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	ii.	What is Macaulay's method for finding the slope and deflection of a beam? Discuss the cases, where it is of a particular use.	6	1	4	1	1
OR	iii.	Derive a relation for the slope and deflection of a simply supported beam subjected to a uniformly distributed load of w/m length.	6	2	4	2	1
Q.6		Attempt any two:					
	i.	Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure.	5	1	5	1	1
	ii.	Derive a relation for the changes of diameter and length of a thin cylindrical shell, when subjected to an internal pressure.	5	1	5	1	1
	iii.	Differentiate between a thin cylindrical shell and a thick cylindrical shell.	5	1	5	1	1

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Total No. of Questions: 6

Total No. of Printed Pages:4

Enrollment No.....



Faculty of Engineering  
End Sem Examination Dec 2024  
RA3CO23

Strength of Materials for Mechanical Engineers

Programme: B.Tech.

Branch/Specialisation: RA

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	The term deformation per unit length is applied for-	1	1	1	1	1
		(a) Stress (b) Strain					
		(c) Modulus of elasticity (d) None of these					
	ii.	Modulus of elasticity is the ratio of-	1	1	1	1	1
		(a) Stress to strain					
		(b) Stress to original length					
		(c) Deformation to original length					
		(d) All of these					
	iii.	If a cantilever beam is subjected to a point load at its free end, then the shear force under the point load is-	1	1	2	1	1
		(a) Zero (b) Less than the load					
		(c) Equal to the load (d) More than the load.					
	iv.	When shear force at a point is zero, then bending moment at that point will be-	1	1	2	1	1
		(a) Zero (b) Minimum					
		(c) Maximum (d) Infinity					
	v.	When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its centre is-	1	1	3	1	1
		(a) Zero (b) Minimum					
		(c) Maximum (d) Average					

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|-------|--|----------|---|---|---|---|
| vi.   | Torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress ( $\tau$ ) is equal to-  | <b>1</b> | 1 | 3 | 1 | 1 |
|       | (a) $\pi/16 \times \tau \times D^2$  |          |   |   |   |   |
|       | (b) $\pi/16 \times \tau \times D^3$  |          |   |   |   |   |
|       | (c) $\pi/32 \times \tau \times D^2$  |          |   |   |   |   |
|       | (d) $\pi/32 \times \tau \times D^3$  |          |   |   |   |   |
| vii.  | A simply supported beam AB of span (l) carries a point load (W) at C at a distance (a) from the left end A, such that $a < b$ . The maximum deflection will be-  | <b>1</b> | 1 | 4 | 1 | 1 |
|       | (a) At C   |          |   |   |   |   |
|       | (b) Between A and C  |          |   |   |   |   |
|       | (c) Between C and B  |          |   |   |   |   |
|       | (d) Any where between A and B  |          |   |   |   |   |
| viii. | Two simply supported beams of the same span carry the same load. If the first beam carries the total load as a point load at its centre and the other uniformly distributed over the whole span, then ratio of maximum slopes of first beam to the second will be- | <b>1</b> | 1 | 4 | 1 | 1 |
|       | (a) 1 : 1  |          |   |   |   |   |
|       | (b) 1 : 1.5  |          |   |   |   |   |
|       | (c) 1.5 : 1  |          |   |   |   |   |
|       | (d) 2 : 1  |          |   |   |   |   |
| ix.   | The design of a thin cylindrical shell is based on   | <b>1</b> | 1 | 5 | 1 | 1 |
|       | (a) Internal pressure  |          |   |   |   |   |
|       | (b) Diameter of shell  |          |   |   |   |   |
|       | (c) Longitudinal stress  |          |   |   |   |   |
|       | (d) All of these   |          |   |   |   |   |
| x.    | In a thin shell, the ratio of longitudinal stress to the circumferential stress is-  | <b>1</b> | 1 | 5 | 1 | 1 |
|       | (a) $1/2$  |          |   |   |   |   |
|       | (b) $3/4$  |          |   |   |   |   |
|       | (c) 1  |          |   |   |   |   |
|       | (d) 2  |          |   |   |   |   |

