



May 2015 FBPE Education Rules Committee Conference Call

May 19, 2015 at 09:00 AM

FBPE Board Office

2639 N. Monroe St., Ste. B-112

Tallahassee, Florida 32303

May 2015 FBPE Education Rules Committee Conference Call Meeting Book

1. Call to Order. Roll Call
2. Approval of Agenda
3. Review of Proposed Changes to Educational Requirements

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4. Adjourn

MEMO

To: Zana Raybon
FBPE Executive Director

From: Michelle Roddenberry
FBPE Education Rules Committee Chair

Date: May 5, 2015 (revised Memo from April 10, 2015)

**RE: APRIL 9 COMMITTEE MEETING and PROPOSED RULES on
FBPE EDUCATIONAL REQUIREMENTS FOR LICENSURE**

The Education Rules Committee met on April 9, 2015 to discuss proposed changes to FBPE's rules on educational requirements for licensure. This memo includes the proposed changes, which also incorporate modifications that were suggested by committee members during the meeting. The most substantial changes pertain to requirements for non-ABET degree holders, although changes to other rules are also proposed. Where acceptable, the rules are aligned with the recently-revised NCEES Engineering Education Standard, of which I was a part because of my involvement in the NCEES Committee on Education.

A second committee meeting will be held in May to finalize the proposed rules changes. Thereafter, the changes will need to be taken to the entire Board to consider for adoption.

61G15-20.001 Definitions.

...

(2) “Board approved engineering programs” shall mean:

(a) Engineering programs accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc. (EAC/ABET [or EAC/M-ABET](#)), or

[\(b\) Engineering programs accredited by the Canadian Engineering Accreditation Board \(CEAB\) in 1980 or later \(which, for the purpose of Division 61G15, F.A.C., is considered equivalent to EAC/ABET\), or](#)

~~(b) (c)~~ (c) In the case of an applicant who did not graduate from an approved program as set forth in paragraph (2)(a) [or \(2\)\(b\)](#) above, and who holds a baccalaureate degree from an engineering program that is not accredited by EAC/ABET, provided the applicant meets the educational requirements set forth in subsection 61G15-20.007(1), F.A.C., or

~~(e) (d)~~ (d) In the case of an applicant who holds a [non-EAC/ABET-accredited degree coupled with a master’s or doctoral post-baccalaureate degree in engineering from a school or college in the United States which has an EAC/ABET-accredited engineering program in a related discipline at the baccalaureate level](#), provided the applicant meets the educational requirements set forth in subsection 61G15-20.007(1), F.A.C., or

~~(d) (e)~~ (e) Programs which have been approved by the Board of Professional Engineers under the provisions of Section 455.11(3), F.S.

Rationale for (b): The Canadian Engineering Accreditation Board (CEAB) of Engineers Canada has a similar process and criteria as EAC/ABET. Furthermore, EAC/ABET and CEAB have a Mutual Recognition Agreement, which is applicable to students who graduated from accredited engineering programs in 1980 or later. See [Attachments 1 and 2](#) for information on CEAB and how it compares to ABET.

Rationale for (d): If an applicant who has a non-EAC/ABET *B.S.* degree can be eligible for licensure, why shouldn’t an applicant who has a non-EAC/ABET *M.S.* or *Ph.D.* degree be eligible? They are all required to meet FBPE’s educational requirements anyway, and that should suffice. NCEES differs slightly; they will conduct evaluations on the following: “1. Bachelor’s degree in engineering from a non-U.S. based program, or 2. Non-EAC/ABET-accredited degree programs *in engineering, engineering technology, related science, or mathematics* only when coupled with a master’s degree or doctorate in engineering.”

61G15-20.0015 Application for Licensure by Endorsement.

(2) If an applicant for licensure by endorsement satisfies ~~any one of~~ the conditions found in Section 471.015(5)(a) ~~1, 2, or 3~~, F.S., then the Board shall deem that the applicant has passed an examination substantially equivalent to part I, fundamentals, of the engineering examination. If an applicant for licensure by endorsement satisfies the conditions found in Section 471.015(5)(b), F.S., then the Board shall deem that the applicant has passed an examination substantially

equivalent to part I, fundamentals, and part II, principles and practice, of the engineering examination.

