

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

**Course Code: ME210****Course Name: METALLURGY AND MATERIALS ENGINEERING**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any three questions, each carries 10 marks.*

Marks

- 1 a) What is the significance of atomic packing factor? Obtain the APF of HCP structure. (6)
- b) Tantalum has a BCC crystal structure with a density of  $16.6 \text{ g/cm}^3$  and an atomic weight of  $180.9 \text{ g/mol}$ . Find its lattice parameter. (4)
- 2 a) Differentiate between slip and twinning. (6)
- b) What is critically resolved shear stress? How is it determined? (4)
- 3 a) What is the influence of grain size on the mechanical properties of a material? (6)
- b) How is the concept of Frank Read source used to explain multiplication of dislocations? (4)
- 4 a) What are the factors influencing diffusion rate as per Fick's laws of diffusion? (6)
- b) What is a slip system? (4)

**PART B***Answer any three questions, each carries 10 marks.*

- 5 What is the difference between iron-carbon diagram and TTT diagram? Sketch the TTT diagram for eutectoid steel and explain the influence of cooling rate on final microstructure and properties. (10)
- 6 How does surface hardening differ from hardening? Explain how surface hardening is attained by carburizing, nitriding and flame hardening. (10)
- 7 Explain the composition, microstructure, properties and uses of any four types of cast iron. (10)

- 8 What is work hardening? What are the metallurgical and property changes that occur when a work hardened material passes through various phases of its removal? (10)

**PART C**

*Answer any four questions, each carries 10 marks.*

- 9 a) Why is fatigue regarded as a type of catastrophic failure? What is the nature of loading in fatigue? (6)
- b) What is thermal fatigue? (4)
- 10 a) What is endurance limit? What are the factors influencing its value? (6)
- b) Which type of failure exhibits a necking behaviour? Explain. (4)
- 11 What is creep in metals? What are the different stages in it? How do temperature and stress influence creep? (10)
- 12 a) Explain the mechanism of fatigue failure. (6)
- b) Under what temperature conditions can ductile to brittle transition occur? Explain. (4)
- 13 a) Explain Griffith's theory of brittle fracture. (6)
- b) What is a smart material? Give some typical applications. (4)
- 14 a) Write short notes on
- (i) superplasticity (3)
  - (ii) bio materials (3)
  - (iii) applications of composites (4)

\*\*\*\*