8. Construct the bending moment and shearing force diagram for the beam as shown in Fig. 1.2 20

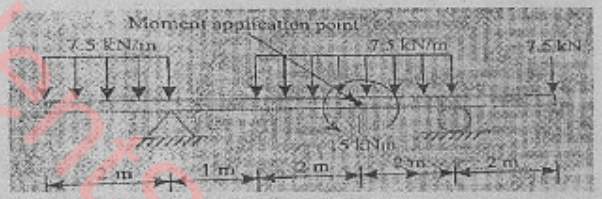

Fig. 1.2

9. (a) Determine the slope and deflection at B and C in the cantilever beam as shown in Fig.1.3 by Conjugate beam method. 10

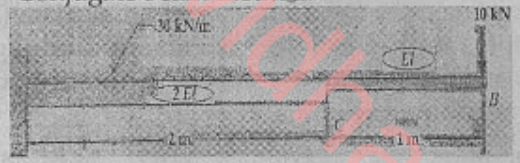

Fig. 1.3

(b) Using method of virtual work, find the horizontal deflection of the free end of the frame shown in Fig.1.4. $E = 250\ KN/mm^2$. $I = 40 \times 10^6\ mm^4$. 10

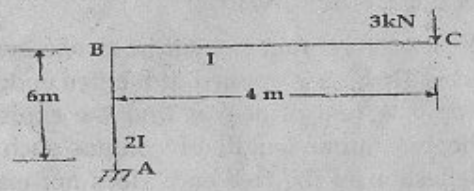

Fig. 1.4

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24064

B. Tech 3rd Sem. (Civil Engg.)

Examination – December, 2015

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 : Question No. 1 is ***compulsory***. Students have to attempt 5 questions in total at least ***one*** questions from each Section. All Questions carry equal Marks.

1. (i) Define Influence Line. $10 \times 2 = 20$

(ii) State a few applications of Williot's diagram.

(iii) What is meant by Muller-Breslau's principle ?

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

(v) Define modular ratio.

(vi) Define Maxwell law of reciprocal theorem.

(vii) Explain the principle of least work.

(viii) State the principle of Virtual work for deflection.

(ix) Define thermal stresses and thermal strains.

(x) Differentiate between determinate and Indeterminate Structure.

2. If at a point within the material, the minimum and maximum principal stresses are 30 MN/m^2 and 90 MN/m^2 respectively both tensile, determine the normal and shearing stresses on a plane passing through the point and making an angle of tan-1 0.25 with the plane on which the maximum principal stresses acts. 20

3. A composite bar made up of aluminium and steel is held between two supports as shown in Fig.1.1. The bars are stress - free at a temperature of 40°C. What will be the stresses in two bars when the temperature is 30° C if (i) the supports are non-yielding and (ii) the supports come nearer to each other by 0.1 mm. It can be assumed that the change of temperature is uniform all along the length of the bars. Take: Es = 210 GN/m^2, Ea = 84 GN/m^2, $\alpha_s = 11.8 \times 10^{-6}$ per °C, $\alpha_a = 24.8 \times 10^{-6}$ per °C. 20

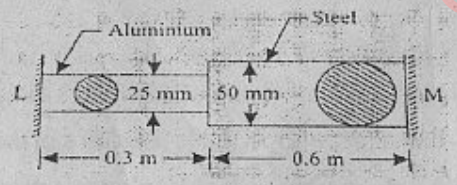

Fig. 1.1

4. (a) Two circular beams where one is solid of diameter D and other is a hollow of outer diameter D_0 and inner dia. D_i, and the same length, same material and of same weight. Find the ratio of section modulus of these circular beams. 10

(b) An I-section with rectangular ends has the following dimensions : 10

Flanges: 150 mm x 20 mm

Web: 300 mm x 10 mm

Total Depth: 340 mm

Determine the maximum shearing stress developed in the beam for the shearing force of 35 KN.

5. A steel shaft 1 m long, 30 mm diameter is rigidly fixed at the ends. A torque of 650 Nm is applied at a distance of 250 mm from one end. Calculate (i) fixing couple at the ends (ii) maximum shearing stress (iii) angle of twist at the point of application of torque. C = 85 GN/m^2. 20

6. Determine the maximum stress induced in a horizontal strut of length 3.5 m and rectangular cross-section 45 mm wide and 85 mm deep when it carries an axial thrust of 150 kN and a vertical load of 9 kN/m length. The strut is having pin joints at its ends. Take E = 210 GN/m^2 20

7. (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. 10

(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 metres long. Use Euler's formula with a factor of safety of 6 and take : 95 GN/m^2.10