Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2162107 **Date: 03/05/2017**

Subject Name: Heat Treatment

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **Short Questions** **14**

1 The Hardenability is not affected by
(a) Chemical composition (b) Critical cooling rate
(c) Air (d) Quenching media & method of quenching

2 The fastest cooling rate is achieved when steel is quenched in
(a) Air (b) Water (c) Oil (d) Brine

3 Which of the following is not correct
(a) Martensite has BCC structure
(b) Austenite has FCC structure
(c) Cementite has orthorhombic structure
(d) Ferrite has BCC structure

4 Hardenability of steel is not assessed by
(a) Jominy end quench test
(b) Grossman's method
(c) Hardness test
(d) None of above

5 Heat treatment that requires heating a part below A1 temperature i.e. between 550°C & 650°C is called
(a) Hardening (b) Process annealing (c) Full Annealing
(e) Normalizing

6 Martensitic transformation never goes to completion i.e. 100%. True or False.

7 As tempering temperature increased, the steel becomes hard. True or False.

8 Plain carbon steel is effectively nitrided. True or False.

9 0.08% carbon steel can be surface hardened by induction hardening. True or False

10 Define: Bainite

11 Define: CCR (Critical Cooling Rate)

12 Quenching Crake during heat treatment of steel parts may occur due to
(a) Heating at higher temperature for larger duration
(b) Presence of oxidizing atmosphere inside the furnace
(c) Irregular martensitic transformation within the parts
(d) All a,b,c.

13 Hardened Aluminum bronzes have lower hardness than hardened steel, even though both have the marensitic structure. True or False.

	14	Nodular cast iron can be obtained from the gray cast iron by a suitable heat treatment. True or False.	
Q.2	**(a)**	Write a note on quench cracks.	**03**
	(b)	Why heat treatment of steel is done? Explain with examples.	**04**
	(c)	Draw sketch of 0.8 %C plain carbon steel TTT diagram. Define terminologies and different transformation & transformation product regarding it.	**07**
		OR	
	(c)	Explain construction of TTT diagram for 0.8 %C steel with its limitation.	**07**
Q.3	**(a)**	Why heating is important in heat treatment?	**03**
	(b)	Explain the heat treatment used to improve machinability of high carbon steels.	**04**
	(c)	Define hardenability. How it is measured? What affect the hardenability?	**07**
		OR	
Q.3	**(a)**	How the continuous cooling diagram (CCT) does is differ from the isothermal transformation diagram.	**03**
	(b)	Write a note on patenting.	**04**
	(c)	Differentiate Annealing and Normalizing heat treatment processes.	**07**
Q.4	**(a)**	Write a note on Isoforming.	**03**
	(b)	Write a note on secondary hardening.	**04**
	(c)	Explain age hardening with example.	**07**
		OR	
Q.4	**(a)**	Write a note on temper embrittlement.	**03**
	(b)	What is sub-zero treatment? Under what circumstances this treatment is given to hardened component.	**04**
	(c)	Discuss Bain distortion model.	**07**
Q.5	**(a)**	Write purposes of tempering.	**03**
	(b)	Write a note on Induction hardening.	**04**
	(c)	Write a note on Pearlitic transformation.	**07**
		OR	
Q.5	**(a)**	Write a note on mechanism of quenching.	**03**
	(b)	State advantages and limitation of nitriding over carburizing.	**04**
	(c)	Write a note on malleablizing annealing.	**07**

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