

## 59:007 Engineering Fundamentals I – Statics

### Experimental Studies

Fall Semester 2008

**Overview:** The study of Statics involves examining (and maintaining!) objects in an equilibrium state. While the course has focused on learning many fundamentals – including laws and their mathematical expressions (equations) – it is also important to connect what we learn to the numerous real-world examples that we encounter every day. The goal of performing the experiments described below is to improve your understanding of Statics through hands-on activities.

You will be asked to perform three experiments, which focus on the following areas:

1. Measuring Force
2. Determining Friction Coefficients
3. Identifying the Center of Mass of a Body

Below you will find a suggested experiment for each of these three categories. Alternatively, you are welcome to design your own experiments, but the end goal should be the same.

- 1. Measuring Force:** The ability to accurately measure force cannot be underestimated; forces are important in every aspect of engineering.

*Suggested experiment:* Determine the force required to roll a cylinder over a step-wise obstacle. (Hint: you may consider using a ramp to help in your evaluation).

- 2. Determining Friction Coefficients:** Friction is a resistive force that occurs when two objects are in contact. Friction coefficients are used to predict the resistance between two bodies, and are dependent upon the composition/material of each body. Coefficients of friction are always experimentally determined.

*Suggested experiment:* Determine the coefficient of static friction between wood and three materials of your choice. (Hint: an adjustable incline may be helpful).

- 3. Identifying the Center of Mass of a Body:** While a rigid body can be very complex in shape and behavior, identifying its center of mass can be helpful for many reasons. In statics, the object's weight can be considered as concentrated at its center of mass. In dynamics, the center of mass of a rigid body behaves in a predictable manner, much like a single particle.

*Suggested experiment:* Determine the center of mass of three bodies (or a single body with weight distributed in three different configurations). (Hint: using a meter stick with other household objects is a good approach). In your final write-up, compute the center of mass of the body using what you have learned in class, and compare your results with the center of mass that you have measured.

#### Important notes:

- For each experiment, document your work. This includes noting the weights and measures (in consistent units!) of any objects you are using and the results you are obtaining.
- It is always a good idea to perform an experiment *at least* twice, to ensure that your results are consistent and reproducible.
- In addition to being evaluated for your writing skills (by the CTC), you will also be evaluated for your scientific merit. The experiments presented in the final lab report will count as three, 40-point homework assignments, while the overall writing project is also 15% of your final grade.
- Some of the topics described in these experiments have not yet been covered in lecture. These will all be covered before you will be required to perform the experiments. Do not be concerned if your *proposed* experiments are different from the experiments you eventually perform. Although the CTC will evaluate all three documents you hand in (letter of intent, proposal, and lab report), the Statics instructors will only be evaluating your final lab report.
- You will find that all three of the experiments above will require some analytic component. Your experiments will not be considered complete without it.