Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER MAKE UP EXAMINATIONS, NOV/DEC 2016

SUBJECT: AIRCRAFT STRUCTURES [AAE 2101]

REVISED CREDIT SYSTEM
(28/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. What do you understand by Pure bending and Moment of resistance? **(2)**

1B. A rectangular beam 200mm deep and 300mm wide is simply supported over a span of 8m. What uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2. **(4)**

1C. Prove that the bending stress in any fibre is proportional to the distance of that fibre from neutral layer in a beam. **(4)**

2A. Define the terms: Principal stresses and principal planes. **(2)**

2B. Derive an expression for the major and minor principal stresses on an oblique plane when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress. **(4)**

2C. A rectangular block of material is subjected to a tensile stress of 100N/mm^2 on one plane and a tensile stress of 50N/mm^2 on a plane at right angles, together with a shear stresses of 60N/mm^2 on the faces. Find: **(4)**

(i) The direction of principal planes (ii) Magnitude of principal stresses
(ii) Magnitude of greatest shear stress, using Mohr's circle method.

3A. Define the terms: Column, strut and crippling load. **(2)**

3B. Determine the section of a cast iron hollow cylindrical column 3m long with both ends fixed, if it carries an axial load of 800kN. The ratio of internal to external diameter is 5/8. Use a factor of safety 4. Take σ_c = 550N/mm^2 and Rankine's constant =1/1600. **(4)**

3C. Derive an expression for the slope and deflection of a simply supported beam, carrying a point load at the center. **(4)**

4A. What do you mean by 'strength of a shaft'? **(2)**

4B. Derive the relation for a circular shaft when subjected to torsion as given below **(4)**

$$\frac{T}{J} = \frac{G\theta}{l} = \frac{\tau}{R}$$

4C. A hollow propeller shaft of a steam ship is to transmit 3750 kW at 240 rpm. If the internal diameter is 0.8 times the external diameter and if the maximum shear stress developed is to be limited to 160N/mm^2, determine the size of the shaft. **(4)**

5A. Define the terms: unsymmetrical bending and shear centre. **(2)**

5B. Write a short note on Bredt Batho theory of torsion. **(3)**

5C. Cross section of an airplane elevator as shown in fig.1. is 2m long and is constructed from a material with allowable shear stress of 180 MN//m^2 , G= 80GN/m^2. Calculate the total angle of twist of the section and the magnitude of the shear stress in each part for an applied torque of 100Nm. **(5)**

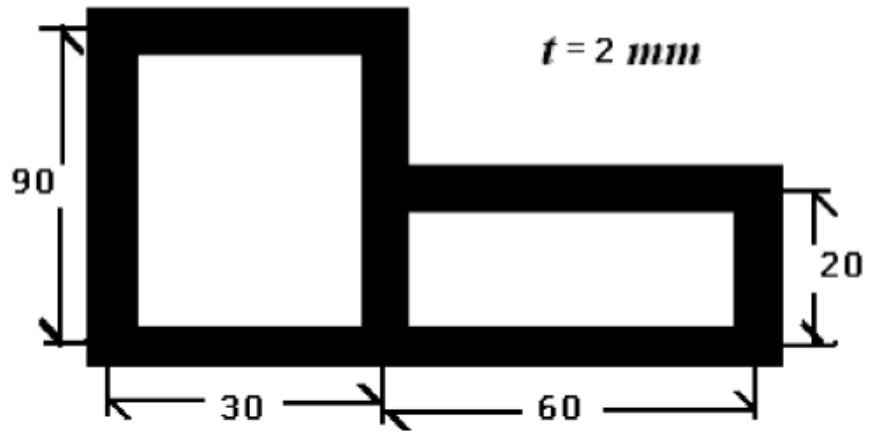

Fig.1.