Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016**

**Subject Code:2150103 Date:19/11/2016**

**Subject Name:Aircraft Structures II**

**Time:10:30 AM to 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.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | | **Short Questions** | **14** |
| | **1** | Define load factor. | |
| | **2** | Give two examples of structural components in the wing and fuselage of an aircraft which take bending. | |
| | **3** | Distinguish between torsion and bending moment. | |
| | **4** | Give a realistic example of any situation in which torsion is experienced by any component of an aircraft. | |
| | **5** | List and explain the types of fuselage. | |
| | **6** | Explain Redundancy. | |
| | **7** | Discuss types of load coming on aircraft. | |
| | **8** | Explain the significance role of an I-section in structures. | |
| | **9** | Discuss the importance of neutral axis | |
| | **10** | Why is the wing of an aircraft selected to be cantilever? | |
| | **11** | Why is the cross section of a fuselage circular/elliptical? | |
| | **12** | Discuss statically determinate structures | |
| | **13** | Why are thin walled sections preferred over solid sections? | |
| | **14** | Draw stress strain diagrams for brittle and elastic materials. | |
| **Q.2** | **(a)** | State the difference between Symmetrical Bending and Unsymmetrical Bending. | **03** |
| | **(b)** | Explain with neat sketch the state of stress at a point in three dimensions. | **04** |
| | **(c)** | Explain the State of Plane Strain. Write the basic equations of equilibrium, compatibility and stress-strain relations for plane strain condition in polar coordinate system. | **07** |
| | | **OR** | |
| | **(c)** | The state of stress at point is given by $\sigma_x$ = 20, $\sigma_y$= -10, $\sigma_z$= 7 MPa and $\tau_{xy}$= -6, $\tau_{yz}$= 8, $\tau_{zx}$= 10 MPa, Determine the principal stresses and principal directions. | **07** |
| **Q.3** | **(a)** | Define Stiffness and state the characteristics of Stiffness Matrix. | **03** |
| | **(b)** | Enlist the basic equations of equilibrium, compatibility and stress-strain relations for plane stress condition in polar coordinate system | **04** |
| | **(c)** | Find the reactions for the beam shown in Figure-1 using Displacement Method. Assume that the beam has constant flexural rigidity EI. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain the State of Plane Stress | **03** |
| | **(b)** | Prove that'Stiffness matrix andFlexibility matrix are inverse to one another'. | **04** |
| | **(c)** | Determine the value of the redundants for the beam shown in the Figure-2 using Flexibility Method. Consider redundants in the form of moments. | **07** |
| **Q.4** | **(a)** | Define the terms: Shear Centre and Shear Flow | **03** |
| | **(b)** | Explain Framed Structures and Continuum Structures with the help of neat sketch. | **04** |

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|---|---|---|---|
| | **(c)** | An Indian Standard I-section ISMB 300 is shown in Figure- 3. The properties of the section are as below: Ixx = 7719 $cm^4$, Iyy = 456 $cm^4$. The plane of loading is inclined at 30° to the Y-axis. Find moment 'M' if the maximum bending stress induced is 120 $N/mm^2$. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Define: Principal Moment of Inertia | **03** |
| | **(b)** | Determine the stress fields that arises from the following stress function:<br>(i) $\Phi=Cy^4$<br>(ii) $\Phi=Ax^2+Bxy+Cy^3$<br>(iii) $\Phi=Ax^3+Bx^2y+Cxy^2+Dy^3$ | **04** |
| | **(c)** | Determine the position of the shear centre for the thin-walled open section shown in Figure-4. Moment of Inertia of the section $I_u$= 1070 x $10^6$ $mm^4$. | **07** |
| **Q.5** | **(a)** | Explain the role of skin and ribs in detail. | **03** |
| | **(b)** | Discuss the difference between torsion of open and closed sections | **04** |
| | **(c)** | Explain V-N diagram in detail along with a neat sketch and all the critical points of concern | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain the role of bulkheads and longerons in detail. | **03** |
| | **(b)** | Explain displacement associated with Bredt-Batho Shear flow for closed sections. | **04** |
| | **(c)** | Explain Prandtl's torsion theory for solid sections | **07** |

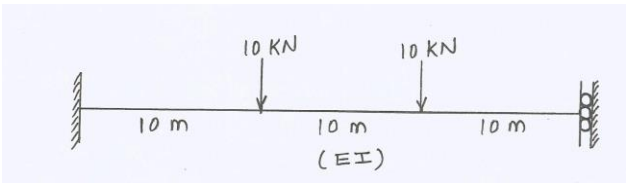


Figure-1

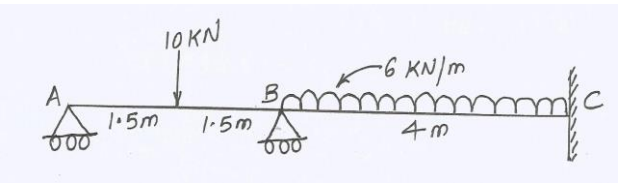


Figure-2

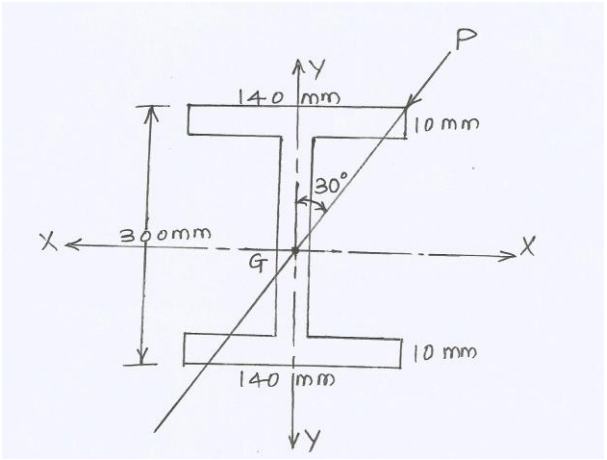


Figure-3

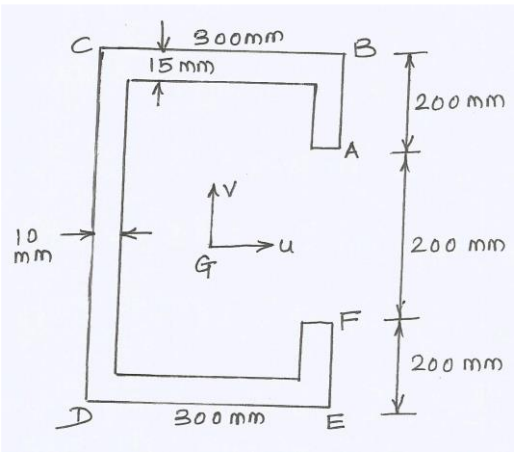


Figure-4

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