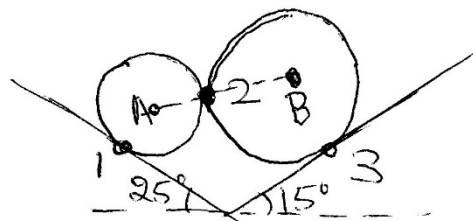


(1) Question No. 1 is compulsory

(2) Attempt any THREE from remaining five questions

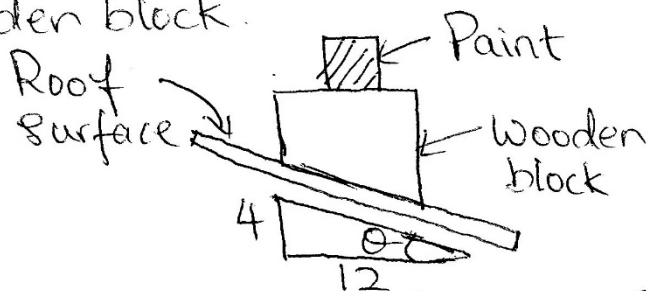
1(a) 3 concurrent forces $P=150\text{N}$, $Q=250\text{N}$, $S=300\text{N}$ are acting at 120° with each other. Calculate resultant force magnitude and direction with respect to P . What is their equilibrant [4]

(b) Find reactions at points 1, 2, 3



Weight of $A=1\text{kg}$ [4]
Weight of $B=4\text{kg}$

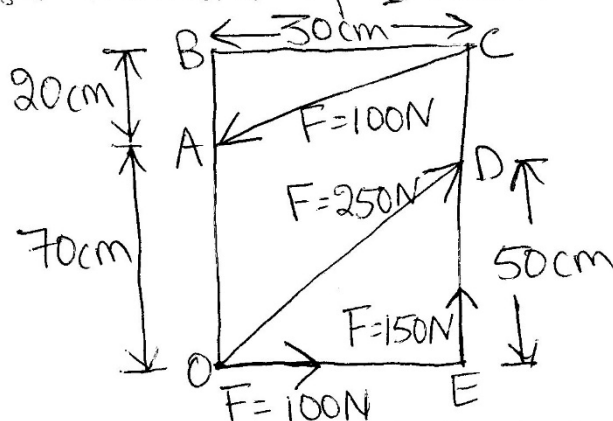
(c) A paint box weighing 9kg is kept on a wooden block of 1.2kg . Calculate magnitude & direction of friction force exerted by roof surface on wooden block & the normal force exerted by roof on wooden block. [4]



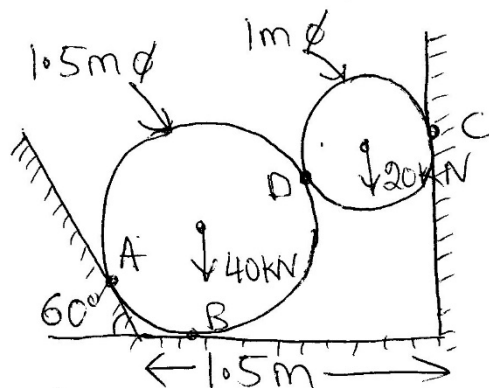
(d) A motorist is travelling at 90kmph , when he observes a traffic signal 250m ahead of him turns red. The traffic signal is timed to stay red for 12sec . If the motorist wishes to pass the signal without stopping just as it turns green. Find (i) The required uniform deceleration of the motor. (ii) The speed of motor as it passes the signal [4]

(e) A sprinter in a 100m race accelerates uniformly for the first 35m and then runs with constant velocity. If his time for first 35m is 5.4 seconds, find his time for the race [4]

2(a) Find the resultant and its point of application with respect to O on x-axis (X-intercept). A clockwise moment of 5000 N-cm is acting at O [6]

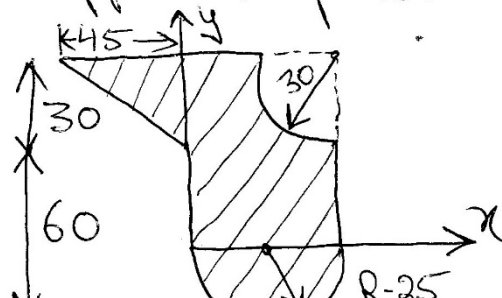


(b) Find reactions at A, B, C, D. [8]



