SCUPI
Sichuan University - Pittsburgh Institute

# ENGR 0011 - INTRODUCTION TO ENGINEERING
# Course Syllabus

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## Catalog Description

An introduction to the principles of engineering problem solving. Topics include: problem definition; graphical representation of data; unit conversions; dimensional analysis; order of magnitude estimations; elementary statistics; solution verification. Students will use computational software tools to define, solve, and present engineering problems related to mechanics, strength of materials, material and energy balance, engineering economics, electrical theory, and other areas. No prerequisites. 3 credit hours. (This course was previously called Introduction to Engineering 1.)

## Instructor

Prof. Michael Reed reed@scu.edu.cn

## Textbook

*Engineering Fundamentals and Problem Solving*, 6th Edition, by Arvid Eide, Roland Jenison, Larry Northup and Steven Mickelson (published by McGraw Hill).

We will cover approximately one chapter per week. Textbook reading assignments will be posted to the class website. Read the assigned chapter BEFORE class.

## Software

We will use a powerful software tool, Matlab, to perform calculations and draw graphs. Matlab is installed on the class computers, and you will also need a copy for your own computer.

You will also use Microsoft Word to write up your assignments. Learn how to use the equation editor in Word and how to format documents.

## Course Goals

- To develop skills in engineering problem definition and solving
- To gain proficiency in communication through written and oral reports
- To practice solving problems through teamwork
- To understand the importance of economic considerations in engineering design
- To learn how to acquire, judge, and use information in solving problems

## Topical Coverage

| Week | Topic | Chapter |
|---|---|---|
| 1 | The engineering method | 4 |
| 2 | Using Matlab | |
| 3 | Representing information | 5 |
| 4 | Significant figures | 6 |
| 5 | Unit conversions | 7 |
| 6 | Dimensional analysis | |
| 7 | Estimation problems | |
| 8 | More estimation problems; midterm exam | |
| 9 | Statistics | 10-11 |
| 10 | Material balance | 14 |
| 11 | Energy balance | 15-16 |
| 12 | Rigid body mechanics | 12 |
| 13 | Strength of materials | 13 |
| 14 | Engineering economics | 8-9 |
| 15 | Electrical theory | 17 |

## Class Format

Introduction to Engineering I will be taught using a combined lecture/studio format. Each class will begin with a short (20 to 30 minute) lecture to review material from the text and introduce new concepts. During the remainder of the scheduled time you will work in small groups (teams) to apply these concepts. Teams will be formed during the first week of class; team makeup will remain constant for the entire semester.

There are two types of weekly assignments: studio problems, and homework problems. Studio problems are easy to moderately difficult, and will require only a short writeup. Studio problems are solved as a team. Homework problems will be more difficult, and will require considerable thought and effort outside of class.

**It is imperative that you come to class prepared.** This will generally involve reading one or more chapters of the textbook, viewing tutorial videos, thinking, engaging with fellow students, practice using Matlab, and performing preliminary calculations. This is a three credit hour class, which means you should expect to devote at least 9 to 12 hours of effort outside the scheduled class time every week.

## Studio Assignments

In each class, you will be assigned a number of studio problems. You will work on and complete these problems as a team during the class period; your team will demonstrate the solution to the instructor or TA before the end of class. The problems will be graded

as either satisfactory or unsatisfactory; if they are unsatisfactory you must redo them and demonstrate them the following week.

Each week, several teams will be selected to present their solution during class. Over the course of the semester, each team will present at least twice. Following the presentation, the entire class will critique the presentation and solution. Teams not presenting will demonstrate their solutions to one of the instructors.

## Presentations

When you are selected to present, follow these guidelines:

- Introduce yourself and your team members.
- Succinctly state the problem, the assumptions made, and the appropriate theory or principle you used to solve the problem.
- Describe your solution as if your audience is unfamiliar with the problem.
- Comment on your solution; (e.g., does it make sense? What are the limits of validity? What will change if the assumptions are incorrect?)
- Describe how you verified your solution.
- Speak LOUDLY and clearly. The people at the back of the room have to hear and understand every word.

