I-I

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Code: CE 101 — Course Title: Engineering Mechanics I
Full Marks: 100 (=10×10) — Time: 3 Hours

There are fourteen (14) questions. Answer any ten (10)

1. In the fig:1 below, calculate the resultant (magnitude and direction) of the following coplanar concurrent force system.

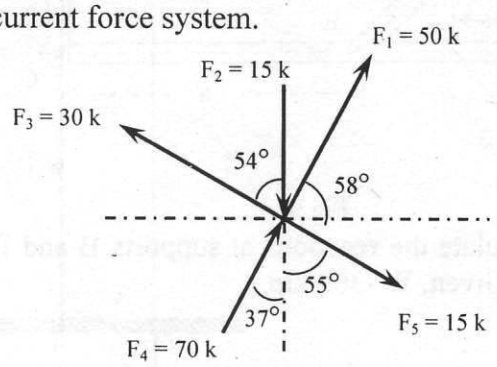

Fig :1

2. In the fig :2 below, a chord supported at A and B carries a load of 20 kN at D and a load W at C. Find the value of W so that CD remains horizontal.

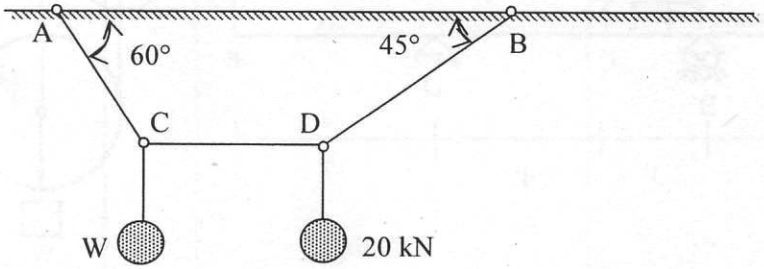

Fig :2

3. Three spheres 1, 2 and 3 are at equilibrium as shown in Fig. 3 below. $W_1 = 60$lb, $W_2 = 150$ lb and $W_3 = 30$ lb. Find the reaction at F

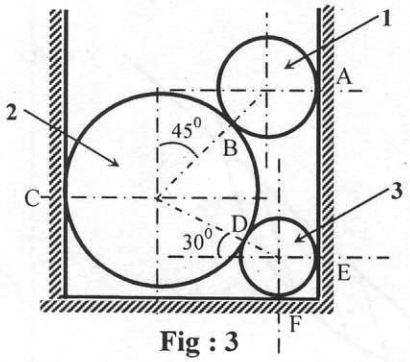

Fig : 3

4. In the fig: 4 below determine support reactions at A & B and all other internal pins. Identify two-force members and determine the forces in those members. Assume all the members of the framework are weightless.

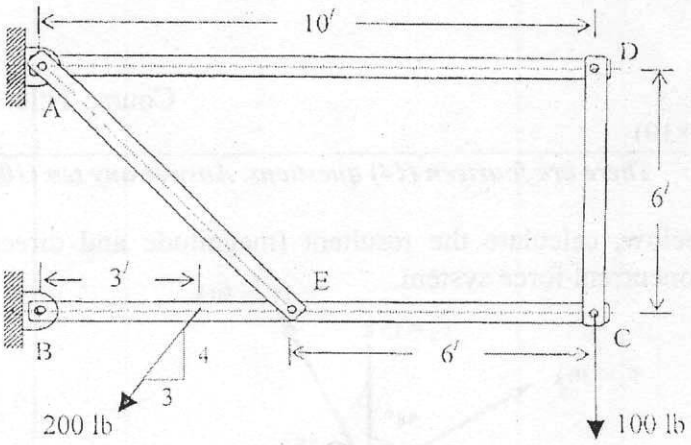

Fig :4

5. In the fig: 5 shown below calculate the reactions at supports B and D and the shear force and bending moment at C. Given, W=300 kip.

