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Clifford J. Bruell, Ph.D. **Professor & Chair**

December 19, 2012

Accreditation Board for Engineering and Technology (ABET), Inc.
111 Market Place
Suite 1050
Baltimore, MD
21202-4012

Regarding: Civil and Environmental Engineering Department 30 Day Response to the Engineering Accreditation Commission of ABET Draft statement.

To whom it may concern;

Attached please find the University of Massachusetts Lowell Department of Civil and Environmental Engineering 30 Day Response to the Engineering Accreditation Commission of ABET Draft statement. Please feel free to contact me if you have any questions.

Regards;

Clifford J. Bruell, Ph.D.

Professor and Chair of
Civil and Environmental Engineering

Civil and Environmental Engineering Department 30 Day Response to the Engineering Accreditation Commission of ABET Draft statement.

The following response is based on the Draft Statement dated November 20, 2012 sent by the Engineering Accreditation Commission of ABET to Dr. Jack Wilson, Acting Dean of the University of Massachusetts Lowell James B. Francis College of Engineering, and deals with those items specifically identified within the Civil Engineering Program.

Program Strengths

The ABET Evaluation Team noted the following Program Strengths for the Civil and Environmental Engineering (CEE) Department:

1. The growth in undergraduate enrollment and hiring of additional faculty members indicate a healthy program. Significant improvement in student performance on the FE over the last four years coupled with increased admission standards indicates a commitment to improvement of the program.

2. The program has a well developed system for data collection through surveys of students, alumni, and other constituencies for evaluation and assessment to implement improvements to the program. Multiple incremental improvements were documented in the self-study report.

CEE Department Response

The CEE Department would like to thank the ABET evaluation team for observing our program is growing and healthy and that the CEE Department, College of Engineering, and University is committed to improving our program. Furthermore, we thank the ABET evaluation team for noting that we evaluate and assess our program with a "well developed" system involving our key constituencies (i.e., students, faculty, and alumni).

Program Weaknesses

The ABET Evaluation Team noted the following Program Weaknesses for the Civil and Environmental Engineering (CEE) Department:

1. **Criterion 2. Program Educational Objectives.** This criterion requires program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and the criteria. The program educational objectives as stated in the self-study report and accessible to the public on the department website are essentially a restatement of student outcomes rather than broad statements of what the program is preparing graduates to attain within a few years after graduation. Therefore, the program lacks strength of compliance with this criterion.

2. **Program Criteria.** Program criteria for civil engineering programs require that the program must prepare graduates to apply knowledge of mathematics through differential equations,

calculus-based physics, chemistry and at least one additional area of basic science. Criterion 5 defines basic sciences as biological, chemical and physical sciences. The program listed EE 16.213, Fundamentals of Electricity, or CH 10.347, Thermodynamics, as satisfying the additional basic science requirement. Examination of these courses showed the content is mostly engineering. Therefore, the program lacks strength of compliance with this criterion.

CEE Department Response

We agree with the 2012 Draft Statement identification of our program weaknesses and the comments made by our ABET Program Evaluator. To correct these program weaknesses, we have done the following:

- Revised our Program Educational Objectives (PEO's) and developed a new plan for data collection and assessment procedures relating to our PEO's.

- Embarked on a process to add a basic science course (89.325 Geology for Engineers) as a requirement to students within the Civil and Environmental Engineering Program starting with students entering the program in the Fall 2013 semester.

The specific actions undertaken to rectify our Program Weaknesses are as follows.

Revision of Program Educational Objectives

Based on the suggestion of the ABET Program Evaluator for the CEE Department (Mr. Robert Thompson, PE) made to our Department Chair and several faculty during his visit, the CEE Department explored the notion of revising our PEO's to align with our Program Goals. After reviewing our Program Goals, the PEO's from other departments within the UMass Lowell College of Engineering, and the appropriate sections of ABET's Criteria for Accrediting Engineering[1], the faculty approved the replacement of the five (5) existing PEO's with three (3) new PEO's during a CEE Department faculty meeting on September 28, 2012. A summary of the CEE Department's previous and new PEO's is provided in Table 1.

In addition to approving the replacement of the five (5) existing PEO's with three (3) new PEO's, the faculty approved a new plan for data collection and assessment procedures relating to our PEO's. This plan includes collecting data from our key constituencies (i.e., students, faculty, and alumni) using existing assessment methods (e.g., course and alumni surveys) and new assessment methods currently under development, such as a UMass Lowell Department of Civil and Environmental Engineering Alumni Group on the professional social network LinkedIn. Summaries of the data sources, assessment methods, and performance targets used for assessment of the previous and new PEO's are presented in Tables 2 and 3, respectively.

