Question Paper

Exam Date & Time: 19-Nov-2019 (08:30 AM - 11:30 AM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

THIRD SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2019

AIRCRAFT STRUCTURES [AAE 2155]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A steel bar 35 mm x 35 mm in section and 100 mm in length, as shown in **Fig.1** is acted upon by a tensile load of 180 kN along its longitudinal axis and 400 kN and 300 kN along the axes of lateral surfaces. Determine: Change in bar dimension, change in volume and longitudinal axial load required to produce same strain as change in bar dimension. (E=205 GPa, μ=0.3) (5)

A)

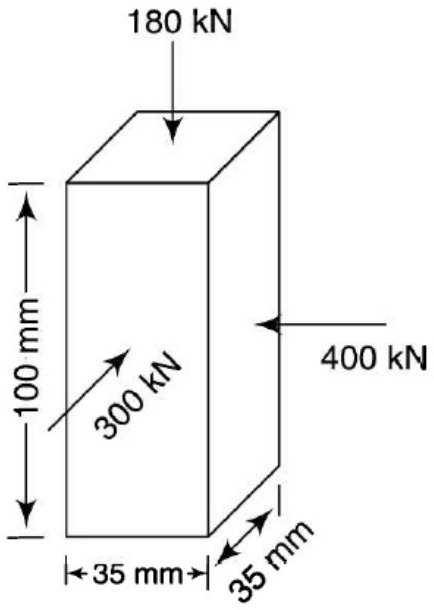

Fig.1

B) A 10 m long simply supported beam, as shown in **Fig.2** carries 2 point loads of 10 kN and 6 kN at 2 m and 9 m respectively from the left end. It also has a UDL of 4 kN/m run for the length between 4 m and 7 m from the left end. Calculate and draw the shear force and bending moment diagram at each point. (5)

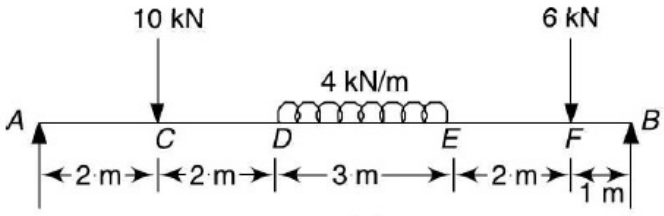

Fig.2

2) Derive a relation to calculate slope and deflection of a simply supported beam with eccentric point load at a distance of 'a' from left end and 'b' from right end, using Macaulay's method. Assume a>b. (5)

A)

B) A simply supported beam of 8 m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left-hand end. Find the deflection under each load and maximum deflection. E = 210 GPa, I= $180*10^6$ mm^4 . (5)

3) Calculate the shear flows in the web panels and the axial loads in the flanges of the wing rib shown in **Fig. 5**. Assume that the web of the rib is effective only in shear while the resistance of the wing to bending moments is provided entirely by the three flanges 1, 2, and 3. (7)

A)

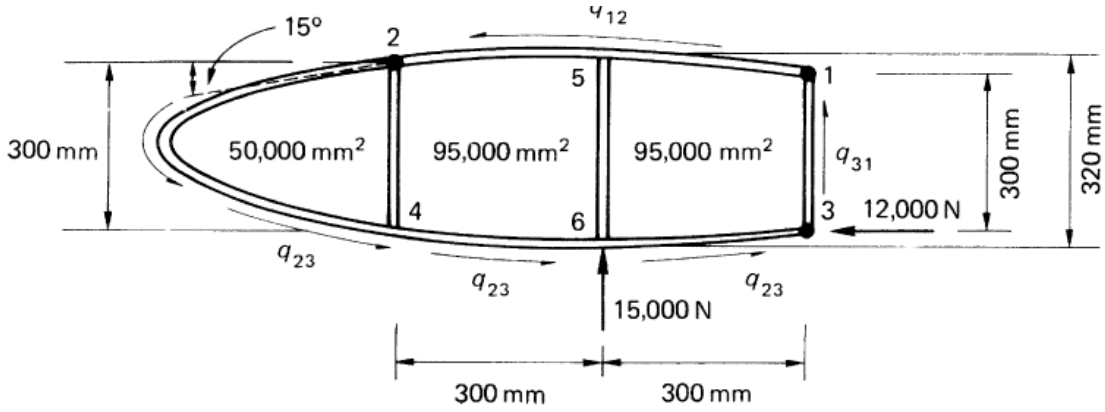

Fig. 5

B) A 4 m long circular bar deflects 20 mm at the centre when used as a simply supported beam under a 200 N load at the centre. Determine the critical load for the same bar when used as a strut which is firmly fixed at one end and pin-jointed at the other. (3)

4) Define equivalent length of a column. Mention the relationship for crippling load in terms of actual length and effective length for the following conditions: Both ends hinged, both ends fixed and one end fixed and other end hinged. (4)

A)

B) With a neat sketch of a section of a beam of length 'dx' derive the relation for shear formula. (4)

C) A wooden box beam consists of 2 boards as flanges and 2 webs of plywood, as shown in **Fig.3**. If shear force acting in the cross section is 10.5 kN, determine the maximum permissible longitudinal spacing 's' of the screws. (4)

