

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

June, 2017

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BICE-008 : STRUCTURAL ANALYSIS – I

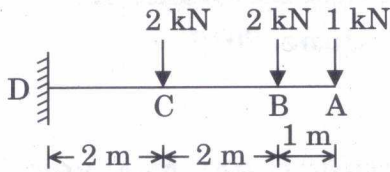
Time : 3 hours

Maximum Marks : 70

Note : Attempt any seven questions. Assume missing data, if any. Use of scientific calculator is allowed. All questions carry equal marks.

1. (a) Derive the relation between Young's modulus (E) and bulk modulus (K). 4
(b) A concrete cylinder of diameter 140 mm and length 250 mm when subjected to an axial compressive load of 240 kN resulted in an increase of diameter by 0.13 mm and a decrease in length of 0.27 mm. Compute the value of Poisson's ratio (μ) and modulus of elasticity (E). 6
2. A thin cylinder with closed ends has an internal diameter of 50 mm and a wall thickness of 2.5 mm. It is subjected to an axial pull of 10 kN and torque of 500 Nm while under an internal pressure of 6 MN/m^2 . Determine the principal stresses in the tube and the maximum shear stress. 10

3. Draw the S.F. and B.M. diagrams for a cantilever loaded as shown in the figure. 10



4. A 250 mm (depth) \times 150 mm (width) rectangular beam is subjected to maximum bending moment of 750 kNm. Determine the maximum stress in the beam. If the value of E for the beam material is 200 GN/m^2 , find out the radius of curvature for that portion of the beam where the bending is maximum. 10

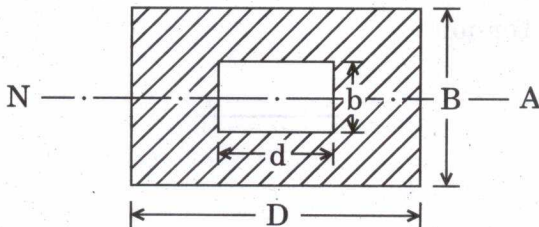
5. (a) Explain the different types of columns depending upon Slenderness ratio. 4
- (b) Calculate the safe compressive load on a hollow cast-iron column (one end rigidly fixed and the other hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m length. Use Euler's formula with a factor of safety of 5, and $E = 95 \text{ GN/m}^2$. 6

6. A bar of length 4 m when used as a simply supported beam and subjected to a u.d.l. of 30 kN/m over the whole span, deflects 15 mm at the centre. Determine the crippling loads when it is used as a column with the following end conditions : 10

- (a) Both ends pin-jointed
- (b) One end fixed and the other end hinged
- (c) Both ends fixed

7. (a) Explain the assumptions of theory of simple bending. 5

- (b) Calculate the section modulus of a hollow rectangular cross-section of the following dimensions : 5



8. A beam consists of a symmetrical rolled steel joist. The beam is simply supported at its ends and carries a point load at the centre of the span. If the maximum stress due to bending is 140 MPa, find the ratio of the depth of the beam section to span in order that the central deflection may not exceed $\frac{1}{480}$ of the span. Take

$E = 200 \text{ GPa}.$

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9. An object of 100 N weight falls by gravity, a vertical distance of 5 m, when it is suddenly stopped by a collar at the end of a vertical rod of length 10 m and diameter 20 mm. The top of the bar is rigidly fixed. Calculate the maximum stress and strain induced in the bar due to impact. Take $E = 200 \text{ GN/m}^2$ for the material of the rod. 10
10. Write short notes on the following : 10
- (a) Ductility
 - (b) Elasticity
 - (c) Non-destructive Test
 - (d) Torsion
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