GALGOTIAS UNIVERSITY

ADMISSION NUMBER

School of Engineering

M.Tech Structural Engineering
Semester End Examination - Jun 2024

Duration : 180 Minutes
Max Marks : 100

Sem II - G1PC202T - Theory of Elasticity and Plasticity

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1)	Recall and explain Vonmises theory	K1(2)
2)	Explain Airy's Stress Function.	K2(4)
3)	Illustrate maximum Principal Stress theory	K2(6)
4)	Solve the following problem: The following is the stress tensor is given according to cartesian coordinate system. The Coordinate system is rotated about z axis in anticlockwose direction to about 30 degree. Determine the new stress components. σ_x=50 MPa; σ_y=30 MPa; σ_z=15 MPa; τ_(xy)=20 MPa; τ_yz=5 MPa ; τ_xz=10MPa.	K3(9)
5)	Construct the octaheral planes and prove the following. $\tau_{oct}^2 = \frac{1}{9}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_1 - \sigma_3)^2$	K3(9)
6)	The components of strain tensor in matrix form is given as follows: $\begin{bmatrix} 0.001 & 0.002 & 0.005 \\ 0.002 & 0.003 & 0.004 \\ 0.005 & 0.004 & 0.005 \end{bmatrix}$ Find the octahedral and normal shear strain.	K5(10)
7)	Examine the following problem: At a point in a material, the state of stress in MPa is given by the components σx = 12.8, σy = 27, σz= 51.3, τxy = 23.4, τyz = -6.24 and τxz = 11 Determine the normal and shear stresses on a plane whose normal makes angles of 48° and 71 ° to the x and y axes respectively.	K4(12)
8)	The state of stress at a point is given by the following matrix. $\sigma_{ij} = \begin{bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{bmatrix}$ Determine the principal stresses and principal directions.	K5(15)
9)	An I section with flanges 10 cm × 2 cm and web 28 cm × 1 cm is subjected to a torque = 2 kNm. Find the maximum shear stress and angle of twist per unit length. G = 80,000 N/Sq.mm	K5(15)
10)	Consider the bar of cast iron under complex loading. The bar is subjected to BM of 39 N-m and twisting moment of T = 225 N-m. Diameter of the bar is 20mm. The bar yields at yield stress 128 MPa in simple tension test. Analyse whether the bar will fail according to maximum principal stress criterion.	K6(18)