Your presentation should take no more than ten minutes. Five minutes will be allotted for questions and discussion following your presentation, although we may continue past five minutes if necessary.

Be prepared in case of technology breakdown (e.g., use the whiteboard if the computer or projector fails).

Important: if your team is selected to present, you must present; a severe grade penalty will be levied on unprepared teams. Each team must be ready to present every week; advance notice will not be given.

Both the instructors and your fellow students will evaluate presentations.

## Homework

Throughout the semester, homework problems will also be assigned every week. These are to be solved and turned in by Friday at 12:00 noon the following week. You may work with other people on homework, but all writeups must be individual efforts. Homework will be graded on a 0-100 point scale. Late homework will not be accepted.

Unless specifically requested, emailed homework will not be accepted.

Please adhere to these homework guidelines:

- Your assignment must be typeset using Word, printed, and stapled. Handwritten assignments will not be accepted.
- Put your name, ID number, and class section at the top of the first page.
- List the names of other people you've worked with on the assignment.
- All work must be shown for each solution to receive full credit. Present your solution in a logical fashion, showing and explaining all steps in detail.
- Adherence to form is an important part of this course. This includes proper English grammar, spelling, and word usage. Your computer has a spell checker, use it!
- A significant amount of the homework points is associated with obtaining the correct answer. This includes getting the correct quantity, **number of significant digits**, sign, and **unit**. Pay attention to all of these, they are important!

All of the homework scores will be used in your grade computation. Unless otherwise indicated, you can work with your fellow students in the class, but you must submit a distinct and independent write-up to receive credit.

If you're sick, or have a compelling emergency that prevents you from turning in the homework on time, email Prof. Reed.

If you believe an error has been made in the grading of an assignment, bring it to the attention of a TA or Prof. Reed within ONE WEEK of its return.

## Exams and Grading

The will be a midterm exam on November 15, and a comprehensive final examination at the end of the semester. The test and exam are CLOSED BOOK, CLOSED NOTES, CLOSED COMPUTER. You may bring one A4 page of notes (both sides). You will also find a calculator and a straightedge helpful.

Your grade will be based on the test (20%), homework (35%), final examination (25%), satisfactory completion of all studio assignments (15%) and class participation (5%).

The instructor's role is to guide you in learning how to define, solve, and present engineering problems. You will not be judged on your ability to recite memorized information, but on how well you make use of information and methods we cover in class. This should already be one of your primary educational goals in coming to university. The key to your success in this class is active participation.

## Office Hours

If you don't understand something, and talking to your classmates doesn't help, then you should be seeking help from one of the instructors.

Office hours are times we have specifically set aside to be available to students. During office hours, you can come to our office; you don't need an appointment. We are also

available at other times; please email to schedule a time. Current office hours will be posted on the class website.

## Plagiarism and Academic Misconduct

Collaboration on studio problems and homework assignments is permitted and encouraged. Studio assignments are to be done as a team, with a single solution and writeup. Your homework writeups will be individually written and represent your independent efforts.

Plagiarism, copying, and any other form of academic misconduct or dishonesty will not be tolerated. Cite all references, including books, technical reports, and web sites you have used. You may discuss the homework with other people currently taking this class, the instructors, and teaching assistants.

Examples of disallowed sources include websites that offer homework help; course documents from previous semesters; people or agencies that do your work for you.

You are not to share materials distributed in class with people outside the University. Uploading of course materials, including homeworks, handouts, homework and test solutions, etc. to the web is prohibited.

To reiterate: use of homework or test solutions from previous semesters or the web is not allowed. Getting homework help from the instructors and fellow students in the class is ok; looking up things on the Google, Baidu, and the Wikipedia is ok; getting help from websites offering homework help and problem solutions is NOT ok.

