UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Materials Technology   **Semester: IV**
Program: B.Tech Mechatronics   **Time 03 hrs.**
Course Code: MEMA 2002   **Max. Marks: 100**

Instructions: Section A is compulsory. Section B & C have internal choice in question 9 & 11

	SECTION A		
S. No.		**Marks**	**CO**
Q 1	Explain the effects of various alloying elements added to carbon steels.	4	CO3
Q 2	Describe the factors governing the substitutional solubility with an example.	4	CO3
Q 3	Distinguish between ductile and brittle fracture.	4	CO5
Q 4	Describe briefly the Austempering and Martempering processes.	4	CO4
Q 5	Explain coring in alloy system. How it can prevent?	4	CO3
	SECTION B		
Q 6	Explain the principles of construction of T.T.T. diagrams and discuss the effect of various cooling rates on transformation in an eutectoid steel using isothermal transformation diagram.	10	CO4
Q 7	Draw the equilibrium diagram of iron-carbon system and discuss transformations that takes place from melting point to room temperature at any percentage of carbon.	10	CO2
Q 8	Metallic iron changes from BCC to FCC at 9100 C. At this temperature, the atomic radii of the iron atom in the two structures are 0.1258 nm and 0.1292 nm respectively. Calculate the volume change in percentage during this structural change.	10	CO1
Q 9	For a Cu-Ni system, draw a phase diagram.	10	CO2

Ni %	0	20	40	60	80	100
Liquidus Temp	1084	1200	1275	1345	1440	1455
Solidus Temp(^{0}C)	1084	1165	1235	1310	1380	1455

At 50% Ni alloy find:

a) Composition of first solid formed
b) Composition of last solid formed
c) Amount of solid & liquid at 1400^0C

OR

The solidus and liquidus temperature for copper and gold system is given. Construct the phase diagram for this system and label each region.

Composition (wt.% Au)	Solidus Temperature (^0C)	Liquidus Temperature (^0C)
0	1085	1085
20	1019	1042
40	972	996
60	934	946
80	911	911
90	928	942
95	974	984
100	1064	1064

SECTION-C

Q 10	Draw the equilibrium diagram for the given data:	20	CO2

Melting temp of Ag   = 961^0C

Melting temp of Cu   = 1083^0C

Eutectic temp   = 780^0C

Eutectic Composition   =   28.1% Cu

Maximum solubility of Cu in Ag i.e., in α-Solid Solution (at 780^0C i.e., eutectic temp) = 8.8% Cu

Maximum solubility of Ag in Cu i.e., in β-Solid Solution (at 780^0C i.e., eutectic temp) =7.9% Ag i.e., 92.1% Cu

The solubility of both Cu in Ag and Ag in Cu decreases with decreasing temp and are around 2% at room temp.

In detail discuss the following

	I. Cooling of an Alloy with 6% Cu II. Cooling of Hypoeutectic alloy with 20% Cu III. Cooling of eutectic alloy with 28.1% Cu IV. Cooling of Hyper eutectic alloy with 50% Cu		

Q 11	a) Explain Creep in metals. Draw a typical creep curve and explain the three stages of creep.
	
	b) Explain the phenomena of Fatigue in metals. Discuss the effect of (i) surface residual stress, and (ii) stress concentration on fatigue strength of metal.
	
	OR
	
	  a) Explain the term polymorphism. What is meant by allotropy, discuss the term with particular reference to iron.
	  b) Distinguish between hardness and hardenability of steels with examples. Discuss various factors on which hardenability depends. Describe how you would carry out a Jominy test on a steel sample.
		20	**CO5**
			
			CO4