



# CBCS SCHEME

15AE54

## Fifth Semester B.E. Degree Examination, June/July 2019 Aircraft Structure – I

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. What are codes and standards? Explain. (04 Marks)  
b. A steel saw blade 1mm thick is bent into an arc of a circle of 500mm radius. Determine the flexural stress induced and the bending moment required to bend the blade which is 15mm wide. Take  $E = 210\text{GPa}$ . (12 Marks)

OR

- 2 a. What is factor of safety? Write the formulae for tension stress, pure shear stress. (04 Marks)  
b. A point in a plate is subjected to a horizontal tensile stress of  $100\text{N/mm}^2$ . And a vertical stress of  $60\text{N/mm}^2$ . Find the magnitude of principle stresses. (12 Marks)

### Module-2

- 3 a. What is impact stress? (04 Marks)  
b. A steel rod is 1.5M long. It has to resist longitudinally an impact 2.5kN falling under gravity at a velocity of 0.99M/sec. Maximum computed stress is limited to 150MPa. Determine :  
i) Diameter of the rod  
ii) Impact factor  
Given  $E = 206.8 \times 10^3\text{N/mm}^2$ . (12 Marks)

OR

- 4 a. What is Fatigue strength, and stress cycle? (06 Marks)  
b. A steel rod (SAE 9260 oil quenched with  $\sigma_{ut} = 1089.5\text{MPa}$ ,  $\sigma_{yp_t} = 689.4\text{MPa}$ ,  $\sigma_{en} = 427.6\text{MPa}$ ) is subjected to a tensile load which varies from 120kN to 40kN. design the safe diameter of the rod using Soderberg relationship. Take factor of safety as 2, stress concentration factor as unity and correction factor for load, size and surface as 0.75, 0.85 and 0.91 respectively. (10 Marks)

### Module-3

- 5 a. Draw a velocity diagram and explain. (04 Marks)  
b. An aircraft having weight of 250 kN with tricycle landing gear lands with a sink rate of 3.7M/sec such that the vertical and horizontal reaction on wheels are 1200kN and 400kN respectively. At this instant, the nose wheel is 1m form the ground. If the moment of inertia of the aircraft about its C.G is  $5.65 \times 10^8\text{ N/s}^2\text{mm}$ . Determine the inertia force on the aircraft, the time taken for its vertical velocity to become zero and its angular velocity at this instant. (12 Marks)

OR

- 6 a. What are the types of titanium used in aircraft and give their properties. (06 Marks)  
b. Derive Griffith theory of crack growth on brittle material. (10 Marks)

**Module-4**

- 7 a. Derive the expression for maximum shear stress on a rectangular element acted on by two tensile force perpendicular to each other, of unit depth. (06 Marks)
- b. A rectangular element in a linearly elastic isotropic material is subjected to tensile stress of 83 and 65 N/mm<sup>2</sup> on mutually perpendicular planes. Determine the strain in the direction of each stress and in the direction perpendicular to both stresses. Find also the principal strains, the maximum shear stress, the maximum shear strain and the directions at that point. Take  $E = 2 \times 10^5$  N/mm<sup>2</sup> and  $\gamma = 0.3$ . (10 Marks)

OR

- 8 a. Derive Claperon's 3 moment equation. (08 Marks)
- b. In the truss, determine the force in the member AB. (Ref. Fig.Q8(b)). (08 Marks)

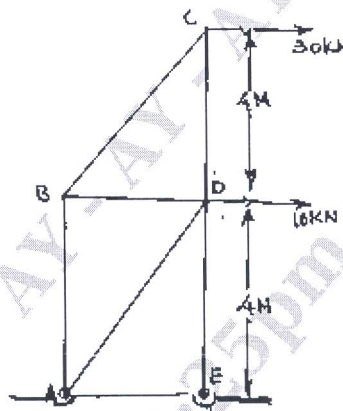


Fig.Q8(b)

**Module-5**

- 9 a. What is Castiglion's first theorem? Write the proof. (10 Marks)
- b. Define Maxwell's reciprocal theorem and give proof. (06 Marks)

OR

- 10 a. Derive the expression for crippling load when one end is fixed and the other end is hinged of a beam. (10 Marks)
- b. A 2 meter long pin ended column of square cross section of wood, having  $E = 12$ GPa and allowable shear stress 12MPa is subjected to a load of 96kN. Determine the size of the column. Use FOS of 3 and use Euler crippling load for buckling. (06 Marks)

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