Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Regular / Remedial Examination December 2010

Subject code: 130604 **Subject Name: Structural Analysis - I**

Date: 14 /12 /2010 **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)** Differentiate between curved beam and arches. **03**

(b) What are the different indeterminacies in the structure? Explain their uses in the structural analysis giving the examples. **04**

(c) What are the different types of the strain energies stored in the structure? Why is it important for the analysis of the structure? **03**

(d) What is the difference between mode of failures of long and short column? For a mild steel having modulus of elasticity as 200 GPa and yield stress of 250 N/mm^2, calculate the critical slenderness ratio that separates short and long column. **04**

Q.2 **(a)** For a structure as shown in the figure.1, draw bending moment, shear force and axial force diagrams. **07**

(b) For a structure as shown in the figure.2, draw bending moment, shear force and torsion diagrams. **07**

OR

(b) A curved beam has semicircular shape with radius of 3m and is loaded by a point load of 10kN at centre of arc. Calculate the maximum bending moment, shear force and torsion. **07**

Q.3 **(a)** For a beam as shown in the figure.3, calculate the deflection and slope at the free end by Macaulay's method of double integration. Assume E= $2x10^5$ N/mm^2 and I = $5x10^6$ mm^4. **07**

(b) For the truss as shown in the figure.4, calculate the vertical deflection at the central lower point. Assume that all the members are having equal E and A. **07**

OR

Q.3 **(a)** For a beam as shown in the figure.3, calculate the deflection under the point load by Moment Area method OR Conjugate Beam Method. Assume E= $2x10^5$ N/mm^2 and I = $5x10^6$ mm^4. **07**

(b) Analyze the compound truss as shown in the figure.5 and tabulate the forces in the members. **07**

Q.4 **(a)** A column has one end fixed and other end hinged with length of 6.0m. It is made up of a tube having external diameter of 100mm and wall thickness of 10mm. If the yield strength of the material is 410 N/mm^2 and rankine's constant is 1/4800, calculate Euler's critical load and rankine's critical load. **07**

(b) A bar of diameter 25mm and length of 3m is attached with a collar at bottom. If a weight of 10kN is falling on the collar from a 200mm height, calculate the maximum instantaneous strain, stress and elongation of the bar. Assume E= $2x10^5$ N/mm^2. **07**

OR

Q.4 **(a)** Calculate the external diameter required for a tubular column loaded by an axial load of 200kN. The effective length of the column is 5m. The permissible strength of the material is 180N/mm2 and rankine's constant is 1/ 3600. The thickness of the material is to be taken as 10% of the external diameter. **07**

(b) A bar of diameter 20mm and length of 2m is attached with a collar at bottom. If the maximum stress developed is to be limited up to 100N/mm2, calculate the maximum value of weight that can be allowed to fall on the collar form 0.2m height. Assume E= $2x10^5$ N/mm^2. **07**

Q.5 **(a)** A simple support beam has span of 20m and loaded by a train of wheels as shown in the figure.6. Calculate the maximum bending moment and shear force induced at 8m from left support. **05**

(b) For a three hinged parabolic arch having rise of 6m, span of 40m and loaded by a point load of 200 kN at 10m from left support and an udl of 20 kN/m over right half, calculate the maximum bending moment in both the halves. Also calculate the bending moment, shear force and normal thrust at 15m from left support. **06**

(c) A thin cylinder is filled with fluid which exerts pressure $2kN/m^2$ on the wall. If the diameter of cylinder is 1m, length of 3m and shell thickness of 15mm. Calculate the change in the volume of the cylinder. Assume E= $2x10^5$ N/mm^2 and poisson's ratio as 0.22. **03**

OR

Q.5 **(a)** A simple support truss as shown in the figure.7 is loaded by a moving udl of 10kN/m traveling from left to right. Calculate the maximum axial force induced in the top chord and bottom chord. **05**

(b) A cable bridge as shown in the figure.8 is loaded by a udl of 10kN/m. the cable has sag of 1.5m at the centre. Calculate the maximum axial force in the cable. Also calculate the forces acting on the pillars. **06**

(c) A thin sphere of 1.5m diameter is filled with fluid which exerts internal pressure of 3kN/m2. Calculate the thickness required for the sphere if the change in the volume is not to exceed 2% of the original volume. **03**

