

# CBCS SCHEME

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17AE54

Fifth Semester B.E. Degree Examination, June/July 2023

## Aircraft Structures – I

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- Explain the design considerations and codes and standards used in design of structural components. (10 Marks)
  - Determine the maximum stresses on the top element of a solid circular crank arm, as shown in Fig.Q1(b), subjected to a load of 2.25kN.

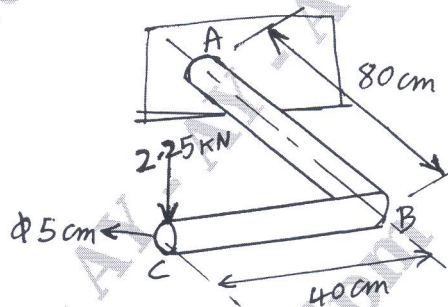


Fig.Q1(b)

(10 Marks)

OR

- Discuss the purpose of theories of failures. Explain any four theories of failures. (10 Marks)
  - The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5kN. Find the diameter of bolt required according to :
    - Maximum principal stress theory
    - Maximum shear stress theory
    - Maximum distortion energy theory. Take permissible tensile stress at elastic limit = 100MPa and Poisson's ratio = 0.3. (10 Marks)

### Module-2

- Define Fatigue, Stress concentration factor, miners rule, Fluctuating stress and repeated stresses. (10 Marks)
  - A steel rod 1.5m long has to resist longitudinally an impact of 2.5kN falling under gravity at a velocity of 0.99m/sec. Maximum computed stress is limited to 150Mpa. Determine :
    - Diameter of rod required
    - Impact factor use  $E = 206.8 \times 10^3 \text{ N/mm}^2$ . (10 Marks)

OR

- Draw an SN diagram, highlight all the salient points and explain also discuss the factors on which endurance strength depends. (10 Marks)
  - Explain the Soderberg's criteria for fatigue. Obtain the expression for the same. (10 Marks)

### Module-3

- Draw a neat sketch of an Vn diagram and explain the basic flight loading conditions. (10 Marks)
  - Derive the equations of motion for an aircraft in level flight and symmetric maneuver considering also the tail load. (10 Marks)

OR

- 6 a. A semi aerobatic aircraft has reached its design diving speed of 185m/s in a dive inclined at  $45^\circ$  to the horizontal ground. If the maximum maneuver load factor for the aircraft is 5.5, determine the height at which the pullout from the dive must begin for straight and level flight to be achieved at a height of 500m. (10 Marks)
- b. Discuss the desirable properties to be considered while selecting the material for aircraft structure. (10 Marks)

Module-4

- 7 a. Define Principal stress, plane stress, plane strain determinate structure and indeterminate structure. (10 Marks)
- b. A point in a strained member is subjected to stresses as shown in Fig.Q7(b). determine :  
 i) Stresses acting on a plane whose normal is at  $40^\circ$   
 ii) Magnitudes of principal stress and maximum and minimum shear stresses  
 iii) Orientations of the stresses.

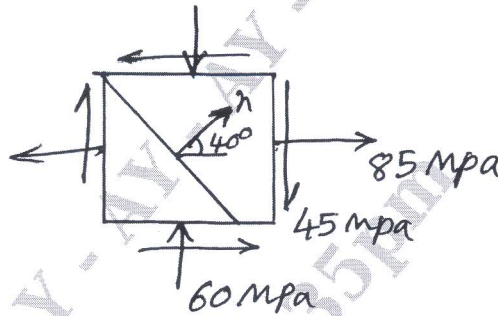


Fig.Q7(b)

(10 Marks)

OR

- 8 a. Explain the difference between the truss and frame with suitable examples. (08 Marks)
- b. Calculate the reactions at the support for the beam shown in Fig.Q8(b) using Clayperon's three moment theorem.

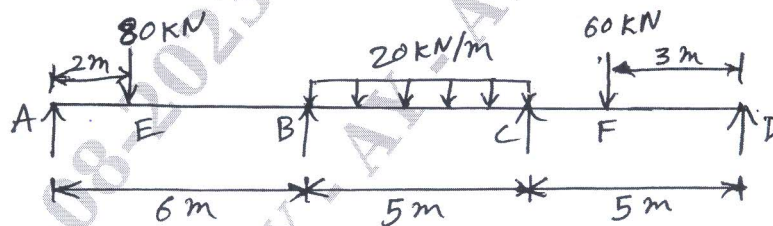


Fig.Q8(b)

(12 Marks)

Module-5

- 9 a. State and prove Castigliano's theorem. (10 Marks)
- b. State and prove Maxwell's reciprocal theorem. (10 Marks)
- OR
- 10 a. Discuss the limitations of Euler's theory and derive the Rankine's formula. (10 Marks)
- b. Arrive at an equation for central deflection for a column with initial curvature. (10 Marks)

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