# CE 8602 STRUCTURAL ANALYSIS -II QUESTION BANK

UNIT - I & II

## INFLUENCE LINE FOR DETERMINATE BEAMS

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## Ih FLUENC E LINE DIAGRAM FOR INDETERMINATE BEAMS

### PART — A

1 State importance of ILD.

2. State Muller Breslau"s principle?

3. What are the types of connections possible in the model of begg's deformeter?

4. What is the influence line diagram?

5. Draw influence lines for support reactions in a simply supported beam?

6. What do you understand by an influence line for bending moment?

7. When a series of wheel loads move along a girder, what is the condition for getting maximum bending moment under any one point load?

8. Draw a qualitative influence line diagrams for the support reactions of a simply supported beam of span L?

9. What is meant by absolute maximum bending moment in a beam?

10. What is the absolute maximum bending moment due to a moving udl longer than the span of a simply supported beam?

11. What are the three types of connections possible with the model used with Begg's deformeter?

12. What is Begg's deformeter?

13. Where do you get rolling loads in practice?

14. Name the type of rolling loads for which the absolute maximum bending moment occurs at the mid span of a beam?

15. Define similitude?

16. What is the principle of dimensional similarity?

17. Where do you have the absolute maximum bending moment in a simply supported beam when a series of wheel loads cross it?

18. State the location of maximum shear force in a simple beam wit h any kind of loading?

19. What is meant by maximum shear force diagram?

20. State Maxwell-Betti"s theorem?

PART — B

1 A system of four loads 80, 160, 160 and 120 kN crosses a simply supported beam of span 25m with the 120 kN load leading. The loads are equally spaced at 1m. Determine the values of the following using influence lines.

i. Maximum bending moment at a section 10m from left support and

ii. Absolute maximum shear force and bending moment in the beam.

2. A beam has a span of 24m, draw the influence line diagram for the bending moment and shear force at a section 8m from the left and also determine maximum bending moment and shear force at this section due to two point loads of 10kN and 6kN at a fixed distance of 2m apart rolling from left to right with 6kN load leading

3. Two point loads of 100kN and 200kN spaced 3m apart cross a girder of span 12 meters from left to right with the 100kN leading. Draw the ILD for shear force and bending moment and find the values of maximum bending moment and find the values of maximum shear force and bending moment at a section 4m from the left hand support. Also evaluate the absolute maximum bending moment due to the given loading system.

4. A simply supported beam has a span of 16m,is subjected to a UDL(dead load) of 5kN/m and a UDL(live load) of 8kN/m(longer than the span) travelling from left to right. Draw the ILD for shear force and bending moment at a section 4m from left end. Use these diagrams to determine the maximum shear force and bending moment at this section.

5. The following system of wheel loads crosses a span of 25m

| | | | | | |
|---|---|---|---|---|---|
| Wheel load (KN) | 16 | 16 | 20 | 20 | 20 |
| Distance between centre (m) | 3 | 3 | 4 | 4 | |

6. Draw the influence line for $M_B$ for the continuous beam ABC simply supported at A and C using Muller Breslau`s principle. AB=3m, BC=4m.EI is constant.

7. Draw the influence line diagram for the propped reaction of a propped cantilever beam having span 6m. EI=Constant.

8. Determine the influence line diagram for bending moment at a point D, the middle point of span AB of a continuous beam ABC of span AB=6m and BC=4m simply supported at supports A,B and C. Compute the ordinates at every 1m interval.

9. The warren girder of 25m span is made of 5 panels of 5m each. The diagonals are inclined at 60° to the horizontal. Draw the influence line diagram for force in upper chord member in the second panel from left. Hence evaluate the forces in it when there is load of 60 kN at each lower joint.

10. Draw the influence line for $R_A$ for the continuous beam ABC of span AB = BC = 4m simply supported at A, B &C. Compute the ordinates at every 1m interval, EI = constant.

## UNIT – III

## ARCHES

PART – A

1. What is an arch? Explain.
2. What are the methods used for analysis of fixed arches?
3. Distinguish between two hinged and three hinged arches?
4. Give the equation for a parabolic arch whose springing is at different levels?
5. State Eddy‟s theorem as applicable to arches?

