

(REVISED COURSE)

QP Code : NP-17702

(3 Hours)

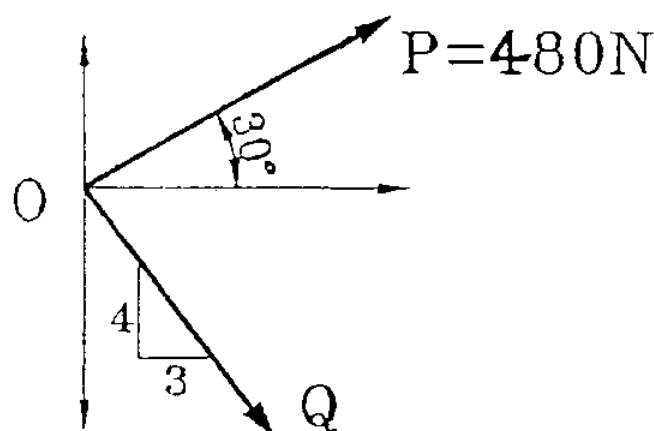
[Total Marks : 80

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

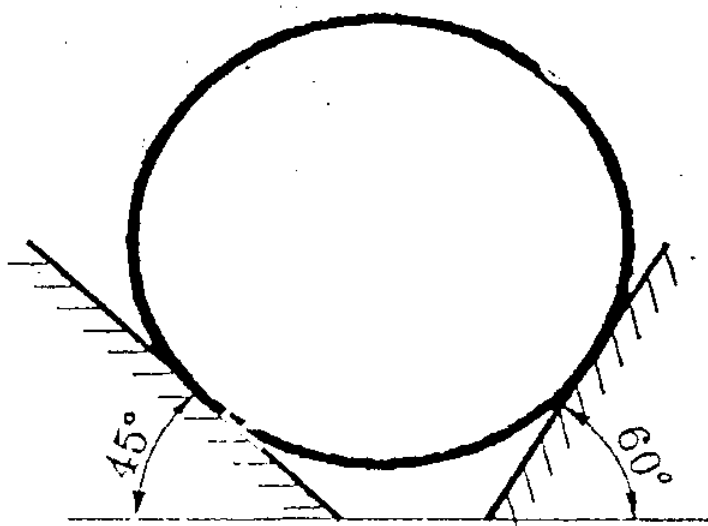
2. Answer any **three more** questions out of **remaining** questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full mark
5. Take  $g = 9.81 \text{ m/s}^2$

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]



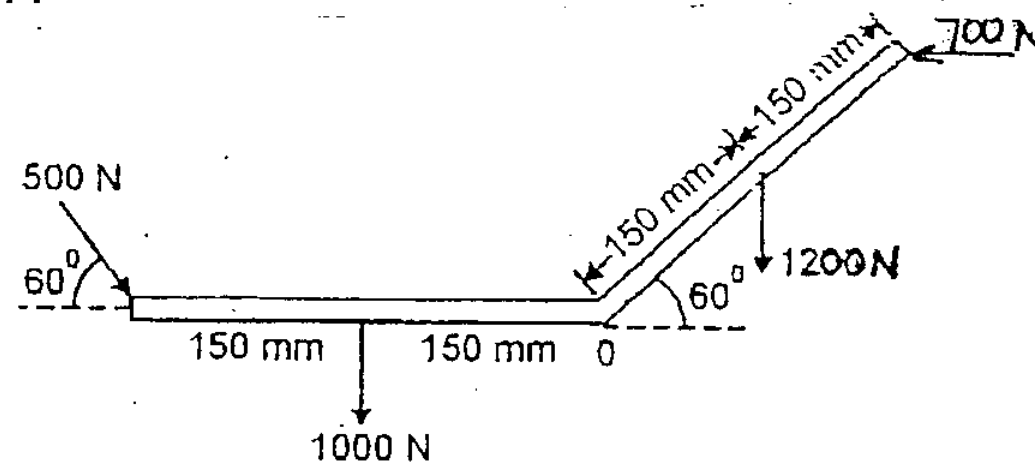
- b) A cylinder with  $1500 \text{ N}$  weight is resting in an unsymmetrical smooth groove as shown in figure. Determine the reactions at the points of contacts [4]



