

ENGINEERING STATICS

(B.E. I)

Time: TWO Hours for working

Ten minutes for perusal before examination begins

ALL questions to be answered

Questions carry the number of marks indicated

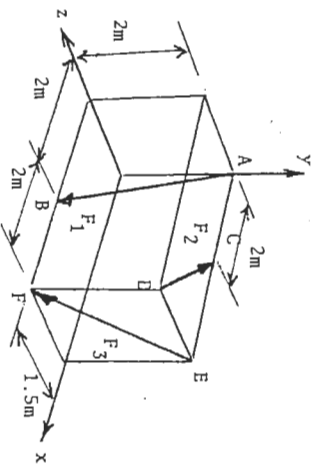
Continuous graph paper supplied

Drawing instruments and silent, battery-operated electronic calculators permitted

1. (a) For the force system shown in Figure 1, find

- (i) the total force component in the z-direction
-
- (ii) the total moment about the x-axis.

FIGURE 1



$$F_1 = 25 \text{ kN}$$

$$F_2 = 10 \text{ kN}$$

$$F_3 = 40 \text{ kN}$$

(13 marks)

15 min

- (b) For the structure loaded as shown in Figure 2, determine reactions at supports B and F.

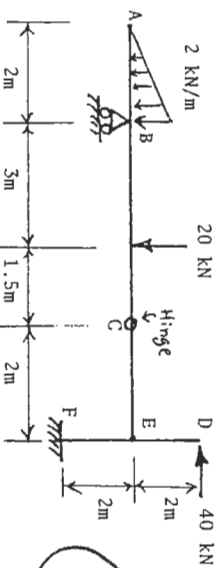


FIGURE 2

(12 marks)

15 min

Second Semester — E2101 (Engineering Statics) — continued

2. Draw the bending moment and shear force diagrams for the beam ABCDEFG loaded as shown in Figure 3. Draw the diagrams carefully and mark all the important values.

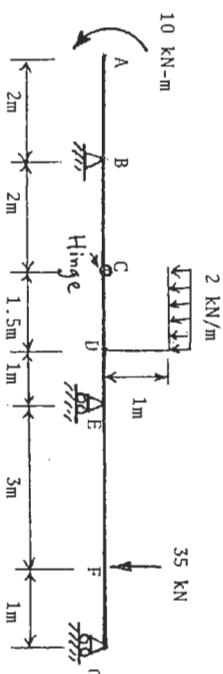


FIGURE 3

(25 marks)

30 min

3. Show that the second moments of area about the x-axis (not passing through centroids) of the sections shown in Figure 4 are,

- (i) triangle
- $I_x = bh^3/12$
-
- (ii) semi-circle
- $I_x = \pi R^4/8$

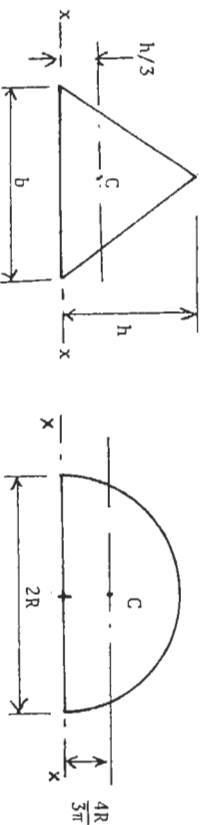


FIGURE 4

(7 marks)

4. (a) Determine the forces in members AB, AD and CD of the truss loaded as shown in Figure 6.

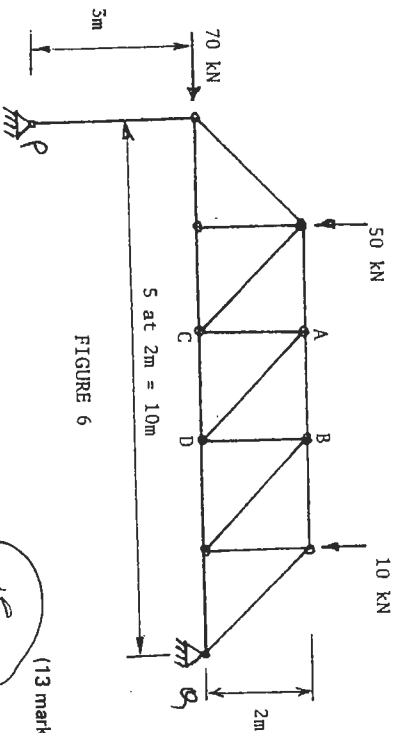


FIGURE 6

(13 marks)
215mm

Second Semester — E2101 (Engineering Statics) — continued

4. (contd)

(b) Two cylindrical bars of circular cross-section, one solid of radius r_1 and the other hollow of radii r_1 and r_2 are shown in Figure 7. If the cross-sectional areas of the bars are equal, determine the ratio of their unit angles of twist and the ratio of their maximum shear stresses for the same applied torque.

