Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme Name: B. Tech Mechanical **Semester : III**
Course Name : Material Science **Time : 03 hrs**
Course Code : MEMA 2001 **Max. Marks: 100**
Nos. of page(s) : 02
Instructions: 1. Assume data only if required and mention the assumption clearly.
2. Use graph sheet for Q8.

SECTION A : 20 marks

S. No.		Marks	CO
Q 1	Sketch completely labelled ideal & real cooling curves for pure substance/metal.	**4**	**CO2**
Q 2	Define superalloys and ceramics.	**4**	**CO4**
Q 3	Discuss various fatigue cycles.	**4**	**CO4**
Q 4	a. Differentiate between ferrous & non-ferrous alloys. b. Define creep.	**4**	**CO4**
Q 5	Differentiate between toughness & resilience.	**4**	**CO1**

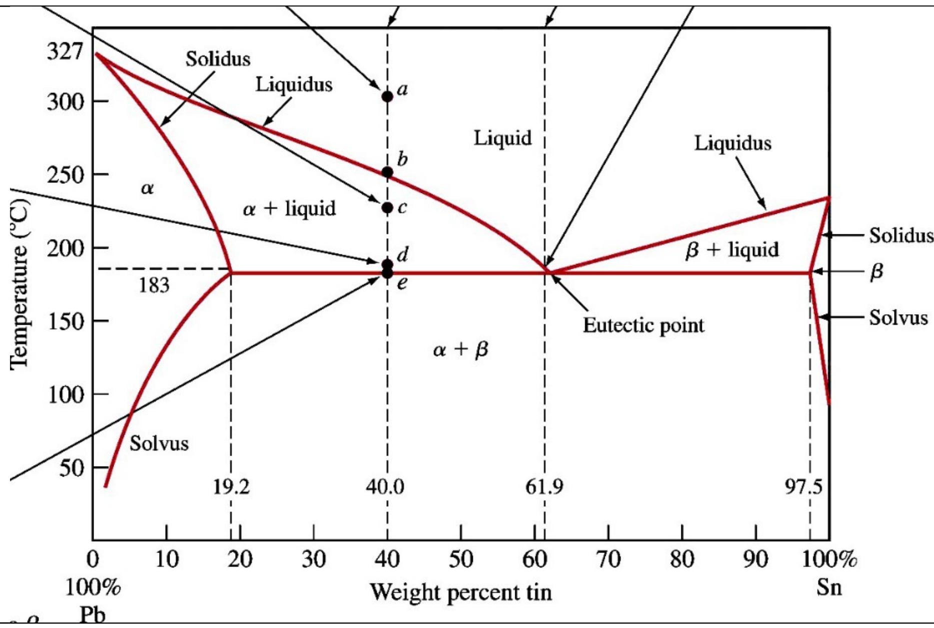
SECTION B : 40 marks

Q 6	Define composites. Classify composites and give one example of each.	**10**	**CO4**
Q 7	Discuss Griffith's theory of fracture. Derive the expression for critical stress for crack propagation.	**10**	**CO4**
Q 8	Data for tensile test for an alloy is given below. Using this data: a. Plot labelled engineering stress vs strain curve (mark yield point, UTS, elastic region, plastic region, fracture point). b. Calculate Young's Modulus of the alloy.	**6+4**	**CO1**

Engineernig Stress (MPa)	Engineernig Strain	Engineernig Stress (MPa)	Engineernig Strain
0	0	524	0.08
210	0.001	515	0.10
380	0.002	500	0.12
415	0.005	475	0.14
470	0.01	448	0.16
490	0.02	385	0.18

510 517	0.04 0.06	355	0.19 (Fracture)

Q 9	Calculate the density of fcc platinum in g/cm^3 if its lattice constant ‘a’ is 0.39239 nm and atomic mass is 195.09 g/mol. OR A sample of bcc metal was placed in an x-ray diffractometer and x-rays of wavelength 0.1541 nm were used. Diffraction from (221) planes was obtained at $2\theta = 88.838°$. Calculate value of lattice constant ‘a’ for this bcc metal. Assume first order diffraction.	**10**	**CO1**
	SECTION C: 40 marks		
Q 10	A. Sketch completely labelled TTT curve. B. Under what cooling conditions Martensite forms? C. How crystal structure of Martensite is formed on cooling? D. What type of pearlite grains are formed during annealing and normalizing processes? Why? **OR** E. Define Hardenability. F. Discuss Jominy End Quench test. G. Discuss Martempering, Austempering and Nitriding Processes.	**10** **2** **4** **4** **4** **4** **12**	**CO3**
Q 11	Given below is the phase diagram of Pb-Sn alloy. If one Kg of 70 % Pb- 30 % Sn alloy is cooled from 300 °C , calculate: a. The weight percent of liquid and alpha at 250 °C. b. The weight percent and weight in kilograms of liquid and alpha just above the eutectic temperature (183 °C). c. The weight percent of alpha and beta at eutectic point.	**20**	**CO2**



327
300
250
200
150
100
50
Temperature (°C)
Solidus
Liquidus
Liquid
Liquidus
α
α + liquid
β + liquid
Solidus
β
Solvus
183
Eutectic point
α + β
Solvus
a
b
c
d
e
19.2
40.0
61.9
97.5
0
10
20
30
40
50
60
70
80
90
100%
100%
Pb
Sn
Weight percent tin