

De Anza College
Introduction to Engineering
Dr. Henry Wang

Fall 2017

Office S42

Office hours:

Wednesday and Thursday 9:30-10:00 am.

Course objective:

This class will introduce students to the way an engineer thinks, works, and communicates. Fundamental concepts and tools in engineering will be introduced in a variety of engineering problems from signal processing, circuits, civil engineering, material science, and management science and engineering. The course will have a broad exposure to the vast possibilities students can embark on as a future engineer.

Emphasis will be given on conceptual understanding and intuition rather than mathematical details or derivations. It is not assumed the students will have had a basic calculus course prior to entering this class. Graphical understanding will be demonstrated in a variety of different context. The goal of the class is to have students a broad perspective on the different areas in engineering.

The class will have a strong team project component, done in small groups of 2 to 3 students. The project will help students to learn the necessary hands-on skills in engineering. Students will learn the iterative process in design, implementation, and debugging. Furthermore, project management skills will be shown so they can carry out their ideas. To translate passion, interest, and curiosity into a real actionable project, students will present both in oral and written forms. The communication aspect of engineering will be encouraged through in-class activities.

Students will also gained the necessary skills to persevere through challenging engineering courses they may face in the future. Skills such as self-encouragement, resilience, stress management, and time management will be discussed through in class activities. Students will gain the motivation to succeed in engineering. Exercises such as intrinsic motivation, how to face obstacles, emotional intelligence, and having the right mindset will be provided in the class.

Topics to be covered in class:

I. Engineering concepts and tools

Product Management (PM)

- Emphasis will be given on hands-on application rather than the theory of PM.
- Develop roadmap for their project from very early stage and iteratively modify based on an agile approach.
- Current industry practices such as scrums, waterfall, daily stand-up will be introduced.

Signals and Systems

- What a signal is and how it is different from a function.
- Duality between time and frequency domain. Some images to demonstrate Fourier transform.
- System level understanding: input, output, system impulse response
- Sampling and reconstruction, undersampling, compressed sensing.
- Control and feedback. Applications of signals and systems and examples from image processing, ultrasound, and audio signal processing.

Civil and Structural Engineering

- Coastal, freshwater, and urban infrastructure
- Environmental science and technology

Circuits

- basic circuit elements such as resistor and capacitor.
- modeling of a simple RC circuit.
- Voltage, current, and Ohm's Law.
- Intuition in circuit design.

Management Science and Engineering

- Topics chosen based on interest of the class

Probability

- modeling a problem by choosing the random variable to represent the quantity of interest
- basic probability concepts such as Bayes' theorem, distribution, mean, variance.
- How to compute these basic quantities in excel.

Optimization

- How do you set up a problem as an optimization problem
- Objective function, constraint, linear programs
- 2-D optimization problem set up using simple examples

Software engineering

- Variables, array, for loops, if statements
- Trees, queues, stacks, and graphs

- An introduction to object oriented programming
- A few lectures dedicated on showing how to use arduino.

Special topics: cancer treatment planning

II. Engineering process and thinking

Problem solving

- Root cause analysis
- Framework for problem solving.
- Setting up a problem
- Debugging skills

Thinking

- Fast thinking vs. slow thinking.
- Deep thinking vs. broad thinking
- Creative thinking and design thinking

Study strategies and learning styles

- Note taking, reading skills, testing skills, and memorization.
- Study groups vs. self-study.
- Auditory, visual, or kinesthetic learner

Attitude, mindset, and motivation

- Facing setbacks, developing resilience, optimism
- Intrinsic vs. extrinsic motivation
- Finding your passion and what interests and excites you

Textbook:

(Optional)

Studying Engineering: A Road Map to a Rewarding Career (Fourth Edition)

Grading:

The grade for the class will be determined based on an in class midterm (20%), a final project (40%), written assignments (10%), and in-class lab exercises and activities (20%). Attendance is mandatory.