Practice Question Paper for revision
FE, Subject : Engg. Mechanics.

N.B.1. Question No. 1 is Compulsory.   Max marks 80   (3 hrs)
2. Answer any Three more questions out of the remaining Five questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full mark
5. Take g= 9.81m/s^2

Q1a)Three concurrent forces P=150N, Q=250Nand S=300N are acting at 120^0 with each other. Determine their resultant force magnitude and direction with respect to P. What is their equilibrant? [4]

b) Two concurrent forces **P** and **Q** act at **O** such that their resultant acts along x-axis. Determine the magnitude of **Q** and hence the resultant.   [4]
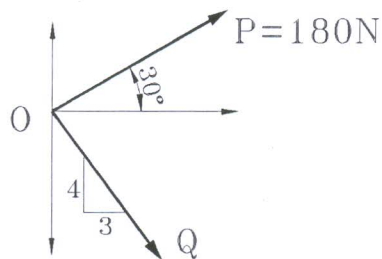

c) Explain the terms i) Coefficient of Static Friction ii) Coefficient of Kinetic Friction
            iii) Angle of Friction   iv) Angle of Repose   [4]
d) A particle travels on a circular path, whose are distance travelled is defined by

S= (0.5t^3 + 5t^2+3t) m. If the total acceleration is 10 m/s^2, at t= 2 sec, find the radius of curvature.
                                                                        [4]

e) A train weighing 500KN , runs at a speed of 36kmph. If the frictional resistance is 100N/KN weight of the train, find the distance it travels before coming to rest.   [4]

Q2 a) Determine the reactions at point of contacts 1, 2 and 3. Assume smooth surfaces.
Mass of cylinder A= 2 kg, mass of cylinder B= 8 kg, radius of A= 1 m, radius of B= 4 m.   [8]
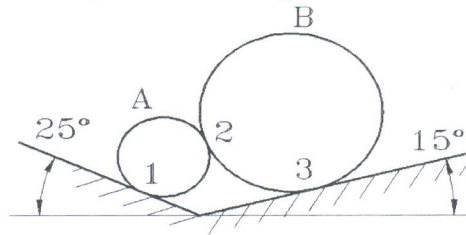

b) The forces acting on 1 m length of a dam are shown in figure. Determine the resultant force acting on the dam. Calculate the point of intersection of the resultant with the base.   [6]
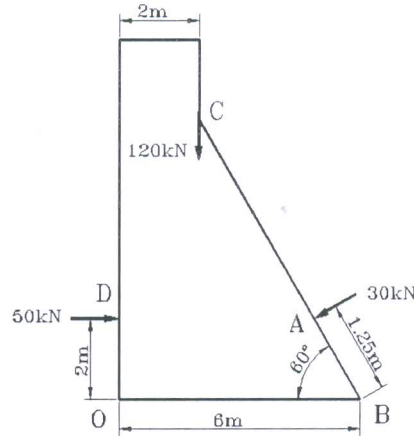
c) Two smooth spheres A and B having a mass of 2 kg and 4 kg respectively collide with initial velocities as shown in the figure. If the coeffecient of restitution for the sphere is e= 0.8, determine the velocities of spheres after collission.   [6]

Q3.a) Determine the Centroid of the shaded area. [8]