Rationale: 471.015(5)(a) no longer has 1., 2., and 3., since the statute was changed last year to not allow Ph.D.s to bypass the F.E. exam. Now, (5)(a) only pertains to the 15/20 rule.

...

~~(4) An applicant for licensure by endorsement whose only educational deficiency under subsection 61G15-20.007(2)(1), F.A.C., involves humanities and social sciences and who has held a valid license and practiced in another state or territory of the United States for two (2) years or more shall be deemed to have satisfied that requirement.~~

~~(5)(4) The Board....engineering experience.~~

~~(6)(5) An applicant....null and void.~~

Rationale: Subsection 61G15-20.007(1), F.A.C., requires 16 college semester credit hours of humanities and social science for non-ABET degree holders. Rather than giving leniency on H&SS for *only endorsement* applicants who have two years of licensure in another state, other means of satisfying H&SS are being proposed for *all* applicants. See proposed changes to 61G15-20.007(1)(b), F.A.C.

See [Attachment 5](#) for results of a survey on how member boards handle Humanities and Social Science deficiencies.

61G15-20.002 Experience.

(1)(b)2. Engineering experience obtained prior to the completion of the engineering degree is usually of a subprofessional nature. Such experience, if full-time and if deemed acceptable and properly verified, may be awarded experience credit at 25% of the actual time. If the full-time experience is obtained after the completion of a substantial number of engineering design courses, and involves matters of average or above average complexity, experience credit may be awarded at up to 50% of actual time. In any event, the total engineering experience credit allowable for pregraduation experience shall not exceed 12 months.

3. Experience credit is based on a 40 hour per week full-time basis. No additional credit is allowable for overtime work, or for part-time work experience obtained while pursuing engineering education on a full-time basis, or for the part-time pursuit of a ~~masters~~ master's or ~~doctorate~~ doctoral degree while obtaining full-time work experience.

Rationale: Per (1)(b)3, we do not count part-time work experience, so revise (1)(b)2 to explicitly speak to *full-time* experience credit. Revise (1)(b)3 to not allow double-dipping: if an applicant works full-time, then he/she should not receive experience credit for educational pursuits.

(2) ...The Board will accept as equivalent to one year's experience a master's degree in engineering from an EAC/M-ABET-accredited program or from a college or university in the U.S. that has an EAC/ABET-accredited engineering program in a related discipline at the baccalaureate level. ~~college or university from a Board approved engineering program as defined in subsection 61G15-20.001(2), F.A.C.~~ The Board will also accept as equivalent to one year's experience a doctorate in engineering from a college or university in the U.S. that has an EAC/ABET-accredited engineering program in a related discipline at the baccalaureate level. ~~college or university from a Board approved engineering program as defined in subsection 61G15-20.001(2), F.A.C.~~ Experience equivalents will be given for the master's or doctoral degree only if the applicant has earned a prior engineering degree from a college or university that solely meets the requirements of a Board approved engineering program as defined in subsection 61G15-20.001(2), F.A.C.; i.e., experience equivalents shall not be given for a master's or doctoral degree if credits earned for the degree are used to satisfy educational requirements. The combination of experience equivalents and work experience shall not exceed the number of actual months during which the experience is claimed.

Rationale: The old rule allowed an applicant to “double dip” by counting a graduate degree towards experience *and* education. I believe that the *intent* of the rule was for a B.S. in engineering to have already been earned. The proposed language remedies this by requiring a B.S. (or equivalent) to be earned before graduate degrees can count towards experience. It also disallows “double dipping” of graduate degree and work experience (an applicant who earns a degree *and* works during a 4-year time period can't earn more than 4 years' experience).

61G15-20.007 Educational Requirements for Applicants Without EAC/ABET Accredited Engineering Degrees.

Preamble: ABET-accreditation is the “gold standard” for engineering degrees in the U.S. ABET now bases their program evaluations on *outcomes* instead of only a *minimum # of credit hours*. FBPE's predicament is how to define/codify an “equivalent” degree, since it is not feasible for the Board to evaluate “outcomes equivalency” for non-ABET programs. FBPE's current rules are very prescriptive with regard to the number of credit hours and types of courses that are required.

