FE | Sem - I CBGS 26|5|14

E.M.

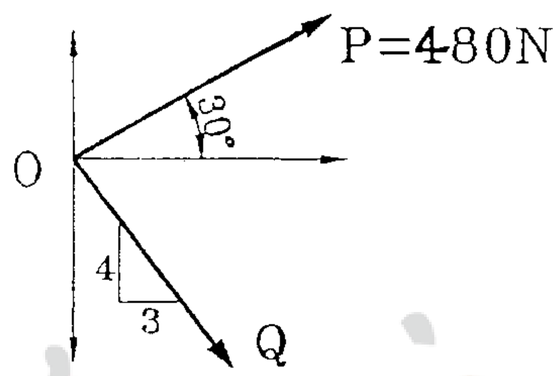
(REVISED COURSE) QP Code : NP-17702

(3 Hours) [Total Marks : 80

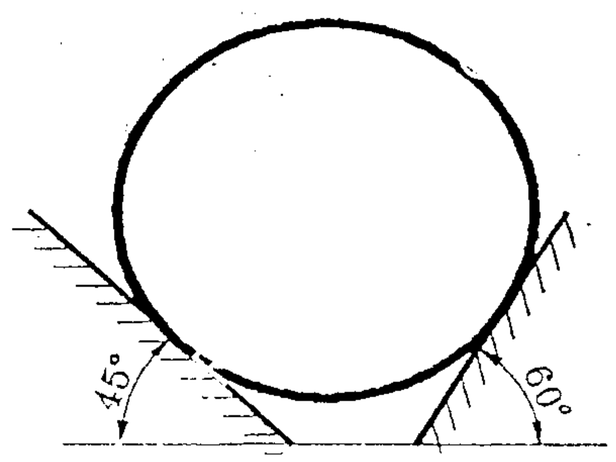
N.B.1. Question **No. 1 is Compulsory.**
2. Answer any **three more** questions out of **remaining** questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full mark
5. Take g= 9.81m/s^2

Q1.

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



b) A cylinder with 1500 *N* weight is resting in an unsymmetrical smooth groove as shown in figure. Determine the reactions at the points of contacts [4]



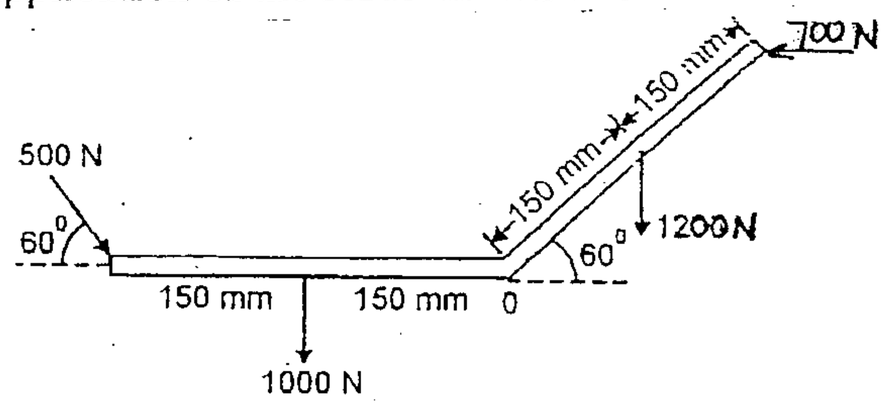
c) Explain Angle of Friction, Angle of Repose and the relation between the two. [4]

d) A sprinter in a 100m race accelerates uniformly for the first 35m and then runs with constant velocity. If the sprinter's time for the first 35m is **5.4** seconds, determine his time for the race. [4]

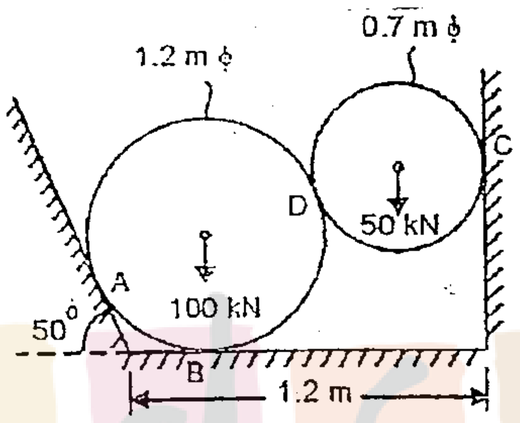
e) A motorist travelling at a speed of 90kmph suddenly applies the brakes and comes to rest after skidding 100 m. Determine the time required for the car to stop and coefficient of kinetic friction between the tires and the road. [4]

[TURN OVER

Q2.a) A system of forces acting on a bell crank is as shown. Determine the magnitude, direction and the point of application of the resultant w.r.t 'O' [6]

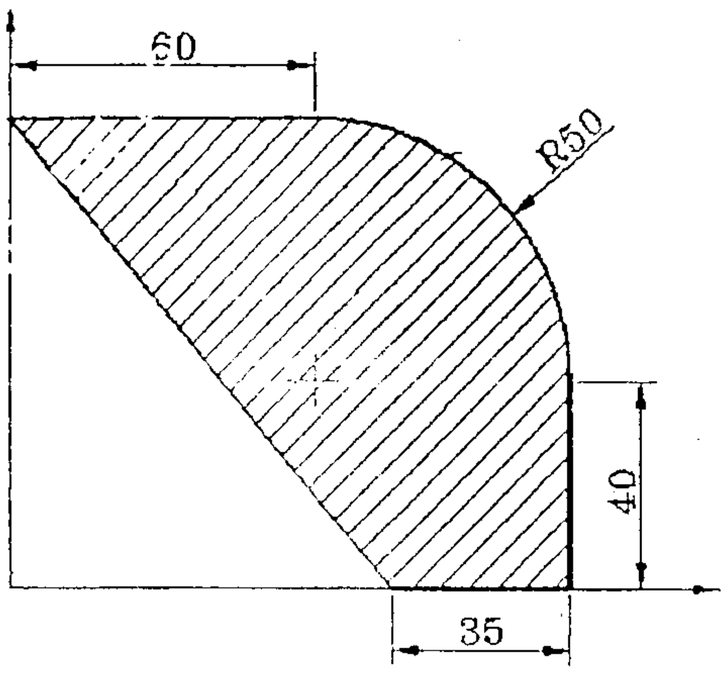


b) Two cylinders are kept in a channel as shown in figure. Determine the reactions at all the contact points A,B,C and D. Assume all surfaces smooth. [8]



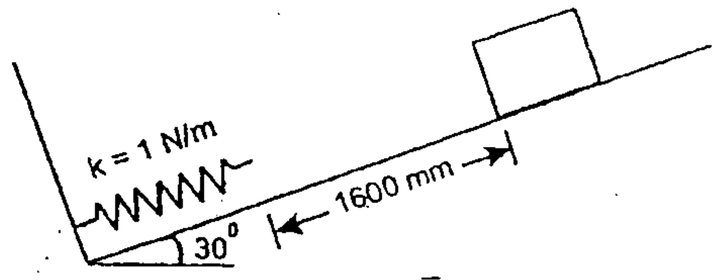
c) A ball of mass 'm' hits directly to a similar ball of mass 'm' which is at rest. The velocity of first ball after impact is zero. Half of the initial kinetic energy is lost in impact. Find coefficient of restitution. [6]

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

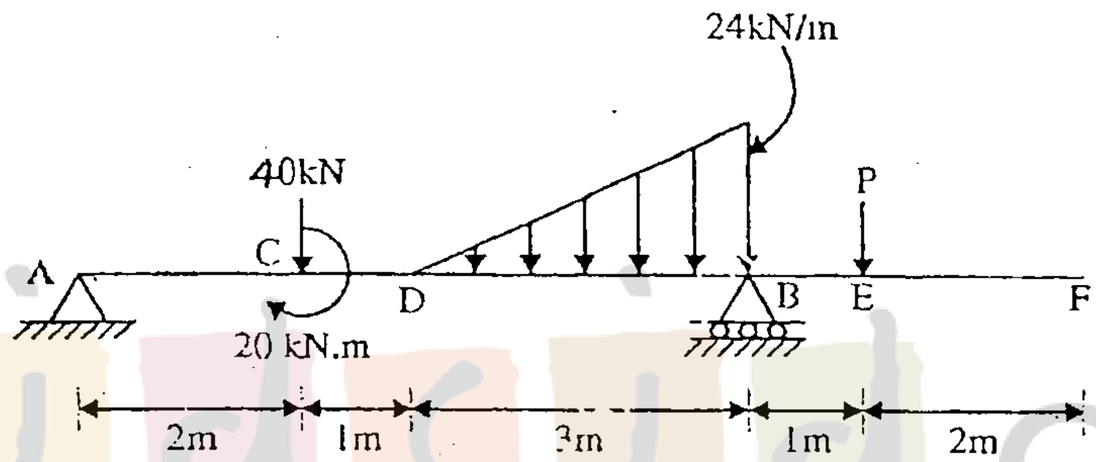


b) The lines of action of three forces concurrent at origin 'O' pass respectively through points A(-1,2,4), B(3,0,-3) and C(2,-2,4)m. The magnitude of forces are 40N, 10N and 30N respectively. Determine the magnitude and direction of their resultant. [6]

c) A 30N block is released from rest. It slides down a rough incline having coefficient of friction 0.25. Determine the maximum compression of the spring. [6]

