Assignment Guidelines

(1) No late submission of assignment problems will be accepted unless previously arranged with the lecturer.

(2) Each assignment question will be marked as follows:
   0 for totally incorrect solution
   1-9 for partially incorrect/correct solution
   10 for correct solution

(3) Solutions of assignment problems must be neatly laid out and all intermediate and final answers clearly highlighted. The detailed working out of the solution must also be included. Failure to do this will result in misinterpretation of your solution which could lead to it being marked incorrectly.

(4) Solutions **MUST BE WRITTEN ON ONE SIDE OF EACH PAGE ONLY.** If you fail to follow this advice and write on both sides of each page only one side will be marked.

(5) Solutions should be securely attached in a manila folder with your name, **surname underlined, student number**, engineering department, subject name, subject code and the assignment number clearly marked on the outside. Each page should be numbered at the bottom. If stapled to the folder, only one staple on the top left hand corner of the page please.

(6) Write every second line so that your work can be easily marked.

(7) Every question should be started on a new page.

(8) Marks may be taken off from the total for poor presentation of solution.

(9) When submissions are identical, the mark of one will be divided by the number of identical submissions and this will be awarded to each.

(10) **Assignments are to be submitted by the appropriate submission date and time in the handing – in boxes on Level 3 in ME building (outside Purcell room)**

(11) Marked assignments will be handed back approximately ten days after they were submitted, during tutorial sessions.

(12) Assignment solutions will be available some time during the semester. You will be informed when and where they are available.
Assignment 3: Hand in your calculations for Questions 1, 2 & 3 (NOTE 3 QUESTIONS ARE DUE)

TIME/DATE: 10 am Mon May 9 2016  PLEASE WRITE YOUR TUTORIAL DAY ON THE COVER (Wed, Thu or Fri)

LOCATION: The handing – in boxes on Level 3 in ME building (outside Purcell room)

LATE PENALTIES will be applied.

This assignment should take each student about four and a half hours to complete.

Question 1 (i)
A 3kg cylinder $A$ can roll without sliding on a 5kg cart $C$ and is attached to a spring $AB$ of constant $K=100$ N/m as shown. The system is released from rest when the spring is stretched by 20 mm. Neglecting wheel friction, determine the velocity of the cart and the angular velocity of the cylinder when the spring first reaches its undeformed state.

![Diagram](image1)

Question 1 (ii)
The 27 kg uniform disk $A$ and the bar $BC$ are at rest and the 4 kg disk $D$ has an initial angular velocity $\omega_1 = 440$ rpm when the compressed spring is released and the disk $D$ contacts disk $A$. The system rotates freely about the vertical spindle $BE$. If disk $D$ rolls without slipping and the final angular velocity of disk $D$ is 176 rpm, determine the final angular velocities of bar $BC$ and disk $A$. Neglect the mass of bar $BC$.

![Diagram](image2)
**Question 2**
The 400-mm diameter disk is rigidly attached to 750-mm long axle and rolls without slipping on a fixed surface in the xy-plane. The axle, which is perpendicular to the disk, is free to pivot about A. As the disk rotates about its axle with angular velocity $\omega_1$, the axle also rotates about the vertical axis with angular velocity $\omega_2$. If $\omega_1 = 2 \text{ rad/s}$ and increasing at the rate of $5 \text{ rad/s}^2$ at the instant shown, determine

1. The angular velocity and the angular acceleration of the disk at this moment
2. The velocity of point C and an expression for the acceleration of point C on the rim of the disk at this given moment.

**Question 3**
The 5-kg disk rotates about its z-axis with an angular velocity $P = 240 \text{ rev/min}$ and the 3 kg slender rod CO rotates about the Y-axis with angular velocity $N = 30 \text{ rev/min}$. If the mass of CB is negligible determine

a. The angular momentum of the system about point B.
b. The angular momentum of the system about point O.
c. The kinetic energy of the system.
**Question 4**
The double wheel has a mass of 3 kg and a radius of gyration about the center of 100 mm. The system is at rest when a force P of magnitude 24 N is applied to cord B, determine

1. The velocity of the center of the pulley after 1.5 sec.
2. The tension in cord C.

![Diagram of the pulley system](image)

**Question 5**
A 60 mm-radius disk spins at a rate $\omega_2 = 4 \text{ rad/s}$, which is increasing at $\omega_2' = 2 \text{ rad/s}^2$, about an axis held by a housing attached to a horizontal rod that rotates at the rate $\omega_1 = 5 \text{ rad/s}$, which is increasing at $\omega_1' = 1 \text{ rad/s}^2$. For the position shown determine

a. The angular velocity and the angular acceleration of the disk
b. The acceleration of point P on the rim of the disk when $\theta = 90^\circ$.

![Diagram of the disk system](image)
**Question 6**
The slender branched rod shown has a mass of 0.25 kg/m, determine

1. The angular momentum $H_0$ (where O is the origin of the coordinate system) by calculating $H_G$ first and then $H_0$. Confirm your result by directly calculating $H$ about point O.

2. The angle between the angular velocity and the angular momentum vector at the instant shown

3. The kinetic energy of the system.

Suggested problems from your text book
Ch 18
18,20,29,47,57, 66.
Ch 19
8,10,15,29,35,49, 50
Ch 20
12,22,53.
Ch 21
32,35,39