- (1) Applicants having engineering degrees from programs that are not accredited by EAC/ABET must demonstrate:**
- (a) 32 college semester credit hours of higher mathematics and basic sciences. Up to 4 credit hours may be substituted with engineering science courses that are in excess of the requirements of subsection (1)(c).**

Alternatively, go with NCEES Engineering Education Standard: Basic engineering science courses or sequence of courses in this area are acceptable for credit but may not be counted twice.

Rationale: Extra earned credit hours in Engineering Science could substitute for M&BS deficiencies. The $32 - 4 = 28$ hours would be equivalent to the Canada Engineers requirement for total M&BS. Alternatively, use NCEES's standard, which sets no limit on ES substitution.

1. The hours of mathematics must be beyond algebra and trigonometry and must emphasize mathematical concepts and principles rather than computation. Courses in ~~probability and statistics~~, differential calculus, and integral calculus, and differential equations are required. Additional courses may include differential equations, linear algebra, numerical analysis, probability and statistics, and advanced calculus. Mathematics courses must be intended for math, science or engineering majors; introductory mathematics courses are not acceptable. Computer skills and/or programming courses cannot be used to satisfy mathematics requirements.

Rationale: ABET *General* Criteria does not require differential equations or probability and statistics.

ABET *Program* Criteria **requires** probability and statistics (or an ability to apply them) for Bioengineering/Biomedical (statistics only), Ceramic, Construction, Electrical/Computer/Communications, Environmental, Manufacturing, Materials/Metallurgical, Mining, Naval Architecture/Marine Engineering, Ocean, Optical/Photonic, Petroleum, and Software.

ABET *Program* Criteria **does not require** probability and statistics for Aerospace, Agricultural, Architectural, Biological, Chemical/Biochemical/Biomolecular, Civil, Engineering/General Engineering/Engineering Physics/Engineering Science, Engineering Management, Engineering Mechanics, Fire Protection, Geological, Industrial, Mechanical, Nuclear/Radiological, Surveying, and Systems.

NCEES Committee on Education recently made changes to their Engineering Education Standard, similar to the proposed changes above. I was involved in this process, and committee members were all in support of these changes. Aligning FBPE's rules with NCEES's will help eliminate problems that arise when an applicant's education evaluation meets NCEES's standards but ultimately is denied by the Board for not meeting FBPE's rules.

2. The hours in basic sciences must include at least two courses. These courses must be in general chemistry, ~~and~~ calculus-based general physics, or biological sciences, but both courses may not be in the same area. ~~with at least a two semester (or equivalent) sequence of study in either area.~~ Additional basic science courses may include life sciences (biology), earth sciences (geology, ecology, or oceanography), advanced biology, ~~and~~ advanced chemistry, or advanced physics. Basic science courses must be intended for science or engineering majors; introductory science courses are not acceptable. Astronomy, computer skills and/or programming courses cannot be used to satisfy ~~mathematics or~~ basic science requirements.

Rationale: FBPE's current rule prescribes requirements for science courses, namely general chemistry and calculus-based general physics AND a sequence course in either. The proposed change defines "science" more broadly, to include "biological, chemical, and physical science". This will be consistent with ABET Criteria for Accrediting Engineering Programs (2014-2015). [See [Attachment 3](#) for this *General Criteria*.] Note that ABET *Program Criteria* specify particular science courses depending on the degree major. [See [Attachment 4](#), which shows that **science requirements vary widely among degrees**.] The proposed change also eliminates the sequence course requirement, which will be consistent with ABET, which does not currently require a sequence course.

The proposed changes are aligned with the recently-revised NCEES Engineering Education Standard. The NCEES Committee on Education, in which I am involved, was entirely in support of these changes.

(b) 16 college semester credit hours in general education humanities and social sciences. Examples of traditional humanities / social sciences courses in this area are philosophy, religion, history, literature, fine arts, sociology, psychology, political science, anthropology, economics (micro and macro), professional ethics, and social responsibility. Examples of other general education courses deemed acceptable include management (such as organizational behavior), accounting, written and oral communications, business, and law.

No more than 6 credit hours can come from courses in management, accounting, business, or law. Courses in engineering economics, engineering management, systems engineering/analysis, production, or industrial engineering/management will not be counted. ~~and no more than~~ Up to 6 credit hours of languages ~~other than English or other than the applicant's native language~~ are acceptable for credit. English and foreign language courses in literature and civilization may be considered in this area. ~~Courses such as accounting, industrial management, finance, personnel administration, engineering economics and military training are not acceptable.~~ Courses that which instill cultural values are acceptable, while routine exercises of personal craft are not.

