Your solutions should be neat, correct and complete. Same instructions as Mission 1 apply here.

**Recommended Homework from Textbook:** problems:

9.3, 9.7, 9.13, 9.22, 9.35, 9.39, 9.45, 9.78, 9.84, 9.99

10.1, 10.4, 10.11, 10.17, 10.34, 10.39, 10.40, 10.43, 10.50, 10.64, 10.67, 10.79, 10.97,

13.5, 13.14, 13.16, 13.22, 13.29, 13.32, 13.37, 13.43, 13.52, 13.62, 13.75.

I also reccommend you work on understanding whatever details of lecture seem mysterious at first.

**Required Reading 6** [1pt] Your signature below indicates you have read:

**(a.)** I read Lectures 26, 27, 28, 29, 30, 31, 32 and 33 by Cook as announced in Blackboard: _____.

**(b.)** I read Chapter 9, 10 and 13 of the required text: _____.

**Problem 51** [3pts] A yo-yo has $300\,J$ of energy in the form of rotational kinetic energy. The yo-yo also has an angular momentum of $L = 20\,m^2kg/s$. What is the moment of intertia of the yo-yo ?

**Problem 52** [3pts] A force $\vec{\mathbf{F}} = (3.0\,N)(3\hat{\mathbf{x}} - 2\hat{\mathbf{z}})$ is applied to a point mass $M = 2.00\,kg$ which has initial velocity $\vec{\mathbf{v}} = (30\,m/s)(\hat{\mathbf{y}} + \hat{\mathbf{z}})$ at the point $(1, 2, 3)m$. Find the torque on $M$ and the angular momentum of $M$ with respect to the origin.

**Problem 53** [3pts] You push the edge of a door of large square door with side-length $2.00\,m$ at the middle of the door. A mischevious genin-level ninja who just learned about mechanical advantage pushes at the edge of the door and stops your push with a smaller force. If you push with force $F$ then what force did the ninja stop you ?

**Problem 54** [3pts] A mass of $100\,kg$ hangs via a very thin wire (with small mass) of the edge of a cylindrical barrel filled with cheese of density $30kg/m^3$. The barrel itself has a mass of $20\,kg$ which includes the caps and the sides. The cylinder has length of $l = 1.23\,m$ and a radius of $R = 0.466\,m$. If the barrel rotates on an essentially frictionless axel then how far will the mass fall in the first second it is released from rest ? How much rotational energy and how much angular momentum will be given to the cheese barrel at that time ?

**Problem 55** [3pts] Problem 13.85 (uniform earth PE, fall to center)

**Problem 56** [3pts] Let masses $m_1 = 1.0\,kg$ be placed at $(1.0\,m, 0, 3.0\,m)$ and $m_2 = 2.0\,kg$ be placed at $(-1.0\,m, 2.0\,m, 0)$. Find the net gravitational force on $M = 0.030\,kg$ placed at the origin. What is the gravitational acceleration due to $m_1$ and $m_2$ at the origin?

**Problem 57** [3pts] A planet has mass $M = 3.54 \times 10^{27}\, kg$. A moon orbits the planet in a circular orbit of radius $R = 2.0 \times 10^{8}\, m$. What is the period of the moon's orbit?

**Problem 58** [3pts] Three planets of identical mass $M$ orbit in a circular orbit of radius $R$. The planets are symmetrically placed. Find the speed of their orbit.

**Problem 59** [3pts] Problem 10.81 (rolling stone with some slipping)

**Problem 60** [3pts] Problem 13.79 (mars rocket orbital modification)