

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra)
Engineering Mechanics (CE101)

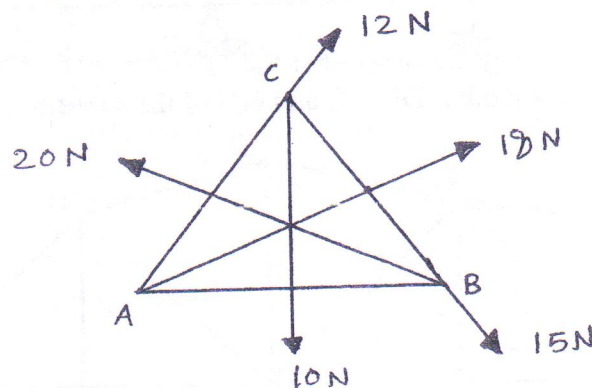
End Semester Examination
Semester: I
Time: 3 Hours

F.Y.B.Tech.
Year: 2008-2009
Max.Marks:50

Instructions to candidates:

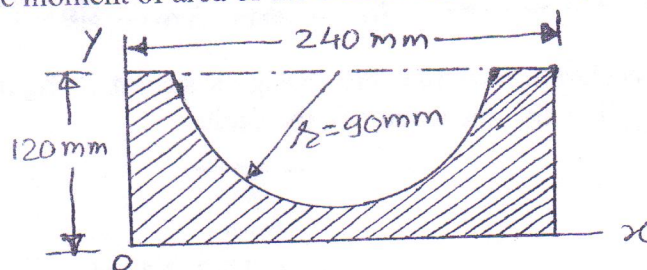
- 1) All questions are compulsory
- 2) Assume suitable data, if necessary
- 3) Use of non-programmable calculators is allowed

- Q. 1 a) Represent the given force system acted upon an equilateral triangle each of side 6 m (as shown in figure 1) into a single equivalent force. Also find the point of application of single equivalent force with respects to the point A



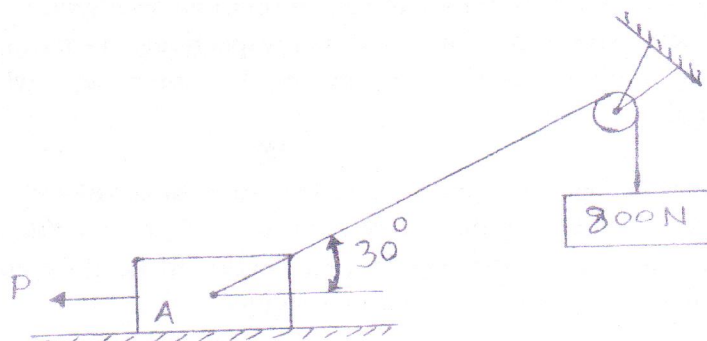
(4)

- b) Determine the moment of area of the shaded area with respect to the x axis.



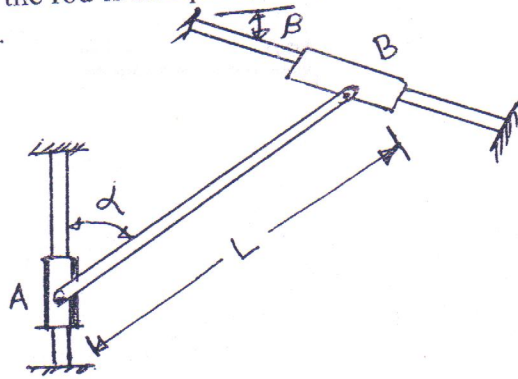
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- Q. 2 a) Block A shown in fig. weighs 2000N. The cord attached to A passes over a fixed drum and supports a weight equal to 800N. The value of coefficient of friction between A and the horizontal plane is 0.25 and between the rope and the fixed drum is 0.1. Solve for P: (1) if motion is impending towards the left, (2) if the motion is impending towards the right.



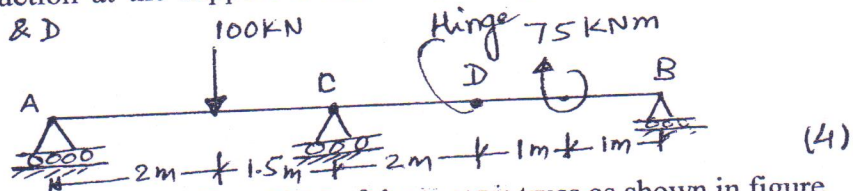
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- b) A slender rod of length L is attached to collars which may slide freely along the guides shown. Knowing the rod is in equilibrium; derive an expression for the angle α in terms of the angle β .



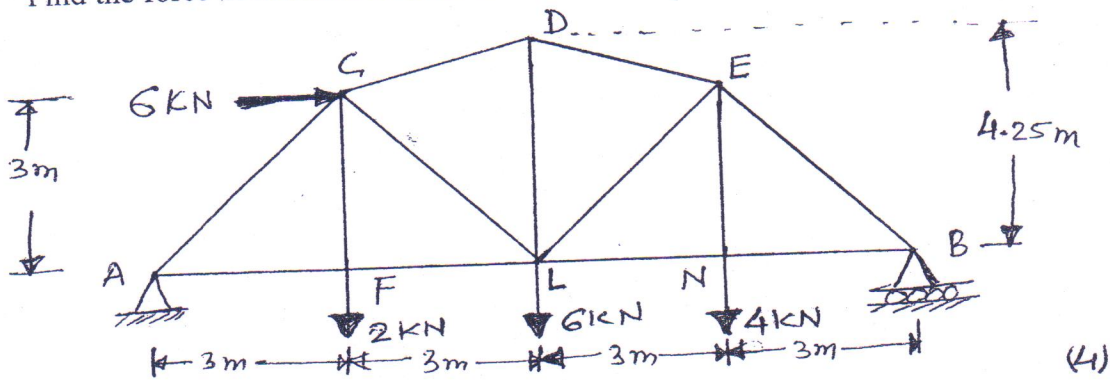
(4)

