Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III • EXAMINATION – WINTER 2012

Subject code: 130604 **Date: 10-01-2013**

Subject Name: Structural Analysis - 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) (a) Define (i) Resilience (ii) Proof resilience (iii) Modulus of Resilience 03

(b) State the assumptions made in the derivation of the equation. 04

$$\frac{T}{Ip} = \frac{\tau}{R} = \frac{C\theta}{l}$$

(c) An Unknown weight falls through a height of 10 mm on a collar rigidly attached to the lower end of a vertical bar 5 m long and 600 mm^2 in cross section. If the maximum extension of the rod is to be 2 mm what is the corresponding stress and magnitude of the unknown weight? Take E = 200 GN/m^2. 07

Q.2 (a) State the assumptions made in the Euler's theory for long column. 03

(b) Derive the Euler's buckling load for the column when both ends are hinged. 04

(c) Find the Euler's crippling load for a hollow cylindrical column of 200mm external diameter and thickness 20 mm. the length of the column is 5 m and it is hinged at both ends. Take E = 120GN/m^2. 07

Compare the crippling load given by Rankine's formula taking σc =550MN/m^2 and α = (1/1600).

OR

(c) Determine the slope and vertical deflection at B of the cantilever beam shown in figure 1 by Moment Area Method. 07

Q.3 (a) Derive the equation 07

$$\frac{T}{Ip} = \frac{\tau}{R} = \frac{C\theta}{l}$$

(b) A solid circular shaft transmits 120 kW power at 200rpm. If the twist in the shaft is not to exceed 1^0 in 3 m length of the shaft and shear stress is limited to 50MN/m^2. Calculate the required shaft diameter Take C = 100 GN/m^2. 07

OR

Q.3 (a) Derive the expression for the strain energy due to bending for a beam 07

simply supported at the ends loaded with a udl w/unit run over entire span. The beam has constant flexural rigidity EI through out its span.

(b) Prove that the change in volume of a spherical shell of diameter d and internal pressure p is 07

$$\delta V = \frac{\pi p d^4}{8 t E}\left[1 - \frac{1}{m}\right]$$

where t is the thickness of the shell.

Q.4 (a) Derive the general equation of a cable from the first principle. 07

(b) A three hinged parabolic arch of span 100 m and rise 20m carries a uniformly distributed load of 4 kN/m on the right half of the arch. Determine the maximum bending moment in the arch. Also draw B. M. diagram. 07

OR

Q.4 (a) A RCC chimney of hollow circular cross section has external and internal diameters of 2.5m and 2m respectively. It is subjected to a horizontal wind pressure of 120kg/m^2. Determine the greatest height of the chimney, if no tension is allowed to occur at the base . Take unit weight of RCC 2500kg/m^3. 07

(b) A masonry pier is supporting a vertical load of 60kN as shown in figure2. Compute the stresses at each corner of the pier. 07

Q.5 (a) Draw the influence line diagram for the beam shown in figure 3 (i) the reaction at A (ii) the reaction at C(iii) the shear at B. 07

(b) A simply supported rolled steel joist carries a point load of 20kN point load as shown in figure 4. Calculate using Conjugate Beam Method (i)the deflection under the load (ii) the maximum deflection on the span. Take I_{XX} =5.1 X 10^7 mm^4, E = 2 X 10^5 N/mm^2 . 07

OR

Q.5 (a) Explain Principle of Superposition with example. 03

(b) State and explain Maxwell's Reciprocal theorem for deflection with example. 04

(c) A simply supported beam carries two point loads as shown in figure 5 . Calculate deflections under the load by Macaulay's method. Take I = 1.6X10^9 mm^4 and E = 2 X 10^5 N/mm^2. 07

