

Printed Pages : 4

EOE037

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0933

Roll No.

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B.Tech

**(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10
MATERIALS SCIENCE**

Time : 3 Hours]

[Total Marks : 160

Note : *Attempt all five questions, there are choices within. Marks are indicated therein.*

1 Answer any **four** of the following : **5×4=20**

- (a) Briefly describe the historical importance of materials towards technological developments, citing examples of steels of semiconductors towards the industrial and electronic revolutions.
- (b) Derive the following formula for hydrogen-spectra-wavelengths(λ) from Bohr's atomic

$$\text{model } \frac{1}{\lambda} = R \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ where the symbols}$$

have their usual meaning.

- (c) Enlist and briefly describe the chemical-bondings.

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- (d) For the cubic crystals (SC, BCC, FCC), find the number of atoms per unit cell, relationship between atomic radius (r) and cell-size (a). Also find atomic packing fraction for SC, BCC, FCC crystals.
- (e) A first order diffraction pattern is obtained with monochromatic X-ray of $\lambda = 1.5 \text{ \AA}$ at a glancing angle $\theta = 30^\circ$ from the planes (110). Find the interatomic-spacing d and the cell-size a .
- (f) Enlist and briefly describe the defects and dislocations in solids.

2 Answer any **two** of the following : **10×2=20**

- (a) What do you understand by toughness ? Explain. Describe the impact-testing for toughness. What is meant by ductile-material and brittle material ? Explain with example. Mild-steel is considered to be a reasonably good tough-material, but what is its toughness of very low (cryogenic) temperature ?
- (b) Draw the microstructures and stress-strain diagrams of mild steel and cast iron, indicating the details on it.
- (c) Draw a neat labelled neat sketch of iron-carbon equilibrium-diagram, showing various points, temperatures and the constituents. Also, explain why low carbon steel is soft whereas high carbon steel is hard.



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Answer any **two** of the following :

10×2=20

- (a) Write the typical composition, properties and applications of (i) Mild steel (ii) Gray cast iron (iii) Stainless steel (iv) High speed steel.
- (b) Enlist and describe various heat-treatment processes and its purpose. Also draw TTT diagram and mention its importance.
- (c) Write the typical composition, properties and applications of (i) Muntz metal (ii) Gun metal (iii) Solder alloy (iv) Durelumin.

4

Answer any **two** of the following :

10×2=20

- (a) Draw and describe the hysteresis curve and hysteresis loop and mention the role of domains for it. Differentiate between soft and hard magnets.
- (b) Enlist the various types of semiconductor and its basic devices. Show and explain the principle and working that how p-n junction (as diode) can be used as rectifier, and transistor (as triode) can be used as amplifier.
- (c) What is superconductivity and enlist its possible applications. Differentiate between type-I and type-II superconductors. What is meant by high T_c superconductor ? What is it normally ?

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Answer any **two** of the following :

- (a) Enlist various types of plastics (polymers), its chemistry and applications. Also briefly describe injection moulding and blow moulding of plastic products.
- (b) Describe briefly the mechanism and types of corrosion. Also describe various possible methods of corrosion prevention.
- (c) Write short notes on any **two** of the following :
 - (i) Ceramics and its applications
 - (ii) Composite materials and its applications
 - (iii) Fatigue failure and endurance limit.