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D 4007

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

Aeronautical Engineering

AE 1254 — AIRCRAFT STRUCTURES — I

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give a relation between the number of members and the number of joints in a truss and explain its significance.

2. A solid cylinder 100 cm long and 5 cm in diameter is subjected to a tensile force of 80 kN. One part of this cylinder of length L_1 is made of steel (E = 210 GPa) and the other part of length L_2 is made of aluminium (E = 70 GPa). Determine the length L_1 and L_2 so that the two parts elongate to an equal amount.

3. Write down three moment equation in the general form.

4. Define and give the S.I. units for (a) Stiffness (b) Flexural rigidity.

5. A cantilever beam of length L is subjected to a tip load P, find the deflection at the tip using Castigliano's theorem.

6. State Reciprocal theorem. Give an example.

7. Find the slope at the support of a simply supported beam of length L and subjected to a uniformly distributed load by unit load method.

8. Draw Euler's curve for a column and explain critical slenderness ratio.

9. Give the Rankine's formula and its significance.

10. A solid cube of steel (G = 80 GPa) is subjected to a shear of 56 MPa. Find the strain energy per unit volume.

PART B — (5 × 16 = 80 marks)

11. (a) Find the forces in the members of the truss shown in the Fig. 1 by any one method.

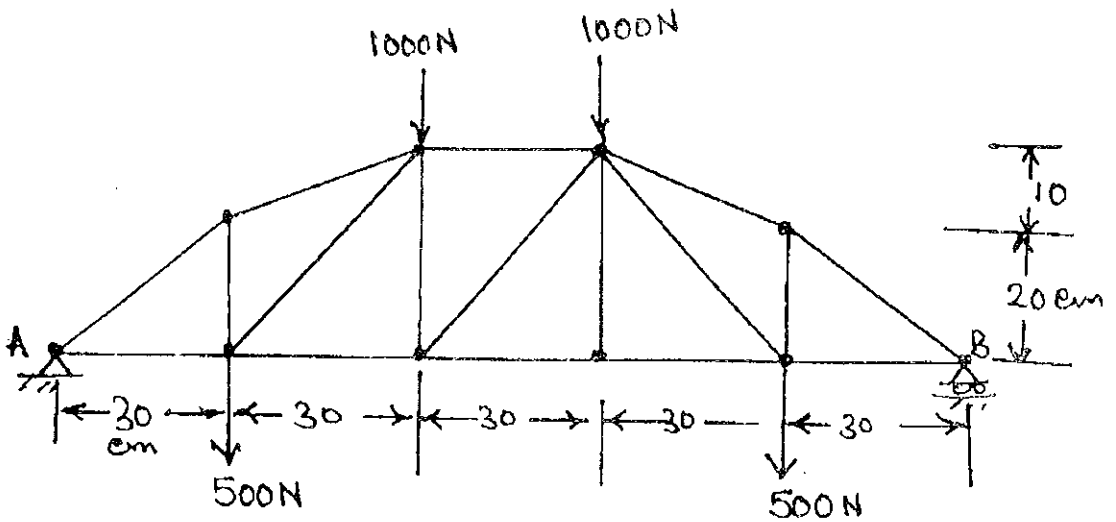

Fig. 1

Or

(b) Find the forces in the members of the landing gear tripod shown in the Fig. 2.

