



April 2015 FBPE Education Rules Committee Meeting

Apr 09, 2015 at 11:00 AM

The Shores Resort

2637 S. Atlantic Ave.

Daytona Beach Shores, Florida 32118

April 2015 FBPE Education Rules Committee Meeting Book

A. Call to Order

B. Roll Call, Determination of Quorum and Address Absences

C. Review of Proposed Changes to Educational Rules

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D. Adjourn

MEMO

To: Zana Raybon
FBPE Executive Director

From: Michelle Roddenberry
FBPE Educational Advisory Committee Chair

Date: February 21, 2015

RE: FBPE EDUCATIONAL REQUIREMENTS FOR LICENSURE

A few years of Board service and scores of application reviews have led me to reflect on our existing educational requirements for licensure. I've given a thorough review of our rules and would like to propose some changes, especially pertaining to educational requirements for non-ABET degree holders. This document contains suggested changes and discussion points for the Educational Advisory Committee to consider. A few non-substantive changes are also included. **Rules are bolded, suggested revisions are blue,** and comments/discussion points are in regular font.

Furthermore, the NCEES Committee on Education, in which I have been involved, recently made some changes to their Engineering Education Standard. NCEES uses the Standard to evaluate applicants with non-ABET engineering degrees. It would be fitting to align any changes to FBPE's rules with NCEES's, where agreeable to the Board. With that in mind, information on NCEES's educational requirements is provided in this document where relevant.

Also included is information gathered on ABET's General Criteria, science requirements in ABET's Program Criteria, Engineers Canada accreditation, and other jurisdictions' handling of humanities & social science deficiencies.

Please forward this to the Educational Advisory Committee for their review and to Chairman Bracken for his information. I welcome your comments, also. After discussion and revision by the committee, any recommended changes should be forwarded to the Rules Committee for review, followed by Board consideration.

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.~~ ABET (EAC/ABET), or

Comment: Minor, non-substantive revision. In 2005, the “Accreditation Board for Engineering and Technology, Inc.”, began doing business as simply “ABET”. This should be changed also in other sections where it occurs.

(b) Engineering programs accredited by the Canadian Engineering Accreditation Board (CEAB) in 1980 or later, or

For Discussion: Consider allowing degrees accredited by CEAB to be equivalent to ABET degrees or at least Board approved. 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.

~~(b)~~ (c) In the case of an applicant who did not graduate from an approved program as set forth in paragraph (2)(a) 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

~~(c)~~ (d) In the case of an applicant who holds a post-~~baccalaureate~~ baccalaureate degree 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

Comment: Spelling correction.

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

For Discussion: Consider deleting this subsection if we are allowed to do so. Section 455.11(3), F.S., states, “Each board within the department shall adopt and implement programs designed to qualify for examination all persons who were resident nationals of the Republic of Cuba and who, on July 1, 1977, were residents of this state.” Why do we have to have an extra process for program approval? Can these persons not get their transcripts evaluated like any other non-ABET degree holder? If not, then how would we approve their degree program that existed in Cuba many years ago? (It would be nonsense to look at a current Cuban degree program and assume that it is the same as an old Cuban degree program. We can’t even do that for U.S. programs.)

61G15-20.0015 Application for Licensure by Endorsement.

...

(4) An applicant for licensure ~~by endorsement~~ whose only educational deficiency under subsection 61G15-20.007(2), F.A.C., involves humanities and social sciences and who has ~~xx total years of verifiable engineering practice in the U.S. 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.

For Discussion: Section 61G15-20.007, F.A.C., requires 16 college semester credit hours of humanities and social science for non-ABET degree holders. Why do we give leniency only to *endorsement* applicants? Is two years of *licensure* in another state a rational substitute for Humanities and Social Science credits, or is it *experience in the U.S.* that we are looking for? What is a good “substitute” for humanities and social science courses? Consider:

- 1) Eliminating this section altogether, to not allow substitutes for H&SS educational deficiency, or
- 2) Changing the language above (in which case, the subsection would no longer fall under “Licensure by Endorsement”), or
(Rationale: By specifying “practice in the U.S.”, the Board will have reason to believe that the applicant’s experience has been cultured by U.S. practices, ethics, and societal needs.)
- 3) Coming up with another substitute or additional substitutes, or
- 4) Changing subsection 61G15-20.007(1)(b), F.A.C., to allow some leniency in H&SS hours. This will be discussed a few paragraphs below.

See Attachment 5 for results of a survey on how member boards handle Humanities and Social Science deficiencies.

61G15-20.002 Experience.

