

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Third semester B.Tech degree examinations (S) September 2020

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) Sketch within a cubic unit cell the following planes $(1\bar{1}1)$, $(1\bar{2}1)$, (001) and directions $[111]$, $[110]$ | (5) |
| | b) An atom having FCC crystal structure has a density of 22.4 gm/cc and atomic weight of 192.2 gm/mol. Calculate its atomic radius. | (5) |
| 2 | a) Explain the mechanism of crystallization in pure metals. What factors favour fine grain size? | (6) |
| | b) Distinguish between a unit cell and a grain. | (4) |
| 3 | a) Differentiate between edge dislocation and screw dislocation. | (5) |
| | b) Explain any two diffusion mechanism with neat sketches. | (5) |
| 4 | a) Define grain size number. | (2) |
| | b) Describe the procedure for metallographic specimen preparation? Name any two etchants. | (8) |

PART B

Answer any three questions, each carries 10 marks.

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|---|---|-----|
| 5 | a) Justify the need of Heat treatment processes for metals. Explain with neat sketch TTT diagram for heat treatment of steel. | (8) |
| | b) What is critical cooling rate? | (2) |
| 6 | a) Draw the iron carbon equilibrium diagram, label it and show the invariant points. | (7) |
| | b) Write the reactions occurring at the invariant points indicating the temperature and composition of each phase. | (3) |
| 7 | Give the microstructure, composition, properties and applications of the following: | |
| | a) Nodular Cast Iron | (5) |
| | b) Grey cast iron. | (5) |

- 8 a) Give the factors affecting recrystallisation. (5)
b) Differentiate hot working and cold working. (5)

PART C

Answer any four questions, each carries 10 marks.

- 9 a) What is fatigue? Explain the different stages involved in fatigue failure. (6)
b) Describe how the fatigue life of a machine element can be improved. (4)
- 10 a) Explain Ductile to Brittle Transition Temperature. List the factors affecting this phenomenon. (5)
b) Define Fracture toughness. (5)
- 11 What do you mean by ductile fracture? With the help of neat sketches, explain the various stages of ductile fracture. (10)
- 12 a) Write notes on smart materials. Give the advantages and applications of smart materials. (6)
b) Write notes on (i) piezo electric materials (ii) shape memory alloys. (4)
- 13 a) Define creep and briefly explain the factors affecting creep. (5)
b) Write notes on: (i) Superplasticity (ii) creep resistant materials (5)
- 14 a) With the help of a neat sketch explain creep test. (5)
b) Give the functions of matrix phase in composites. (5)