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|-----|------|---|----------|---|---|---|---|
| Q.2 | i.   | Define thermal stress and thermal strain.   | <b>2</b> | 1 | 1 | 1 | 1 |
|     | ii.  | Describe volumetric strain.   | <b>3</b> | 1 | 1 | 1 | 1 |
|     | iii. | The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of $55^\circ$ with the axis of major tensile stress. Also find the magnitude of the maximum shear stresses in the component. | <b>5</b> | 2 | 1 | 2 | 1 |
| OR  | iv.  | Obtain an expression for the major and minor principal stresses on a plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress.   | <b>5</b> | 2 | 1 | 2 | 1 |
| Q.3 | i.   | Explain the difference between a cantilever beam and a simply supported beam.   | <b>2</b> | 1 | 2 | 1 | 1 |
|     | ii.  | Explain the theory of simple bending, including the assumptions made and the bending equation. Provide an example to illustrate the concept.  | <b>8</b> | 2 | 2 | 2 | 1 |
| OR  | iii. | A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw the S.F. and B.M. diagrams for the beam and also calculate the maximum B.M. on the section.   | <b>8</b> | 2 | 2 | 2 | 1 |
| Q.4 | i.   | Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.   | <b>3</b> | 1 | 3 | 1 | 1 |
|     | ii.  | Prove $\tau/R \theta = C\theta/l$ in case of torsion of a circular shaft.   | <b>7</b> | 1 | 3 | 1 | 1 |
| OR  | iii. | A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 r.p.m. Find the intensity of shear stress in the shaft.   | <b>7</b> | 2 | 3 | 2 | 1 |
| Q.5 | i.   | What is the relation between slope, deflection and radius of curvature of a simply supported beam?  | <b>4</b> | 1 | 4 | 1 | 1 |

**Marking Scheme**  
**RA3CO23 (T) Strength of Materials for Mechanical Engineers (T)**

Q.1	i)	(b)	1
	ii)	(a)	1
	iii)	(c)	1
	iv)	(c)	1
	v)	(a)	1
	vi)	(b)	1
	vii)	(c)	1
	viii)	(c)	1
	ix)	(d)	1
	x)	(a)	1
Q.2	i.	Thermal Stress 1M Thermal Strain 1M	2
	ii.	Volumetric Strain Definition 2M Formula 1M	3
	iii.	Intensities of normal, shear and resultant stresses on a plane inclined at an angle of $55^\circ$ with the axis of major tensile stress. Also find the magnitude of the maximum shear stresses in the component. <b>1+1+1+2</b>	5
OR	iv.	Derivation 4M Diagram 1M	5
Q.3	i.	One marks for one difference 1+1	2
	ii.	Theory of simple bending 2M Assumptions made 2M Bending equation 2M	8

OR	iii.	Example 2M S.F. diagrams 2M B.M. diagrams 4M The maximum B.M. on the section. 2M	8
Q.4	i.	One marks for one assumption <b>1+1+1</b>	3
	ii.	For complete proof full marks and for partial derivation provide marks for step marking	7
OR	iii.	For right answer provide full marks in case of wrong answer but write step provide marks accordingly	7
Q.5	i.	Explanation 2M Relation 2M	4
	ii.	Macaulay's method Explanation Cases, 4M Use. 1M With significance, convention and diagram 1M	6
OR	iii.	Derivation 4M Diagram 2M With significance, convention and diagram	6
Q.6	i.	Circumferential stress- Detected explanation 3M Longitudinal stress- Detected explanation 2M With neat and clean diagram, with proper significance, convention	5
	ii.	Writing of all parameters 2M Derivation 3M	5
	iii.	One marks for one difference 1M for each	5

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