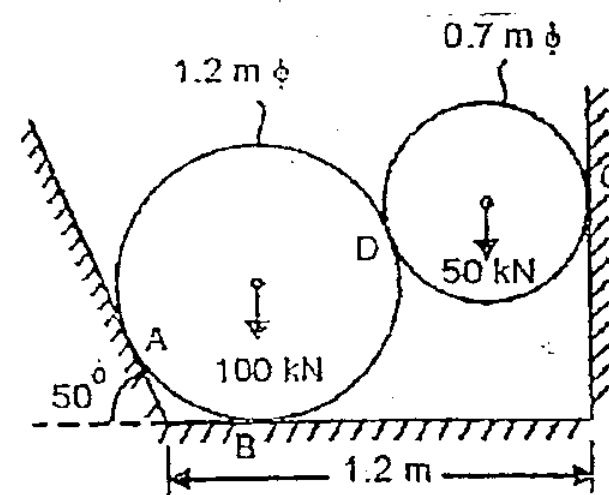
- c) Explain Angle of Friction, Angle of Repose and the relation between the two. [4]
- d) A sprinter in a  $100 \text{ m}$  race accelerates uniformly for the first  $35 \text{ m}$  and then runs with constant velocity. If the sprinter's time for the first  $35 \text{ m}$  is  $5.4$  seconds, determine his time for the race. [4]
- e) A motorist travelling at a speed of  $90 \text{ kmph}$  suddenly applies the brakes and comes to rest after skidding  $100 \text{ m}$ . 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]

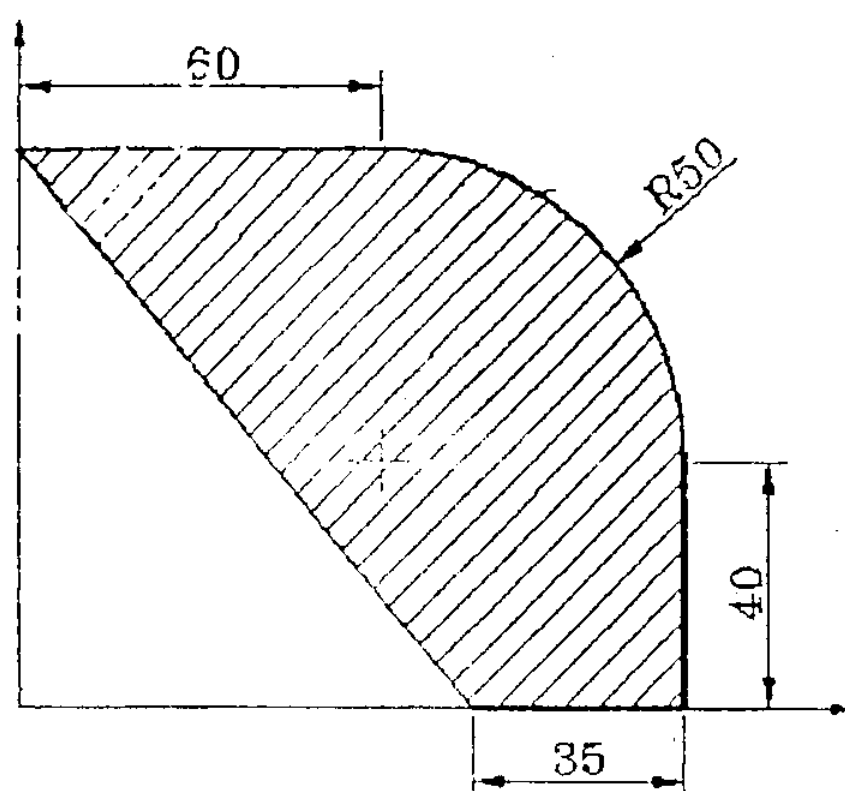


b) Two cylinders are kept in a channel as shown in figure. Determine the reactions at all the contact points A,B,C and D. Assume all surfaces smooth. [8]



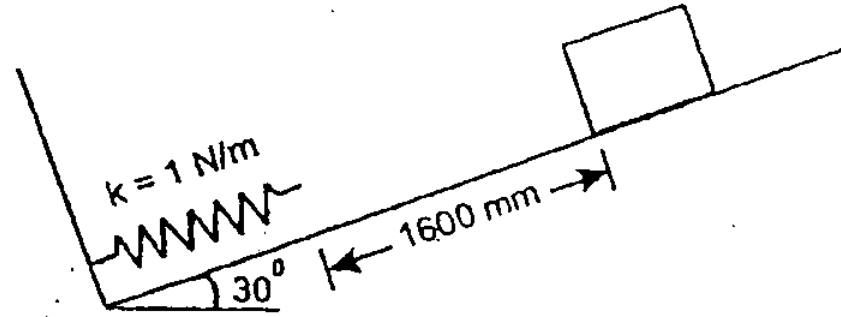
c) A ball of mass 'm' hits directly to a similar ball of mass 'm' which is at rest. The velocity of first ball after impact is zero. Half of the initial kinetic energy is lost in impact. Find coefficient of restitution. [6]

