SE - Civil - Sem III - CBSGS

182

SOM

03/12/15

QP Code : 5147

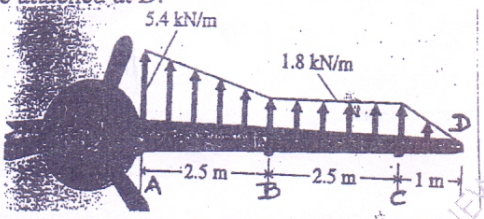
(3 Hours) 80 MARKS

INSTRUCTIONS: 1. Question number 1 is **COMPULSORY**. 2. Attempt any **THREE** from the remaining. 3. Each full question carries **EQUAL** marks. 4) **ASSUME** any suitable data, if needed.

---

1. A) **Fig. 1** shows the approximate distribution of forces that act on an airplane wing (including the lift force & the wing weight). End A is a fixed end. Calculate the bending moment at A. Drawing the BMD is not needed. A design engineer finds that the Bending Moment at A is too large. He asks you to attach a weight at point D to reduce the BM at A by 50%. Find the weight to be attached at D. **(04 M)**

FIG.1



B) A nylon thread is subjected to 10 N. tension force. Knowing that E = 3.4 GPa & that the length of the thread increases by 1.1%, determine: (i) the stress in the thread (ii) the diameter of the thread. **(04 M)**

C) What are the assumptions made in the Theory of Pure Torsion? **(04 M)**

D) A cylindrical shell is 3 m long & has 1.2 m internal diameter. It is subjected to an internal fluid pressure of 2 MPa. If the shell thickness is 10 mm, find the hoop stress & longitudinal stress. **(04 M)**

E) A steel bar having (45 mm X 45 mm) C/S & 5 m long is subjected to an axial pull of 170 kN. Find the strain energy stored in the bar. Also, determine the extension of the bar. Take E = 200 GPa. **(04M)**

---

2. A) A S/S beam has a span of 9 m & carries a UDL of 1600 N/m over the entire span. It is T section with flange dimensions (120 mm X 20 mm) & web dimensions (100 mm X 25 mm). Overall depth of section = 120 mm. Calculate the maximum shear stress. Draw the Shear Stress Distribution Diagram. **(10 M)**

B) Draw Shear Force Diagram & Bending Moment Diagram for the beam shown in **fig. 2.** Locate the Point of Contra flexure, if any. **(10 M)**

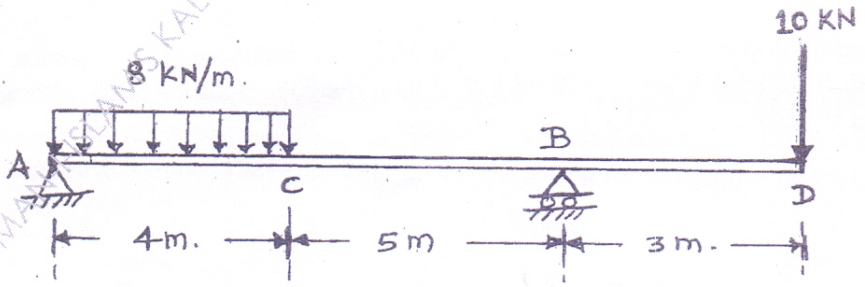
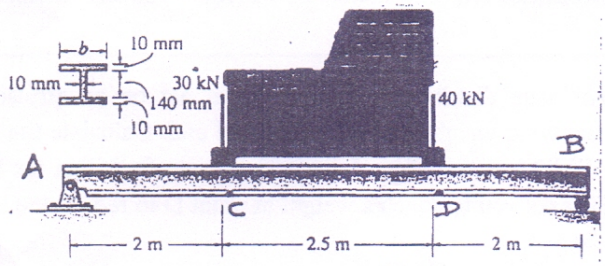


FIG.2

3. A) The beam is to be used to support the machine, which exerts the forces of 30 kN & 40 kN (**fig. 3**). If the Maximum Bending Stress is not to exceed 155 MPa, determine the required width (b) of the flanges. **(10 M)**



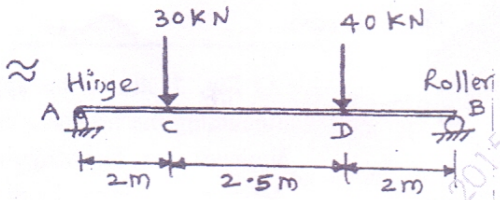


FIG-3

B) The masonry pier (**fig. 4**) is subjected to the 800 kN load. If x = 0.25 m & y = 0.5 m, find the resultant stress intensities at each corner A, B, C & D. Neglect the weight of the pier. **(10 M)**

