/\text{S}$. Carbon content is 0.9% at the surface. (08 Marks)

Z	0.75	0.80	0.85
erf Z	0.7112	0.7421	0.7707

OR

- 2 a. With a neat creep curve, explain different stages of creep deformation. (08 Marks)
- b. Explain the mechanisms of fatigue failure in engineering materials with necessary diagram. (08 Marks)

Module-2

- 3 a. What is meant by Homogeneous nucleation? Derive an expression for critical radius required for homogeneous nucleation, with free energy curve. (08 Marks)
- b. Explain Substitutional and Interstitial solid solutions. Discuss Hume – Rothary rules governing formation of solid solutions. (08 Marks)

OR

- 4 a. Draw a neat Iron – Carbon equilibrium phase diagram and label all phases, regions and invariant phase. (08 Marks)
- b. Two metals A & B are completely soluble in liquid and partially soluble in solid state. Draw their phase diagram for following details.
i) Solid solubility of B in A is 5% at 600°C and 0°C.
ii) Solid solubility of A in B is 10% at 600°C and 0°C.
iii) Eutectic is formed at 60% B.
Also find the liquid and solid phase percentages in an alloy with 20% B at 650°C. (08 Marks)

Module-3

- 5 a. Draw a neat labeled TTT diagram for eutectoid steel. Show a cooling curve for the formation of 100% marten site on it and explain the curve. (08 Marks)
- b. Differentiate clearly between Normalizing and Annealing. Discuss Spheroidising Annealing with applications. (08 Marks)

OR

- 6 a. With a neat diagram, explain induction hardening process. Discuss the advantages, limitations and applications of the process. (08 Marks)
- b. Discuss on various types of cast irons with necessary micro structures. (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. Differentiate between Thermo setting and Thermoplastic polymers. What are the advantages and disadvantages of plastic materials? (08 Marks)
- b. What is meant by Residual Life Assessment? Explain the Nondestructive testing methods useful for Assessing residual life of materials. (08 Marks)

OR

- 8 a. Describe Shape memory alloys. Explain briefly the applications of shape memory alloys. (08 Marks)
- b. Classify Ceramic materials. Explain the application and processing method of any one class. (08 Marks)

Module-5

- 9 a. Classify the composite materials on matrix and reinforcement. List the roles of matrix, reinforcement and interface. (08 Marks)
- b. For a directionally oriented fiber – reinforced composite, the Young's modulus in iso - strain and iso – stress condition are 33.1 GPa and 3.66 GPa respectively. For a fiber volume fraction of 0.30, determine the Young's modulus for fiber and matrix phases. (08 Marks)

OR

- 10 a. With a neat figure, explain Injection moulding process for particulate reinforced polymers. (08 Marks)
- b. List the advantages and limitations of composite materials. Mention any four applications of polymer matrix composites. (08 Marks)

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