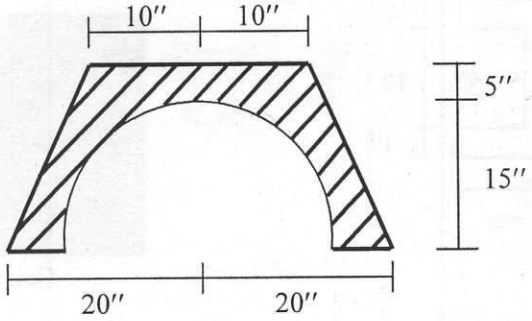
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

A

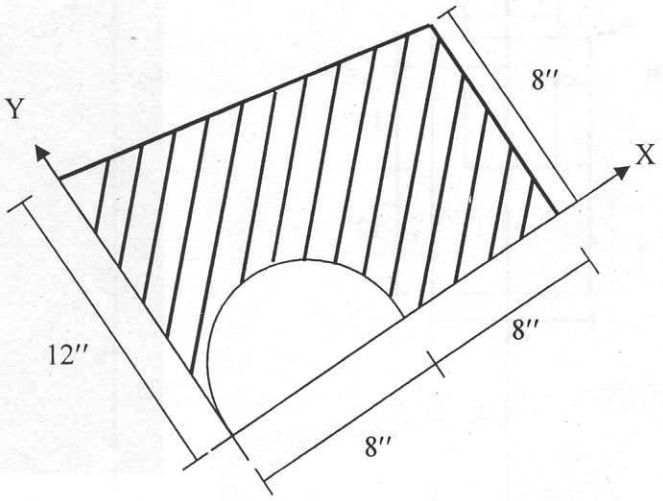
Course Title: Engineering Mechanics I | Course Code: CE 101
Time: 3 hours | Full Marks: 100(= 10 x 10)

[Answer **any 10 (ten)** of the following 14 questions]

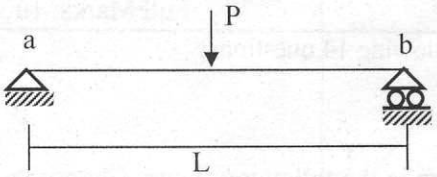
1. Determine the centroid of the shaded area as shown in the following figure. Choose the location and orientation of the axes according to your convenience.

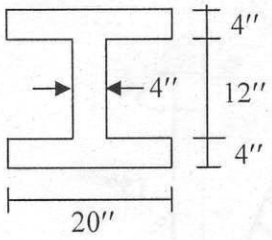


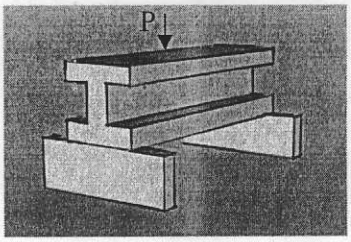
2. Determine the position of center of gravity of the shaded area. The location and orientation of the axes are shown in the figure.



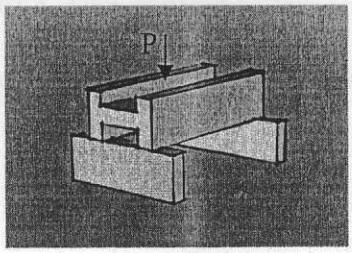
3. Suppose that you will have to transfer a constant vertical load "P" from support "a" to support "b" which are located at "L" distance from each other. You are provided with an "I-section" (dimensions are given in the following figure) to serve the purpose. Two possible orientations are shown in the figure below. Which orientation will you prefer? Why?





