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OLE-24064

B. Tech. 3rd Semester (Civil Engg.) Examination – April, 2021

STRUCTURAL ANALYSIS – I

Paper : CE-201-F

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in total selecting at least ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. (i) What is factor of safety.

(ii) What do you mean by Mohr's correction ?

(iii) Define thermal stresses and thermal strains.

(iv) What is the assumption made in the analysis of a pin-jointed plane truss ?

(v) Define Maxwell law of reciprocal theorem.

(vi) State the assumption for shearing stress in a circular shaft subjected to torsion.

(vii) Define Virtual displacement and Virtual Work done.

(viii) Differentiate between determinate and Indeterminate Structure.

(ix) Difference between column and strut. Gives the different end condition of the column.

(x) What is the maximum bending moment for a simply supported beam subjected to uniformly distributed load and where it occurs ?

SECTION – A

2. A solid cylindrical brass bars of 25 mm diameter is enclosed in a steel tube of 50 mm external diameter and 25 mm internal diameter. The bar and the tube are both initially 1.5 m long and are rigidly fastened at both ends. Find the stresses induced in two materials when the assembly is subjected to an increase in temperature of 50°C. Take coefficient of thermal expansion of steel as 12×10^{-6}/°C and that of brass as 18×10^{-6}/°C, Modulus of elasticity of steel as 200 GPa and Modulus of elasticity of brass as 100 GPa.

3. A short metallic column of 500 mm^2 cross-section area carries an axial compressive load of 100 kN. For a plane inclined at 60 degrees with the direction of load. Find normal stress, tangential stress and resultant stress, maximum shear stress and obliquity of resultant stress .

SECTION – B

4. (a) A channel section made with 120 mm × 10 mm horizontal flanges and 160 mm × 10 mm vertical web is subjected to a vertical shearing force of 120 kN. Draw the shear stress distribution diagram across the section.

(b) A beam 500 mm deep of a symmetrical section has I – 1×10^9 mm^4 and is simply supported over a span of 10m. Calculate

1. The uniformly distributed load it can carry if the maximum bending stress is not to exceed 150 N/mm^2.

2. The maximum bending stress if the beam carries a central point load of 25 KN.

5. A solid cylindrical shaft is to transmit 450 kW at 100 r.p.m. What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameters, the length, the material and maximum shear stress being the same.

SECTION – C

6. (a) A slender column is built-in at one end and an eccentric load is applied at the free end. Working from the first principles find the expression for the maximum length of column such that the deflection of the free ends does not exceeds the eccentricity of loading.

(b) Calculate the safe compressive load on a hollow cast iron column one end rigidly fixed and other pin-jointed, 180 mm outer and 100 mm inner diameter, 10 meters long. Use Euler's formula with a factor of safety of 6 and take : 95 GN/m^2.

7. A steel strut has an outside diameter of 120 mm and inside diameter of 80 mm and is 6 m long. It is hinged at both ends and is initially bent. Assuming the center line of the strut as sinusoidal with maximum deviation of 6 mm, determine the maximum stress developed due to an axial load of 100 kN. Take E = 208 GN/m^2.

SECTION – D

8. A 10 m long beam ABC is simply supported at B and C over a span of 8 m with end A being free. It carries point loads of 8 kN and 4 kN at distances 3 m and 5 m from C. The beam also has two uniformly distributed loads of intensity 4 kN/m for a distance of 4 m starting from C and 6 kN/m on AB. Draw shearing force and bending moment diagram indicating all principal values.

9. (a) A cantilever of span I is carrying uniformly distributed load of w per unit run on a length "a" from the fixed end. Determine the slope and deflection at the free ends. Use conjugate beam method.

(b) Determine the slope and deflection at the free end of a cantilever beam as shown in Fig.1 by moment area method (Take EI = 3000kNm^2)

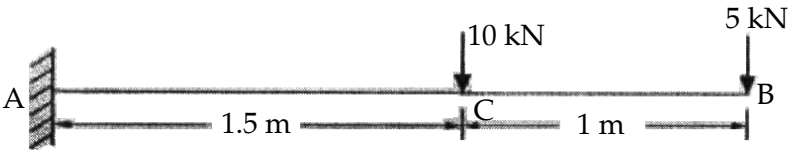

Fig. 1