(c) A ball of mass m hits directly to a similar ball of mass m which is at rest. The velocity of first ball after impact is zero. Half of initial kinetic energy is lost in impact. Find coefficient of restitution [6]

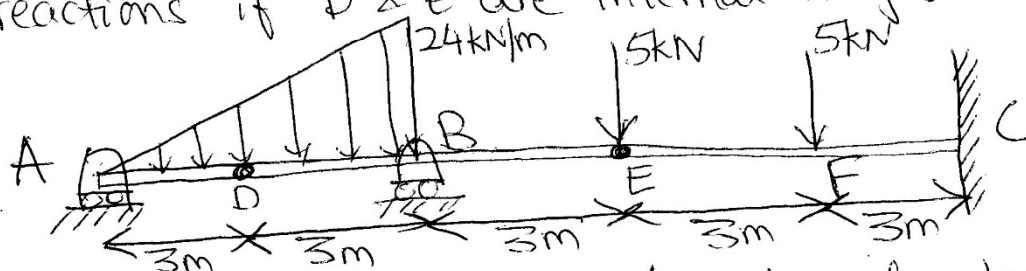
3(a) Find centroid of shaded figure if all dimensions are in mm. [8]



(b) Force of 5kN is acting along AB where $A(0,0,-1)$ & $B(5,-2,-4)$ m. Another force 8kN is acting along BC where $C(3,3,4)$ m. Find resultant of 2 forces and find moment of resultant force about a point $D(0,3,-2)$ m. [6]

(c) A wheel is attached to the shaft of an electric motor of rated speed of 1740 RPM. When the power is turned on, the unit attains the rated speed in 5 seconds & when the power is turned off, the unit comes to rest in 90 seconds. Assuming uniformly accelerated motion, determine the number of revolutions the unit turns (i) To attain the rated speed & (ii) To come to rest [6]

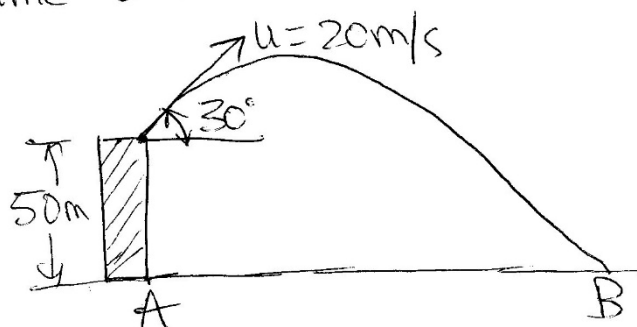
4(a) Using principle of virtual work find support reactions if D & E are internal hinges.



[8]

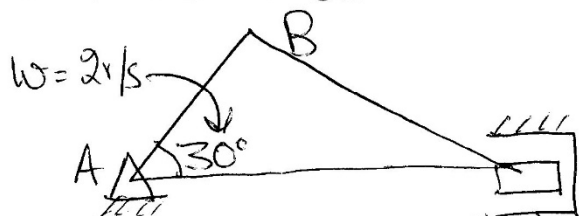
(b) A particle is projected from top of a tower 50m high with velocity of 20 m/sec at an angle of 30° to the horizontal. Calculate

- Horizontal distance AB it travels from foot of tower
- The velocity with which it strikes ground at B.
- Total time taken to reach point B.

