EGR 140
Statics

<u>Test #3 Overview</u>

Chapters covered: Chapter 6 in Statics, 12th Edition, by Hibbeler
Related Homework Assignments: Chapter 6 homework in Mastering Engineering
Format: No books, notes, or formula sheets are allowed on the test.
Problems are similar to homework, class, and textbook problems mainly.
Table 5-1 (2D reactions) and Table 5-2 (3D reactions) provided.
Probably 4-6 problems.
Most likely problem breakdown:

- Truss analysis – Method of Joints 1 problem
- Truss analysis – Method of Sections 1 problem
- Frame analysis 1-2 problems
- Machine analysis 1-2 problems

Hints for success: Work more textbook problems for preparation.
Study the sample problems in the textbook.
Show clear diagrams and all work on the test.
If significant work is done using a calculator, write down what you entered into the calculator for possible partial credit.

Major Topics in Chapter 6

Three key structures covered: trusses, frames, and machines

Trusses:

- Made up of 2-force members only (so members only experience axial forces)
- Joints are pinned so yield no moments
- Designed to support a load
- Loads applied only at joints
- Axial forces in members in tension (T) or compression (C)
- Zero-force members can often be spotted by inspection
- Analyzed by two methods: Method of Joints and Method of Sections (you must use the method specified on test)

Method of Joints:

- Tedious, but best method for finding forces in all members
- Generally begin by analyzing the entire structure to determine the reactions at the supports - draw FBD for the entire structure
- Continue by analyzing one joint at a time (look for joints with only 2 unknowns) - draw FBD for the joint being analyzed
- Analyze each joint with 2 equations: $\Sigma F_x = 0$, $\Sigma F_y = 0$

Method of Sections:

- Often the best method for finding the forces in members in the middle of a truss
- Draw a section line through the truss cutting it in half (generally cutting only 3 members in order to obtain a full solution).
- Often begin by analyzing the entire structure to determine the reactions at the supports - draw FBD for the entire structure. (Note: You actually only need to find the reactions on the section that you will be analyzing.)
- Analyze either section (draw a FBD for the section to be used) using 3 equilibrium equations (see boxed section below)

Frames:

- Structures designed to support some load that contain at least one ***multiforce member***
- Generally begin by analyzing the entire structure to determine the reactions at the supports - draw FBD for the entire structure using 2D equilibrium equations (see boxed section below).
- Continue by analyzing multiforce members (draw a FBD for the multiforce member and apply 2D equilibrium equations). Look for multiforce members with 3 unknowns or less.
- If no multiforce members have 3 unknowns or less, a partial solution can sometimes be found for one multiforce member and then the results can be transferred to another multiforce member.
- When an internal force is found on one multiforce member, be sure to reverse the direction when transferring it to another multiforce member.

Machines:

- Structures or devices that contain at least one multiforce member
- Generally designed to modify or transmit a force
- There are often no supports with machines (Example: pliers). If supports are present, we generally begin by analyzing the entire machine to determine the reactions at the supports using 2D equilibrium equations (see boxed section below).
- Continue analyzing multiforce members as with frames.

2D Equilibrium equations: (3 equations total in most cases)

- most common set of equations: $\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma M_A = 0$ (for any point A)
- other possible sets: 1) $\Sigma F_x = 0$, $\Sigma M_A = 0$, $\Sigma M_B = 0$ (A and B not on a vertical line)
  2) $\Sigma F_y = 0$, $\Sigma M_A = 0$, $\Sigma M_B = 0$ (A and B not on a horizontal line)
  3) $\Sigma M_A = 0$, $\Sigma M_B = 0$, $\Sigma M_C = 0$ (A, B, and C not on any line)