CBCS SCHEME

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18AU33

Third Semester B.E. Degree Examination, June/July 2023
Material Science and Metallurgy

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 iv) Coordination number. **(04 Marks)**

b. State and explain Fick's first law of diffusion. **(06 Marks)**

c. What do you mean by crystalline imperfection? Explain briefly and scalar/line defects. **(10 Marks)**

OR

2 a. With the help of a neat sketch conventional stress-strain diagram for mild steel under uniaxial tension, explain clearly the behaviour of the material till fracture. **(08 Marks)**

b. Explain slip and twinning plastic deformation of crystal. **(08 Marks)**

c. List and explain the factor affecting diffusion. **(04 Marks)**

Module-2

3 a. With the help of neat sketch, explain the different stages of ductile cup and cone fracture. **(08 Marks)**

b. Define Creep. With a typical creep curve, explain the different stages of creep. **(08 Marks)**

c. List and explain creep properties. **(04 Marks)**

OR

4 a. What is fatigue? Explain in brief fatigue test and plot S-N curve for mild steel and aluminium alloy. **(10 Marks)**

b. Explain the various types of fatigue loading with examples. **(06 Marks)**

c. Discuss the factors affecting the fatigue life of a component. **(04 Marks)**

Module-3

5 a. Explain the homogenous nucleation. Discuss the significance of critical radius of nuclei. **(10 Marks)**

b. Define solid solution, and explain the different types of solid solution with figures. **(10 Marks)**

OR

6 a. Draw the iron-carbon equilibrium diagram and label all the fields. Write the different invariant reactions. **(10 Marks)**

b. Explain Hume-Rothary rules for the formation of substitution solid solution. **(04 Marks)**

c. State and explain Gibb's phase rule and Lever rule. **(06 Marks)**

Module-4

7 a. Explain the steps to construct TTT diagram. Draw a sketch of a TTT diagram, label all the fields for an eutectoid steel. **(10 Marks)**

b. Write a short note on the following heat treatment processes. **(10 Marks)**
i) Annealing ii) Carburizing

OR

8 a. Discuss properties, composition and uses of Grey cast iron and S.G cast iron. **(10 Marks)**

b. Define hardenability and how it is determined. **(04 Marks)**

c. Differentiate between austempering and martempering of steels. **(06 Marks)**

Module-5

9 a. Discuss any two types of $C_u - Z_n$ alloys with respect to properties, composition and applications. **(10 Marks)**

b. Discuss the properties, composition and applications of $A\ell - C_u$ alloy and $A\ell$ – Si alloy. **(10 Marks)**

OR

10 a. Explain the following for production of FRP.

i) Hand layup process

ii) Pultrusion process **(12 Marks)**

b. Explain with a neat sketch production of MMC by using powder metallurgy process. **(08 Marks)**

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