Other means towards satisfying the general education requirement are as follows: Each year of progressive U.S. engineering experience as approved by the Board is equivalent to 2 credit hours, for a maximum of 8 credit hours; obtaining U.S. citizenship is equivalent to 10 credit hours; and earning a doctoral degree is equivalent to 10 credit hours if the degree is from a college or university in the U.S. that has an EAC/ABET-accredited engineering program in a related discipline at the baccalaureate level.

Rationale: ABET no longer prescribes a minimum number of credit hours in humanities and social science. They require "a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives". Nonetheless, the proposed changes give applicants a wider variety of ways in which to meet the H&SS requirement. See [Attachment 5](#) for results of an NCEES survey to member boards regarding how they handle H&SS deficiencies. State practices vary widely.

(c) 48 college semester credit hours of engineering science and engineering design taught within the college or by the faculty of engineering. Courses in this area shall have their roots in mathematics and basic sciences but carry knowledge further toward creative application of engineering principles. Examples of approved engineering science courses are mechanics, thermodynamics, heat transfer, electrical and electronic circuits, materials science, transport phenomena, engineering economics, and computer science (other than computer programming skills). Courses in engineering design stress the establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. Graduate-level engineering courses can be included to fulfill curricular requirements in this area. Thesis or dissertation hours shall not be granted credit. A maximum of six credit hours will be granted for special topics and independent study at any level. Graphics, surveying, or engineering technology courses will not be considered to meet engineering science and design requirements. In order to promote breadth, at least one engineering course outside the major disciplinary area is required.

Rationale: The proposed changes above will make FBPE's rules consistent with the recently-revised NCEES Engineering Education Standard. The only difference is that NCEES allows thesis or dissertation hours, whereas the proposed rule does not.

(d) ~~In addition, evidence of attainment of appropriate laboratory experience, competency in English, and understanding of the ethical, social, economic and safety considerations of engineering practice must be presented. As for competency in English, Satisfactory evidence includes the following: transcripts of course work completed; course content syllabi; testimonials from employers; college level advanced placement tests; Test of English as a Foreign Language (TOEFL) scores of at least 550 in the paper-based version, 80 on the internet-based version, or 213 in the computer-based version, will be accepted as satisfactory evidence.~~

Rationale: FBPE does not usually check for laboratory experience when reviewing applications. Lab courses can certainly improve student learning, by providing hands-on experience to supplement classroom lectures. However, it is the committee's opinion that labs should not be a requirement for licensure. Furthermore, evaluating whether or not applicants have "understanding of the ethical, social, economic and safety considerations of engineering practice" would require all too subjective judgment.

~~(4)(2) Any applicant whose only educational deficiency is under subsection (1)(b) above involves humanities and social sciences shall be entitled to receive conditional approval to take the Fundamentals of Engineering examination. Such an applicant shall not become eligible for the Principles and Practice examination until satisfactory completion and documentation of the necessary hours in humanities and social sciences as provided required in subsection (1)(b) above.~~

~~(5)(3) College Level Examination Programs (CLEP) examinations that are outlined at <http://www.collegeboard.com/student/testing/clep/exams.html> <http://clep.collegeboard.org/exam> may be recognized as satisfying education deficiencies, provided the exams are in courses that meet the requirements of~~

paragraph (1)(b) above. The applicant shall achieve a passing score as determined either by CLEP or by showing and the applicant is able to show that the results are recognized by a college or university with an EAC/ABET-accredited engineering program. College- or university-level courses can also be taken to satisfy deficiencies. Credit shall not be given for a college, university, or CLEP course if credit in a similar course has already been earned.

Rationale: Applicants will no longer be required to show that the CLEP course is acceptable by a college/university. Achieving CLEP's passing course will be sufficient.

~~(2)~~(4) The FBPE Educational ~~Advisory~~ Committee shall make the final decision regarding equivalency of programs and shall make recommendations to the Board as to whether an applicant shall be approved for admittance to the examination or for licensure by endorsement.

