

**B.TECH SEM – IV (2007 COURSE) (MECHANICAL ENGG.)  
: WINTER - 2017**

**SUBJECT : MATERIAL SCIENCE & ENGINEERING METALLURGY**

Day : **Thursday**  
Date : **23/11/2017**

Time : **02.30 PM TO 05.30 PM**  
Max. Marks : 80

**W-2017-2428**

**N.B.**

- 1) **Q.1** and **Q.5** are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from Section – I and any **TWO** questions from Section – II.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SEPARATE** answer book.

**SECTION – I**

- Q.1** Solve any **SEVEN** of the following: (14)
- a) What do you mean by ‘Dendritic Solidification’? Show with the help of a diagram?
  - b) State the effect of grain size on properties of metal.
  - c) State Gibb’s phase rule. What is its importance/utility?
  - d) Describe briefly magnetic particle inspection as NDT.
  - e) Draw a typical creep curve and explain the different stages of creep.
  - f) Explain the procedure for finding of miller indices.
  - g) What are metallurgical advantages of hot working process over cold working process?
  - h) Explain the phenomena of ‘Bauschinger effect’.
  - i) Why complex part are very difficult to test by ultrasonic method.
- Q.2** a) If element A shows atomic radius 1.278. Find out the following: (05)
- i) Theoretical density if atomic weight is 63.54 gm/mole and  $[N = 6.02 \times 10^{23}]$  in F.C.C. arrangement
  - ii) In B.C.C. arrangement and planar density in (1 0 0) plane in both structural arrangement.
- b) Describe the effect of imperfections in crystal structure on plastic deformation of metals. (04)
- c) What is strain hardening? How it is eliminated? (04)
- Q.3** a) What is the necessity of non-destructive testing? Explain the principle of Eddy current testing. (05)
- b) Write the advantages and limitations of BHN over VHN hardness methods. (04)
- c) Explain few factors that affects the fatigue life of components. (04)
- Q.4** a) Draw the equilibrium diagrams for following system. (08)
- Melting point of element A is  $650^{\circ}\text{C}$ .  
Melting point of element B is  $910^{\circ}\text{C}$   
Solubility of element A and B at room temperature is 15% and it increases to 19% at temperature  $500^{\circ}\text{C}$ .  
While solubility of element B in A at room temperature is 8% and it is increased to 14% at temperature  $500^{\circ}\text{C}$ . Both mixture will melt at  $500^{\circ}\text{C}$  for 40% B and also find out amount of 2% at 25% B by lever rule.
- b) Write down the applications of eutectic alloys. (03)
- c) What is micro-segregation? (02)

P.T.O.

## SECTION – II

- Q.5** Explain why? (any **SEVEN**): (14)
- a) What do you know about peritectic, eutectoid and eutectic reactions in Fe-Fe<sub>3</sub>C diagram?
  - b) Effect of 'C' and Si contents on microstructure of cast irons.
  - c) As amount of Zn increases in Cu, give how properties are changed in brasses.
  - d) Applications of Al-Si alloys in automobile industries.
  - e) Write in short on refractory materials as ceramics.
  - f) Describe laminar composites.
  - g) Magnetic particle test can be used for surface defect as well as subsurface defects. Explain how?
  - h) Draw standard creep curves showing effect of temperature when  $T_1 > T_2 > T_3$ .
  - i) Explain why coarse grain structure shows more ductility than fine grain structure.
- Q.6** a) Explain with respect to Fe-Fe<sub>3</sub>C diagrams. What do you know about  $\alpha$ -Ferrite,  $\gamma$ -Austenite and pearlite? (05)
- b) Give the classification and properties of cast irons. (04)
- c) Draw the microstructure of following : (04)
- i) Steel –AISI 1020.
  - ii) Ferritic S.G. Iron.
- Q.7** a) What are ceramic materials? Name some advance ceramic materials with its properties and applications. (05)
- b) A glass fibre reinforced polystyrene contains 40 vol% of parallel fibres. Estimate the Young's modulus of the composite in the longitudinal direction of the fibre if Young's modulus of glass is 70 GNm<sup>-2</sup> and that of polystyrene is 2.6 GNm<sup>-2</sup>. (04)
- c) Write a short note on SAP as composite. (04)
- Q.8** a) What are the typical alloys of copper used in engineering? Describe briefly their composition and uses. (05)
- b) Draw the Cu-Be equilibrium diagram and give the properties and applications. (04)
- c) Give compositions and uses of the following alloys. (04)
- i) Babbits            ii) Naval brass
  - iii) Invar            iv) LM6