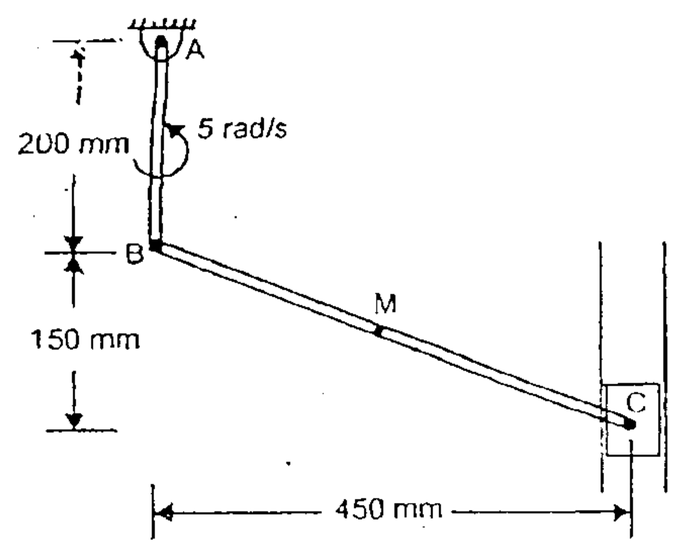


Q4.a) Find the support reaction at B and the load P, for the beam shown in figure if the reaction at support A is zero. [8]



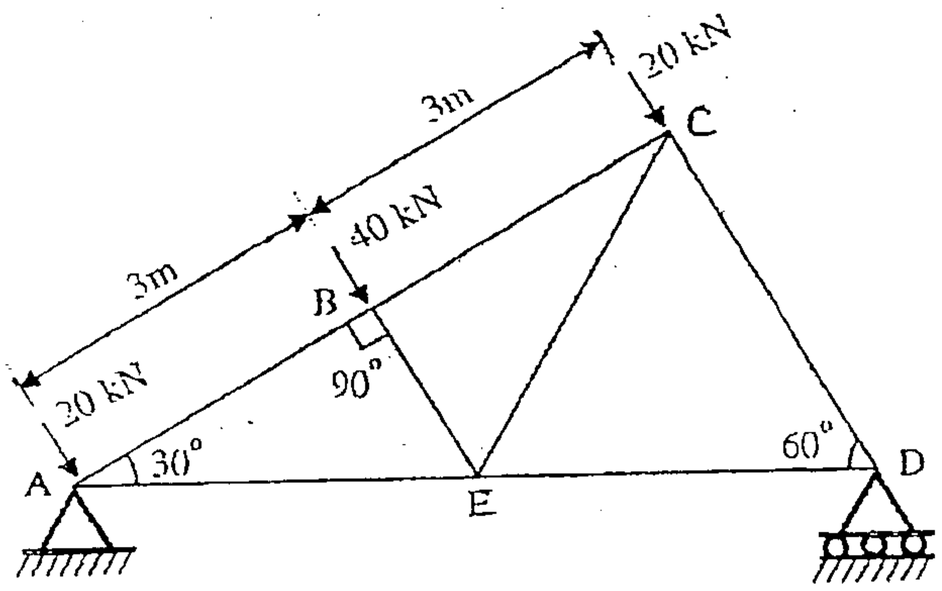
b) A gunman fires a bullet with a velocity of 100m/s, 50° upwards from the top of a hill 300m high to hit a bird. The bullet misses its target and finally lands on the ground. Calculate (a) the maximum height reached by the bullet above the ground (b) total time of flight (c) velocity with which the bullet hits the ground. [6]

c) In the mechanism shown the angular velocity of link AB is 5 rad/sec anticlockwise. At the instant shown, determine the angular velocity of link BC and velocity of piston C. [6]

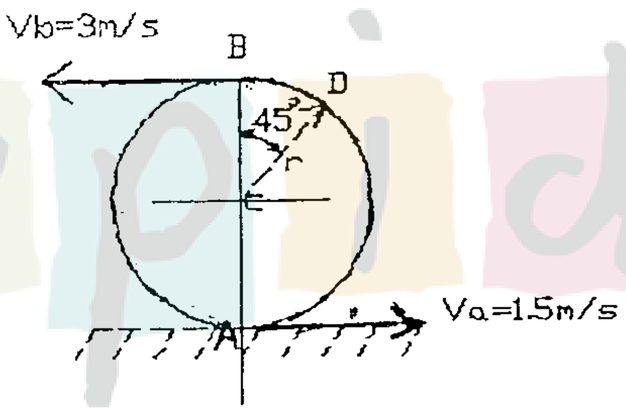


[TURN OVER

Q5.a) Determine the forces in members BC, CE and DE by method of sections and all other members by method of joints. Give the result in a table. [8]

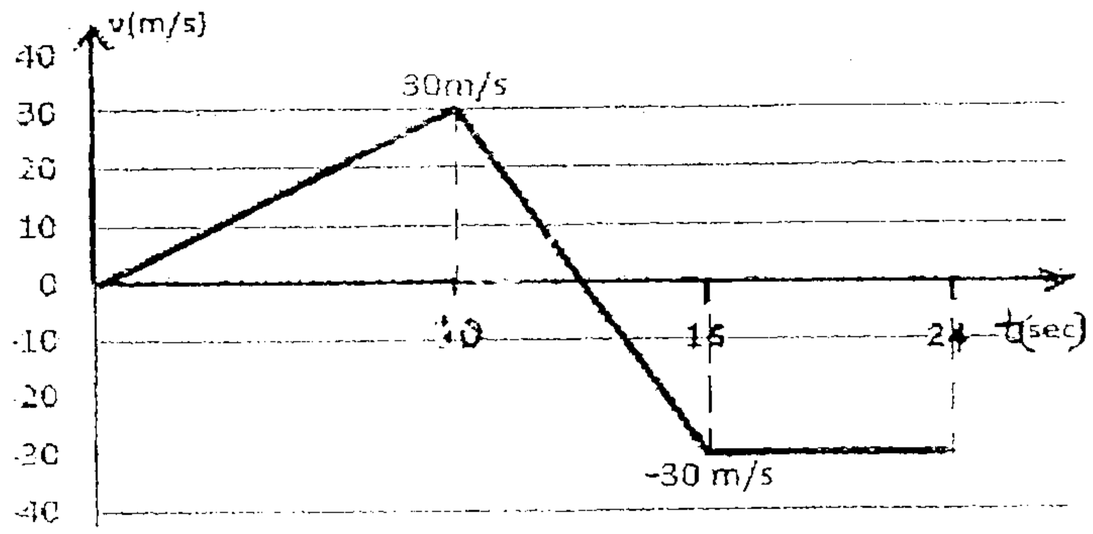


b) Due to slipping, points A and B on the rim of the disk have the velocities as shown in figure. Determine the velocities of the centre point C and point D on the rim at this instant. Take radius

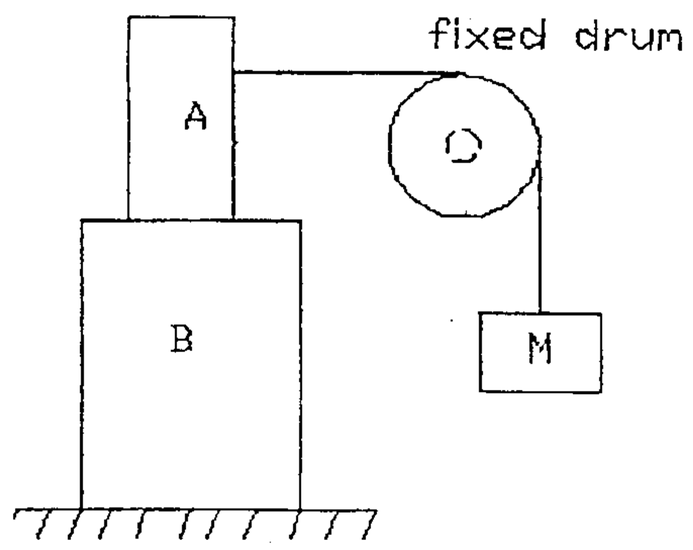


of disk 0.24m. [6]

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]



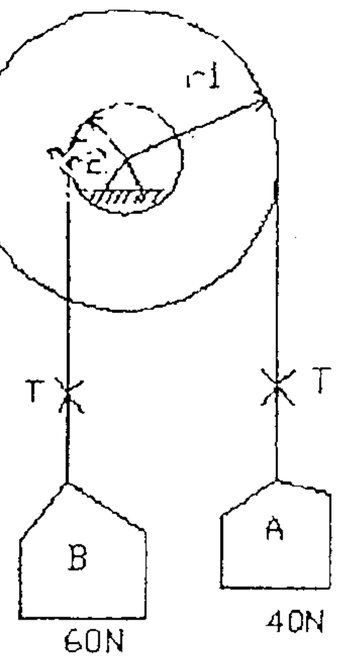
Q6.a) The mass of A is 23kg and mass of B is 36kg. The coefficient of friction are 0.4 between A and B, and 0.2 between ground and block B. Assume smooth drum.. Determine the maximum mass of M at impending motion. [8]



b) A force of 1200N acts along PQ, P(4,5,-2) and Q (-3,1,6)m. Calculate its moment about a point A(3,2,0) m [4]

c) A point moves along the path $y=x^2/3$ with a constant speed of 8m/s. What are the x and y components of the velocities when x=3. What is the acceleration of the point when x=3. [4]

d) A two step pulley supports two weights A=40N and B=60N as shown. Find the downward acceleration of A if radius of bigger pulley is double that of the smaller one. Neglect friction and inertia of pulley. [4]



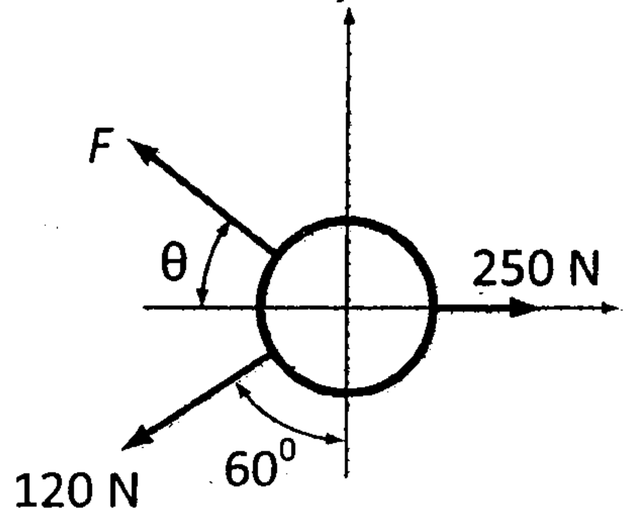
FE(semI) CGS
Engineering Mechanics. 13/12/13

Con. 5808–13. **(REVISED COURSE)** **GX–10020**

(3 Hours) **[Total Marks : 80**

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **three** questions out of **remaining** questions.
(3) **Use** acceleration due to gravity **g = 9·81 m/s²**.
(4) **Use** of electronic calculator is **permitted**.

