X. A steel disc of uniform thickness and of diameter 400 mm is rotating about its axis at 2000 rpm. The density of the material is 7700 Kg/m^3 and Poisson's ratio is 0.3. Determine the variations of circumferential and raidal stresses. (20)

***

BTS 117(C)

B.TECH. DEGREE III SEMESTER (SUPPLEMENTARY) EXAMINATION IN CIVIL ENGINEERING
JUNE 2001

CE 303 STRENGTH OF MATERIALS
(1998 Admissions)

Time: 3 Hours Maximum Marks: 100

I. (a) Draw the stress-strain diagram for mild steel and explain the behaviour of the material. (6)

(b) A bar ABCD is subjected to loads as shown in figure 1. Determine:

(i) The force P necessary for equilibrium

(ii) Total elongation of the bar.

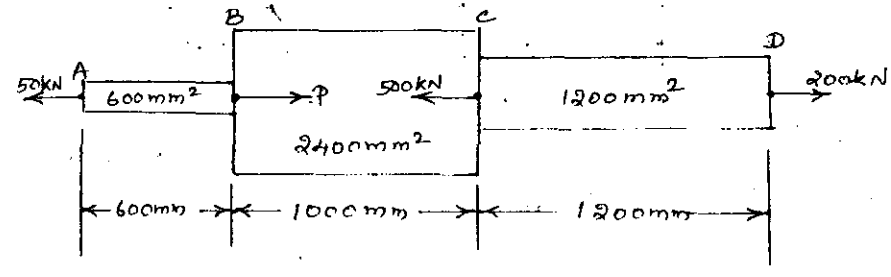

Fig. 1

(14)

OR

II. (a) Explain principal stresses and principal planes. (8)

(b) At a point in a bracket, the stresses on two mutually perpendicular planes are 35 MPa (tensile) and 15 MPa (tensile). The shear stress on the planes is 9 MPa. Find the magnitude and direction of the resultant stress on a plane making an angle of 40° with the plane of first stress. Find also the normal and tangential stresses on the planes. (12)

(Turn over)

III. For the beam loaded as shown in figure 2, calculate the value of the intensity of uniformly distributed load w so that the bending moment at C is 50 kNm. Draw the shear force and bending moment diagrams for this beam with the calculated value of w. Locate the point of contraflexure if any. (20)

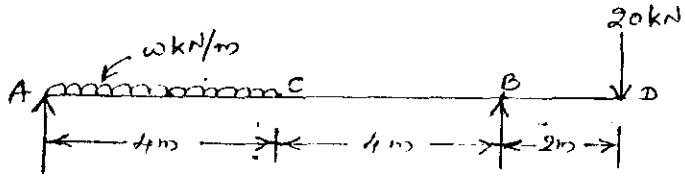

Fig. 2

OR

IV. (a) Derive the bending equation. (6)

(b) Determine the dimensions of a wooden joint for a span of 8 metres to carry a brick wall 200 mm thick and 5 metre high, if the density of brick is 1850 kg/m^3 and the maximum permissible stress is limited to 7.5 MPa. The depth of the joint is twice the width. (14)

V. (a) Derive the expressions for slope and deflection at the free end of a cantilever subjected to a uniformly distributed load of intensity W/m. Use double integration method. (8)

(b) A simply supported beam of span 4.5 metres carries a point load of 30 kN at 3 metres from the left support. If Ixx = 54.97 x 10^{-6} m^4 and E = 200 GN/m^2, find (i) the deflection under the load and (ii) the position and amount of maximum deflection. (12)

OR

VI. (a) Find the slope and deflection at the load point for a simply supported beam as shown in figure 3. (10)

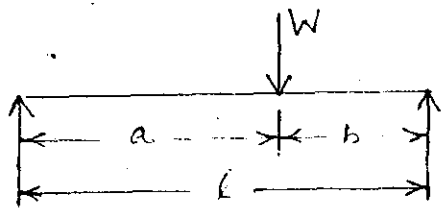

Fig. 3.

Contd.....

VI. (b) A cantilever 2 metre long carries a load of 15 kN at a distance of 1 metre from the fixed end and a load of 10 kN at the free end. Using conjugate beam method, find the deflection at the free end. (10)

VII. (a) Derive Euler's formula for crippling load for a column of length 'ℓ' metres when one end of the column is fixed and the other end is hinged. (8)

(b) A slender pin ended aluminium column 1.8 metre long and of circular cross section is to have an outside diameter of 50 mm. Calculate the necessary internal diameter to prevent failure by buckling if the safe load applied is 13.6 kN and the critical load is twice the safe load. Take E = 70 GPa. (12)

OR

VIII. (a) A solid circular shaft transmits 75 kN power at 200 rpm. Calculate the diameter of the shaft if the twist in the shaft is not to exceed 1° in 2 metres length ofshaft and shear stress is limited to 50 MPa. Take C = 100 GPa. (10)

(b) A close coiled helical spring of 100 mm mean diameter is made of 10 mm diameter rod and has 20 turns. The spring carries an axial load of 200 N. Determine the shearing stress. Taking the value of modulus of rigidity = 84 GPa, determine the deflection when carrying this load. Also calculate the stiffness of the spring. (10)

IX. (a) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MPa. Also calculate the increase in length, diameter and volume of the cylinder. (10)

(b) A pipe of 200 mm internal diameter and 50 mm thickness carries a fluid at a pressure of 10 MPa. Calculate the maximum and minimum intensities of circumferential and radial stresses across the section., Plot the variation. (10)

OR

Contd.....4.