

Total No. of Questions—12]

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**S.E. (Production) (I Sem.) EXAMINATION, 2010**

**MATERIAL SCIENCE**

**(2008 COURSE)**

**Time : Four Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer any *three* questions from each Section.  
(ii) Answers to the two Sections should be written in separate answer-books.  
(iii) Neat diagrams must be drawn wherever necessary.  
(iv) Figures to the right indicate full marks.  
(v) Use of logarithmic tables, slide rule, Mohr charts, electronic pocket calculator and steam tables is allowed.  
(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Why is it essential for a materials engineer to have the systematic classification of materials? [4]  
(b) Show the following planes and directions in a cubic cell : [4]  
(111), (110), [001],  $\frac{1}{2}$ [101].  
(c) Distinguish between slip and thinning. [8]

*Or*

2. (a) Derive the expression for critical resolved shear stress of a single crystal. [8]  
(b) Write the differences between Cold working and Hot working. [8]
3. (a) Derive the relationship between engg. stress and true stress and engg. strain and true strain. [6]

P.T.O. —

- (b) Draw engg. stress-engg. strain curves for the following materials : [4]
- (i) Mild steel ,
  - (ii) Copper
  - (iii) Cast iron
  - (iv) Polymer.
- (c) What is hardness ? How is the Brinell test conducted ? [6]

Or

4. (a) What is impact test ? Write the differences between Izod and Charpy tests. [4]
- (b) Vicker hardness test is independent of applied load. Justify it. [4]
- (c) Write short notes on (any two) [8]
- (i) Fatigue test
  - (ii) Creep test
  - (iii) NDT.

5. (a) Draw an equilibrium diagram for metal A and metal B that are soluble in each other in liquid state but insoluble in solid state. [8]

Given that :

Melting point of Metal A =  $271^{\circ}\text{C}$

M.P. of Metal B =  $321^{\circ}\text{C}$

Eutectic  $t^{\circ}\text{C}$  =  $144^{\circ}\text{C}$

Eutectic composition = 39.7% B

Also calculate percentage of eutectic in 20% B alloy at room  $t^{\circ}\text{C}$  ?

- (b) Define the term solid solution. Explain the laws governing the formation of solid solution. [6]
- (c) State Gibbs' phase rule. [4]

Or

6. (a) What is an equilibrium diagram ? Write the method to plot an equilibrium diagram. [8]
- (b) What is non-equilibrium cooling ? What are its effects on equilibrium diagram and mechanical properties of the material ? [6]
- (c) Draw an equilibrium diagram for an isomorphous system. [4]

## SECTION II

7. (a) What do you understand by precipitation hardening ? Consider an Al-4% Cu alloy and show how it is hardened by this method. [8]
- (b) Explain in short : [8]
- (i) Refinement of grain size to improve strength
- (ii) Composite materials.
- Or
8. (a) Differentiate between total radiation pyrometer and disappearing filament pyrometer. [8]
- (b) Explain the principle of Thermocouple. State the types of it giving at least one example with its range of  $t^{\circ}\text{C}$ . [8]
9. (a) Discuss how corrosion can be reduced by modification in design. [6]
- (b) Explain the following (any four) : [12]
- (i) Season cracking
- (ii) PVD
- (iii) CVD
- (iv) Anodising
- (v) Electroless plating
- (vi) Inhibitors.

Or

10. (a) Differentiate between cathodic protection and anodic protection. [6]
- (b) Write short notes on the following (any three) : [12]
- (i) Aluminising
  - (ii) Plasma nitriding
  - (iii) Electroplating
  - (iv) Ion implantation.

11. (a) What is meant by powder characteristics ? Discuss in brief. [6]
- (b) The property of the final sintered compact depends on size, shape and distribution of powders. Discuss. [4]
- (c) Describe in brief any one method of powder production. [6]

Or

12. (a) What is the purpose of mixing ? Describe mixing operations and their mechanisms. [6]
- (b) What are the basic principles of compacting ? [4]
- (c) Write in brief about the following (any two) : [6]
- (i) Self lubricated bearings
  - (ii) Cermets
  - (iii) Diamond impregnated tools.