Lab 1.2 Statics

Objectives:
- Review statics concepts
- Work stability problems that involve sliding
- Work statics problems, and compare answers to measured results

Task 1. The class favorite - concept questions!

1. A (static) mobile hangs as shown. The rods are massless and have lengths as indicated. The mass of the ball at the bottom right is 1 kg. What is the total mass of the mobile?
   - a. 5 kg
   - b. 6 kg
   - c. 7 kg
   - d. 8 kg
   - e. 9 kg

2. A bungee jumper momentarily comes to rest at the bottom of the dive before she springs back upward. At that moment is the bungee jumper in equilibrium?
   - a. Yes
   - b. No
   - c. Not enough information

3. The number of unknown reaction forces at point A is:
   - a. one
   - b. two
   - c. three
   - d. zero

4. There is an inclined load on the beam AB. Draw each component of the load and then determine the moment of the 180 lb force about point B (CCW is positive):
   - a. $(180\,\text{lb})2\cos30^\circ + (180\,\text{lb})4\sin30^\circ$
   - b. $-(180\,\text{lb})2\cos30^\circ + (180\,\text{lb})4\sin30^\circ$
   - c. $(180\,\text{lb})2\cos30^\circ - (180\,\text{lb})4\sin30^\circ$
   - d. $-(180\,\text{lb})2\cos30^\circ - (180\,\text{lb})4\sin30^\circ$

5. There is an 180 lb load on the 6 ft long inclined beam CD. Draw each component of the beam’s length and then determine the moment of the 180 lb force about point D (CCW is positive):
   - a. $-(180\,\text{lb})6\cos40^\circ + (180\,\text{lb})6\sin40^\circ$
   - b. $(180\,\text{lb})6\cos40^\circ$
   - c. $-(180\,\text{lb})6\cos40^\circ$
**Task 2:** Simple Frame
For each part, draw a good FBD, write out the appropriate equilibrium equations, and solve for what is asked for.

A. Use the scale to measure the weight. Hang the weight from the end of the beam. Attach the 20 N spring scale 20 cm from the pivot point (second hook from the pivot) and adjust the support on the ring stand so the beam is level. Use the protractor to measure the angle between the spring scale and horizontal beam. Using the measured weight and angle, draw a FBD and sum moments to calculate what should be the force in the spring scale, and compare to the measured value.

Calculated: ______________________
Measured: ______________________

B. Now attach the 20 N spring scale 40 cm from the pivot point (fourth hook from the pivot). Adjust the support on the ring stand so the spring scale is level. Measure the angle between the beam and the horizontal with the protractor. Using the measured weight and angle, draw a FBD and sum moments to calculate what should be the force in the spring scale, and compare to the measured value.

Calculated: ______________________
Measured: ______________________

C. Fun with Force Effect on the iPad.
1. Go to the end of the gallery, and tap to create a new diagram.
2. Choose Camera from ‘Use Background From:' option. Take a picture of your simple frame, similar to what is shown above. Select “Use Photo”.
3. Using the icon that looks like this, draw the beam. You can change the length of the beam when you first draw it. Or, you can select the beam (use the arrow icon at the top of the left menu), hold down on the beam, and select the right, ‘change length’ icon on the selection wheel.
4. Draw the spring scale. You now have a line drawing of the frame. Tap on the triangle on the left menu, which is a pin support, and tap on the left end of the beam and the left end of the spring scale to add supports. These are the places where the beam and spring scale are attached to the ring stand.
5. Tap on the middle arrow on the left menu, which is how you add a load. Tap on the right end of the beam, and drag upward to apply a downward load. You can set the value of the load.
6. And the magic instantly happens. The reactions are shown. First tap somewhere outside of the beam area. Then, if you hold down on one of the reactions, you get a menu in which you can change from magnitude to components of the reactions. If you tap on a member, it will show the forces on the member.
7. If you tap on the report icon at the top (icon with the summation sign), you will get full results. The results include something called a shear and moment diagram, which shows the internal forces in the beam. We will not cover these, but shear and moment diagrams are very important in actual design.

This is a free app, so if you have an iPad, download it and have fun solving some ME 202 problems.