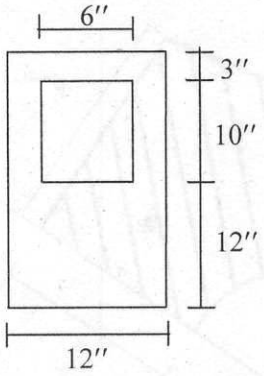


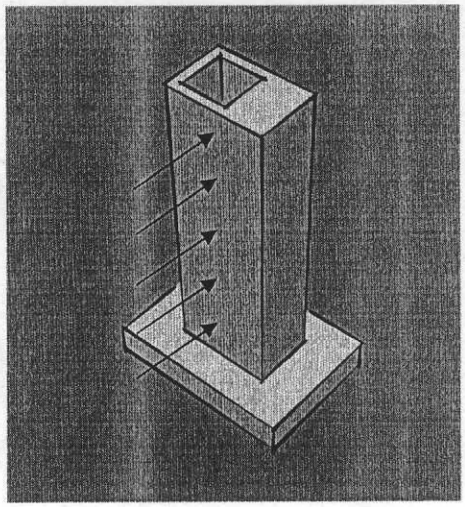
Orientation-1



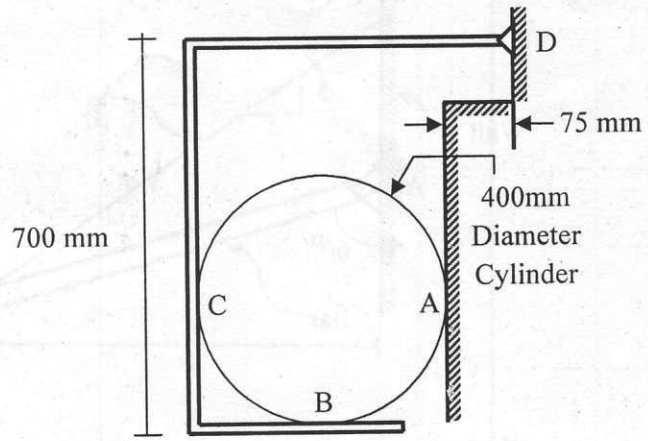
Orientation-2

4. A box-beam is loaded as shown in the following figure. Pay your attention to the direction of applied load. Calculate the moment of inertia that you think is relevant while considering the bending phenomenon of the beam under the load shown.

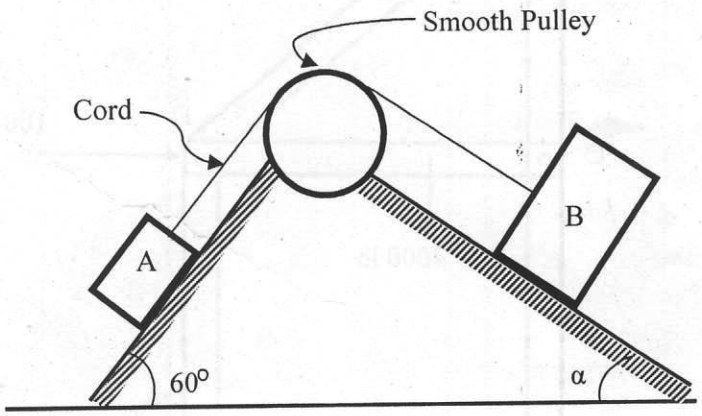




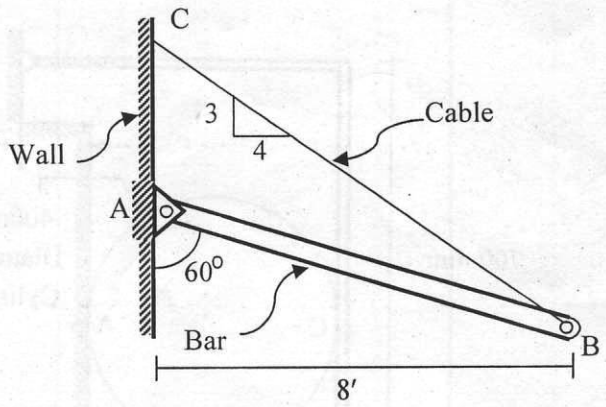
5. A 500 N cylinder is supported by the frame BCD as shown in the following figure. The frame is hinged at D. Determine the reactions a A, B, C and D. Assume all the surfaces to be smooth and also neglect weight of the frame.



6. In the following figure, the bodies A and B weighing 250 N and 320 N respectively rest on smooth inclined planes and are attached to each other by a cord (which passes over a smooth pulley). Determine the values of the angle "α" and the reactions at the inclined planes, if the bodies are in equilibrium.



7. A bar of weight 1000 lb (pound) is hinged to a vertical wall at A and supported by a cable as shown in the following figure. Determine the components of pin reactions at A and C.

