INTRODUCTION TO ENGINEERING ANALYSIS   Fall 2017
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.

Schedule

Lecture/Studio, Room 212

Section 02:	Tuesdays	1:50 – 6:25
Section 01:	Wednesdays	1:50 – 6:25
Section 03:	Thursdays	1:50 – 6:25

Instructors

Prof. Michael Reed   reed@scu.edu.cn
Office Hours: Wednesdays 12:00 - 1:00 PM, and by appointment

Teaching Assistants:

Ms. Chen Ling (Amber)   2016223065120@stu.scu.edu.cn
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Mr. Theodore Schwarz   tds32@pitt.edu

When emailing the instructors, include "ENGR" in the subject field of your message. Use your university email account (student_number@stu.scu.edu.cn); mail from other accounts such as qq.com and 163.com will be stopped by the SCU spam filter.

Textbook

Engineering Fundamentals and Problem Solving, 7th 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.

Matlab is a potent tool, used worldwide by engineering and science professionals in many fields. The effort you put in to master it will repay you many times over in this class and others. To make learning it easier, there is a wealth of information, examples, and documentation available within the program and on the web. Learn to tap into these resources so you can make the best use of the program.

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.

Do NOT use Excel to do numerical calculations or draw graphs. There are several reasons why Excel is not suitable for these tasks; we will discuss them in class.

Web Site

This course uses the Blackboard system; the web site is

https://learn.scupi.cn/

(Note: the **https** is important, otherwise it may not load.) There you will find the course syllabus, studio and homework assignments, and other materials. Current announcements and assignments will be posted on the home page. All assignments will be uploaded through the Blackboard system. Please check the class page frequently.

Class Format

Introduction to Engineering Analysis is taught using a combined lecture/studio format. Each class begins 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.

Each week you will turn in two 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

You will form teams the first week of class, instructions are posted on Blackboard. Please sit in the same seats every week.

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 turn in a short writeup by 6:30 PM the day of your class. The writeups will be graded on a 0 - 8 point scale. Writeups turned in after 6:30 PM the day of your class will be penalized by 3 points; writeups not submitted by 6:30 PM Friday the week of your class will receive zero points.

Studio writeups need not be long, but they MUST describe the process you used to arrive at your answer. To receive full credit use the spell checker in Word; spelling mistakes will result in point deductions.

Homework Assignments

Homework problems will be assigned every week and posted on Blackboard. These are to be solved and turned in by **Thursday 1:30 PM** 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.

All work will be submitted electronically through the Blackboard system. 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 and submitted electronically through Blackboard. Handwritten assignments will not be accepted.
- Put your name, ID number (last four digits), 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**.

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 your TA within ONE WEEK of its return.

Presentations

The last two weeks of class will be devoted to team presentations. Each team will have an individual assignment. Following the presentation, the entire class will critique the presentation and solution. More information about the presentations will be posted later in the semester.

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).

Both the instructors and your fellow students will evaluate presentations.

For each session every team will grade the other presentations for that day and rank them from 1 (best) to 11 (worst). The three teams with #1 rankings (one for each session) will have points added to their final exam scores.

Exams and Grading

The will be a midterm exam tentatively scheduled for Saturday November 11, 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 homework (30%), test (20%), final examination (20%), studio assignments and class participation (20%), and the team presentation (10%) .

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 <u>active participation</u>.

Office Hours

If you don't understand something, and talking to your classmates doesn't help, then you should be seeking help from the instructor or teaching assistant.

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.

Phones and Laptops

Out of respect for your fellow students, please mute and put away your phones, and close your laptops when class begins.

Web surfing, emailing, text messaging, and the like during lecture is distracting to other students and the instructor, and is likely to result in your missing some important information. Don't do it.

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 music. 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, use variables to denote the quantities and parameters specific to the problem. Delay substituting numerical values as long as possible; this will make it easier to check your work and find errors.

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 3.1415926535897932385) 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.

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

Approximate Schedule

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