

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****ROBOTICS AND AUTOMATION****(2020 SCHEME)****Course Code: 20RBT201****Course Name: Processing and Properties of Materials****Max. Marks: 100****Duration: 3 Hours****PART A***(Answer all questions. Each question carries 3 marks)*

1. What is an ionic bond? List the important properties exhibited by ionic crystals.
2. Define critically resolved shear stress.
3. What is grain boundary energy? How does it influence grain growth?
4. What is steady state diffusion? Explain the Fick's law that is relevant to steady state diffusion.
5. A martensitic microstructure is very hard. Why?
6. Plot a typical hardenability curve obtained from end quench test and explain it.
7. What is the role of fibre phase and matrix phase in a composite?
8. What is a semi-crystalline polymer? Give examples.
9. What is the effect of temperature on the resistance of a conductor?
10. Give the characteristic properties by which a paramagnetic material can be distinguished from a diamagnetic material.

**PART B***(Answer one full question from each module, each question carries 14 marks)***MODULE I**

11. a) Is iron an allotropic metal? Why? (4)
- b) What is twinning? (3)
- c) The yield stress measured for aluminium specimen of grain size  $10^4$  nm is 240MPa and of grain size  $10^5$  nm is 225MPa. Determine the yield stress for a grain size of  $10^3$  nm. (7)

**OR**

12. a) What is the procedure for finding Miller indices of crystallographic planes and directions? Draw (100), (110) and (111) planes in a cubic unit cell. (10)
- b) What is a slip system? (4)

**MODULE II**

13. What is a crystal imperfection? How are they classified? Explain the important surface defects seen in a crystal. (14)

**OR**

14. a) Differentiate between edge dislocation and screw dislocation. (8)  
b) Explain the steps involved in the preparation of specimen for metallographic examination. (6)

**MODULE III**

15. a) State Hume-Rothery's rule for the formation of substitutional and interstitial solid solution. (6)  
b) Sketch and label iron-carbon equilibrium diagram. Specify the invariant reactions in an iron-carbon system. (8)

**OR**

16. a) How is spheroidizing performed? What are the changes in microstructure when spheroidizing is done? (6)  
b) Sketch and explain TTT diagram for eutectoid steel. (8)

**MODULE IV**

17. a) What is a composite material? Give a comparison between metal matrix and ceramic matrix composites. (10)  
b) Why are composites particularly attractive for aerospace applications? (4)

**OR**

18. List and explain the composition, properties and applications of any two alloys each of aluminium and copper. (14)

**MODULE V**

19. What is a band structure? Why are solids having a band structure? How can solids be classified on the basis of band theory? (14)

**OR**

20. a) Explain magnetic anisotropy. (6)  
b) Differentiate between hard and soft materials with examples. (8)

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