QP Code: RD21BTECH051 | Reg. No | | | | | | | | | | | AR 21

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester - Regular) Examinations, December – 2022

21BCVPC23001 – Mechanics of Materials

(Civil Engineering)

Time: 3 hrs | Maximum: 70 Marks

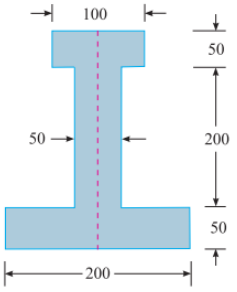
Answer ALL questions

(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.	Draw the shear stress distribution of I-section and T- section.	2	2
b.	Mention the assumptions in the theory of simple bending.	1	2
c.	Write the formulas for circumferential stress and longitudinal stress of a thin cylindrical shell.	4	2
d.	Write the formulas for the principal stresses and maximum shear stress.	3	2
e.	A solid steel shaft is to transmit a torque of 7.5 kN-m. If the shearing stress is not to exceed 30 MPa, find the minimum diameter of the shaft	2	2

PART – B **(15 x 4 = 60 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2. a.	A wooden floor is required to carry a load of 12 kN/m^2 and is to be supported by wooden joists of 125 mm × 250 mm in section over a span of 4 metres. If the bending stress in these wooden joists is not to exceed 8 MPa, find the spacing of the joists.	8	2	2
b.	A rectangular beam 300 mm deep is simply supported over a span of 4 metres. What uniformly distributed load the beam may carry, if the bending stress is not to exceed 120 MPa. Take I = 225 × 10^6 mm^4	7	2	2
	(OR)			
c.	Find the centre of gravity and moment of inertia of a T-section with flange 150 mm × 15 mm and web also 150 mm × 10 mm.	7	2	2
d.	 If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist.	8	2	2
3.a.	In a tensile test, a test piece 25 mm in diameter, 200 mm gauge length stretched 0.0975 mm under a pull of 60kN. In a torsion test, the same rod twisted 0.025 radian over a length of 200 mm, when a torque of 450 Nm was applied. Evaluate Poisson's ratio.	8	1	2
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.	7	1	2

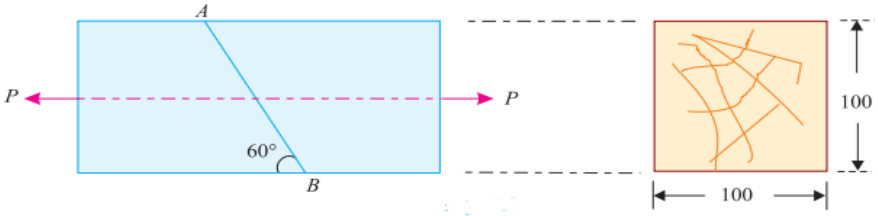
(OR)

c.	A cast-iron bracket subjected to bending, has a cross-section of I-shape with dimensions top flange (250 mm x 50 mm), bottom flange (150 mm x 50 mm) & web (250 mm x 50 mm). If the compressive stress in top flange is not to exceed 17.5 MPa, what is the bending moment, the section can take? If the section is subjected to a shear force of 100 kN, draw the shear stress distribution over the depth of the section.	10	1	2
d.	A hollow shaft has to transmit 53 kW at 160 r.p.m. If the maximum shear stress is 50 MPa and internal diameter is half of the external diameter, find the diameters of the shaft.	5	2	2
4.a.	Important notes on thin cylinders and failures. Explain two major stresses acting on the thin cylinder with neat sketch.	10	4	2
b.	A stream boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, find the circumferential and longitudinal stresses induced in the boiler plates.	5	4	2

(OR)

c.	Derive the formulation with neat sketch: i. Hoop stress for thin cylindrical shell ii. Longitudinal stress for thin cylindrical shell iii. Stress for thin spherical shell	9	4	2
d.	A steam boiler of 1.5 m in diameter is subjected to an internal pressure of 2.0 MPa. If the steam boiler is made up of 20 mm thick plates, calculate the circumferential and longitudinal stresses. Take efficiency of the circumferential and longitudinal joints as 70% and 50% respectively.	6	4	2
5.a.	The strain measured using 60° strain rosette as shown in figure are $\varepsilon_p = 300 \times 10^{-6}$, $\varepsilon_q = 150 \times 10^{-6}$ and $\varepsilon_r = 100 \times 10^{-6}$. Find out: i. $\varepsilon_x, \varepsilon_y$ & γ_{xy}. ii. Principal strains and their direction. iii. Maximum shear strain and their direction. iv. Principal stresses at the point. E= 200 GPa and $\vartheta = 0.3$.	10	3	3
b.	The principal stresses at a point in the section of a member are 100 MPa and 50 MPa both tensile. If there is a anticlockwise shear stress of 40 MPa, find analytically the normal stress, shear stresses on a section inclined at an angle of 30° with the major tensile stress. Also, find the maximum and minimum principal stress and maximum shear stresses.	5	3	3

(OR)

c.	A point is subjected to a tensile stress of 250 MPa in the horizontal direction and another tensile stress of 100 MPa in the vertical direction. The point is also subjected to a simple shear stress of 25 MPa, such that when it is associated with the major tensile stress, it tends to rotate the element in the clockwise direction. Find the magnitude of the normal and shear stresses inclined on a section at an angle of 20° with the major tensile stress ?	10	3	3
d.	Two wooden pieces 100 mm × 100 mm in cross-section are joined together along a line AB. Find the maximum force (P), which can be applied if the shear stress along the joint AB is 1.3 MPa. 	5	1	3

--- End of Paper ---