Q.1. (a) A ring is pulled by three forces as shown in figure. Find the force F and the angle θ if resultant of these three forces is 100 N acting in vertical direction. **[04]**



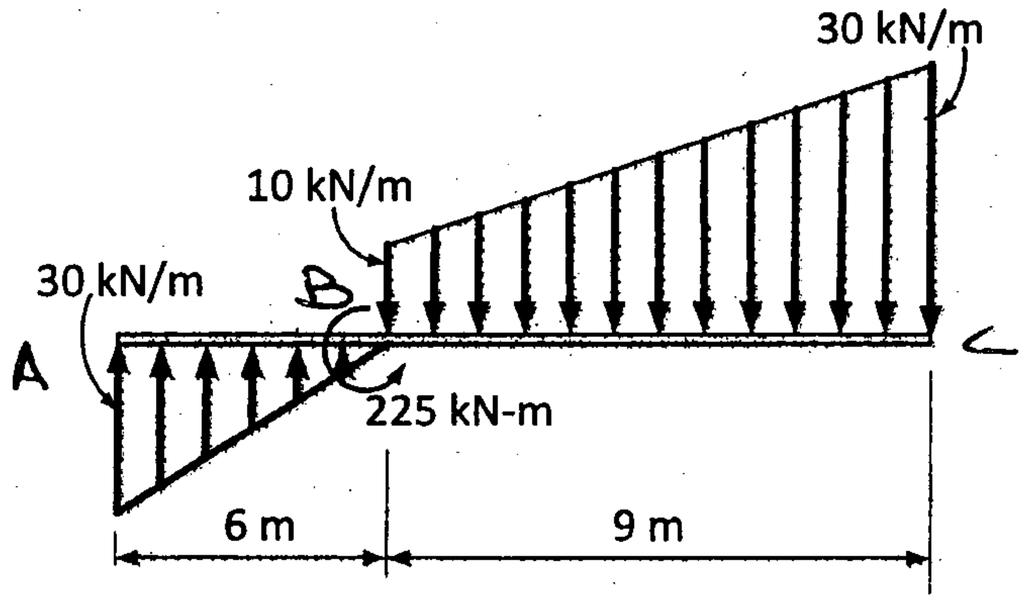
(b) State and prove Lami's Theorem. **[04]**

(c) Laws of friction. **[04]**

(d) A motorist is travelling at 90 kmph, when he observes a traffic signal 250 m ahead of him turns red. The traffic signal is timed to stay red for 12 sec. If the motorist wishes to pass the signal without stopping just as it turns green. Determine (i) The required uniform deceleration of the motor. (ii) The speed of motor as it passes the signal. **[04]**

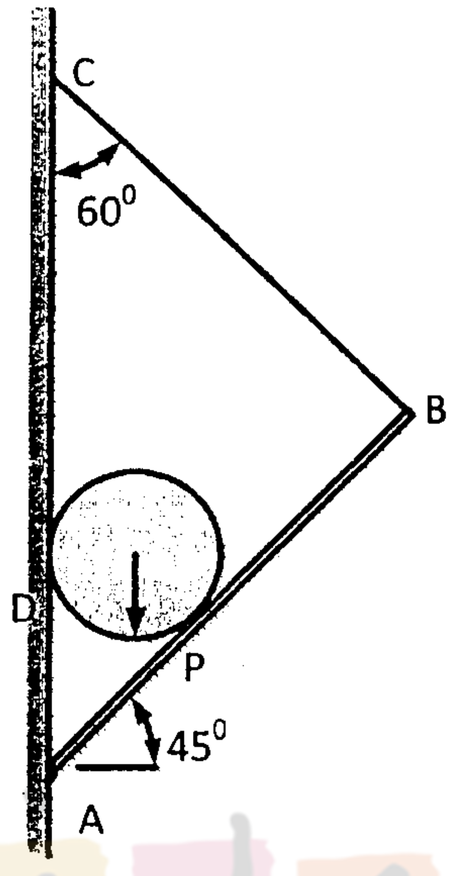
(e) A 50 kg block kept on a 15^0 inclined plane is pushed down the plane with an initial velocity of 20 m/s. If $\mu_k = 0.4$, determine the distance traveled by the block and the time it will take as it comes to rest. **[04]**

Q.2. (a) A member ABC is loaded by distributed load and pure moment as shown in the Figure. Find the (i) magnitude and (ii) position along AC of the resultant. **[06]**

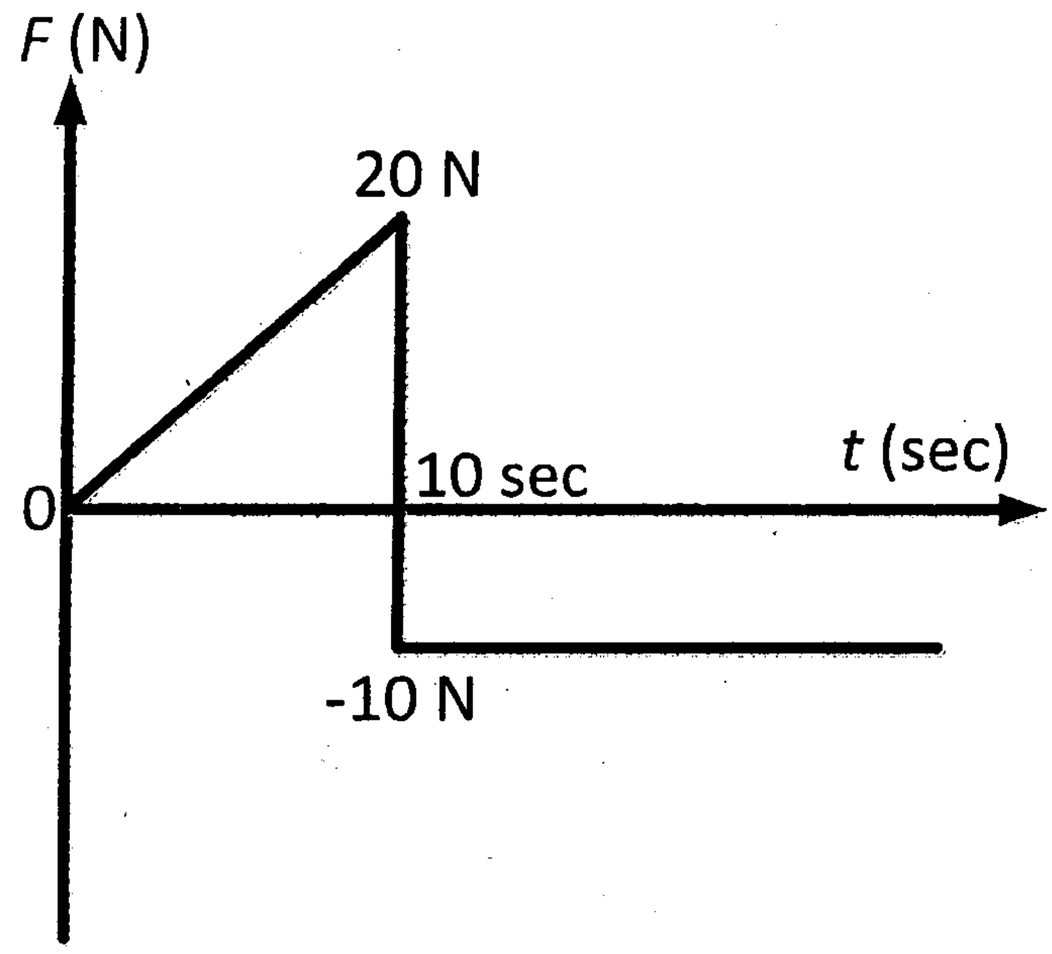


[TURN OVER

(b) A cylinder weighing 1000 N and 1.5 m diameter is supported by a beam AB of length 6 m and weight 400 N as shown in figure. Neglecting friction at the surfaces of contacts, determine (i) Wall reaction at D. (ii) Tension in the cable BC and (iii) Hinged reaction at support A. **[08]**

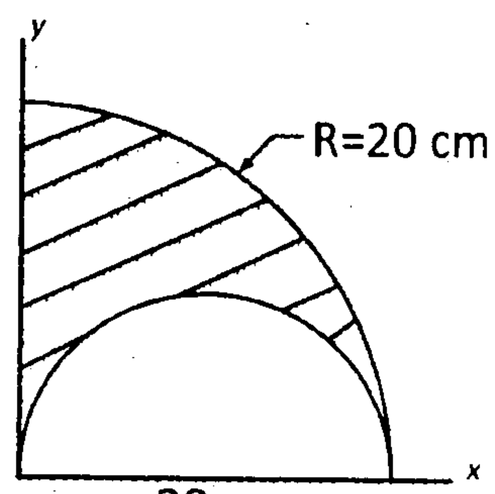


(c) A particle of mass 1 kg is acted upon by a force F which varies as shown in figure. If initial velocity of the particle is 10 m/s determine (i) what is the maximum velocity attained by the particle. (ii) Time when particle will be at the point of reversal. **[06]**

