

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2022

MECHANICAL ENGINEERING (2020 SCHEME)

Course Code: 20MET205

Course Name: Metallurgy and Material Science

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. What is a unit cell ? Give two examples.
2. Describe the procedure to obtain Miller indices for crystal directions
3. Describe Burgers vector.
4. Write the significance of High angle and Low angle grain boundaries.
5. Define CCT with an example.
6. List any two surface hardening methods.
7. Explain Recrystallization temperature.
8. Draw and explain SN curve.
9. What is the metallurgical phenomena for Titanic ship wreckage?
10. Differentiate Brittle and ductile fracture.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Derive the equation for atomic packing factor for the BCC crystal structure. (7)
b) Copper has an atomic radius of 0.128 nm, an FCC crystal structure, and atomic weight of 63.5 g/mol. Compute its theoretical density. (7)

OR

12. a) Explain the mechanism of crystallization in pure metals. What factors favor fine grain size formation? (8)
b) How do we correlate slip system with plastic deformation in metals ? (6)

MODULE II

13. a) State and explain Fick's laws. (7)
b) Describe working of SEM with a neat sketch (7)

OR

14. a) Differentiate between edge dislocation and screw dislocation with neat sketches (8)
b) With neat diagrams, explain the steps to determine the microstructure and grain size for a metal. (6)

MODULE III

15. a) What is hardenability? Explain the Jominy end quench test. (7)
b) Explain any two strengthening mechanisms. (7)

OR

16. a) Explain Iron – Carbon Phase diagram with the various invariant reactions involved in it. (8)
b) Define solid solutions? State Hume-Rothery's rule for the formation of substitutional solid solution. (6)

MODULE IV

17. a) What is the significance of alloying? Mention any three alloying elements in Iron with its advantages and applications. (7)
b) Briefly explain the factors affecting fatigue strength (7)

OR

18. a) With neat diagrams, explain the process of crack initiation and crack propagation in fatigue. (7)
b) Explain (with figure) how the fatigue limit of a ferrous material is determined. (7)

MODULE V

19. a) Sketch and discuss the process of ductile to brittle transition and explain the significance of Ductile-Brittle Transition Temperature. (8)
b) Define ceramics. Enumerate the types of ceramics. Mention any two advantages of ceramics. (6)

OR

20. a) Define creep. Sketch a typical creep curve and explain different stages of creep. (7)
b) What are composites? Give the classification of composites and the application of composites. (7)
