

N.B.1. Question No. 1 is Compulsory.

2. Answer any Three more questions out of the remaining Five questions.

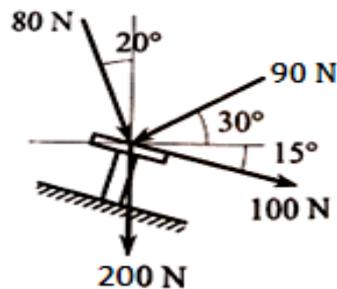
3. Assume any suitable data wherever required but justify the same.

4. Figures to the right indicate full mark

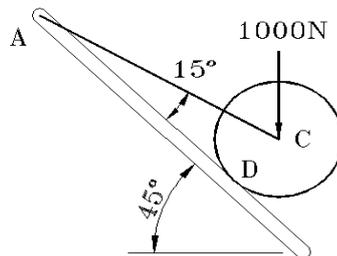
5. Take $g = 9.81 \text{ m/s}^2$

Q1a) Four forces act on a bolt as shown in fig. Find their resultant .

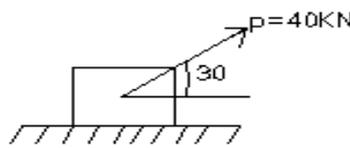
[4]



b) A roller of weight 1000N rests on a smooth inclined plane. It is kept from rolling down the plane by a string AC. Find the tension in the string and the reaction at point of contact D. [4]



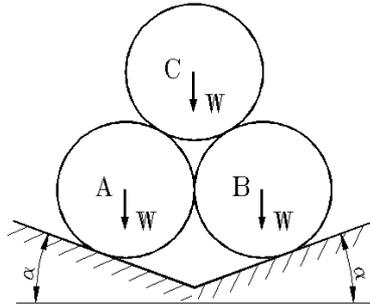
c) A block weighing 100KN is placed on rough horizontal plane. A pull force of 40KN is applied at an angle 30° on it. If the block is just on the point of moving, find the Coefficient of friction. [4]



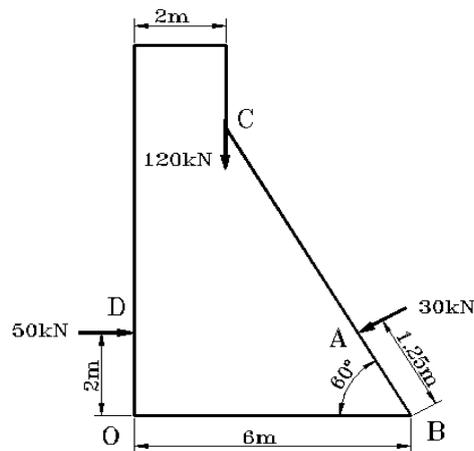
d) A point P moves along a straight line according to the equation $X = 4t^3 + 2t + 5$, [4] where X is in meters, t is in seconds. Determine the velocity & acceleration when $t = 3$ sec.

e) 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]

Q2a) Three identical right circular cylinders *A*, *B* and *C*, each of weight *W* are arranged on smooth inclined surfaces as shown in the figure. Determine the least value of angle α that will prevent the arrangement from collapsing. [8]

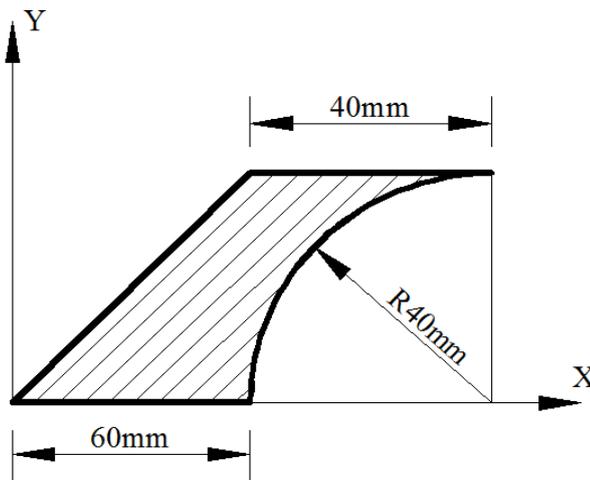


b) The forces acting on 1 m length of a dam are shown in figure. Determine the resultant force acting on the dam. Calculate the point of intersection of the resultant with the base. [6]



c) A boy throws a ball vertically downwards from a height of 1.5m. He wants to rebound it from floor and just touch the ceiling of room which is at a height of 4m from ground. If coefficient of restitution is 0.8. find the initial velocity with which the ball should be thrown. [6]

Q3.a) Determine the Centroid of the shaded area. All dimensions are in mm. [8]



b) Determine the resultant force and resultant moment about point A (3,1,2) of the following force system.

