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

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2140101 **Date: 26/05/2017**

Subject Name: Aircraft Structures I

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)**	A truss is considered as deficient or unstable truss if _____	**01**
	(b)	The total degree of freedom at each joint in case of plane truss is _____	**01**
	(c)	The external degree of redundancy of beams is given by _____	**01**
	(d)	Conjugate beam method is a modified form of _____	**01**
	(e)	The strain energy due to sudden load is _____ times the strain energy due to gradual load.	**01**
	(f)	The elastic energy stored due to shear loading is known as _____	**01**
	(g)	The effective length of a long column having one end fixed and other end free is _____	**01**
	(h)	The number of vibration cycles completed in one second is referred as _____	**01**
	(i)	In actual structure, if the support is fixed then it is modified to _____ in conjugate beam.	**01**
	(j)	The ratio of effective length of column to radius of gyration is referred as _____	**01**
	(k)	For the statically determinate structure, the value of S.I. is always _____	**01**
	(l)	The differential equation of the elastic curve is given by _____	**01**
	(m)	The angle through which the cross-section rotates with respect to the original position is called as _____	**01**
	(n)	The axis of the loaded beam that bends in a curve is known as _____	**01**
Q.2	**(a)**	Differentiate: Simple Truss, Compound Truss and Complex Truss with suitable sketch.	**03**
	(b)	State and Explain " Maxwell's Reciprocal Theorem "	**04**
	(c)	Analyse the plane truss shown in Figure-1 using Tension Coefficient Method.	**07**
		OR	
	(c)	Define the terms: Static Indeterminacy and Kinematic Indeterminacy. Find the S.I and K.I of a plane frame as shown in Figure-2.	**07**
Q.3	**(a)**	State the Principle of Virtual Work.	**03**
	(b)	Define the term Effective Length of Column. Draw the probable sketch which represent the buckled shape of the column with different support conditions.	**04**
	(c)	Determine the deflections under the position of loads for the beam shown in Figure-3. Take E = 200 GPa, I = 160 x 10^6 mm^4. Use any method.	**07**
		OR	

Q.3	**(a)**	Explain the Principle of Super position with its statement.	**03**
	(b)	Enlist various methods to find slope and deflection. Mention the assumptions required for deriving the differential equation.	**04**
	(c)	A beam AB of 4.0 m span is simply supported at the ends and is loaded as shown in Figure-4. Determine (i) Deflection at C, (ii) Maximum deflection, and (iii) Slope at the end A. Take the value of $E = 200 \times 10^6$ kN/m^2 , $I = 20 \times 10^{-6}$ m^4. Use Macaulay's Method.	**07**
Q.4	**(a)**	Define: Time Period, Amplitude and Natural Frequency	**03**
	(b)	Differentiate between: Column and Strut	**04**
	(c)	A bar 54 mm in diameter is 4 m long. An axial load of 180 kN is suddenly applied to it. Find maximum instantaneous stress, maximum instantaneous elongation and the work stored in the bar. Take $E = 2 \times 10^5$ N/mm^2.	**07**

OR

Q.4	**(a)**	Explain Simple Harmonic Motion for the vibratory body.	**03**
	(b)	State the assumptions and limitations of Euler's Theory of Column Buckling.	**04**
	(c)	A strut 2.5 m long is 60 mm in diameter. One end of the strut is fixed while its other end is hinged. Find the safe load for the member using Euler's Theory, allowing Factor of Safety as 3.5. Take $E = 2.1 \times 10^5$ N/mm^2.	**07**
Q.5	**(a)**	Define: Crushing Load, Slenderness Ratio and Radius of Gyration.	**03**
	(b)	Derive the differential equation of deflected curve with neat sketch.	**04**
	(c)	An I-Section has 260 mm depth and 120 mm width. Thickness of flange and web is 10 mm. It is used as a column with one end fixed and other hinged using Euler's Formula. Determine Safe Load using FOS = 3 and length of column = 8.0 m. Take $E = 2 \times 10^5$ N/mm^2.	**07**

OR

Q.5	**(a)**	Explain D'Alembert's Principle.	**03**
	(b)	A hollow rectangular column having outside dimensions 200 mm x 150 mm and inside dimensions 150 mm x 100 mm. It's length is 6.0 m and both ends are fixed. Find the Euler's Load if $E = 2 \times 10^5$ N/mm^2.	**04**
	(c)	A solid circular shaft is subjected to a bending moment of 30 kN-m and a torque of 15 kN-m. Design the diameter of the shaft according to maximum principle stress theory. Take stress at elastic limit as 200 N/mm^2 and Factor of safety as 2.	**07**

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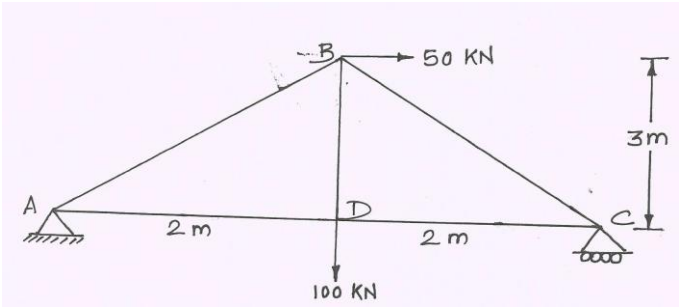

Figure-1

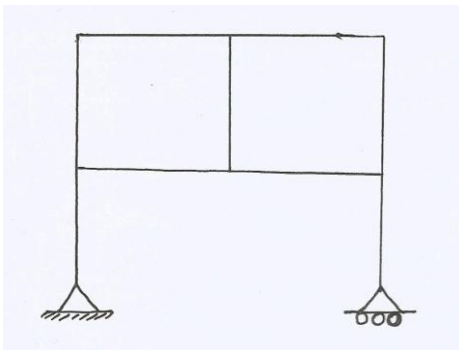

Figure-2

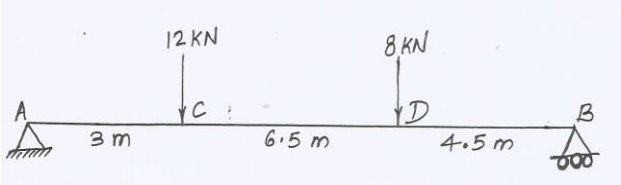

Figure-3

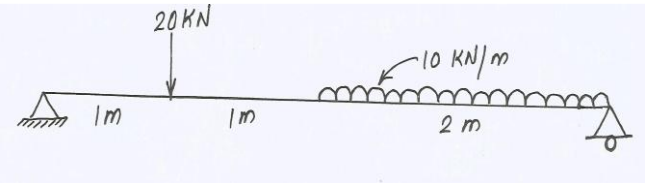

Figure-4