[1] Criteria for Accrediting Engineering Programs - Effective for Reviews During the 2012-2013 Accreditation Cycle, Engineering Accreditation Commission, ABET Inc., Baltimore, MD.

Table 1. Previous and New CEE Department Program Educational Objectives.

PREVIOUS		NEW	
PEO1	Graduates will be prepared to practice the profession of Civil Engineering with a solid foundation in basic sciences and in four areas of Civil Engineering: environmental, geotechnical, structural and transportation engineering.	**PEO1**	Graduates will be prepared to practice the profession of Civil Engineering or related fields at a professional level.
PEO2	Graduates will have the skills and knowledge necessary to develop into active contributors to the economic and social vitality of the region, the nation and the world.	**PEO2**	Graduates will be prepared to continue their education in graduate school.
PEO3	Graduates will understand their moral, ethical, legal and professional obligations to society.		
PEO4	Graduates will possess strong written, oral, and graphical communication skills and will be able to function on multidisciplinary teams.	**PEO3**	Graduates will recognize the need for engaging in life-long learning and continued professional development.
PEO5	Graduates will recognize the need for engaging in life-long learning and continuing professional development.		

During a meeting on October 10, 2012, the CEE Department Industrial Advisory Board (IAB) approved the adoption of the new PEO's and the accompanying assessment methods without revision. Representatives of the CEE Department Student Advisory Committee (SAC) present at the IAB meeting also approved the adoption of the new PEO's and the accompanying assessment methods without revision.

Table 2. Current CEE Department Program Educational Objectives (PEO's) and Assessment Methods.

PEO No.	Program Educational Objective	Data Source	Assessment Method	Performance Target
PEO1	Graduates will be prepared to practice the profession of Civil Engineering with a solid foundation in basic sciences and in four areas of Civil Engineering: environmental, geotechnical, structural and transportation engineering.	Students	Course Surveys	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	70% FE Pass Rate
PEO2	Graduates will have the skills and knowledge necessary to develop into active contributors to the economic and social vitality of the region, the nation and the world.	Students	Course Survey	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	≥ 70% Employment Rate
				≥ 3.0 Average (0-4 Scale)
				≥ 3.0 Average (0-4 Scale)
				≥ 3.0 Average (0-4 Scale)
PEO3	Graduates will understand their moral, ethical, legal and professional obligations to society.	Students	Course Survey	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	≥ 3.0 Average (0-4 Scale)
PEO4	Graduates will possess strong written, oral, and graphical communication skills and will be able to function on multidisciplinary teams.	Students	Course Survey	70% FE Pass Rate
		Alumni	Alumni Survey	≥ 3.0 Average (0-4 Scale)
PEO5	Graduates will recognize the need for engaging in life-long learning and continuing professional development.	Students	Course Survey	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	≥25% w/Additional Degrees
				70% FE Pass Rate

Table 3. New CEE Department Program Educational Objectives (PEO's) and Assessment Methods.

PEO No.	Program Educational Objective	Data Source	Assessment Method	Performance Target
PEO1	Graduates will be prepared to practice the profession of Civil Engineering or related fields at a professional level.	Students	Course Survey	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	≥ 70% FE and PE Pass Rate
				% TBD Alumni with CE jobs
			LinkedIn	≥ 70% FE and PE Pass Rate
				% TBD Alumni with CE jobs
PEO2	Graduates will be prepared to continue their education in graduate school.	Students	Course Surveys	≥ 3.0 Average (0-4 Scale)
			Exit Interview	% TBD Students accepted/attending GS
			UML BS/MS Prog. Enrollment	% TBD Students accepted into program
		Alumni	Alumni Survey	% TBD Alumni successfully completed a GC
				% TBD Alumni with advanced degrees
			LinkedIn	% TBD Alumni successfully completed a GC
				% TBD Alumni with advanced degrees
PEO3	Graduates will recognize the need for engaging in life-long learning and continued professional development.	Students	Course Surveys	≥ 3.0 Average (0-4 Scale)
		Alumni	Alumni Survey	≥ 25% w/Additional Degrees/Cert.
				≥ 70% PE Pass Rate
			LinkedIn	≥ 25% w/Additional Degrees/Cert.
				≥ 70% PE Pass Rate

Notes: GS = Graduate School, GC = Graduate Course, TBD = To be determined

Addition of Basic Science Course (89.325 Geology for Engineers) to CEE Curriculum.

Based on the suggestion of the ABET Program Evaluator for the CEE Department (Mr. Robert Thompson, PE) made to our Department Chair and several faculty during his visit, the CEE Department explored the addition of a three (3) credit geology course to fulfill the requirement of a basic science course. This geology course, 89.325 *Geology for Engineers*, would be an additional required course within our undergraduate curriculum.