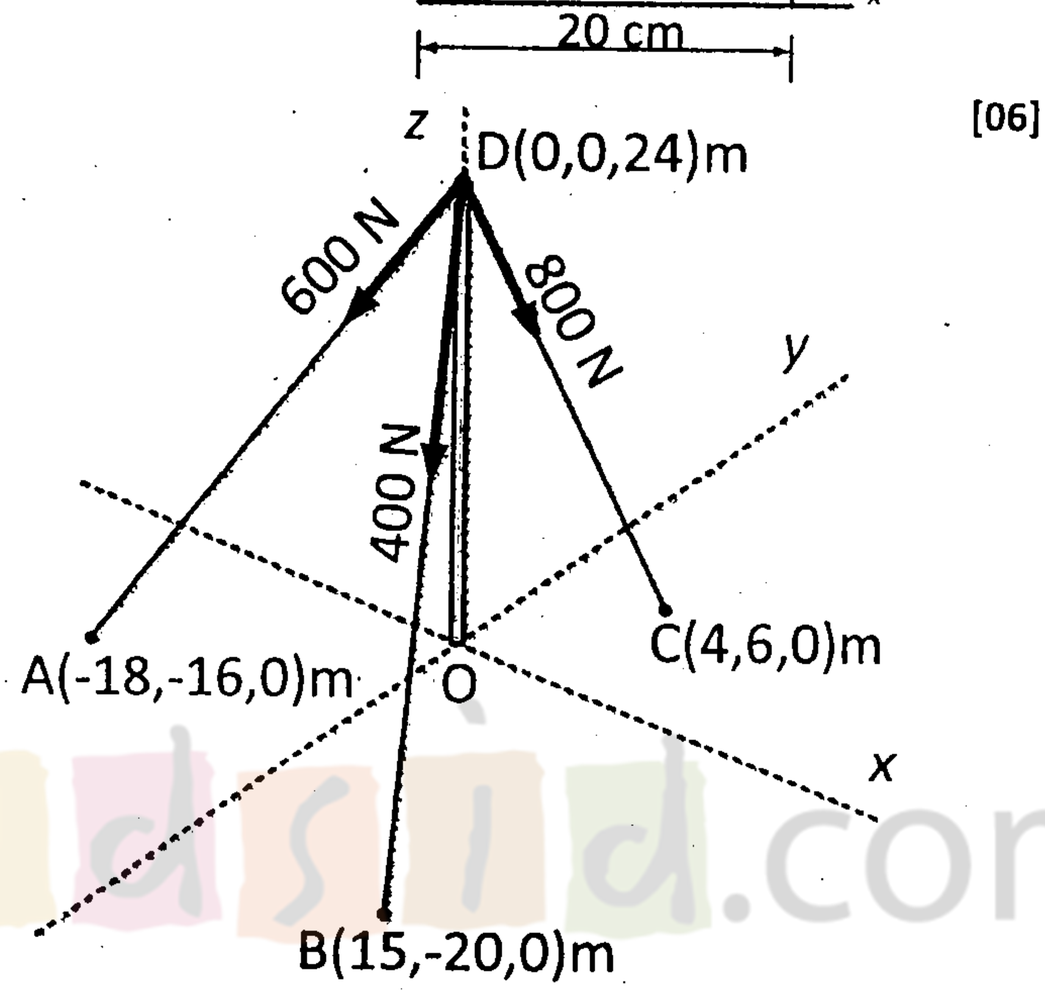


Con. 5808–GX–10020–13. 3

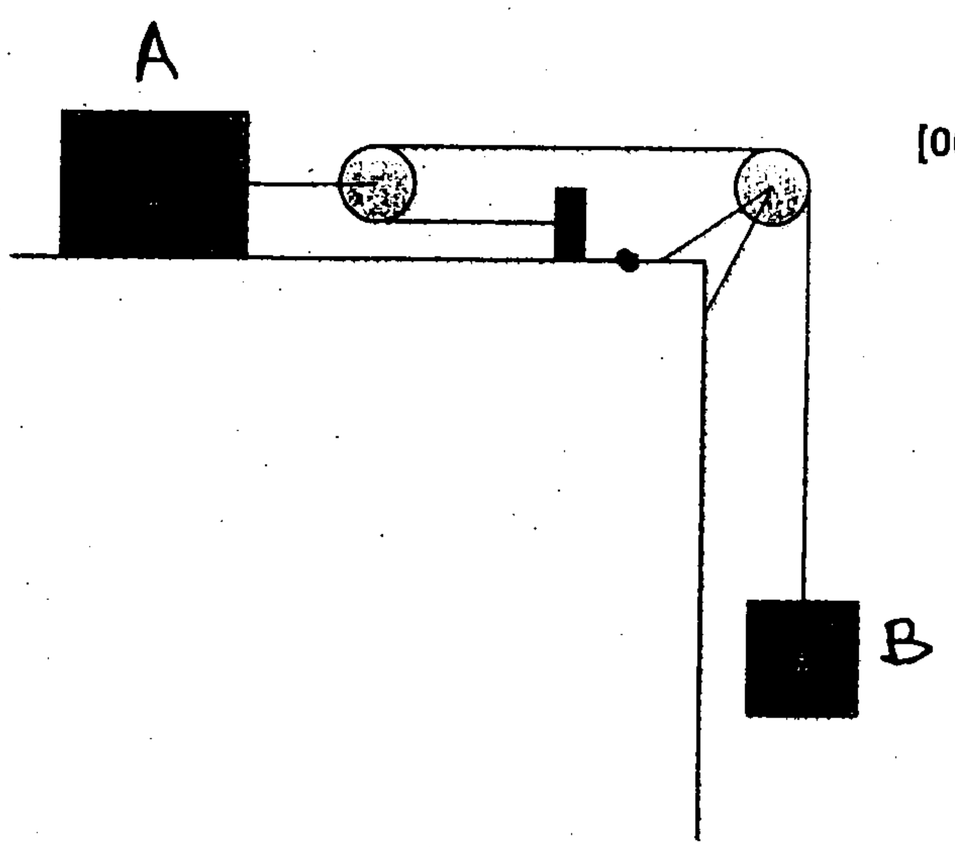
Q.3. (a) Locate the centroid of the shadded area. [08]



(b) A pole is held in place by three cables. If the force of each cable acting on the pole is as shown in figure determine the resultant. [06]



(c) Two blocks m_A=10 kg and m_B=5 kg are connected with cord and pulley system as shown in figure. Determine the velocity of each block when system is started from rest and block B gets displacement by 2 m. Take μ_K=0.2 between block A and Horizontal surface. [06]



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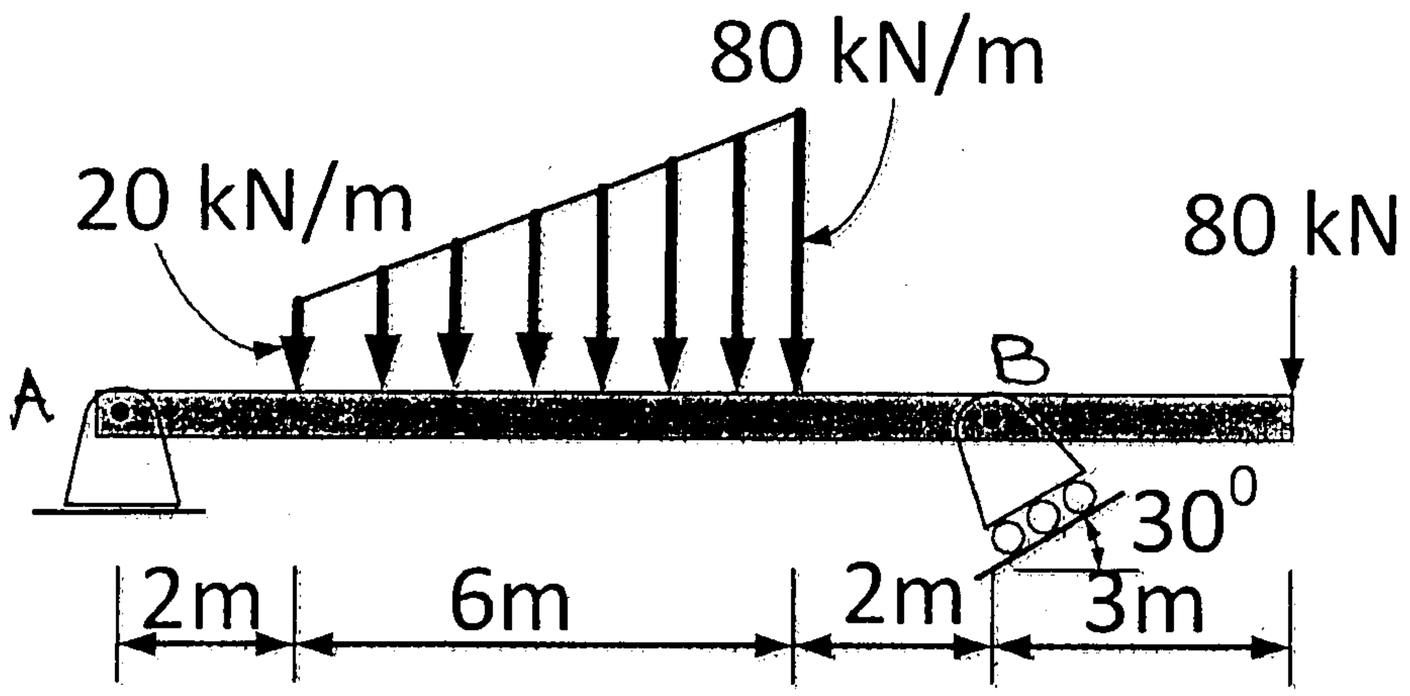
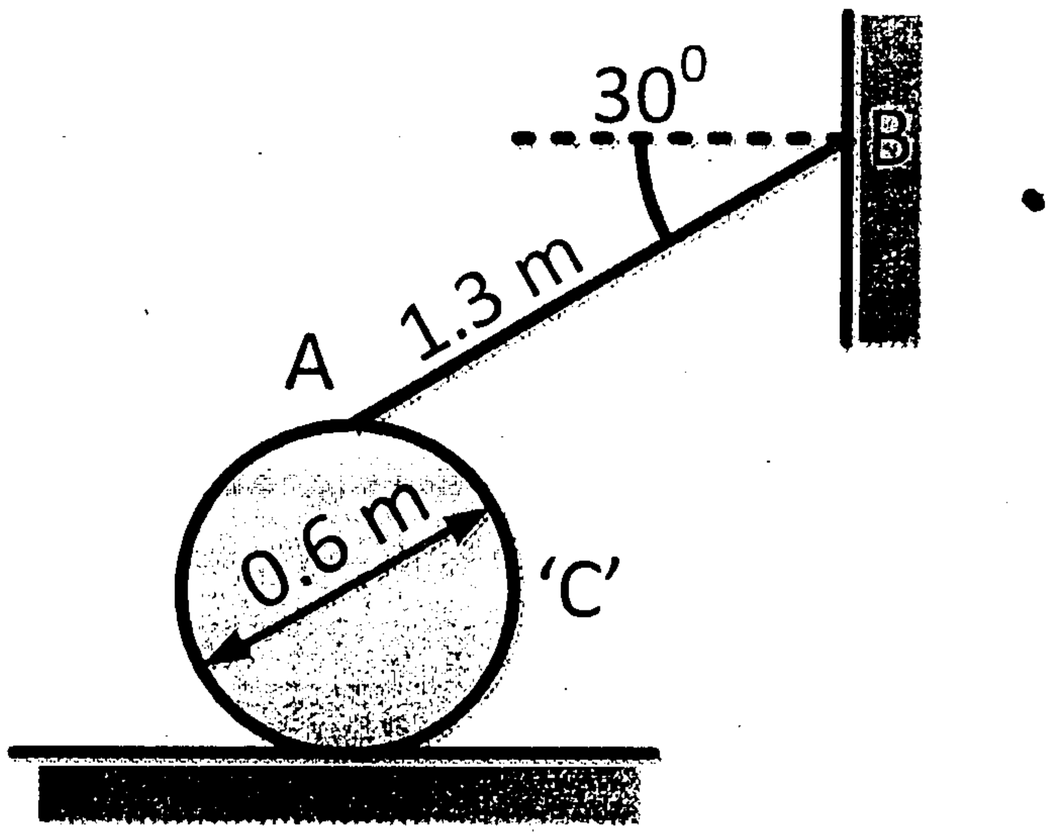
Q.4. (a) Find the support reactions at A and B for the beam shown in figure. **[08]**

