

Name:	 UPES UNIVERSITY WITH A PURPOSE
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2020

Course: Mechanical Behavior of Materials	Semester: VII
Program: B. Tech Mechanical	Time 03 hrs.
Course Code: MEMA 4001	Max. Marks: 100

Instructions:

SECTION A: 5 marks each

S. No.		Marks	CO
Q 1	(i) Yielding criteria is defined for _____ materials. (ii) Young's modulus is _____ proportional to temperature. (iii) Coarse precipitates provide _____ to crystals. (iv) GP zones are _____ with the matrix. (v) Intermetallic compounds may _____ the strength of polycrystalline materials.	5	CO3
Q 2	Process of fracture involves _____, _____ and _____. Fracture may take place in _____ and _____ manner.	5	CO2
Q 3	LEFM stands for _____ and EPFM stands for _____. LEFM is applicable for _____ materials while EPFM for _____ materials. DBTT stands for _____.	5	CO1
Q 4	Under _____ and _____ condition, even ductile material can fail in brittle manner. For brittle materials, fracture strength is _____ than yield strength. For ductile materials, fracture strength is _____ than yield strength and _____ amount of plastic deformation occurs.	5	CO2
Q 5	Brittle materials show _____ necking, _____ reduction in area and _____ elongation. Fractured surface appear _____ and _____ in brittle failure.	5	CO2
Q 6	During precipitation hardening of Al-Cu alloys, first _____ forms followed by formation of _____, _____ and _____ precipitates. Stoichiometry of the final precipitates is _____.	5	CO3

SECTION B: 10 marks each

Q 7	Describe critical resolved shear stress. Derive the expression for it.	10	CO2
Q 8	A steel plate with a through thickness crack of length $2a = 20$ mm is subjected to a stress of 400 MPa normal to the crack. If the yield strength of the steel is 1500 MPa, calculate the	10	CO4

	plastic zone size and the stress intensity factor for the crack. Assume that the plate is infinitely wide.		
Q 9	<p>A steel bar is subjected to a fluctuating axial load that varies from a maximum of 330 kN tension to a minimum of 110 kN compression. The mechanical properties of the steel are:</p> <p style="text-align: center;">UTS: 1090 MPa, Proof stress: 1010 MPa, Fracture stress: 510 MPa</p> <p>Determine the bar diameter to give infinite fatigue life based on a safety factor of 2.5 using Goodman's model.</p>	10	CO4
Q 10	Explain viscoelasticity with the help of a neat stress strain curve.	10	CO3
Q 11	Derive the relationship between (i) true and engineering stress (ii) true & engineering strain.	10	CO1
SECTION-C: 20 marks (Attempt any one)			
Q 12	<p>(i) Define Fracture toughness. (ii) Explain the three modes of fracture. (iii) Differentiate between LEFM and EPFM. Name various LEFM and EPFM approaches. (iv) Discuss Plasticity correction at the crack tip.</p> <p style="text-align: center;">OR</p> <p>(i) Discuss J-Integral approach. (ii) Discuss R-curve approach. Sketch R,G vs 'a' curve for ductile and brittle materials.</p>	20	CO4