Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 140101 **Date: 23-12-2013**

Subject Name: Aircraft Structure - I

Time: 02:30 pm to 05:00 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 Attempt the following **14**

1. state the Principle of Super position with expression only
2. Find static indeterminacy of structures given in figure 1(a) and (b)
3. Find kinematic indeterminacy of structures given in figure 1 (a) and (b)
4. Which points should be take care while using Macaulay's Method.
5. Give the relation between Loading, shear force, banding moment, Slope and deflection
6. Explain hook stress in brief
7. Define Crippling load and Crushing load

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 80 mm x 80 mm, with inner radius 120 mm is initially unstressed, if a force 100 kN is applied to the bar and tends to straighten it. Find the stress at the inner and outer fane. **07**

Q.3 **(a)** Derive the differential equation of deflected curve. **07**

(b) Calculate deflection at point D for the beam as shown in figure 3 using Macaulay's method. Take EI = 32000 kN.m^2. **07**

OR

Q.3 **(a)** 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 4 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**

(b) Calculate slope and deflection at point C for the beam as shown in figure 5 using conjugate beam method. Take EI = 32000 kN.m^2. **07**

Q.4 **(a)** Write the equation of the strain energy stored in a member due to different loading condition and derive for any one load case. **07**

(b) Calculate the strain energy in a bar 3m long and 40mm diameter, when it is **07**

Subjected to a tensile load of 100KN. What will then a modulus of resilience of the material of the bar?

OR

Q.4 **(a)** Write the formula for Euler's crippling load for different end conditions and derive any one of them. **07**

(b) A column of size 450 mm depth and 300 mm width, 4.0 m in length with its both ends are fixed. Find it's load carrying capacity of the column by 1) Euler's formula 2) Rankine's formula. Take f_c=300 N/mm^2 , E = 2.1 x 105 N/mm2 , α = 1/7500 **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**

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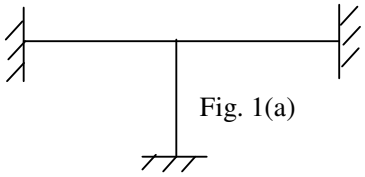

Fig. 1(a)

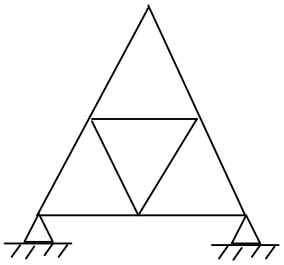

Fig. 1(b)

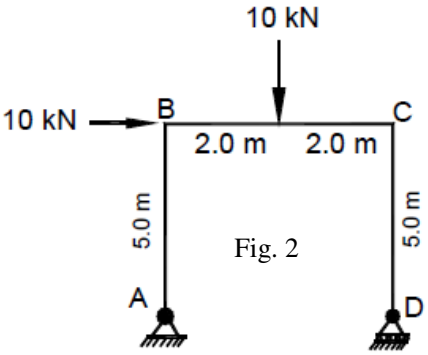

Fig. 2

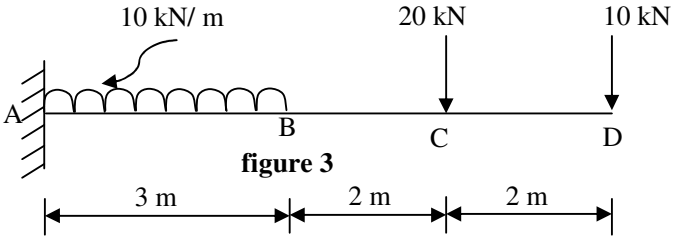

figure 3

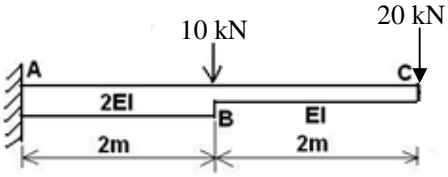

Figure 5

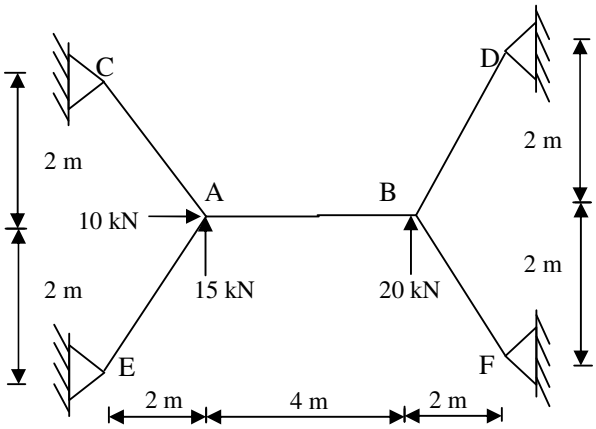

Figure 4