Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- IVth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 140101 **Date: 25/05/2012**

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)**	Define and prove Maxwell's reciprocal theorem	**04**
	(b)	Explain the Principle of Super position with its statement.	**04**
	(c)	Find static and kinematic indeterminacy of structures given in fig. 1 (a, b, c)	**06**
Q.2	**(a)**	A 20 mm diameter bolt is subjected to a pull of 20 kN and a shear force of 5 kN. Calculate the maximum direct and shear stresses induced in the section and specify the position of planes carrying these stresses with reference to axis of the bolt. Clearly depict all the stresses acting on the body	**07**
	(b)	Analyse the plane frame as shown in figure 2. Draw shear force diagram, Bending moment diagram, and axial force diagram.	**07**
		OR	
	(b)	A crane hook has a square cross section 75 mm X 75 mm, with inner radius 125 mm is initially unstressed, if a bending moment of 15 kN.m is applied to the bar and tends to straighten it. Find the stress at the inner and outer fane.	**07**
Q.3	**(a)**	Calculate slope and deflection at point B and C for the beam as shown in figure 3 using Macaulay's method. Take EI = 32000 kN.m^2.	**07**
	(b)	A Space truss as shown in fig. 4 is supported at C, D, E, and F in a horizontal plane through a hinge joint. The member AB is horizontal and is at a height of 3 m above the base. The loads at the joint A and B, shown in figure act in a horizontal plane. Find the forces in all the members of the truss by using method of Tension co-efficient.	**07**
		OR	
Q.3	**(a)**	Which points should be take care while using Macaulay's Method.	**03**
	(b)	Find Slope and Deflection at the free end of the cantilever beam subjected to point load at the free end.	**04**
	(c)	Calculate slope and deflection at point B for the beam as shown in figure 5 using conjugate beam method. Take EI = 32000 kN.m^2.	**07**
Q.4	**(a)**	Define strain energy, Proof resilience and modulus of resilience	**03**
	(b)	Derive the equation of the strain energy stored in a member due to Torsion.	**04**
	(c)	Calculate the strain energy in a beam of size 230 mm x 350 mm, 4 m length subjected to U.D.L. over the entire span of length 4 m. take E = 200000 N/mm^2.	**07**
		OR	
Q.4	**(a)**	Define Crippling load, Slenderness ratio, Crushing load	**03**
	(b)	Derive Euler's crippling load formula for the long column pinned at both ends.	**04**
	(c)	A square column of size 500mm depth and 350 mm width, 4.2 m in length with its one end is fixed and other is free. Find it's load carrying capacity of the column by 1) Euler's formula 2) Rankine's formula. Take f_c=400 N/mm^2 , E = 2 x 10^5 N/mm^2 , α = 1/7200	**07**
Q.5	**(a)**	What are Principal stresses and principal planes? Derive them on an inclined plane with neat sketches.	**07**

(b) At a point in a strained material, there exists a state of pure shear, where τ_{xy}= 40 MPa. Determine the stresses on an inclined plane at 30^0 to the vertical. Also determine the principal tension and compression. Clearly depict all the stresses acting on the body. **07**

OR

Q.5 **(a)** Explain shear stress and state of pure shear and derive these equations on an inclined plane. **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**

****

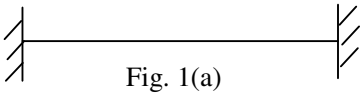

Fig. 1(a)

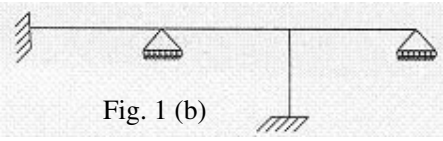

Fig. 1 (b)

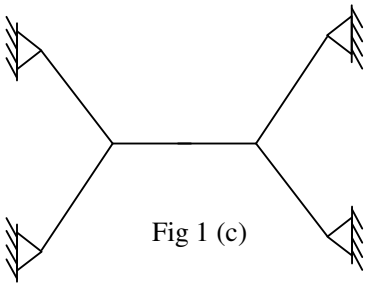

Fig 1 (c)

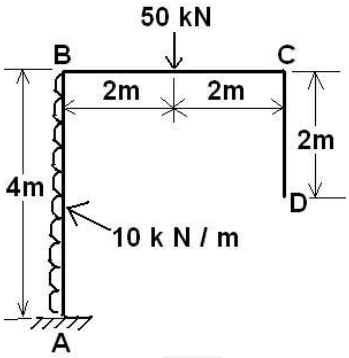

Fig. 2

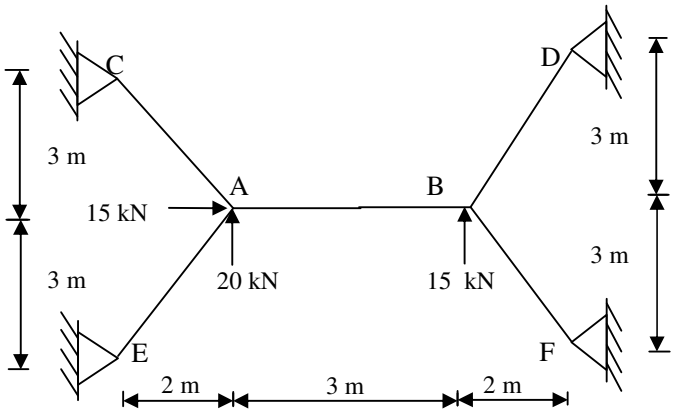

Figure 4

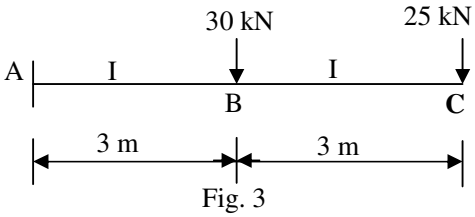

Fig. 3

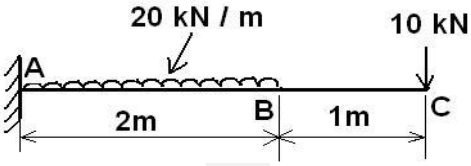

Fig. 5