CBCS SCHEME

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21ME33

Third Semester B.E. Degree Examination, June/July 2024
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is the difference between crystalline and amorphous materials? What is atomic packing factor? Show that the atomic packing factor for FCC crystal structure is 0.74. **(10 Marks)**

b. Distinguish between metals, ceramics and polymers with respect to bonding. **(05 Marks)**

c. Differentiate between Frankel and Schottky defects. **(05 Marks)**

OR

2 a. Mention the types of Bravias lattices possible in crystalline materials. Show that atomic packing factor for BCC crystal structure is 0.68. **(07 Marks)**

b. Define Burgers vector. Distinguish between edge and screw dislocations. **(07 Marks)**

c. Explain with neat sketch grain boundaries and stacking faults defects. **(06 Marks)**

Module-2

3 a. Explain with suitable examples the following:
i) Gibbs phase rule
ii) Rules of formation of solid solutions
iii) Fick's laws of diffusion. **(15 Marks)**

b. Explain substitutional solid solution with an example. **(05 Marks)**

OR

4 a. Draw Fe-C equilibrium diagram and label all the fields, also explain all the invariant reactions in the system. **(10 Marks)**

b. Discuss two component phase diagram. **(05 Marks)**

c. Discuss with suitable examples ordered substitutional and disordered substitutional solid solutions. **(05 Marks)**

Module-3

5 a. Differentiate between homogeneous and heterogeneous nucleation. **(04 Marks)**

b. Derive an expression for the critical size of the nucleus for homogeneous nucleation. **(06 Marks)**

c. Briefly differentiate the following:
i) Slip and twinning
ii) Recovery and recrystallization. **(10 Marks)**

OR

6 a. Discuss the following strengthening mechanisms:
Solid solution and precipitation hardening. **(08 Marks)**

b. What is meant by heat treatment? Discuss briefly cyaniding and flame hardening. **(12 Marks)**

Module-4

7 a. Write a note on corrosion as it pertains to materials. (05 Marks)
b. Discuss metallic and organic coating applied to metals for corrosion prevention. (10 Marks)
c. List the advantages and disadvantages of surface coatings. (05 Marks)

OR

8 a. Discuss briefly steps in powder metallurgy. (10 Marks)
b. Discuss briefly the applications of powder metallurgy. (06 Marks)
c. List the methods normally used for the production of metal powders. (04 Marks)

Module-5

9 a. Explain briefly the need for material selection in design. (08 Marks)
b. Discuss briefly related to material selection and design:
i) Evolution of engineering materials
ii) Design tools and material data. (12 Marks)

OR

10 Write a note on:
a. Processing of obtaining material data
b. Material property charts
c. Selection criteria for materials
d. Materials data bases. (20 Marks)

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