Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 140101 Date: 20-06-2014

Subject Name: Aircraft Structure - I

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 the clear difference between displacement and deformation.	**02**
	(b)	State and explain the "Maxwell's Reciprocal Theorem".	**03**
	(c)	Find the Kinematic Indeterminacy (KI) of a plane frame as shown in Fig.-1, if all beams are of infinite stiffness. Also neglect axial deformation of a member.	**02**
	(d)	Define the terms: 1-) Buckling Length. 2-) Slenderness Ratio. 3-) Strain Energy. 4-) Tension Co-efficient.	**04**
	(e)	State the difference between determinate and indeterminate structure.	**03**
Q.2	**(a)**	Analyze the Plane truss as shown in fig.-3 using Method of Tension Co-efficient.	**07**
	(b)	What do we mean by Static Indeterminacy (SI) and Kinematic Indeterminacy (KI) of a structure? Find the SI and KI of a structure as shown in fig.-1 (plane frame) and fig.-2 (plane truss).	**07**
		OR	
	(b)	Find the displacement at free end of a cantilever beam as shown in fig.-4 using any suitable method. Member 'AD' is of infinite stiffness. Also draw probable deflected shape of a beam. Take E= 200 kN/mm^2 and I = 10^9 mm^4.	**07**
Q.3	**(a)**	Draw a probable sketch which shows a buckle shape of a long column for following support conditions; 1-) Both the ends are fixed. 2-) Both the ends are Free. 3-) One end fix and other end is free. 4-) One end fix and other is hinged. Also mention the formula of buckling length in each case.	**07**
	(b)	A simply supported beam having length 8m is subjected to a downward point load of 25 kN at a distance 3 m from left end support. Determine the rotation at left end support and deflection at the canter span of a beam using Double Integration Method. Take E= 200 kN/mm^2 and I = 10^9 mm^4.	**07**
		OR	
Q.3	**(a)**	Determine the central span deflection for a simply supported beam as shown in fig.-5 using Moment area Method. Take E= 200 kN/mm^2 and I = 10^9 mm^4.	**07**
	(b)	Determine slope and deflection at the free end of a cantilever beam as shown in Fig.-6 using Macaulay's Method. Take E= 200 kN/mm^2 and I = 10^9 mm^4.	**07**
Q.4	**(a)**	Explain plane stress problem by giving suitable example. Also write the stress-strain relationship for the same.	**07**

(b) In a plain strain problem, we have stress $f$xx = 1200 MPa, $f$yy = -80 MPa, young modulus E = 200 GPa and passion ratio μ = 0.25. Determine the value of stress $f$zz. **07**

OR

Q.4 **(a)** Explain plane strain problem by giving suitable example. Also write the stress-strain relationship for the same. **07**

(b) 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**

Q.5 **(a)** Derive the strain energy equation for a member subjected to a axial load. **07**

(b) Write the different required characteristics of the Aircraft structure. Why hollow section and I-sections are preferred for aircraft structure? **07**

OR

Q.5 **(a)** Derive the strain energy equation for a member subjected to shear force. **07**

(b) Calculate the total strain energy stored in a 6 m long cantilever beam subjected to a point load of 80 kN at free end due to flexure and shear. The cross section of a beam is rectangle having dimension 120 mm x 300 mm. Take E = 180 kN/mm^2 and G = 80 kN/mm^2. **07**

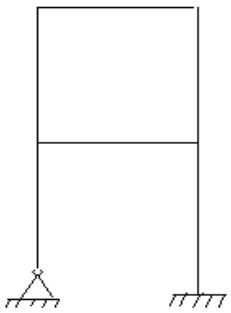

Fig.-1

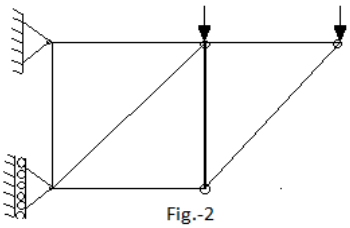

Fig.-2

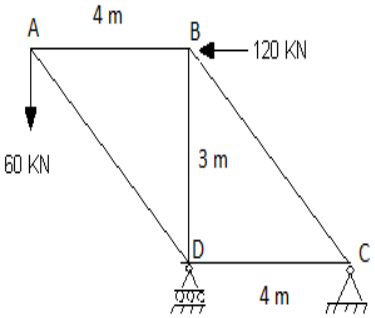

Fig.-3

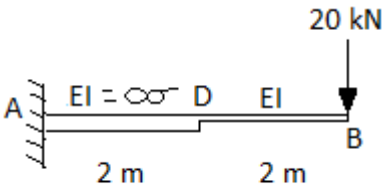

Fig.-4

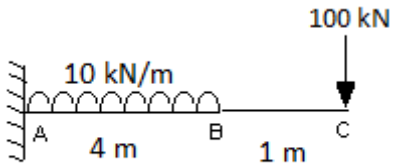

Fig.-6

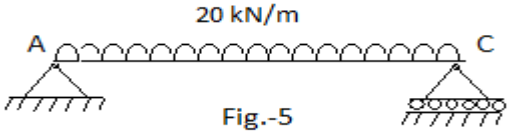

Fig.-5

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