Stony Brook University | The State University of New York

ABET: Description and Preparation Efforts

Toshio Nakamura

Department of Mechanical Engineering

State University of New York at Stony Brook, NY, USA

JABEE シンポジウム

-海外の技術者教育認定の実例-

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OUTLINE

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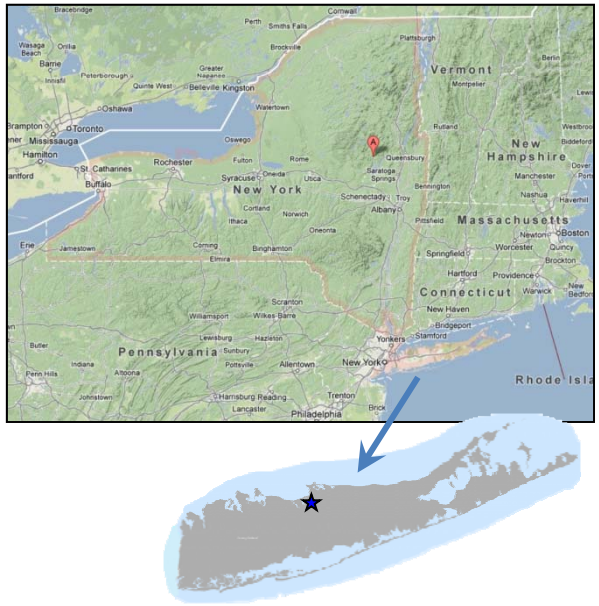
Information is primarily based on the Mechanical Engineering program at State University of New York at Stony Brook with references from other school programs.

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 student

- **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 is 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**

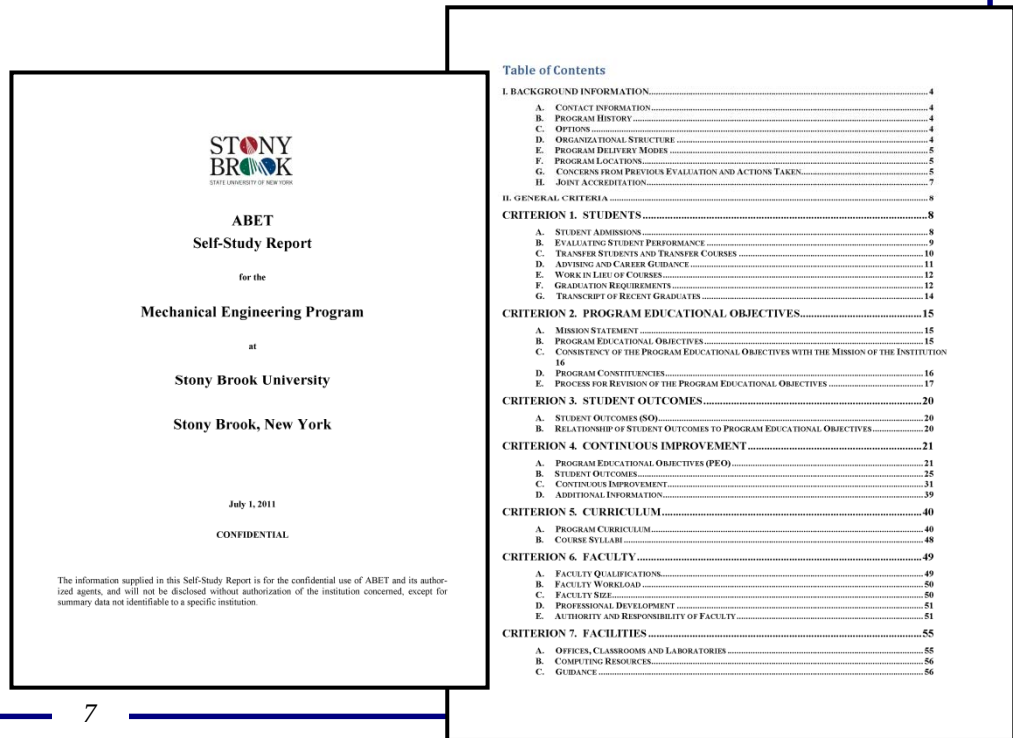
  Complete and submit **Self-Study Report**.

