Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Mechanical Behaviour of Materials **Semester: IV**

Program: B. Tech AMNT **Time : 03 hrs.**

Course Code: MEMA 2008 **Max. Marks: 100**

Instructions: Assume data wherever necessary.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Describe stress-strain curve for a mild steel material subjected to axial tensile loading. Also, show how stress-strain behaviour varies with change in the carbon content.	**4**	**CO2**
Q 2	Illustrate with graph for: (i) Creep recovery test, (ii) Stress relaxation tests.	**4**	**CO1**
Q 3	What are the different approaches used to determine the crack propagation life of a cracked component?	**4**	**CO2**
Q 4	Differentiate between engineering stress-strain and true stress strain.	**4**	**CO1**
Q 5	The tensile stresses at a point across two mutually perpendicular planes are 120 MPa and 60 MPa. Determine the normal, tangential and resultant stresses on a plane inclined at 30^o to the axis of minor axis.	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Define Griffith's theory of brittle fracture and derive the expression for fracture stress and energy release rate. State the conditions under which the crack will propagate in a brittle material.	**10**	**CO3**
Q 7	Explain the role of dislocation theory and its effect on plastic deformation. Also, explain the effect of temperature on plastic deformation of a material.	**10**	**CO4**
Q 8	A rotating bar made of steel 45C8 (S_{ut} = 630 MPa) is subjected to a completely reversed bending stress. The corrected endurance strength of the bar is 315 MPa. Calculate the fatigue strength of the bar for a life of 90,000 cycles.	**10**	**CO3**
Q 9	Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 25 mm and of length 1.2 m if the longitudinal strain in a bar during a tensile test is four times the lateral strain. Find the change in volume when the bar is subjected to a hydrostatic pressure of 120 MPa. Take E = 1.2 x 10^5 MPa.	**10**	**CO3**

	OR Evaluate the pressure required to inflate a thin spherical balloon made from a Hookean Elastic Materials. Derive the expression for young's modulus in terms of Poisson's ratio and bulk modulus.	**10**	**CO3**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	State and explain distortion energy theory for ductile materials. Derive the expression for Von-mises stress and draw the region of safety diagram for distortion energy theory. Determine the minimum diameter of a steel wire, which is used to raise a load of 4000 N if the stress in the rod is not to exceed 95 MN/m^2.	**20**	**CO3**
Q 11	Explain the following with respect to high cycle fatigue: (i) Gerber's Parabola, (ii) Soderberg and Goodman Line, (iii) Modified Goodman line, (iv) Endurance Strength. Determine the diameter of the bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN using: (i) Maximum principal stress theory, (ii) Maximum principal strain theory. **OR** Explain the high cycle fatigue test (S-N) curve and its outcome. A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 MPa. The bar is made up of steel 40C8 (S_{ut} = 600 MPa). Calculate the life of the bar for a reliability of 90%.	**20** **20**	**CO4** **CO4**