CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **17MR32**

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019

Material Science and Metallurgy

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define the following:
(i) Unit cell (ii) Space Lattice (iii) Atomic packing factor **(06 Marks)**
b. Determine atomic factor of FCC unit cell. **(08 Marks)**
c. The unit cell of chromium is cubic and contain 2 atoms. Determine the dimension of the chromium unit cell. Given atomic weight of chromium is 52 and density of chromium is 7.19 Mgm^{-3}. **(06 Marks)**

OR

2 a. Classify crystal imperfections. Explain the line defects in detail. **(10 Marks)**
b. Explain the Fick's I and II laws of diffusion. **(06 Marks)**
c. Define: (i) Stiffness (ii) Resilience (iii) toughness (iv) Ductility **(04 Marks)**

Module-2

3 a. Differentiate between slip and twinning deformations in materials. **(06 Marks)**
b. With a neat sketch explain the stages in ductile fracture. **(08 Marks)**
c. Explain the methods to improve fatigue life. **(06 Marks)**

OR

4 a. Define creep and explain typical creep curve. **(07 Marks)**
b. Explain the Griffith's theory for brittle fracture. **(08 Marks)**
c. Draw the S-N curve for steel and Aluminium. **(05 Marks)**

Module-3

5 a. Explain homogeneous nucleation. Discuss the significance of critical radius of nuclei. **(09 Marks)**
b. Explain with a neat sketch the grain structure of cast metal. **(06 Marks)**
c. Explain Hume-Rothery rules for solid solution behavior. **(05 Marks)**

OR

6 a. State Gibbs phase rule and explain each term. **(06 Marks)**
b. Describe the construction of phase diagrams by thermal analysis. **(08 Marks)**
c. Write equations for the following invariant reactions:
(i) Eutectic (ii) Eutectoid (iii) Peritectoid **(06 Marks)**

Module-4

7 a. Draw Fe-C equilibrium diagram and label all the fields. Explain the invariant reaction in the system. **(10 Marks)**
b. Define Hardenability. Explain with a neat sketch the Joming end quench test. **(10 Marks)**

OR

8 a. What is TTT diagram? Draw the TTT diagram for a eutectoid steel. (08 Marks)
b. Define carburizing. Explain pack carburizing process. (06 Marks)
c. Briefly explain induction hardening process. (06 Marks)

Module-5

9 a. Write a note on plain carbon steels properties and applications. (05 Marks)
b. Explain structure and composition of Gray Cast Iron and S.G. iron. (06 Marks)
c. With a neat sketch explain pultrusion process and state the applications. (09 Marks)

OR

10 Write notes on:
a. Al-Cu alloys
b. Applications of composites
c. Filament winding process
d. Stir casting process (20 Marks)

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