B.Tech.
THIRD SEMESTER EXAMINATION 2015-16
EME301
MATERIAL SCIENCE IN ENGINEERING

Time: 3 Hours   Max. Marks: 100

Note:

- Attempt all questions.
- Marks and number of questions to be attempted from the section is mentioned before each section.
- Assume missing data suitably. Illustrate the answers with suitable sketches.

1. Attempt **any four parts** of the followings.   [4x5]
   a. Define the term Material Science and Materials Engineering. What is the importance of material to an engineer? What factors are to be considered for selecting a material for any application?
   b. Classify the engineering materials. Differentiate between iron and steel, alloys and composite, ceramic and polymer.
   c. What is the significance of bonding force and bonding length? Classify the various types of bond with example.
   d. Define the atomic packing factor. Derive the expression for Simple cubic, FCC.
   e. Lattice constant of copper (FCC) unit cell is 3.61 Å. Compute the density of atoms per unit length along the direction [110] and [111].

2. Attempt **any four parts** of the followings.   [4x5]
   a. What do you mean by X ray diffraction How rotating crystal method is different from Laue's concept of X-ray diffraction.
   b. What is slip plane; how is it related to dislocation. Show Burgers vector and burgers circuit to define a screw dislocation.
   c. Draw the stress- strain diagram of plain carbon steel for 0.2 %, 0.5%, and 1.0% carbon steel. Explain and mark the important points on it. How do these curves differ from the cast iron Stress-strain curve?
   d. What is fatigue? What are its effects on properties of material? Describe the experimental determination of fatigue limit.
   e. Differentiate between the destructive and nondestructive test. Describe the one technique for determination of surface crack.

3. Attempt **any four parts** of the followings.   [4x5]
   a. During a grain growth process, the ASTM grain size no 5 increased to ASTM no 2. Compute the change in size.
   b. Determine the relative amount of proeutectoid ferrite α and pearlite for the overall composition 0.44 wt % Carbon steel when slowly cooled to a temperature below eutectoid temperature 723°C.Consider the tie line extended from phase boundary α - (α+Fe₃C) phase boundary (0.022 wt %C) to the eutectoid composition (0.76 wt %C).
   c. Explain the Gibb's Phase rule. Draw the pure iron phase diagram and narrate the total number of variables and degree of freedom at different phase boundaries and triple point.
   d. Classify the ferrous material and explain the process of manufacturing the pig iron with figure and temperature details inside the furnace.
   e. Compare the following
      (i)   Quench hardening and case hardening
      (ii)   Annealing and Normalizing

4. Attempt **any four parts** of the followings.   [4x5]
   a. Differentiate the between the brass and bronze. Discuss the various types of Bronze with their characteristics and application.
   b. Explain the mechanism of origin of permanent magnetic dipole. Differentiate between diamagnetism and paramagnetism.
   c. Classify the different type of semiconductor. Explain them briefly. Why intrinsic semiconductor are not suitable for electronic devices.
   d. What is superconductivity? How it is different from conductivity. Explain the Ideal and hard superconductors.
   e. Classify plastics. Enumerates the various processing technique of plastic explain the injection moulding process.

5. Attempt **any four parts** of the followings.   [4x5]
   a. Explain ceramic material, their characteristics, basic structure and application.
   b. Discuss with neat sketch press and blow technique to manufacture a glass bottle
   c. Define the Griffith theory of brittle fracture. Obtain the expression for fracture stress.
   d. Classify the corrosion and discuss the corrosion protection technique.
   e. Write the short notes on following
      (i) Nano material (ii) smart material