# ECE 105 Quiz 7

## Thursday Tutorial



**Individual (10 marks)** A uniform solid cube with a mass of 3.00 kg and edges of length a = 0.200 meters is set into rotational motion with an initial angular velocity of 3.00 radians/s counterclockwise about a rotation axis that is along one of its edges that is in contact with a horizontal surface at an initial angle of 30.0o.

(a) Given that the moment of inertia of a cube of side a and mass M about its centre of mass is Ma2/6, what is the moment of inertia of the cube about the edge that is in contact with the surface?

(b) What is the angular acceleration of the cube about the axis through this edge when it is at its initial position?

(c) For the initial conditions described, will the cube rotate past 45.0o and tip over or not?

**Thursday Group work:**

**1**  The moment of inertia of the cube about its edge

1. is zero
2. is smaller than its moment of inertia about its centre of mass
3. is the same as its moment of inertia about its centre of mass
4. is larger than its moment of inertia about its centre of mass

**2** The angular acceleration of the cube

**a)** is always increasing

**b)**  is initially increasing

**c)** is initially decreasing

**d)** is always decreasing

**3** The kinetic energy of the cube

**a)** is always increasing

**b)**  is initially increasing

**c)** is initially decreasing

**d)** is always decreasing

**4** The potential energy of the cube

**a)** initially increases

**b)** initially decreases

**c)** is constant throughout the motion

**d)** is zero

**5**  What force(s) contribute to rotating the cube?

**a)** None, because the net torque on the cube is zero

**b)** Normal force of contact of the edge with the surface

**c)** Friction of the edge with the surface

**d)** Gravity

## Friday Tutorial

**Individual (10 marks):**

****The system is released from rest.



1. What is the acceleration of mass m1?
2. What is the acceleration of mass m2?
3. What is the angular acceleration of the double pulley?

**Friday Group work:**

**1**  Suppose we change the value of one of the masses so that the pulley doesn’t move. The ratio of these masses m2/m1 must be

1. Unity (both masses equal)
2. 2
3. 2/3
4. 3/2

**2** If the outer wheel were replaced by a solid disk of the same mass, then to balance the pulley we would need

**a)** 2m2=3m1

**b)** 3m2=2m1

**c)** m2=m1

**d)** m2=2m1

**3** If the inner disc were replaced by a wheel of the same mass, with massless spokes

**a)** the angular acceleration of the pulley would remain unchanged

**b)** the angular acceleration of the pulley would be zero

**c)** the angular acceleration of the pulley would increase

**d)** the angular acceleration of the pulley would decrease

**4** Provided m2<m1 , which of the 4 statements below is correct?

**a)** It is possible to choose a mass ratio m2/m1 so that the acceleration of both masses is larger than g=9.8 m/s2

**b)** It is possible to choose a mass ratio m2/m1 so that the acceleration of one mass is larger than g=9.8 m/s2

**c**) It is impossible to choose a mass ratio m2/m1 so that the acceleration of one mass is larger than g=9.8 m/s2

**d)** It is impossible to choose a mass ratio m2/m1 so that the acceleration of both mass is smaller than g=9.8 m/s2

**5** If m2 is removed the net torque on the pulley

**a)** remains the same

**b)** decreases

**c)** increases

**d)** could either increase or decrease depending of the value of m1

# Solutions

## Thursday Tutorial

A uniform solid cube with a mass of 3.00 kg and edges of length a = 0.200 meters is set into rotational motion with an initial angular velocity of 3.00 radians/s counterclockwise about a rotation axis that is along one of its edges that is in contact with a horizontal surface at an initial angle of 30.0o with the horizontal surface.

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## Friday Tutorial

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