Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U1602

M.E. DEGREE EXAMINATION, APRIL 2024

First Semester

Structural Engineering

21PSE102– THEORY OF ELASTICITY AND PLASTICITY

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (10 x 2 = 20 Marks)

1.	Explain stress invariants.	CO1- U	(2)
2.	Define the term: Principal stresses and Principal planes.	CO1- U	(2)
3.	Define plane stress.	CO2- U	(2)
4.	What are Cartesian coordinates?	CO2- U	(2)
5.	Classify finite beams and infinite beams.	CO3- U	(2)
6.	Name and state the energy theorems.	CO3- U	(2)
7.	List the analogous quantities in membrane analogy.	CO4- U	(2)
8.	Discuss the torsional resistances of thin walled closed and open sections.	CO4- U	(2)
9.	List out the various failure theories of plasticity?	CO5- U	(2)
10.	What is meant by yield line?	CO5- U	(2)

PART - B (5 x 16 = 80 Marks)

11.	(a)	Consider an isotropic material that is subjected to uniform stress. Show that the elastic constants are only two by generalized Hooke‟s law.	CO1-App	(16)
		Or		
	(b)	The state of stress at a point is given by σ_x= 4MPa, σ_y= 6MPa, σ_z= 8MPa, τ_{xy} = 1MPa, τ_{yz} =0MPa, τ_{zx} = 2MPa.Find the stress invariants remain unchanged by transformation of the axes by 45˚ about the *z*-axis.	CO1-App	(16)
12.	(a)	Describe the deflection equation for the bending of a cantilever loaded (point load) at the end in terms of Cartesian coordinates.	CO2-App	(16)

Or

	(b)	Discuss the effect of radial and tangential stress for a circular hole on a plate.	CO2-App	(16)
13.	(a)	Find out bending moment and shear force for Semi infinite beams with concentrated loads.	CO3-App	(16)

Or

	(b)	Calculate the strain energy for a simply supported rectangular beam AB of span 10m with 1kN point load at the centre of the span. The beam size is 40x60mm.	CO1-App	(16)
14.	(a)	Derive the equations for torsion of an elliptical cross section bar section by analogous methods.	CO1-App	(16)

Or

	(b)	A square shaft rotating at 250 rpm transmits torque to a crane which is designed to lift maximum load of 150 kN at a speed of 10m/min. If the efficiency of crane gearing is 65%, predict the size of the shaft for the maximum permissible shear stress of 35MPa. Also Evaluate the angle of twist of the shaft for a length of 3m.Take G = 100 GPa	CO1-App	(16)
15.	(a)	A rectangular beam having linear stress-strain behavior is 6cm wide and 8cm deep.It is 3m long, simply supported at the ends and carries a uniformly distributed load over the whole span. The load is increased so that the outer 2cm depth of the beam yields plastically. If the yield stress for the beam material is 240MPa, illustrate the residual stress distribution in the beam.	CO5-App	(16)

Or

	(b)	The state of stress at a point is given by σx= 70MPa, σy= 120MPa, and τxy= 35 MPa, if the yield strength for the material is 125 MPa, check whether yielding will occur according to Tresca's and Von Mises condition.	CO5-App	(16)