~~(3)~~(5) The applicant with an engineering degree from a non-EAC/ABET-accredited degree program foreign institution must request an evaluation of substantial equivalency of his or her credentials to EAC/ABET standards through either; of the following: National Council of Examiners for Engineering and Surveying, 280 Seneca Creek Road, Clemson, South Carolina 29678; or Joseph Silny & Associates, Inc., P.O. Box 248233, Coral Gables, Florida 33124. The applicant with an engineering degree from a domestic engineering program not accredited by EAC/ABET must request such an evaluation from Josef Silny & Associates, Inc.

Rationale: Rule 61G15-20.001 on "Board Approved Engineering Programs" uses the wording "non-EAC/ABET" rather than "foreign institution". Also, NCEES *will* evaluate an applicant from a non-ABET domestic engineering program upon FBPE's request, so we shouldn't limit an applicant's evaluator options to only Silny.

61G15-21.001 Written Examination Designated; General Requirements.

(2) Applicants for licensure by examination must be graduates of a Board-approved engineering program as defined in Rule 61G15-20.001, F.A.C. Acceptance into the fundamentals examination, either in Florida or elsewhere, does not indicate automatic acceptance for the principles principles and practice examination, nor does it exempt said applicant from meeting the criteria set forth in Chapter 471, F.S. and Chapter 61G15, F.A.C.

Comment: Spelling correction only.

61G15-21.004 Passing Grade.

(1) The passing grade for the Engineering Fundamentals Fundamentals of Engineering Examination is 70 or better determined by National Council of Examiners for Engineering and Surveying, where a scaled score is compared to the minimum ability level determined by psychometric statistical methods.

(2) The passing grade for the Principles and Practice Examination is ~~70 or better~~ determined by National Council of Examiners for Engineering and Surveying, where psychometric statistical methods are used to determine the level of performance that corresponds with minimal competence in the discipline.

Rationale: NCEES determines the passing scores using psychometrics. They do not publish a passing score because it varies with each exam administration and difficulty.

[End of rules changes]

ENGINEERS CANADA & ABET (Synopsis by M Roddenberry)

ABET is a signatory to five **Mutual Recognition Agreements (MRAs)**, the most notable one being the bilateral agreement between:

**Canadian Engineering Accreditation Board (CEAB) of Engineers Canada
&
Engineering Accreditation Commission (EAC) of ABET**

This MRA pertains to accredited engineering programs in Canada and the United States. See <http://abet.org/engineering-mra-engineers-canada/> for more information.

Excerpt from ABET's website:

Mutual Recognition Agreements – often known as "accords" – are agreements among organizations that accredit academic degree programs. These are non-governmental agreements that recognize the *substantial equivalency* of the organizations' accreditation processes and the graduates' preparedness to begin professional practice at the entry level.

Substantial equivalency means that the accreditation systems have comparable standards, outcomes, and processes, though they may not be identical. The mutual recognition of accrediting systems is intended to improve technical education worldwide and foster the mobility of students and graduates.

This MRA assists in determining if engineering programs in Canada or the U.S. are recognized for purposes of licensure and registration, employment, or admission to graduate school in either of these two countries.

...is applicable to students who graduated from accredited engineering programs in 1980 or later. Engineers Canada and ABET are under no formal obligation to recognize one another's accredited engineering programs or their graduates prior to 1980. However, they may do so at their own discretion.

List of Engineers Canada Accredited Programs:

http://www.engineerscanada.ca/sites/default/files/accredited_engineering_programs_institution.pdf

Includes University of Alberta; University of Calgary; Carleton University; Concordia University; The University of Manitoba; McGill University; McMaster University; University of New Brunswick; University of Ottawa; Queen's University; University of Waterloo; and others.

CONCLUSION: The accreditation criteria and procedures for CEAB of Engineers Canada are very similar to ABET's. See **Attachment 2** for details.

ENGINEERS CANADA ACCREDITATION PROCESS (Synopsis by M Roddenberry)

More at http://www.engineerscanada.ca/sites/default/files/sites/default/files/accreditation_criteria_procedures_2013.pdf

A. Overview of Process (nearly identical to ABET):

- The institution prepares a **detailed report** prior to the accreditation team's site visit.
- The team consists of volunteer **engineers** from private, public, and academic sectors.
- The team **visits** the institution to examine the **quality** of faculty, support staff, laboratories, equipment, computer facilities, curriculum, and students' work.
- Programs are expected to continually improve.
- Program outcomes are assessed in the context of graduate attributes.
- Accreditation may be granted for up to **six years**.