60
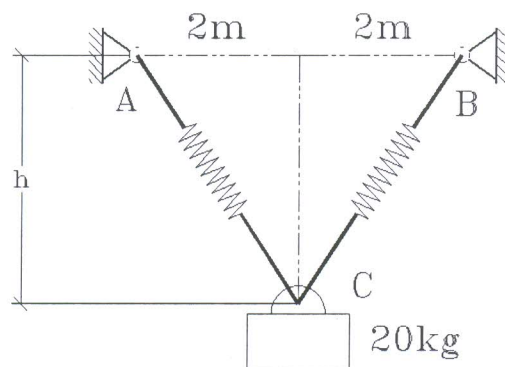
R50

40

35

2kg
A

4kg
B

30°

60°

UA= 2m/s

UB= 4m/s
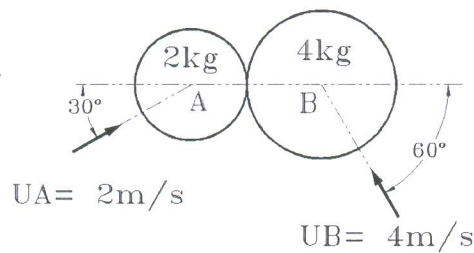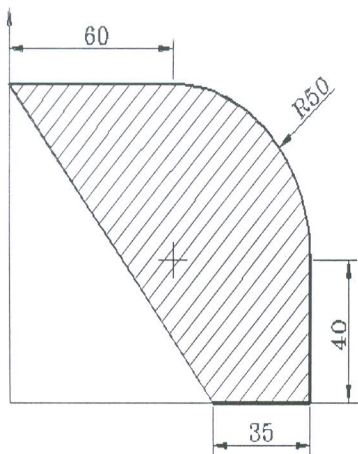
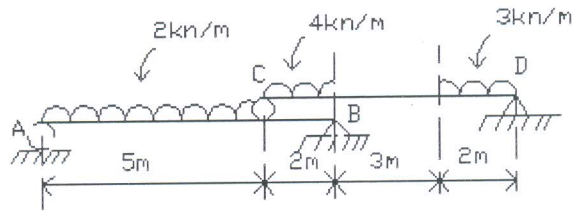b) A force of 1200N acts along PQ, P(4,5,-2) and Q (-3,1,6)m. Calculate its moment about a line joining A(3,2,0) to B(2,2,1)m
[6]

c) A cylinder has mass 20 kg and is released from rest when h= 0, determine the speed when h= 3 m. The spring each have unstretched length of 2 m. Spring constant K= 40 N/m. [6]
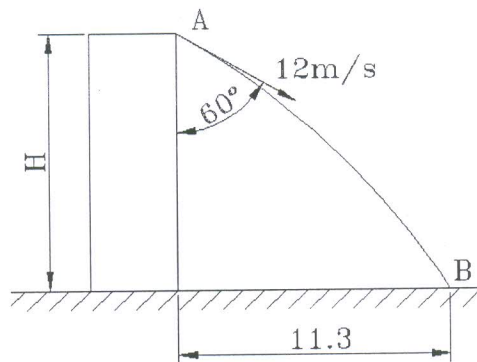

2m   2m

A   B

h

C

20kg

Q4.a Determine the reactions at supports A,B,C and D. [8]

b) A ball thrown with speed of 12 m/s at an angle of 60° with a building strikes the ground 11.3 m horizontally from the foot of the building as shown. Determine the height of the building. [6]
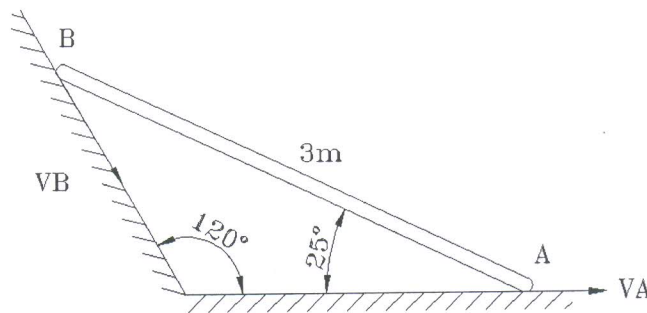

c) A bar AB 3m long slides down the plane. The velocity of end A is 3.6 m/s. Using velocity diagram, determine
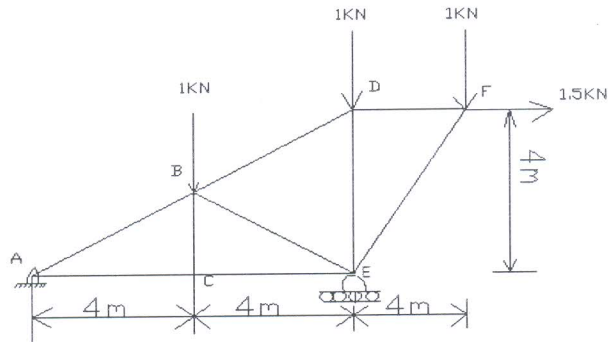
(i) Angular velocity of bar AB

