No. of Printed Pages : 05

Roll No. ....

## E203

## B. Tech. EXAMINATION, 2020

(Fifth Semester)

(B Scheme) (Re-appear Only)

(AER)

## AER305B

## AIRCRAFT STRUCTURE-I

*Time : 2<sup>1</sup>/<sub>2</sub> Hours*]

[Maximum Marks : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

**Note** : Attempt *Four* questions in all. All questions carry equal marks.

1

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- With the help of a neat diagram, explain V-n diagram, its importance in the design of an aircraft and its salient characteristics.
- 2. (a) Direct stresses and shear stresses are acting along *x*, *y* and *z* axes of an element in an elastic body. Derive the equations of equilibrium by considering the components of body forces per unit volume.
  - (b) A rectangular element in a linearly elastic isotropic material is subjected to tensile stresses of 83 and 65 N/mm<sup>2</sup> on mutually perpendicular planes. Determine strain in the direction of each stress and in the direction perpendicular to both stresses. Find also the principal strains, maximum shear stress, maximum shear strain and their directions at the point. Take  $E = 2 \times 10^5$  N/mm<sup>2</sup> and v = 0.3

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2

**3.** (a) Determine the vertical deflection of free end of the cantilever beam shown below by applying method of virtual work.



(b) Determine the value of deflection of the cantilever beam at free end by method of complementary energy for the beam shown below :



- **4.** (a) Prove that strain energy and complementary energy are interchangeable for a linearly elastic member.
  - (b) Explain the concept of total potential energy and principle of stationary value of total potential energy.

3

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- **5.** Explain the salient characteristics of the following materials used for aircraft construction :
  - (i) Aluminium alloys
  - (ii) Steel
  - (iii) Composite materials.
- 6. Determine the horizontal and vertical components of the tip deflection of the cantilever shown below :



The second moments of area of its unsymmetrical section are  $I_{xx}$ ,  $I_{yy}$  and  $I_{xy}$ . (2)M-E203 4

- 7. Explain the characteristics of aircraft steels, the heat treatment and effect of alloying elements on the properties of the steel.
- 8. Explain the manufacturing process of fibre reinforced and particulate composite materials. Describe the strength to weight comparison of these composites with other metals. Also discuss relative merits and demerits of composites as compared with other metals.

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5

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