ABET: Description and Preparation Efforts

Toshio Nakamura
Department of Mechanical Engineering
State University of New York at Stony Brook, NY, USA
OUTLINE

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Information is primarily based on the Mechanical Engineering program at State University of New York at Stony Brook with references from other school programs.
State University of New York at Stony Brook

- **University**
  One of four NY State University Centers and located 60 miles from New York City. The campus is home of 24,000 undergraduate and graduate students and more than 13,500 faculty and staff.

- **Engineering College**
  Consists of 7 departments with ~2,000 undergraduate and ~1,200 graduate students.

- **Mechanical Engineering**
  18 full-time faculty with ~350 undergraduate and ~130 graduate students. Last ABET accreditation in 2011.
What is ABET? (from www.abet.org)

- **Vision**
  Assures quality and stimulating innovation in applied science, computing, engineering, and engineering technology education.

- **Mission**
  Accredits educational programs. Promotes quality and innovation in education. Consults and assists in the development and advancement of education worldwide…

- **History**
  Established in 1932 as the Engineers' Council for Professional Development (ECPD) by seven engineering societies (ASCE, ASME, IEEE, AIChE, etc.) to accredit engineering programs.

- **Current Status**
  The Board is governed by 31 member societies and accredits over 3,100 programs at more than 670 colleges and universities in 24 countries. It has 4 commissions and has ~2,000 volunteer evaluators/reviewers. Headquartered in Baltimore and the current executive director has industrial and military background.
Overview of ABET Accreditation

- **Process**
  Initiated by the institution seeking accreditation, and it is given to individual program. Accredited programs must request re-evaluation every 6 years to retain accreditation.

  Prior to ABET visit (~4 month before), "Self-Self Study" is prepared and submitted to ABET.

  “On-Site Visit” is conducted by one evaluator for each program plus one team chair during 3 day period. Interview students, faculty and visit selected classes and labs. Review display materials (textbooks, exams and homework). During an “exit meeting”, preliminary summary is given.

  Within a few months, draft statement is given and the institute’s responses may be soft. Then “Final Statement” will be delivered.

- **Accreditation Actions/Decisions**
  Without deficiencies and weakness, 6 year extension. With weakness, *interim report or visit* is required. With deficiencies, *show cause report or visit* is required (yellow card).
Preparation Efforts at Stony Brook

- **Curriculum/Course Improvements**
  Reviewed every 3~6 years to make sure course contents and offerings are satisfactory and they follow the ABET guidelines. Continuous adjustments to correct minor issues.

- **Annual Efforts**
  **Survey**: Collect data and opinions from graduated students.
  **Industrial Advisory Board**: Hold annual meeting attended by 6~8 people from industry to review our program and make recommendations.
  **Faculty Retreat**: Hold one-day meeting (off-campus) to review individual courses (by course coordinators).

- **2 Years before ABET Visit**
  Begin collecting **Display Materials** (syllabus, exams, homework, etc.) from undergraduate courses and form a special **ABET Committee**.

- **1.5 Years before ABET Visit**
  Start preparing **Self-Study Report**.
Preparation Efforts at Stony Brook (continued)

- **1.2 Years before ABET Visit**
  Hold **Mock Visit** by inviting former ABET evaluator. Ask for necessary changes and improvements for upcoming ABET visit.

- **~4 Month before ABET Visit**
  Complete and submit **Self-Study Report**.

- **During 1.5 Years before ABET Visit**
  Hold frequent Faculty Meeting to understand and prepare ABET Visit.

- **Self-Study Report**
  Contains every details about the mechanical engineering program at Stony Brook (245 page long). Includes survey data, course syllabus, faculty resume, etc.
Preparation Efforts at Stony Brook (continued)

Unique Actions at Stony Brook

Course Coordinators: Every required undergraduate course is assigned with 3 course coordinators (may include instructor) and reviewed every 3 years at Faculty Retreat, and may make recommendations.

Course assessment and recommendation by coordinators

ABET format course guide

Course-Level Outcome Assessment

Spring 2011
MEC 363: Mechanics of Solids
Instructor: Oscar Lopez-Panies
Course Coordinator: Nakamura, Cha, Leong, Oscar Lopez-Panies

Student Outcomes (SOs) are measured by Performance Indicators at the program level, which are in turn supported by Course Learning Objectives or (CLOs) at the course level. For MEC 363, the primary assessment tools for CLOs include: course exams and quizzes.

