**B.Tech. SEM -IV Mechanical 2014 Course (CBCS) : WINTER - 2017**

**SUBJECT : MATERIAL SCIENCE**

Day : **Wednesday** Time : **02.30 PM TO 05.30 PM**

Date : **22/11/2017** Max. Marks : 60

**W-2017-2095**

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**N.B.:**

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

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**Q.1** **a)** Define the following terms: **[05]**

**i)** Dislocation **iii)** Recrystallization

**ii)** Atomic packing factor **iv)** Single crystal structure

**v)** Slip

**b)** Explain the role of imperfections in plastic deformation of polycrystalline materials. **[05]**

**OR**

**a)** Find the number of atoms/cm$^2$ on (001) and (101) planes of Copper (F.C.C.) if r = 2.07 A$^0$. **[05]**

**b)** What is work hardening? How does it occur? Also explain why strain hardening does not occur in hot working. **[05]**

**Q.2** **a)** Find out the hardness number from following data: **[05]**

**i)** If the steel block is tested under the 2.5 mm ball indenter and 100 kg load gives circular impression of diameter 1.4 mm.

**ii)** Copper plate is tested by diamond indenter with load 120 kg and observe square impression of diagonal length $d_1$ = 0.791 and $d_2$ = 0.898 mm.

**b)** Explain the factors to be considered while selecting the NDT technique for the particular applications. **[05]**

**OR**

**a)** Suggest suitable NDT methods that might be used to identify: **[05]**

**i)** Surface defects with a copper metal.

**ii)** Internal flaws in steel block.

**iii)** Shrinkage cavity in Aluminium casting.

**iv)** Residual stresses in steel wire.

**b)** How is the creep life and fatigue life of the component improved? **[05]**

**Q.3** **a)** Explain the methods of plotting an equilibrium diagram by use of cooling curves. **[05]**

**b)** What is a dendrite? Explain the mechanism of formation of dendrites. **[05]**

**OR**

**P.T.O.**

a) Explain the following in brief: [05]
   i) Gibbs Phase rule
   ii) Uses of Eutectic alloys

b) Construct a phase diagram for the system A – B from the following data: [05]
M.P. of A = $1000^0$C, M.P. of B = $800^0$C
Eutectic point = $500^0$C at 40% B.
Maximum solubility of A in B at $500^0$C = 10%.
Maximum solubility of B in A at $500^0$C = 20%.
And solubility decreases with temperature to 5% in each other.
Lable the phase diagram.
Calculate the phases at 35% B and show the cooling of this alloy from high temperature to room temperature.

**Q.4** a) Define the following structural components: [05]
   i) Ferrite iii) Cementite
   ii) Austenite iv) Pearlite
   v) Ledeburite

b) List out the different types of cast iron and its properties, phases and applications. [05]

**OR**

a) Describe the three reaction that occur in Iron – Iron carbide system. [05]

b) Explain Nodular cast iron and state it's manufacturing method [05]

**Q.5** a) What is precipitation hardening? Explain with suitable example of such alloys. [05]

b) Draw the copper – zinc equilibrium diagram and give the types of brasses. [05]

**OR**

a) What is LM series? What do you mean by LM6 and LM11? [05]

b) Explain the significance of zinc in brasses. [05]

**Q.6** a) Explain the details about PVD processes and Ion implantation. [05]

b) What is passivity? Explain in details the theories of passivity. [05]

**OR**

a) Explain the role of design considerations and changes in environmental conditions in corrosion prevention methods. [05]

b) Explain in detail about stress corrosion cracking and intergranular corrosion. [05]

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