

# III SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2016/DEC 2016

# SUBJECT: MATERIAL SCIENCE AND ENGINEERING [MTE 2101]

# **REVISED CREDIT SYSTEM**

# Time: 3 Hours

## MAX. MARKS: 50

#### **Instructions to Candidates:**

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- Draw neat labelled diagram (using scale and pencil) wherever necessary.
- 1A. Compute theoretical density of Copper having an atomic radius of 0.128 nm, an FCC (02) crystal structure, and an atomic weight of 63.5 g/mol.
- **1B.** Determine the number of atoms along the direction [110] in Aluminium having (03) lattice parameter 0.405nm, an FCC crystal structure, and calculate linear density along the given direction.
- 1C. Draw neat labelled sketch of various microstructures that forms in iron-carbon alloy (05) of hypo-eutectoid composition (containing less than 0.76 wt% C), as it is cooled from within the austenite phase region to below the eutectoid temperature.
- 2A. What do you understand by atomic packing factor? Determine APF for BCC and (03) FCC crystal structure?
- **2B.** For a 40 wt% Sn–60 wt% Pb alloy at 150°C in figure 1, (a) What is the composition (04) of the each phase (b) Mass fraction of each phase and (c) Density of  $\alpha$  and  $\beta$ ? Take the densities of Pb and Sn to be 11.23 g/cm<sup>3</sup> and 7.24 g/cm<sup>3</sup>, respectively.



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**2C.** Explain any three invariant reactions taking place in phase transformation of metals (03) with example for each type.

(02)

- **3A.** Write a short note on the following :
  - i. Pack Carburizing
  - ii. Normalizing
- **3B.** Classify polymers by their molecular structures with an example for each type. (04) Support your answer by suitable sketches.
- **3C.** State important properties of Low carbon steels, Medium carbon steel, laminar (04) structured composite and sandwich structured composite.
- **4A.** Explain the mechanism by which Diamagnetism and Para magnetism occurs in **(04)** materials in short. Give examples for both types of magnetism.
- **4B.** Write a short note on Piezo electricity and Ferro Electricity with their area of **(04)** application.
- **4C.** Estimate the size of critical nucleus of tin when it is super cooled by  $20^{\circ}$ C. Assume nucleation to be homogeneous. The enthalpy change for solidification of tin is 0.42 GJ/m<sup>3</sup>. The liquid / solid interfacial energy is 0.055 J/m<sup>2</sup>. The melting point of tin is 232° C. (02)
- 5A. Show and explain the following transformations from austenite on TTT curve with (04) temperatures

(i) Fine Pearlite	(iii) Bainite
(ii)Coarse Pearlite	(iv) Martenesite

- **5B.** What do you understand by the term "luminescence" and what is the difference (03) between fluorescence and phosphorescence? State which type of luminescence occurs in (i) Electron microscope (ii) LED
- **5C.** Where does Sputtering thin film deposition technique finds its application? What are **(03)** the advantages and disadvantages of sputter deposition?