6. Explain the effect of temperature on the horizontal thrust of a two hinged arch subjected to a system of vertical loads?
7. Indicate the positions of a moving point load for maximum negative and positive Bending moments in a three hinged arch.
8. Write down the expressions for radial shear and normal thrust in a three hinged parabolic arch?
9. Define radial shear and normal thrust.
10. Mention the examples where arch action is usually encountered?
11. What is a linear arch?
12. What is the degree of static indeterminacy of a three hinged parabolic arch?
13. Under what conditions will the bending moment in an arch be zero throughout?
14. Distinguish between two hinged and three hinged arches?
15. In a parabolic arch with two hinges how will you calculate the slope of the arch at any point?
16. How will you calculate the horizontal thrust in a two hinged parabolic arch if there is a rise in temperature?
17. What are the types of arches according to their shapes?
18. What are the types of arches according to their support conditions?
19. Draw the influence line for radial shear at a section of a three hinged arch?
20. Write the formula to calculate the change in rise in three hinged arch if there is a rise in temperature.

PART – B

1. A circular three hinged arch of span 25m with a central rise of 5m is hinged at the crown and the end supports. It carries a point load of 100 kN at 6m from the left support .Calculate

i. The reaction at the supports

ii. Moment at 5m from the left support.

2. A three hinged circular arch of span 16m and rise 4m is subjected to two point loads of 100 kN and 80 kN at the left and right quarter span points respectively. Find the reaction at the supports. Find also the bending moment, radial shear and normal thrust at 6m from left support.

3. A symmetrical three hinged arch has a span of 50 & rise 5m. Find the maximum bending moment at a quarter point of the arch caused by a uniformly distributed load of 10kN/m which occupies any portion of the span. Indicate the position of the load for this condition.

4. A three hinged parabolic arch of span 30m and rise 5m carries a uniformly distributed load of 40kN per meter on the whole span and a point load of 200kN at a distance of 5m from the right end. Find the horizontal thrust, resultant reaction, bending moment and normal thrust at a section 5m from the left end.

5. A three hinged parabolic arch has supports at different levels having span 20m and carries a UDL of 30kN/m over the left half of the span. The left support is 5m below the crown and the right support is 4m below the crown. Draw the BMD. Also find the normal thrust and radial shear at a section 4m from the left support.

6. A parabolic two hinged arch has a span of 40m and a rise of 5m. A concentrated load 10kN acts at 15m from the left support. The second moment of area varies as the secant of the inclination of the arch axis. Calculate the horizontal thrust and reactions at the hinge. Also calculate maximum bending moment at the section.

7. Evaluate the horizontal thrust in a two hinged parabolic arch of span 10m and rise 25m carrying an UDL of 24 kN/m over the left half span, assuming secant variation of its sectional moment of area. Also calculate the Bending Moment at the crown and draw the BMD.

8. Derive the expression for horizontal thrust in a two hinged parabolic arch carrying a point load P at distance one fourth span from left support .Assume $I=I_0 \, Sec\theta$.

2 4 24

Make sure that $u_1$ =0.

**UNIT -V**

PLASTIC ANALYSIS OF STRUCTURES

PART-A

1. What is a plastic hinge?
2. What is a mechanism?
3. What is difference between plastic hinge and mechanical hinge?
4. Define collapse load.
5. List out the assumptions made for plastic analysis.
6. Define shape factor.
7. List out the shape factors for the following sections.
    a) Rectangular section,
    b) Triangular section,
    c) Circular section,
    d) Diamond section

8. Mention the section having maximum shape factor.
9. Define load factor.
10. State upper bound theory.
11. State lower bound theory.
12. What are the different types of mechanisms?
13. Mention the types of frames.
14. What are symmetric frames and how they analyzed?
15. What are unsymmetrical frames and how are they analyzed?
16. Define plastic modulus of a section Zp.
17. How is the shape factor of a hollow circular section related to the shape factor of an ordinary circular section?
18. Give the governing equation for bending.
19. Give the theorems for determining the collapse load.
20. State plastic moment of resistance.
21. Explain pure bending with its assumptions.

PART-B

1.Calculate the shape factor for a a)rectangle section of breadth'b' and depth 'd', b)diamond section of breadth'b' and depth'd'.

