MAY 1987 STRUCTURES.

1. (8 marks)

For the structure shown and loaded as in Fig. 1, determine and draw the axial force, shear force and bending moment diagrams for the horizontal member ABCD. The structure is encastered at A, pinned at B, has a horizontal roller support at C and a rigid, right-angled joint at D. It has a uniformly distributed loading of intensity 4 kN/m acting on ABCD, and has concentrated loads of 5 kN and 10 kN acting at D and E respectively.

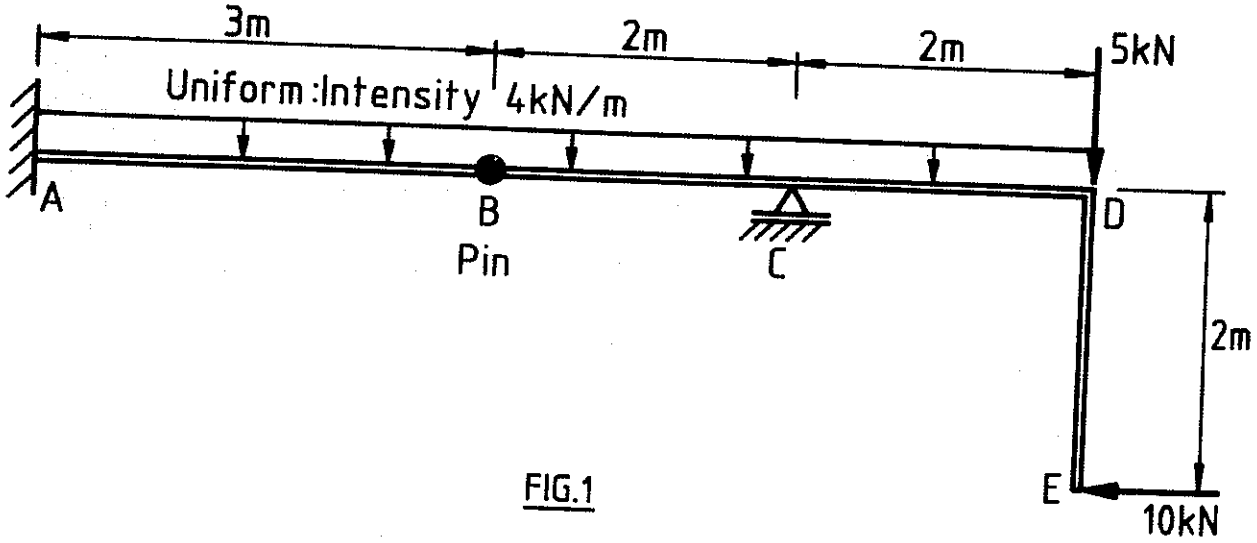

FIG.1

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2. (5 marks)

The extruded beam shown in cross-section in Fig. 2 is square, with dimension 60 mm. A rectangular cut-out of dimensions 15 mm x 10 mm is centred 20 mm above the horizontal diagonal.

(a) Locate the centroid ($\bar{y}$) of the cross-section.

(b) Calculate the second moment of area of the section about a <u>horizontal</u> axis through this centroid.

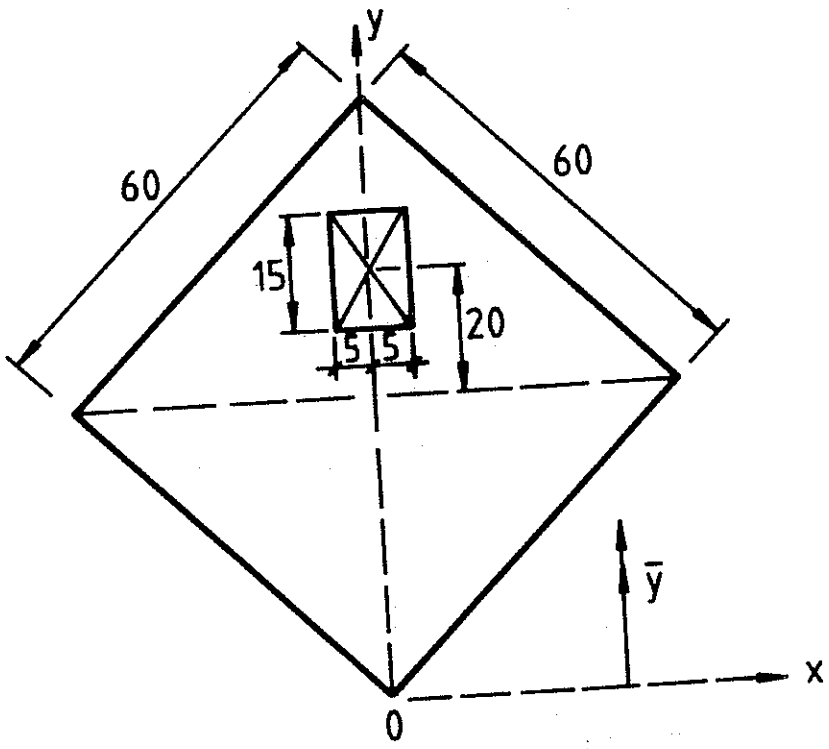

FIG.2

3. (7 marks)

The rigid member ABC rests on a 50 mm diameter brass cylinder BE as shown in Fig. 3. Steel rods AD and CF, each of 20 mm diameter, pass through clearance holes in the member and are secured by nuts. A force of 200 kN is applied at B and the nuts are snugly tightened; the force is then removed.

Find (a) the force in rod AD, (b) the elongation of rod AD.

Given E (steel) = 210,000 MPa, E (brass) = 105,000 MPa.

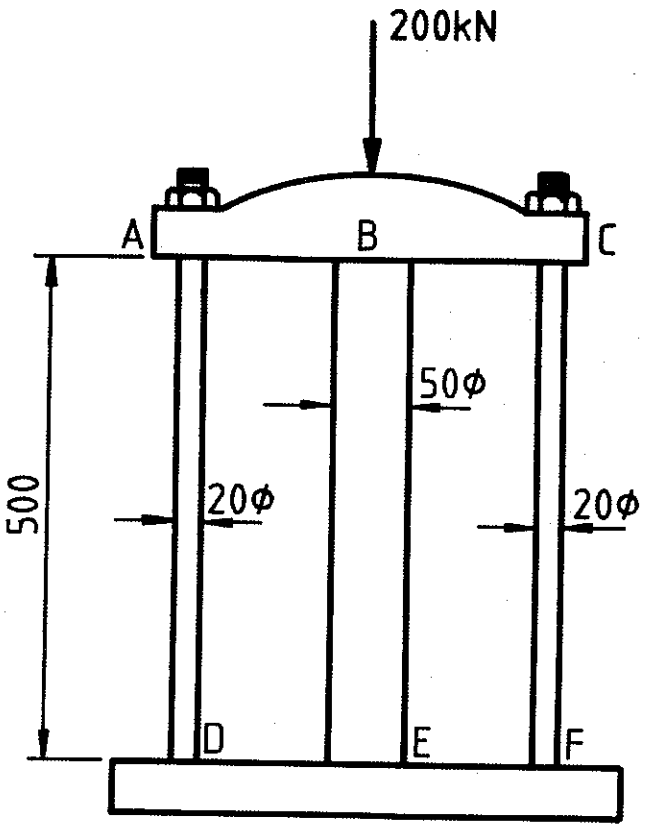

FIG.3