Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–V EXAMINATION – WINTER 2015**

**Subject Code: 150103** **Date:08/12/2015**

**Subject Name: Aircraft Structure II**

**Time: 10:30am to 1:00pm** **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)** | For a _____ material, the strain energy and complimentary strain energy are same. (linearly elastic, non-linear elastic, plastic) | **02** |
| | **(b)** | Which of the following method is most suitable for computer programming _____? (stiffness matrix method, flexibility matrix method, energy methods) | **02** |
| | **(c)** | Action required to produce unit displacement is referred as _____ . (strain energy, flexibility, stiffness). | **02** |
| | **(d)** | The diagonal terms in a flexibility matrix are always _____. (>0, =0, <0) | **02** |
| | **(e)** | The size of stiffness matrix is _____. (SI x SI, KI x KI, KI x1, SI x1) | **02** |
| | **(f)** | If the external load is passing through _____ , the section is free from torsion. (shear centre, centre of gravity, point of contraflexure) | **02** |
| | **(g)** | The thearom of least work is used for _____ . (Analysis of indeterminate st., Analysis of determinate st., Both) | **02** |
| **Q.2** | **(a)** | Expuilain Flight Envelope (V-n diagram) with the help of sketch. | **07** |
| | **(b)** | State and derive an equation of a Castiglione's displacement theorem $\Delta = \partial U/\partial F$ with usual notation. | **07** |
| | | **OR** | |
| | **(b)** | State the difference between symmetrical and unsymmetrical bending by giving suitable example. | **07** |
| **Q.3** | | For a section as shown in fig.-1, locate the neutral axis, the principal centroidal axis and the shearcentre. | **14** |
| | | **OR** | |
| **Q.3** | **(a)** | At a point in a body subjected to a three dimensional forces, the state of stress is define as $\sigma_{xx}$ = 100 N/mm$^2$, $\sigma_{yy}$ = -50 N/mm$^2$ , $\sigma_{zz}$ = -50 N/mm$^2$ and the shear stresses $T_{xy}$= $T_{yz}$= $T_{zx}$= 75 N/mm$^2$. Compute the normal, Shearing and Resultant stresses on a plane that is equally inclined to all the three principal axes. | **08** |
| | **(b)** | Explain the criteria for obtaining the redundant structure for the analysis of indeterminate structure by giving suitable example. | **06** |
| **Q.4** | **(a)** | Find the internal forces in a truss member as shown in fig.2 by Stiffness Matrix Method. Consider cross-section area of all truss member A=10000 mm$^2$ and E=200kN/mm$^2$. | **10** |
| | **(b)** | Enlist the step to be follow in flexibility matrix method. | **04** |
| | | **OR** | |
| **Q.4** | **(a)** | A simply supported beam of 5m length is subjected to clockwise moment of 100 Kn-m at left end. Find the support displacement in beam using Stiffness matrix Method. Take EI = 3 x 10$^7$ kN-m$^2$. | **07** |
| | **(b)** | Analyze the fix beam of 6 m length subjected to u.d.l. of 20 kN/m throughout | **07** |

its length using flexibility Matrix Method. Take EI = 3 x $10^7$ kN-$m^2$. Also draw shear force and bending moment diagram.

**Q.5** **(a)** A propped cantilever beam of 6 m length is subjected to a point load 50 kN at the mid span. Find the support reaction using Theorem of Least Work. Consider EI as constant. Also plot bending moment diagram. Take EI = 3 x $10^7$ kN-$m^2$. **07**

**(b)** Solve same above example Q-5 a-) using Unit Load Method. Take EI = 3 x $10^7$ kN-$m^2$. **07**

**OR**

**Q.5** Find the vertical and horizontal displacement at joint B for a plane truss as shown in fig.-3 using any suitable method of energy approach. Assume EA is constant for all truss members. Take A=10000 $mm^2$ and E=200kN/$mm^2$. **14**

**********

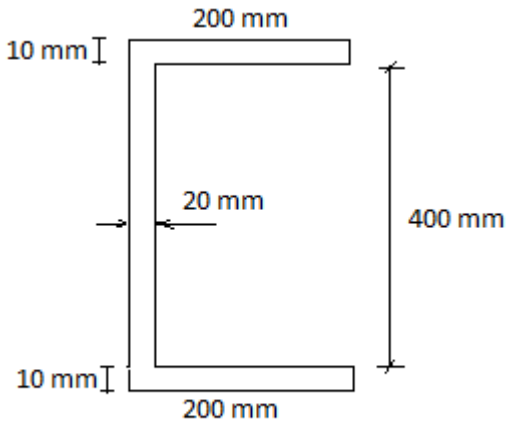


Fig.-1

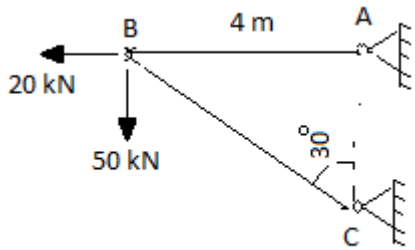


Fig.-2

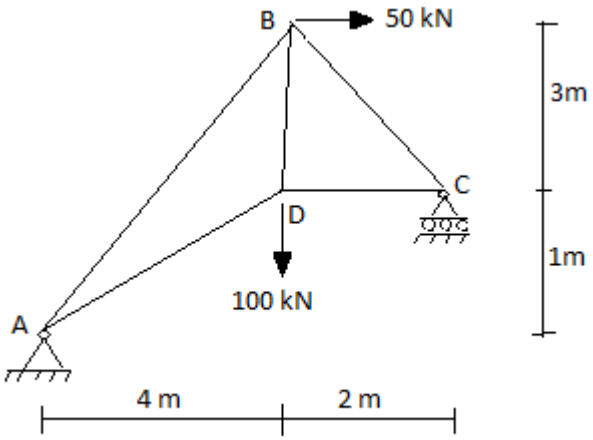


Fig.- 3