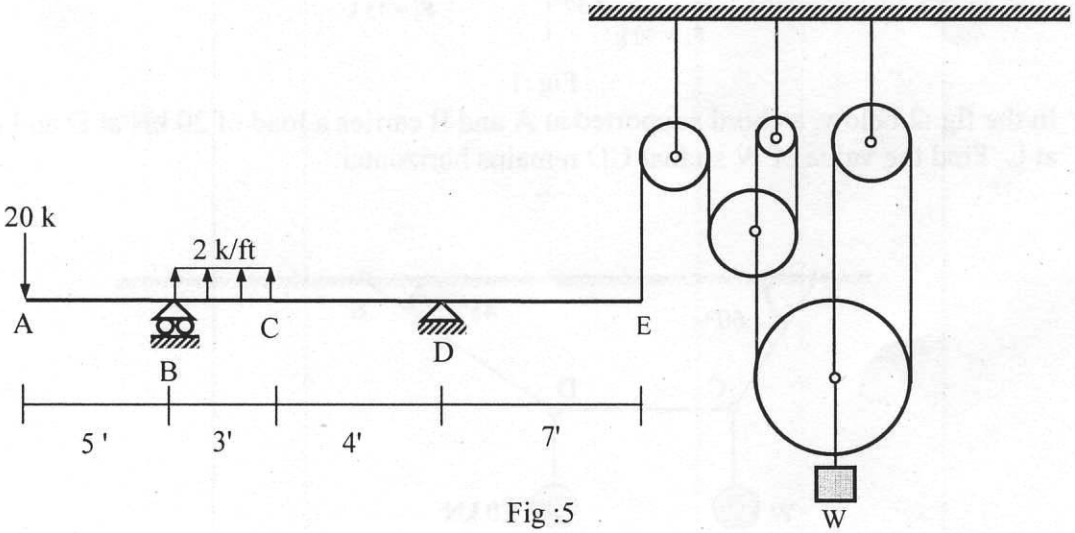

Fig :5

6. In the fig: 6 below, find the co-ordinates of the centroid of the area bounded by $y = ax$ and $y = bx^2$.

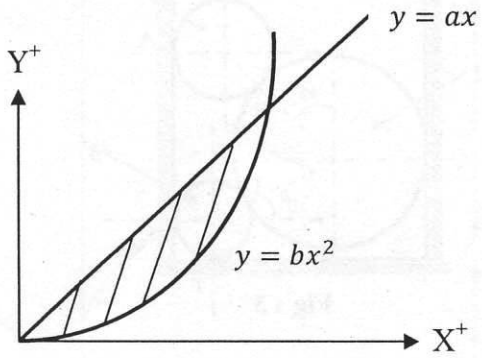

Fig :6

7. Determine the centroid of the shaded area shown in Fig.7.

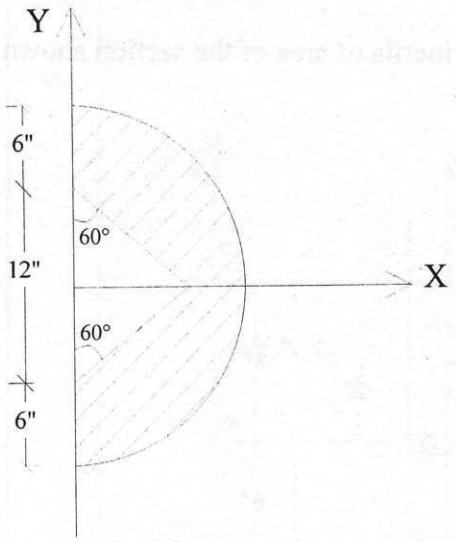

Fig. 7

8. Compute I_x and I_y for the shaded area shown in the fig: 8 below.

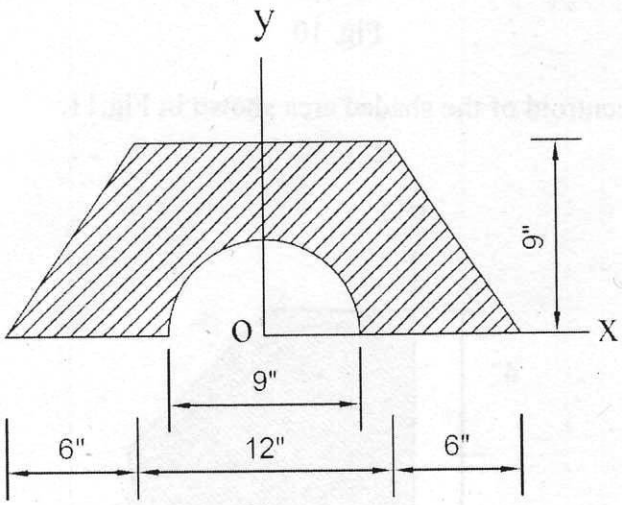

Fig. 8

9. In designing a beam, the moment of inertia of a section of the beam about a centroidal axis is needed. Find the moment of inertia of the T-section shown in fig 9 about a centroidal axis parallel to MN.