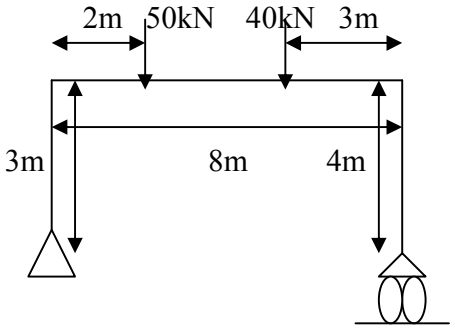

Figure 1

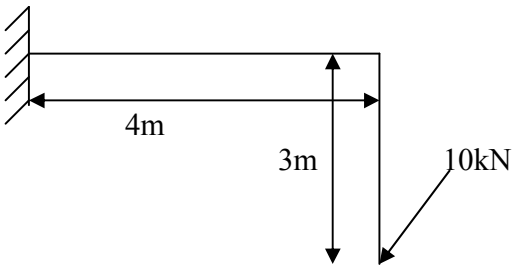

Figure.2

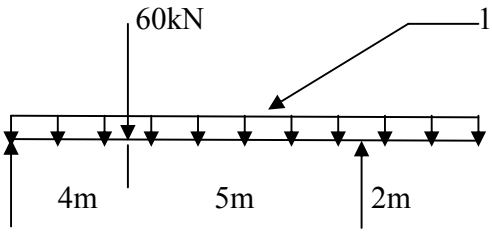

Figure.3

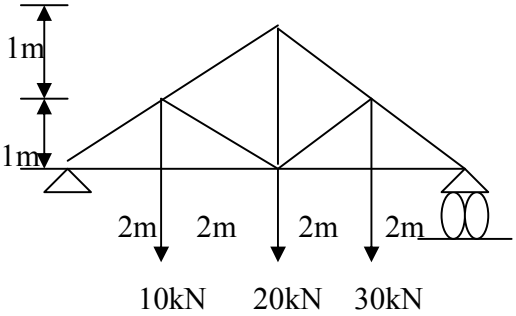

Figure.4

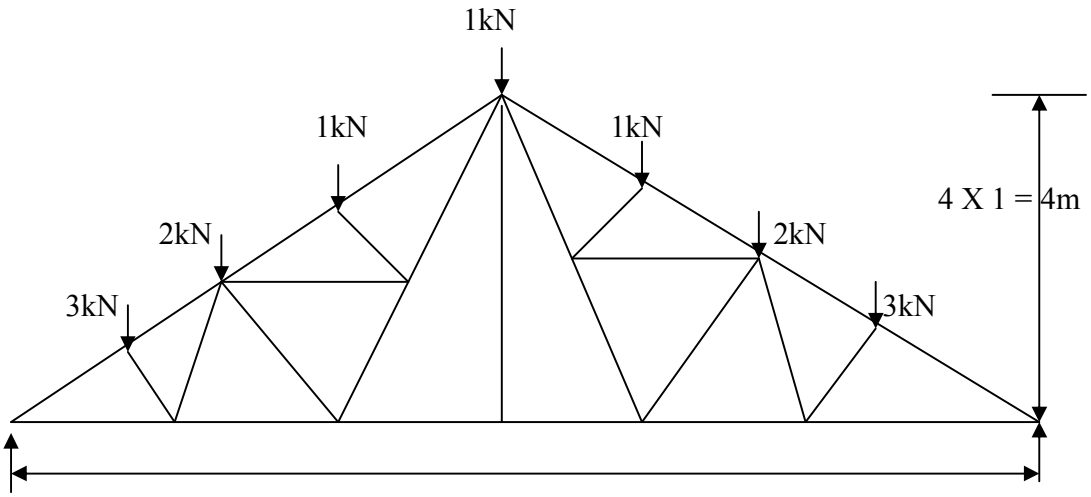

Figure.5

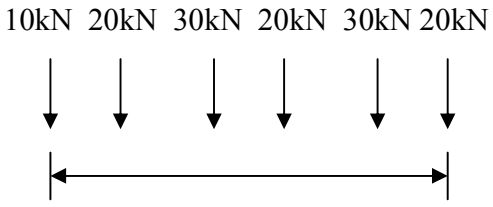

Figure.6

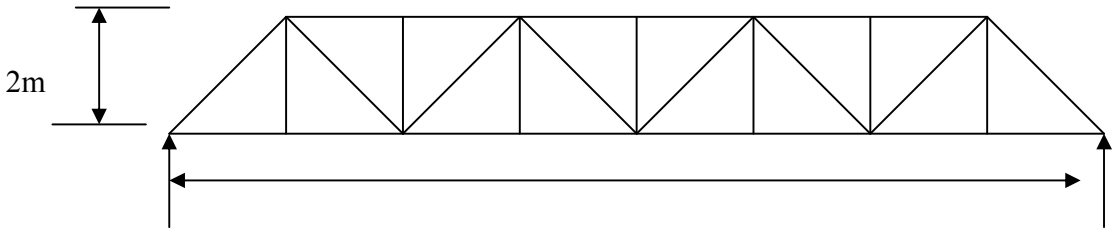

figure.7

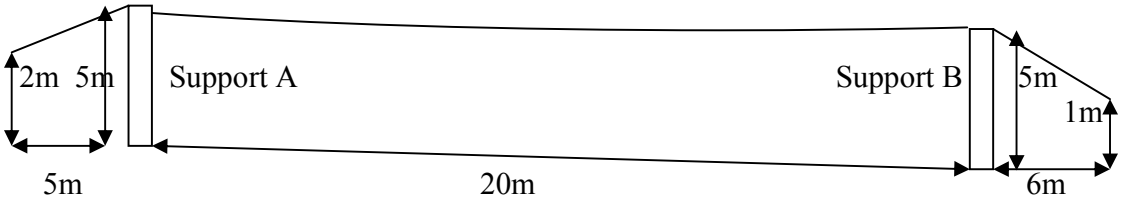

Figure. 8