CBCS SCHEME

USN

18AE53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Aircraft Structures – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the following:
   i) Principal stress
   ii) Plane stress
   iii) Stress Tensor **(06 Marks)**

b. A point in a structural member subjected to a plane stress is shown in Fig.Q.1(b). Determine the following:
   i) Normal and Tangential stress intensities on plane MN inclined at an angle 45°
   ii) Principal stresses and their directions.
   iii) Maximum shear stress and direction of planes on which it occurs.

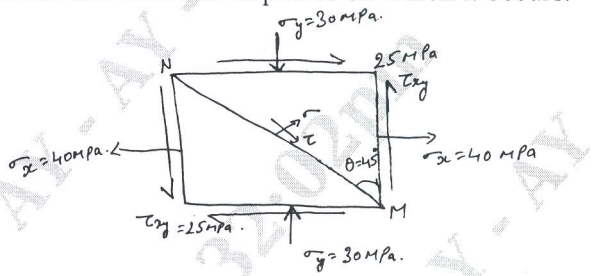

Fig.Q.1(b)

(14 Marks)

OR

2 a. Explain the following failure theories:
   i) Maximum normal stress theory
   ii) Maximum shear stress theory
   iii) Maximum strain theory
   iv) Distortion energy theory. **(16 Marks)**

b. Explain the failure of brittle and ductile material. **(04 Marks)**

Module-2

3 a. Derive the equation for instantaneous stress due to axial impact on bars. **(12 Marks)**

b. A cantilever beam of span 800mm has a rectangular cross section of depth 200mm. The free end of the beam is subjected to a transverse load of 1kN that drops t_o it from a height of 40mm. Where σ_y = 328.6MPa. Factor of safety is 3, determine the width of rectangular cross section. **(08 Marks)**

OR

4 a. Explain with a neat sketch SN diagram and endurance limit. **(10 Marks)**

b. Derive the equation for Soderberg relationship. **(10 Marks)**

Module-3

5 a. Explain the types of loads acting on aircraft and v-n diagram. **(10 Marks)**

b. An aircraft having a total weight of 45kN lands on the deck of an aircraft carrier and is bought to rest by means of a cable engaged by an arrestor hook, as shown in Fig.Q.5(b), if the deceleration induced by the cable is 3g determine the tension T in the cable, the load on an undercarriage struct and the shear and axial loads in the fuselage at the section AA; The weight of the aircraft aft of AA is 4.5kN. Calculate also the length of deck covered by the aircraft before it is bought to rest if the touch down speed is 25m/s. **(10 Marks)**

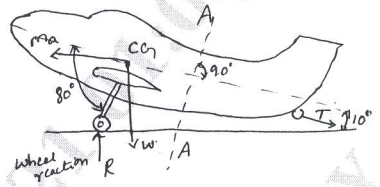

Fig.Q.5(b)

OR

6 a. Explain about metallic and nonmetallic materials used in aerospace. **(10 Marks)**

b. Discuss the importance of composite materials in aerospace industry and enumerate advantages and disadvantages of composites. **(10 Marks)**

Module-4

7 a. Derive three dimensional equilibrium equation. **(10 Marks)**

b. Consider the displacement field $u = [y^2i + 3yzj + (4 + 6x^2)K] \times 10^{-2}$. Determine the rectangular strain components at the point P(1, 0, 2). **(10 Marks)**

OR

8 a. Differentiate between determinant and indeterminant structures. **(06 Marks)**

b. Find the forces acting in all members of the truss shown in Fig.Q.8(b). **(14 Marks)**

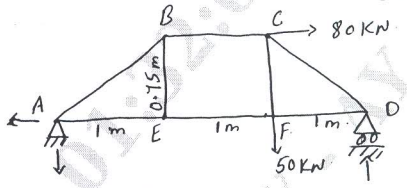

Fig.Q.8(b)

Module-5

9 a. Derive the equation for strain energy due to axial and bending. **(08 Marks)**

b. State and prove Maxwell reciprocal theorem. **(08 Marks)**

c. An axial pull of 50kN is suddenly applied to a steel bar 2m long and $1000mm^2$ in cross section if $E = 200kN/mm^2$ find maximum instantaneous stress and maximum instantaneous extension. **(04 Marks)**

OR

10 a. Derive Rankine formula of a column. **(08 Marks)**

b. Enumerate the Eulers theory assumptions. **(04 Marks)**

c. Find the Euler's crippling load for a hollow cylindrical steel column of 40mm external diameter and 4mm thick. The length of column is 2.5m and is hinged at both ends, also compute the Rankines crippling load using constants 335MPa and 1/7500 take E = 205GPa. **(08 Marks)**

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