

TME-301

131

Printed Pages : 2

Roll No. to be filled in your Answer Book

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**Semester: III****B. Tech End Semester Examination Dec 2014****MATERIAL SCIENCE**

Time : Three Hours]

[Max. Marks : 100

**Note:** Attempt all questions, the marks assigned to each question is indicated at question itself.

**Q1. Attempt any four****(4X5)**

- Discuss energy band concept of conductors, insulators and semiconductors. Discuss intrinsic and extrinsic semiconductors. How does alloying alter the conducting properties of materials?
- State the Gibbs phase rule and describe the terms therein.
- Discuss non ferrous metals and alloys as engineering materials.
- Describe Brunel's and Rockwell's tests for hardness.
- Define Ionization potential, electron affinity and electronegativity. Why 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> ionization potentials become subsequently greater? Write the difference between electronegativity and electron affinity in one line.
- Calculate the atomic packing efficiency of bcc and fcc lattice.

**Q2. Attempt any four****(4X5)**

- Draw the Millers indices for  $(\bar{1}\bar{1}1)$ , (112), (110), (0), (221).
- Discuss the microstructure of Brass for its tensile strength and Duralumin for heat treatment and age hardening. Discuss their applications.
- Discuss stress corrosion; inter granular corrosion and the measures to improve such structural defects.

- (d) Discuss the structural properties of cast iron and its uses.
- (e) Describe dislocations in solids. Draw burgers' vector for edge and screw dislocations.
- (f) Express the edge face diagonal and body diagonal of the unit cells in terms of the atomic radius  $r$  for simple cubic, face centered cubic and body centered cubic lattice.

**Q3. Attempt any two (2x10)**

- (a) Discuss superconductivity, type I and type II superconductors and Meissner effect. Discuss possible applications if ambient temperature superconductors are developed.
- (b) Explain annealing normalizing, tempering and hardening of Iron-Carbon alloys.
- (c) What are plastics? Describe their processing techniques and mechanical behavior.

**Q4. Attempt any two (2x10)**

- (a) Explain the TTT diagram for eutectoid steels.
- (b) Discuss composite materials with reference to young's modulus as the parameter of their design. Discuss their applications.
- (c) Write a note on smart materials and nanomaterials as emerging engineering materials with special emphasis on exploiting their optical and thermal properties.

**Q5. Attempt any two (2x10)**

- (a) Discuss ceramics and polymers for their structural, mechanical and electrical properties. Describe their engineering applications.
- (b) Describe the orientation of electronic spins in ferromagnetic, antiferromagnetic and ferrimagnetic materials. What are magnetic domains? Explain Hysteresis loops for a ferromagnetic structure and its relation to power loss in transformer core. Define soft magnetic materials.
- (c) Discuss phase transformations in steels highlighting compositional and structural changes in the transformation of Austenite into Pearlite, Cementite, Bainite and Martensite.