# ACCREDITATION UPDATE: OVERVIEW OF US ACCREDITATION AND ABET PROPOSED CHANCES

Randy Collins

Professor of ECE and Director of Academic Initiatives

Clemson University

# The US Undergraduate BS Curriculum

- Approximately 125 – 130 Credit Hours (roughly 40 courses – semester equivalents)
  - Average 15 to 16 credits per semester
  - Many students enter with significant AP/IP/Dual Enrollment Credit (but not necessarily helpful).
- Accreditation dictates the minimums
  - Regional accreditation generally requires a minimum 120 semester credit hours, including General Education
    - Most General Education programs are 25% of the curriculum
  - ABET: Criteria establish minimum standards for programs consistent with regional accreditation

# ABET Accreditation

- ABET
  - Was "Accreditation Board for Engineering and Technology" – now just ABET, Inc.
- Comprised of member societies like ASME, ASCE, IEEE, AICHE, etc.
- Assures quality of educational programs and continuous improvement.
- Generally, a normal review cycle is 6 years.
- Must demonstrate attainment of criteria, in part via assessment.

# Importance of ABET Accreditation

- Industry looks for ABET accreditation as a quality threshold.
- Used as a minimum standard of BS program for graduate school admission.
- Used to qualify for professional engineering licensure in US.
- Increasing number of international institutions (outside of US) seeking ABET accreditation.
- Global E3 Executive Committee uses ABET accreditation or equivalent as one measure of the "fit" of a university into the consortium.

# Global Accreditation Activities of ABET as of October 1, 2015

- Accredited **3,569** programs at **714** colleges and universities in **29** countries
  - Non-U.S. Programs Accredited **475** programs at **95** institutions in **28** countries
  - Uniform accreditation criteria, policies, and procedures used for all visits, regardless of location

Source: ABET presentation to NAE, Brackin and Sussman, February 2016.
https://www.nae.edu/File.aspx?id=150807

# Global Accreditation Activities of ABET as of October 1, 2015

Bahrain
Chile
China
Colombia
Ecuador
Egypt
Germany
India
Indonesia
Jordan
Kazakhstan
Kuwait
Lebanon
Mexico
Philippines
Portugal
Morocco
Oman
Palestine
Peru
Qatar
Russian Federation
Saudi Arabia
Singapore
South Africa
Spain
Turkey
United Arab Emirates
Vietnam
USA

Source: ABET presentation to NAE, Brackin and Sussman, February 2016.

# ABET requirements

- There are 8 General Criteria plus a Program Specific Criterion.
- A "Lead Society" oversees the accreditation process and dictates any program specific criteria.
- The current ABET Criteria were developed nearly 20 years ago, under "EC 2000".
- Two Criteria of Interest since they have proposed changes:
  - Criterion 3: Student Outcomes
  - Criterion 5: Curriculum
- Here's a link to the full criteria:
  - http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2016-2017/

# Current Criteria Preamble

These criteria are intended to assure quality and to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment.

It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

# Proposed Criteria Preamble

These criteria are intended to provide a framework of education that prepares graduates to enter the professional practice of engineering who are:

(i) able to participate in diverse multicultural workplaces;

(ii) (ii) knowledgeable in topics relevant to their discipline, such as usability, constructability, manufacturability and sustainability; and

(iii) (iii) cognizant of the global dimensions, risks, uncertainties, and other implications of their engineering solutions.

Further, these criteria are intended to assure quality to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

# Criterion 3: Student Outcomes

The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(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

# Criterion 3: Student Outcomes

(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 3 Proposed Revision

The program must have documented student outcomes. Attainment of these outcomes prepares graduates to enter the professional practice of engineering.

Student outcomes are outcomes (1) through (7) plus any additional outcomes that may be articulated by the program.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

# Criterion 3 Proposed Revision

4. An ability to communicate effectively with a range of audiences.

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

# Criterion 5: Curriculum

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

# Criterion 5: Curriculum

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

# Criterion 5: Curriculum

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

# Criterion 5: Proposed Revisions

- ~~The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:~~
- ~~(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.~~
- ~~(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.~~
- ~~(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.~~
- ~~Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.~~
- ~~One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.~~

# Criterion 5: Proposed Revisions

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

- (a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.
- (b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.

# Criterion 5: Proposed Revisions

- (c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.

Students must be prepared to enter the professional practice of engineering through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple constraints.

# Process for Adoption of New Criteria

- **Spring 2015:** ABET received more than 100 comments. Further discussions result in the addition of a seventh topic area reflecting teamwork and elements of project management. Other changes incorporated as well.
- **Summer 2015:** Proposed changes were submitted for adoption.
- **Fall 2015:** Engineering Area Delegation approved changes at first reading and released for public review and comment.

See: http://www.abet.org/accreditation/accreditation-criteria/accreditation-alerts/

# Take-aways

- Unclear what the impact on programs since the changes have not been adopted or implemented by programs.
- Once adopted, will likely be a transition period.
- International experiences will not harm a program, and can only enhance a student's experience.
- Comment period still open for input.

 OPINION BY MARY BESTERFIELD-SACRE AND LARRY SHUMAN

# ABET CHANGES: THE GOOD, THE BAD AND THE UGLY

While some revisions are welcome, others are shortsighted.

Changes proposed to Criterion 3 by ABET, the board that accredits engineering and technology programs, reduce the required outcomes from 11 to seven. There are benefits in the proposal, but also problems and missed opportunities to match criteria with 21st century education. Having published a review of some of the current outcomes in 2005, we offer our examination of the changes. *[Editor's Note: See page 36 for a side-by-side comparison of the current and proposed criteria.]*

### The Good

Proposed Outcome 7, "an ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty," recognizes a need for project management skills. Further, introducing risk

WHY **RESTRICT** OUTCOMES TO **THOSE** WHO **WILL BECOME** PRACTICING

### The Bad

Outcome 7 has two serious deficiencies. First, today's engineering challenges require teams from multiple areas. By removing "multidisciplinary," we leave it to industry to train engineers, missing opportunities to bring students together with social scientists and the humanities to address today's complex problems. Second, engineering occurs in culturally diverse settings with individuals from a wide variety of backgrounds, countries, ages, and genders.

ing students' interpretation of experimental results—especially ambiguous results—requiring students to make judgments beyond current data. Simulations or case studies could be needed for students to demonstrate such ability.

Troublesome is the omission of "knowledge of contemporary issues." Students need knowledge of such current issues as climate change, jobs versus pollution, crumbling infrastructure, and globalization to understand the long-term impact of their engineering solutions.

### The Ugly

ABET justifies collapsing outcomes that are "vague and broad" and "difficult to assess." However, all 11 can be assessed. Engineering programs define each outcome's meaning, define metrics, and find or develop measures

# Let your voice be heard!

- "Vote" early and often:

https://www.surveymonkey.com/r/CRIT35R2

- Deadline: June 30, 2016.