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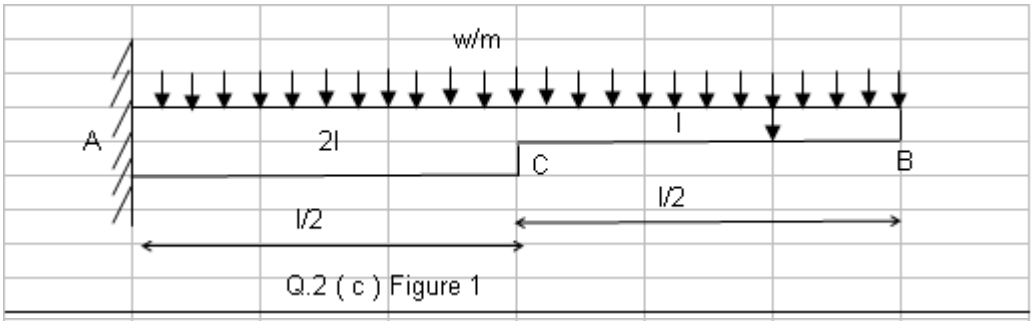
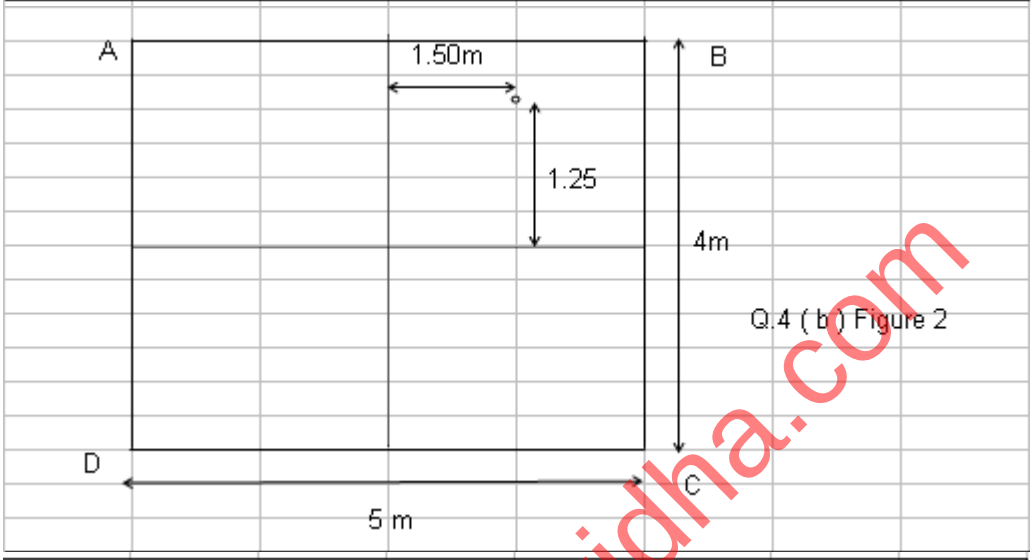
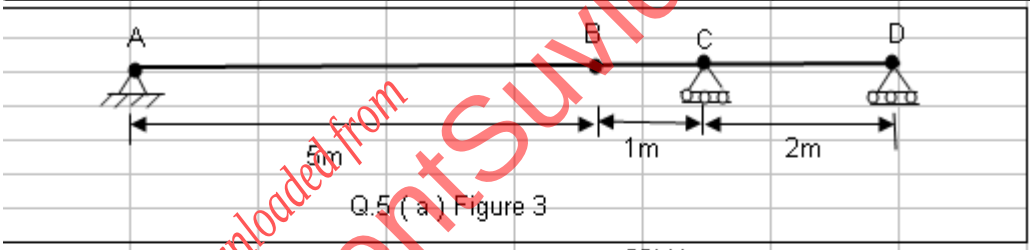


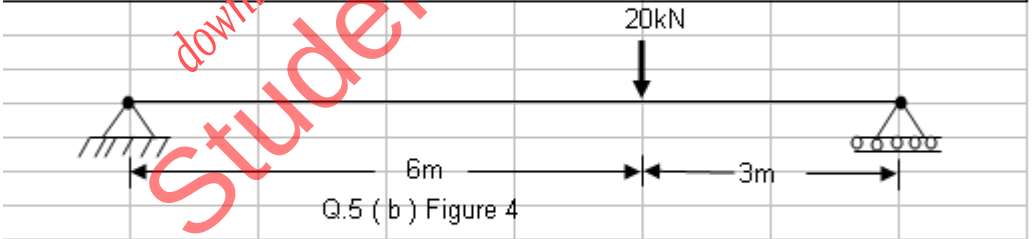
Q.2 (c) Figure 1



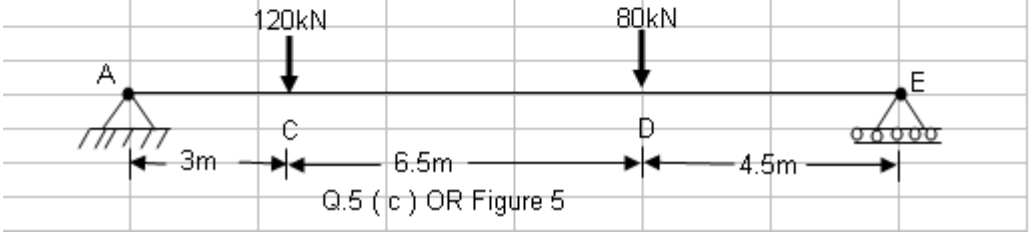
Q.4 (b) Figure 2



Q.5 (a) Figure 3



Q.5 (b) Figure 4



Q.5 (c) OR Figure 5