



CBCS SCHEME

21AE53

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026 Aero Structures

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Discuss maximum normal stress theory and maximum strain theory. (10 Marks)
- b. Determine the diameter of bolt which is subjected to an axial pull of 10 kN together with a transverse shear force of 5 kN using maximum permissible stress of 100 MPa.
- i) Maximum Principal Stress Theory
- ii) Maximum Shear stress Theory (10 Marks)

OR

- 2 a. Discuss the methods of reducing stress concentration? (10 Marks)
- b. A plane element in a boiler is subjected to tensile stress of 401 MPa on one plane and 151 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa such that when associates with the minor tensile stress tends to rotate the element in anticlockwise direction. Find principal stresses and their direction. Also find τ_{Max} . (10 Marks)

Module-2

- 3 a. Define impact stress and derive an instantaneous stress due to axial impact. (10 Marks)
- b. A cantilever beam of span 800 mm has a rectangular cross section of depth 200 mm. The free end of the beam is subjected to a transverse load of 1 kN that drops to it from a height of 40 mm, where $\sigma_y = 328.6$ MPa, FoS is 3. Determine the width of rectangular cross section. (10 Marks)

OR

- 4 a. Derive Soderberg relationship for fatigue loading. (10 Marks)
- b. Determine the maximum load for the simply supported beam cyclically loaded as shown in Fig Q4(b). The ultimate strength is 700 MPa, the yield point in tension is 520 MPa and the endurance limit is reserved bending is 320 MPa. Use factor of safety of 1.25. The load, size and surface correction factors are 1, 0.75 and 0.9 respectively.

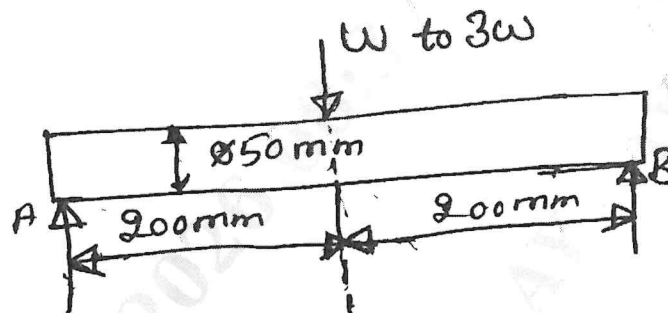


Fig Q4(b)

(10 Marks)

Module-3

- 5 a. Construct V-N diagram and explain the salient features of flight envelope. (10 Marks)
- b. Discuss structural nomenclature and function of aircraft structural components. (10 Marks)

OR

- 6 a. Summarize the use of aluminum alloy titanium, stainless steel and composite materials merits and demerit in aircraft. (10 Marks)
- b. Define Load Factor? Explain the brief the parameters affecting load factor. (10 Marks)

Module-4

- 7 a. Derive Equilibrium equations for a body which is under 3D state of stress. (10 Marks)
- b. A point in a body is subjected to tensile stresses 180 MPa and 120 MPa along with two mutually perpendicular directions. The point is also subjected to shear stress of magnitude 80 MPa. Determine :
- The direction of the principal planes
 - The magnitude of principal stresses.

(10 Marks)

OR

- 8 a. Determine the forces in all the members of the truss shown in Fig Q8(a) and indicate magnitude and nature of forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2m.

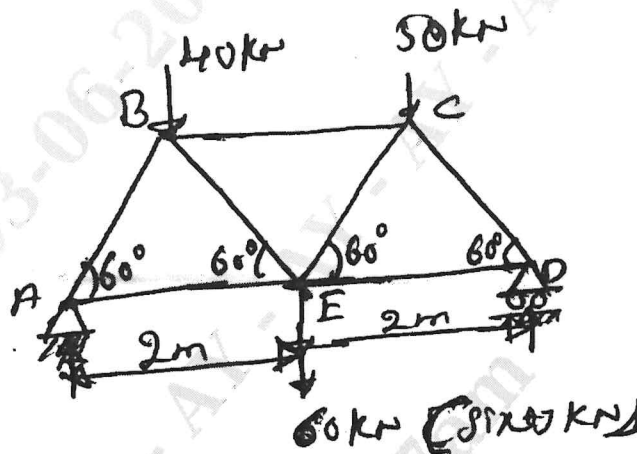


Fig Q8(a)

(10 Marks)

- b. Derive the Clapeyron's equation or moment distribution equation.

(10 Marks)

Module-5

- 9 a. Derive an expression for south well plot for a column with usual notations. (10 Marks)
- b. Explain brief Maxwell reciprocal theorem. (10 Marks)

OR

- 10 a. Obtain an expression for columns with one end pinned other end hinged with relevant sketches. (10 Marks)
- b. A bar of length 4m when used as a simple supported beam and subject to a UDL of 30kN/m, over a whole span deflects 15 mm at the centre. Determine the crippling loads when it is used as a column with the following conditions :
- Both ends pin jointed
 - One end fixed and other end hinged
 - Both ends fixed

(10 Marks)
