DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE
Supplementary End Semester Examination – Summer 2023
Branch: Mechanical Engineering
Semester: III

Course: B Tech

Subject Code & Name: Material Science and Metallurgy (BTMEC302)

Date: 10/08/2023

Max Marks: 60
Duration: 3 Hr.

Instructions to the Students:
1. Each question carries 12 marks.
2. Attempt any Five questions of the following.
3. Illustrate your answer with neat sketches, diagram, etc., wherever necessary.
4. Assume suitable data wherever necessary & mention it clearly.

(Marks)

Q.1 Solve the following.	**(12)**
a) Explain in short different imperfections in crystal structure.	6
b) Explain slip mechanism of plastic deformation. Give difference between slip and twinning.	6
Q. 2 Solve the following.	**(12)**
a) Define Creep. Explain effect of creep rate on creep curve.	6
b) Explain Brinell hardness test w.r.t. principle of working, indenter details, formula, advantages and limitations.	6
Q. 3 Solve the following.	**(12)**
a) Draw the Fe-Fe3C diagram. Explain Phases and Critical Temperatures.	6
b) What is the importance of TTT diagram? Explain TTT diagram in detail.	6
Q. 4 Solve the following.	**(12)**
a) Define heat treatment and give its objectives. Explain tempering process w.r.t. types, variation of properties with tempering temperature.	6
b) What is surface hardening? Explain induction hardening with neat sketch.	6
Q. 5 Solve the following.	**(12)**
a) Explain specimen preparation for optical metallurgical microscope.	6
b) Explain sulphur print test w.r.t. purpose, significance, and procedure.	6
Q. 6 Solve the following.	**(12)**
a) Give Different types of NDT. Explain in brief Magnaflux Test.	6
b) Write short notes on: 1) Basic Types of Crystal Structure 2) Space Lattice and Lattice Parameters	6

End

Course: B. Tech.   Branch: Mechanical & Allied Engg.   Semester: III
Subject Code & Name: BTMES304 Materials Science and Metallurgy
Max Marks: 60   Date:09-01-24   Duration: 3Hrs.

Instructions to the Students:
1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

		(Level/CO)	Marks

Q. 1 Solve Any Two of the following. **12**

A) Sketch the following directions and planes within a cubic unit cell: **6**

$[\bar{3}12]$ $[10\bar{2}]$ $(2\bar{1}1)$ $(3\bar{1}2)$

B) Explain, in brief, the slip and twinning mechanisms of plastic deformation with the help of schematic diagrams.   **6**

C) Compare Brinell Hardness Test with Rockwell Hardness Test.   **6**

Q.2 Solve Any Two of the following.   **12**

A) Explain the Hume-Rothery's rules of solid solubility. Show the solidification of pure metals graphically. https://www.batuonline.com   **6**

B) What is lever rule? Derive the statement of Lever rule using schematic diagrams.   **6**

C) Discuss the eutectoid transformation on the equilibrium diagram of steels. Draw the microstructure of the eutectoid steel.   **6**

Q. 3 Solve Any Two of the following.   **12**

A) Explain the mechanism of removal of heat during cooling with the help of schematic diagrams/graphs. Give the requirements of an ideal quenchant.   **6**

B) Differentiate clearly between annealing and normalizing heat treatments. Show the temperature range of these treatments on the equilibrium diagram.   **6**

C) Describe the different types of flame hardening processes. What is the principle of induction hardening treatment?   **6**

Q.4 Solve *Any Two* of the following.

A) Compare macroscopy with microscopy w.r.t. definition, purposes, specimen preparation, merits, and demerits.

B) Define etching. Differentiate clearly between the mechanism of etching for single phase and two phase alloys.

C) Explain sulphur print test w.r.t. purpose, procedure, and chemical reactions involved.

Q. 5 Solve *Any Two* of the following.

A) Explain dispersion strengthening w.r.t. basic mechanism, critical factors, advantage, and commercial examples

B) Discuss age/precipitation hardening process w.r.t. basic principle, conditions, and steps.

