D 41954 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

CE / EE / PTCE 2K 302 / PT 2K 403 – MECHANICS OF SOLIDS

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Assume suitable data that are not given.

I. (a) Define stress, strain, young modulus and Poisson's ratio.

(b) Draw the Mohr's circle for a state of pure shear and indicate the principal stresses.

(c) Derive the relation between shear force and bending moment.

(d) What is a beam of uniform strength ? Obtain the equation for the depth of a cantilever beam of uniform strength subjected to uniformly distributed load.

(e) Differentiate between successive integration method and Mecaulay's method.

(f) Compare Moment area method and conjugate beam method.

(g) Differentiate between thin cylinder and thick cylinder with respect to thickness and stresses.

(h) What is a helical spring ? What are the *two* types ? Explain.

(8 × 5 = 40 marks)

II. (a) A brass tube 100 mm external diameter and 10 mm thick surrounds tightly a copper tube of an equal thickness. The composite section is subjected to a compressive load of 120 kN. Estimate the load shared by brass and copper. Find also the stresses developed in brass and copper. $E_C = 1.1 \times 10^5$ N/mm² and $E_b = 0.9 \times 10^5$ N/mm².

Or

(b) An element in plane stress is subjected to stresses $\sigma x = -50$ MPa, $\sigma y = 20$ MPa and $\sigma xy = -30$ MPa. Determine (i) the stresses acting on an element rotated through an angle of 45° (ii) the principal stresses and (iii) the maximum shear stress.

(15 marks]

III. (a) Draw the shear force and Bending Moment diagram for the beam shown in Fig.1.

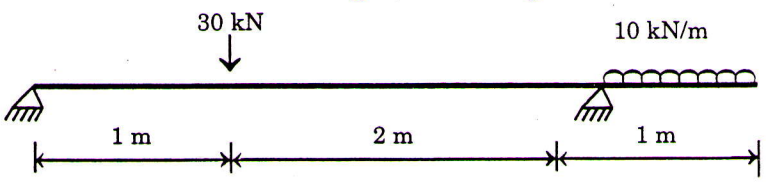

Fig. 1.

Or

(b) A timber beam of 4 m span has to carry an udl of 25 kN/m. Calculate the dimensions of the beam if the maximum permissible stress is limited to 8 N/mm². The ratio of depth a width is to be 1.5. Calculate the maximum shear stress in the beam.

(15 marks]

Turn over

IV. (a) Calculate the maximum deflection for the beam shown in Fig.2.

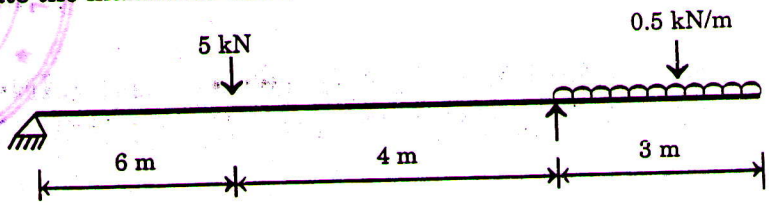

Fig. 2.

Or

(b) Using the conjugate beam method find the slope at 'C' and the deflection at D of the over-hanging beam shown in fig.3.

$E = 2 \times 10^5$ N/mm^2, $I = 120 \times 10^6$mm^4.

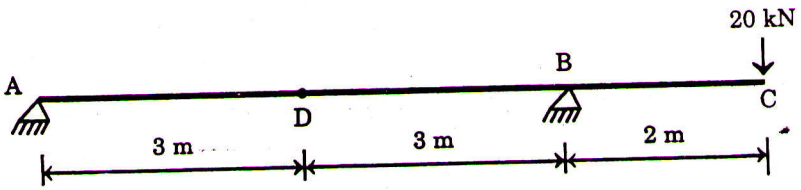

Fig. 3.

(15 marks]

V. (a) A shaft has to transmit 150 kW at 200 rpm. If the shear stress is not to exceed 60N/mm^2 and the twist per unit length in not to exceed 0.3 degrees. Find a suitable diameter if modulus of rigidity is 0.8×10^5 N/mm^2.

Or

(b) A compound cylinder is formed by shrinking one cylinder on the another. The internal and external radius of the compound cylinder are 150 mm and 240 mm respectively. At the junction the radius is 210 mm. If after shrinking on the radius pressure at the junction is 4 N/mm^2, calculate the hoop stress across the section of the inner and outer cylinder.

(15 marks]

[4 × 15 = 60 marks]