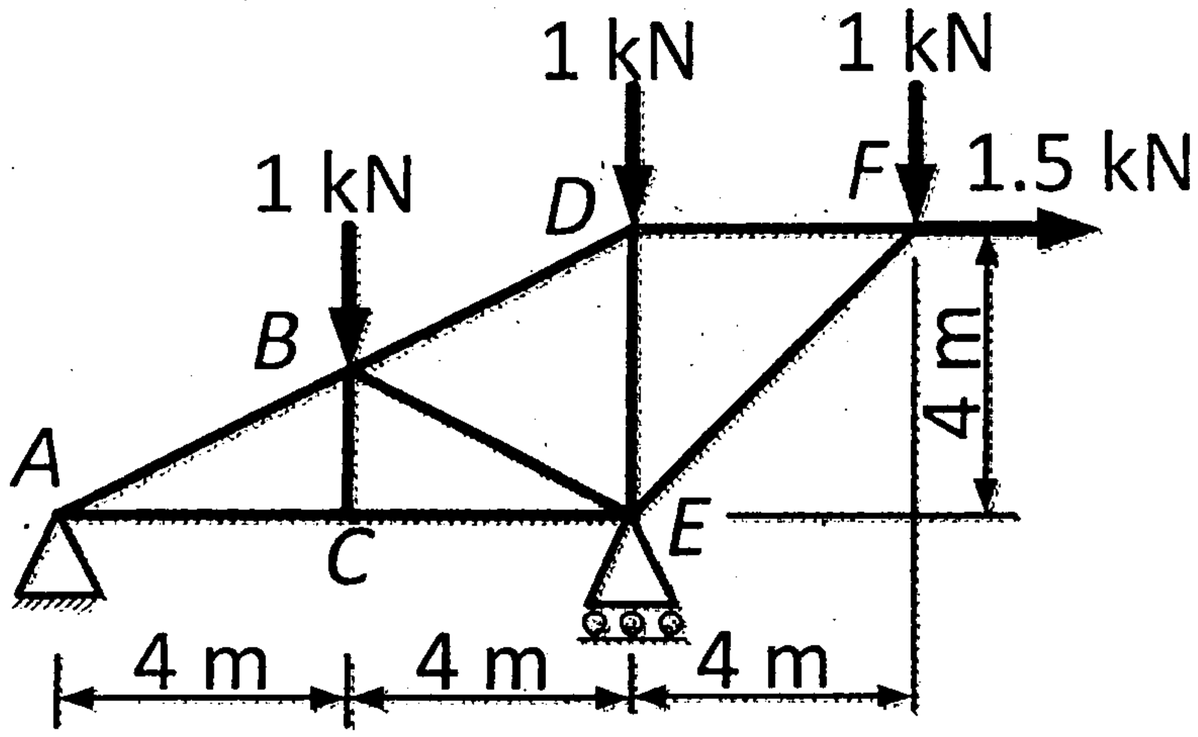


(b) A ball is thrown from horizontal level, such that it clears a wall 6 m high, situated at a horizontal distance of 35 m. If the angle of projection is 60^0 with respect to the horizontal, what should be the minimum velocity of projection? **[06]**

(c) 'C' is a uniform cylinder to which a rod 'AB' is pinned at 'A' and the other end of the rod 'B' is moving along a vertical wall as shown in figure. If the end 'B' of the rod is moving upward along the wall at a speed of 3.3 m/s find the angular velocity of the cylinder assuming that it is rolling without slipping. **[06]**

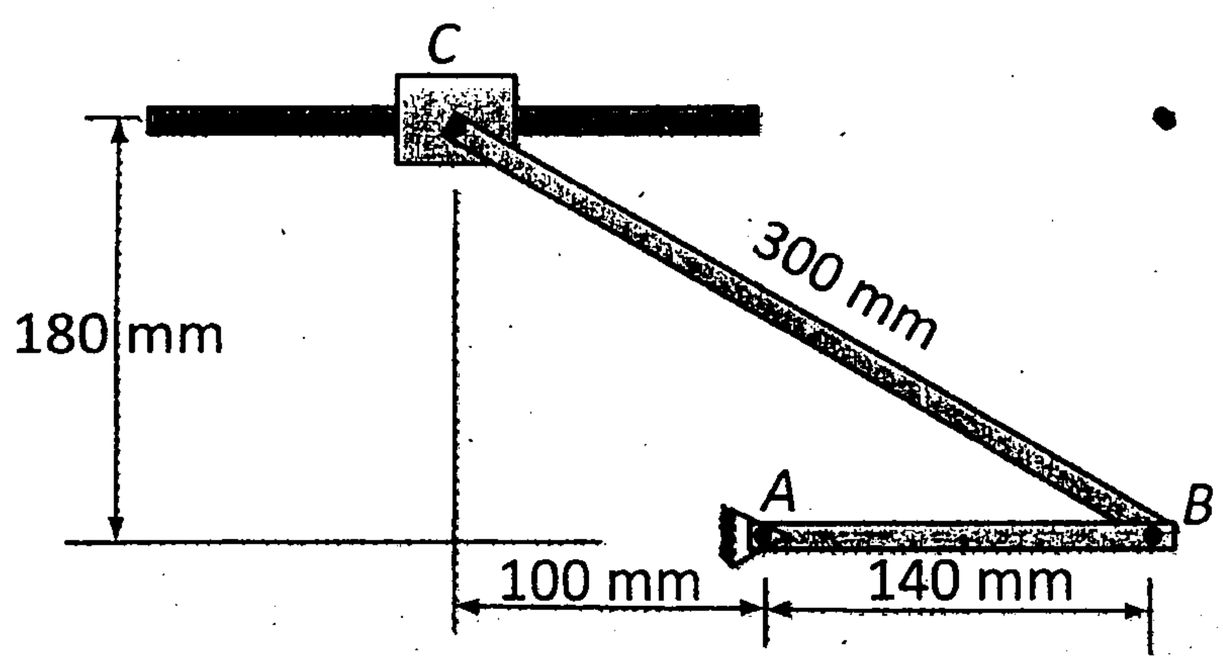


Q.5. (a) Find the forces in members BD, BE and CE by method of section only for the truss shown in the figure. Also find The forces in other members by method of joints. **[08]**



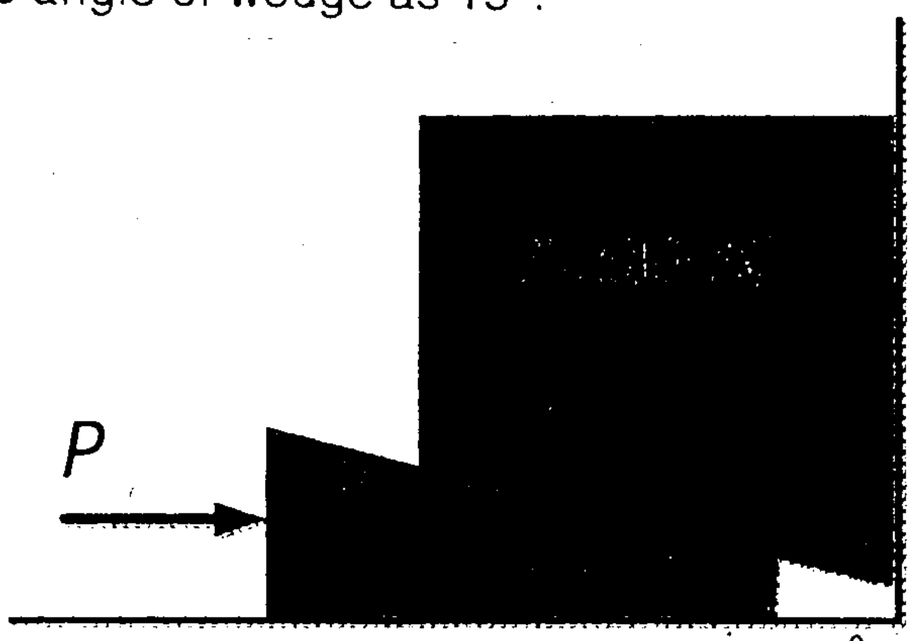
(b) In Asian games, for 100 m event an athlete accelerates uniformly from the start to his maximum velocity in a distance of 4 m and runs the remaining distance with that velocity. If the athlete finishes the race in 10.4 sec, determine (i) his initial acceleration, (ii) his maximum velocity. **[06]**