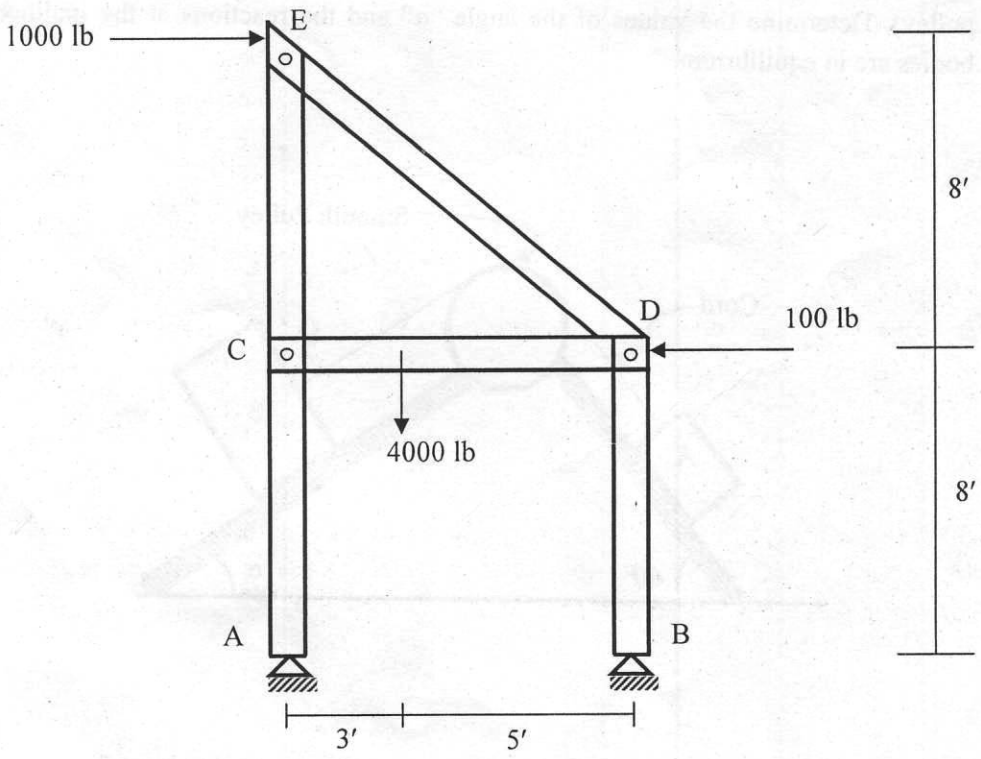


8. The frame shown in the following figure consists of two vertical members AE and BD, a horizontal member CD and an inclined member DE. All the members have been assumed to be weightless.

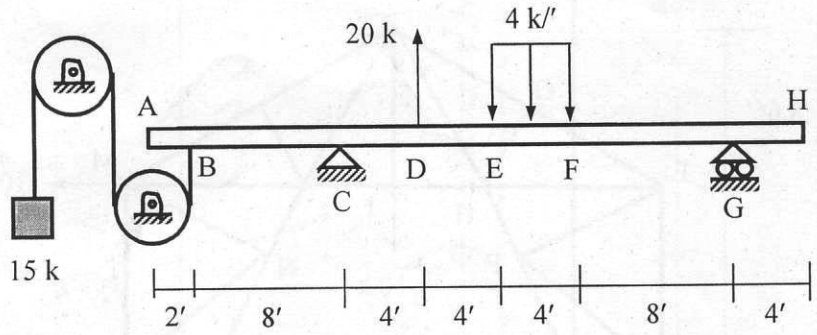
i) Identify the two force member(s)

ii) Calculate the components of pin reactions at A

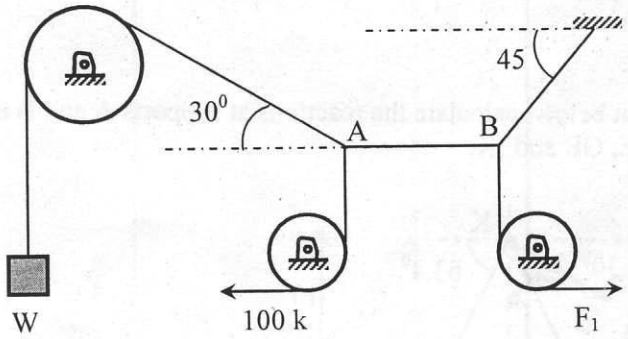
iii) Determine the axial force in the two force member(s)



9. For the simply supported beam shown in the following figure, determine the reactions at the supports. Also calculate the magnitudes of shear force and bending moment at F.



