PHYS 2101 — Test II

Monday, 17 November 2003 — 3:00 – 4:30 p.m.

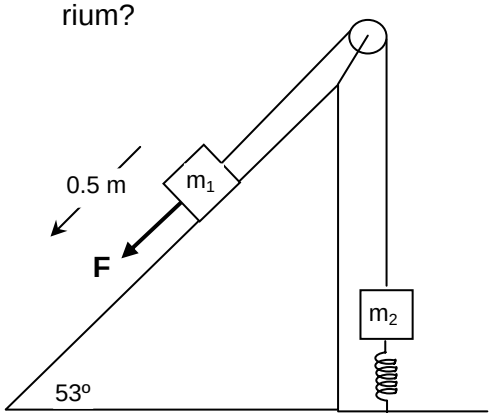
ID No:
NAME:
SECTION:

1	2	3	4	Total

Full Mark: 40 points	**Please check that your examination paper has 4 pages!**

1. A block of mass m_1 = 4 kg is on a 53º inclined plane with coefficient of kinetic friction 0.5. It is tied to a second block of mass m_2 = 6 kg. This second block is attached to a spring with spring constant 80 N m^{-1}. Initially the spring is at its natural length. A force F = 100 N, parallel to the inclined plane, is applied to the first block and it is displaced by 0.5 m as shown.
   a) Find the velocity of the blocks at the end of this displacement.
   b) Assume that there is no friction. At which extension of the spring is this system at equilibrium?

(9 points)



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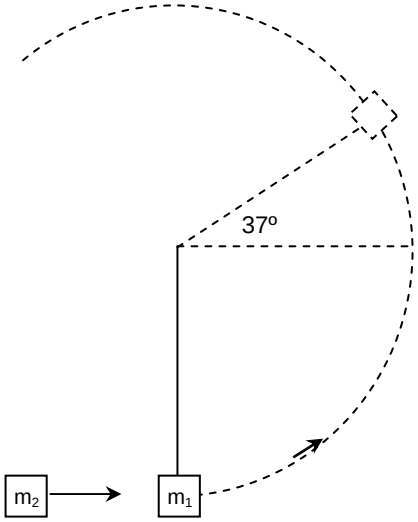
2. A block of mass m_1 = 4 kg is hanging from a 0.8 m long string. A second block of mass m_2 = 2 kg, traveling with a speed of 10 m s^{-1}, hits the first block and bounces back with a speed of 2 m s^{-1}.
   a) If the collision last 4 ms, how large a force does the second block exert on the first?
   b) How large is the tension in the string when it makes an angle of 37° with the horizontal as shown?
   c) How large is the maximum tension in the string during this motion?
   d) Show if the block will be able to reach the top of the circle.

(11 points)



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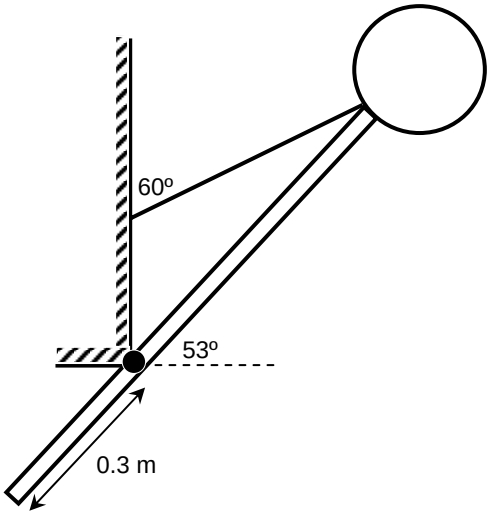
3. A rod of weight 100 N and length 1 m is hinged 0.3 m from one end and is making an angle of 53º with the horizontal. A disk of weight 20 N and radius 0.2 m is attached to the end of the rod. This end of the rod is tied to a wall with a rope making an angle of 60° with the wall.
   a) Find the tension in the rope.
   b) Find the forces at the hinge.
   c) If the rope breaks, with which angular acceleration will the system begin to rotate? (Moments of inertia about the center of mass: $I_{rod} = ML^2/12$, $I_{disk} = MR^2/2$).

(11 points)



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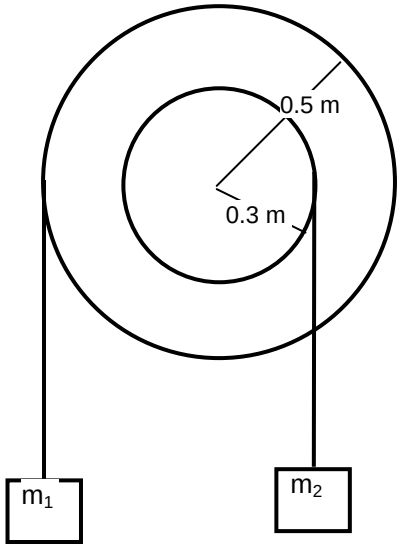
4. A pulley with an outer radius of 0.5 m has a shaft of radius 0.3 m. Its moment of inertia is 3.3 kg m^2. A block of mass m_1 = 9 kg is hanging from a string wound around the outer rim. A second block of mass m_2 is hanging from a string wound around the shaft as shown.
   a) What must the mass of the second block be so that the system remains at equilibrium?
   b) If the second block is observed to move upwards with an acceleration of 1.5 m s^{-2}, how large is its mass?
   c) After how many revolutions will the angular velocity of the pulley be 10 rad s^{-1}?

(9 points)



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