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Question Paper Code : 52527

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Aeronautical Engineering

AE 6403 — AIRCRAFT STRUCTURES - I

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the criterion to define whether the structure is statically determinate or not?

2. Define stiffness factor in moment distribution method.

3. What is meant by strain energy? Give an expression for strain energy due to shear.

4. What is the difference between dummy load method and unit load method?

5. What is meant by equivalent length of the column? Give the same for the various types of column.

6. An allowable axial load for a 3 m long column with hinged ends is 30 kN. Another column of the same material, same cross-section and same length but with one end fixed and the other end hinged suffers buckling. What is buckling load for the column?

7. What is meant by Southwell plot? State it significance.

8. Give the advantages of octahedral shear stress theory over distortion theory.

9. What is meant by thermal stress?

10. Define stress relaxation.

PART B — (5 × 13 = 65 marks)

11. (a) Determine the force in the members of the truss shown in the figure.11 (a). Also state the nature of forces in the member of the given truss.

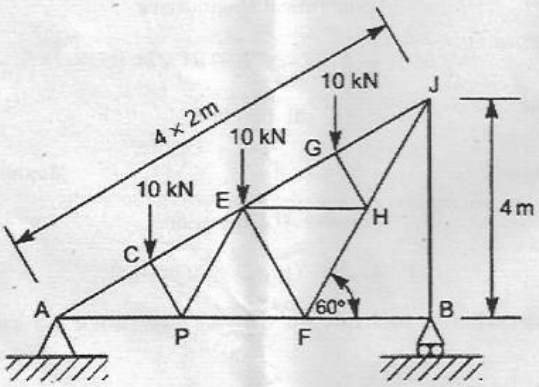

Fig. 11(a)

Or

(b) A continuous beam ABC is carrying uniformly distributed load of 2 kN/m as shown 10 in figure 11(b). The moment of inertia of span AB is twice that of span BC. Evaluate the reactions using 3 moment equation.

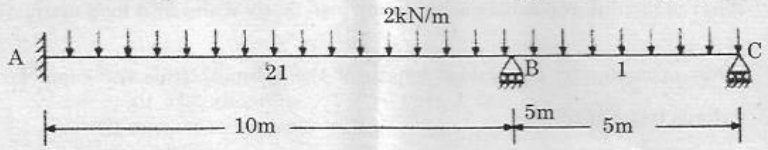

Fig. 11(b)

12. (a) (i) State and Prove Castigliano's theorems. (8)

(ii) State and Verify Maxwell-Betti law of reciprocal displacement. (5)

Or

(b) (i) Find the horizontal deflection at joint C of the pin-jointed frame as shown in Figure 12(b) (i). AE is constant for all members. (7)

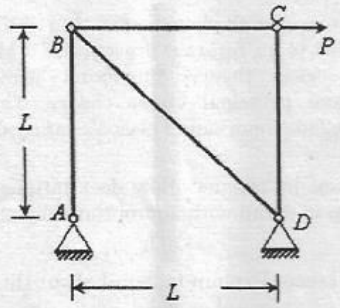

Fig. 12(b) (i)

(ii) Verify Maxwell-Betti law of reciprocal displacement for the cantilever beam shown in Fig. 12(b) (ii). (6)

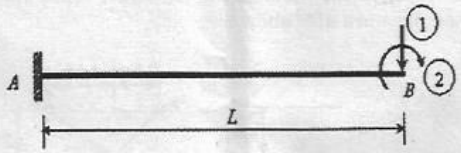

Fig. 12(b) (ii)

13. (a) A steel tube of 80 mm outer diameter, 50 mm inner diameter, and 3 m long is used as a column with both ends hinged. The load is parallel to the axis of the column but is eccentric. Find the maximum value of eccentricity so that the crippling load on the column is equal to 50 % of the Euler's crippling load.

Or

(b) A column of length 'L' and flexural rigidity 'EI' is hinged at both the ends subjected to a uniformly distributed lateral load over its entire length in addition to its axial compressive load. Derive the expression for maximum deflection.

14. (a) Determine the thickness of a thin cylinder of 600 mm diameter subjected to an internal pressure of 3 MPa according to Tresca theory, Rankine's theory St, Venant's theory and Von Mises theory. Take FOS as 2, yield stress as 280 N/mm^2 and poisson's ratio as 0.28.

Or

(b) (i) With neat sketches, explain all the salient points on the stress-strain curve of ductile materials. Also explain how failure occurs in brittle and ductile materials with suitable sketches. (7)

(ii) Determine the thickness of a thin cylinder of 600 mm diameter subjected to an internal pressure of 3 MPa according to maximum shear stress theory, maximum principal strain theory and maximum principal stress theory. Take FOS =2, yield stress (σ_{yp}) = 280 N/mm² and Poisson's ratio (v)=0.28. (6)

15. (a) What is meant by fatigue? How does fatigue load leads to the failure? Explain them in detail with appropriate sketches.

Or

(b) (i) Define creep. Explain in detail about the various stages involved in it with necessary sketches. (8)

(ii) Explain briefly on the types of impact testing methods? (5)

PART C — (1 × 15 = 15 marks)

16. (a) Find the forces in the members of the space truss shown in Figure 16 (a). Suggested axes are also shown.

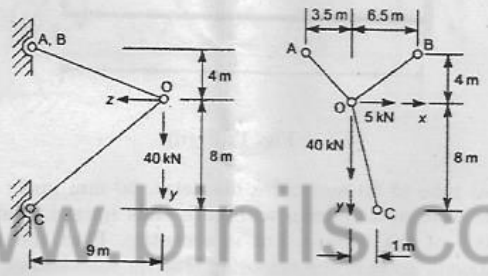

Fig. 16(a)

Or

(b) A long strut AB of length L is of uniform section throughout. A thrust P is applied at the ends eccentrically on the same side of the centre line with eccentricity at the end B twice than that at end A. Show that the maximum bending moment occurs at a distance x from end A, where

$$\tan kx = \left(\frac{2 - \cos kL}{\sin kL}\right) \text{ where } k = \sqrt{\frac{P}{EI}}.$$