

- 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

\*\*\*\*\*

*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					

[2]

- vi. Torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress ( $\tau$ ) is equal to-
- $\pi/16 \times \tau \times D^2$
  - $\pi/16 \times \tau \times D^3$
  - $\pi/32 \times \tau \times D^2$
  - $\pi/32 \times \tau \times D^3$
- 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-
- At C
  - Between A and C
  - Between C and B
  - 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-
- 1 : 1
  - 1 : 1.5
  - 1.5 : 1
  - 2 : 1
- ix. The design of a thin cylindrical shell is based on
- Internal pressure
  - Diameter of shell
  - Longitudinal stress
  - All of these
- x. In a thin shell, the ratio of longitudinal stress to the circumferential stress is-
- 1/2 6
  - 3/4
  - 1
  - 2

1 1 3 1 1

1 1 4 1 1

1 1 4 1 1

1 1 5 1 1

1 1 5 1 1

[3]

- Q.2 i. Define thermal stress and thermal strain. **2** 1 1 1 1
- ii. Describe volumetric strain. **3** 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. **5** 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. **5** 2 1 2 1
- Q.3 i. Explain the difference between a cantilever beam and a simply supported beam. **2** 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. **8** 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. **8** 2 2 2 1
- Q.4 i. Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion. **3** 1 3 1 1
- ii. Prove  $\tau/R \theta = C\theta/l$  in case of torsion of a circular shaft. **7** 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. **7** 2 3 2 1
- Q.5 i. What is the relation between slope, deflection and radius of curvature of a simply supported beam? **4** 1 4 1 1

### Marking Scheme

#### **RA3CO23 (T) Strength of Materials for Mechanical Engineers (T)**

<b>Marking Scheme</b>		
<b>RA3CO23 (T) Strength of Materials for Mechanical Engineers (T)</b>		
<b>Q.1</b>	i) (b)	<b>1</b>
	ii) (a)	<b>1</b>
	iii) (c)	<b>1</b>
	iv) (c)	<b>1</b>
	v) (a)	<b>1</b>
	vi) (b)	<b>1</b>
	vii) (c)	<b>1</b>
	viii) (c)	<b>1</b>
	ix) (d)	<b>1</b>
	x) (a)	<b>1</b>
<b>Q.2</b>	i. Thermal Stress 1M Thermal Strain 1M	<b>2</b>
	ii. Volumetric Strain Definition 2M Formula 1M	<b>3</b>
	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>	<b>5</b>
OR	iv. Derivation 4M Diagram 1M	<b>5</b>
<b>Q.3</b>	i. One marks for one difference 1+1	<b>2</b>
	ii. Theory of simple bending 2M Assumptions made 2M Bending equation 2M	<b>8</b>
		OR    iii. Example 2M S.F. diagrams 2M B.M. diagrams 4M The maximum B.M. on the section. 2M
		Q.4    i. One marks for one assumption <b>1+1+1</b> ii. For complete proof full marks and for partial derivation provide marks for step marking
		OR    iii. For right answer provide full marks in case of wrong answer but write step provide marks accordingly
		Q.5    i. Explanation 2M Relation 2M ii. Macaulay's method Explanation Cases, 4M Use. 1M With significance, convention and diagram 1M
		OR    iii. Derivation 4M Diagram 2M With significance, convention and diagram
		Q.6    i. Circumferential stress- Detected explanation 3M Longitudinal stress- Detected explanation 2M With neat and clean diagram, with proper significance, convention ii. Writing of all parameters 2M Derivation 3M iii. One marks for one difference 1M for each
		*****

[2]

[3]