As a student at NJIT, I (sign) ____________________________, will conduct myself in a professional manner and will comply with the provisions of the NJIT Academic Honor Code. I also understand that I must subscribe to the following pledge on major work submitted for credit as described in the NJIT Academic Honor code: On my honor, I pledge that I have not violated the provisions of the NJIT Academic Honor Code.

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. A uniform beam having a mass of 60 kg and a length of 2.8 m is held in place at its lower end by a pin. Its upper end leans against a vertical frictionless wall as shown in the figure. What is the magnitude of the force the pin exerts on the beam?

   a. 0.35 kN  
   b. 0.63 kN  
   c. 0.74 kN  
   d. 0.57 kN  
   e. 0.68 kN

2. The diagram below shows five 20-kg rods of the same 2.0-m length free to rotate about axes through the rods, as indicated. Which rod experiences the greatest gravitational torque?

   a.  
   b.  
   c.  
   d.  
   e.  
3. The diagrams below show forces applied to a wheel that weighs 20 N. The symbol W stands for the weight. In which diagram(s) is the wheel in equilibrium?

a. A  
b. B  
c. C  
d. D  
e. A and C

4. A 25-ft long crane supported at its lower end by a pin is elevated by a horizontal cable as shown in the figure. A 250-lb load is suspended from the outer end of the crane. The center of gravity of the crane is 10 ft from the pin, and the crane weighs 200 lb. What is the tension in the horizontal cable?

a. 540 lb  
b. 640 lb  
c. 2000 lb  
d. 610 lb  
e. 570 lb
5. A horizontal meter stick supported at the 50-cm mark has a mass of 0.50 kg hanging from it at the 20-cm mark and a 0.30 kg mass hanging from it at the 60-cm mark. Determine the position on the meter stick at which one would hang a third mass of 0.60 kg to keep the meter stick balanced.
   a. 86 cm
   b. 70 cm
   c. 65 cm
   d. 62 cm
   e. 74 cm

6. Five identical cylinders are each acted on by forces of equal magnitude. Which force exerts the biggest torque?
   a. 
   b. 
   c. 
   d. 
   e. 

7. A car of mass 1000 kg moves with a speed of 50 m/s on a circular track of radius 100 m. What is the magnitude of its angular momentum (in kg $\cdot$ m$^2$/s) relative to the center of the race track?
   a. $5.0 \times 10^6$
   b. $5.0 \times 10^3$
   c. $2.5 \times 10^6$
   d. $5.0 \times 10^2$
   e. $2.5 \times 10^4$
8. A horizontal non-uniform bar is supported by two vertical ropes at the ends. The center of mass of the bar is closer to the right end. Which rope exerts a greater tension?
   a. Rope at the left end
   b. Rope at the right end
   c. The tensions in both ropes are equal
   d. A horizontal non-uniform bar cannot be supported by two vertical ropes at the ends
   e. Not enough information

9. A particle located at the position vector \( \mathbf{r} = \left( \hat{i} + \hat{j} \right) \text{ m} \) has a force \( \mathbf{F} = \left( 2\hat{i} + 3\hat{j} \right) \text{ N} \) acting on it. The torque about the origin is
   a. \( (1\mathbf{k})\text{N} \cdot \text{m} \)
   b. \( (-1\mathbf{k})\text{N} \cdot \text{m} \)
   c. \( (5\mathbf{k})\text{N} \cdot \text{m} \)
   d. \( (2\hat{i} + 3\hat{j})\text{N} \cdot \text{m} \)
   e. \( (-5\mathbf{k})\text{N} \cdot \text{m} \)

10. A skater extends her arms horizontally, holding a 5-kg mass in each hand. She is rotating about a vertical axis with an angular velocity of one revolution per second. If she drops her hands to her sides, what will the final angular velocity (in rev/s) be if her moment of inertia remains approximately constant at 5 kg \cdot m^2, and the distance of the masses from the axis changes from 1 m to .1 m?
   a. 7
   b. 9
   c. 3
   d. 4
   e. 6
11. A puck on a frictionless air hockey table has a mass of 5.0 g and is attached to a cord passing through a hole
in the surface as in the figure. The puck is revolving at a distance 2.0 m from the hole with an angular velocity
of 3.0 rad/s. The cord is then pulled from below, shortening the radius to 1.0 m. The new angular velocity (in
rad/s) is

a. 8.0  
b. 4.0  
c. 12  
d. 2.0  
e. 6.0

12. A thin rod of mass $M$ and length $L$ is struck at one end by a ball of clay of mass $m$, moving with speed $v$ as
shown in the figure. The ball sticks to the rod. After the collision, the angular momentum of the clay-rod
system about A, the midpoint of the rod, is

a. $(m + M/6)(vL/2)$  
b. $mvL$  
c. $(m + M/3)(vL/2)$  
d. $(m + M/12)(vL/2)$  
e. $mvL/2$
13. A solid cylinder of radius $R = 1.0$ m and mass 10 kg rotates about its axis. When its angular velocity is 10 rad/s, its angular momentum (in kg $\cdot$ m$^2$/s) is
a. 25.
b. 40.
c. 20.
d. 50.
e. 70.

14. A tilted uniform rectangular metal plate is supported by two vertical ropes as shown below. Which rope exerts a greater tension?

- a. Rope on left
- b. Rope on right
- c. The tensions in both ropes are equal
- d. The plate cannot be supported by two vertical ropes as shown above
- e. Not enough information
15. The figure shows a uniform, horizontal beam (length = 10 m, mass = 25 kg) that is pivoted at the wall, with its far end supported by a cable that makes an angle of $51^\circ$ with the horizontal. If a person (mass = 60 kg) stands 3.0 m from the pivot, what is the tension in the cable?

a. 0.30 kN
b. 0.39 kN
c. 3.0 kN
d. 0.42 kN
e. 0.83 kN
Common Exam 2, Physics 106, Summer 2010
Answer Section

MULTIPLE CHOICE

1. ANS: E  
   PTS: 1
2. ANS: D  
   PTS: 1
3. ANS: C  
   PTS: 1
4. ANS: E  
   PTS: 1
5. ANS: B  
   PTS: 1
6. ANS: A  
   PTS: 1
7. ANS: A  
   PTS: 1
8. ANS: B  
   PTS: 1
9. ANS: A  
   PTS: 1
10. ANS: C 
    PTS: 1
11. ANS: C 
    PTS: 1
12. ANS: E 
    PTS: 1
13. ANS: D 
    PTS: 1
14. ANS: A 
    PTS: 1
15. ANS: B 
    PTS: 1