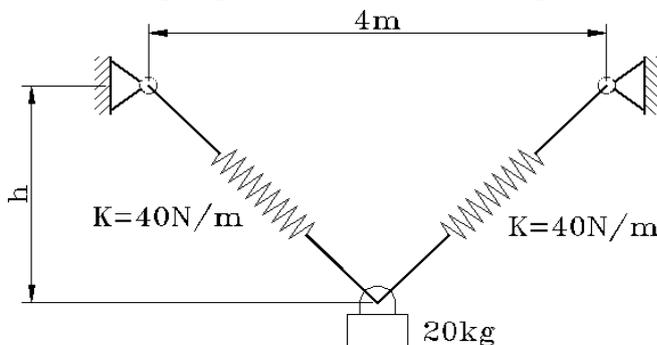
$F_1 = (5i + 8k)$ N acting at point B (8,3,-1) m.

$F_2 = (3i + 2j - 4k)$ N acting at origin.

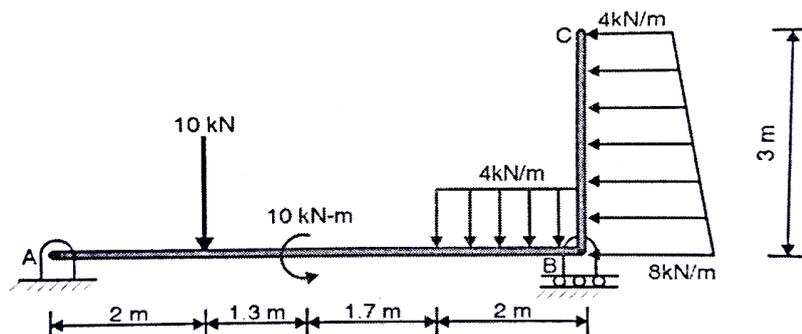
$M = (12i - 20j + 9k)$ N m.

[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 has an un-stretched length of 2 m. [6]

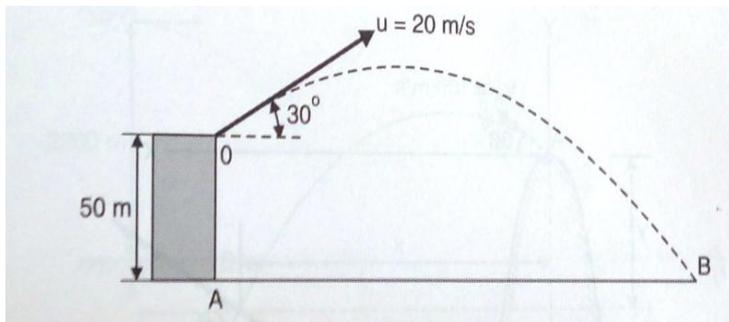


Q4.a) Find support reactions at A and B for the beam loaded as shown in figure. A is hinged and B is roller. [8]



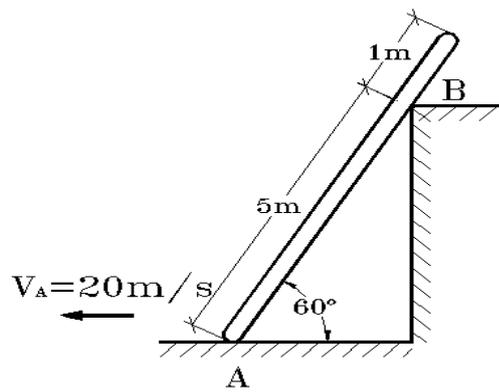
- b) A particle is projected from the top of a tower of height 50 m with a velocity of 20 m/sec at an angle 30 degree to the horizontal. Determine
- Horizontal distance AB it travel from the foot of the tower
 - The velocity with which it strikes the ground at B.
 - Total time taken to reach point B

[6]



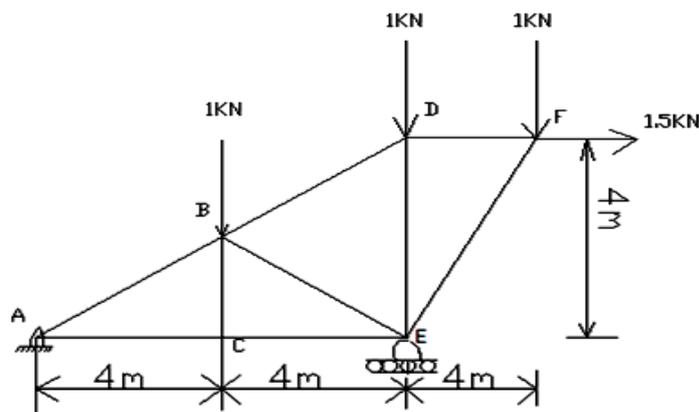
- c) Velocity of point A on rod is 20 m/s at the instant shown in figure. Locate ICR for the rod and determine velocity of point B on the rod.