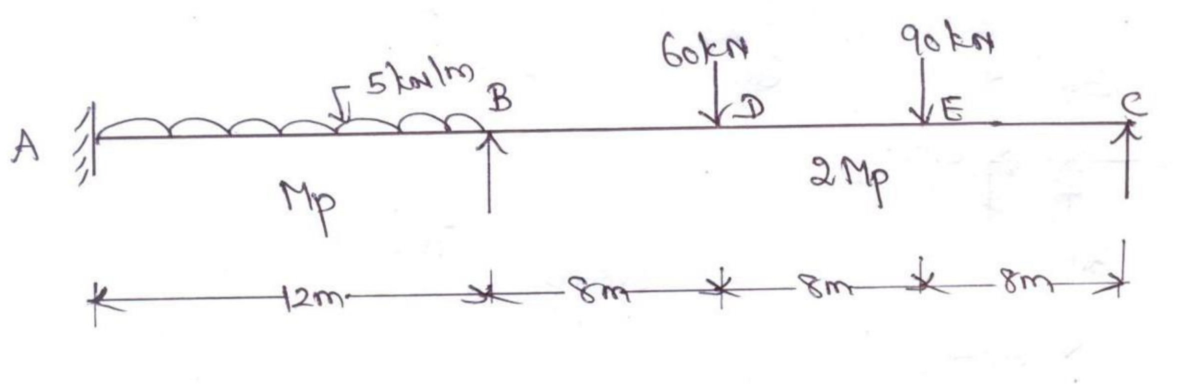
2.Calculate the shape factor for a triangle a)centroid lying at d/3 from the base of depth'd',andbreadth'b'. b)circular section of dia 'D'.

3.A mild steel I-section 200mm wide and 250mm deep has a mean flange thickness of 20mm and a web thickness of 10mm.Calculate the S.F.Find the fully plastic moment if $\sigma_y$=252N/mm$^2$.

4.Find the shape factor of the I-section with top flange 100mm wide,bottom flange 150mm wide,20mm tk and web depth 150mm and web thickness 20mm.

5.Find the shape factor of the T-section of depth 100mm and width of flange 100mm,flangethickness and webthickness 10mm.

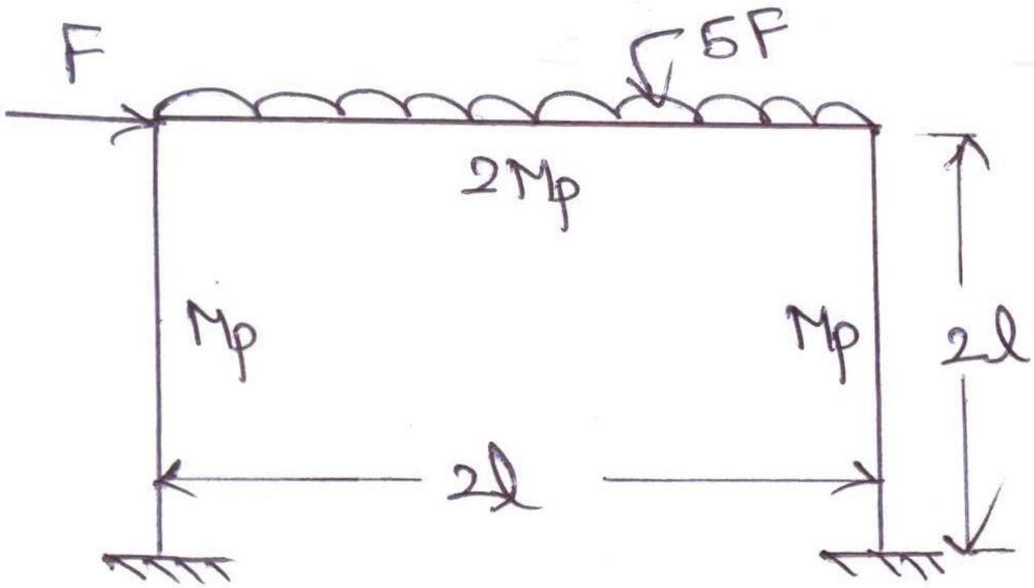
6.Acontinuous beam ABC is loaded as shown .Determine the required $M_p$ if the load factor is3.2.



