

HOW TO SURVIVE ENGINEERING SCHOOL

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Dear Engineering Student,

Don't take the title of this column literally. Despite the incomprehensible lectures, endless homework, and impossible tests, studying engineering has rarely been fatal. Nevertheless, things may not always go quite the way you would like—classes with absurd amounts of work and test averages in the 50s are facts of life in engineering. I had lots of classes like that when I was where you are now, and I complained about them just as loudly. Unfortunately, while complaining may make you feel better, it won't do a thing for your grades.

I'd like to propose several better ways to help yourself. First, though, let me suggest that the real problem may not be that professor who's making your life miserable. It is that over the years you may have unconsciously bought into a message that goes like this: *"My teachers know everything I need to know to be an engineer. Their job is to tell it to me in lectures, and my job is to soak it up and then repeat it on exams. If I can do that, I've learned it."*

Wrong! That approach may have worked in high school but it begins to fail in college, and once you get into the plant or research lab, it stops working completely. Out there, there are no professors, lectures, or texts with worked-out examples, and the problems don't come neatly packaged with all the information needed to solve them. In fact, often the hardest part of a real problem is figuring out exactly what the problem is.

But you also need to remember this. Around the world, hundreds of thousands of engineers—most no smarter than you, many not as smart—who once struggled with their own confusing instructors and unreadable texts and didn't understand entropy any better than you do, are out there doing just fine. Every day they figure out what they need to know to solve their problems, and then they solve them. If they could learn to do that, so can you. What I'd like to do here is give you five simple tips to help you start learning it now. If you find yourself struggling in classes, give the tips a try. If they work (and I'm pretty sure that they will), you'll have an easier time in school and hit the ground running in your first job.

Tip 1. Figure out what might make course material clearer and try to get it in class.

Do you ever find yourself expressing one of these common complaints? *"I need practical, real-world applications before I can understand something, but all we get in class is theory."* *"I want to understand how things work, but all we get are facts to memorize and formulas to substitute into."* *"I understand what I see—pictures, diagrams,*

demonstrations—better than what I hear and read, but all we get are words and formulas."

If you do, pay attention to yourself—identifying what you're missing in a course is the first step toward getting it. The obvious next step is to ask your professor, in or out of class, for whatever it may be. Most professors genuinely want their students to learn—that's why they became professors—and often complain that their students rarely ask questions except "Are we responsible for this on the test?" So if you don't understand something, try asking for something that might clarify it. "*Could you give an example of how you would use that formula?*" "*Could you sketch what that (device, solution, plot) might look like?*" "*Where did that equation you just wrote come from?*" Even if you're afraid a question may sound stupid, ask it anyway. I guarantee that others in the class are equally confused and will be grateful to you for having the courage to speak up. And if you need more help, go to the professor's office and ask for it.

Caution, however. Even instructors who really want to help will get annoyed if they think you're trying to get them to do your homework for you. *Never ask your instructor for help on a problem until you have made a serious effort to solve it by yourself.* When you ask, be prepared to show what you tried and how far you got. Bring in your flow charts and free body diagrams and calculations, including the ones that didn't work. The more you bring in, the more likely you are to get the help you need.

Tip 2. Read.

Some textbooks try to clarify difficult material by giving practical illustrations and explanations. Check out those parts of your text if you're having trouble rather than just searching for solved examples that look like the homework problems. Another good strategy is to look at a second reference on the same subject—a different text, a handbook, or a Web site. Even if you can't find the crystal-clear explanations and examples you'd like, just reading about the same topic in two different places can make a big difference in understanding.

Tip 3. Work with other students.

When you work alone and get stuck on something, you may be tempted to give up, where in a group someone can usually find a way past the difficulty. Working with others may also show you better ways to solve problems than the way you have been using.

Here are two ideas for making groupwork effective.

- *Outline problem solutions by yourself first and then work out the details in your group.* Someone in every group is generally fastest at figuring out how to start problem solutions and does it for every problem when everyone works together. If that student isn't you, you may have to figure it out for the first time on the test, which is not a particularly good time to do it. Outlining the solutions before meeting with the group is the way to avoid this disaster.

- *Get group members—especially the weaker ones—to explain all completed problem solutions before ending a problem-solving session.* If everyone can do that, the session worked.

Tip 4. Consult experts.

Sometimes you'll run into a problem that completely stumps you and everyone you're working with. When practicing engineers run into such problems, as they all do occasionally, they consult experts. You also have experts available to you. Your course instructor is an obvious candidate, but that doesn't always work out. Other potential consultants include graduate teaching assistants, other professors who teach the same course, students who have previously taken the course, smart classmates, and tutors. No matter whom you go to, though, go early: waiting until two days before the final exam probably won't cut it.

Tip 5. Believe that you have what it takes to be a good engineer.

If this advice is hard for you to take now, you're probably suffering from what psychologists refer to as the *Impostor Phenomenon*, which is like a tape that plays inside people's heads. If you're an engineering student looking around at your classmates, the tape goes something like this: "*These people are good—they understand all this stuff. They really belong here...but I don't. Over the years I've somehow managed to fool them all—my family, my friends, my teachers. They all think I'm smart enough to be here, but I know better...and the very next hard test or hard question I get in class will finally reveal me as the impostor I am.*" And what would happen next is too horrible to contemplate, so at that point you just rewind and replay the tape.

What you don't know is that almost everyone else in the class is playing the same tape, and the student in the front row with the straight A average is playing it louder than anyone else. Furthermore, the tape is usually wrong. If you survived your first year of engineering school, you almost certainly have what it takes to be an engineer. Just remember all your predecessors who had the same self-doubts you have now and did just fine. You do belong here, and you'll get through it just like they did. Try to relax and enjoy the trip.

Sincerely,

Richard Felder

[*Note:* For more about student survival skills and the Impostor Phenomenon, go to www.ncsu.edu/felder-public/Student_handouts.html.]