May 2024
B.Tech. (ME) (IV Semester)
Materials Engineering (PCC-ME-402-21)

Time: 3 hours **Max. Marks: 75**

PART A (1.5 marks each)

Q1 (a) Name any rhree properties of Engineering materials

(b) What do you mean by slip system in any crystal? Give one example.

(c) How do edge dislocations interact with each other in crystals? What is meant by dislocation annihilation?

(d) List any three methods of materials strengthening.

(e) Illustrate three types of dynamic stress cycles with the help of sketches.

(f) List any three factors that affect the creep deformation in materials.

(g) What do you understand by interstitial solid solution? Give one such example.

(h) Write down Gibbs Phase rule. What is the significance of this rule in materials engineering?

(i) Name any three applications of Biomaterials.

(j) What are Shape Memory Alloys (SMAs)? List some applications of SMAs.

PART B

Q2 (a) Briefly explain the family of cubic crystal directions and planes by giving suitable examples. Convery the Miller Indices [1 1 2] into Bravais Miller Indices (4 indices system). (8)

(b) Rhodium has an atomic mass of 103 g/mol, atomic radius of 0.1345 nm and a density of 12.41 g/cm^3. Determine whether it has an FCC or BCC structure. Take Avagadro's Numer as 6.022 x 10^{23} per mol. (7)

Q3 (a) Explain the plastic deformation in polycrystalline materials with the help of stress strain curve. (7.5)

(b) Discuss in detail the deformation by twining mechanism in crystalline materials with neat sketches. (7.5)

Q4 (a) Differentiate between the ductile and brittle fracture. (7.5)

(b) Explain in detail the fatigue fracture in metals and alloys (7.5)

Q5 (a) The mass fraction of total ferrite and total cementite in an iron-carbon alloy is 0.91 and 0.09 respectively. Is this a hypoeutectoid or hypereutectoid alloy? Why? (7.5)

(b) Classify and describe solid solutions with suitable examples and sketches. (7.5)

Q6 Discuss in detail different types of heat treatment processes for steels. (15)

Q7 Write short notes on the following

(a) Composite materials (7.5)

(b) Economic, environmental, and societal issues in materials engineering. (7.5)