(c) In figure collar C slides on a horizontal rod. In the position shown rod AB is horizontal and has angular velocity of 0.6 rad/sec clockwise. Determine angular velocity of BC and velocity of collar C. **[06]**



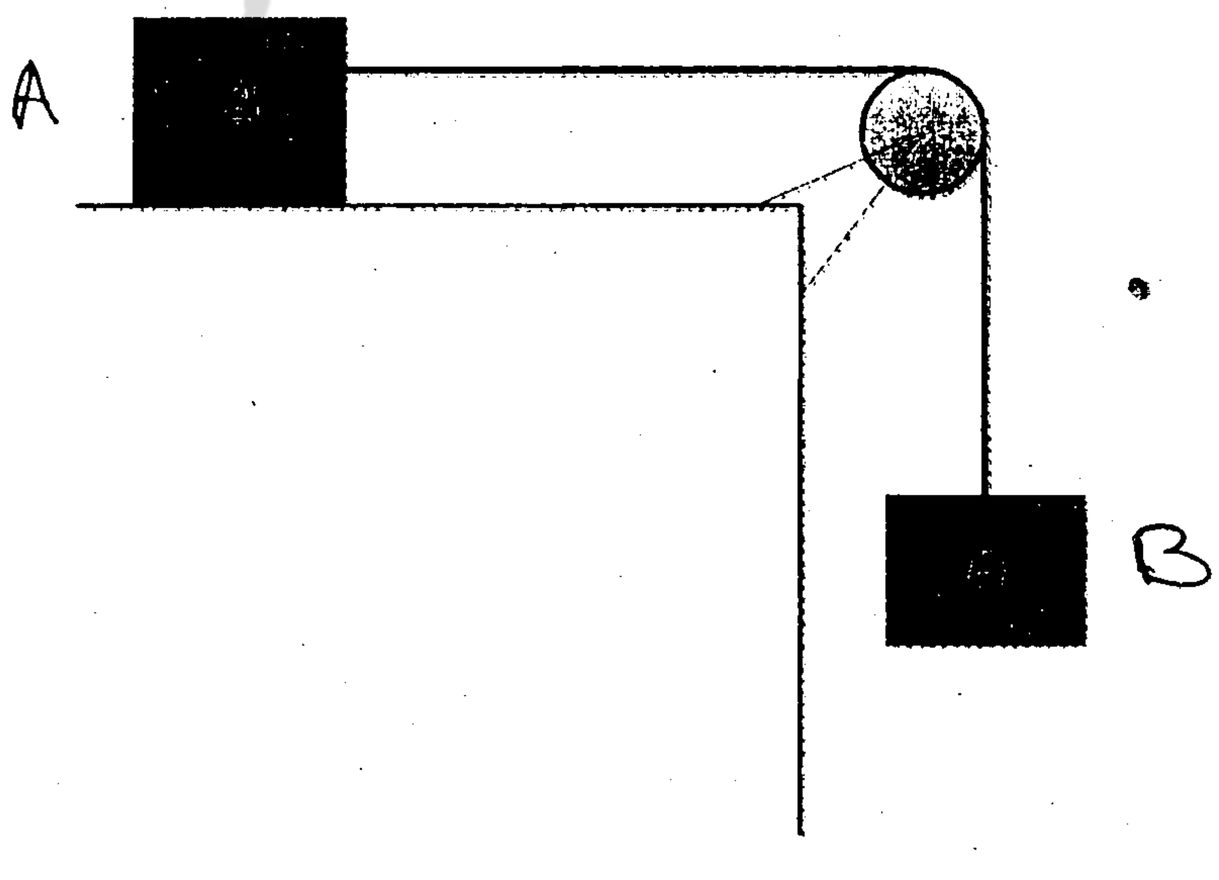
Q.6. (a) A force of 10 kN acts at a point P(2,3,5) m and has its line of action passing through Q(10,-3,4) m. Calculate moment of this force about a point S(1,-10,3) m. **[04]**

(b) Find the necessary force to raise a heavy stone block of 2000 N. Take coefficient of friction as 0.25 for all surfaces. Neglect the weight of wedge. Take angle of wedge as 15°. [08]



(c) A ship A travels in the north making an angle of 45^0 to the West with a velocity of 18 km/hr and ship B travels in the East with a velocity of 9 km/hr. Find the relative velocity of B w.r.t. ship A. [04]

(d) A body of mass 25 kg resting on a horizontal table is connected by string passing over a smooth pulley at the edge of the table to another body of mass 3.75 kg and hanging vertically as shown. Initially, the friction between the mass A and the table is just sufficient to prevent the motion. If an additional 1.25 kg is added to the 3.75 kg mass, find the acceleration of the masses. [04]



FE - Sem I (CBSGS) Engg. Mech. - I

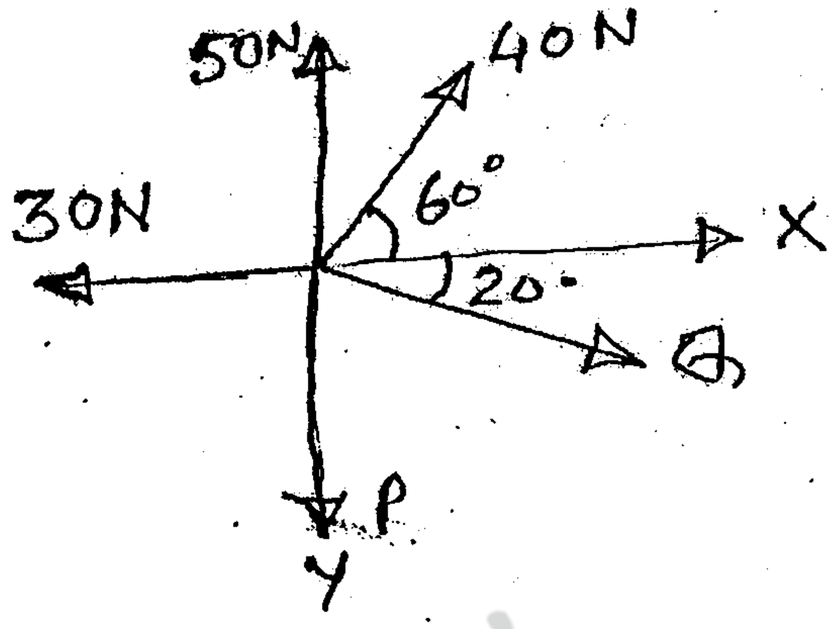
Con. 8797-13. **GS-5157**

(REVISED COURSE)

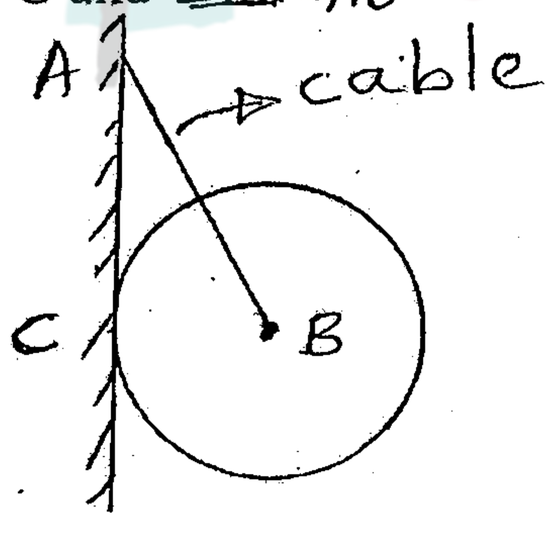
(3 Hours) **[Total Marks : ~~100~~ 80**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from remaining **five** questions.
(3) Assume suitable **data if required**.

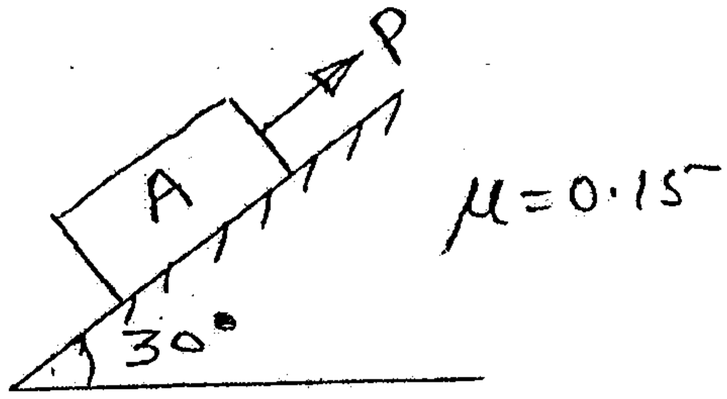
1. (a) Find forces P and Q such that resultant of given system is zero. **4**



(b) A cylinder B, W_B = 1000 N, dia. 40 cm, hangs by a cable AB = 40 cm rests against a smooth wall. **4**
Find out reaction at C and ~~T~~ T_{AB}.