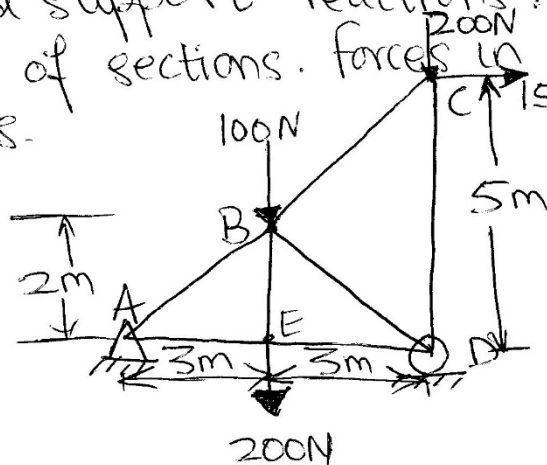


[6]

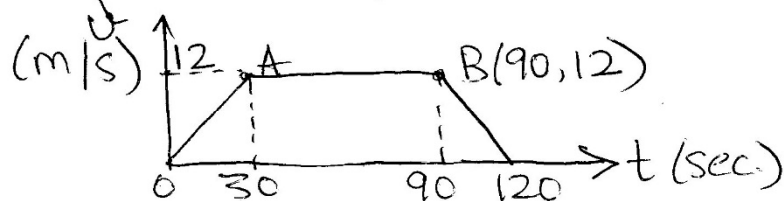
(c) Figure shows the crank and connecting rod mechanism. The crank AB rotates with an angular velocity of 2 rad/sec in clockwise direction. Find angular velocity of connecting rod BC & velocity of piston C using ICR method. $AB = 0.3 \text{ m}$, $CD = 0.8 \text{ m}$



5(a) Find support reactions. Forces in BC, BD by method of sections. Forces in AB, AE, BE by method of joints. [8]

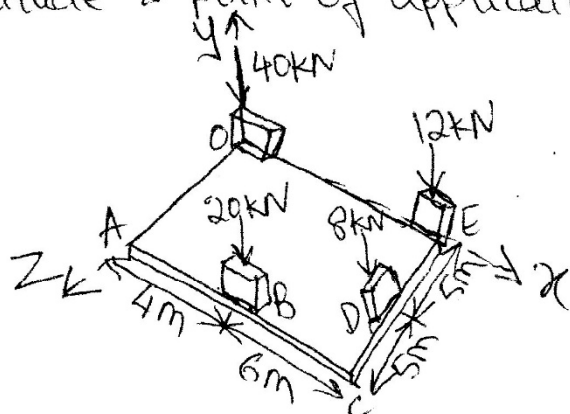


(b) For v-t graph of motion of train as it moves from A to B draw a-t graph & find average speed of train & distance between stations. [6]



(c) The y coordinate of a particle is given by $y = 6t^3 - 5t$. If $a_x = 14t \text{ m/sec}^2$ & $v_x = 4 \text{ m/sec}$ at $t = 0$, find velocity & acceleration of particle when $t = 1 \text{ second}$. [6]

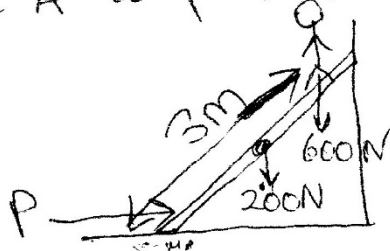
6(a) A square foundation has 4 columns. Find magnitude & point of application of resultant.



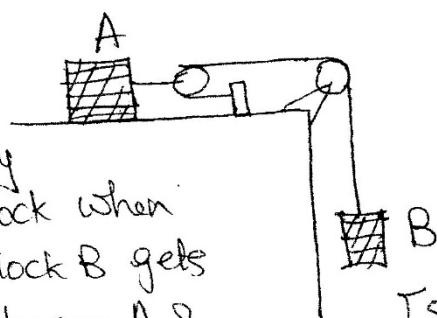
[5]

(b) A ladder AB of 4m length has 200N weight. If $\mu_A = 0.25$, $\mu_B = 0.35$. Calculate minimum horizontal force at A to prevent slipping.

[5]



(c) 2 Blocks $m_A = 10\text{kg}$, $m_B = 5\text{kg}$ are connected with cord & pulley system. Find velocity of each block when system is started from rest & block B gets displacement by 2m. $\mu_k = 0.2$ between A &



[5]

(d) A stone is thrown with a velocity (u) m/sec at an angle of 20° with horizontal from a point 2m above ground. The stone strikes the ground 5m away from the original position. The motion of stone is subjected to gravitational acceleration & wind resistance of 0.82 m/sec^2 , opposing horizontal motion. Find time of flight of stone.

[5]