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

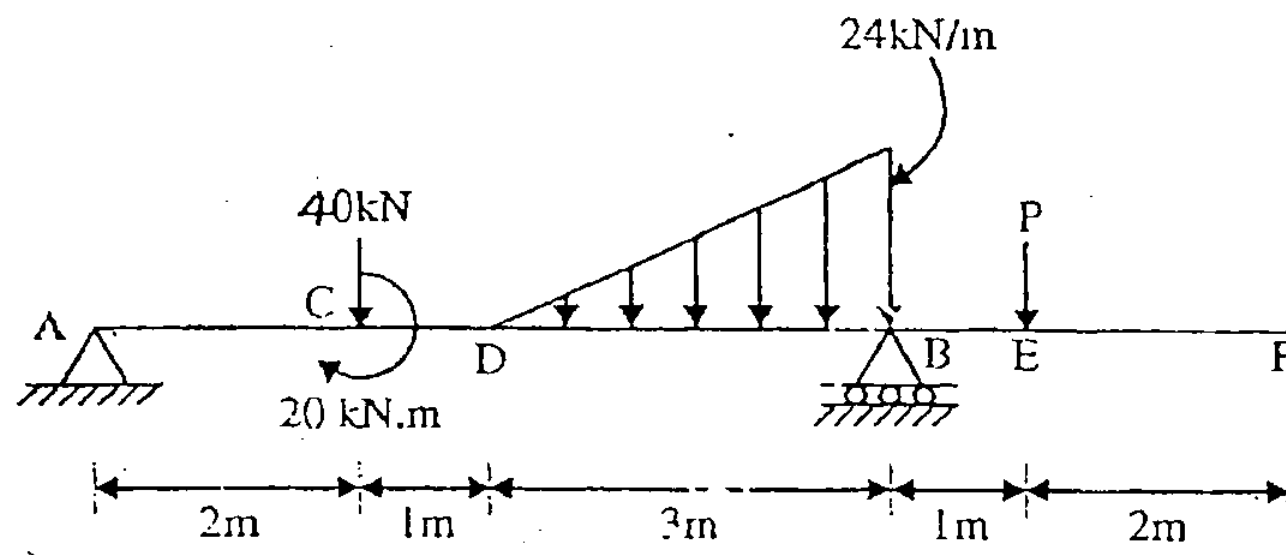


b) The lines of action of three forces concurrent at origin 'O' pass respectively through points A(-1,2,4), B(3,0,-3) and C(2,-2,4)m. The magnitude of forces are 40N, 10N and 30N respectively. Determine the magnitude and direction of their resultant. [6]

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]

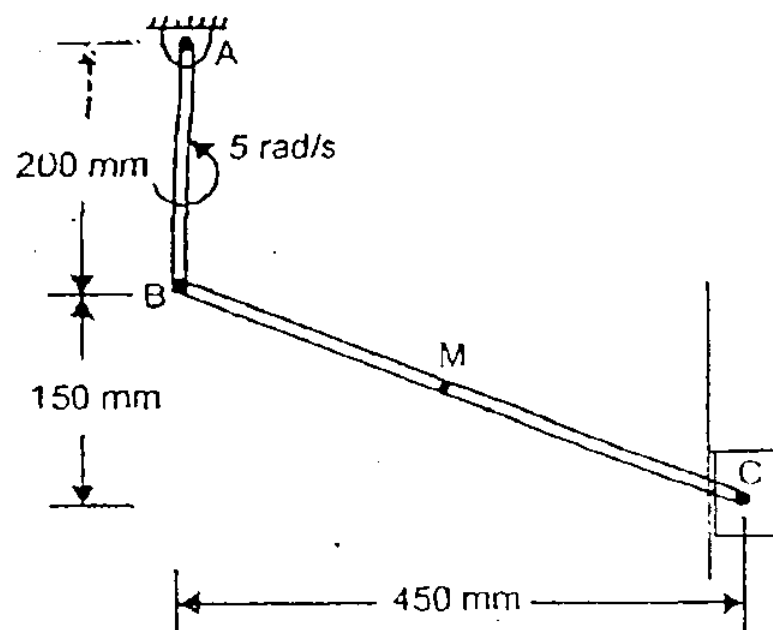


Q4.a) Find the support reaction at B and the load P, for the beam shown in figure if the reaction at support A is zero. [8]



