Project for Statics

Project description.

This project is about the role of supports in equilibrium problems. There are two parts to the project. The first part is focused on constraints and statical determinacy, and the second part is focused on equilibrium of rigid bodies in three dimensions.

Think of your project as a tutorial that you give someone so they could learn about these topics.

Part 1

Describe what is meant by "statical determinacy" and what is required for a body to be properly constrained. (You will find an introduction to this topic in Section 5.7. In addition there are excerpts on this topic from three other textbooks linked on the schedule page.) Why is it important for a body to be properly constrained? Are there situations where it is all right, or necessary for a body to be partially constrained or improperly constrained?

For illustration, give examples of the following situations (if they can occur). Problems where the body is:

statically determinate and properly constrained;
statically determinate and improperly constrained;
statically determinate and partially constrained;
statically indeterminate and partially constrained;
statically indeterminate and improperly constrained.

For these examples draw a picture of the body with the supports AND draw the associated free body diagram. Explain why this drawing illustrates the combination.

Do not use the examples provided in our text or the excerpts provided on the web site. Make up your own examples. It's fun! I suggest that you use problems in two dimensions for your examples, but you can use 3D problems if you prefer.

Part 2

Summarize the method that should be used to solve 3D equilibrium problems involving rigid bodies. Explicitly describe each step in the solution process. In particular, describe what needs to be included on the free body diagram, and discuss why the FBD is essential in solving equilibrium problems. Use a simple example to illustrate the solution process, and explain what you are doing in each step as if you are teaching a friend how to do it.

Then solve at least four additional 3D problems, and include the following supports:

> a cable (or string);
> a single hinge (as in problem 5.69);
> two or more hinges or bearings on the same axis (as in 5.77);
> a smooth surface support or roller,
> a ball and socket.

All of the examples should be taken from the text book (13th edition of Hibbler). For the hinge (or bearing) problems explain why you do or don't include reaction moments. Do NOT use problems that are 3D, but essentially 2D due to symmetry.

General guidelines:

For the writing…
1. Keep it short. Write as much as needed to fully explain what you want to say, but don't fluff it up. I hate reading (and grading) fluff.
2. Write with good organization, clarity, and good grammar.
3. Please write in your own words rather than copying description from a book or the web. If you use materials from a book or a website, give credit and provide a page reference or a link.
4. Clarity and simplicity are better than using important sounding words or academic sounding sentence construction.

For the problem solutions…
Well, you probably know what I look for by now.

What you turn in

Please turn in a legible project. I prefer that the explanatory parts be typed, but it isn't necessary. Do NOT use report cover – it will just make me grouchy while I read your report.

Due date: First Draft.

A first draft of the project is due on Friday 2/20.

It should include a complete first draft of part 1, and a first draft of the following part of Part 2:

"Summarize the method that should be used to solve 3D equilibrium problems involving rigid bodies. Explicitly describe each step in the solution process. In particular, describe what needs to be included on the free body diagram, and discuss why the FBD is essential in solving equilibrium problems."

Due date: Final Draft.

The final version of the project is due IN CLASS or AT MY OFFICE by 5PM on Friday 3/13/15. You are welcome to turn in your project early.

Only paper copies of your project will be accepted (no electronic copies).

If you turn in the project after 5 PM on 3/13 but before midnight, you will loose 10% of your score. Projects will not be accepted after midnight (except in the case of documented illness or emergency).

Grading: First Draft

The first draft is intended to help you complete a good final draft. We will read and comment on your work, and the comments will be aimed at helping you produce a complete and good quality final draft. It will be graded very simply: is it mostly complete in terms of requested content? Is it missing significant pieces of what was requested? Was it turned in?

Grading: Final Draft

These are the things I will look at when grading the finished project.

General:
Is your project legible, well organized, clearly written, and grammatical?

For Part 1:
Do you clearly define and explain all of the relevant terms?
Do your examples illustrate the various configurations?
Do you clearly describe the examples and explain what they are meant to show?
Computerized spell checking and grammar checking is not enough - proof read your work before you turn it in.

For Part 2:
Do you clearly describe all the steps that should be included in a solution?
Does your explanatory example really explain all the steps?
Do you have problems that include all the required supports?
For each problem:
Is the problem statement for each problem clear and complete?
Are the drawings clear, with dimensions and units?
Is your solution correct and complete?
Does it include all of the necessary diagrams?
Is it clear and easy to follow?
Do you explain all of the assumptions you made?