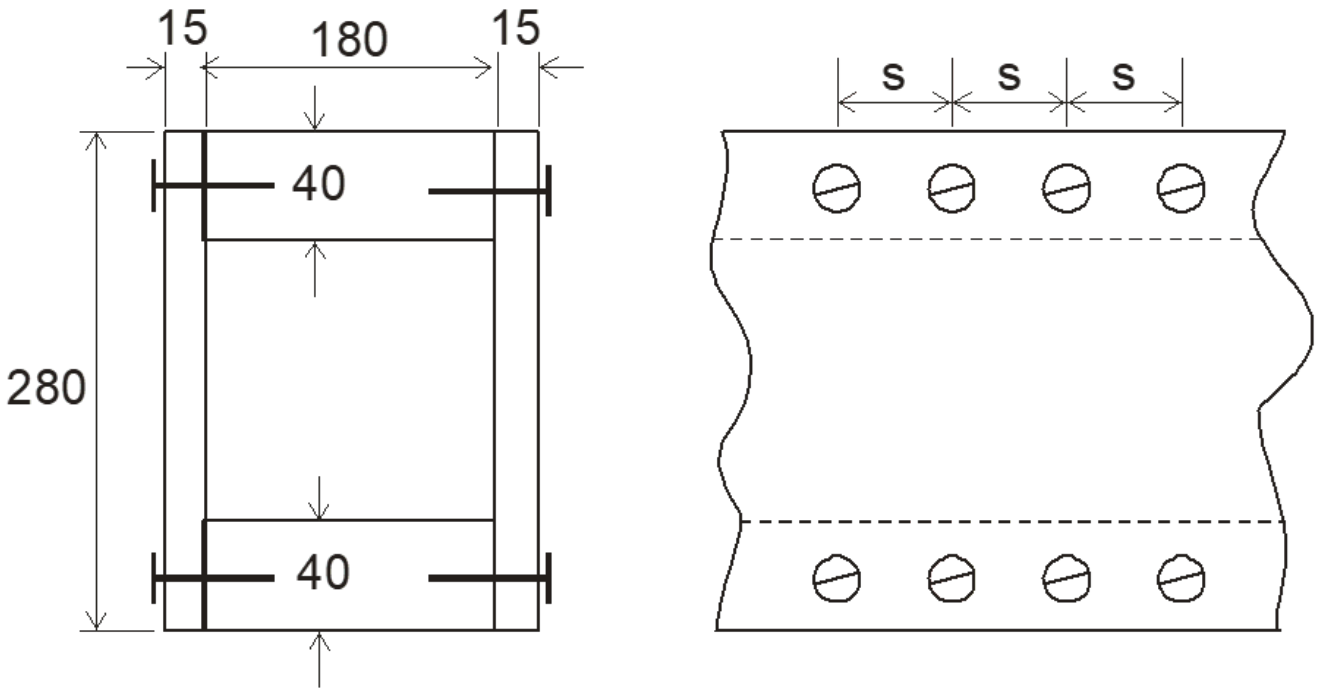

Fig.3

5) A beam having a cross section as shown in **Fig. 4** is subjected to a bending moment of 1500 N-m in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts. (4)

A)

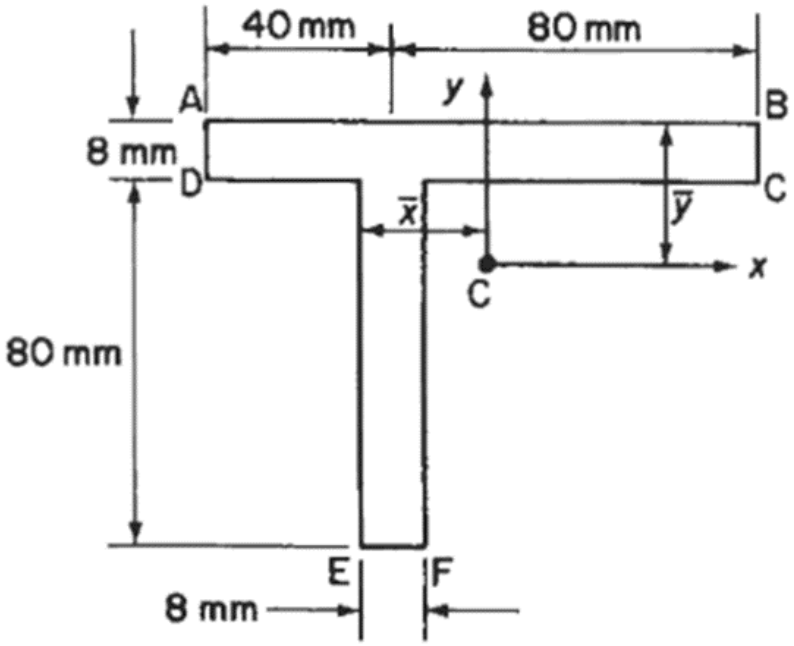

Fig. 4

B) Define: Shear modulus, slenderness ratio, longitudinal strain and indeterminate loads. (4)

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