GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Third Semester - Regular) Examinations, November – 2024

23BCVPC23002 – Mechanics of Materials

(Civil Engg.)

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)**

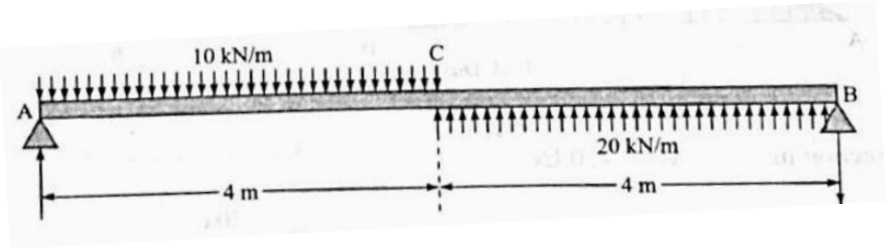
Q.1. Answer ***ALL*** questions		CO #	Bloom's Level
a.	Define strain and write different types of strain.	CO1	K2
b.	Find the reactions of a simply supported beam of length 5m carrying a point load of 10kN at 2m from the left support.	CO2	K2
c.	Define Poisson's ratio.	CO3	K2
d.	A solid shaft of 40 mm diameter is subjected to a torque of 0.8 kN-m. Find the maximum shear stress induced in the shaft.	CO5	K2
e.	A point in a strained material is subjected to two mutually perpendicular tensile stresses of 100 MPa and 50 MPa. Determine the normal stress on a plane inclined at 30° with the minor axis.	CO4	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Bloom's Level
2. a.	Two wires, one of steel and the other of copper, are of the same length and are subjected to the same tension. If the diameter of the copper wire is 4 mm, find the diameter of the steel wire, if they are elongated by the same amount. Take E for steel as 200 GPa and that for copper as 100 GPa.	5	CO1	K3
b.	A compound bar ABC 1.5 m long is made up of two parts of aluminium and steel and that cross-sectional area of aluminium bar is twice that of the steel bar. The rod is subjected to an axial tensile load of 200 kN. If the elongations of aluminium and steel parts are equal, find the lengths of the two parts of the compound bar. Take E for steel as 200 GPa and E for aluminium as one-third of E for steel.	5	CO1	K3
	(OR)			
c.	A load of 270 kN is carried by a short concrete column 250 mm × 250 mm in size. The column is reinforced with 8 bars of 16 mm diameter. Find the stresses in concrete and steel, if the modulus of elasticity for the steel is 18 times that of concrete. If the stress in concrete is not to exceed 5 MPa, find the area of steel required, so that the column may carry a load of 500 kN.	10	CO1	K3
3.a.	An I section has flanges of width *b* and the overall depth is *2b*. The flanges and the web are of uniform thickness *t*. Find the ratio of the maximum shear stress intensity to the mean shear stress intensity.	10	CO3	K3
	(OR)			
b.	A vertical wooden plate of circular section stands as a 2m high Cantilever fixed at the base. It is subjected to a horizontal force of 2000 N at its top. Determine the minimum diameter of the pole.	6	CO3	K3

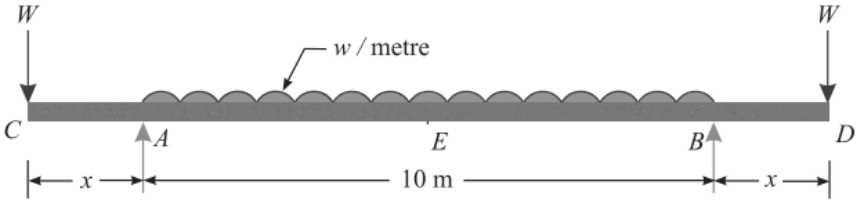
a. If the permissible bending stress is 12.5 N/mm^2
b. If the permissible shear stress is 0.75 N/mm^2

c.	Find the centre of gravity of an inverted T-section with flange 60 mm × 10 mm and web 50 mm × 10 mm.	4	CO3	K3
4.a.	Sketch the shear force and bending moment diagram.	10	CO2	K4



(OR)

b.	If W = 10 w, what is the overhanging length on each side, such that the bending moment at the middle of the beam, is zero? Construct the shear force and bending moment diagrams.	10	CO2	K4



5.a.	An element in a strained body is subjected to a tensile stress of 150 MPa and a shear stress of 50 MPa tending to rotate the element in an anticlockwise direction. Find the followings using analytical method: (i) the magnitude of the normal and shear stresses on a section inclined at 40° with the tensile stress (ii) the magnitude and direction of principal stresses (iii) the magnitude and direction of maximum shear stress	10	CO4	K4

(OR)

b.	The strain measured using 60^o strain rosette as shown in figure are $\varepsilon_p = 500 \times 10^{-6}$, $\varepsilon_q = 250 \times 10^{-6}$ and $\varepsilon_r = 100 \times 10^{-6}$. Find out the $\varepsilon_x, \varepsilon_y$ & γ_{xy}. Also, determine the principal strains and maximum shear strain. Evaluate the principal stresses at the point. Take E= 200 GPa and $\vartheta = 0.3$.	10	CO4	K4
6.a.	In a tensile test, a test piece 25 mm in diameter, 200 mm gauge length stretched 0.0975 mm under a pull of 50 kN. In a torsion test, the same rod twisted 0.025 radian over a length of 200 mm, when a torque of 400Nm was applied. Evaluate the Poisson's ratio and the three elastic moduli for the material.	10	CO5	K4

(OR)

b.	A cylindrical shell of 1.3 m diameter is made up of 18 mm thick plates. Find the circumferential and longitudinal stress in the plates, if the boiler is subjected to an internal pressure of 2.4 MPa. Take efficiency of the joints as 70%.	5	CO6	K3
c.	A spherical vessel of 2 m diameter is subjected to an internal pressure of 2 MPa. Find the minimum thickness of the plates required, if the maximum stress is not to exceed 100 MPa. Take efficiency of the joint as 80%.	5	CO6	K3

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