Paper Code: ME-101/EME-102	**Roll No.**									

B TECH
***BACKPAPER* FIRST SEMESTER EXAMINATION, 2016-17**
ENGINEERING MECHANICS

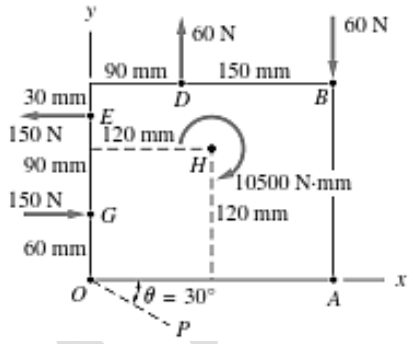
[Time: 3 Hours] [Total Marks: 100]

Note:

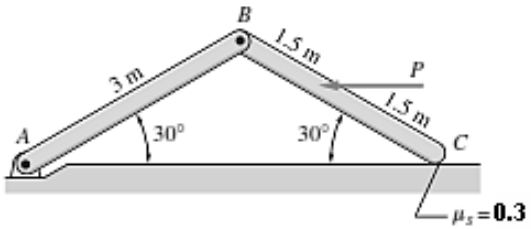
(i) Attempt all questions. All questions carry equal marks.
(ii) Notations/ Symbols/ Abbreviations used have usual meaning.
(iii) Make suitable assumptions, wherever required.

1. Attempt any TWO parts of the following:- **(10x2=20)**

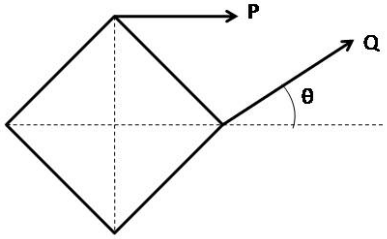
(a) Figure shows a flat plate acted upon by three couples. Replace the three couples with (i) a couple vector, (ii) two forces, one acting along line OP and the other acting at point A and (iii) smallest pair of forces with one force acting at O and other acting at A.



(b) Determine the largest and smallest values of the force *P* for which the system in figure will be in static equilibrium. The homogeneous bars *AB* and *BC* are identical, each having a mass of 50 kg. The coefficient of static friction between the bar at *C* and the horizontal plane is 0.3.

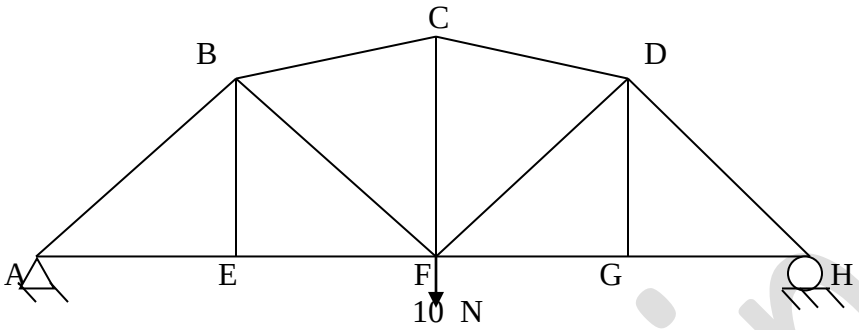


(c) Two forces *P* and *Q* are applied to the corners of a *100 mm²* square plate as shown in figure. Find forces *P*, *Q* and angle θ if resultant of two forces has a magnitude of *140 N*, passing through the centroid of the plate and making an angle of *30°* with positive x-axis.

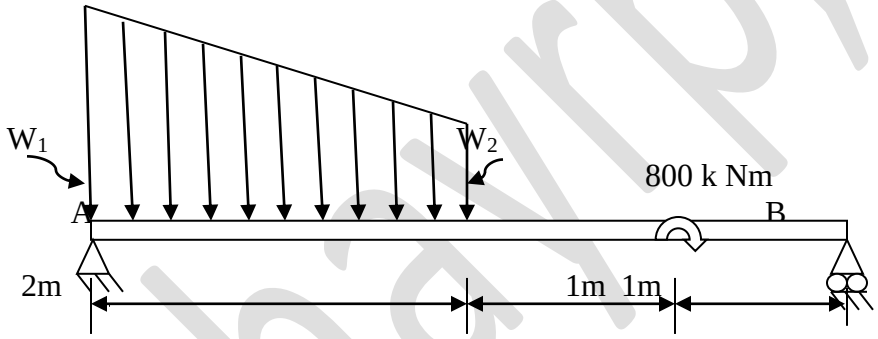


2. Attempt any TWO parts of the following:- **(10x2=20)**

(a) Determine the forces in the members BC, BF and EF of the truss. Take CF=5m and AE=EF=FG=GH=BE=DG=4m.



