USN | | | | | | | | | |

18ME34

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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 atomic packing factor. Determine the atomic packing factor of an ideally packed HCP unit cell. **(10 Marks)**
    b.   Classify the different types of crystal imperfections. Sketch and explain the edge dislocation and screw dislocation. **(10 Marks)**

OR

2   a.   Sketch and explain engineering stress-strain and true stress-strain diagram and explain the stages of fracture. **(10 Marks)**
    b.   Sketch and explain linear and non-linear elastic properties, when a material is subjected to static tension. **(10 Marks)**

Module-2

3   a.   Sketch and explain Type – I, Type – II and Type – III fracture. **(06 Marks)**
    b.   Draw and explain S-N curve. **(04 Marks)**
    c.   Draw $Fe-Fe_3C$ diagram and indicate the phase temperatures and also write the invariant reactions. **(10 Marks)**

OR

4   a.   Explain the different types of solid solutions. **(05 Marks)**
    b.   Sketch and explain binary phase diagram. **(05 Marks)**
    c.   Sketch and explain mechanism of fatigue. Explain different types of fatigue loading with sketch. **(10 Marks)**

Module-3

5   a.   Draw TTT diagram for eutectoid steel and explain briefly. **(07 Marks)**
    b.   Distinguish between Austempering and Martempering. **(05 Marks)**
    c.   Define Hardenability. Sketch and explain Jominy end quench test. **(08 Marks)**

OR

6   a.   Distinguish between annealing and normalizing. **(04 Marks)**
    b.   Sketch and explain flame hardening and induction hardening process. **(08 Marks)**
    c.   Explain composition, properties and uses of grey cast iron and medium carbon steel. **(08 Marks)**

Module-4

7   a.   Define composite material. Give its classifications. Explain metal matrix composites. **(08 Marks)**
    b.   Sketch and explain hand layup and spray layup process. **(12 Marks)**

OR

8 a. Derive an expression for Young's modulus for ISO-stress and ISO-strain condition.

   (12 Marks)

   b. Calculate the tensile modulus of elasticity of unidirectional carbon fibre-reinforced composite material which contains 62% by volume of carbon fibres in ISO-strain and ISO-stress condition.

   Where $E_{carbon\ fibre} = 37.86 \times 10^4$ N/mm^2

   $E_{Epoxy} = 41.98 \times 10^2$ N/mm^2

   Find Young's modulus of composite = E_C = ?

   (08 Marks)

Module-5

9 a. Define ceramic. Explain the types of ceramics. **(05 Marks)**
   b. Distinguish between Thermo plastic and Thermo setting plastics. **(05 Marks)**
   c. Sketch and explain processing of plastic by Injection moulding method. **(10 Marks)**

OR

10 a. Define smart material. Explain any four types of smart materials. **(10 Marks)**
   b. Explain, how the residual life assessment is done using different types of non destructive testing methods. **(10 Marks)**

* * * * *