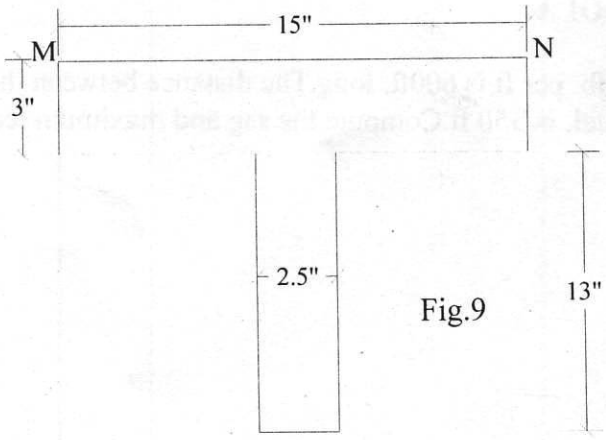

Fig.9

10. Find the centroidal moment of inertia of area of the section shown in Fig.10.

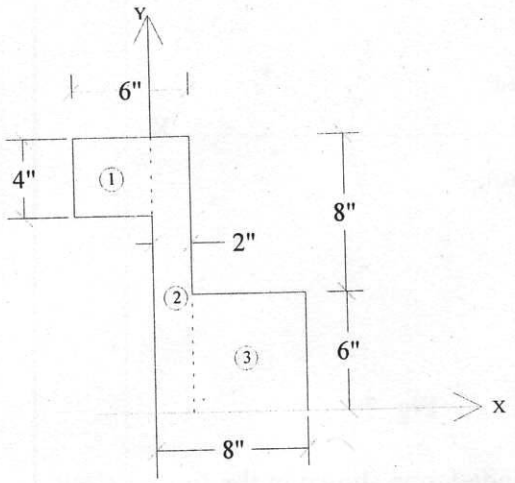

Fig. 10

11. Determine the centroid of the shaded area shown in Fig.11.

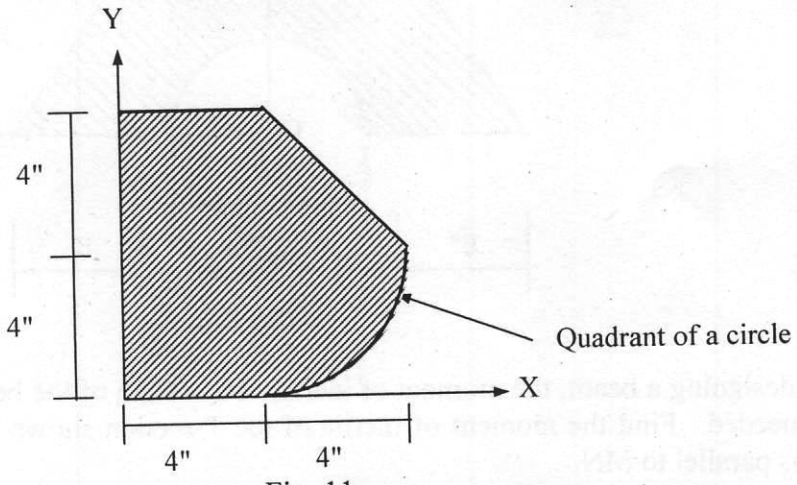

Fig: 11

12. a) Prove that the shape of a flexible chord loaded by uniform loading per unit of horizontal span length is **PARABOLA.**

b) A cable weighing 2 lb. per ft is 600ft. long.The distance between the points of support , which are on a horizontal, is 350 ft.Compute the sag and maximum tension in the cable.

