

III/SEM/MECH/AUTO/Ele & Mech/2015(W)

(2)

STRENGTH OF MATERIAL

Sub Code - **MET-301**

Full Marks : 70

Time : 3 hours

Answer any **five** questions

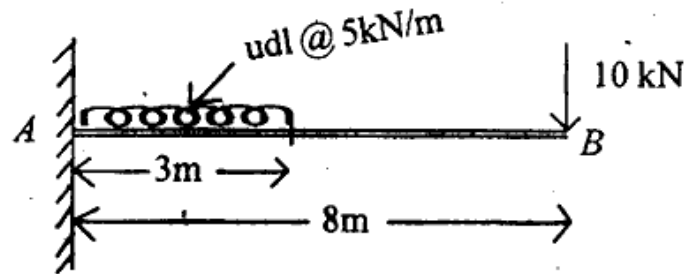
The figures in the right-hand margin indicate marks

- 1. (a) What are the measures of stiffness ? 2
- (b) Find out the thermal stress in a simple bar of length (l), increase in temperature (t) and coefficient of linear expansion (α). 5
- (c) A reinforced concrete column 500 mm x 500mm in section is reinforced with 4 steel bars of 30 mm diameter, one in each corner. The column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take E for steel = 210 GPa and E for concrete = 14 GPa. 7
- 2. (a) Define strain energy and resilience. 2
- (b) Explain how a thin cylinder fails due to lack of hoop stress as well as longitudinal stress. 5

(Turn Over)

- (c) A cylindrical thin drum 900 mm in diameter and 4 m long is made of 10 mm thick plates. If the drum is subjected to an internal pressure of 3 MPa, determine its changes in diameter and length. Take $E = 200$ GPa and Poisson's ratio = 0.25. 7
- 3. (a) Define principal stress and principal plane. 2
- (b) Derive an expression for the stresses on an oblique plane of a rectangular body when it is subjected to direct stress in two mutually perpendicular direction. 5
- (c) A point in a strained material is subjected to a tensile stress of 140 MPa and a clockwise shear stress of 40 MPa. What are the values of normal and shear stresses on a plane inclined at 30° with the normal to the tensile stress. 7
- 4. (a) Define point load and u.d.l. 2
- (b) Show diagrammatically different types of beams and loads. 5
- (c) Draw the S.F. and B.M. diagram of the following loaded beam : 7

(3)



5. (a) What is 'pure bending' ? 2
- (b) Prove that neutral axis in a loaded beam is the centroidal axis. 5
- (c) A rectangular beam 300 mm deep is simply supported over a span of 4 m. What uniformly distributed load the beam may carry if the bending stress is not to exceed 120 MPa. Take $I = 225 \times 10^6 \text{ mm}^4$. <http://www.sctevtonline.com> 7
6. (a) What is slenderness ratio ? 2
- (b) What is eccentric loading ? How it affects when it is subjected to a column ? 5
- (c) A rectangular column 250 mm wide and 150 mm thick is carrying a vertical load of 150 kN at an eccentricity of 60 mm in a plane bisecting the thickness. Determine the maximum and minimum intensities of stress in the section. 7

(4)

7. (a) What is 'Torsional rigidity' ? 2
- (b) Write down the assumptions taken for finding out the torsion formula. 5
- (c) Find out the relation $T = \frac{\pi}{16} \tau \cdot D^3$ in case of a solid shaft of diameter D . 7

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