Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50079

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Aeronautical Engineering

AE 8403 – AIRCRAFT STRUCTURES – I

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between the truss and frame.
2. What are the methods available to solve statically determinate structures.
3. What do you understand by section modulus of a beam?
4. How do you define complementary shear stresses?
5. What is beam column?
6. Explain the concept of equivalent length of a column.
7. Name some examples for ductile materials.
8. Draw stress-strain curve for brittle materials.
9. How do you define creep?
10. Define impact load.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Differentiate between statically determinate and indeterminate structures. (5)

(ii) Explain Clapeyron's three moment equation. (8)

Or

(b) (i) What are the assumptions made in solving the truss by the method of joints? (5)

(ii) Evaluate the forces in the members AB, AC, BC, BD and CD of the truss structure shown in figure 1.0 (8)

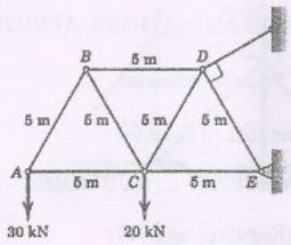

Figure 1.0

12. (a) (i) Explain the Castigliono's theorem. (5)

(ii) Use unit load method to find the deflection at the center of the beam shown in figure. Take E=200 GPa and I = 400 × 10^6 mm^4. (8)

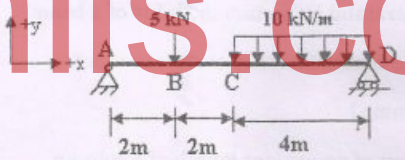

Figure 2.0

Or

(b) (i) Explain the principle of superposition with an example. (7)

(ii) What are the non-metallic materials used in aircraft construction? Explain briefly. (6)

13. (a) (i) What are the limitations of Euler's theory of column? (5)

(ii) Derive an expression for the buckling/crippling load of a column with one end fixed and other end free. (8)

Or

(b) (i) Define slenderness ratio of a column. Write a short note on short and long columns. (4)

(ii) Determine the minimum value of slenderness ratio for a mild steel column with both ends hinged for which Euler's formula is applicable. Take E=2. 1×10^6 N/mm². (9)

14. (a) (i) What are the various theories of failure? (5)

(ii) A machine element is subjected to following stresses

$\sigma_x = 60\ MPa, \sigma_y = 45\ MPa, \tau_{xy} = 30\ MPa.$

Find the factor of safety, if it is made of C45 steel having yield stress as 353 MPa using maximum principal stress theory and maximum shear stress theory. (8)

Or

(b) (i) Explain the maximum shear stress theory. (5)

(ii) A machine member is subjected to the following stresses

$\sigma_x = 150\ MPa, \tau_{xy} = 24\ MPa.$

Find out the equivalent stress as per the shear stress, normal stress and Von-mises failure theories. (8)

15. (a) (i) What do you understand by thermal stresses in materials? (5)

(ii) Explain the concept of creep and its importance in aircraft structures. (8)

Or

(b) (i) Explain the concept of fatigue load in materials. (6)

(ii) Explain the concept of stress relaxation in materials. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Evaluate the forces in the members AB, AC, BC, BD and CD of the truss structure shown in figure 3.

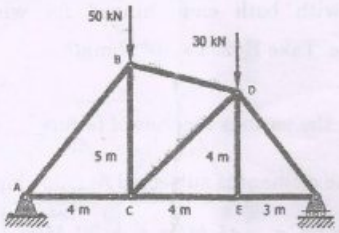

Figure 3

Or

(b) A solid round bar 60 mm in diameter and 2.5 m long is used as a strut, one end of the strut is fixed while its other end is hinged. Find the safe compressive load for this strut using Euler's formula. Assume E= 200 GPa.