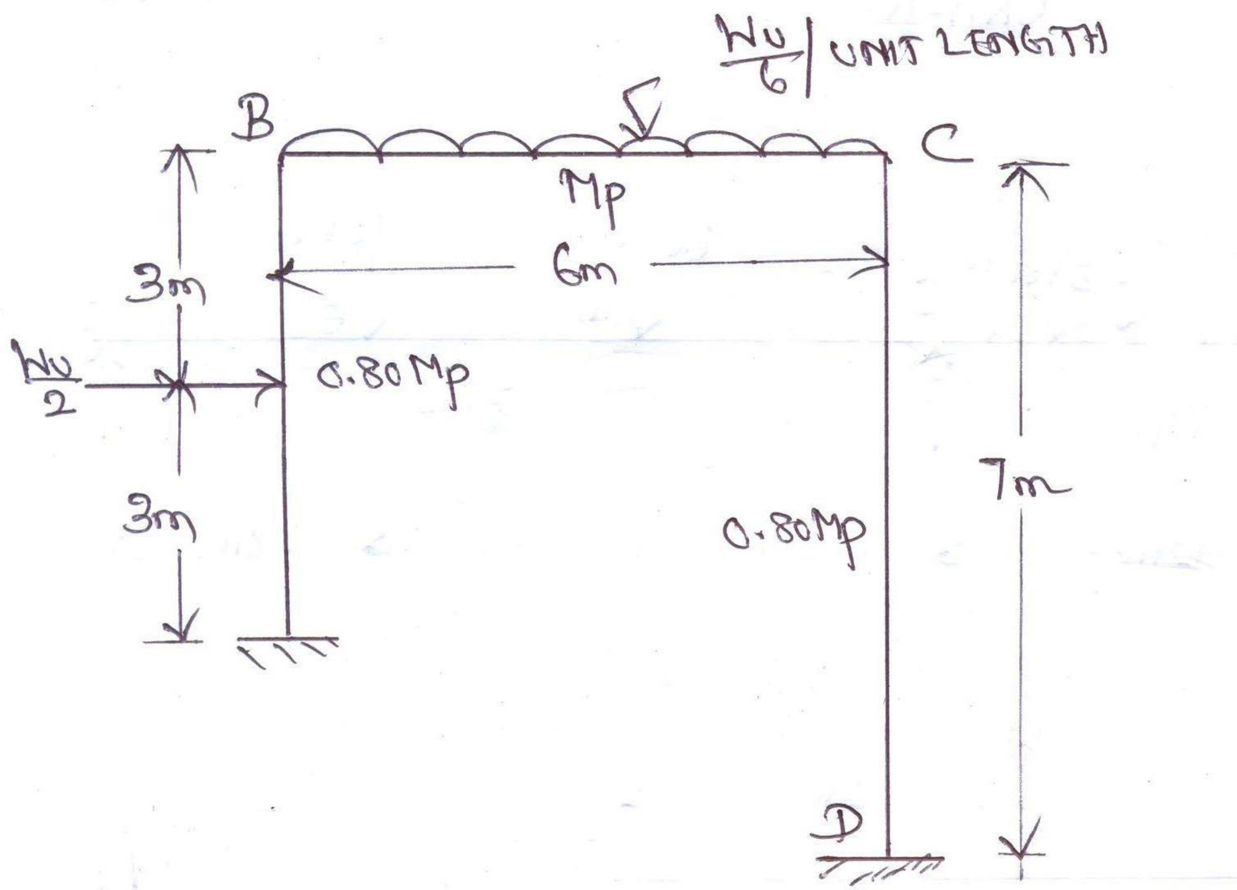

7. A two span continuous beam ABC has span length AB=6m and BC=6m and carries an udl of 30 kN/m completely covering the spans AB and BC.A and C are simple supports.If the load factor is 1.8 and the shape factor is 1.15 for the I-section ,find the section modulus,assume yield stress for the material as 250N/mm².