C) Describe magnetic particle inspection method using schematic diagrams.

*** End ***

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter Semester Examination –- Dec. 2019

Branch: B Tech Mechanical Engineering   **Sem.:- III**

Subject:- Material Science and Metallurgy (BTMEC302)   **Marks: 60**

Date:- 12/12/2019   **Time:- 3 Hr.**

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

		(Marks)
Q.1.		**(12)**
a)	Explain in short different imperfections in crystal structures	6
b)	Draw stress strain diagram for mild steel, show effect of Carbon content on shape of stress strain diagram	6
Q2.		**(12)**
a)	What is solid solution? Differentiate between substitutional and interstitial solid solution?	6
b)	Draw Fe-Fe$_3$C equilibrium diagram. Show all temperatures and phases	6
Q3.		**(12)**
a)	Draw neat labeled TTT diagram for eutectoid steel and give stepwise experimental procedure for drawing it.	6
b)	What is annealing? List different types of annealing along with their purpose.	6
Q4.		**(12)**
a)	Explain with neat sketches different types of flame hardening.	6
b)	What is surface hardening? Explain induction hardening with neat sketch.	6
Q5.		**(12)**
a)	Explain steps in specimen preparation for microscopy.	6
b)	For spark test draw the sparks for the following specimen 1. CI 2. MS 3. HSS	6
Q6.		**(12)**
a)	Write a note on strain hardening	6
b)	Explain dye penetrant test. What is its application?	6

_____**Paper End**_____

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Winter Semester Examination –- Dec. 2019

Branch: B Tech Mechanical Engineering　　　　　　**Sem.:- III**

Subject:- Material Science and Metallurgy (BTMEC302)　　**Marks: 60**

Date:- 12/12/2019　　　　　　　　　　　　　　**Time:- 3　Hr.**

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Instructions to the Students
1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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b)	Explain dye penetrant test. What is its application?	6

_____**Paper End**_____

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE
End Semester Examination – SUMMER 2019

Course: B. Tech in Mechanical Engineering　　　　　　　　　　　　**Sem: III**

Subject Name: Material Science and Metallurgy　　　　　　**Subject Code:** BTMEC302

Max Marks: 60　　　　　　　　　**Date: 29-05-2019**　　　　　　　　**Duration: 3 Hr.**

Instructions to the Students:
1.　*Solve **ANY FIVE** questions out of the following.*
2.　*The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3.　*Use of non-programmable scientific calculators is allowed.*
4.　*Assume suitable data wherever necessary and mention it clearly.*

Marks

Q. 1 **Solve Any Two of the following.**　　　　　　　　　　　　　　　　**12**

  A) What is plastic deformation? Explain with neat sketch plastic deformation by slip.

  B) Define the term coordination number, packing density and atomic radius. And prove the packing density of the FCC unit cell is 0.74

  C) Classify crystal imperfections and explain screw dislocation in details.

Q.2 **Solve Any Two of the following.**　　　　　　　　　　　　　　　　**12**

  A) Derive relation between engineering and true stress-strain and also draw true stress-strain curve for mild steel.

  B) Classify hardness tests. Explain Rockwell hardness test in detail.

  C) Explain with neat sketch Izod impact test. How Izod impact test is different from charpy impact test.

Q. 3 **Solve Any two of the following.**　　　　　　　　　　　　　　　　**12**

  A) Explain Iron-Iron carbide equilibrium diagram with neat sketch.

  B) With neat sketch describe the mechanism of transformation of austenite to bainite.

  C) Define the critical cooling rate of a steel and show the critical cooling rate on a TTT diagram.

Q.4 **Solve Any Two of the following.**　　　　　　　　　　　　　　　　**12**

  A) What is annealing? State the purpose of annealing and also plot the heating temperature band for full annealing.

  B) Define hardenability. Explain Jominy-End quench test for hardenability with neat sketch.

