Total No. of Questions : 5] [Total No. of Printed Pages : 5

Roll No. ....

CE/FT-303

B. E. (Third Semester) EXAMINATION, June, 2009

(New Scheme)

(Common for CE & FT Engg.)

STRENGTH OF MATERIALS

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Answer all questions. There is internal choice within each question. Assume suitable missing/misprint data if required. It should be clearly stated.

1. Two vertical rods, one of steel and other of bronze are suspended from a horizontal ceiling, the horizontal distance between them being 800 mm. Each rod is $2 \cdot 5$ m long and $12 \cdot 5$ mm in diameter. A horizontal cross-piece connects the lower ends of the bars. Where should a load of 10 kN be placed on this cross-piece so that it remains horizontal after being loaded ? Estimate the stress in each rod. Take $E_S = 2 \times 10^5 \text{ N/mm}^2$ and $E_B = 1 \cdot 1 \times 10^5 \text{ N/mm}^2$. Neglect the bending of the cross-piece. 20

Or

(a) The Young's modulus of a material is $21 \times 10^4 \text{ N/mm}^2$ and its modulus of rigidity is

P. T. O.

$8 \cdot 4 \times 10^4 \, N/mm^2$. Determine its Poisson's ratio and Bulk modulus. 6

(b) Fig. 1 shows the state of stress of a point in a two-dimensional stressed body. Find graphically (Mohr's circle) : 14

(i) The magnitude and direction of principal stresses.

(ii) The plane of maximum shear and its intensity.

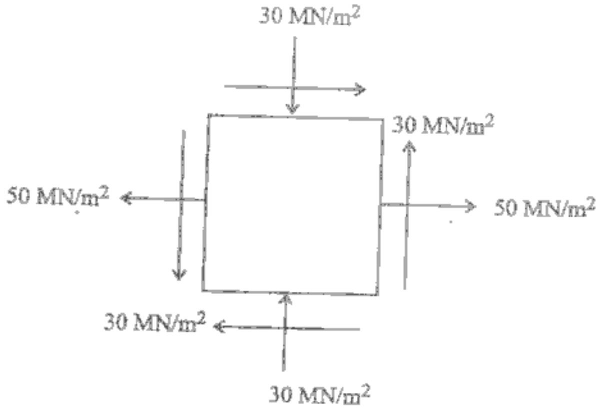

Fig. 1

2. A horizontal beam of section shown in fig. 2 is 3 m long and is simply supported at the ends. Find the maximum U. D. L. it can carry if the compressive and tensile stresses must not exceed 56 MN/m^2 and 30 MN/m^2 respectively. 20

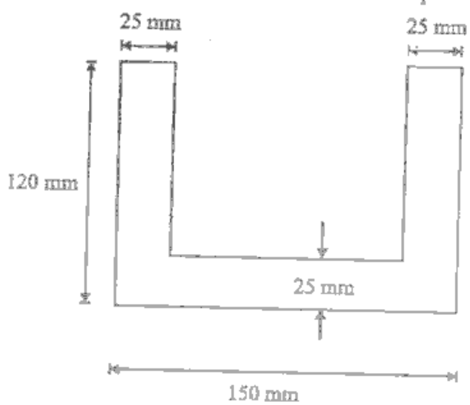

Fig. 2

Or

For the beam shown in fig. 3, using conjugate beam method, determine the following : 20

(i) Slope at end A

(ii) Deflection at the mid span

(iii) Maximum deflection

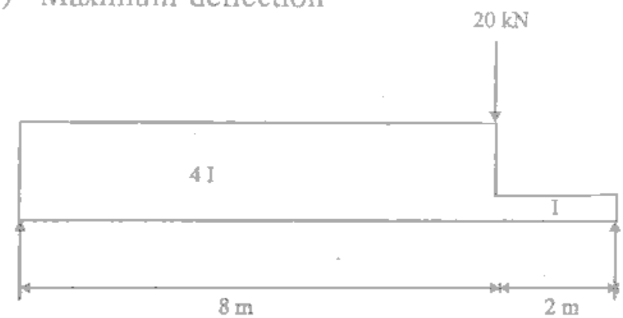

Fig. 3

Take $E = 200 \times 10^6$ kN/m^2 and $I = 8 \times 10^{-5}$ m^4.

3. (a) A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if it is subjected to an internal pressure of 1·5 MN/m^2. Take E = 200 GN/m^2 and $\frac{1}{m} = 0{\cdot}3$. 10

(b) A hollow shaft of diameter ratio $\frac{3}{5}$ is required to transmit 600 KW at 110 r. p. m., the maximum torque being 12% greater than the mean. The shear stress is not to exceed 60 MN/m^2 and the twist in a length of 3 m not to exceed 1°. Calculate the maximum external diameter satisfying these conditions. Take C = 80 GN/m^2. 10

P. T. O.

Or

(a) A close-coiled spring has mean diameter of 75 mm and spring constant of 90 kN/m. It has 8 coils. What is the suitable diameter of the spring wire if maximum shear stress is not to exceed 250 MN/m^2 ? Modulus of rigidity of the spring wire material is 80 GN/m^2. 10

(b) A solid circular shaft transmits 75 KW power at 200 r. p. m. Calculate the shaft diameter if the twist in the shaft is not to exceed 1° in 2 metres length of shaft and shear stress is limited to 50 MN/m^2. Take $C = 100\ GN/m^2$. 10

4. (a) Determine the principal moments of inertia for an unequal angle section 60 mm × 40 mm × 6 mm. 15

(b) What do yo understand by 'Shear Centre' ? 5

Or

A curved beam, rectangular in cross-section is subjected to pure bending with couple of + 400 kN-mm. The beam has width of 20 mm and depth of 40 mm and is curved in a plane parallel to the depth. The mean radius of curvature is 50 mm. Find the position of the neutral axis and the ratio of the maximum to the minimum stress. Also plot the variation of the bending stress across the section. 20

5. Compare the critical loads given by Rankine's and Euler's formulae for tubular strut 2·25 m long having outer and inner diameters of 37·5 mm and 32·5 mm loaded through pin-joint at both ends.

Take $f_y = 315\ MN/m^2$;

$$\alpha = \frac{1}{7500} \text{ and } E = 200\ GN/m^2.$$

If elastic limit for the material is taken as 200 MN/m^2, then for what length of the strut does the Euler formula cease to apply ? 20

Or

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 end does not exceed the eccentricity of loading. 20