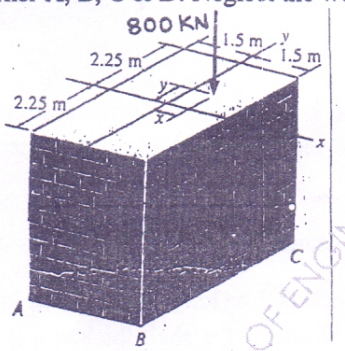


FIG-4

4. A) The thin walled cylindrical pressure vessel of inner diameter (d) & thickness (t) is subjected to an internal fluid pressure (p). If E = Young's modulus & μ = Poisson's ratio, find the strains in the circumferential & longitudinal directions. Using these results, compute the increase in diameter & length of a steel pressure vessel filled with air & having an internal pressure of 16 MPa. The vessel is 3 m. long & has an inner radius of 0.5 m & a thickness of 9 mm (**fig. 5**). Est = 200 GPa & μ = 0.3. **(06 M)**

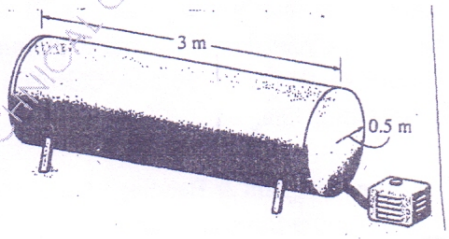


FIG.5

B) Write a note on temperature stresses. **(04 M)**

C) A column of height12 m is fixed at both the ends. Its C/S is a symmetrical I-section. Flanges are (100 mm X 15 mm) & web is (130 mm X 15 mm). Find the factor of safety with respect to buckling for an axial load of 17 kN. Use Euler's theory. **(10 M)**

$E = 2 \times 10^5 \text{ N/mm}^2$

5. A) Determine the maximum torque that can be applied safely to a solid shaft of diameter 270 mm. The permissible angle of twist = 1.3 degrees in a length of 5.8 m & the shear stress is not to exceed 60 MPa. Take Modulus of Rigidity G = 90 MPa. **(06 M)**

B) An element in a stressed body is subjected to normal stresses on mutually perpendicular directions (**fig. 6**). Determine the normal, tangential & resultant stresses on a plane P-P inclined as shown. Either use analytical method or graphical method. **(10 M)**

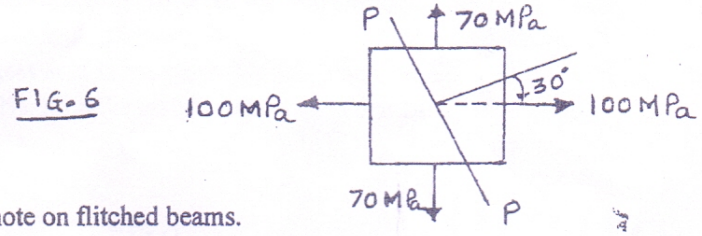


FIG-6

C) Write a note on flitched beams. **(04 M)**

---

6. A) A bar is subjected to a tensile load of 55 kN. Bar diameter = 31 mm, Gauge length = 300 mm, extension = 0.115 mm, change in diameter = 0.00367 mm. Find: Poisson's ratio, Young's modulus, bulk modulus & modulus of rigidity. **(05 M)**

B) The pole (**fig. 7**) is supported by a pin at C & a steel guy wire AB. If the wire has a diameter of 5 mm, determine how much it stretches when a horizontal force of 15 kN acts on the pole. E_{wire} = 200 GPa. **(05 M)**

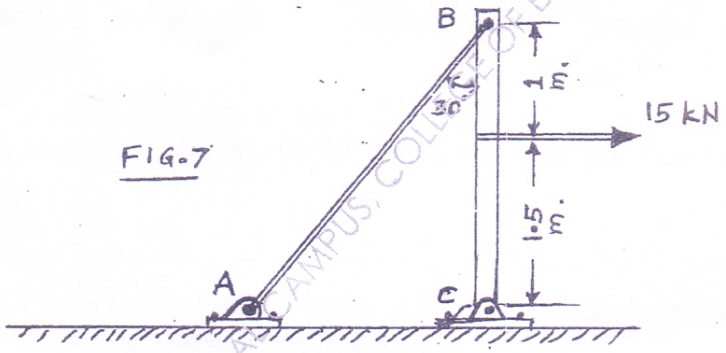


FIG-7

C) A square element is subjected to Principal Stresses (**fig. 8**). Find the intensity of normal stress on plane BD? **(05 M)**

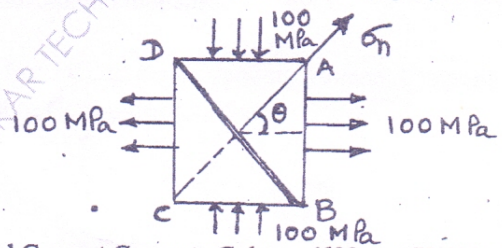


FIG-8

D) A short, Reinforced Cement Concrete Column (600 mm X 600 mm) has 8 steel rods of 25 mm diameter as reinforcement. Find the stresses in steel & concrete & the elastic shortening of the column if E = 200000 MPa for steel & 10000 MPa for concrete. Load on column = 3000 kN & length = 3 m. **(05 M)**