CBCS Scheme

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% c steel component is to be carburized at $920^{\circ}C$. Calculate the time required to increase the carbon content at 0.5mm below the surface to 0.4%.
   $D920^{\circ}C$ 1.28×10^{-11} m²/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 $600^{\circ}C$ and $0^{\circ}C$.
   ii) Solid solubility of A in B is 10% at $600^{\circ}C$ and $0^{\circ}C$.
   iii) Eutectic is formed at 60% B.
   Also find the liquid and solid phase percentages in an alloy with 20% B at $650^{\circ}C$. **(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)**

Module-4

7 a. Differentiate between Thermo settling and Thermoplastic polymers. What are the advantages and disadvantages of plastic materials? **(08 Marks)**

b. What is meant by Residual Life Accessment? Explain the Nondestructive testing methods useful for Accessing 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 Yong's modules 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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