Name:

Enrolment No:

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Programme Name: M.Tech. Structural Engineering **Semester : I**
Course Name : Theory of Elasticity & plasticity **Time : 03 hrs**
Course Code : CIVL 7002 **Max. Marks : 100**
Nos. of page(s) : 2
Instructions: **Answer all questions of Section A, B & C**
(Assume all the necessary data if necessary)

SECTION A

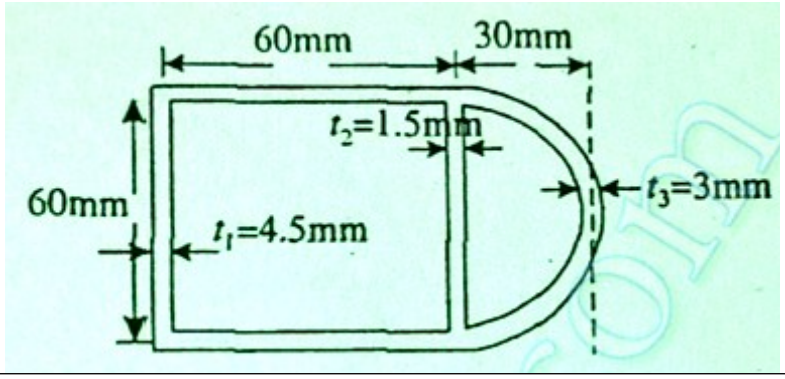
S. No.		Marks	CO
Q 1	Write short notes on following: i. Stress invariants ii. Reciprocal Theorem iii. Homogeneous deformations iv. Spherical & Deviator stress tensor	5*4=20	CO1 CO2 CO3 CO4

SECTION B

Q 2	Rectangular stress components at a point in a 3D stress system are as follows: σ_x = 20 N/mm^2, σ_y = -40 N/mm^2, σ_z = 80 N/mm^2, τ_{xy}= 40 N/mm^2, τ_{xy}= -60 N/mm^2, τ_{xy}= 20 N/mm^2; Determine Principal stresses at a given point.	10+10	CO1 CO2
Q 3	The displacement field components at a point are given by u= -0.0001y^2 + 0.0015xyz, v= 0.0002x^{2}y + 0.0003x^{2}z, w = 0.0015xyz + 0.0002x^{2}yz i. Determine the strain tensor at a point (2, -3, -1) ii. Find the principal strains and their orientation iii. If E=210 GPa and υ=0.28, find Lame's constants	6+8+6	CO1 CO2

SECTION-C

Q 4	Derive the expression of an infinite beam resting on elastic foundation for BM, SF, deflection and rotation if it is subjected to i. Point load and ii. UDL	10+10	CO1 CO2
Q 5	The stresses in a rotating disk (of unit thickness) can be regarded as due to centrifugal force as body force in a stationary disk. Show that this body force is derivable from the potential v = -1/2 δω^2(x^2 + y^2), where δ is the density and ω the angular velocity of rotation (about the origin). **OR** A two cell tube as shown in figure is subjected to a torque of 10 kNm. Determine the	20	CO2 CO3

	shear stress in each part and angle of twist per metre length. Take modulus of rigidity of the material as 80 kN/mm^2.  		

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Name of the School (Please tick, symbol is given)	:	**SOE**	☐	**SOCS**		**SOP**	
Programme	:	**M.Tech. Structural Engineering**					
Semester	:	**I**					
Name of the Course	:	**Theory of Elasticity & plasticity**					
Course Code	:	**CIVL 7002**					
Name of Question Paper Setter	:	**Susanta Kumar Sethy**					
Employee Code	:	**40001073**					
Mobile & Extension	:	**7830323739/1221**					
Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention "NOT APPLICABLE":							

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Note: - Pl. start your question paper from next page

Model Question Paper (Blank) is on next page

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(Assume all the necessary data if necessary) (Internal Choice is there in Q 3-Section B & Q 5- Section C)

SECTION A

S. No.		**Marks**	**CO**
Q 1	Explain Plastic Stress strain relation with expressions	**10**	**CO4**
Q 2	Explain maximum strain energy and distortion energy theory	**10**	**CO2**
	SECTION B		
Q 3	Rectangular stress components at a point in a 3D stress system are as follows: σ_x = 20 N/mm^2, σ_y = -40 N/mm^2, σ_z = 80 N/mm^2, τ_{xy}= 20 N/mm^2, τ_{xy}= -60 N/mm^2, τ_{xy}= 40 N/mm^2; Determine Principal stresses at a given point.	**10+10**	**CO1 CO2**
Q 4	Show that $\phi = Ar^2 logr$ is a stress function. Determine the stresses σ_r, σ_Θ and $\tau_{r\Theta}$.	**10+10**	**CO1 CO2**
	SECTION-C		
Q 5	The stresses in a rotating disk (of unit thickness) can be regarded as due to centrifugal force as body force in a stationary disk. Show that this body force is derivable from the potential v = -1/2 $\delta\omega^2(x^2)$, where δ is the density and ω the angular velocity of rotation (about the origin).	**6+8+6**	**CO2 CO3**
Q 6	A semi infinite beam resting on an elastic foundation is hinged at one end and 2 kNm moment applied at this end. If the beam is 100mm wide and 50mm thick, determine the maximum deflection stresses in the beam. E = 90 GPa, Poission's ratio = 0.3 and modulus of elastic foundation = 8.4 N/mm^2. **OR** Derive the expression for shear stress of a bar with elliptical cross section subjected to a torque of "T" and compare the same with hexagon side "a"	**20**	**CO2 CO3**