B. Program Outcomes (nearly identical to ABET):

Students are expected to: take math, science, and engineering courses; perform lab experiments; design systems and solutions for complex, open-ended problems; develop communication skills; work in teams; understand the roles/responsibilities of the professional engineer; apply ethics; understand environmental, cultural, economic, and social impacts of engineering; know concepts of sustainable development; have capacity for life-long learning.

C. Credit Hours & Curriculum (similar to ABET):

Entire program must include a minimum of **1950 AUs** (\approx **130 credit hrs**), to include:

1. 420 AU in Math & Natural Sciences \approx 28 credit hrs

(195 AU min. in each Math & Science)

(includes linear algebra, diff. & integral calc., diff. eq., prob., stats., numerical analysis, discrete math, physics, and chemistry)

ABET requires 32 credit hrs.
FBPE requires 32 credit hrs.
Proposed change allows 28 hrs.

2. 900 AU Engineering Science & Design \approx 60 credit hrs

(225 AU min. in each Eng. Science & Eng. Design)

ABET requires 48 credit hrs.
FBPE requires 48 credit hrs.

3. 225 AU Complementary Studies (Humanities & Social Science) \approx 15 credit hrs

4. Lab experience & safety procedures

5. Significant design experience

6. Use of modern tools

Similar to ABET. FBPE only requires lab experience, but we don't check it.
Proposed change removes lab requirement.

ABET used to require 16 credit hrs., but now they don't specify.
FBPE requires 16 credit hrs.
Proposed change allows other ways of earning hrs.

D. How Engineers Canada differs from ABET:

- Slight difference in *credit hours* required. (See Part C above.)
- Does not specify *calculus-based* physics, but I suspect they take calculus-based.
- Does not specify requirement for a *sequence* course in chemistry or physics.
- Engineering economics *can* count towards H&SS.

[1 Accreditation Unit (AU) = 1 hour lecture. 1 credit hr = 15 AUs approx.]

ABET's GENERAL CRITERIA FOR ALL ENGINEERING PROGRAMS & HOW THEY DIFFER FROM FBPE RULES

See PDF at <http://www.abet.org/eac-criteria-2014-2015/> or [http://www.abet.org/uploadedFiles/Accreditation/Accreditation_Step_by_Step/Accreditation_Documents/Current/2014_-_2015/E001_2014-15_20EAC_20Criteria_203-13-14\(2\).pdf](http://www.abet.org/uploadedFiles/Accreditation/Accreditation_Step_by_Step/Accreditation_Documents/Current/2014_-_2015/E001_2014-15_20EAC_20Criteria_203-13-14(2).pdf)

Excerpt from *ABET Criteria for Accrediting Engineering Programs (2014-2015)* (emphasis added):

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.
- (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. [End excerpt]

Notes by M Roddenberry.

Key:

FBPE matches ABET. ✓

FBPE does not match ABET. ✗

Note: ABET requires 1 year ✓
MATH & BASIC SCIENCE (essentially 32 hours) for ALL engineering programs.

SCIENCE is defined as "biological, chemical, and physical sciences". ✗
See next page for Program Criteria **SCIENCE requirements** for specific engineering disciplines.

Note: ABET requires 1.5 years ✓
ENGINEERING SCIENCE & DESIGN (essentially 48 hours) for ALL engineering programs.

Note: ABET no longer prescribes # hours for ✗
HUMANITIES & SOCIAL SCIENCE.

