Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 140101 **Date: 06/06/2017**

Subject Name: Aircraft Structure-1

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.**

Q.1 **(a)** The geometric failure in a axially loaded compression member is referred as _____. (buckling, bending, torsion) **02**

(b) The effect of buckling is reduced by using _____ material. (stronger, stiffer, both stronger and stiffer) **02**

(c) The shear force in a conjugate beam at any section gives _____ in original neam. (slope, deflection, bending moment) **02**

(d) The value of internal static indeterminacy is always zero in _____ . (beam, truss, plane frame) **02**

(e) Match the following; **04**

1-) Flexural rigidity	GJ
2-) Shear Rigidity	AE
3-) Axial rigidity	EI
4-) Torsional rigidity	GA_s

(f) The amount of work done w.r.t. rigid body is referred as _____ while in that of deformed body is referred as _____. **02**

Q.2 **(a)** Enlist the common material properties required for aircraft structures. Explain about different materials for aircraft structure. **07**

(b) A steel rod of cross section 10 mm x10 mm is subjected to a gradual axial tensile load of 150 kN. Determine the maximum stresses, total amount of strain energy stored and displacement induced in a material. Take E= 200 kN/mm^2. **07**

OR

(b) A weight W = 30 N falls freely along a rod until it strikes the nut at the bottom fixed from a height of 500 mm. If the diameter of the rod is 12 mm and the length of the rod is 800 mm, find the maximum instantaneous stresses and amount of strain energy stored in rod caused by the falling weight. Take E= 200 kN/mm^2. **07**

Q.3 **(a)** Derive the formula for Static Indeterminacy of a Plane Truss by giving suitable example. **07**

(b) What is triaxial stress state and plane stress? For an element subjected to plane stress system, derive the maximum and minimum principal stresses and maximum shear stress. **07**

OR

Q.3 **(a)** A cantilever beam of a rectangular cross section (b x d) having length "L" is subjected to a point load "F" at free end. Considering the stress function € = Axy + Bxy^3, investigate the stress field and by satisfying the boundary conditions, obtain the stress distribution in a beam. **07**

(b) Find the Kinematic Indeterminacy (KI) of a plane frame as shown in Fig.-1, for following cases: **07**

1-) all beams are of infinite stiffness.

2-) columns are vertically inextensible and of infinite stiffness.

3-) consider regular frame.

Q.4	**(a)**	Derive Moment Curvature Relationship of an elastic beam along with suitable assumptions.	**07**
	(b)	Find the deflection at point 'C' and rotation at point 'B' for a beam as shown in fig.-2 using Macaulay's Method. Take EI = 20000 kN/m^2.	**07**

OR

Q.4	**(a)**	Find the deflection at point 'C' and rotation at point 'B' for a beam as shown in fig.-2 using Moment Area Method. Take EI = 20000 kN/m^2.	**07**
	(b)	Find the deflection at point 'C' and rotation at point 'B' for a beam as shown in fig.-2 using Conjugate Beam Method. Take EI = 20000 kN/m^2.	**07**
Q.5	**(a)**	State and prove Maxwell's Reciprocal Theorem.	**07**
	(b)	Analyse the truss as shown in fig.-3, using Tension Co-efficient method.	**07**

OR

Q.5	**(a)**	Explain Euler's theory of long column along with suitable assumption.	**07**
	(b)	Explain plane stress and plain strain condition along with suitable sketches. Also write the stress strain matrix in each case.	**07**

****

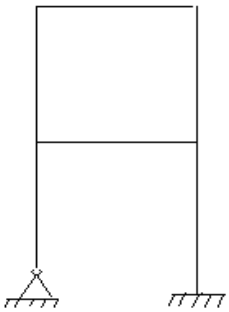

Fig.-1

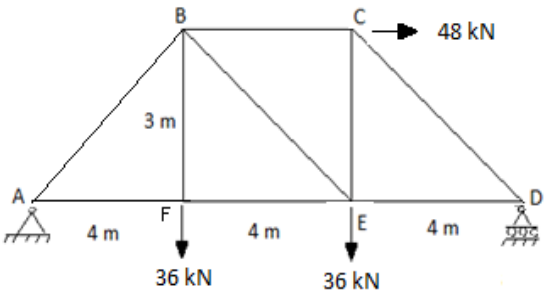

Fig.-3

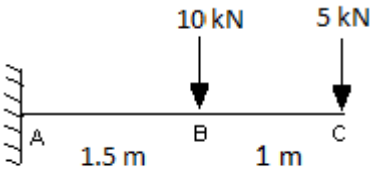

Fig.-2