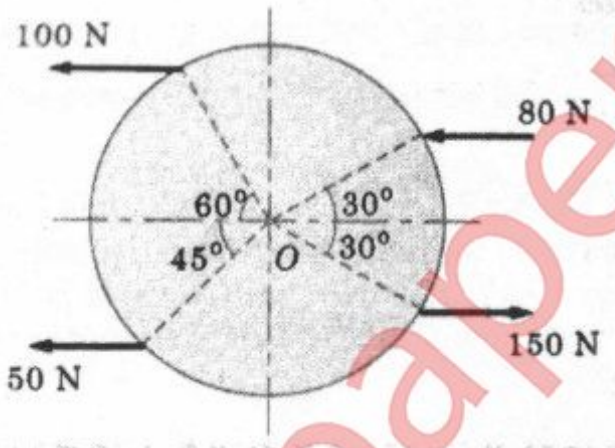
F.E.(Sem-I) / CBSGS / App. Mech. / May-17
22-05-17

Q. P. Code:-18134

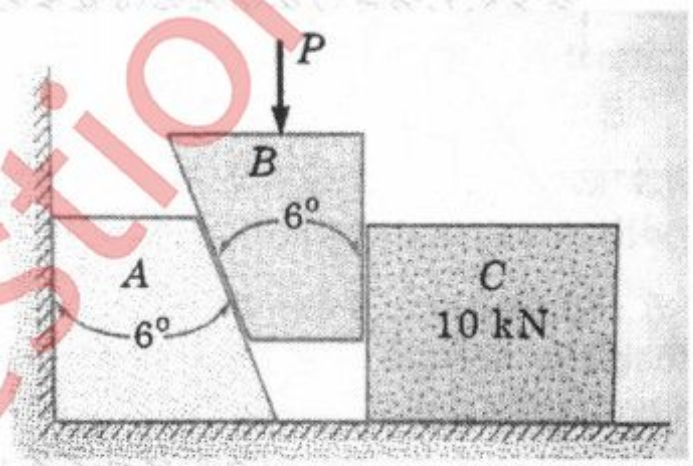
(3Hrs.) Total Marks: 80

N.B. 1 Question number 1 is compulsory
2 Attempt any 3 questions from remaining questions
3 Figure to right of the question indicates full marks
4 Assume suitable data wherever necessary.
5 Assume Acceleration due to gravity value g = 9.81 m/s^2

Q1 a) Determine the resultant of the following parallel forces and locate the position of resultant w.r.t. point O. Take radius r = 50 cm [4]

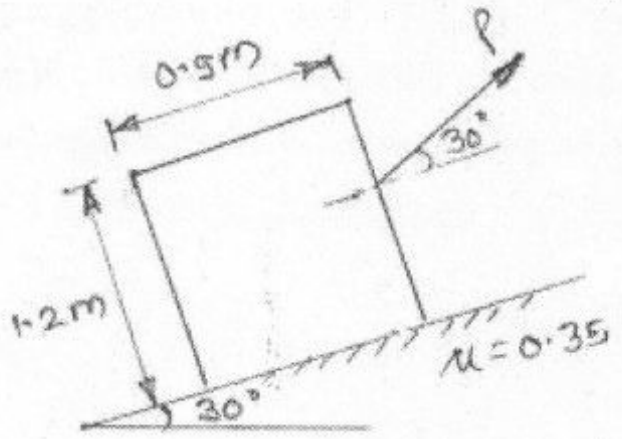


b) Two 6° wedges are used to push a block horizontally as shown. Calculate the minimum force required to push the block of weight 500 N. Take μ = 0.2 for all contact surfaces. [4]



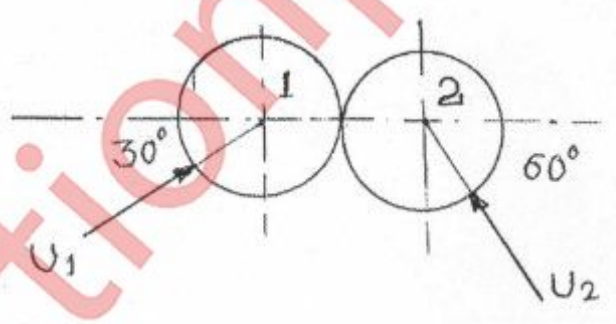
c) of weight 8 KN moving from rest with constant acceleration acquires an upward velocity of 4m/s over a distance of 5m. Determine the tension in the cables supporting the lift. [4]

d) Find the value of 'P' which will desturb the equilibrium of the system μ= 0.35 [4]