8. Determinethe collapse load for the frame shown in the diagram,$M_p$ is the same for all members.

9. Find the collapse load for the portal frame loaded as shown.




10 Find the collapse load for the loaded frame loaded as shown.




CABLE AND SPACE STRUCTURES

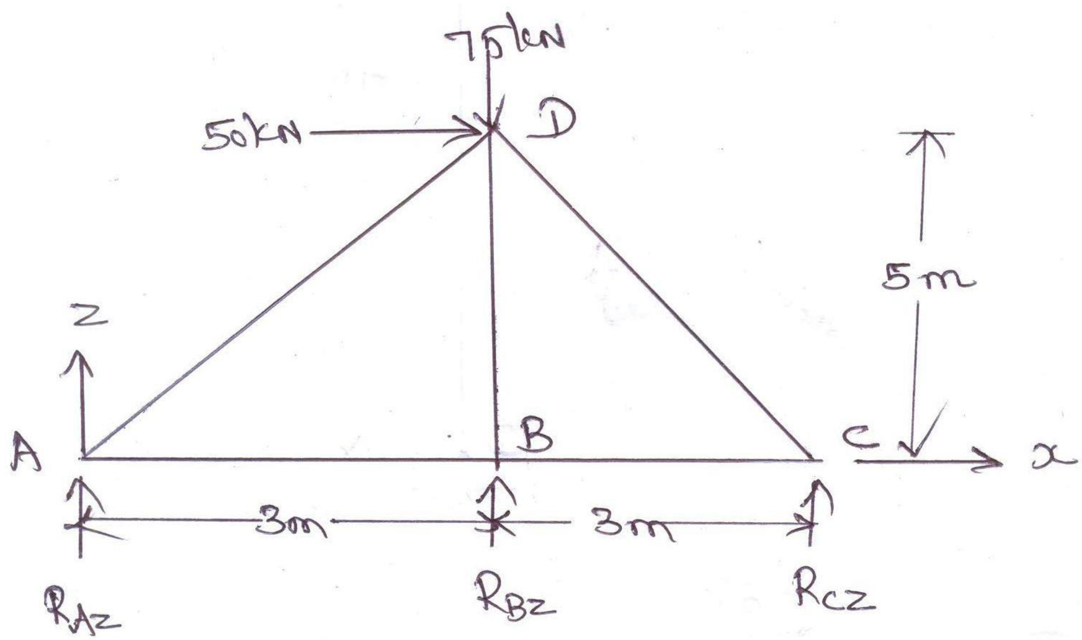
PART-A

1. What are cable structures? Mention its needs.
2. What is the true shape of cable structures?
3. What is the nature of force in the cables?
4. What is a catenary?
5. Mention the different types of cable structures.
6. Briefly explain cable over a guide pulley.
7. Briefly explain cable over saddle.
8. What are the main functions of stiffening girders in suspension bridges?
9. What is the degree of indeterminacy of a suspension bridge with two hinged stiffening girder?

10. Differentiate curved beams and beams curved in plan.
11. Differentiate between plane truss and space truss.
12. Define tension coefficient of a truss member.
13. What are curved beams?
14. What are the forces developed in beams curved in plan?
15. What are the significant features of circular beams on equally spaced supports?
16. Give the expression for calculating equivalent UDL on a girder.
17. Give the range of central dip of a cable.
18. Give the expression for determining the tension in the cable.
19. Give the types of significant cable structures
20. Give examples of three hinged stiffened girder.
21. What are the methods available for the analysis of space truss?