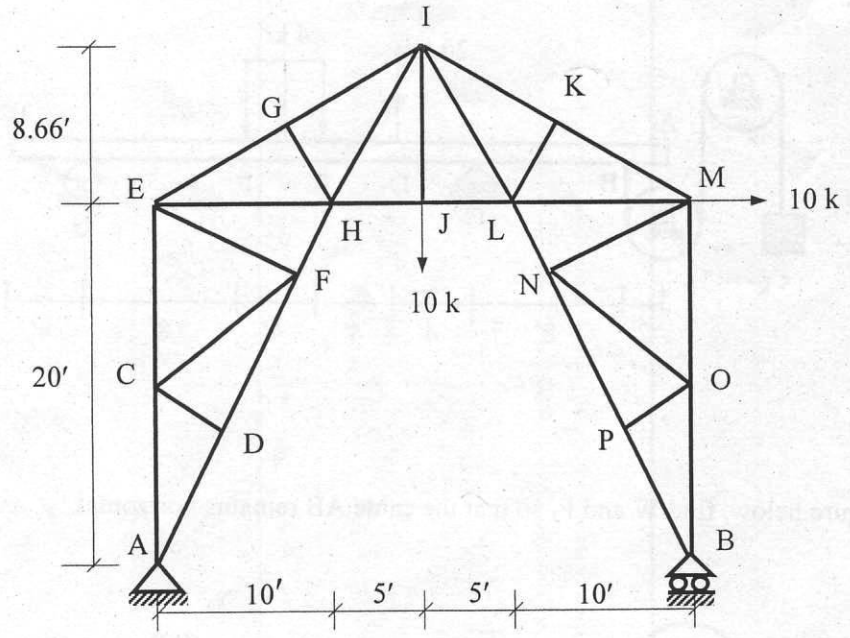
10. In the figure below, find W and F_1 so that the cable AB remains horizontal.



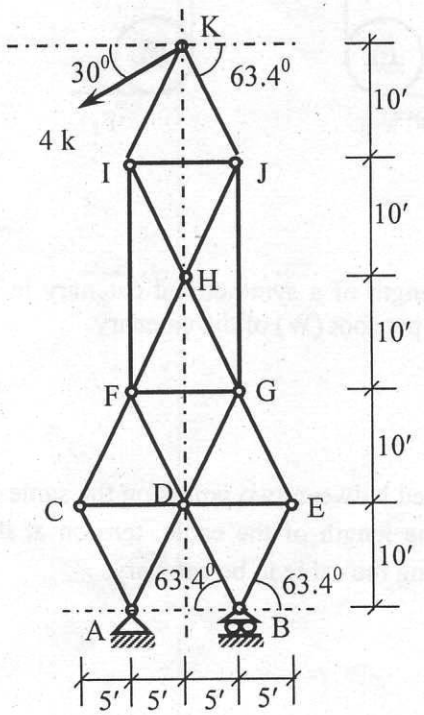
11. Derive the expression for the total length of a symmetrical catenary in terms of tension at low point (Q), span length (L) and weight per foot (W) of the catenary.

12. A cable weighing 2.5 lb/ft is suspended between two points on the same elevation with a span of 300 ft and sag of 30 ft. Calculate the length of the cable, tension at the lowest point and the tension at the support reaction assuming the cable to be catenary.

13. In the truss shown below, distinguish the zero-force members (without showing any calculations), compute the external reactions at the supports and the forces in the members PB, GI and HJ.



14. In the truss shown below, calculate the reactions at supports A and B and the forces in the members BD, DE, GE and IK.



