

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

**B.Tech.(Marine Engineering) (2013 Onwards)**  
**B.Tech (ME) (2011 Onwards) (Sem.-3)**  
**ENGINEERING MATERIALS & METALLURGY**  
Subject Code : BTME-306  
Paper ID : [A1143]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

**1. Write briefly :**

- a) What is bainite?
- b) Sketch the close packed hexagonal crystal structure.
- c) Differentiate between recovery and recrystallization.
- d) What do you understand by non-crystalline materials?
- e) Explain the concept of allotropy.
- f) What is the effect of the addition of tungsten on the properties of steel?
- g) Briefly explain phase rule.
- h) Give examples of interfacial defects.
- i) State the basic principle of induction hardening.
- j) What is sub-zero treatment?

## SECTION-B

2. What is peritectic transformation? Explain the various phases occurring in iron-carbon equilibrium diagram during peritectic transformation.
3. Differentiate between steady-state and non-steady-state diffusion and briefly explain the factors affecting diffusion process.
4. List down some significant heat treatment defects. Explain the causes and remedies of any two of them.
5. What are line defects? Explain with the help of suitable examples.
6. What is hardenability? Describe one method which is commonly used for the measurement of hardenability.

## SECTION-C

7.
  - a) Explain the basic principle and operation of oxyacetylene flame hardening with the help of a neat sketch.
  - b) Differentiate between annealing and normalizing. Give specific applications of each process.
8.
  - a) What is liquid carburizing? Give the advantages, limitations and applications of this process.
  - b) Discuss the effects of the various types of quenching media used in the hardening process. Which type of quenching medium is more suitable for alloy steels?
9. Write short notes on :
  - a) Theoretical yield strength
  - b) Eutectic transformation
  - c) Miller's indices
  - d) Lever Rule