- Q. 3. a) Determine the reaction at the support A and B by using Virtual Work Principle and also at C & D



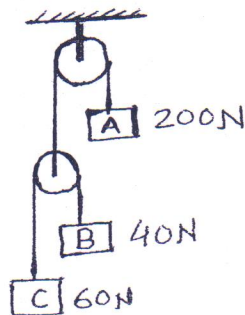
(4)

- b) Find the force in member DE, LE and LN of the given truss as shown in figure



(4)

- Q. 4. a) Find the acceleration of the three weights shown in figure. Assume pulleys are frictionless. Find also the tension in the cables.



(5)

- b) A particle starts from rest, the equation of an acceleration $a = 0.8\sqrt{v^2 + 49}$, where a and v are expressed in m/s^2 and m/s respectively. Determine (a) the position of the particle when $v = 24 m/s$, (b) the speed of the particle when $x = 40 m$. Also draw the motion curves

(5)

OR

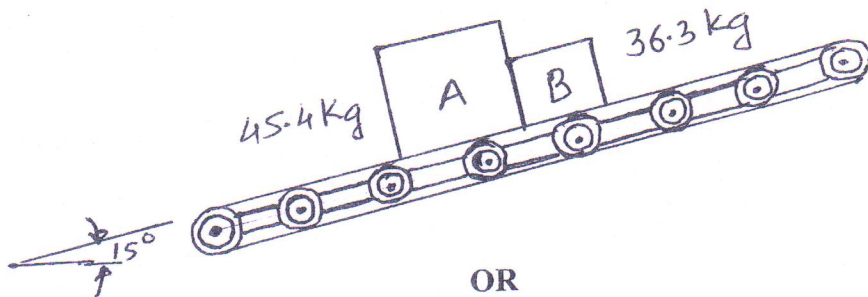
- b) On level ground A, a particle is projected at a velocity of $u m/s$ at an angle α upwards. Neglecting the air resistance, find the (i) the total time of flight, (ii) horizontal range of the particle, (iii) maximum height reached by the particle and (iv) time required to reach maximum height.

(5)

Q. 5. a)

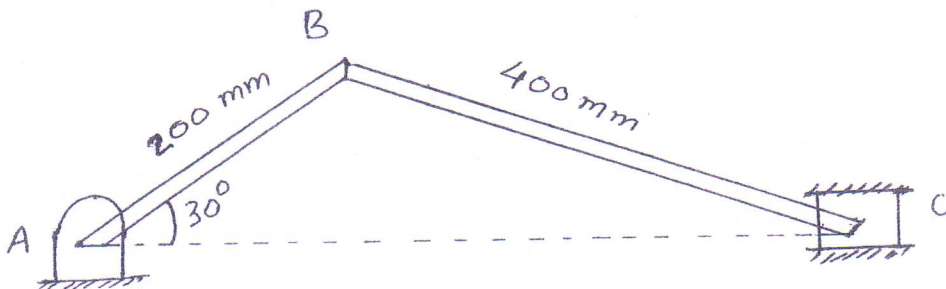
A pile hammer weighing 20 kN drops from a height of 750 mm on a pile of 10 kN. The pile penetrates 100 mm per blow. Assuming that the motion of the pile is resisted by a constant force, find the (i) resistance to penetrate of the ground and (ii) time during which the pile is in motion for each blow. (4)

b) Boxes A and B are rest on a conveyor belt that is initially at rest. The belt is suddenly started in an upward direction so that slipping occurs between the belt and the boxes. Knowing that the coefficients of kinetic friction between the belt and the boxes are $(\mu_k)_A = 0.3$ and $(\mu_k)_B = 0.32$, determine the initial acceleration of each box



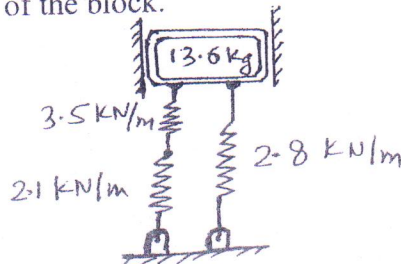
OR

b) A crank and piston mechanism is shown in figure, crank AB rotates at an angular velocity of 2.094 m/s clockwise, if lengths AB and BC are 200 and 400 mm respectively, find the velocity of piston "C" sliding in the straight guides angle BAC = 30° (Use ICR Method)



Q. 6. a)

A 13.6 kg block is supported by the spring arrangement shown. If the block is moved from its equilibrium position 44 mm vertically downward and released, determine (i) the period and frequency of the resulting motion, (ii) the maximum velocity and acceleration of the block.



b)

The period of vibration of the system shown is observed to be 0.2s. After the spring of constant $k_2 = 3.5$ kN/m is removed and block A is connected to the spring of constant k_1 , the period is observed to be 0.12s. Determine (a) the constant k_1 of the remaining spring, (b) the weight of block A