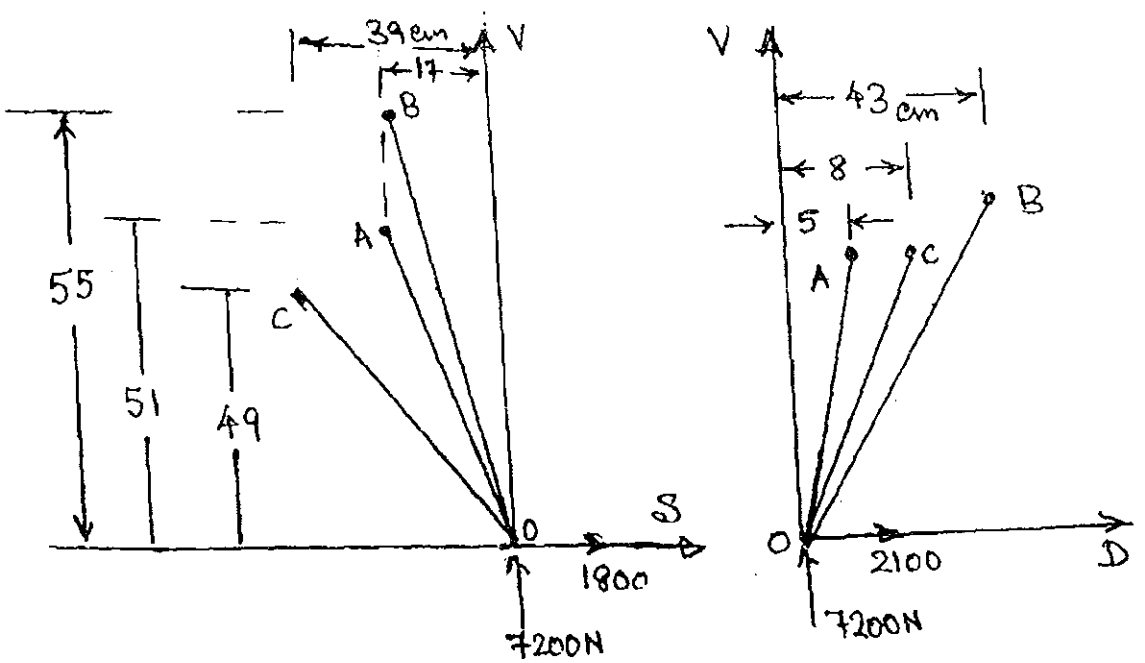

Fig. 2

12. (a) Find the support moments and draw bending moment diagram of the continuous beam shown in the Fig. 3 using three moment equation.

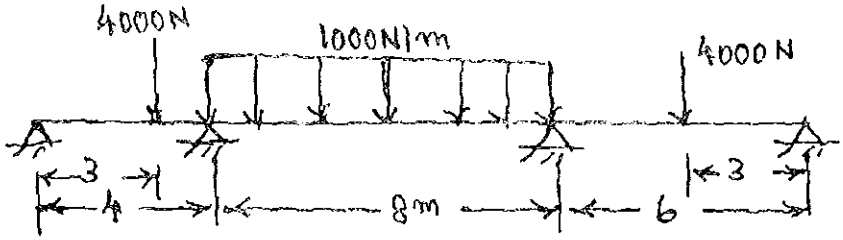

Fig. 3

Or

(b) Find the support moments and draw bending moment diagram of the continuous beam shown in the Fig. 3 using moment distribution method.

13. (a) Find the horizontal reaction of the frame shown in the Fig. 4, using strain energy method.

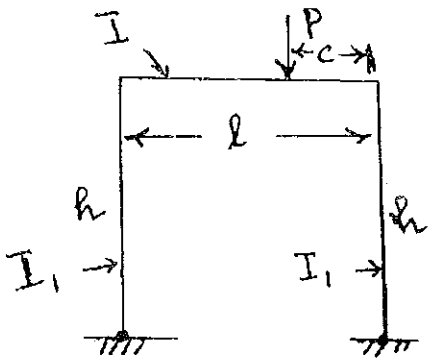

Fig. 4

Or

(b) Determine the forces in the system shown in the Fig. 5, assuming the cross section area of all bars equal and taking the force X in the diagonal AD as the statically indeterminate quantity.

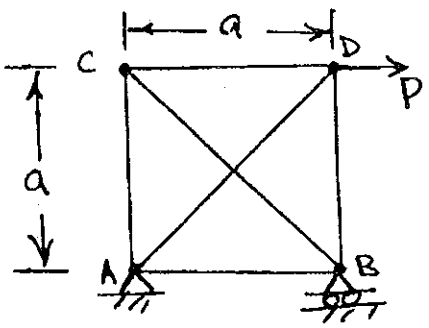

Fig. 5

14. (a) The cross section of a hinged-hinged column 1 m long is Z with 3 cm × 2 mm top and bottom flange and 5 cm × 2 mm middle web. Derive the formula used. E = 70 GPa.

Or

(b) A beam-column made of steel simply supported at both ends is subjected to a concentrated load of 1000 N at a distance 1 m from the right support and an axial load of 1000 N. Find the deflection at mid-point and the maximum deflection. Given : L = 4 m, b = 20 mm, d = 40 mm, E = 210 GPa, calculate the load the column can carry. Derive the formula used.

15. (a) A simply supported beam column of length L is subjected to a axial load P and a moment at M at one of the support. Find the slope at the supports.

Or

(b) A circular shaft of tensile yield strength 300 MPa is subjected to a combined state of loading defined by a bending moment M = 15 kN-m and torque T = 20 kN-m. Calculate the diameter d which the bar must have in order to achieve a factor of safety N = 3. Apply the following theories.

(i) Maximum shear stress theory

(ii) Maximum distortion energy theory

(iii) Octahedral shear stress theory.
