VIII. (a) Derive the torsional equation.

(b) A solid shaft has to transmit 150HP at 160 rpm. If the shear stress is not to exceed 60N/mm² and the twist in a length of 3m not to exceed 1°, find the diameter required for the shaft. Assume modulus of rigidity as 8×10^4 N/mm².

IX. (a) Differentiate between thin and thick cylinders.

(b) The maximum stress permitted in a thick cylinder of radii 200mm and 300mm is 20 N/mm². If the external pressure is 5 N/mm², what internal pressure can be applied? Plot curves showing the variation of hoop and radial stress through the cylinder.

OR

X. Explain different theories of failure and compare them illustrating an example.

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B.Tech. Degree III Semester Examination January 2002

CE/SE 303 STRENGTH OF MATERIALS

Time: 3 Hours Maximum Marks: 100

(All questions carry ***EQUAL*** marks)

I. (a) Differentiate between -

(i) Axial stress and shear stress

(ii) Linear strain and lateral strain

(iii) Yield stress and working stress

(b) A copper rod 32mm diameter passes centrally through a steel tube of internal diameter 36mm and external diameter 46mm. The composite section is rigidly fixed together with nuts and washers of negligible thickness. The bar is then heated through 30°C. Find the stresses in the rod and the tube.

Take $E_s = 200 kN/mm^2$, $E_c = 110 kN/mm^2$,

$\alpha_s = 0.000012/^\circ C$, $\alpha_c = 0.000016/^\circ C$.

OR

II. (a) What do you understand by-

(i) Complementary shear,

(ii) Principal stress?

II. (b) At a point in a material under stress, the intensity of resultant stress on a plane is 50 MN/m² (tensile) inclined at 30° to the normal of that plane. A plane at right angles to this plane is subjected to a normal tensile component of intensity 30 MN/m².
Determine-

(i) the resultant stress on the second plane,
(ii) the principal planes and stresses,
(iii) the planes of maximum shear and its intensity.

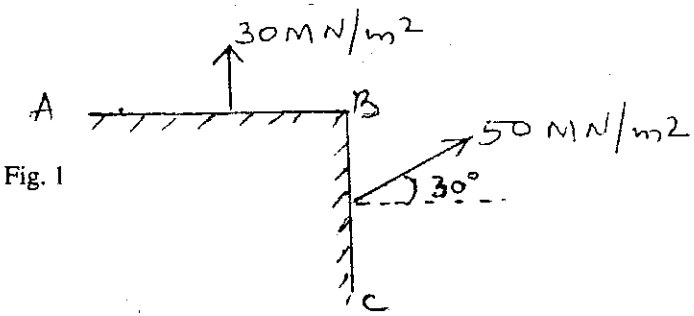

Fig. 1

III. (a) What do you understand by "beam of uniform strength"?

(b) Draw the shear force and bending moment diagrams for the beam shown in figure 2.

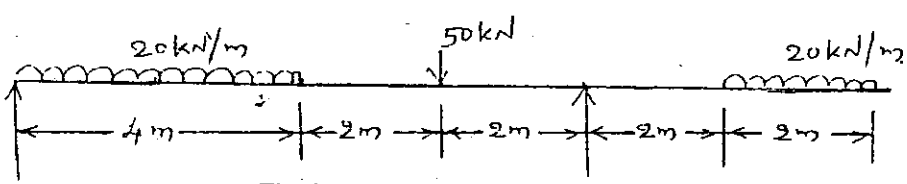

Fig. 2

OR

IV. (a) Explain the development of various stresses in a beam while bending.

Contd.....3.

IV. (b) A T-section is subjected to a bending moment and a shear force of magnitude 50kNm and 75 kN respectively. Given flange size = 120mm x 12mm, web thickness = 15mm, overall depth of web = 130mm. Draw the bending stress and shear stress distributions across the depth.

V. (a) Explain the method of successive integration.

(b) A beam of 6m span is freely supported and carries a point load at centre. Calculate the deflection at quarter span. Use Macaulay's method.

OR

VI. (a) Explain moment area theorems.

(b) A cantilever 2 metre long carries a point load of 20 kN at the free end and 30 kN at the middle. Using conjugate beam method, find the slope and deflection at the free end.

VII. (a) Explain the difference in the analysis of short struts and long columns.

(b) A hollow cast iron column of 400mm external diameter and 280mm internal diameter is used as a column of 5m long with one end hinged and the other fixed. Determine the safe load with a factor of safety of 4. f_c = 550 N/mm² and a = 1/1600 in Rankine's formula.

OR

Contd..... .....4.