B

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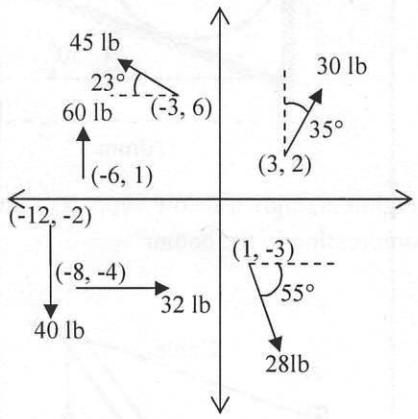
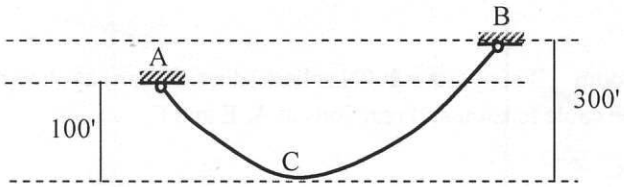
[Answer **any 10 (Ten)** of the following **14** questions]

1. Find the magnitude, direction and position of the resultant of the following force diagram.

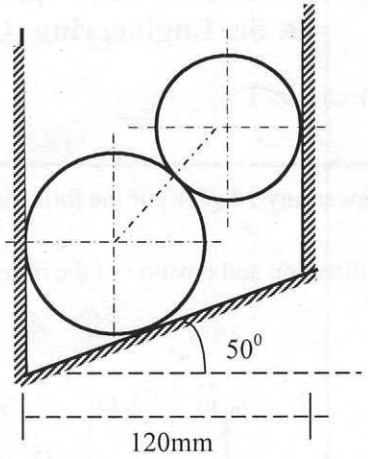


2. A 0.75" (dia) steel wire is supported between two supports as shown below. Tension measured in lower supported is 15kip.Determine the-
(a)Tension at upper support
(b)Total length of the cable
(c) Horizontal distance between the supports
(Assume **catenary**)

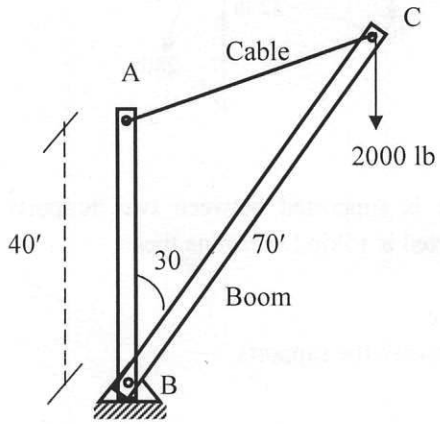


3. Derive the expression for the total length of a catenary cable in terms of horizontal length L, horizontal bottom tension Q and weight W.

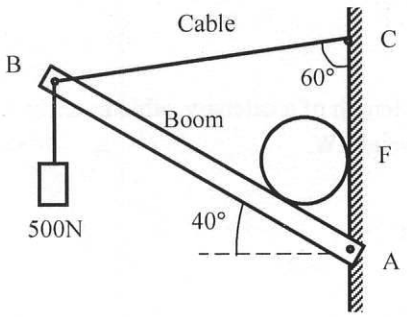
4. The system shown below is in equilibrium. The upper sphere weighing 50N has a diameter of 50mm and the lower sphere weighing 200N has a diameter of 100mm. Determine the wall reactions.



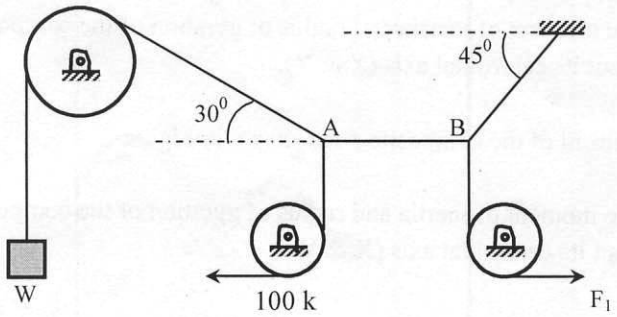
5. A derrick (assume weightless) shown below supports a load of 2kip. Find the tension in the boom cable and the compression in the boom.



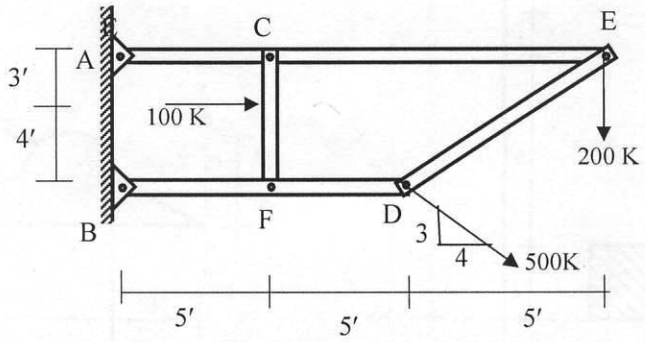
6. A 5m long Boom AB supports a 200N sphere (dia=300mm) as shown in the figure below. Determine the cable tension and reactions at A, E and F.



