Engineering Education and Outcomes Assessment

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Engineering Education - Context

- High school students with strong math and science background tend to consider engineering
- Engineering education prepares for jobs in industry, government (including military), graduate schools in engineering, business, medicine, law, ...
- Engineering fields change and evolve
  - Pace of change seems to be increasing
Admissions

• Students admitted to UF – may indicate an interest in engineering
  – Admissions officers consider math/science preparation for engineering students
• SAT Average for Fall 03 class ~ 1305
• Requirements to continue to the upper division:
  – a C grade or better in each tracking course (math, physics, chemistry),
  – an average of 2.5 in these tracking courses
  – better than 2.0 overall
• Transfer students from community colleges are also required to meet similar requirements
Structure of Engineering Curriculum

- Math + Chemistry + Physics (Years 1, 2)
- Humanities, social sciences, general education (Years 1, 2)
- Core required courses in the engineering discipline (Year 3, 4)
- Specialized elective courses in the discipline (Year 4)
- Key recognition: students need to be equipped for life long learning
Accreditation

- Engineering degree programs are accredited by ABET (Accreditation Board for Engineering and Technology)
- In 2000, ABET changed from a “bean counting” approach to an outcomes oriented approach - EC2000
- Philosophy: A “measurement based continuous improvement process” to demonstrate that appropriate educational outcomes are met
Key Elements of EC2000

- Define institutional mission, college mission, program mission, program educational objectives, and program outcomes
  - For each course, explicitly define expected outcomes; demonstrate that the outcomes are measured
- Define measurements
  - Course grade, degree requirements, student portfolios, employer assessment, alumni assessment, …
- Establish processes for continuous improvement
  - Frequency of measurements, course revisions, degree requirement revisions, advising improvements,
The Two Loops of EC2000

1. Determine Educational Objectives
2. Determine Outcomes Required to Achieve Objectives
3. Determine How Outcomes will be Achieved
4. Determine How Outcomes will be Assessed
5. Establish Indicators that Objectives are Being Achieved
6. Formal Instruction Student Activities
7. Evaluate/Assess
8. Input from Constituencies

The cycles represent the continuous improvement process.
EC2000: Specified Program Outcomes

Engineering Programs must demonstrate that their graduates have:

a. An ability to apply knowledge of mathematics, science and engineering appropriate to the discipline
b. An ability to design and conduct experiments, analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs
d. An ability to function on multi-disciplinary teams
e. An ability to identify, formulate and solve engineering problems
f. An understanding of professional and ethical responsibility
ABET EC2000: Specified Program Outcomes (Cont’d)

g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a societal context
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Specific Disciplinary Knowledge Requirements
Student Progress Monitoring

• Each student has an advisor
  – Required to meet at least once a semester
  – Ensure that the student is making expected progress

• Student portfolio - proof to ABET that any given graduate met all the requirements specified by the ABET criteria
  – A file on each student containing a record of all courses taken, letters from advisor, internship documents,
  – Senior design project report

• We are required to provide this proof in order to maintain our accreditation
Professional Organizations

• Each engineering field has a professional body, e.g., IEEE (Institute of Electrical and Electronic Engineers)
• These professional societies set the standards for what is expected from fresh undergraduates in their fields
• Faculty are active members of these societies
• We have student sections of these professional societies so that our students can become involved early in their educational process
Industry Feedback

• Each department has an Industry Advisory Board
  – These boards meet once or twice a year to discuss the departmental activities and provide feedback

• College has an Engineering Advisory Council and a Dean’s Advisory Board
  – Provide a higher level feedback on our education and research programs and strategic directions
  – E. g., Issues arising from “outsourcing of engineering jobs” will be discussed at the February 2004 meeting

• Employer surveys through the Career Resource Center
  – CRC & Engineering have developed a web based survey tool to automate the process
Alumni Feedback

• Exit interview with each graduating student
• Alumni are surveyed after they have been away from the College for a certain number of years
  – Get feedback after they have become seasoned professionals
Student Employment

- Companies from all over the state and the nation come to recruit our students
  - Harris, Honeywell, Raytheon, Progress Energy, Intel, Dell, Microsoft, ExxonMobil, Dow Chemical, Ford, Alcoa, ...

- A sizeable fraction (~20-25%) goes to graduate schools

- Very strong demand for our undergraduates