

USN

--	--	--	--	--	--	--	--	--	--

06ME32A

**Third Semester B.E. Degree Examination, June 2012**  
**Material Science and Metallurgy**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer FIVE full questions, selecting  
at least TWO questions from each part.**

**PART – A**

- 1 a. Define atomic packing factor. Determine atomic packing factor of HCP crystal structure. (10 Marks)  
 b. A 0.2% C steel component is to be carburised at 920°C. Calculate the time required to increase the carbon content to 0.4% at 0.5mm below the surface. Assume that carbon content at the surface is 0.9%. Given  $D_{920^{\circ}\text{C}} = 1.28 \times 10^{-11} \text{ m}^2/\text{sec}$ . (10 Marks)  
 Error function values
 

Z	erf(z)
0.75	0.7112
0.80	0.7421
- 2 a. Draw the stress-strain curve for M.S. and label various points and explain them. (10 Marks)  
 b. Explain the plastic deformation of metals and mechanisms that contribute to it. (10 Marks)
- 3 a. Explain with neat sketch the different stages of creep formation. (10 Marks)  
 b. What is fatigue? Draw SN curves for  
 i) Materials that display fatigue limit      ii) Materials that do not display fatigue limit. (10 Marks)
- 4 a. What is solid solution? With suitable examples, explain the different types of solid solutions. (06 Marks)  
 b. Describe the construction of phase diagram by thermal analysis. (06 Marks)  
 c. Explain how the interpretation of phase diagrams is done. (08 Marks)

**PART – B**

- 5 a. Explain three types of invariant reactions occurring in iron carbon diagram, with Gibb's phase rule. (08 Marks)  
 b. Explain how TTT diagrams are constructed. (06 Marks)  
 c. Explain the microstructure of steel at 0.83 and 1.2% C. (06 Marks)
- 6 a. Define hardenability. Explain the Jominey end quench test, with related figures. (10 Marks)  
 b. Explain the Austempering and martempering, with figure. (10 Marks)
- 7 a. Discuss AISI-SAE designation of steels, with examples. (08 Marks)  
 b. Show schematically, the microstructures of cast iron, gray cast iron, white iron, malleable iron, ductile iron and compacted graphite iron. (12 Marks)
- 8 a. Explain general methods of corrosion prevention. (12 Marks)  
 b. Write short notes on:  
 i) Stress corrosion cracking  
 ii) Cavitation damage. (08 Marks)

\* \* \* \* \*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.