Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

III SEMESTER B.TECH (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2015 / DEC 2015

SUBJECT: AIRCRAFT STRUCTURES [AAE-2101]

REVISED CREDIT SYSTEM

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 neutral axis and moment of resistance? **(02)**

1B. A water main of 50 mm internal diameter and 20 mm thick is running full. The water main is of cast iron and is supported at two points 10 m apart. Find the maximum stress in the metal. The cast iron and water weigh 72000 N/m^3 and 10000 N/m^3 respectively. **(04)**

1C. Prove that relation, **(04)**

$$\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$$

Where, M= bending Moment, I= M.O.I
σ = Bending stress, y= distance from neutral axis
E= Young's modulus, R= Radius of curvature

2A. What do you mean by strength of a shaft? **(02)**

2B. A solid cylindrical shaft is to transmit 300 kW power at 100 rpm **(04)**
(a) If the shear stress is not to exceed 80 N/mm^2 ,find its diameter.
(b) What percentage of saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

2C. Derive the relation for a circular shaft when subjected to torsion as given below **(04)**

$$\frac{G\theta}{l}=\frac{\tau_s}{R}$$

Where, T=Torque transmitted, J=Polar M.I.
R= Radius of the shaft, G= Modulus of Rigidity
L=Length of the shaft, τ = Max. shear stress

3A. Define the terms: Principal Planes and principal stresses. **(02)**

3B. Derive an expression for the stresses on an inclined plane of a rectangular body when the body is subjected to a direct stress in one plane only. **(04)**

3C. At a certain point in a strained material, the intensities of stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both are tensile. They are accompanied by a shear stress of magnitude 10 N/mm^2. Find Graphically principal stresses and their location, maximum shear stress. Also check the answers analytically. **(04)**

4A. Explain how the failure of a short and of a long column takes place? **(02)**

4B. Derive an expression for the Euler's formula for a column having one end is fixed and other end is free. **(04)**

4C. Derive an expression for the deflection and slope for a cantilever beam with a point load at the free end. **(04)**

5A. Determine the position of shear centre for the section shown in fig.1 **(05)**

5B. Calculate the bending stress at points A,B,C for the section shown in fig.2 (Take M_x = 1kNm) **(05)**

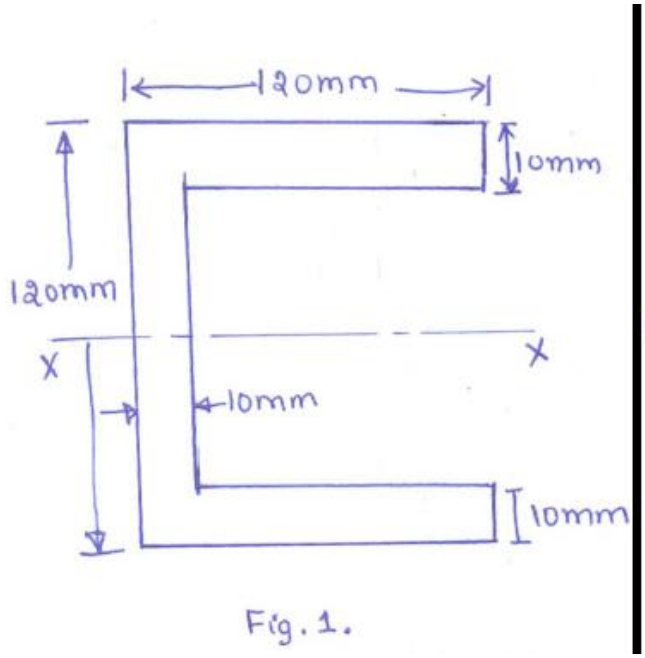

Fig. 1.

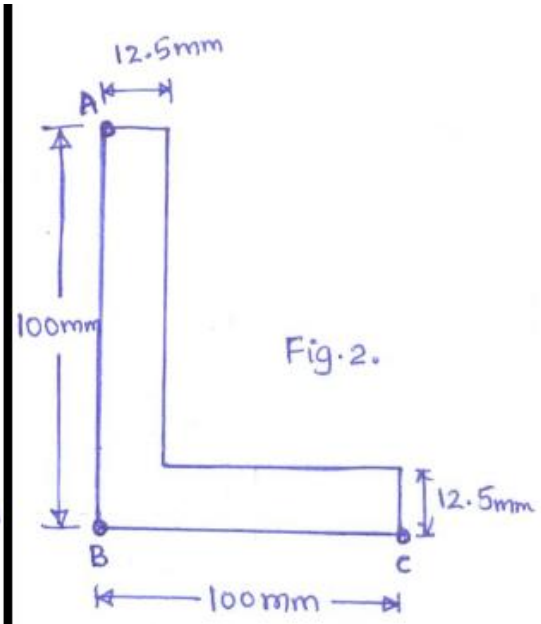

Fig. 2.