Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER • 2014

Subject Code: 150103 Date: 03-12-2014

Subject Name: Aircraft Structure - II

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** State and derive an equation of a Castiglione's displacement theorem $\Delta = \partial U/\partial F$ with usual notation. **07**

(b) State the difference between symmetrical and Unsymmetrical Bending. **04**

(c) State the difference between Neutral axis and Principal Centroidal axis. **03**

Q.2 **(a)** Explain Flight Envelope (V-n diagram) with the help of sketch. **07**

(b) At a point in a body subjected to a three dimensional forces, the state of stress is define as σ_{xx} = 200 N/mm^2, σ_{yy} = -100 N/mm^2 , σ_{zz} = -100 N/mm^2 and the shear stresses T_{xy}= T_{yz}= T_{zx}= 200 N/mm^2. Compute the normal, Shearing and Resultant stresses on a plane that is equally inclined to all the three principal axes. **07**

OR

(b) 1-) Define the terms: Shear Centre **07**

2-) Suggest the different way of making the section free from torsion.

3-) A 125 mm x 75 mm x 10 mm unequal angle bar as shown in fig.-9 is placed with the longer leg vertical and used as beam simply supported at ends. It is subjected to a bending moment of 3 kN-m about x-x axis due to point load acting in a vertically downward direction. The Moment of inertia of a angle section about it's centroidal axis are I_{xx} = 304.66 x 10^4 mm^4, I_{yy} = 84.06 x 10^4 mm^4, I_{xy} = 92.20 x 10^4 mm^4. Locate the Principal Centroidal axis and Neutral axis in a angle section.

Q.3 For a beam as shown in fig.1, the rotation at point 'B' and 'C' are 0.000571 radian (anticlockwise) and 0.00570 radian (anticlockwise) respectively. Find the support reaction using Stiffness Matrix Method. Take E = 200 x 10^6 N/mm^2 and I = 10^5 mm^4. Also plot shear force and bending moment diagram. **14**

OR

Q.3 **(a)** Find the support reaction for a beam as shown in fig.-2, using Flexibility Matrix Method. (EI=constant). **10**

(b) For a beam as shown in fig.2, obtain all possible release beam along with sketch by considering various redundant. **04**

Q.4 **(a)** Find the internal forces in a truss member as shown in fig.3 by Stiffness Matrix Method. Consider cross-section area of all truss member A=10000 mm^2 and E=200kN/mm^2. **10**

(b) Define the terms: Stiffness, Flexibility. **04**

Enlist the properties of Stiffness Matrix.

OR

Q.4 Find the internal forces in a truss member as shown in fig.4 by Flexibility Matrix Method. The diagonals member have an area of 5000 mm^2 and others 3200 mm^2. Take E=2 x 10^5 MPa. **14**

Q.5 **(a)** Determine the reaction at point 'B' for a propped cantilever beam AB as shown in Fig.-7, using Theorem of Least Work. Consider EI as constant. **07**

(b) Find the vertical deflection at point 'C' for a plane frame as shown in fig.-5, using Unit Load Method. Take EI = 3×10^7 kN-m^2. **07**

OR

Q.5 **(a)** Find the internal forces in a truss member as shown in Fig.-8 using Castiglione's theorem. All the members have same cross sectional areas. **07**

(b) Find the rotation at the free end of a cantilever beam as shown in fig.-6, using Castiglianos Theorem. Take EI = 2×10^{13} N-mm^2. **07**

****

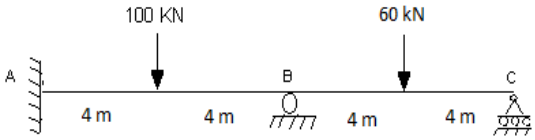

Fig.1

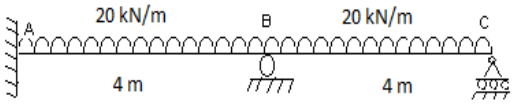

Fig.-2

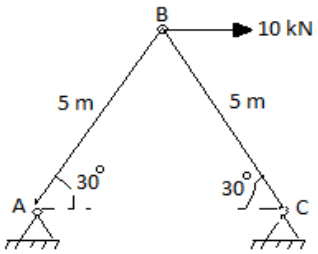

Fig.-3

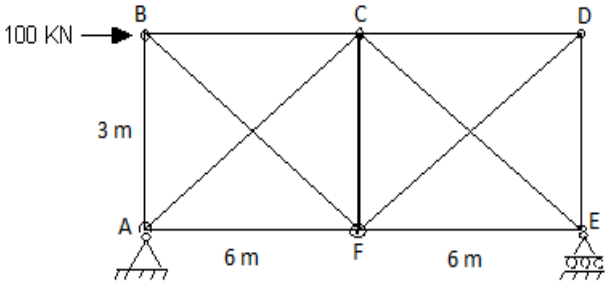

Fig.- 4

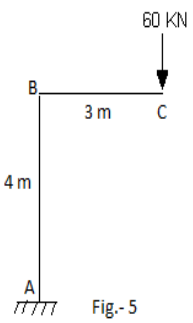

Fig.- 5

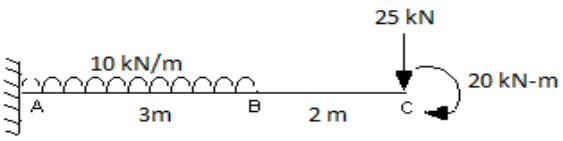

Fig.-6

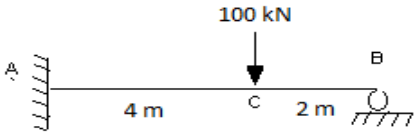

Fig.-7

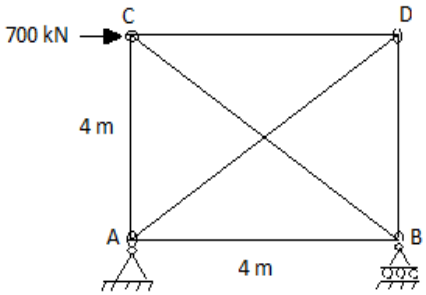

Fig.-8

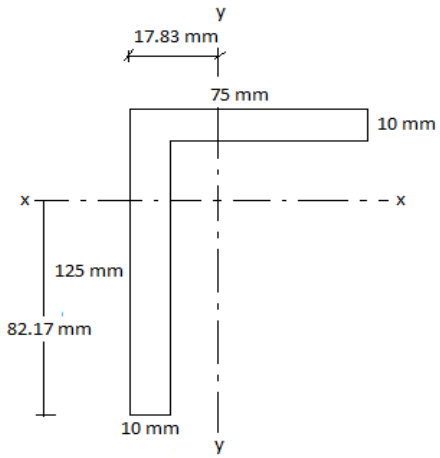

Fig.-9