13. For the truss shown in Fig.12, find the forces in the members bl, mc, bc, eq,dp, gf and al.

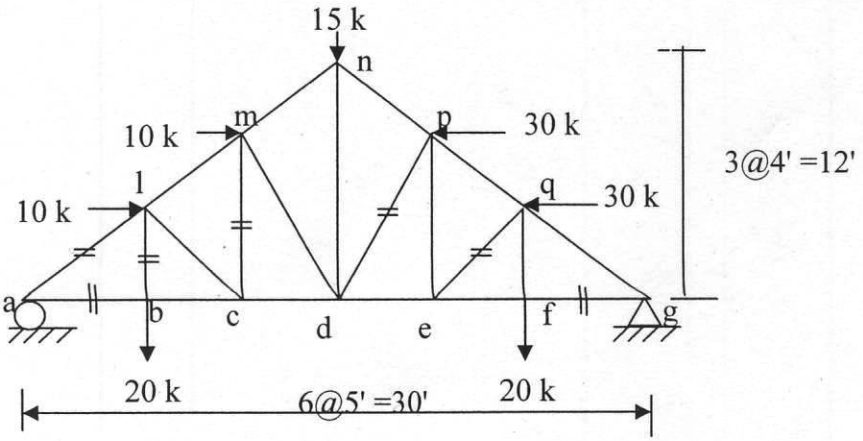

Fig: 12

14. In the fig: 13 shown below, the frictional force F = (0.15)(N). If R is the resultant of W, T, N and F, calculate the magnitudes of N, F and R.

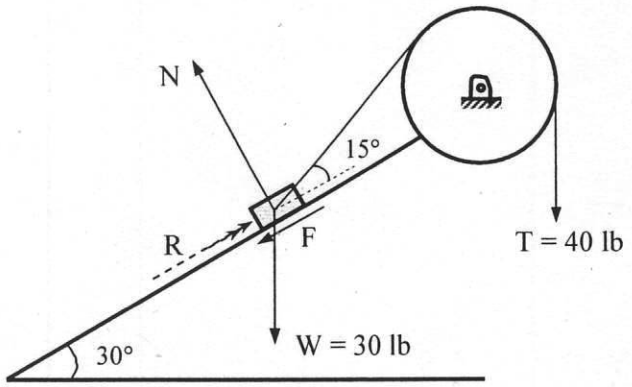

Fig: 13

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*There are **fourteen (14)** questions. Answer any **ten (10)**.*
Assume any missing data reasonably.

1. In the figure-1 below, calculate the resultant (magnitude and direction) of the following coplanar concurrent force system.

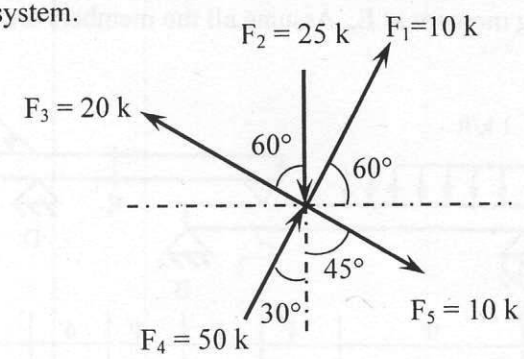


Figure-1

2. In the figure-2 shown below, the frictional force F = (0.15)(N). If R is the resultant of W, T, N and F, calculate the magnitudes of N, F and R.