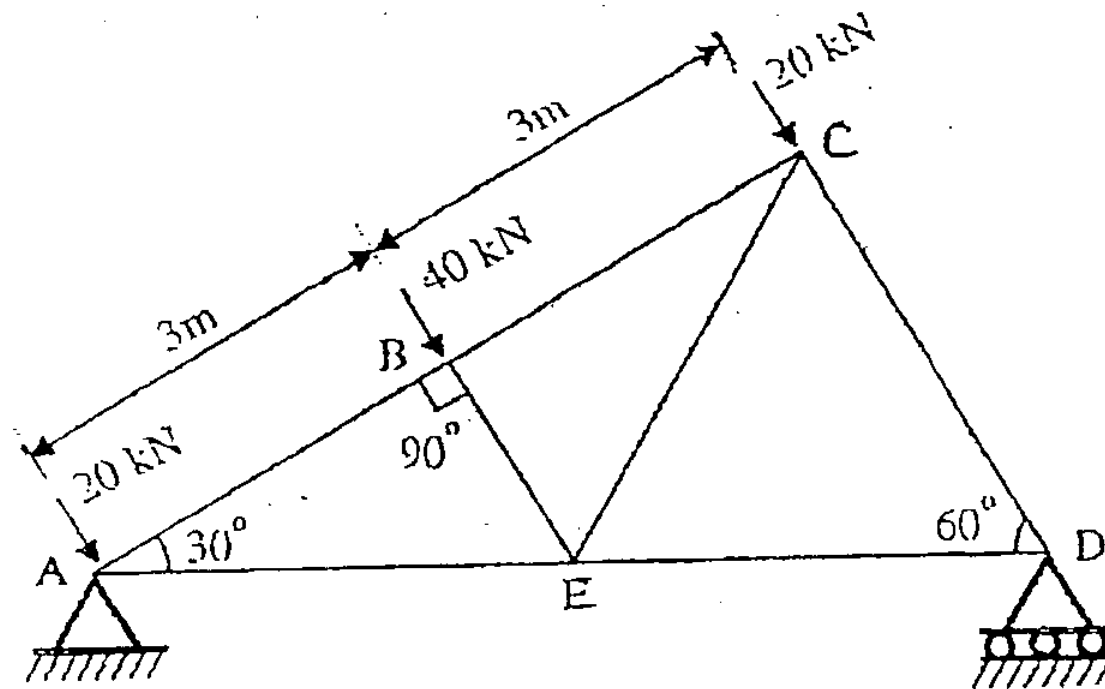
b) A gunman fires a bullet with a velocity of 100m/s,  $50^\circ$  upwards from the top of a hill 300m high to hit a bird. The bullet misses its target and finally lands on the ground. Calculate (a) the maximum height reached by the bullet above the ground (b) total time of flight (c) velocity with which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

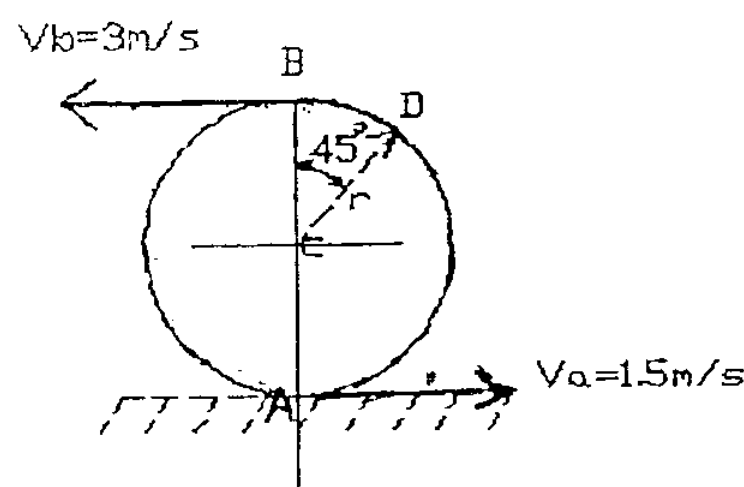


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Q5.a) Determine the forces in members BC, CE and DE by method of sections and all other members by method of joints. Give the result in a table. [8]



