An Overview of International ABET Accreditation

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• ABET, Inc., is a professional organization
• I have no affiliation with ABET and do not claim to represent their views
• ABET did not participate in my preparation of this presentation
What is ABET?

- Formerly, “American Board of Engineering and Technology” but official name is now “ABET, Inc”
- Private, not-for-profit (NGO)
  - Accreditation is therefore voluntary
  - Everybody does it!
- Started by consortium of professional engineering organizations as quality control
  - Today, 29 technical societies
- Supported by fees paid by universities
- Has permanent paid staff, but most evaluators are volunteers from industry and universities
- Headquarters in Baltimore, MD
- Accredits engineering, technology, computer science, applied science
ABET Accreditation Overview

• “Accreditation” = independent outside certification of engineering education quality
  – Normally a “binary” decision (yes or no)
  – Length can vary up to 6 years

• Accreditation of specific degree programs only!
  – Not granted to universities (e.g., UB has 8 accredited programs)
  – Some US schools have 15 or more ABET programs
  – Total of 2700 programs in US, at 550 different schools/universities
  – Each program must be accredited alone, but some information can be shared across programs

• ABET will accredit MS programs, but in US, essentially all accreditation is of BS programs
ABET Engineering Programs

Aerospace Engineering
Agricultural Engineering
Architectural Engineering
Bioengineering and Biomedical Engineering
Biological Engineering
Ceramic Engineering
Chemical Engineering
Civil Engineering
Computer Engineering
Construction Engineering
Electrical and Electronic Engineering
Engineering, General Engineering, Engineering Physics, and Engineering Science
Engineering Management
Engineering Mechanics
Environmental Engineering
Forest Engineering
Geological and Geophysical Engineering
Industrial Engineering
Manufacturing Engineering
Materials and Metallurgical Engineering
Mechanical Engineering
Mining Engineering
Naval Architecture and Marine Engineering
Nuclear and Radiological Engineering
Ocean Engineering
Petroleum Engineering
Software Engineering
Surveying Engineering

→ Similar names to above are allowed
ABET Accreditation Concept

- Program “defines itself” by objectives, outcomes, etc, in terms of graduates
  - Examples:
    - Prepare students for successful careers in industry
    - Prepare students for possible continuation to higher degrees in engineering
  - Considerable flexibility, but must be reasonable/professional
- Accreditation is the process of proving that the program achieves what it says it does
- Emphasis on “assessment” of “outcomes” via a “self-study” that is prepared by the program and then carefully reviewed by evaluators
- Additional emphasis on “continuous improvement”
Accreditation Definitions

(From Section II.D.1. of the ABET Accreditation Policy and Procedure Manual):

- **Program Educational Objectives** – Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

- **Program Outcomes** – Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program.

- **Assessment** – Assessment is one or more processes that identify, collect, and prepare data to evaluate the achievement of program outcomes and program educational objectives.

- **Evaluation** – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program outcomes or program educational objectives are being achieved, and results in decisions and actions to improve the program.
ABET Accreditation Process

• Standards in each discipline defined by professional societies and educators
• A “self-study” report is prepared by the institution, reviewed by evaluators
• Actual on-site evaluation by team (one per program plus leader, most/all unpaid volunteers)
• Team prepares immediate verbal feedback, then writes draft evaluation report
• Institution responds to draft report
• Final report and decision
Self-Study Components

NOTE: A standard format is available from ABET, normally used

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Criteria for Accreditation: 1-9

1. Students
2. Program Educational Objectives
3. Program Outcomes
4. Continuous Improvement
5. Curriculum
6. Faculty
7. Facilities
8. Support
9. Program Criteria
Example Program-specific Criteria for Accreditation

“MECHANICAL” AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: American Society of Mechanical Engineers
These program criteria will apply to all engineering programs including "mechanical" or similar modifiers in their titles.

- 1. Curriculum
   The program must demonstrate that graduates have the ability to: apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes; and work professionally in both thermal and mechanical systems areas.

