QP Code: RJ23MTECH071 | Reg. No | | | | | | | | | | | AY 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester) Examinations, January – 2024

MPEMD1044 - Advanced Mechanics of Solids

(Machine Design)

Time: 3 Hrs | Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

Q.1. Answer all questions	CO#	Blooms Level
a. Differentiate between thick and thin cylinder.	CO3	K1
b. State maximum strain theory.	CO4	K1
c. Define stress concentration factor.	CO2	K1
d. State two assumptions of bending as per Winkler-Bach's theory.	CO2	K1
e. State and explain Castigliano's theorem.	CO1	K2
f. State maximum principal stress theory.	CO4	K1
g. Define shear centre.	CO3	K1
h. Draw the stress strain curve for mild steel showing the salient features.	CO1	K1
i. What do you understand by the term unsymmetrical bending.	CO4	K1
j. Explain Goodman's law. Where it is used?	CO4	K2

PART – B **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions	Marks	CO#	Blooms Level
2. Derive the equations for circumferential and radial stress developed in thick walled cylinder under plane stress condition subjected to external and internal pressure with boundary conditions. Assume proper symbols of the variables used.	10	CO1	K2
3. A solid aluminium shaft 1 m long and of 50 mm diameter is to be replaced by a hollow shaft of the same length and same outside diameter, so that the hollow shaft could carry the same torque and has the same angle of twist. What must be the inner diameter of the hollow shaft? Take modulus of rigidity for the aluminium as 28 GPa and that for steel as 85 GPa.	10	CO1	K2
4. Determine by energy method the deflection of the tip of the linearelastic cantilever beam shown in Fig.1 as a result of the point force P.	10	CO2	K3

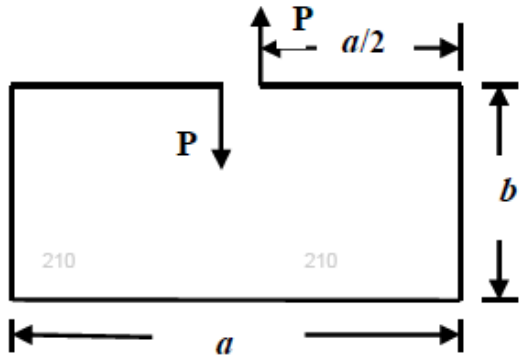

Fig. 1

5.	A solid steel shaft of 60 mm diameter is to be replaced by a hollow steel shaft of the same material with internal diameter equal to half of the external diameter. Find the diametres of the hollow shaft and saving in material, if the maximum allowable shear stress is same for both shafts.	10	CO2	K3
6.	Following unit elongation were measured with a rectangular strain rosette: $e_0=3x10^{-4}$, $e_{45}= -4x10^{-4}$, $e_{90}=5x10^{-4}$. Determine the principal strain and their directions.	10	CO3	K3
7.	A closed ring of the mean radius of curvature 100mm is subjected to a pull of 4 KN. The line of action of the load passes through the centre of the ring. Calculate the maximum tensile and compressive stresses in the material of the ring, if the ring is circular in cross section with a diameter equal to 20mm.	10	CO3	K3
8. a.	Using Prandtl's stress function method derive the expression for (i) twist per unit length, (ii) torsional rigidity and (iii) the resultant stress for elliptical cross section under torsion.	5	CO4	K3
b.	Starting from first principles, demonstrate that the St. Venant's warping function (ψ) should obey the Laplace's equation, $\nabla^2\psi = 0$.	5	CO4	K2

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