(2) ...The Board will accept as equivalent to one year’s experience a master’s degree in engineering from a 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 from a Board approved engineering program as defined in subsection 61G15-20.001(2), F.A.C. To be given experience equivalents for a master’s and/or doctoral degree, the applicant must have first completed a prior EAC/ABET engineering degree for which experience equivalents are not being given. Experience equivalents will not be given for a graduate degree that is the first engineering degree earned.

For Discussion: A master’s or doctoral degree holder without a baccalaureate degree usually has to “articulate” into the graduate program by first taking some undergraduate engineering courses. However, they typically do not take as many courses as required for an undergraduate engineering degree. Consider adding the language above to limit

giving the one-year experience only to applicants who have earned an EAC/ABET degree prior to the degree for which they claim experience equivalents.

Example: The current rule gives one year's experience to an applicant with a B.S. geology degree and an EAC/ABET M.S. engineering degree. The applicant would have his academic credentials evaluated, and the Board would make sure that he has the required hours in M&BS, ES&D, and H&SS. It is possible that he would not have any/many credits beyond the required – when the spirit of the rule is that he would have about 30 extra ES&D hours.

Ramification of proposed rule change: Some applicants may need to work another year or two before applying for licensure, rather than being allowed the experience “shortcut”.

61G15-20.006 Educational Requirements.

~~(1) The evaluation of curricula and standards of accreditation for approval of degree programs required by Section 471.013, F.S., shall be made by the Education Advisory Committee and shall be based upon an overview of engineering programs within the United States accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc. (EAC/ABET), and an evaluation of such programs and schools, following the definition of the practice of engineering set forth in Section 471.005(7), F.S. Acceptable curricula requirements and degree programs shall conform to the criteria for accrediting engineering programs set forth by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc. (EAC/ABET) and found in the applicable Annual Report of EAC/ABET.~~

~~(2) A non-EAC/ABET accredited engineering degree program (hereinafter “engineering program”) which seeks approval pursuant to Section 471.013(1)(a), F.S., shall submit the following to the Board:~~

~~(a) A completed application form “Request for Evaluation” [FBPE/007 (11-07)] and “Self-Study Report” [FBPE/008 (1-08)]...~~

~~(b) A current catalog and student and faculty handbook...~~

~~(3) The Board's survey and evaluation of an engineering program shall consist of two elements:...[and so on]...~~

For Discussion: Have degree programs ever requested Board approval? Does the Board have the expertise to approve programs? Why would we take on that responsibility, when EAC/ABET already has a process for approving programs? Or does this section exist because 455.11(3), F.S., requires it? What is the history of this section?

Consider removing Section 20.006 altogether, if we are allowed to.

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

For Discussion: FBPE's Predicament: ABET is the "gold standard" for degrees in the U.S. The difficulty of defining/codifying an "equivalent" degree is that ABET now bases their program evaluations on *outcomes* instead of *minimum # of credit hours*. It is not feasible for the Board to evaluate "outcomes equivalency" for non-ABET programs – forcing us to rely instead on "bean counting" as was done by ABET before 2000. ABET Criterion 3, Student Outcomes, are as follows:

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*
- (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.*

(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 or engineering design courses that are in excess of the requirements of subsection (c).*

(*Note: NCEES Engineering Education Standard states, "basic engineering science courses or sequence of courses in this area are acceptable for credit but may not be counted twice". NCEES apparently sets no limit on the number of engineering science credits that can count for M&BS, whereas the proposed change above limits it to 4 credit hours.)

For Discussion: Consider allowing extra earned credit hours in Engineering Science and Design to substitute for M&BS deficiencies. This would be especially helpful for foreign-degree applicants who take less M&BS and more ES&D, because of their college-preparatory education. Also, the $32 - 4 = 28$ hours would be equivalent to the Canada Engineers requirement for total M&BS.

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.

For Discussion: 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; acceptable courses must be intended for science or engineering majors. ~~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), advanced biology, ~~and~~ advanced chemistry, or advanced physics. Computer skills and/or programming courses cannot be used to satisfy mathematics or basic science requirements.

For Discussion: FBPE's current rule prescribes requirements for science courses, namely general chemistry and calculus-based general physics AND a science 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.

Another option would be to require specific science courses depending on the degree major or area of practice, but this would make application review more complicated or subjective, and if a person's area of practice differs from his degree, then which sciences would we require? This option is not as preferred as the proposed, more flexible rule above.

NCEES Committee on Education recently made similar changes to their Engineering Education Standard. 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.

(b) 16 college semester credit hours in general education that complements the technical content of the curriculum ~~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 n~~ No more than 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.

For Discussion: 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". Consider:

- 1) Removing the H&SS requirement, or
- 2) Reducing the H&SS requirement, or
- 3) Allowing substitutes, such as extra earned credit hours in Engineering Science and Design, or
- 4) Allowing additional courses in management, accounting, written and oral communications, business, and law, as proposed above.

