013402

August/September 2022
B.Tech. (ME) IV SEMESTER
Materials Engineering (PCC-ME-402-21)

Time : 3 Hours]   [Max. Marks : 75

Instructions :

  1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.

  2. Answer any four questions from Part-B in detail.

  3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

1. (a) Define planar density.   (1.5)

   (b) Define coordination number.   (1.5)

   (c) What is slip system?   (1.5)

   (d) What is Hume-Rothery rule?   (1.5)

   (e) What are the factors affecting fatigue life of the component?   (1.5)

   (f) What is the effect of temperature on creep rate? (1.5)

   (g) Define lever rule for phase diagram.   (1.5)

   (h) Define Gibbs phase rule.   (1.5)

6. (a) Discuss and mark various heat treatment processes of TTT diagram. (8)

(b) What is quench crack? How it can be eliminated? (7)

7. (a) What are ceramics? Discuss its types and applications also. (8)

(b) Discuss the various applications of nano-materials and shape memory alloys. (7)

———————

(i) How TTT diagrams are different from CCT diagrams? (1.5)

(j) What is shape memory alloy? (1.5)

PART-B

2. (a) Draw the following directions and planes in a cubic crystal :

[1 1 0] [1 1 1] (1 1 1) (2 2 2) (2 3 2) (10)

(b) What is meant by crystal imperfection? Classify them in order of their geometry. (5)

3. (a) What is plastic deformation? How plastic deformation takes place in the material? (10)

(b) Derive relation for Schmid's law. (5)

4. (a) Explain Griffith theory of brittle fracture. (8)

(b) What are the types of failure/fracture in an uniaxial tension test. Explain in detail. (7)

5. (a) Draw binary eutectic phase diagram of any two-component system along with the microstructure development. (8)

(b) What is the proeutectoid phase for an iron-carbon alloy in which the mass fractions of total ferrite and total cementite are 0.92 and 0.08, respectively? Why? (7)