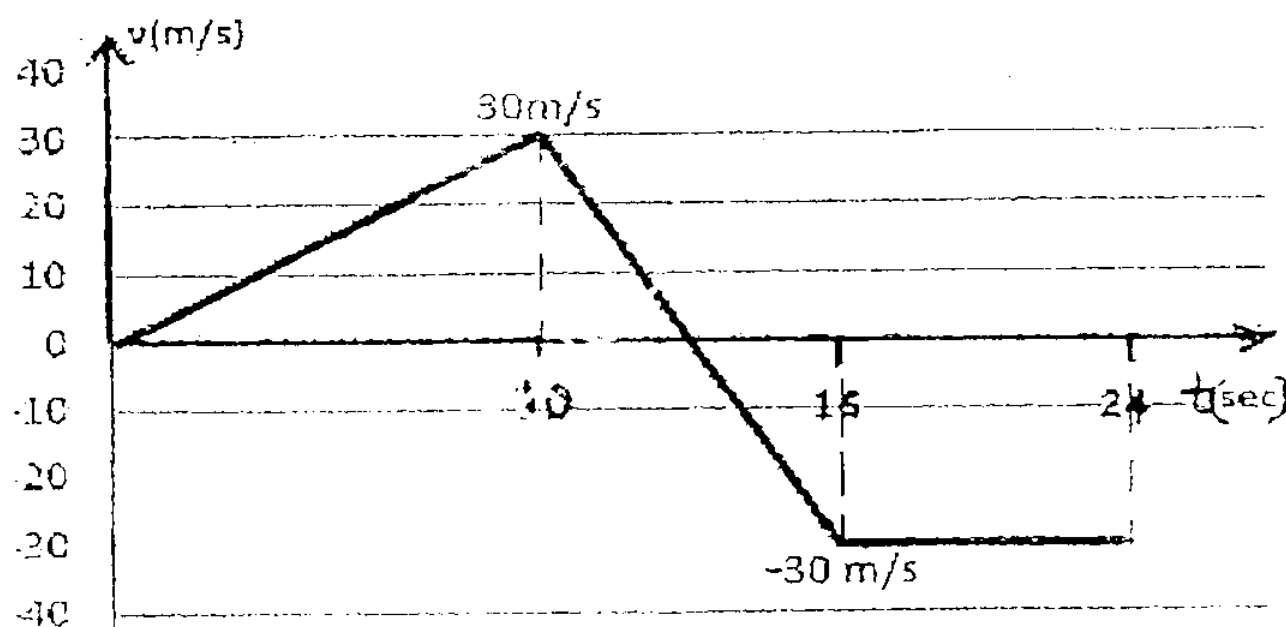
b) Due to slipping, points A and B on the rim of the disk have the velocities as shown in figure. Determine the velocities of the centre point C and point D on the rim at this instant. Take radius



of disk 0.24m.

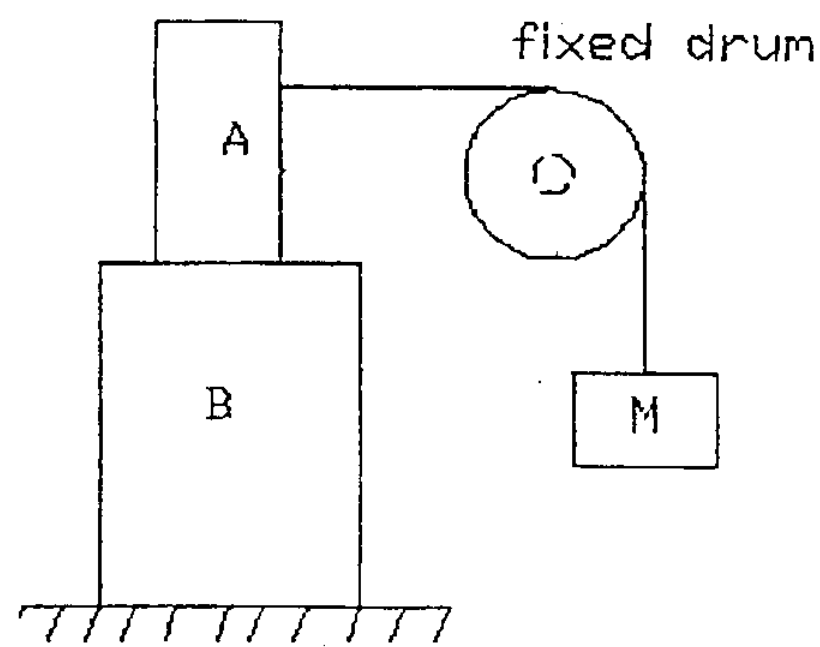
[6]

c) A particle moves in a straight line with a velocity-time diagram shown in figure. If  $S = -25\text{m}$  at  $t=0$ , draw displacement-time and acceleration time diagrams for 0 to 24 seconds. [6]



[TURN OVER

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 3m/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]