Note: **MAJOR DESIGN EXPERIENCE** is typically a senior capstone design course. ✗

SCIENCE REQUIREMENTS NAMED IN ABET PROGRAM CRITERIA *

	FBPE 61G15-20.007 for non-EAC/ABET degrees		No specific criteria beyond									
	1	2	3	4	5	6	7	8	9	10	11	12
	Chemistry	Calc-based physics	Sciences	Biology	Physiology	Ocean-ography	Computer science	Geological sciences	Earth science	One other area of basic	General Criteria	No specific sciences mentioned
Aerospace												
Agricultural			✓	(Biological and engineering sciences)								✓
Architectural	✓	✓										
Bioengineering,				✓	✓	(Proposal to add chemistry and calc-based physics)						
Biomedical				✓	✓	(Biology and advanced biological sciences)						
Biological	✓			✓	✓	(advanced science such as chemistry and physics)						
Ceramic												
Chemical, Biochemical,			✓	(Chemistry, physics, and/or biology, with some content at an advanced level)								
Biomolecular												
Civil	✓	✓								✓		
Construction	✓	✓										
Electrical, Computer, Communications												
General engineering, Engineering physics, Engineering science											✓	
Engineering management												✓
Engineering mechanics												✓
Environmental	✓	✓		✓	(Biological science)				✓			
Fire protection												✓
Geological	✓	✓					✓	(Geology, geophysics)				
Industrial												✓
Manufacturing												✓
Materials, Metallurgical			✓	(Advanced science such as chemistry and physics. Proposal to add biology.)								
Mechanical			✓									
Mining								✓				
Naval architectural,	✓	✓										
Marine												✓
Nuclear, Radiological			✓	(Science and engineering science, including atomic & nuclear physics)								
Ocean					✓							
Optical, Photonics			✓									✓
Petroleum												(-geological formations..)
Software							✓					
Surveying												✓
Systems											✓	

* Data compiled by M. Roddenberry, based on ABET Criteria for Accrediting Engineering Programs (2014-2015 Cycle)

Example: Agricultural programs: “The curriculum must include mathematics through differential equations and biological and engineering sciences consistent with the program educational objectives. The curriculum must prepare graduates to apply engineering to agriculture, aquaculture, forestry, human, or natural resources.”

**NCEES MEMBER BOARD SURVEY ON REQUIREMENTS FOR
HUMANITIES & SOCIAL SCIENCE COURSEWORK**

The information below was gathered and summarized by NCEES, based on a survey of the boards about 1.5 years ago. Sent by Stefani Goodenow (NCEES) to M. Roddenberry on 10/6/2014.

CHARGE 4: Evaluate how member boards handle the reports from credential evaluators which include deficiencies in the humanities/social sciences, and make recommendations for uniformity among the jurisdictions.

SURVEY QUESTIONS ASKED:

When your Board receives a credential evaluation that includes deficiencies in the humanities/social sciences do they:

- 1) Accept the degree without this requirement being met?
- 2) Require credits to be made up if deficiency is over a certain number?
- 3) Require that all deficient credits be made up?
- 4) Other (Example: some combination of education and additional experience?)

If your Board requires these deficiencies to be made up, please give us a brief description of how applicants are expected to make up these deficiencies.

SURVEY RESULTS: 42 responses were received.

16 jurisdictions do not require that these deficiencies be made up:

Connecticut, Maryland, Minnesota, Missouri, New Hampshire, Rhode Island, Wyoming

Arizona, Colorado, Maine, Nevada, West Virginia – with the understanding that they always have a very large overage of technical course hours

Delaware – Yes, if all math, science or engineering-related subjects are acceptable, additional consideration given for an MS degree

Idaho – Currently, but have proposed a rule that will adopt verbatim the NCEES Educational Standard which will require humanities and social sciences

Montana – looks at on a case by case basis, but accepts degree if all of the math and science credits have been met

Virginia – as long as they have met math and science requirements

12 jurisdictions require that all deficiencies be made up with course work (with explanations of their process):

Illinois – requires that an official transcript be submitted for the Board to review after the courses have been completed. At that time the Board will re-review the applications.

Kansas – requires that proposed course work be pre-approved by the Board and reported on an official transcript when completed.

Massachusetts – Board reviews additional coursework. They recommend following the guidelines provided by NCEES when choosing coursework to compensate for any deficiencies.

Mississippi – Courses in humanities/social sciences do not have to be taken at an ABET accredited university. They accept courses from even a community college. When the transcript comes in to prove the course work has been taken, the education is again reviewed by the Board.

Nebraska – rewriting their rules. Must be taken at an institution offering ABET engineering program; or “transferable” to an ABET program; will accept CLEP; up to 9 credit hours if degree from an institution whose primary language is not English.

North Carolina – Deficiencies can be made up at any institution of higher learning including at a community college or a traditional university. They must be submitted on a transcript from the school.