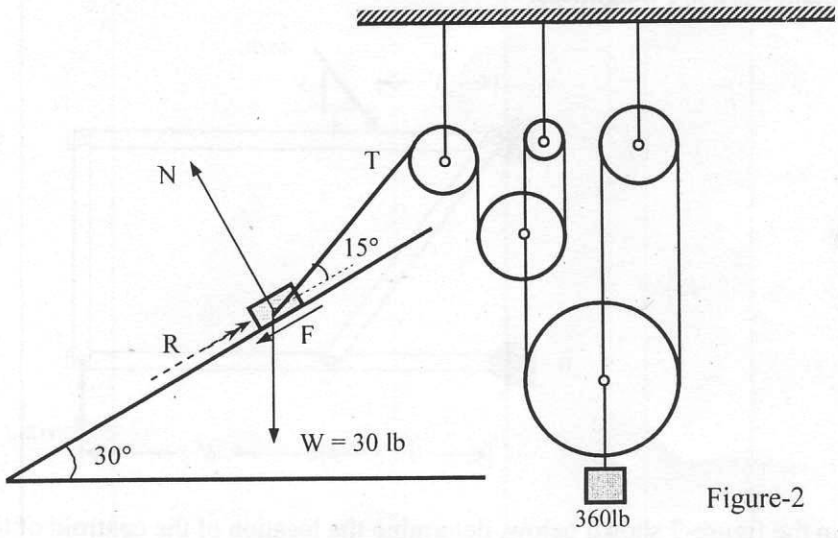


Figure-2

3. Three spheres 1, 2 and 3 are at rest (in equilibrium) against smooth surfaces (frictionless) as shown in the figure-3 below. $W_1 = 60$ lb and $W_2 = 120$ lb and $W_3 = 30$ lb. Find the reactions at A, B, C and D.

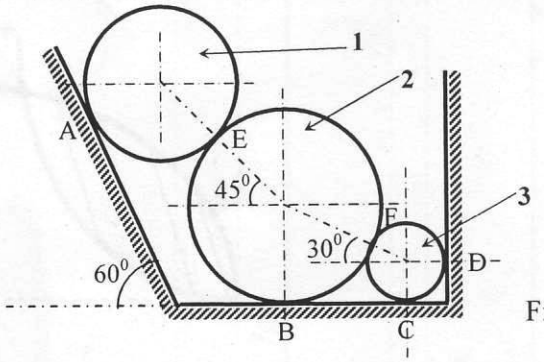


Figure-3

4. In the figure-4 shown below, find W and F_1 so that the cable AB remains horizontal.

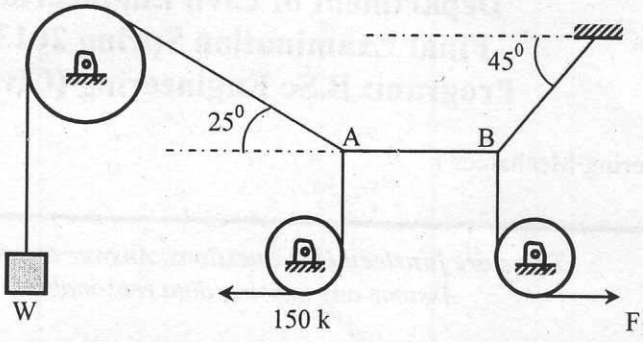


Figure-4

5. In the figure-5 shown below, calculate the reactions at supports A, B and D and also calculate the axial force, shear force and bending moment at E. Assume all the members are weightless.

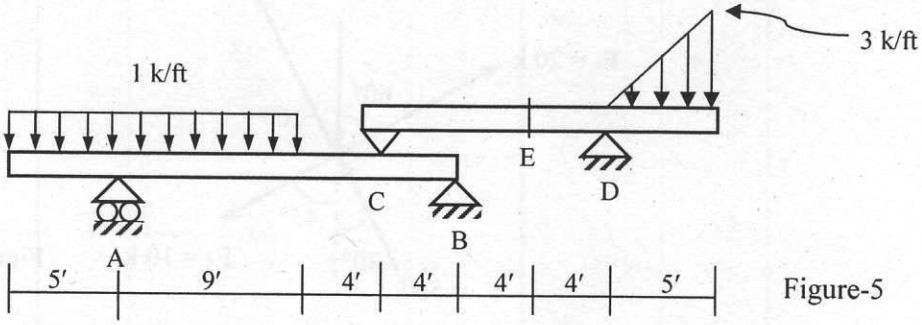


Figure-5

6. In the figure-6 shown below, determine support reactions at A & B and all other internal pins. Identify two-force members and determine the forces in those members. Assume all the members of the framework are weightless.

