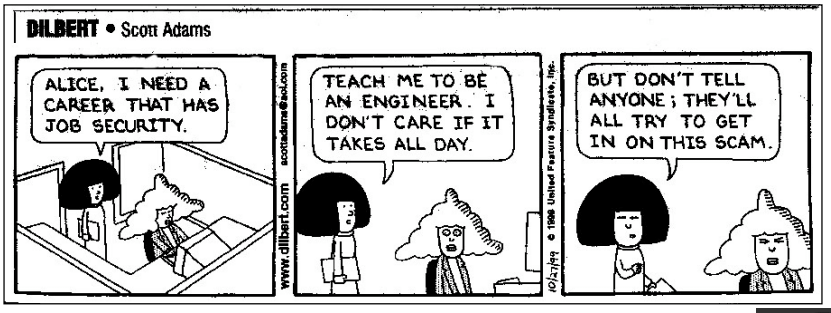
Stanford University
School of Engineering

ENGINEERING 1N

THE NATURE OF ENGINEERING



TODAY

- Introductions/Logistics
- Course Goals
- Course Strategy/Syllabus
- Expectations
- An Initial Exercise

ENGINEERING 1N
THE NATURE OF ENGINEERING

http://www.stanford.edu/class/engr1n/

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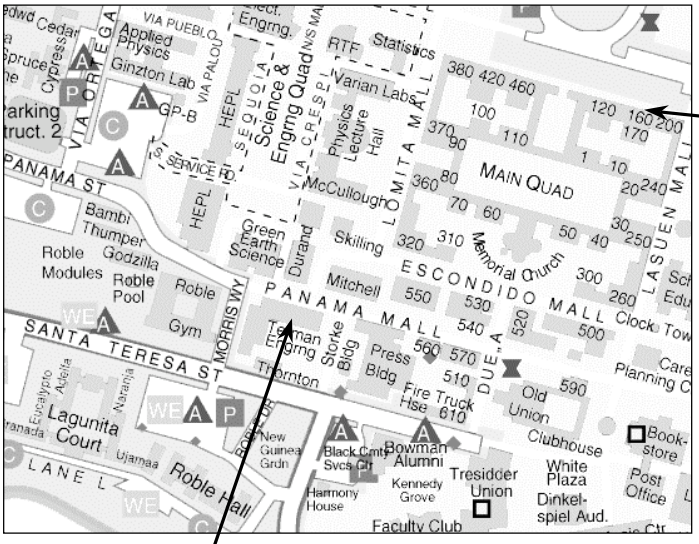

COURSE GOALS

- Develop a reasonably sophisticated understanding of the nature of engineering

  What is it that is common to the many different fields of engineering (chemical, civil, electrical, etc.)?

  What distinguishes engineering from other human endeavors?

  What do engineers do?

  How do engineers do what they do?

  Why do engineers do what they do?

DEFINING ENGINEERING

- 1) The activities or the function of an engineer. 2) The application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people. The design and manufacture of complex products [software engineering]. 3) Calculated manipulation or direction, as of behavior [social engineering]

  Merriam-Webster On-Line Dictionary
  http://www.m-w.com/dictionary.htm

- 1) The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems. 2) The profession of or the work performed by an engineer. 3) Skillful maneuvering or direction: [geopolitical engineering, social engineering]

  Dictionary.com
  http://www.dictionary.com/

DEFINING ENGINEERING

- Engineering is the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.

  Accreditation Board for Engineering and Technology (ABET)

- . . . The art or science of making practical application of the knowledge of pure sciences.

  Florman, Samuel C., *The Existential Pleasures of Engineering*

- Engineering refers to the practice of organizing the design and construction [and, I would add, operation] of any artifice which transforms the physical world around us to meet some recognized need.

  Rogers, G.F.C., cited in Vincenti, Walter G., *What Engineers Know and How They Know It*

DEFINING ENGINEERING

- . . . Invention [engineering] causes things to come into existence from ideas, makes the world conform to thought; whereas science, by deriving ideas from observation, makes thought conform to existence.

  Mitcham, Carl, "Types of Technology", *Research in Philosophy and Technology, Vol. 1*

COURSE STRATEGY

- Focus on key engineering activities and characteristics

  Measurement, estimation, approximation, uncertainty
  Design
  Engineering as a sociotechnical enterprise
  Engineering education

- Activity, reflection, and discussion

  Activities designed to make you the decision-maker

EXPECTATIONS

- Reading:

  Adams, James L., *Flying Buttresses, Entropy, and O-rings*
  Taylor, John R., *An Introduction to Error Analysis*
  Handouts

  On reserve in the Engineering Library, Terman Engineering Center, 2nd floor

- In-class Exercises:

  Measurement, design, design communication

- Out-of-class Exercises:

  Measurement, data analysis, uncertainty analysis, design principles and analysis

EXPECTATIONS

- Projects:

  About four design projects—e.g., renewable energy system, manufacturing system improvement, balsa glider, and biomedical process design

  Mechanical dissection project

- Reports/Papers:

  Design reports (oral and written), mechanical dissection report

- Field Trips:

  Depending on time and interest

EXPECTATIONS

- Classroom Participation:

  Enthusiastic and vigorous discussion expected!

- Grades based on a balanced assessment:

  Out-of-class exercises: 20%
  Design projects: 40%
  Mechanical dissection project: 10%
  Participation (discussion, exercises, field trips): 30%

THE STANFORD HONOR CODE

The Honor Code is an undertaking of the students, individually and collectively:

1) That they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
2) That they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.

THE STANFORD HONOR CODE

The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.

While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.

THE STANFORD HONOR CODE

- The Honor Code

  http://www.stanford.edu/dept/vpsa/judicialaffairs/guiding/honorcode.htm

- Interpretations and Applications of the Honor Code

  http://www.stanford.edu/dept/vpsa/judicialaffairs/guiding/honorcode.int.htm

FOR TUESDAY

- Reading:

  Taylor, Ch. 1-3

  Handout (on the website): *Accuracy, Precision, Errors, and Significant Figures*