  C) Classify surface hardening processes. Explain any one in detail.

Q. 5 **Solve Any two of the following.**　　　　　　　　　　　　　　　　**12**

  A) Explain the procedure followed in specimen preparation in metallography.

  B) Describe spark test. What observations to be noted and also draw spark patterns for low and high carbon steels

C) State and explain working principle of metallurgical microscope with neat sketch.

Q. 6 **Solve Any two of the following.** 12

A) Explain magnetic particle inspection and also enumerate the limitations of magnetic particle inspection.

B) What are the various strengthening mechanisms? Explain any one method in detail.

C) Explain the principles of the following methods of the inspection.

1). Dye Penetrant inspection
2). Ultrasonic inspection.
3). Eddy current testing,

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech. in Mechanical Engineering **Semester:** III

Subject Name: Materials Science and Metallurgy **Subject Code:** BTMEC 302

Date:03/12/2018 **Marks: 60** **Duration: 3 Hrs.**

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is permitted.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	*Marks*
Q. 1	**Solve the following.**		**12**
A)	Derive the expressions for planar atomic densities on (100), (110), and (111) planes of both BCC and FCC crystal structures.	*(Understand, CO1)*	
B)	Explain slip mechanism of plastic deformation w.r.t. conceptual meaning, its occurrence due to the movement of edge and screw dislocations, and comparison with twinning.	*(Understand)*	
Q.2	**Solve the following.**		**12**
A)	A tension test was conducted on steel specimen of diameter 12.5 mm and gauge length 50 mm. The loads at lower and upper yield points were recorded to be 45000 and 46000 N respectively. The maximum and fracture loads were 75000 and 50000N respectively. The gauge length after fracture was 62.5 mm. The diameter at fracture was found to be 8 mm. At a load of 20000 N, the total extension was 0.035 mm. Determine the following: (i) Lower yield stress (ii) Ultimate tensile stress (iii) True fracture stress (iv) Percentage elongation (v) Percentage reduction in area (vi) Modulus of resilience.	*(Apply, CO 2)*	
B)	Discuss Vickers Hardness Test w.r.t principle of working, indenter details, formula, advantages, and limitations.	*(Understand)*	
Q. 3	**Solve the following.**		**12**
A)	Describe the types of solid solutions. Explain Hume-Rothery's rules of solid solubility.	*(Remember)*	
B)	What is the importance of T-T-T diagrams? Explain the procedure to determine these diagrams with the help of schematic diagrams.	*(Understand)*	
Q.4	**Solve *Any Two* of the following.**		**12**

A) Define heat treatment and give its objectives. Give the names of two different heat treatment processes along with the major objective of each. *(Understand)*

B) Explain tempering process w.r.t. purposes, process details, types, and variation of properties with tempering temperature. *(Understand)*

C) Discuss induction hardening process w.r.t. principle of working, process details, advantages, and limitations. *(Understand)*

Q. 5 Solve *Any Two* of the following. 12

A) Describe the procedure of specimen preparation for microscopy. *(Understand)*

B) Explain the principle of working of optical metallurgical microscope. Compare it with electron microscope. *(Remember)*

C) Discuss sulphur print test w.r.t. purpose, significance, procedure, and chemical reactions. *(Understand)*

Q. 6 Solve the following. 12

A) Explain dispersion strengthening w.r.t. basic mechanism, critical factors, advantage, and commercial examples. *(Remember)*

B) Describe ultrasonic inspection technique w.r.t. principle of working, types, and applications. *(Understand)*

☆ **End of Paper** ☆

Course: B. Tech. in Mechanical Engineering　　　　　　　　　**Semester:** III

Subject Name: Materials Science and Metallurgy　　　　　　　**Subject Code:** BTMEC 302

Date:03/12/2018　　　　　　　　**Marks: 60**　　　　　　　　**Duration: 3 Hrs.**

Instructions to the Students:

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☆**End of Paper** ☆