B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

ⵊⵊⵊⵊⵊⵊ   **December, 2014**

BICE-008 : STRUCTURAL ANALYSIS – I

*Time : 3 hours*   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Use of calculators is allowed. Assume missing data, if any.*

1. (a) Define the shear modulus and modulus of rigidity.   *3*

    (b) A square steel rod 20 mm × 20 mm in section is to carry an axial load (compressive) of 100 kN. Calculate the shortening in length of 50 mm. Take $E = 2 \cdot 14 \times 10^8$ kN/m^3.   *7*

2. (a) What is principal planes and principal stress ?   *3*

    (b) Derive the expression for normal and shear stress of an inclined plane making an angle of θ with horizontal axis by Mohr's Circle method. This plane is acted on by two like tensile stresses.   *7*

3. (a) Discuss the use of shear force and bending moment diagrams. *3*

(b) A symmetrical section 200 mm deep has a Moment of Inertia $2 \cdot 26 \times 10^{-5}$ m^4 about its N.A. Determine the longest span of simply supported beam which can carry a u.d.l. of 4 kN/m run without the stress due to bending excluding 125 MN/m^2. *7*

4. Draw the S.F. and B.M. diagrams for a cantilever beam as shown below : *10*
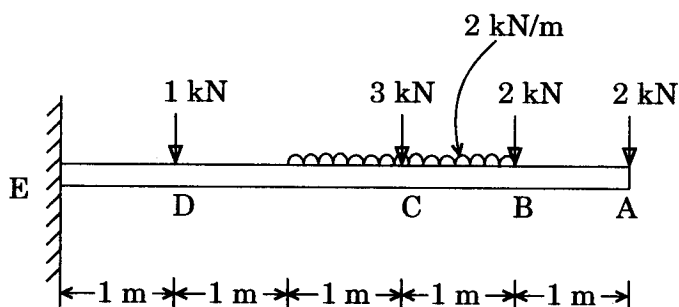
5. A timber beam 150 mm × 250 mm in cross-section is simply supported at its ends and has a span of 3·5 m. The maximum safe allowable stress in bending is 7,500 kN/m^2. Find the maximum safe u.d.l. which the beam can carry. What is the maximum shear stress in the beam for the u.d.l. ? *10*

6. (a) Classify the various types of columns based on slenderness ratio. *4*

(b) What is the effective length of a column ? Discuss the effective length of a column for different end conditions. *6*

7. Calculate the safe compressive load on a hollow C.I. column (one end rigidly fixed and other hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m length. Use Euler's formula with F.O.S. of 5 and $E = 95 \text{ GN/m}^2$. *10*

8. (a) Differentiate between impact and fatigue testing methods. *5*

(b) Discuss the assumptions in the material properties of steel. *5*

9. A solid steel shaft has to transmit 75 kW at 200 r.p.m. Taking allowable shear stress as 70 MN/m^2, find the suitable diameter for the shaft, if the maximum torque transmitted on each revolution exceeds the mean by 30%. *10*

10. Write short notes on any *two* of the following : *2×5=10*

(a) Shear centre

(b) Temperature stresses

(c) Non-destructive testing and standard tests on concrete