CLOs

<table>
<thead>
<tr>
<th>CLO</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>1st Attempt</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>2nd Attempt</td>
<td>100%</td>
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Summary of Assessment

CLO 1, 2, and 3 have been assessed with competency questions. Two opportunities have been given to all students enrolled. Cumulative passing rates are recorded in the table below. The results indicate that all students have passed the competency questions.

SOs

<table>
<thead>
<tr>
<th>Performance Indicators Related to the Course</th>
<th>CLOs</th>
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<tbody>
<tr>
<td>(a) Define the fundamental definitions of stress, strain, and equilibrium</td>
<td>CLOs 1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>(b) Know how to analyze the mechanical behavior of real-world structures made of bars, columns, shells, and beams subjected to axial loading, torsion, hydrostatic pressure, and bending</td>
<td>CLOs 1, 2, 3, 4, 5</td>
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<tr>
<td>(c) Know how to systematically approach statically indeterminate systems</td>
<td>CLOs 1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>(d) Know how to compute principal stresses and strains</td>
<td>CLOs 1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>(e) Have the ability to design structures for given applications in a simple and logical manner by employing the concepts of stress, strain, constitutive equations, and equilibrium</td>
<td>CLOs 1, 2, 3, 4, 5</td>
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Course-Level Outcome Assessment (CLOs)

<table>
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<th>Assessment Tools</th>
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<td>1. Define the fundamental definitions of stress, strain, and equilibrium</td>
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<td>5. Have the ability to design structures for given applications in a simple and logical manner by employing the concepts of stress, strain, constitutive equations, and equilibrium</td>
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Unique Actions at Stony Brook

Competency Questions: In every required course, 6~10 problems are given to students to test their fundamental knowledge. They must get 100% correct solutions in order to pass the course.

Sample Problem
Forces are acting on the cube as shown.
a) Express the stress components $\sigma_x$, $\sigma_y$, $\tau_{xy}$ in terms of forces and $a$.
b) Express the strain components $\varepsilon_x$, $\varepsilon_y$, $\gamma_{xy}$ in terms of forces, $a$, $E$ and $a$.

After the 1st try, the solutions are provided to students. If they fail, they need to re-take the test with the same problems ⇒ need to memorize solutions.
Pros and Cons

- Do we need ABET?

**Facts…**

- In New York State/City, to be a civil servant in technical area, an engineering degree from **ABET accredited university** is (generally) required.

- To get PE (professional engineering) license in NY State, graduating from an **ABET accredited university** gives 2-year advantage in work experience. (Some states require BS from ABET accredited university for PE license).

- Most of engineering schools (over 600) in USA, including the top schools in USA are accredited with ABET.

**Therefore…**

There is no choice for us but to retain **ABET accreditation**. In fact, if we lose ABET, the State will likely to close our Department.
Pros and Cons (continued)

- **Negatives of ABET**
  - A lot of work to prepare for the visit.
  - Loses some flexibility in teaching.
  - Confusing requirements (e.g., Mission Statements, Program Educational Objectives, Student Outcomes, Course Learning Objects).

- **Merits of ABET**
  - Forces instructors to well organize undergraduate courses. Each courses must be taught consistently under guidelines.
  - Mechanism to monitor instructions of faculty (especially new assistant professors) without awkwardness. (Note unless other schools, college faculty do not have teaching certificate/license).
  - Usually the university/college administration is supportive in providing resources for ABET accreditation (e.g., equipment for lab courses.)
  - ABET makes look Engineering as more professional degree.

*In summary, the benefits outweighs the negatives.*
Summary and Discussions

- ABET appears to value continuous improvements on the education. This requires assessment process, outcome and survey data. Their aim is to make sure universities/colleges are serious about educating undergraduate students for engineering jobs and post-graduate education.

- ABET appears to emphasize on the design aspect of education (where there is no single solution), understanding engineering standards and work within a group ⇒ Capstone course is senior design project performed by a group of 3~4 senior students. (ABET used to count “design credits” from courses to require for graduation but they are more flexible now.)

- Industrial inputs and understanding their needs are also important factors in the setting educational objectives of program.

- In overall, the ABET accreditation benefits the engineering education and profession in USA.
Some of Senior Design Projects

"Design of a device for raising, lowering, and transporting a disabled individual with limited lower body strength"
- Won 1st Prize at the 2010 ASME Mechanism Design Competition for undergraduate students

Air Therapy Reclining Wheelchair

Hand Driven Tricycle

Mini-Baja

The Stony Brook University Motorsports team took 2nd place out of an international field of 120 collegiate teams at the 2008 Baja SAE competition in Montreal,