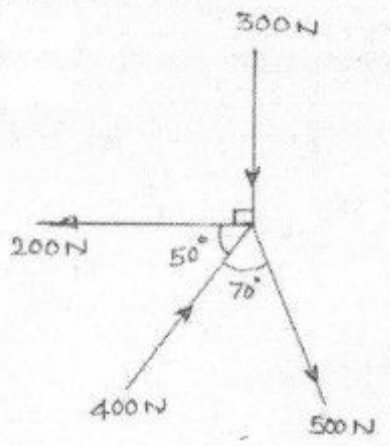


e) The position of a particle which moves along a straight line is given by $x = t^3-6t^2-15t+40$ where x is in meters and t is in seconds. Find the time at which velocity will be zero. Also find the position of the particle in that time [4]

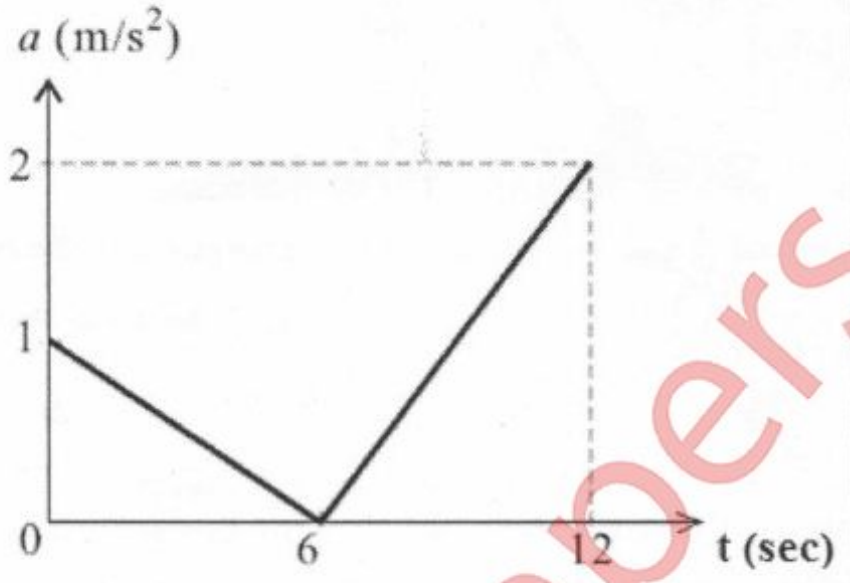
Q2 a) Two smooth spheres 1 and 2 having a mass of 2 Kg and 4 Kg respectively collide with initial velocities as shown in fig. if the co-efficient of restitution for the spheres is e=0.8, determine the velocities of each sphere after collision. Angles made by velocities U1 and U2 with line of impact are 30^0 and 60^0 respectively. [8]



b) Find the resultant force and its direction? [4]

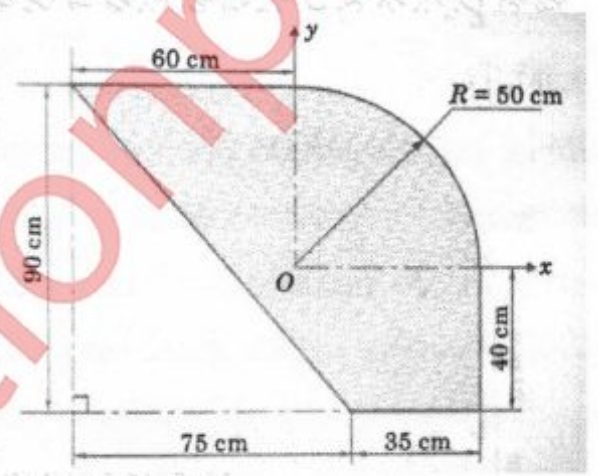


c) The a-t diagram for the linear motion is shown in Fig. Construct velocity time and displacement time diagrams for the motion assuming that the motion starts with initial velocity of 5 m/s from the starting point. [8]



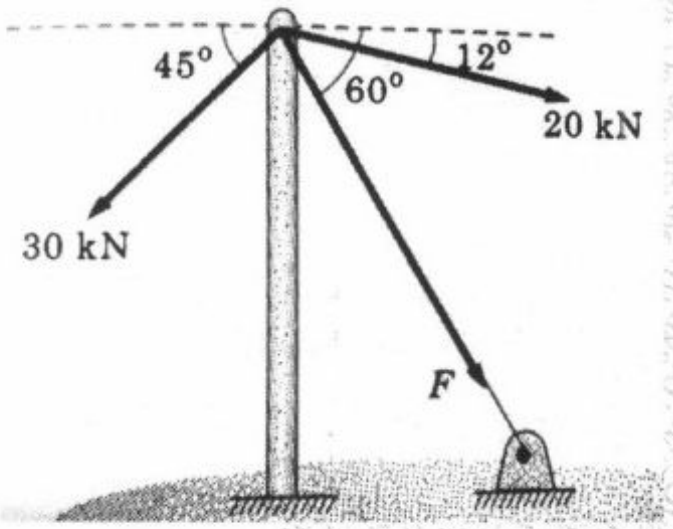
Q3 a) Find centroid of the given shaded area with reference to O. [8]

