CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **18MR32**

Third Semester B.E. Degree Examination, July/August 2022
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 the following:
   (i) Unit cell   (ii) Space Lattice   (iii) Atomic packing factor   **(06 Marks)**
   b. Calculate the atomic packing efficiency for FCC structure.   **(06 Marks)**
   c. State and explain Fick's law of diffusion.   **(08 Marks)**

OR

2 a. Classify crystal imperfections. Explain the line defects in detail.   **(08 Marks)**
   b. With the help of an engineering stress strain diagram, explain the bahaviour of mild steel.   **(08 Marks)**
   c. State and explain the factors affecting diffusion.   **(04 Marks)**

Module-2

3 a. Sketch and explain the plastic deformation of a single crystal by slip.   **(08 Marks)**
   b. Explain the various factors affecting fatigue life.   **(05 Marks)**
   c. With a neat sketch, explain the stages in ductile fracture.   **(07 Marks)**

OR

4 a. Define creep. With a neat sketch, explain the different stages of creep.   **(10 Marks)**
   b. With a neat sketch, explain how the fatigue testing is carried out.   **(10 Marks)**

Module-3

5 a. Explain homogeneous nucleation. Discuss the significance of critical radius of nuclei.   **(08 Marks)**
   b. Explain the solidification of pure metals.   **(07 Marks)**
   c. Explain Hume-Rothery rule for solid solution behaviour.   **(05 Marks)**

OR

6 a. What is a solid solution? With a neat sketch, explain the different types.   **(08 Marks)**
   b. State Gibbs phase rule and explain each term.   **(06 Marks)**
   c. Explain the following and write invariant reactions:
   (i)   Eutectic system
   (ii) Eutectoid system
   (iii) Peritectoid system   **(06 Marks)**

Module-4

7 a. Draw Fe-C equilibrium diagram and label all the fields, also explain all the invariant reactions in the system.   **(10 Marks)**
   b. What is T-T-T diagram? Draw T-T-T diagram for an eutectoid steel. Explain the various transformed products of austenite on cooling.   **(10 Marks)**

OR

8 a. Define heat treatment process. How heat treatment processes are classified? (06 Marks)
  b. Explain with the help of a sketch, normalizing and any one type of carburizing process. (08 Marks)
  c. With a neat sketch, explain induction hardening process. (06 Marks)

Module-5

9 a. Classify the different types of steels. Discuss the effects of alloying elements on steel. (08 Marks)
  b. Write short notes on:
     (i) Tool steel
     (ii) Stainless steel
     (iii) Spheroidal graphite iron (06 Marks)
  c. Mention composition, properties and uses of :
     (i) Cartridge brass
     (ii) Muntz metal
     (iii) Phosphor bronze (06 Marks)

OR

10 a. What are composite materials? Write the classification of composites. (06 Marks)
   b. Explain the following processes:
      (i) Hand lay-up process
      (ii) Pultrusion process (10 Marks)
   c. Mention the different applications of composite materials. (04 Marks)

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