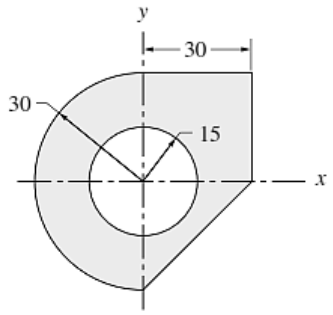
(b) Find the equations for shear force and bending moment for the simply supported beam shown in figure after taking the origin at A (the left end of the beam), then draw the shear force and bending moment diagrams. Take W_1 =800 kN/m and W_2 = 400 kN/m



(c) A beam weighing 10kN A simply supported beam of length 4 m and weighing 40 kN is subjected to an upward concentrated load at mid point of the beam. Find the value of the concentrated load P, such that the bending moment at the point of application of concentrated load is zero. Using this (calculated) value of P, find the expressions for shear force and bending moment for the beam and draw SFD & BMD. Also determine the magnitude and location of maximum bending moment for beam.

3. Attempt any TWO parts of the following:- **(10x2=20)**

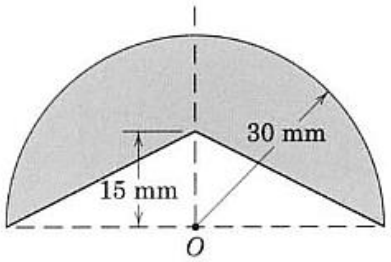
(a) Find area moment of inertia of the planar area about given *x* and centroidalaxes.



Dimensions in mm

(b) Determine the mass moment of inertia of a uniform density sphere of radius R about its centroidal axes using integration method.

(c) Calculate the polar moment of inertia of the shaded area about point O.



4. Attempt any TWO parts of the following:- **(10x2=20)**

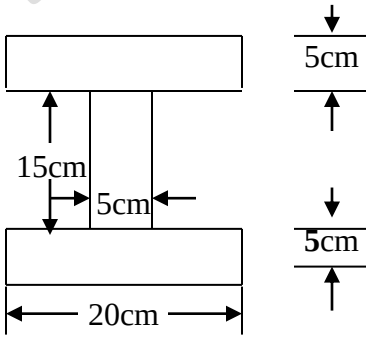
(a) Acceleration of a ship, moving along a straight course, varies directly as the square of its speed. If the speed drops from 3 m/s to 1.5 m/s in one minute, find the distance moved in this period

(b) A car starts from rest on a curved road of 200 m radius and accelerates at a constant angular acceleration of 0.5 m/s². Determine the distance and time which the car will travel before the total acceleration attained by it becomes 0.75 m/s².

(c) A body of mass 30 kg is projected up an incline of 30° with an initial velocity of 10 m/s. The friction coefficient between the contacting surfaces is 0.2. Determine distance travelled by the body before coming to rest.

5. Attempt any TWO parts of the following:- **(10x2=20)**

(a) A simply supported beam of I section (as shown in figure) carries a uniformly distributed load of 10 kN/m over its entire span of 4 m and is also subjected to a concentrated downward load of 100 kN at 1m from left end. Determine the maximum flexural stress in the beam.



(b) A hollow and a solid shaft of same material have the same weight and length. The inner diameter of hollow shaft is half the outer diameter. What will be the torque carried by the hollow shaft if solid shaft carries a torque T for same maximum shearing stress in both the shaft.

(c) Draw nominal stress versus strain and true stress versus strain diagrams for Mild Steel, and discuss the salient points of the curve. Explain the toughness and resilience of a material.