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Total No. of Pages : 03

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B.Tech.(ANE) (Sem.-4) AIRCRAFT STRUCTURES – I Subject Code : ANE-206 M.Code : 60514

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES :

- 1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- 2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
- 3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

- a) Derive the relations between stress and strain in a plane stress problem.
- b) State the principle of superposition.
- c) What is Prandtl stress function solution?
- d) Derive an expression for the strain energy of a bar subjected to uniaxial tensile force.
- e) What is Shear lag?
- f) What is meant by a doubly redundant structure?
- g) State the different types of loads acting on aircraft structural components.
- h) Write down an expression for the shear flow in an open section beam subjected to shear forces S_x and S_y .
- i) Explain the term : 'Margin of Safety'
- j) What are principal planes and principal stresses?



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SECTION-B

- 2. A point in a strained material is subjected to a tensile stress of 120 N/mm² and a compressive stress of 80 N/mm² acting at right angles to each other. Find the normal stress, tangential stress and the resultant stress on a plane inclined at an angle of 30° with the compressive stress.
- 3. A circular section bar of radius R is subjected to equal and opposite torque T at each of its free ends. Determine ; (a) rate of twist and (b) stress distribution.
- 4. Calculate the rotation of point 1 of the contilever beam in Fig. 1. Using the principle of complementary virtual work. Neglect shear deflection.



Fig.1

- 5. Sketch a typical V-H diagram and briefly explain (a) stall regions (b) method of plotting various segments of the diagram (c) Red-line speed of the air plane and (d) Significance of maneuver point and corner velocity.
- 6. Describe the different types of fitting failures with the help of suitable sketches.

SECTION-C

7. A cantilever of length L and depth 2h is in a state of plane stress. The cantilever is of unit thickness, is rigidily supported at the end x = L and is loaded as shown in fig. 2.

Show that the stress function :

$$\phi = A x^{3} + B x^{2} y + cy^{3} = D (5x^{2} y^{3} - y^{5})$$

is valid for the beam and evaluate the constants A, B, C and D in terms of q and h.



Fig.2

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- 8. A structure is shown in Fig. 3. Assuming the member to be of uniform cross-section throughout find :
 - a) Strain energy stored by the structure and hence
 - b) Determine the vertical deflection of end A.





- 9 Write notes on :
 - a) Maneuver Loads
 - .g. com b) Direct stress distribution due to bending.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.