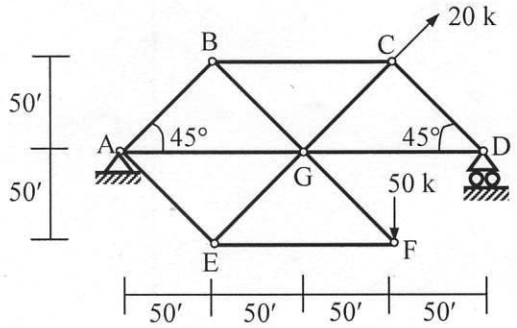
7. In the figure below, find W and F_1 so that the cable AB remains horizontal.



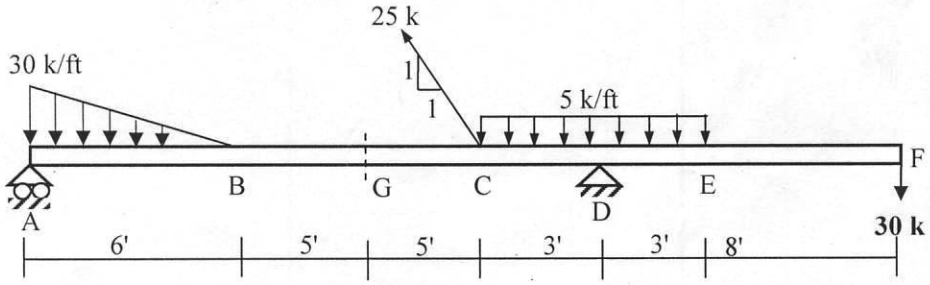
8. For the Frame shown below, calculate the reaction at A and B. Also find the bar force of two force members.



9. In the truss shown below, calculate the reactions at supports A and D and forces in members BC, CG and EF.



10. Determine the support reactions at **A** and **D** of the beam shown in the figure below. Also calculate the axial force, shear force and bending moment at point **G**.



11. Find the centroid of the following composite Area shown in Figure-1.

12. Calculate the moment of inertia and radius of gyration of the composite area shown in Figure-1 about its centroidal axis (X & Y).

13. Find the centroid of the composite Area shown in Figure-2.

14. Calculate the moment of inertia and radius of gyration of the composite area shown in Figure-2 about its centroidal axis (X & Y).

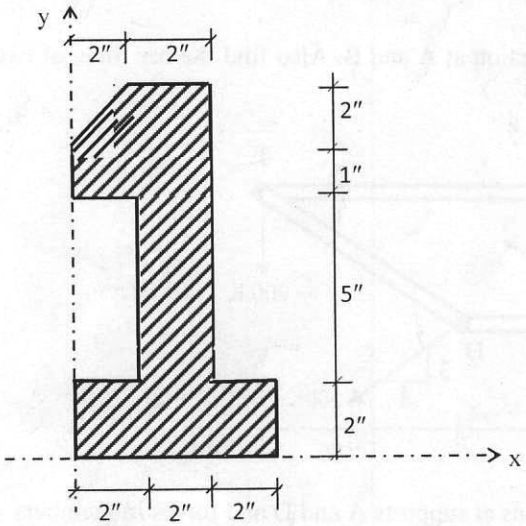


Figure-1

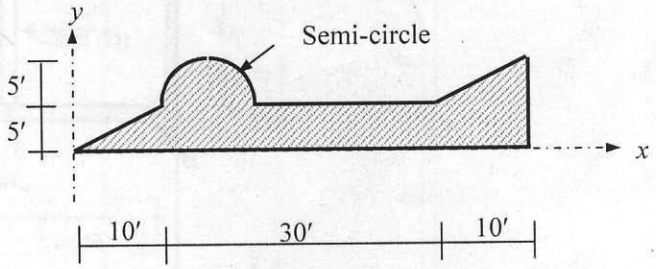


Figure-2