Have you noticed that clarity is important to me?

Remark: hand drawings are fine. Please don't spend hours making perfect multicolor drawings on the computer unless you really don't need to be studying for any classes.

Constraints on collaboration.

This project should be your idea, your work, and your writing. But it is often useful to talk about your ideas with other people, and it's a good idea to ask others to comment on your writing and drawings to be sure that someone else can understand what you mean. Where is the line between too much collaboration and a healthy and useful discussion about your ideas and work?

I'd like to refer you to on excellent discussion on collaboration from the instructors of a computer science course at Carnegie Mellon University, Charlie Garrod and Danny Sleator. You can find the original at http://www.cs.cmu.edu/~211/policy/cheating.html. The parts that apply to this class are quoted below, with some minor modifications in square brackets.

> "Certain forms of collaboration are beneficial for helping everyone understand the material better and overcome small stumbling blocks. Blatant copying of projects does not benefit anyone, and undermines trust.
>
> In this course, certain forms of collaboration are acceptable and beneficial to your learning process. Direct engagement with the material, in discussion or in doing [homework or projects] is the best path to understanding. Therefore, activities such as discussing the projects to understand them better, helping locate conceptual bugs, and discussing lecture and textbook content are acceptable. But *what you hand in must be your own work*.
>
> You might find it helpful to keep this analogy in mind: Imagine that you are taking an English course on short stories. Imagine further that you have been given the assignment to write a short story. It is acceptable collaboration to discuss your story ideas with others. You may try out your ideas by telling your stories to others, discussing plot development, character development, and so on. You can even read a classmate's draft (if he/she asks you to do so) and provide a critique. But when it comes down to writing your story, *must write your own words and your own story*. You might be able to read Edgar Allen Poe and even understand thoroughly why his stories are great; but this doesn't mean that you are able to write like Edgar Allen Poe. Copying his words accomplishes nothing.
>
> It is, of course, difficult at times to know if what you are doing will be considered cheating. If you are unsure whether an action you are contemplating would be considered cheating, then contact a member of the course staff first. *When in doubt, ask.*
>
> Here are some examples of **acceptable collaboration**:

> Clarifying ambiguities or vague points in class handouts, textbooks, or lectures.
> Discussing or explaining the general class material.
> Discussing the assignments to better understand them.
> Getting help from anyone concerning [ideas] which are clearly more general than the specific [assignment].
> In general, verbal collaboration is OK.
> Now for the dark side. As a general rule, if you do not understand what you are handing in, or if you have written [approximately] the same [words] as someone else, you are probably cheating. If you have given somebody [your work], simply so that it can be used in that person's [assignment or] project, you are probably cheating. In order to help you draw the line, here are some examples of clear cases of cheating:
>
> Copying [solutions] or parts of [solutions] from another person or source. [This applies to copying any other type of work as well.]
> Copying (or retyping) [solutions or other work] or parts of [solutions or other work] with minor modifications such as style changes or minor logic modifications.
> *Allowing* someone else to copy your [work] or written assignment, either in draft or final form.
> [Using] help that you do not fully understand, and from someone whom you do not acknowledge on your solution.
> Reading the current solution (handed out) if you will be handing in the current assignment late.
>
> Pedagogical Rationale and Advice
>
> Collaboration not only helps you get the job done, it teaches you how to explain inchoate ideas to others. This is why we permit discussion of the problems between students. But it is also important that your collaborations be balanced and fair with respect to other students. If you misuse the opportunity for collaboration, you will do poorly in the course.
>
> We do note that many of the course materials will be the similar to those from previous years. This is not because we are lazy. It takes years to develop good problems. In many cases the only reason to change them is to make cheating more difficult. It is far better for you to work on the most excellent problems that we could find."

Professors Garrod and Sleator give a good description of constructive collaboration (that helps you learn) and "collaboration" that actually makes it harder for you to learn the skills that will make you a good engineer.

But sometimes these descriptions seem like they don't even apply to your situation - what should you do if you are behind and feeling like you can't figure out examples for your project or if you think you can't write or if your idea doesn't seem to work and you don't know what to do?

Come see me. I'll expect you to work hard, but I'll work with you to help you complete a successful project.