Ohio – can be made up at any college, university or community college provided that college has ABET accredited programs and the institution is accredited by a Regional Institution Accrediting Agency of the U.S. Dept. of Education. Also allow them to complete the deficiencies by CLEP testing provided that test leads to college credit and is listed on a transcript at a school mentioned above.

South Carolina – will accept course work shown on an official transcript with a passing grade, passage of a CLEP exam, and passing of a “challenge” exam in the deficient area administered by an acceptable university and verified by the professor. Before taking courses the applicant may seek approval of the courses from the Board.

South Dakota – All deficiencies must be rectified, and then the individual must be re-evaluated by NCEES. Only when they obtain a “meets the standard” rating from NCEES will the Board consider them.

Tennessee – Any courses taken to remedy these deficiencies must be approved by the Board in advance. In lieu of completing additional course work, the following options are available:

1) One (1) year of progressive engineering experience in the U.S., if applicant has practiced over ten (10) years in the U.S. = 0.5 semester hour

- 2) Civic involvement in one organization in the U.S. for one (1) year = 0.5 semester hour
- 3) Passing tests for U.S. citizenship = 1 semester hour
- 4) 15 PDH's of continuing education in ethics/humanities/social sciences (earned within 2 years of application date) = 1 semester hour
- 5) CLEP credits will be accepted to fulfill up to 12 semester hours of humanities/social sciences deficiencies only if they are offered by a regionally accredited college or university and appear on the official college or university transcript.

Texas – any deficiencies can be made up at a recognized institution. Once the applicant shows transcript evidence that the deficiencies have been covered, the applicant's education is approved. Do not require re-evaluations.

Utah

2 jurisdictions required credits made up over a certain number:

Washington – If the deficiency is 3 hours or less it may be accepted, any larger deficiency is automatically reviewed by exam committee. A specific number of approved course hours may be required depending on where shortage occurs. No degree requirement in state so full credit for the degree may not be granted. Extra experience would be required.

Wisconsin – Take into account the entire application. Historically they will accept a 3 credit shortage. If there is more than a 3-credit shortage, the applicant is asked to make up the coursework.

12 jurisdictions have other ways of dealing with the deficiencies:

Alaska – Evaluated on a case by case basis and usually approved with some combination of additional education and/or experience.

District of Columbia – Case by case basis. May forgive deficiencies if applicant has completed a lot of engineering course work relevant to the discipline applying for.

Florida – rule requires 16 hours of humanities and social sciences. May give conditional approval for an exam and grant EI certification after hours completed and submitted on a transcript. If the applicant is applying for licensure by endorsement and this is the only deficiency it may be waived if holding licensure in another state for two years.

Hawaii – applicant must qualify with additional years of experience.

Iowa – If the credentials evaluation identifies deficiencies in the applicant's course curriculum (humanities or otherwise) compared to the ABET requirements, it is

considered a non-ABET degree. An additional year of experience is required for non-ABET degreed applicants.

Kentucky – Case by case. Will accept deficiencies if the education system in that country requires such courses be taken before admittance to the university program and therefore not included on the transcript; or they have completed a U.S. graduate degree program. If not, such deficiencies would have to be made up at any accredited U.S. college or university and the courses would have to show on an official transcript.

Michigan – Similar to Alaska.

New Jersey – Evaluates each application on a case-by-case basis. Recently adopted new regs requiring an ABET-accredited degree. No set policy, but will most likely now require that deficient credits be made up.

New York – choice, make up the course work or get additional years of experience. In general non-ABET foreign engineering education usually received 6 years of credit toward the required 12, where an EAC/ABET would receive 8 years. Therefore they would need 2 extra years of experience.

Oklahoma – these degrees are accepted as a related science degree.

Pennsylvania – The Board does not require any applicant to correct educational deficiencies that may be found as a result of application evaluation and/or a Foreign Education Credential Evaluation. They would consider the applicant's qualifications in accordance with the work experience requirements established by the Registration Act and the regulations of the Board.

Rhode Island – The Board reviews each application received with a credential evaluation on a case-by-case basis. If the report shows deficiencies in the humanities/social sciences then it is the Board's decision based on the applicant's transcripts and also on what country they received their degree in.