During a CEE Department meeting on September 28, 2012, the faculty approved the addition of the 89.325 course as a requirement to graduate with a Bachelors of Science in Civil Engineering degree starting with students admitted into the program in the Fall 2013 semester. This basic science course is tentatively slated for inclusion on the CEE Curriculum in the Fall Semester of the Junior Year, as shown in Figure 1. The inclusion of the geology course in this semester would expose students to concepts and theories relevant to two courses scheduled for the Spring Semester of the Junior Year (i.e., 14.330 *Soil Mechanics* and 14.333 *Geotechnical Engineering Laboratory*).

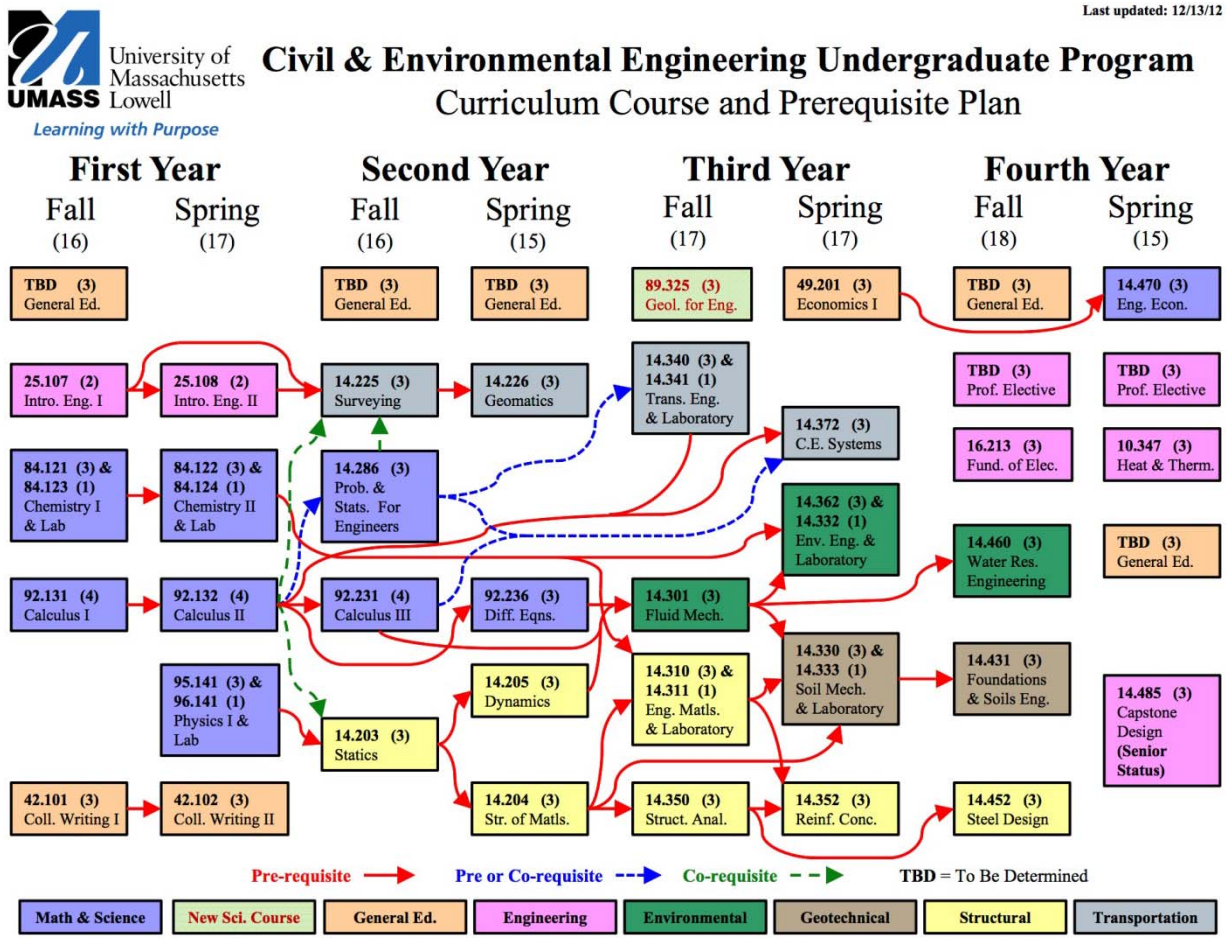

Figure 1. Revised CEE Undergraduate Course Curriculum Plan with Inclusion of 89.325.

The 89.325 course would be developed by Dr. G. Nelson Eby, Chair of the UMass Lowell's Department of Environmental, Earth and Atmospheric Sciences. Guidance was provided to Dr. Eby by the CEE Department geotechnical engineering faculty during the development of a draft course syllabus to verify that the 89.325 course does not duplicate course objectives within the undergraduate geotechnical engineering courses (i.e., 14.330 *Soil Mechanics*, 14.333 *Geotechnical Engineering Laboratory*, and 14.431 *Foundation and Soils Engineering*). A draft ABET formatted syllabus of the course, developed by Dr. Eby in conjunction with Dr. Hajduk of the CEE Department, is presented on Pages 8-9.