[08]

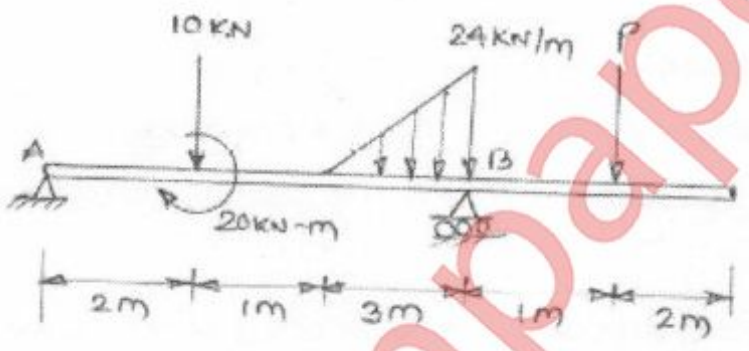


b) A ball is thrown in the air with velocity of 4 m/sec. at an angle of 30° with the horizontal. Determine maximum height reached and range. State condition for maximum range and find maximum range. [6]

c) Determine the force F in the cable shown in figure so that the resultant of three coplanar concurrent forces acting at point A is vertical. Also find the resultant [6]

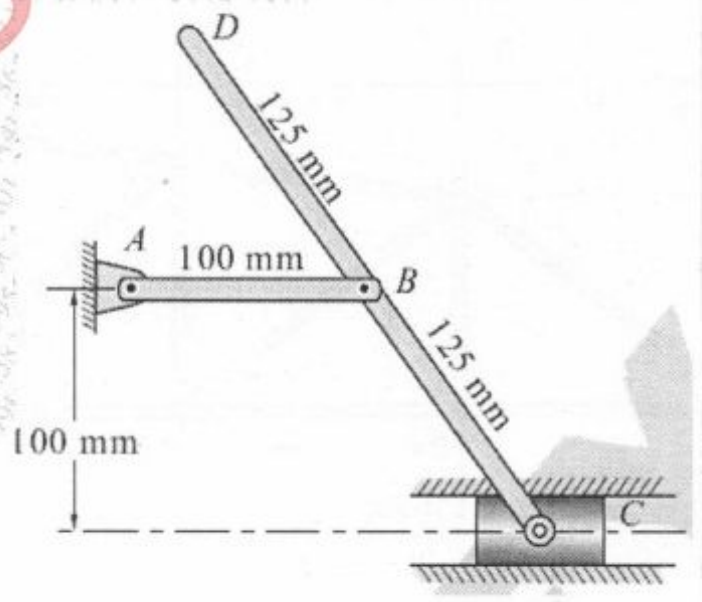


Q4 a) Find analytically the support reaction at B and the load P, for the beam to be in equilibrium as shown in the figure [8]

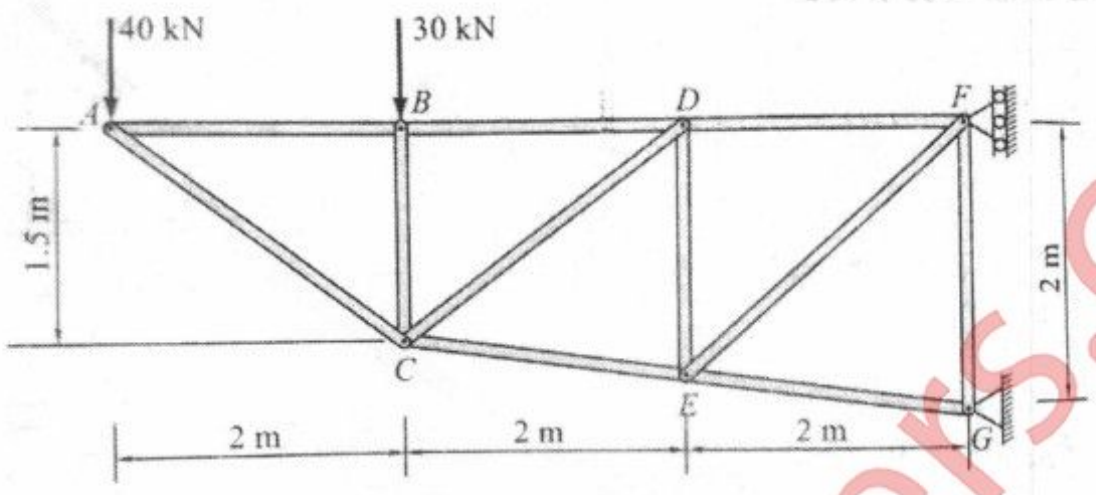


b) A 50 kg block kept on the top of a 15^0 sloping surface is pushed down the plane with an initial velocity of 20 m/s. If $\mu_k = 0.4$, determine the distance traveled by the block and the time it will take as it comes to rest. [6]

c) At the position shown in Fig. the crank *AB* has angular velocity of 3 rad/sec clockwise. Find the velocity of slider *C* and the point *D* at the instant shown. [6]



