QP Code : **NP-19824**

(3 Hours) [Total Marks : 80

N. B. : (1) Question **No. 1** is **compulsory**.
(2) Attempt **any three** questions from remaining five questions.
(3) Draw neat well labeled sketches.
(4) Figures at **right** side indicate marks.

1. Write note on any **four**:- 20
   (a) Flame Hardening
   (b) Composite materials
   (c) Classify crystal imperfections
   (d) Normalising
   (e) Allotropic forms of iron
   (f) Classification of engineering materials.

2. (a) What is Dislocation? What are the sources of Dislocation? Compare edge 10
   and screw Dislocation.
   (b) What is plastic deformation? Discuss how plastic deformation of single crystal 10
   takes place by slip mechanism and twinning mechanism.

3. (a) State Griffith theory of brittle fracture. On its basis, derive an expression 10
   for fracture stress. State Orowan's modification.
   (b) How creep test is carried out? Explain Andrade's analysis of creep. 10

4. (a) What is Fatigue limit explain with S-N curve? Explain fatigue testing. 10
   (b) What is hardenability? Explain Jominy End Quench test method to measure 10
   hardenability.

5. (a) Define 'Alloy'. Name different types of alloys. Discuss Hume-Rothery 10
   conditions of formation of solid solution.
   (b) Draw Fe-Fe$_3$C Diagram and Explain Eutectoid, Eutectic and Peritectic 10
   transformation in the Fe-Fe$_3$C Diagram.

6. (a) Draw a neat Time Temperature Transformation (TTT) and CCT of 0.8% 10
   carbon steel and label all important points and phases.
   (b) Write short note on: 10
      (i) Nanomaterials
      (ii) Effect of alloying element on Fe-C diagram.

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