[6]



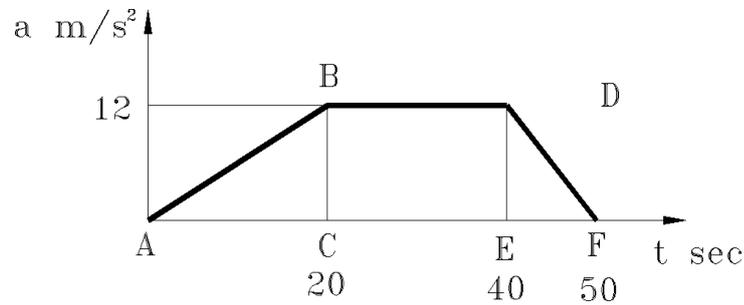
- Q5a) Find the magnitude and nature of forces in members BD, BE and CE of the truss by method of sections and other members by method of joints. Support at A is hinged and support at B is roller.

[8]



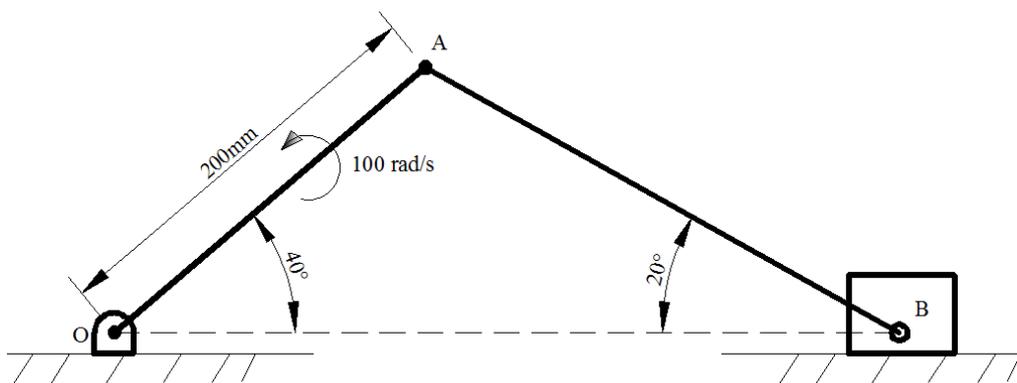
b) Figure below shows a plot of $a-t$ graph for a particle moving along a straight line. Draw $v-t$ graph from 0 to 50 seconds and determine distance covered by the particle at $t=50$ seconds.

[6]



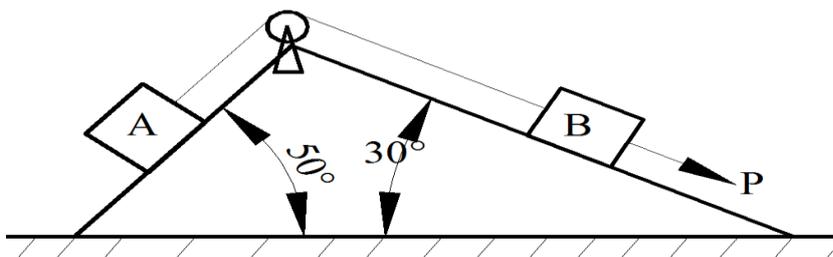
c) A slider crank mechanism is shown in fig. The crank OA rotates anticlockwise at 100rad/s . Find the angular velocity of rod AB & the velocity of the slider at B.

[6]



Q6a) Two blocks A & B of weight 500N & 750N resp. are connected by a cord that passes over a frictionless pulley as shown in fig. the coefficient of friction between the block A & the inclined plane is 0.4 & that between the block B & the inclined plane is 0.3 . Determine the force P to be applied to block B to produce the impending motion of block B down the plane.

[8]



b) Write down the conditions of equilibrium for Forces in Space for

- (i) con-current force system (ii) general force system . [4]

c) A car starts from rest and moves along a circular path having a radius of 20m. Its speed increases at a uniform rate of 0.5 m/s^2 . Find the time from the start and distance travelled when its resultant acceleration becomes 1.5 m/s^2 . [4]

d) Two masses of 5kg & 2kg are positioned over frictionless & mass less pulley as shown in fig. If the 5kg mass is released from rest, determine the speed at which the 5kg mass will hit the ground. [4]

