DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Mechanical Engineering) SEMESTER - 3 Winter 2025 (Regular)

Course :Bachelor of Technology (Mechanical Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 3

Subject Code & Name: 25AF1612PC302 - MATERIAL SCIENCE AND METALLURGY

Time : 3 Hours] **[Total Marks : 60**

Instructions to the Students:

1.Each question carries 12 marks.

2.Question No. 1 will be compulsory and include objective-type questions.

3.Candidates are required to attempt any four questions from Question No. 2 to Question No.6

4.Use of non-programmable scientific calculators is allowed.

5.Assume suitable data wherever necessary and mention it clearly.

Q1. Objective type questions. (Compulsory Question) 12

1 The total number of Bravais lattices is: a) 7 b) 14 c) 21 d) 28

2 Which of the following is not a point defect? a) Vacancy b) Dislocation c) Interstitial d) Substitutional impurity

3 The area under the stress–strain curve up to fracture gives: a) Toughness b) Resilience c) Ductility d) Stiffness

4 Formability of sheet metals is usually tested by: a) Hardness test b) Erichsen test c) Charpy test d) Compression test

5 Gibb's phase rule is expressed as: a) $F = C + P + 2$ b) $F = C – P + 2$ c) $F = P – C + 2$ d) $F = C \times P$

6 Which of the following is NOT a phase in the iron-iron carbide diagram? a) Ferrite (α) b) Austenite (γ) c) Cementite (Fe_3C) d) Graphite

7 The eutectoid composition of steel occurs at approximately: a) 0.025% C b) 0.8% C c) 2.0% C d) 6.67% C

8 Critical cooling rate is the: a) Maximum rate to avoid martensite b) Minimum rate to obtain martensite d) Rate to form bainite d) None of these

9 Tempering is done to: a) Increase brittleness b) Reduce residual stresses and improve toughness c) Convert ferrite to cementite d) None of these

10 Carburizing is used to: a) Increase surface carbon content to improve hardness b) Reduce surface carbon content c) Soften the steel d) Produce martensite in the core

11 The purpose of etching is to: a) Highlight microstructure by selective attack of grain boundaries b) Increase hardness c) Remove inclusions d) Reduce brittleness

12 Tensile fracture generally shows: a) Necking and cup-and-cone features b) Striations C) Hard spots D) Surface oxidation

Q2. Solve the following.

A) Define atomic packing factor. Prove that FCC structure has Atomic Packing Factor of 0.74. 6

B) Explain Edge and Screw Dislocations with the help of schematic diagrams. 6

Q3. Solve the following.

A) Differentiate between slip and twinning mechanisms of plastic deformation using schematic diagrams. 6

B) Elaborate Dye penetrant test w.r.t. purpose, mechanism, procedure using schematic diagrams. 6

Q4. Solve Any Two of the following.

A) Discuss Hume-Rothery's rules of solid solubility for substitutional and interstitial solid solutions. 6

B) Draw Iron-Iron carbide Equilibrium diagram. Explain any two phases w.r.t. definition and properties. 6

C) Draw and explain the Time Temperature, Transformation (T-T-T) diagram for 0.8% carbon steel. 6

Q5. Solve Any Two of the following.

A) Differentiate between Annealing and Normalizing. Show these processes on the equilibrium diagram. 6

B) Explain Flame hardening and induction hardening processes using schematic diagrams. 6

C) Elaborate Hardening treatment with respect to it purpose, process details, quenching media used, mechanism, and applications. 6

Q6. Solve Any Two of the following.

A) Elaborate the process of specimen preparation for microscopy. 6

B) Describe Sulphur printing w.r.t. purpose, importance, procedure, and chemical reactions involved. 6

C) Explain the principle of working of optical Metallurgical microscope. Explain the magnification and resolution of the objective lens. 6

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