- **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.



STONY BROOK
STATE UNIVERSITY OF NEW YORK

ABET
Self-Study Report
for the
Mechanical Engineering Program
at
Stony Brook University
Stony Brook, New York

July 1, 2011

CONFIDENTIAL

The information supplied in this Self-Study Report is for the confidential use of ABET and its authorized agents, and will not be disclosed without authorization of the institution concerned, except for summary data not identifiable to a specific institution.

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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.

ABET format course guide

MEC 363 Mechanics of Solids

Credits: 3 | Contact Hours: 3 hour lectures and 1 hour recitation per week

LEAD COORDINATOR	TEXTBOOK
Nakamura	F.P. Beer, E. R. Johnston, J.T. DeWolf, D. Mazurek. Mechanics of Materials, Fifth Edition. McGrawHill. SUPPLEMENTAL MATERIAL

BULLETIN DESCRIPTION
Stress and deformation of engineering structures and the influence of mechanical behavior of materials. Concepts of stress and strain, constitutive relations, analysis of statically indeterminate systems, study of simple bars and beams, and stability conditions. Emphasis on force equilibrium, elastic response of materials, geometric compatibility, Mohr's circle, stresses and deflections in beams, and torsion and buckling of rods. Design for bending, shear, and combined states of stress.

PREREQUISITES: C or higher in MEC 260	THIS COURSE IS Required

COURSE LEARNING OBJECTIVES	SOs	ASSESSMENT TOOLS
Understand the fundamental definitions of stress, strain, constitutive relations, and equilibrium	a	Competency Questions
Know how to analyze the mechanical behavior of real-world structures made up of bars, columns, shells, and beams subjected to axial loading, torsion, hydrostatic pressure, and bending	a, l,m,n	Competency Questions
Know how to systematically approach statically indeterminate systems	a	Exams
Know how to compute principal stresses and strains	n	Competency Questions
Understand and know how to utilize Mohr's circle	n	, Competency Questions
Have the ability to design structures for given applications in a simple and logical manner by employing the concepts of stress, strain, constitutive relations, equilibrium, and stability	m,n	Exams

STUDENT OUTCOMES SUPPORTED (Scale 1-3)	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	3				1							2	1	3
	3 – Strongly supported 2 – Supported 1 – Minimally supported											Program Criteria		

COURSE TOPICS

1. Stress and Strain
2. Constitutive Relations
3. Axial Loading, Torsion, and Bending
4. Bars, Columns, Shells, and Beams
5. Transformations of Stress and Strain
6. Principal and Shear Stresses and Strains
7. Statically Indeterminate Systems
8. Buckling
9. Introduction to Mechanical Design

Course assessment and recommendation by coordinators

Course-Level Outcome Assessment
Spring 2011
MEC 363: Mechanics of Solids
Instructor: Oscar Lopez-Pamies
Course Coordinators: Nakamura, Chad Korach, Oscar Lopez-Pamies

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 competency questions and exams.

SOs	PEROFORMANCE INDICATORS RELATED TO THE COURSE	CLOs
a	(a1) apply knowledge of mathematics (excluding multivariate calculus and differential equations) in design and analysis	1,3,4,5,6
	(a2) apply the principles of mathematics through multivariate calculus and differential equations	1,6
	(a3) apply knowledge of science in the analysis of mechanical systems	2
c	(c1) convert desired needs and multiple realistic constraints into design specifications	2,6
	(c3) model, analyze, design and realize physical systems, components, or processes	2
e	(e1) use engineering knowledge to construct a problem statement that contains a desired need and constraints	2, 6
l	(l2) apply differential equations for engineering system.	2, 6

COURSE LEARNING OBJECTIVES (CLOs)	ASSESSMENT TOOLS
1. Understand the fundamental definitions of stress, strain, constitutive relations, and equilibrium	Competency Questions 1, 2, 3
2. Know how to analyze the mechanical behavior of real-world structures made up of bars, columns, shells, and beams subjected to axial loading, torsion, hydrostatic pressure, and bending	Competency Question 1
3. Know how to systematically approach statically indeterminate systems	Midterm Exam 1-1
4. Know how to compute principal stresses and strains	Competency Question 3
5. Understand and know how to utilize Mohr's circle	Competency Question 3
6. Have the ability to design structures for given applications in a simple and logical manner by employing the concepts of stress, strain, constitutive relations, equilibrium, and stability	Midterm Exam 2-1, Final Exam 2

CLO #1,2,4, and 5 have been assessed with competency questions. Two opportunities have been given to all 62 students enrolled. Cumulative passing rates are recorded in the table below. The results indicate that all students have passed the competency questions.

