Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
END SEMESTER EXAM, DEC 2021

Course: Theory of Elasticity & Plasticity — **CIVL 7002**
Program: M. Tech (Structural Engg.) — **Time: 03 hrs.**
Max. Marks: 100 — **SEM -Ist**

SECTION A

S. No.		Marks	CO
Q.1	Define stress at a point in a body under the action of external forces.	**4M**	**CO1**
Q.2	Briefly explain plane stress & plane strain problem with example	**4M**	**CO2**
Q.3	Explain the Uniqueness theorem with example.	**4M**	**CO3**
Q.4	Differentiate between isotropic & anisotropic material with an example.	**4M**	**CO4**
Q.5	Briefly explain 1) St. Venant's principle 2) Principle of superposition.	**4M**	**CO3**
	SECTION B		
Q.6	Derive the equilibrium equation for plane problem in Cartesian coordinate system.	**10M**	**CO1**
Q.7	Show that $\phi = \frac{q}{8c^3}\left[x^2(y^3 - 3c^2y + 2c^3) - \frac{1}{5}y^3(y^2 - 2c^2)\right]$ is the stress function & find what problem it solves when applied to the region included $y = \pm c$, $x = 0$ on the side x is positive.	**10M**	**CO2**
Q.8	Derive the equation for stress-strain relationship in 2D plane stress problem in Cartesian coordinate system.	**10M**	**CO2**
Q.9	Given the Strain components $\epsilon_x = e^y \sinh 2x$ & $\epsilon_y = e^x \cosh 2y$. Determine the displacement components at $\boldsymbol{x}$ = 1 & y = 1 **OR** Given the displacement component $u = e^y \log x^2 \tan^{-1} x$ & $v = e^x \log y^2 \sin^{-1} y$. Determine the normal strains at the points $\boldsymbol{x}$ = 1 & y = 0.5	**10M**	**CO1**
	SECTION-C		
Q.10	Derive an expression for the stress concentration due to presence of circular hole.	**20M**	**CO3**
Q.11	A shaft subjects to maximum shear torque of 10kN.m and maximum bending moment of 7.5kN.m at a particular section. If the allowable equivalent stress in simple tension is 160kN/m^2. Determine the diameter of shaft according to shear strain energy theory **OR** A Mild steel shaft 120mm diameter subjects to maximum torque of 20kN/m and maximum bending moment of 12kN.m. Determine Factor of safety according to maximum shear stress theory if elastic limit in simple tension is 220MN/m^2	**20M**	**CO4**