

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2020

Course Code: ME309**Course Name: METALLURGY AND MATERIALS SCIENCE**

Max. Marks: 100

Duration: 3 Hours

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

Marks

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|---|---|-----|
| 1 | a) Obtain the atomic packing factor for FCC crystal structure. | (4) |
| | b) Sketch the following Miller indices in a cubic unit cell. $(1\ 2\ 0)$, $(0\ \bar{1}\ 0)$ and $[1\ 0\ 1]$ | (6) |
| 2 | a) Copper has an atomic radius of 0.128 nm, an FCC crystal structure and an atomic weight of 63.5 g/mol. Determine its theoretical density. | (4) |
| | b) Explain the mechanism of plastic deformation by slip and twinning. | (6) |
| 3 | a) Give the significance of Frank Read source in dislocation. | (4) |
| | b) Differentiate edge dislocation and screw dislocation in relevance with Burger's vector. | (6) |
| 4 | a) Compare SEM and TEM. | (4) |
| | b) State and explain Fick's laws of diffusion. | (6) |

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

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|---|---|------|
| 5 | a) Enumerate the Hume-Rothery rules for substitutional solid solution. | (4) |
| | b) Explain the changes in microstructure when a 0.6% carbon steel is cooled from austenite to room temperature. | (6) |
| 6 | a) Sketch the iron-carbon equilibrium diagram and explain the three invariant reactions in it. | (6) |
| | b) Compare carburizing and flame hardening techniques of surface treatment. | (4) |
| 7 | Explain the microstructure, properties and applications of different types of cast iron. | (10) |
| 8 | a) How does age hardening improve the strength of an aluminium alloy? | (5) |
| | b) Give the significance of adding alloying elements in steel. Explain the effects of adding any four alloying elements in steel with their specific functions. | (5) |

PART C

Answer any four full questions, each carries 10 marks.

- 9 With a neat sketch explain the procedure for fatigue testing and draw the S-N curve. (10)
- 10 a) Explain the importance of Griffith's theory in brittle fracture of materials. (5)
b) Illustrate DBTT in steels. (5)
- 11 a) Differentiate ductile fracture and brittle fracture. (5)
b) Explain five methods to improve fatigue life of components. (5)
- 12 a) Define creep. List any four factors affecting creep rate. (5)
b) Classify and explain the different types of composites. (5)
- 13 a) Describe the different types of nuclear materials. (5)
b) Explain the role of biomaterials in medical application. (5)
- 14 a) Compare the properties and applications of super alloys and intermetallics. (5)
b) Classify ceramics. Give two applications of ceramics. (5)