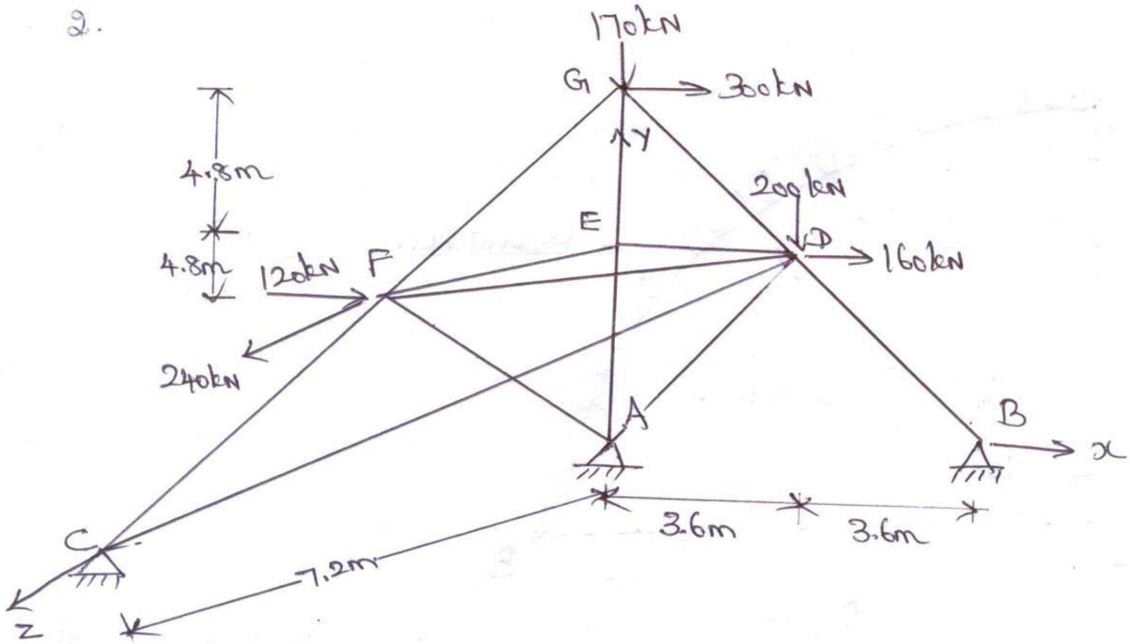
PART-B

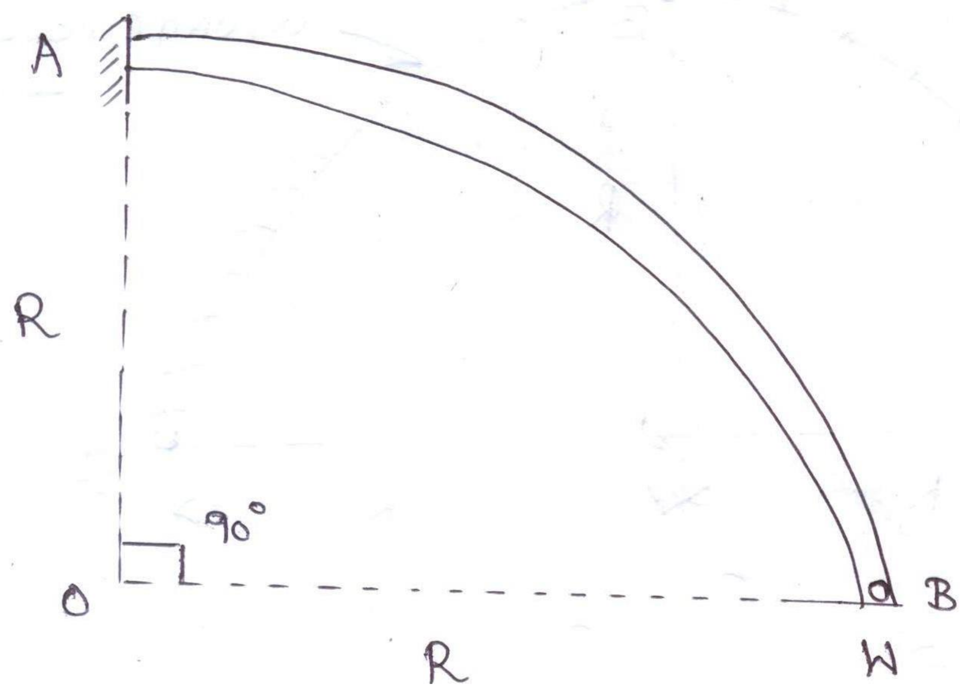
1. Using the method of tension coefficients,analyse the space truss shown in the figure and find the forces in the members of the truss.



