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Question Paper Code : 71325

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth Semester

Aeronautical Engineering

AE 6403 — AIRCRAFT STRUCTURES – I

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Perfect and imperfect truss.

2. Define carry-over factor in moment distribution method.

3. Give the expressions for strain energy due to shear and torsion.

4. State Maxwell-Betti law of reciprocal displacement.

5. Differentiate long and short column.

6. What is meant by Southwell plot?

7. Give the differences between brittle and ductile materials.

8. A shaft is subjected to a torque and an axial compressive force. Shear stress due to torque is 30 MPa and axial compressive stress due to force is 80 MPa. If yield stress is 270 MPa, what is the factor of safety based on maximum principal stress theory? Take Poisson's ratio as 0.3.

9. Write a note on thermal stresses.

10. What is meant by impact loading?

PART B — (5 × 13 = 65 marks)

11. (a) Determine the internal force in the members of the truss subjected to loads as shown in the figure. 11 (a)

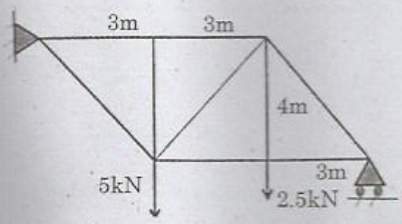

Figure. 11 (a)

Or

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

Figure. 11 (b)

12. (a) A beam of rectangular cross-section of breadth b, depth d and length is simply supported at its ends. It carries a concentrated load W at its centre. Determine the shear strain energy in the beam

Or

(b) A frame as shown in figure 12 (b) is supported by a fixed end at E and is free at end A. A vertical load 12 kN acts at point C. Determine the horizontal deflection at A using Castigliano's theorem, E = 200 kN/mm² and I = 2000 cm⁴. Consider the energy due to bending alone.

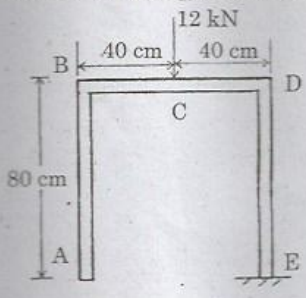

Figure 12 (b)

13. (a) Determine the Euler's buckling load for column fixed at one end and hinged at the other end. Also write the assumptions made for deriving the buckling load.

Or

(b) A steel tube of 80 mm outer diameter, 50 mm inner diameter and 3 m long is used as a strut with both ends hinged. The load is parallel to the axis of the strut but is eccentric. Find the maximum value of eccentricity so that the crippling load on strut is equal to 50% of the Euler's crippling load. Take yield strength = 320 N/mm' and Young's modulus 240 N/mm².

14. (a) A thin aluminium alloy tube bar has a mean diameter of 200 mm and a wall thickness of 2 mm. The tube is subjected to an internal pressure of 2 N/mm² and a torque of 5 kN-m. If the yield strength of the material is 240 N/mm² and the Poisson's ratio is 0.33, determine the factor of safety according to

(i) Rankine's theory (5)

(ii) Tresca theory (4)

(iii) St.Venant's theory. (4)

Or

(b) A mild steel shaft of 40 mm diameter when subjected to a pure torsion ceases to be elastic when torque reaches 2 kN-m. A similar shaft is subjected to a torque of 1.2 kN-m and a bending moment M kN-m. If the maximum strain energy is the criterion for the elastic failure, find the value of M, Poisson's ratio as 0.28.

15. (a) Indicate all the salient points on stress-strain diagram for brittle and ductile materials, and explain it in detail.

Or

(b) Explain in detail about the following

(i) Various stages involved in creep mechanism. (6)

(ii) Various process involved in fatigue. (7)

PART C — (1 × 15 = 15 marks)

16. (a) A Beam ABCD, 6m long is supported on roller at point B and hinged at end D as shown in Figure 16(a). It carries a UDL of 2 kN/m over ABC which is of 4 m from A, a point load of 8 kN at C. Determine the slope and deflection at A if EI = 3200 k-Nm². Also find the deflection at point C under the load 8 kN.

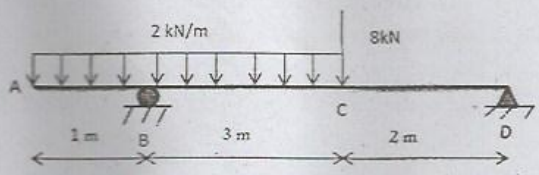

Figure 16(a).

Or

(b) Determine the support reactions of the beam sources in figure 11 (b) of Q.No. 11 (b) using moment distribution method.