Q5 a) For the truss shown in figure. Calculate forces in members BC, CD, DE, and EF by method of section. [8]

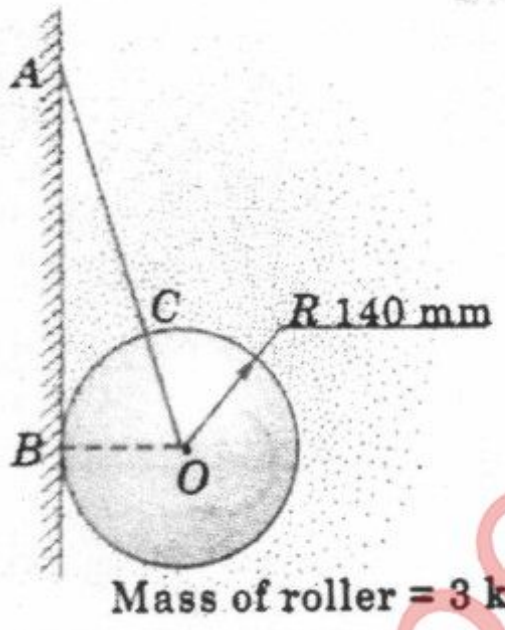


b) A stone is dropped into a well and sound of splash is heard after 5 seconds. Find the depth of the well up to the water level assuming the velocity of sound to be 340m/s. [6]

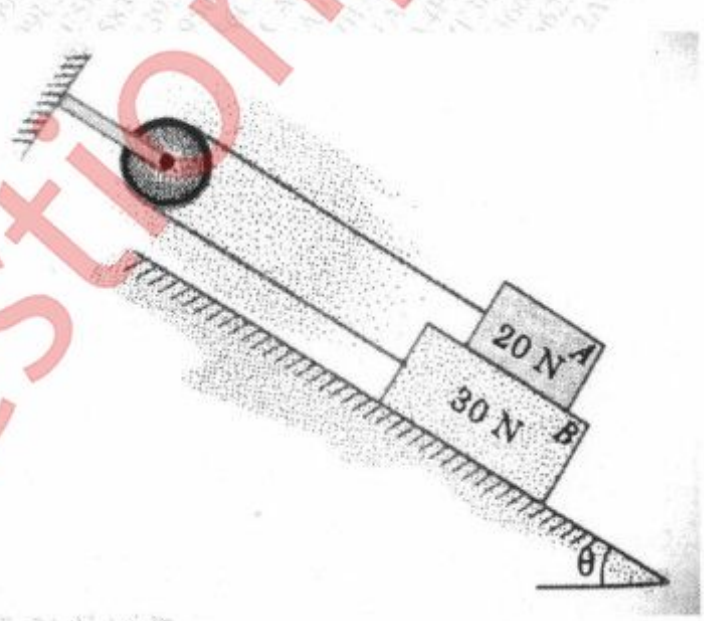
c) The batsman hits a ball of 150 grams coming to him straight with a speed of 72kmph at an angle of 45° with horizontal and velocity of hit is 216 kmph. Find the average force exerted by the bat on the ball if the impact lasts for 0.02 sec. [6]

Q6 a) The acceleration of an oscillating particle is defined by the relation $a = -kx$. Determine **(i)** the value of k such that $v = 15$ m/sec when $x = 0$ and $v = 0$ when $x = 3$ m and **(ii)** the speed of the particle when $x = 2$ m. [4]

b) Roller of mass 3 kg is supported by string as shown in figure , find the tension in the string and reaction at point B if the system is in equilibrium, given AC = 120 mm [4]



c) 20 N block A and 30 N block B are supported by an inclined plane which is held in position as shown in fig. Knowing that the coefficient of friction is 0.15, between the two blocks and zero between block B and incline, determine the value of θ for which motion is impending. [4]



d) Figure shows a collar of mass 20 kg which is supported on the smooth rod. [8] The attached springs are undeformed when $d = 0.5$ m. Determine the speed of the collar after the applied force of 100 N causes it to displace so that $d = 0.3$ m. The collar is at rest when $d = 0.5$ m. Use work energy principle.