QP Code: R252B062 | Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (Second Semester) Regular Examinations, July – 2025

24MMDPC12002 – Applied Elasticity and Plasticity (MD)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

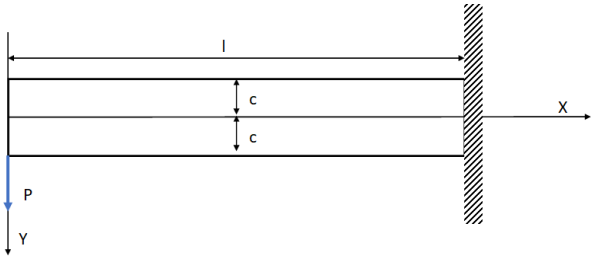
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Write down formula for Principal stresses.	CO1	K1
b.	What do you mean by thermal stress and coefficient of thermal expansion	CO2	K1
c.	Identify the equations relating to bending of a beam by uniform load.	CO2	K1
d.	Outline the general solution of compatibility equation.	CO2	K2
e.	True stress- true strain characteristics of a material behave as $\sigma = K\varepsilon^n$, where K = 850MPa, n = 0.3, Find mean yield stress when it is stretched from 100 mm to 157mm.	CO3	K1

PART – B **(10 x 5 = 50 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2.	Derive the compatibility equations in cartesian coordinates in stress function terms with body force in plain strain condition.	10	CO1	K3
	(OR)			
b.	Given the following systems of strains $\epsilon_x = 5+x^2+y^2+x^4+y^4$, $\epsilon_y = 6+3x^2+3y^2+x^4+y^4$, $\epsilon_{xy} = 10+4xy(x^2+y^2+2)$, $\epsilon_z = \epsilon_{xz}= \epsilon_{yz}=0$ Determine if the system of strain is possible. If this strain distribution is possible, find the displacement components in term of x & y, assuming that the displacement and rotation at the origin are zero.	10	CO1	K4
3.a.	Show that the following Airy's stress functions and examine the stress distribution represented by them: a) $\phi=Ax^2+By^2$, b) $\phi=Ax^3$ c) $\phi=A(x^4-3x^2y^2)$	8	CO1	K3
b.	State the compatibility equation? Express it for 2D without body force.	2	CO1	K3
	(OR)			
c.	Using stress function methods in polar coordinates find the stress distribution equation in thick cylinder under uniform pressure.	10	CO1	K2
4.a.	Using stress functions find the stress distribution for bending of a narrow cantilever under an end load. Take suitable boundary conditions and explain on what condition you can get the equation by simple bending theory.	10	CO2	K3



(OR)

b.	The state of stress at a point is given as $[\sigma] = \begin{bmatrix} -90 & 70 & -55 \\ 70 & -60 & -40 \\ -55 & -40 & 40 \end{bmatrix}$ Determine a) Principal stresses b) Direction cosines for the maximum principal stress c) Maximum shearing strain.	10	CO2	K3
5.a.	Describe the deflection equation for the bending of a cantilever loaded (UDL) at the end in terms of Cartesian coordinates.	10	CO2	K2

(OR)

b.	A thin-walled tube 0.1mm wall thickness, 50mm diameter and 900mm length is subjected to an internal pressure of 140 kPa and an external torque of 22 N-m. If the end are closed, determine (i) the orientation of principal stress axes in relation to the centre line direction of the tube, (ii) the principal stresses, (iii) the maximum shear stress.	10	CO2	K3
6.a.	A rectangular beam having linear stress-strain behaviour 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.	10	CO3	K4

(OR)

b.	Derive the expression P/2k using slab analysis for direct compression of slab of unit width, breadth of b, height h, coefficient of friction at friction surface is □, and pressure applied is P and k is the shear yield strength. What will be the average pressure?	10	CO3	K4

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