(c) A block of weight 1000 N is kept on a rough inclined surface. Find out range of P for which the block will be in equilibrium. **4**



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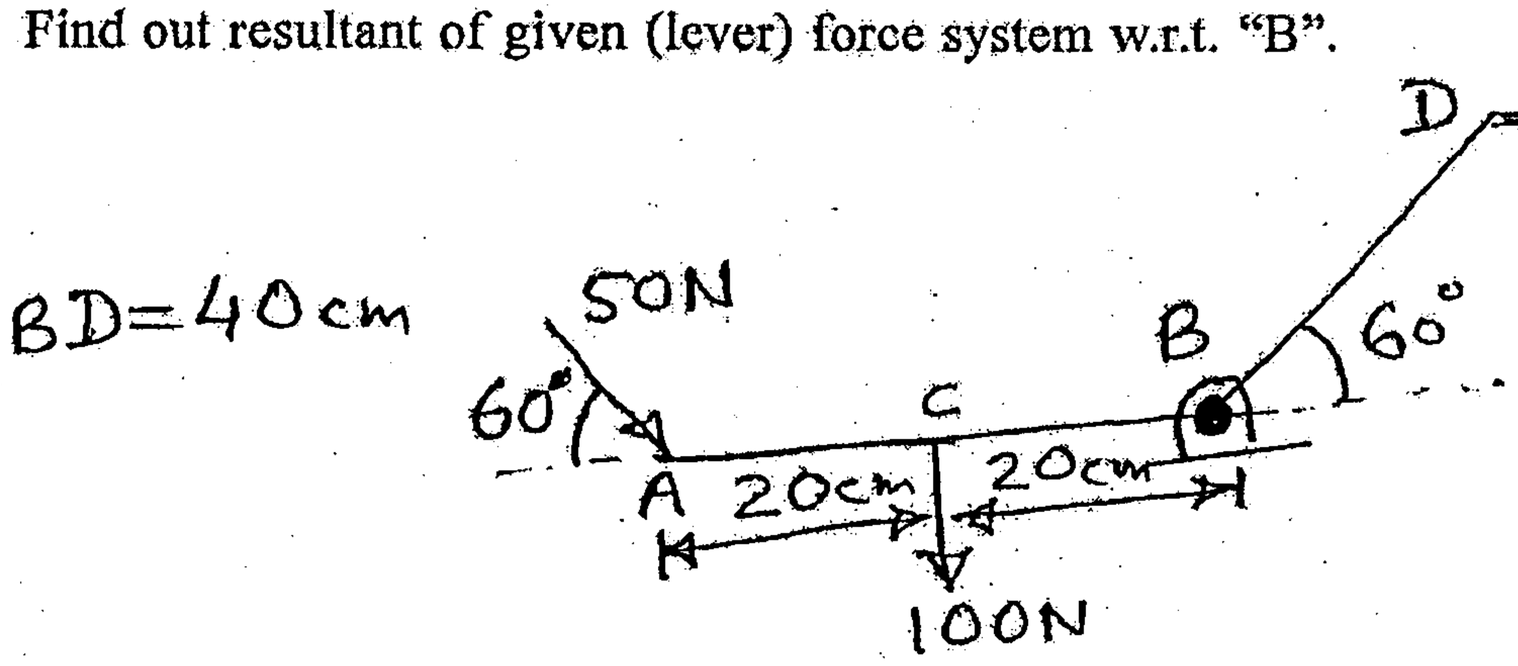
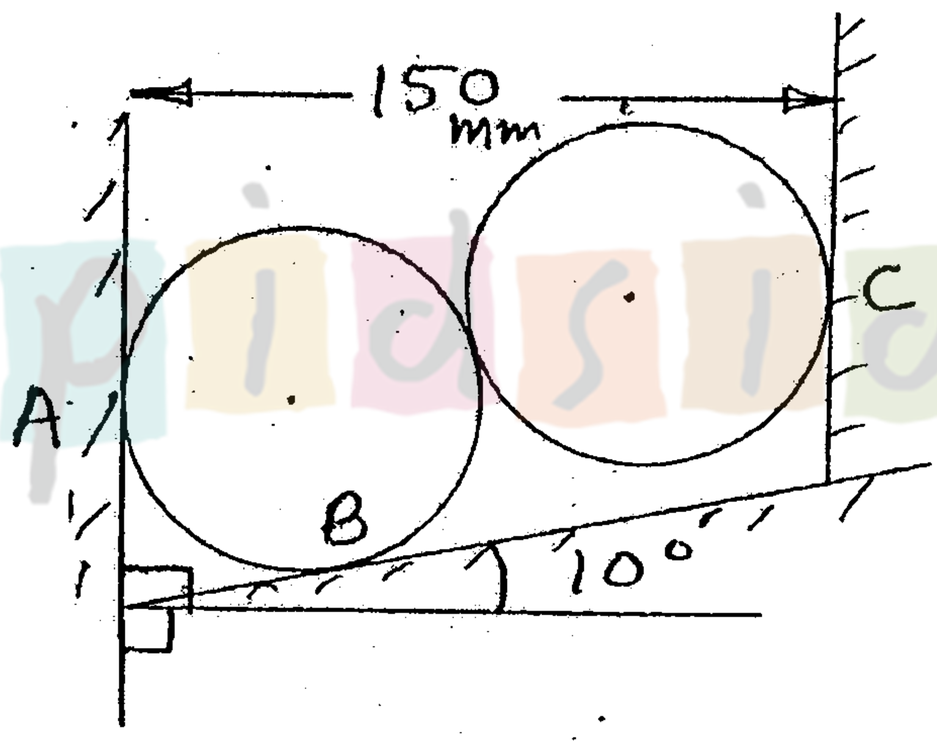
(d) A curvilinear motion of a particle is defined by $v_x = 25-8t$ m/s and $y = 48-3t^2$ m. At $t = 0$, $x = 0$. Find out position, velocity and acceleration at $t = 4$ sec. **4**

(e) State D'Alembert's principle with two examples. **4**

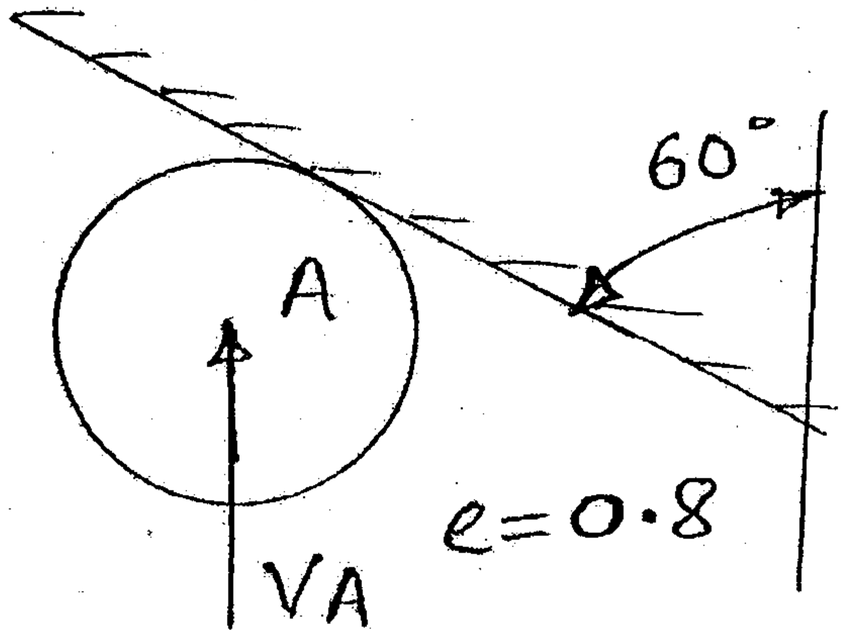
2. (a) Find out resultant of given (lever) force system w.r.t. "B". **6**



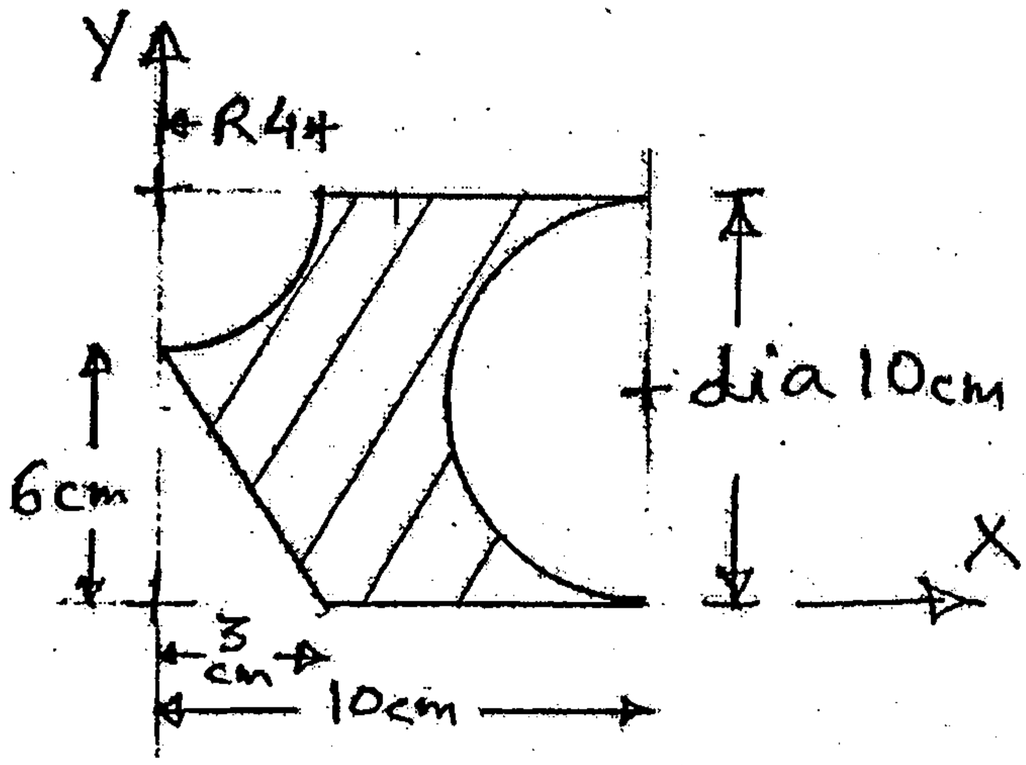
(b) Two identical cylinders dia 100 mm weight 200 N are placed as shown. All contacts are smooth. Find out reactions at A, B and C. **8**