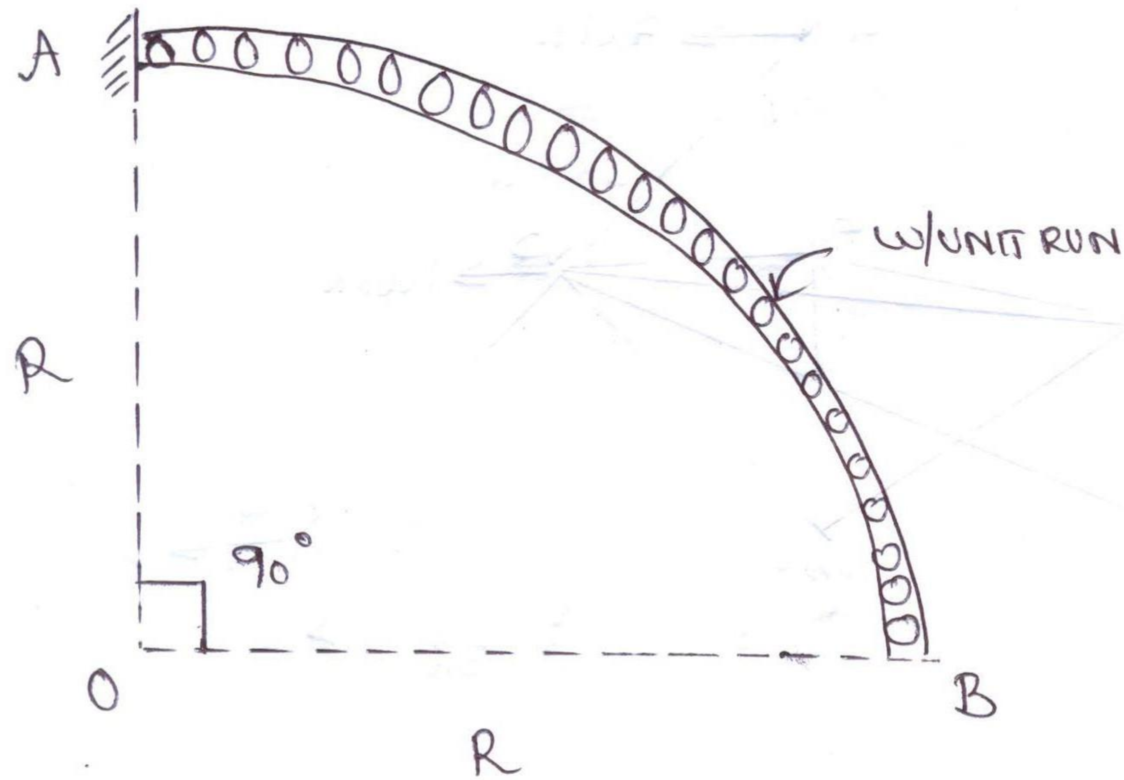

2. Analyse the space truss shown in the figure by the method of tension coefficients and determine the member forces.

2.