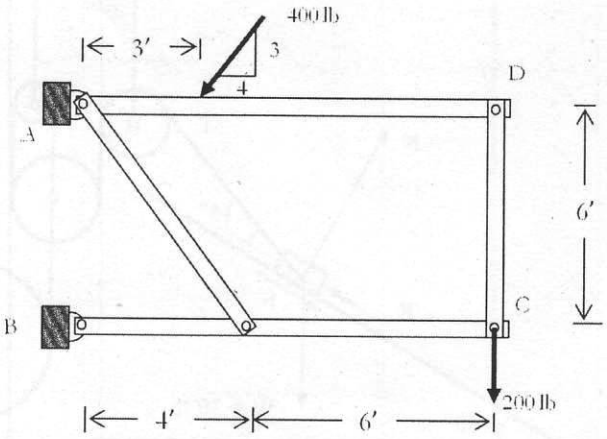


Figure-6

7. In the figure-7 shown below, determine the location of the centroid of the area enclosed by ~~area of~~ the parabola $y^2 = 9x$ and $x^2 = 4y$, where the linear units are in inches.

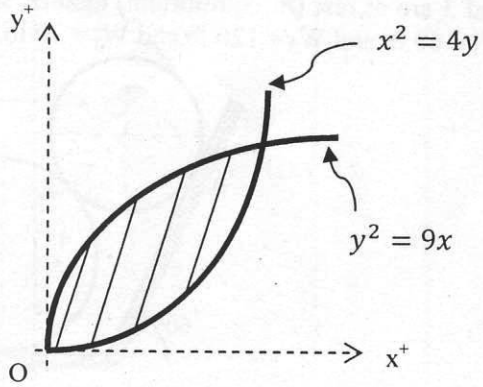


Figure-7

8. In the figure-8 shown below, determine the centroid of the shaded area.

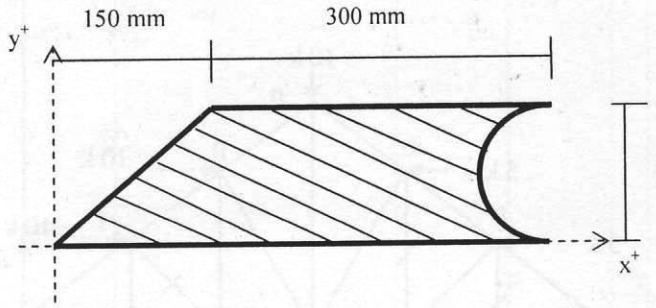


Figure-8

9. a) State the Pappus-Guldinus theorems.
b) Using Pappus-Guldinus theorem, find (i) the surface area and (ii) the volume generated of a cylinder.

10. Compute I_x and I_y for the shaded area shown in the figure-9 below.

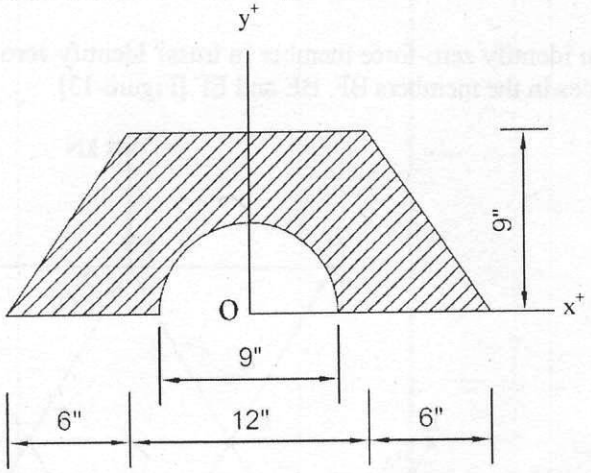
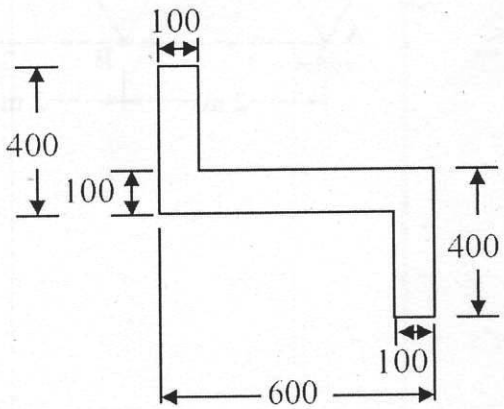