CLO #	1	2	4	5
1st Attempt	64%	86%	97%	97%
2nd Attempt	100%	100%	100%	100%

CLO #3 and 6 have been assessed with exam questions. CLO #3 has been assessed with questions 1 in Midterm 1 and Final exams, while CLO #6 has been assessed with question 1 in Midterm 2 exam and question 2 in the Final exam. The results indicate that all students have passed the competency questions.

CLO #	3	6
Midterm Exams	90%	92%
Final Exam	88%	89%

Summary of Assessment
Basic Competencies (CLOs #1,2,4,5): 100% passing rate
Basic Competencies (CLOs #3,6): 88% passing rate

Recommendations of Course Coordinators
Increase total numbers of homework questions in each assignment (e.g., increase from 4~5 to 6~8 questions) to better prepare students. A half of questions can be chosen arbitrary for grading.

Prepared by Oscar Lopez-Pamies, May 22, 2011. Evaluated and Approved by Course Coordinators May 24, 2011

Preparation Efforts at Stony Brook (continued)

❑ Unique Actions at Stony Brook

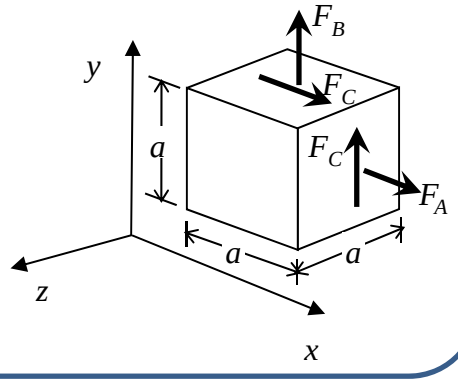
Competency Questions: In every required courses, 6~10 problems are given to students to test their fundamental knowledge. They must get 100% correct solutions in order to pass the course.

Sample Problem

Forces are acting on the cube as shown.

a)Express the stress components σ_x, σ_y, τ_{xy} in terms of forces and a.

b)Express the strain components ε_x, ε_y, γ_{xy} in terms of forces, a, E and



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.

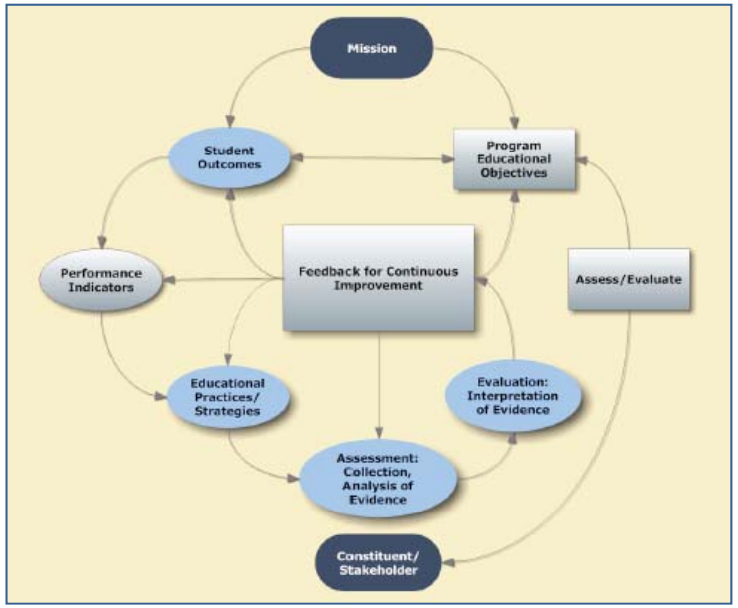
Pros and Cons (continued)

- **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, Couse 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,

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