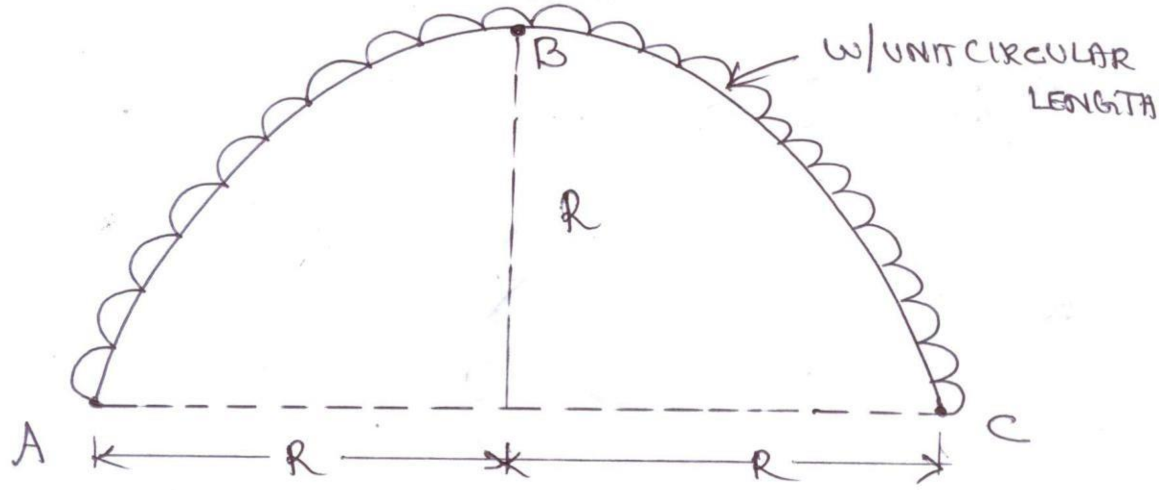

170kN
G
300kN
y
4.8m
200kN
E
D
160kN
4.8m
120kN
F
240kN
A
B
x
3.6m
3.6m
C
7.2m
z

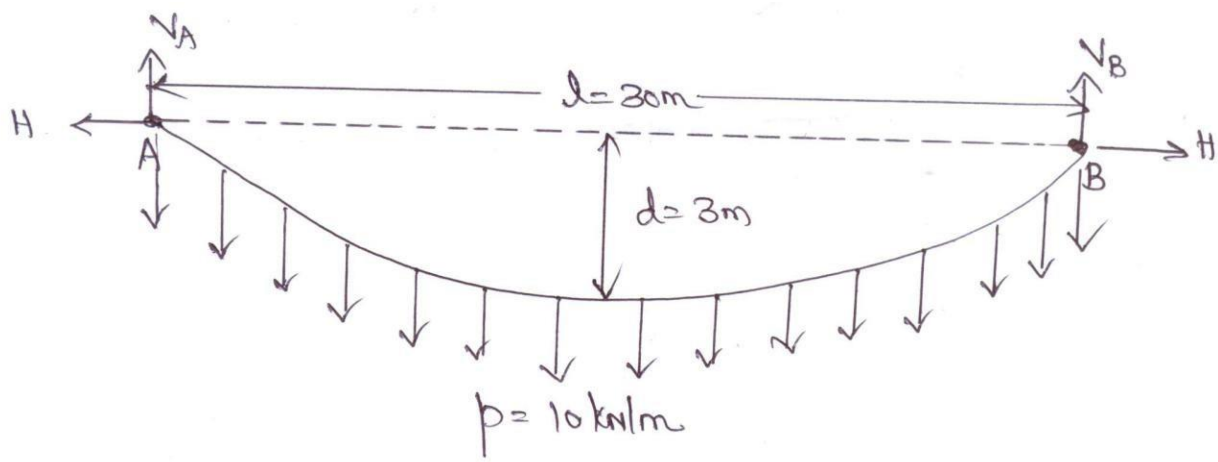

A
R
90°
O
B
R
W

3. A curved beam AB of uniform cross section is horizontal in plan and in the form of a quadrant of a circle of radius R .The beam is fixed at A and free at B.It carries auniformly distributed load of w/unit run over the entire length of the beam as shown.Calculate the shear forces,bending moment and Twisting moment value,atAand B and sketch the variations of the same.Also determine the deflection at the free end B.




4. Diagram shows a curved beam,semi-circular in plan and supported on three equallyspaced supports.The beam carries a uniformly distributed load of w/unit of the circular length.Analyse the beam and sketch the bending moment and twisting moment diagrams.




7.A suspension bridge of 250m span has two nos of three hinged stiffening girdness supported by cables with a central dip of 25m.If 4 point load of 300kN each are placed at the centre line of the roadway at 20,30,40 and 50m from the left hand hinge, find the shear force and bending moment in each girder at 62.5m from each end.Calculate also the maximum tension in the cable.

8.A suspension cable is supported at 2 points 25m apart .The left support is 2.5m above the right support.The cable is loaded with a uniformly distributed load of 10kN/m throughout the span.The maximum dip in the cable from the left support is 4m.Find the maximum and minimum tensions in the cable.

9.A suspension cable of 75m horizontal span and central dip 6m has a stiffening girder hinged at both ends. The dead load transmitted to the cable including its own weight is 1500kN.The girder carries a live load of 30kN/m uniformly distributed over the left half of the span.Assuming the girder to be rigid,calculate the shear force and bending moment in the girder at 20m from the left support.Also calculate the maximum tension in the cable.

10.A suspensioncable has a span of 120m and a central dip of10m is suspended from the same level at both towers.The bridge is stiffened by a stiffening girder hinged at the end supports.The girder carries a single concentrated load of 100kN at a point 30m from left end.Assuming equal tension in the suspension hangers. Calculate

i) the horizontal tension in the cable

ii) the maximum positive bending moment.