During a meeting on October 10, 2012, the CEE Department Industrial Advisory Board (IAB) approved the addition of the 89.325 course to the undergraduate curriculum. Representatives of the CEE Department Student Advisory Committee present at the IAB meeting also approved the addition of the 89.325 course to the undergraduate curriculum.

With the approval of the addition of 89.325 course from our key constituencies (i.e., students, faculty, and alumni), we are currently working to officially add the course to our undergraduate curriculum. The next steps to add this course as a requirement to the Civil and Environmental Engineering curriculum are listed in Table 4.

Table 4. Actions to be taken to add 89.325 *Geology for Engineers* to CEE Curriculum.

Action	Tentative Timeframe
Submit proposal to create a new course (89.325) to the Undergraduate Policy Committee (UPC) of the UMass Lowell Faculty Senate.	January 2013
Submit proposal to add course 89.325 as a requirement for a Bachelors of Science in Civil Engineering degree starting with Fall 2013 semester admitted students to the Undergraduate Policy Committee (UPC) of the UMass Lowell Faculty Senate.	January 2013
Upon approval of new course (89.325) by Faculty Senate, ask for approval from University Chancellor	March 2013
Upon approval of the requirement of 89.325 for a Bachelors of Science in Civil Engineering degree starting with Fall 2013 semester admitted students by the Faculty Senate, ask for approval from University Chancellor	March 2013
Submit 89.325 course title and number to Registrar's Office for inclusion into intercampus Student information System (iSiS)	April 2013
Submit requirement of 89.325 for a Bachelors of Science in Civil Engineering degree starting with Fall 2013 semester admitted students to Registrar's Office for inclusion into intercampus Student information System (iSiS)	April 2013
Update relevant CEE Department, College of Engineering, and University documents (e.g. websites, brochures, etc.) reflecting new course and BSCE degree requirements.	June 2013

89.325 Geology for Engineers

Credits and Contact Hours: 3 credit hours, 4 contact hours

Instructor's Name: G. Nelson Eby, PhD.

Textbook: *Physical Geology, 14th Editon*, Charles C. Plummer, Diane Carlson, Lisa Hammersley, McGraw-Hill, 2012.

Other Supplemental Materials:
None

Catalog Description:
This course will introduce basic geological principles with an emphasis on engineering applications. Topics covered include minerals and rocks and their properties, surface processes, earthquakes and rock deformation, dynamic processes that affect the earth's surface, geological hazards and their mitigation, earth resources.

Prerequisites:
One year of chemistry and one semester of physics, statics, dynamics.

Required Course in CEE Curriculum.

Specific Course Goals:
At the conclusion of this course, students should be able to show that they have realized the following course goals:

1. Understand the basic physical processes that drive the dynamic earth.
2. Identify common minerals and have a basic understanding of how the properties of minerals affect engineering applications.
3. Understand the classification of igneous, metamorphic and sedimentary rocks and their properties and how these properties affect engineering applications – e.g., durability, compressive strength, aggregate properties, etc.
4. Understand rock deformation and the response of rocks to applied stress – faulting versus folding. Stress-strain and the application of the Mohr's circle.
5. Understand the causes of earthquakes, earthquake magnitude, and assessment of seismic risk. The ability to estimate ground motion and the effect of this motion on structures.
6. Understand surface and groundwater flow.
7. Understand the processes of downslope movement and the factors that affect these movements.
8. Understand surficial processes including the development of glacial and arid region landforms.
9. Understand the exploitation of geological resources with emphasis of the engineering aspects of the development of these resources.
10. Understand weathering processes and the development of soils.

Relation of Course Goals to ABET Criterion 3.

Course Goals	ABET Criterion 3
1	a
2	a
3	a
4	a
5	a
6	a
7	a
8	a
9	a, h
10	a

Course Topics:

Basic Geological Concepts and Plate Tectonics
Atoms, Elements and Minerals
The Rock Cycle
Extrusive and Intrusive Igneous Rocks and Volcanic Hazards
Weathering and Soil
Sediment and Sedimentary Rocks
Metamorphism, Metamorphic Rocks, and Hydrothermal Rocks
Engineering Properties of Rocks and Minerals
Mass Wasting and Downslope Movements
Surface and Ground Water
Glaciers and Glaciation
Deserts and Wind Action
Waves, Beaches and Coasts
Geologic Structures
Earthquakes
Earth's Interior and Geophysical Properties
Geologic Resources

Prepared by: G. Nelson Eby, PhD **Date:** December 2012