Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(CE) (2011 Onwards) (Sem.–4)

# STRUCTURAL ANALYSIS – I

Subject Code : BTCE-406

Paper ID : [A1176]

Time : 3 Hrs. Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**
4. **Any missing data can be suitably assumed clearly stating the same.**

## SECTION-A

**1. Write briefly :**

a) What is middle third rule; discuss its importance with reference to retaining walls?

b) Differentiate between a plane truss and compound truss.

c) Define equivalent UDL.

d) Define influence lines.

e) State the Muller-Breslau's principle.

f) Distinguish between a true arch and corbelled arch.

g) What is cable structure?

h) Define Mohr’s theorem.

i) Write down the expression for strain energy due to axial force, Bending Moment.

j) Define moment area theorems.

## SECTION-B

2. A symmetrical parabolic arch hinged at springing and crown has a span of 20 m. The central rise of the arch is 4 m. It is loaded with a UDL of 2.5 kN/m on the left 8 m length. Calculate :

   a. the direction and magnitude of reaction at hinges

   b. the bending moment, normal thrust and shear at 4 m from left end.

3. A suspension cable is suspended from two piers 180 m center to center one support being 5m above the other. The cable carries a uniformly distributed load of 16 N/m and has its lowest point 10 m below the lower support. The ends of the cable are attached to saddles on rollers at top of piers. The backstays which may be assumed straight are inclined at 60° to the vertical. Determine :

   a. the maximum tension of the cable

   b. the thurst on each pier.

4. A masonry dam 7.5 m high, 1.5 m wide at the top 5.5 m wide at the base has its water face vertical and retains water upto 6.5 m. Calculate the maximum and minimum stress intensities at the base. The density of the masonry is 26 kN/$m^3$ and that of water is 10 kN/$m^3$.

5. A beam of length 'L' is simply supported at its ends and carries point load of 'W' at a distance 'a' from both the ends. Using conjugate beam method calculate slope at each end and under each load. Determine the deflection under each load and at the centre.

6. A plane truss is loaded and supported as shown in **Fig**. **1**. Determine the nature and magnitude of the forces in the members 1, 2 and 3.

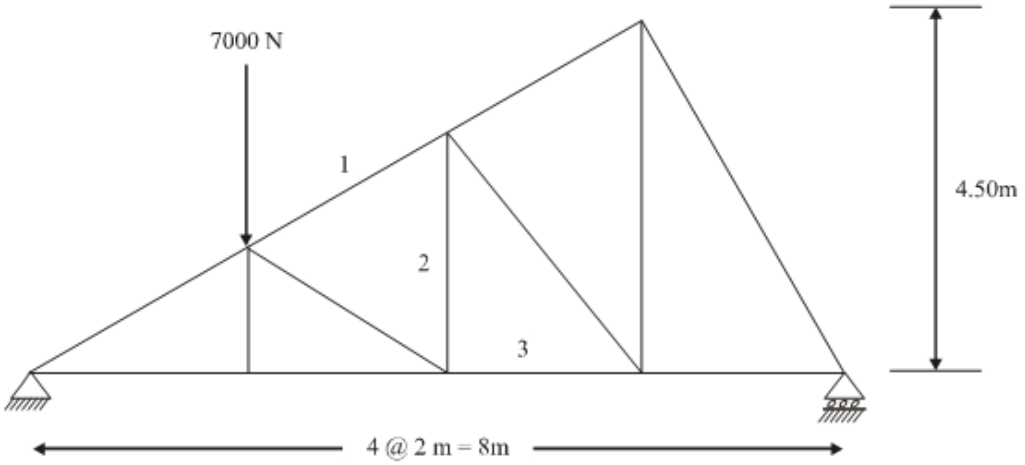


**Fig**. **1**

## SECTION-C

7. Five wheel loads of 180, 180, 180, 100 and 100 kN spaced 3.50, 2.50, 1.50 and 2.00 meters apart respectively, cross a girder of 20 meters span from left to right with 180 kN wheel leading. Calculate the maximum B.M. at the center. Also calculate the position and amount of maximum B.M. anywhere in the girder.

8. A beam AB of 8m span is simply supported at the ends and is loaded as shown in **Fig. 2**. Determine :

   (1) Deflection at C

   (2) Maximum deflection

   (3) Slopes at end A.

   Take $E = 2\times10^5$ N/mm$^2$ and I = 1000 cm$^4$.

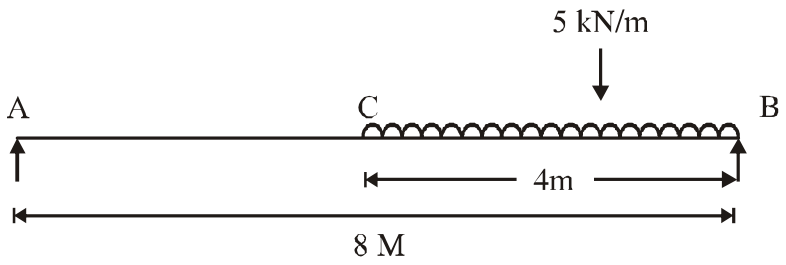


**Fig. 2**

9. A uniformly distributed live load of length 4m and intensity 30 kN/m crosses a beam having a dead load of 10 kN/m and a simply supported span of 10m. Using influence lines, find the maximum shear force and bending moment at a section 3m from the right end. Also find the absolute maximum bending moment on the beam.