

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) (FT/WP/S5PT) Examinations May/June 2026 (2019 Scheme)



Course Code: MET205

Course Name: METALLURGY AND MATERIAL SCIENCE

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks

Marks

- 1 Compare covalent bonds with metallic bond. (3)
- 2 Sketch within a cubic unit cell the following directions: $[1\ 2\ 1]$, $[2\ 1\ 0]$ and $[1\ 1\ 2]$. (3)
- 3 What is the significance of Frank Read source in dislocation? (3)
- 4 Differentiate vacancy diffusion and interstitial diffusion with neat sketches. (3)
- 5 Explain Eutectic reaction with an example. (3)
- 6 Justify the statement, "Martensite is the hardest and strongest microconstituent in iron carbon alloy system". (3)
- 7 Differentiate between hot and cold working. (3)
- 8 Differentiate Bronze and Brass. (3)
- 9 What is superplasticity? (3)
- 10 Give the classification of ceramics. (3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

- 11 (a) Estimate effective number of atoms, co-ordination number and atomic packing factor for a BCC unit cell. (8)
- (b) What are the miller indices? Explain the procedure for obtaining miller indices for any crystallographic plane with a suitable example. (6)
- 12 (a) What are the major mechanisms by which metals undergo plastic deformation? Explain with neat sketches. (8)
- (b) Yield strength of mild steel with an average grain size of 0.05mm is 138MPa (6)

and with a grain size of 0.007mm is 276MPa. What will be the average grain size for the same steel for yield strength of 207MPa?

Module 2

- 13 (a) With the help of simple sketches differentiate between edge dislocation and screw dislocation. (8)
- (b) Describe working of TEM with a neat sketch. (6)
- 14 (a) Derive Bragg's law? Explain the utility of it. (7)
- (b) State and derive Fick's II law of diffusion. (7)

Module 3

- 15 (a) Sketch Fe – Fe₃C phase diagram and label completely. (8)
- (b) Define solid solutions? State Hume-Rothery's rule for the formation of substitutional solid solution. (6)
- 16 (a) Explain normalising and hardening with neat diagrams. (6)
- (b) What is carburising? Describe different types of carburising methods. (8)

Module 4

- 17 (a) Explain the following strengthening mechanism in metals:- (6)
- i) Strain hardening and ii) Dispersion strengthening
- (b) Distinguish between the terms 'recovery' and 'recrystallisation' involved in process of heating cold worked metals with neat sketches. (8)
- 18 (a) Distinguish between white cast iron and malleable cast iron with neat sketches, Give one application of each. (8)
- (b) Write down the composition, properties and uses of different types of Plain carbon steels. (6)

Module 5

- 19 (a) Explain Griffith theory of brittle fracture. Derive Griffiths "Energy balance equation" for crack propagation. (10)
- (b) What is ductile to brittle transition in steel? What are the factors affecting ductile to brittle transition. (4)
- 20 (a) Define creep and sketch and explain the creep curve. (7)
- (b) What is fatigue? Define and explain endurance limit, fatigue strength and fatigue life using S-N curve. (7)
