

Name:	 UPES UNIVERSITY OF TOMORROW
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
END SEMESTER EXAM, DECEMBER 2022

Course: Theory of Elasticity & Plasticity
Program: M. Tech (Structural Engineering)
Max. Marks: 100

CIVL 7002
Time: 03 hrs.
SEM - I

SECTION A

S. No.	Question	Marks	CO
Q.1	State & explain generalized Hook's law.	4	CO1
Q.2	Write the compatibility equation in terms of strain & displacement.	4	CO1
Q.3	Briefly explain 1) St. Venant's principle 2) Principle of superposition.	4	CO2
Q.4	Illustrate warping of torsion.	4	CO3
Q.5	What is meant by yield line? What are the assumptions in yield line theory?	4	CO4

SECTION B

Q.6	Rectangular stress components at a point in a 3D stress system are as follows: $\sigma_x = 9$ kPa, $\sigma_y = 5$ kPa, $\sigma_z = 4$ kPa, $\tau_{xy} = 6$ kPa, $\tau_{yz} = 2$ kPa, $\tau_{zx} = 3$ kPa; Determine Principal stresses at the given point.	10	CO1
Q.7	Using Polynomials, calculate the bending of uniformly distributed simply supported beam.	10	CO2
Q.8	Calculate torsional rigidity for elliptical section using stress function approach. OR Write short note on Airy's stress function. Explain stress and strain invariants.	10	CO3
Q.9	Define different hardening rules for materials in case of plastic state.	10	CO4

SECTION-C

Q.10	When the stress tensor at a point with reference to axes (x,y,z) is given by the array: $\begin{bmatrix} 4 & 1 & 2 \\ 1 & 6 & 0 \\ 2 & 0 & 8 \end{bmatrix} MPa$ Show that the stresses invariants remain unchanged by transformation of the axes by 45° about the z-axis. OR The displacement field components at a point are given by $u = -0.0001y^2 + 0.0015xyz$, $v = 0.0002x^2y + 0.0003x^2z$, $w = 0.0015xyz + 0.0002x^2yz$ i. Determine the strain tensor at a point (2, -3, -1) ii. Find the principal strains and their orientation If $E = 210$ GPa and $\nu = 0.28$, find Lamé's constants.	20	CO1 CO2
Q.11	Compare surface force and body force. Describe the stress-strain curve for a plastic and elastic material. Obtain yield criteria of metals graphically in case of plastic state.	20	CO1 CO4