- 2. Faculty
   The program must demonstrate that faculty members responsible for the upper-level professional program are maintaining currency in their specialty area.
Criteria 3 (a-k):

Criterion 3. Program Outcomes
Engineering programs must demonstrate that their students attain the following outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and 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.
Criterion 1: Students

• The program must evaluate student performance, advise students regarding curricular and career matters, and monitor student’s progress to foster their success in achieving program outcomes, thereby enabling them as graduates to attain program objectives.

• The program must have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere. The program must also have and enforce procedures to assure that all students meet all program requirements.
Criterion 6: Faculty

• The faculty must be of sufficient number and must have the competencies to cover all of the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.

• The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as Professional Engineers.

➤ NOTE: Nothing about international competency per se
ABET Outside of the USA

• Mutual Recognition of Accreditation
  – Currently 12 nations including USA (ABET), Japan Accreditation Board for Engineering Education (JABEE)

• Memorandum of Understanding
  – Normally does not include mutual recognition of accreditation
  – Often used to work towards mutual recognition, especially in nations with relatively new accreditation systems
  – Also exists between ABET and JABEE

• “Substantial Equivalency” – long-standing system, no longer used
  – Not ABET accreditation, but certifies similar quality
  – Last year was 2006
  – Some European (Karlsruhe, Delft, Eindhoven, CETS Spain)

• Direct ABET Accreditation outside of US – very recent (2006)
  – Europe: Karlsruhe, MSc in EE and Computer Engineering 2008
  – Middle East: Numerous programs
Washington Accord

- ABET
- Accreditation Board for Engineering Education of Korea (ABEEK)
- Canadian Engineering Accreditation Board of Engineers Canada
- Engineering Council of South Africa (ECSA)
- Engineering Council UK (ECUK)
- Engineers Australia
- Engineers Ireland
- Hong Kong Institution of Engineers (HKIE)
- Institute of Engineering Education, Taiwan (IEET)
- Institution of Engineers Singapore (IES)
- Institution of Professional Engineers New Zealand (IPENZ)
- Japan Accreditation Board for Engineering Education (JABEE)
Memoranda of Understanding

- Comisión Nacional de Evaluación y Acreditación Universitaria, Argentina
- Acredita CI, Chile
- Chinese Association of Science and Technology
- Commission des Titres D’Ingenieur, France
- Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences, and Mathematics, Germany
- Council for Higher Education, Israel
- The Japan Accreditation Board for Engineering Education
- Accreditation Board for Engineering Education Korea
- Consejo de Acreditación de la Enseñanza de la Ingeniería, Mexico
- Instituto de la Calidad en la Acreditación en las Carreras de Ingeniería y Tecnología, Peru
- Ordem dos Engenheiros, Portugal
- IEET, Chinese Taipei
- Ministry of Higher Education, Ukraine
- UNESCO Regional Office for Science & Technology for Latin America & Caribbean, Uruguay
ABET fee schedule - International

- For the accreditation visit (min 1 per 6 yrs)
  - $8500 per evaluator
  - plus travel expenses (international business class etc)
  - 1 team leader plus 1 evaluator per program

- Maintenance of accreditation
  - $1000 per year per institution
  - $1000 per year per accredited program

- Annualized total cost for one program, full 6-yr cycle:
  \[2000 + \frac{1}{6} \times \{2 \times (8500 + \text{travel})\}\]
  \[= 6000-9000 \text{ per year}\]

- Additional cost per program:
  \[1000 + \frac{1}{6} \times (8500 + \text{travel}) = 3000-4000 \text{ per year per program}\]

- Total cost for 6-yr cycle of, say, 6 programs:
  \[\Rightarrow 125,000\]
Overview of Process

• Inform ABET of intentions and get latest guidelines/information/etc
• Designate 1-2 leaders within each Department
• Attend ABET-sponsored workshop(s), study report guidelines, etc
• Establish operational plan
  – Starting items:
    • Goals of program
    • Overview of how program is designed to meet goals, a-k
  – Biggest item by far: collection of data on outcomes
    • Will be sum of data from most/all faculty
    • Need designated leader to organize the collection in the first place, prepare the data for reports etc
    • Background information on institution, faculty, students, graduates
    • Ongoing information on outcomes of individual courses, whole program
Example from UB Aerospace

• (Separate files will be displayed only, but are not part of the written record for this presentation)