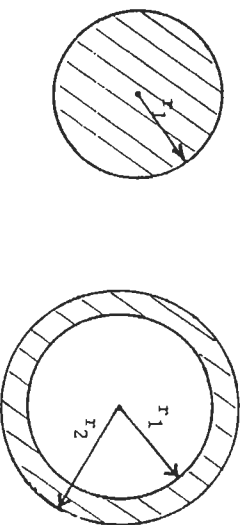


FIGURE 7

(12 marks)

25

INTERNAL STUDENTS ONLY

THE UNIVERSITY OF QUEENSLAND
First Semester Examination, June 1990

E2101
ENGINEERING STATICS
(B.E.I)

Time:

TWO (2) hours for working

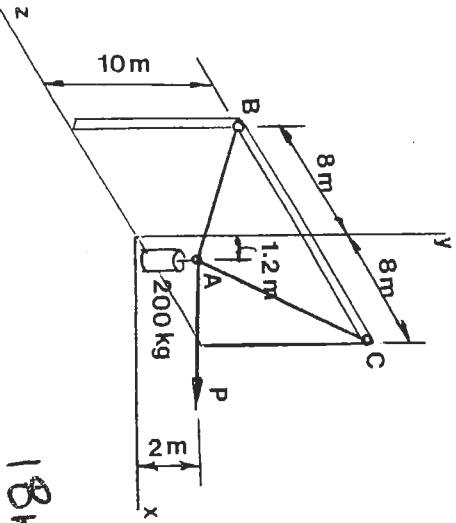
Ten minutes for perusal before examination begins

Answer ALL questions

Questions carry number of marks indicated
Calculators and drawing instruments allowed
Graph paper supplied

1. A 200 kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a vertical wall. A horizontal force P (in the xy plane) perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable.

(15 marks)



18 min.

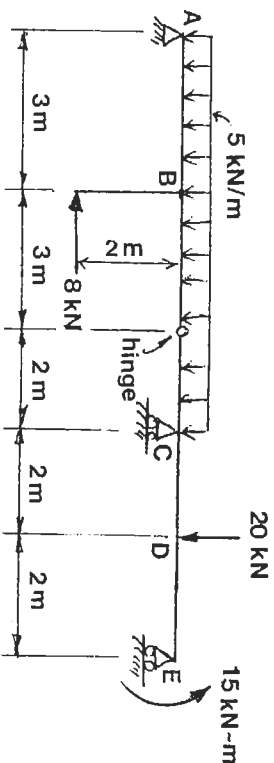
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2. Draw the bending moment and shear force diagrams for the beam ABCDE loaded as shown. Draw the diagrams carefully and mark all the important values.

(25 marks)



30 min

- 3.

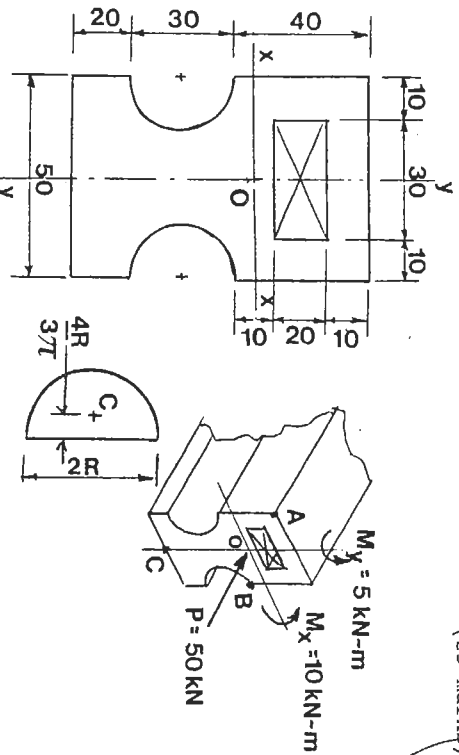
- (a) Locate the centroid of the section shown.

10 min

Calculate the second moment of area, I_{xx} , I_{yy} and the radii of gyration, r_{xx} , r_{yy} about the x- and the y-axes passing through the centroid.

If the section is subjected to both axial force (compressive, through the centroid) and bending moments (about the x- and the y-axes) as shown, determine the direct stresses at Points A, B and C. State whether the stresses are tensile or compressive.

(25 marks)



30 min
Total

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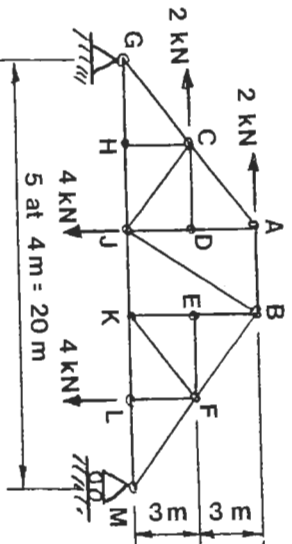
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15/0
15/0
18/015 + 25 + 25 + 15 + 20
100

4. For the pin-jointed truss shown, determine forces in members AB, AC and CJ. State whether the forces in these members are in tension or compression.

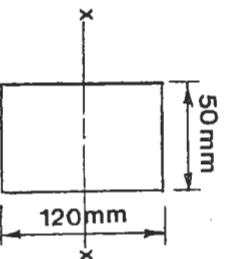
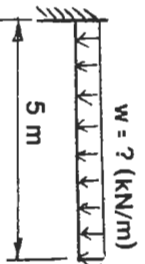
(15 marks)



10. m/m

5. What is the maximum allowable distributed load, w (kN/m) that can be carried by the cantilever beam of rectangular section shown, if the maximum allowable stress in the section (bending about the x-axis) is not to exceed 200 MPa?

(10 marks)



12. m/m

- A hollow steel shaft 4.5 metres long is to transmit a torque of 50 kN-m. The total angle of twist in this length must not exceed 5 degrees, and the allowable shear stress in the section must not exceed 150 MPa. Determine the inside and outside diameters of the shaft, if $G = 85,000$ MPa.

(10 marks)

12. m/m