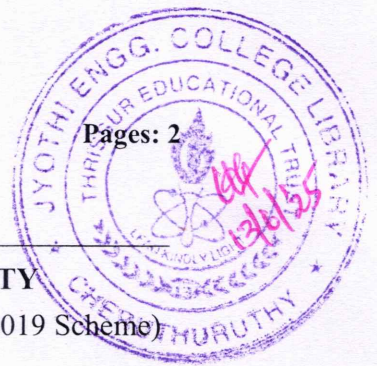


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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) (FT/WP) (S5 PT) Examination May 2025 (2019 Scheme)

Course Code: MET205

Course Name: METALLURGY & MATERIAL SCIENCE

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks

Marks

- | | | |
|----|---|-----|
| 1 | Which one is stronger- primary bond or secondary bond? Explain. | (3) |
| 2 | For a specimen, the yield stress is measured to be 300MPa when the grain size is 10^3 nm and 200MPa when the grain size is 10^5 nm. Find the yield stress if the grain size is 10^7 nm. | (3) |
| 3 | What is Frank Read source? | (3) |
| 4 | Define the terms diffusion flux and coefficient of diffusion. | (3) |
| 5 | What is an invariant reaction? Give examples. | (3) |
| 6 | What is the purpose of performing Jominy's end quench test? | (3) |
| 7 | Differentiate between hot working and cold working. | (3) |
| 8 | What is an austenite stabilizing element? Why is it called so? | (3) |
| 9 | What is ductile to brittle transition temperature? | (3) |
| 10 | Explain the composition and properties of super alloys. | (3) |

PART B

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

Module 1

- | | | |
|-------|--|-----|
| 11(a) | Explain the properties of ionic, covalent and metallic bonding. How does the type of bonding influence the properties? | (8) |
| 11(b) | Differentiate between slip and twinning. | (6) |

OR

- | | | |
|--------|---|-----|
| 12 (a) | How are crystallographic planes and directions specified? Sketch (110) plane and (020) plane in a cubic unit cell. | (8) |
| (12(b) | A face-centered unit cell has a density of 6.23 g cm^{-3} . Given the atomic mass of a single atom is 60g. Evaluate the edge length of the unit cell and the atomic radius. | (6) |

Module 2

- | | | |
|----|---|------|
| 13 | With the help of neat sketches explain point, line and surface defects seen | (14) |
|----|---|------|

in crystals.

OR

- 14 (a) What is the significance of Burger's vector in studying crystal imperfections? (8)
- 14 (b) Explain the principle of X-ray diffraction method. (6)

Module 3

- 15 Sketch and label the iron-carbon equilibrium diagram. Hence explain the microstructure changes when (i) carbon content is increased for a specimen held at a temperature less than lower critical temperature (ii) a hypoeutectoid steel specimen is heated from room temperature to molten state. (14)

OR

- 16 With the help of a suitable diagram, explain the influence of cooling rate on the final microstructure as a eutectoid steel specimen is cooled from austenite phase. Also write notes on the properties of final microstructure obtained for different cooling rates. (14)

Module 4

- 17 (a) What do you mean by strengthening of a metal? What are the different mechanisms by which a metal can be strengthened? (10)
- 17 (b) What is recrystallization temperature? (4)

OR

- 18 What is cast iron? What are the different types of cast iron? How do the properties vary for different types of cast iron? (14)

Module 5

- 19 What is fatigue? What is the nature of loading that leads to fatigue failure? Explain the mechanism of fatigue failure. (14)

OR

- 20 What is creep? What are the stages of creep? How can we increase the resistance of a material against creep? (14)
