Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Non Ferrous Metals **Semester: VIII**
Program: B.Tech Mechanical **Time : 03 hrs.**
Course Code: MEMA4002P **Max. Marks: 100**

SECTION A
(4Qx5M=20Marks)

S. No.		Marks	CO
Q 1	Molybdenum at 20^0C is BCC and has an atomic Radius of 0.140 nm. Calculate a value for its lattice constant a in nanometers.	**5**	**CO1**
Q 2	Classify the wrought copper alloys according to a designation system administered by the CDA.	**5**	**CO2**
Q 3	Describe the properties of Titanium and its biomedical applications.	**5**	**CO3**
Q 4	Mention the basic composition of most nickel-base super alloys.	**5**	**CO4**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 5	Discuss the refractory materials and their applications. How is glass distinguished from other ceramic materials? **OR** Compare the metals & ceramics in terms of their properties. Name the various types of ceramics & explain the processing of ceramics.	**10**	**CO4**
Q 6	Describe the precipitation hardening mechanism in context with Al-Cu phase diagram. Also, explain the overaging with the help of microstructure evolution.	**10**	**CO2**
Q 7	Explain the processing methods of super alloys. Over the years, super alloys have moved from being equiaxed to single crystals. Why?	**10**	**CO3**
Q 8	Explain the complete pyro-metallurgical extraction process of copper from its ore with the help of a flow chart.	**10**	**CO4**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 9	Draw and label the phase diagram for the given data	**20**	**CO2**

	Melting temp of Pb = 327^0C Melting temp of Sn = 232^0C Eutectic temp = 183^0C Eutectic Composition = 61.9% Sn Max^m solubility of Sn in Pb i.e., in α-Solid Solution (at eutectic temp) = 19.2% Max^m solubility of Pb in Sn i.e., in β-Solid Solution (at eutectic temp) = 2.5% The solubility's of both Sn in Pb and Pb in Sn decreases with decreasing temp and are around 1% at room temp. Make the phase analysis for the following points. For each point mention Phases Present, ccomposition of phases and the Amount of Phases. Also draw the microstructure at each point. a) At eutectic composition just below 183^0C b) The point c at 40% Sn and 230^0C. c) The point d at 40% Sn and 183^0C +ΔT d) The point e at 40% Sn and 183^0C -ΔT		
Q 10	a) For BCC, compute (a) the interplanar spacing (b) the diffraction angle for the (220) set of planes. The lattice parameter for the element is 0.2866 nm. Also, assume that monochromatic radiation having a wavelength of 0.179 nm is used, and the order of reflection is 1. b) The metal niobium has a BCC crystal structure. If the angle of diffraction for the (211) set of planes occurs at 75.99^0(first order reflection) with 0.1659 nm wavelength used, compute (a) interplanar spacing for this set of planes and (b) atomic radius for the niobium atom. **OR** a) For which set of crystallographic planes will a first order diffraction peak occur at a diffraction angle of 44.53^0 for FCC nickel when monochromatic radiation having a wavelength of 0.1542 nm is used? A.W= 58.69g/mol density= 8.9 g/cc b) Draw the planes for following Miller indices	**20**	**CO1**

	(a) (101) (b) (221) (c) (632) (d) (100)		