(ii) V_B [6]

Q5.a) Find the magnitude and nature of forces in members BD,BE and CE of the truss by method of section and other members by method of joints. [8]


b) A bar AB is hinged to wall at A. Another bar CD is connected to it by a pin at B such that CB=12cm. and BD=20cm. At the instant shown, (AB is perpendicular to CD) the angular velocities of bar AB is 4rad/sec and that of CD is 6rad/sec both clockwise. Determine the linear velocities of points C and D. [Note:- bar CD is in plane motion.] [6]
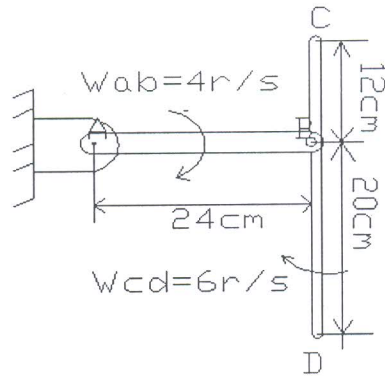
c) A particle moves in a straight line with a velocity-time diagram shown in figure. If S= -25m at t=0, draw displacement-time and acceleration time diagrams for 0 to 24 seconds. [6]
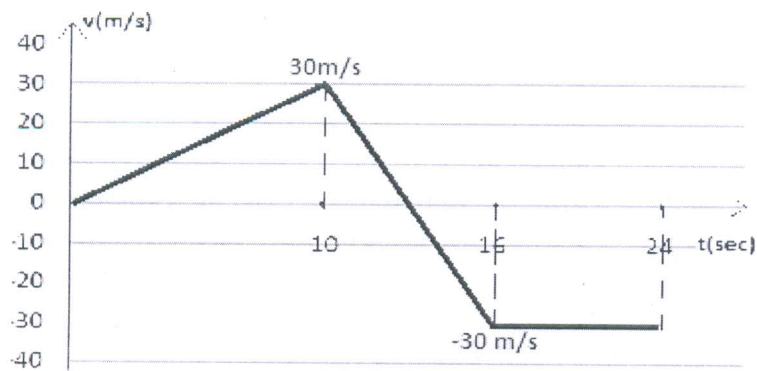
Q6a) What force P must be applied to the weightless wedges shown in figure to start 2000 N block A ? The angle of friction at all contact surfaces are 14°.   [8]
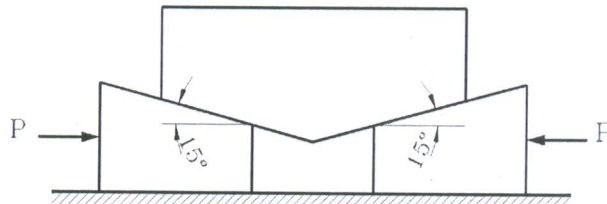
b) A force acts at the origin of a three co-ordinate system, the direction is defined by $\theta_x = 70^0$ and $\theta_z = 58.6^0$. Knowing that the y-component of force is -148 N , determine i) the angle θ_y ii) the x and z components of force.   [4]

c) Two ships leave a port in different directions at the same time. Ship A travels at 36kmph at 10^0 west of north while ship B travels at 45kmph at 60^0 east of north. Find the (i) Relative velocity of ship A with respect to ship B. (ii) Distance between the two ships after 2 minutes. [4]

d) A small block rests on a turn table, 0.7m away from its centre. The turn table, starting from rest, is rotated in such a way that the block undergoes a constant tangential acceleration. Determine the angular velocity of the turn table at the instant when the block starts slipping. $\mu = 0.6$ [4]