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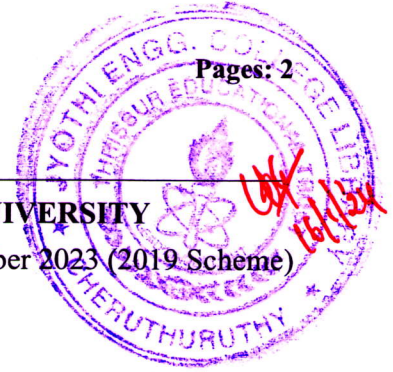
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Reg No.: \_\_\_\_\_

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

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R, S) / S5 (PT) (R, S) Examination December 2023 (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 Compare the important aspects related to Miller indices for directions and Miller indices for planes. (3)
- 2 What are the lattice parameters that define a unit cell? List them. (3)
- 3 Explain the mechanism of dislocation generation by the Frank-Read source. (3)
- 4 Mention the effects of any three factors affecting diffusion in crystals. (3)
- 5 Draw a labelled schematic phase diagram of an isomorphous binary alloy showing the liquidus and solidus lines and mark the single phase and two phase regions. (3)
- 6 Name the three allotropic forms of pure iron with their crystal structures and temperature stability ranges. (3)
- 7 Distinguish between hot working and cold working. (3)
- 8 Give the composition and uses of bronze. (3)
- 9 Define fatigue and explain the characteristics of fatigue failure. (3)
- 10 What is superplasticity? What promotes superplasticity in certain alloys? (3)

**PART B**

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

**Module 1**

- 11 a) What is the significance of atomic packing factor? Obtain the APF of BCC and FCC structures. (7)
- b) With the help of neat sketches explain two modes of plastic deformation in metals and alloys. (7)
- 12 a) 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. Also find the lattice parameter. (7)

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- b) Explain the procedure for obtaining miller indices for any crystallographic plane with a suitable example. (7)

**Module 2**

- 13 a) Give the comparison between an edge dislocation and a screw dislocation with neat sketch. (8)
- b) With the help of neat sketch explain the mechanism of vacancy diffusion and interstitial diffusion. (6)
- 14 a) Explain with appropriate sketches zero dimensional defects in crystals. (7)
- b) Describe the working of SEM with a neat sketch. (7)

**Module 3**

- 15 a) Draw the labelled iron-iron carbide phase diagram showing all phase boundaries and invariant reactions. Write the reactions at the invariant points and mention the phases present. (10)
- b) What is the purpose of normalizing heat treatment? What are the stages involved in the process? (4)
- 16 a) With the help of a neat diagram, explain the development of an isothermal transformation diagram for eutectoid steel. Comment on its significance. (7)
- b) How does surface hardening differ from hardening? Explain how surface hardening is attained by carburizing and flame hardening. (7)

**Module 4**

- 17 a) Describe about grey cast iron and nodular cast iron. (4)
- b) Name any five alloying elements used in steels and explain their effects. (10)
- 18 a) Give an account of composition and uses of any two aluminium alloys. (6)
- b) Compare solid solution hardening with age hardening. (8)

**Module 5**

- 19 a) Draw a typical creep curve and explain the various stages involved in creep. (7)
- b) What are composites? Give the classification and applications of composites. (7)
- 20 a) With the help of neat sketches, explain the various stages of ductile fracture. (7)
- b) Define ceramics? Enumerate the types of ceramics? Mention any two advantages of ceramics. (7)