(c) A ball of mass m kg hits an inclined smooth surface with a velocity $V_A = 3$ m/s. Find out velocity of rebound. **6**



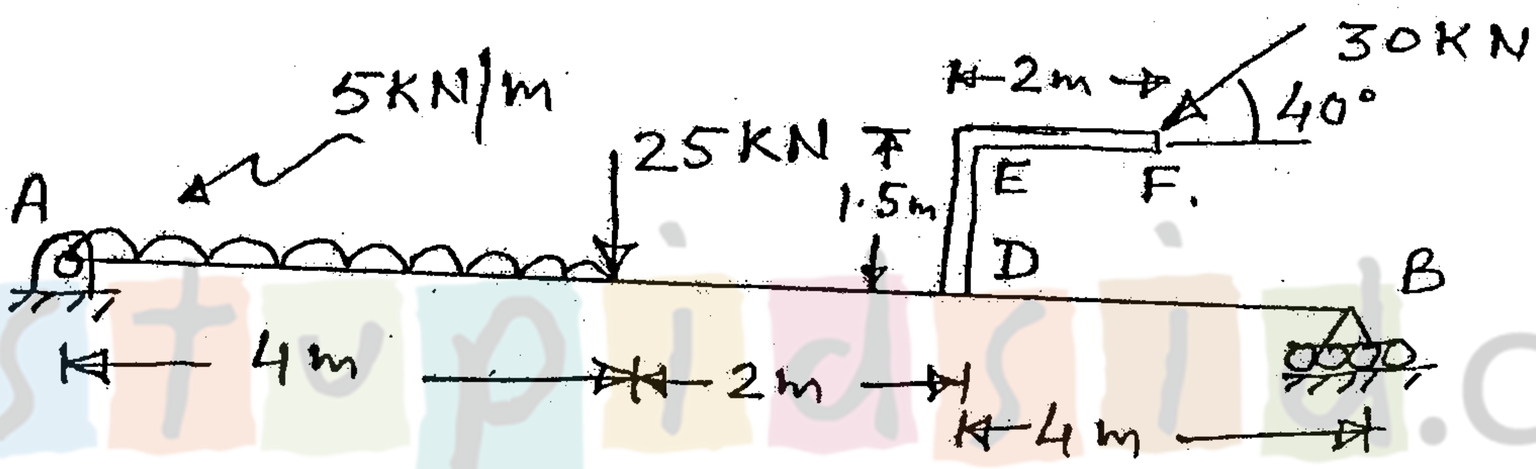
3. (a) Find centroid of the shaded area. 8



(b) Explain conditions for equilibrium for forces in space. 6

(c) Explain work energy principle. 6

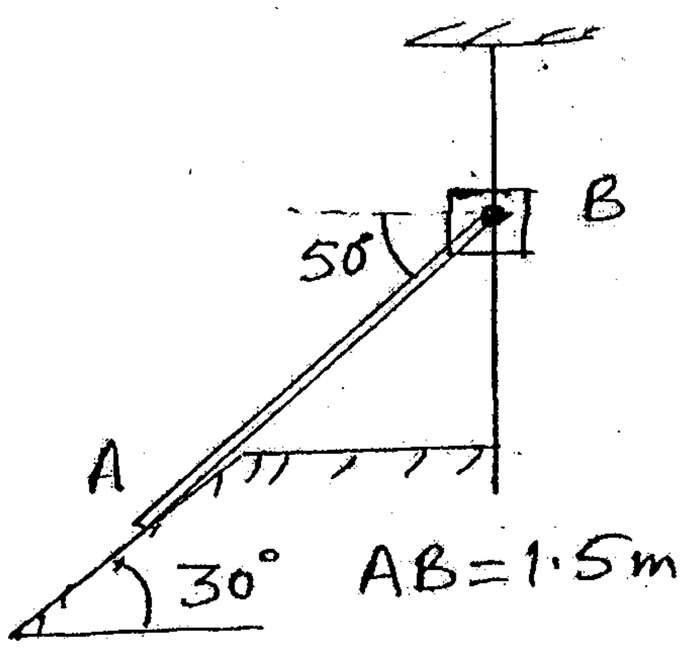
4. (a) 8



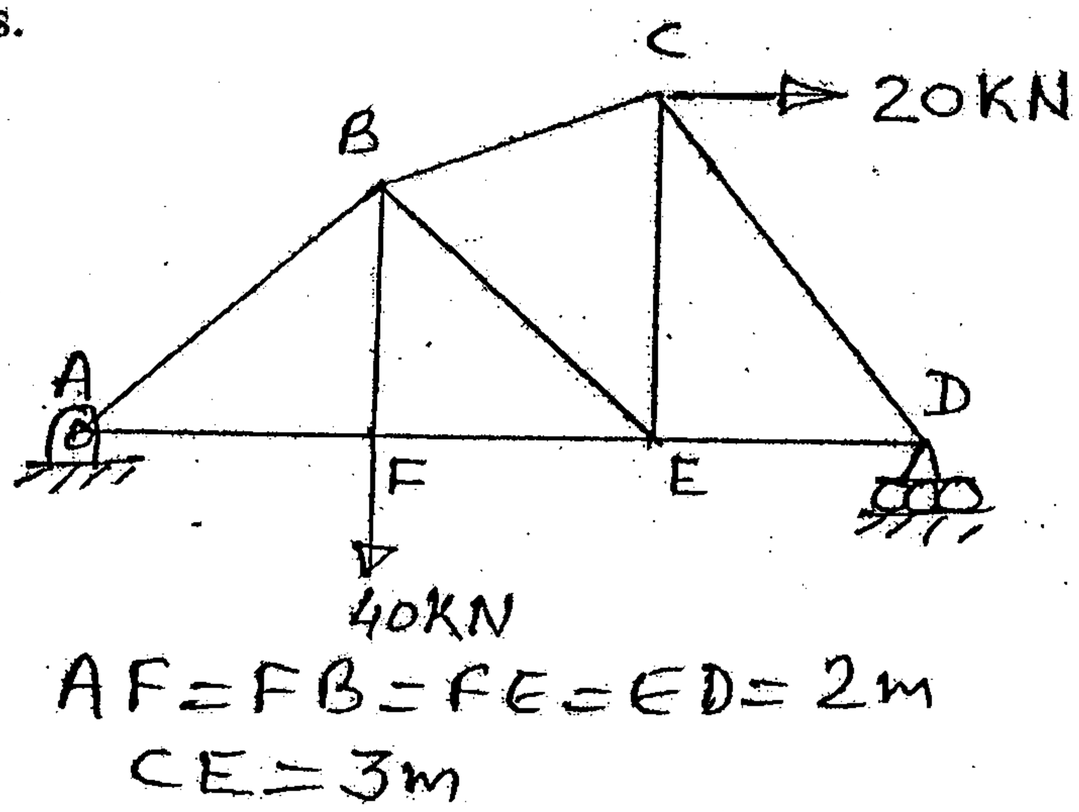
Find the support reactions at Hinge A and Roller B.

(b) Explain x–t, v–t and a–t curves in Kinematics. 6

(c) Collar B moves up with constant velocity $V_B = 2$ m/s. Rod AB is pinned at B. 6
Find out angular velocity of AB and velocity of A.



5. (a) Find out forces in FB and BE using method of section and other members by method of joints. **8**

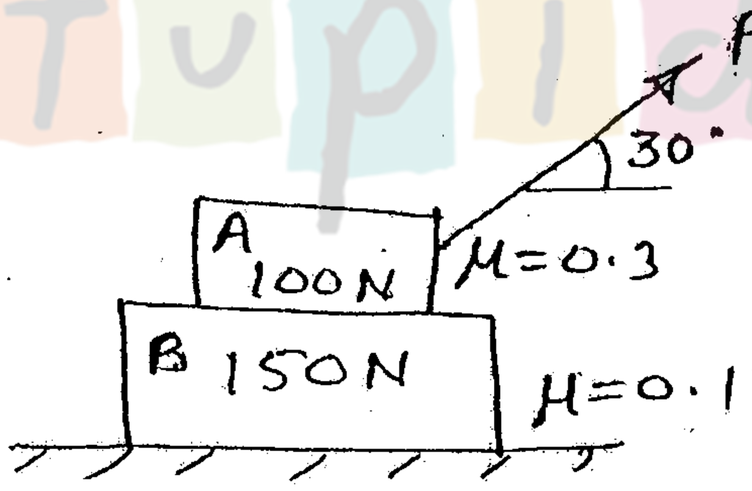


(b) A stone is thrown vertically upwards and returns to the starting point at the ground in 6 sec. Find out max. height and initial velocity of stone. **6**

(c) Explain instantaneous centre of rotation. **6**

6. (a) Force F = (3i – 4j + 12k)N acts at point A (1, –2, 3). Find — **4**
   (i) Moment of force about origin
   (ii) Moment of force about point B(2, 1, 2)m.

(b) Find out min. value of P to start the motion. **8**



(c) For a particle in rectilinear motion $a = -0{\cdot}05\ V^2\ m/s^2$, at v = 20 m/s, x= 0. Find x at v = 15 m/s and acc^n at x = 50 m. **4**

(d) Sphere A is supported by two wires AB, AC. Find out tension in wire AC :— **4**
   (i) before AB is cut
   (ii) just after AB is cut.