Figure-9

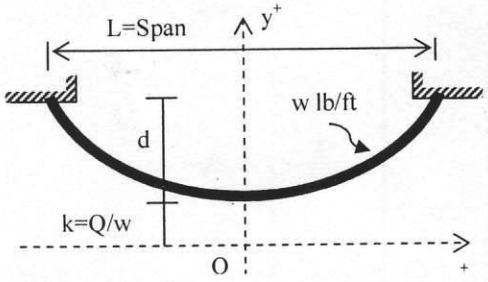
11. In the figure-10 below, determine the moments of inertia of the beam's cross-sectional area about centroidal axes.



Dimension in mm

Figure-10

12. Derive an expression defining the shape of a catenary in cartesian coordinates when the low point of the catenary is a distance $k = Q/w$ above the origin O [figure-11].



Q= Horizontal tension force at the low point of catenary

Figure-11

13. For the truss shown in Figure-12, find the forces in the members bl, mc, bc, eq and fg.

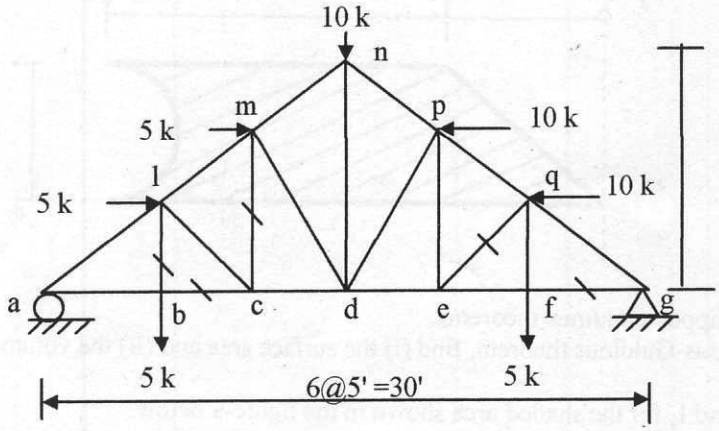
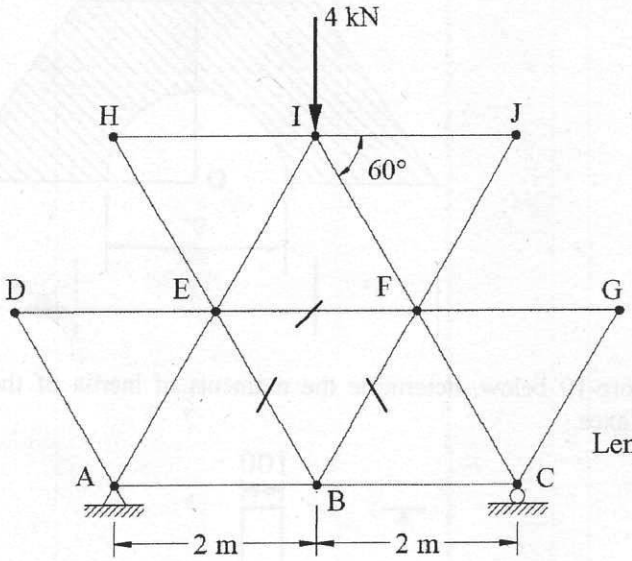


Figure-12

14. How do you identify zero-force member in truss? Identify zero-force member in the following truss and find the forces in the members BF, BE and EF [Figure-13].



Length of each member= 2m

Figure-13