Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | | **Course Code** | 2 | 1 | C | V | 3 | 3 |

Third Semester B.E. Degree Examinations, April/May 2023

STRENGTH OF MATERIALS

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		MODULE – 1		
1.	**a.**	Explain the terms : (i) Poison's ratio (ii)Volumetric strain	**04**	(2 :1 : 1.3.1)
	b.	Derive the relationship between Young's modulus and shear modulus with usual notation.	**06**	(2 :1 : 1.3.1)
	c.	A steel bar of 20 mm diameter subjected to tensile load test. Determine stress, strain, Young's modulus, % elongation from the following data: Gauge length 200 mm. Extension at a load of 100 kN is 0.147 mm Total elongation 50 mm Also determine the decrease in cross sectional area of the specimen if the diameter of the rod at failure is 16 mm.	**10**	(3 :1 : 1.3.1)
		OR		
2.	**a.**	Derive an expression for the deformation of rectangular tapering bar of uniform thickness subjected to an axial force.	**10**	(2 :1 : 1.3.1)
	b.	A bar of 20 mm dia is tested in tension. It is observed that when a load of 37.7 kN is applied the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0036 mm. Find the Poisson's ratio, young modulus, bulk modulus and modulus of rigidity.	**10**	(3 :1 : 2.2.1)
		MODULE – 2		
3.	**a.**	Define (i) Shear force (ii) Bending moment	**04**	(2 :2 : 1.3.1)
	b.	Derive the relationship between load intensity, shear force and bending moment.	**08**	(2 :2 : 1.3.1)
	c.	For the cantilever beam shown in the Fig. Q3(c), draw shear force and bending moment diagram.	**08**	(3 :2 : 2.2.1)

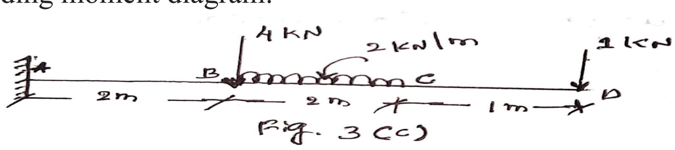

Fig. Q3(c)

		OR		
4.	**a.**	Explain the different types of beam supports with neat sketch.	**06**	(2 :2 : 1.3.1)
	b.	Draw BMD and SFD for the overhanging beam shown in Fig.Q 4(b). Clearly indicate point of contraflexure.	**14**	(3 :2 : 2.2.1)

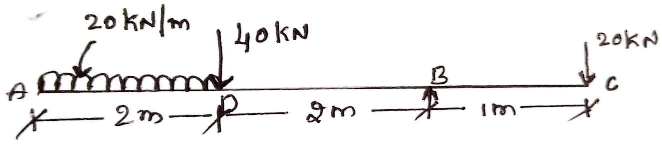

Fig. Q 4 (b)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

MODULE – 3

5. **a.** Derive the bending equations with usual notations. **08** (2 :3 : 1.3.1)

b. A T-section is having a flange of 200 mm x 50 mm. The web is also 200 mm × 50 mm. It is subjected to a bending moment of 15 kN-m and shear force of 50 kN. Draw the bending stress and shear stress distribution across the section indicating the salient values. **12** (3 :3 : 2.2.1)

OR

6. **a.** Derive the expression of the shear stress intensity for triangular section. **10** (2 :3 : 1.3.1)

b. A beam of I section consists of 180 mm × 15 mm flanges and web of 280 mm depth and 15 mm thickness. It is subjected to a bending moment of 120 kN-m and shear force of 60 kN. Sketch the bending and shear stress distribution along the depth of the section. **10** (3 :3 : 2.2.1)

MODULE – 4

7. **a.** Derive torsion equation $\frac{T}{J}=\frac{G_{\theta}}{L}=\frac{\tau}{r}$ with usual notations. **10** (2 :4 : 1.3.1)

b. A hollow shaft has to transmit 600 kW power at 80 rpm. Torque developed may exceed the mean torque by 40%. Design the suitable section if the working stress is 90 MPa. Take diameter ratio as 0.05. What will be the angular twist measured over a length of 2 m. **10** (2 :4 : 2.2.1)

OR

8. **a.** Derive the Expression for principle stress and principle plane of 2-D stress system. **10** (2 :4 : 1.3.1)

b. In a 2-D stress system compressive stresses of magnitudes 100 MPa and 150 MPa act in two perpendicular directions. Shear stresses on these planes have magnitude of 80 MPa. Use Mohr's circle to find, **10** (3 :4 : 2.2.1)
(i) Principal stresses and their planes
(ii) Maximum shears stress and their planes and
(iii) Normal and shear stresses on a plane inclined at 450 to 150 MPa stress.

MODULE – 5

9. **a.** Derive the expression for Euler's buckling load for a column with both ends are hinged. **10** (2 :5 : 1.3.1)

b. A solid round bar 4 m long and 50 mm in diameter is used as a strut with both ends fixed. Compare Euler's crippling load and Rankine's crippling load for the bar and also find the length of bar for which both formulas give same load. Take E = 80 GPa, α = 1/1600, σ_c= 550 MPa. **10** (3 :5 : 2.2.1)

OR

10. **a.** Derive the expression for moment curvature equation. **10** (2 :5 : 1.3.1)

b. For a simply supported beam loaded as shown in Fig Q10 (b), determine the slopes at A, B and deflection at C and D. Also find maximum deflection under 40 kN load. **10** (3 :5 : 2.2.1)

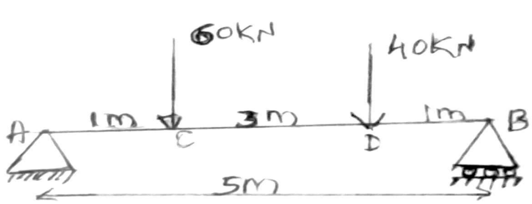

Fig. Q10 (b)

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