If you have any questions about referencing material, or the boundaries of acceptable collaboration, please talk to Prof. Reed.

## Class Participation

As members of an academic community, all students are expected to actively participate in and contribute to class discussions. You are expected to engage with the class during the lecture/studio time, and to be prepared to think and answer questions on your feet. There is no penalty for not knowing the answer to a question, but you need to be able to "think out loud" and demonstrate the procedure you will follow to arrive at a solution. So, if you're asked a question in class, be prepared to figure out the answer.

You are also expected to follow and critique the presentations of other teams, and provide useful feedback to them so they can learn from the experience.

## Other Useful Information

Although there are no formal prerequisites for this class, you are expected to know how, or learn how, to do the following:

- Use an internet browser to find things on the web.
- Use Matlab to evaluate numerical results, make graphs, and do multistep calculations.
- Use Word to write up and print your assignments.
- Open, read, and print Acrobat pdf files.
- Find the logarithm of a number and understand what it is.
- Be proficient in basic pre-calculus mathematics, including plane geometry, trigonometry, algebra, and solution of simultaneous equations.

For most of you, this will be your first introduction to the field of engineering. You have probably taken physics, chemistry, or other science courses, and did well in them, but you will have to learn how to approach engineering problems.

Students are often surprised that engineering problems are not handled the way you learned in science classes. In engineering, we use many approximate methods, and often proceed with incomplete knowledge. Many times, the hard part of the problem is to define the problem, not to find the answer.

The goal of science, broadly speaking, is to learn something about nature. In engineering, the goal is to create something that solves a problem. But to exercise creativity, you must develop skills, just as a composer needs to learn about chords, scales, and how to play an instrument before he or she creates new compositions. In this class, you will develop the skills you need to become a creative problem solver.

By virtue of your being admitted to SCUPI, we know that you are smart, capable, and hardworking. You may find this course challenging and demanding, and might even wonder if you've made a mistake coming here. Fear not! You will do okay if keep a few things in mind:

- This and other classes at SCUPI are being taught using a Western-style approach. This involves a lot of questioning and interaction with the instructor, probably much more than you are used to.
- It's okay to be frustrated. You will be learning a lot of new things, at a fast pace, in a language you're still getting comfortable with. The best way to learn is to ask lots of questions. If you don't understand something in class, ASK! Remember that if you're unsure about something, there is a good chance that many of the people sitting around you are also unsure.
- Develop the habit of ALWAYS expressing numerical quantities in scientific/engineering notation, and use standard units. When working with equations, try to delay substituting numerical values as long as possible.

An important skill to acquire is the art of baloney detection (also known as BS detection). Statements are called baloney (or BS) when they are unsupported by facts, and are often used to deceive unwary people. For example, a salesperson might make unjustified claims regarding the performance of a system or product to make a sale; as an engineer, you need to learn how to be skeptical about unsupported claims. To acquire this skill, you need to always be questioning: how do you know something is true? Do you understand why it is true? Are there counterexamples that show it is not true?

Another important aspect of this class is introducing you to the culture of engineering. For example, expressing a result with the proper number of significant figures (e.g., 3.14 instead of 3.14159265358979323 85) is a sign that you understand the limits of validity of your result; ignoring this convention will cast doubt on your credibility. Expressing your answer with the appropriate and correctly formatted unit (e.g., 3.14 km, not 3.14 KM or 3.14 kilometers or 31,400 dm) helps to minimize confusion when communicating your results to others. Likewise, you need to present your results logically, explicitly state your assumptions, and verify your solution. We will place much emphasis on how your results are presented so that you can become familiar with engineering norms.

When you get your graded homework back, you should go over any problems you did not do well on. Homework solutions will not be distributed, but you may contact a TA if you need help in understanding where you went wrong.

You should be having fun and learning something. If you're not, please tell us.