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. 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. Engineering technology courses cannot be considered to meet engineering topic requirements. In order to promote breadth, at least one engineering course outside the major disciplinary area is required.**

For Discussion: The proposed changes above will make FBPE's rules consistent with NCEES's.

(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, 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.

(2) 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) The applicant with an engineering degree from a foreign institution must request an evaluation of substantial equivalency of his or her credentials to EAC/ABET standards through either; 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.; **or....???**

For Discussion: Should we allow other evaluators besides NCEES and Silny? See Attachment 6 for list of evaluators accepted by a few other states.

(4) Any applicant whose only educational deficiency under subsection (1) 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 in subsection (1).

For Discussion: This section may need to be revised, if H&SS requirements are changed.

(5) 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 ~~and the applicant is able to show that the results are recognized by a college or university with an EAC/ABET accredited engineering program.~~

Comment: Minor, non-substantive changes only.

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.**

For Discussion: NCEES determines the passing score using psychometrics. According to NCEES's website, for computer-based exam scoring:

Your exam results are based on the total number of correct answers that you selected. There are no deductions for wrong answers. The score is then converted to a scaled score, which adjusts for any minor differences in difficulty across the different exam forms. This scaled score represents an examinee's ability level and is compared to the minimum ability level for that exam, which has been determined by subject-matter experts through psychometric statistical methods. NCEES does not publish the passing score because it varies slightly based on difficulty. NCEES scores each exam with no predetermined percentage of examinees that should pass or fail. All exams are scored the same way. First-time takers and repeat takers are graded to the same standard.

(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.

For Discussion: NCEES determines the passing score using psychometrics. According to NCEES's website, for the paper-and-pencil PE and SE exam scoring:

When an exam is introduced or when its specifications change, a committee of subject-matter experts works with experienced psychometricians (testing experts with a background in statistics) to determine the level of performance that corresponds with minimal competence in that discipline. This becomes the passing score. NCEES does not publish passing scores because they change with each administration. NCEES scores each exam with no predetermined percentage of examinees that should pass or fail. All exams are scored the same way. First-time takers and repeat takers are graded to the same standard.

[End rules discussion]

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** (**≈ 130 credit hrs**), to include:

1. 420 AU in Math & Natural Sciences ≈ 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)

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

2. 900 AU Engineering Science & Design ≈ 60 credit hrs

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

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

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

4. Laboratory experience & safety procedures

5. Significant design experience

6. Use of modern tools

FBPE requires 16 credit hrs.
ABET used to require 16 credit hrs.,
but now they don't specify.

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 **32 hours MATH & BASIC SCIENCE (or 25% of total 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 **48 hours ENGINEERING SCIENCE & DESIGN (or 37.5% of total 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 General Criteria	No specific sciences mentioned	
	Chemistry 1	Calc-based physics 2	Sciences 3	Biology 4	Physiology 5	Ocean-ography 6	Computer science 7	Geological sciences 8	Earth science 9	One other area of basic 10	11	12		
Aerospace													✓	Aerospace
Agricultural				✓ (Biological and engineering sciences)										Agricultural
Architectural	✓	✓												Architectural
Bioengineering, Biomedical				✓	✓ (Proposal to add chemistry and calc-based physics)									Bioengineering, Biomedical
Biological	✓			✓ (Biology and advanced biological sciences)										Biological
Ceramic			✓ (advanced science such as chemistry and physics)											Ceramic
Chemical, Biochemical, Biomolecular			✓ (Chemistry, physics, and/or biology, with some content at an advanced level)											Chemical, Biochemical, Biomolecular
Civil	✓	✓								✓				Civil
Construction	✓	✓												Construction
Electrical, Computer, Communications			✓ (Biological, chemical, or physical science)											Electrical, Computer, Communications
General engineering, Engineering physics, Engineering science													✓	General engineering, Engineering physics, Engineering science
Engineering management													✓	Engineering management
Engineering mechanics													✓	Engineering mechanics
Environmental	✓	✓		✓ (Biological science)					✓					Environmental
Fire protection													✓	Fire protection
Geological	✓	✓					✓ (Geology, geophysics)							Geological
Industrial													✓	Industrial
Manufacturing													✓	Manufacturing
Materials, Metallurgical			✓ (Advanced science such as chemistry and physics. Proposal to add biology.)											Materials, Metallurgical
Mechanical			✓											Mechanical
Mining	✓	✓					✓							Mining
Naval architectural, Marine													✓	Naval architectural, Marine
Nuclear, Radiological			✓ (Science and engineering science, including atomic & nuclear physics)											Nuclear, Radiological
Ocean							✓							Ocean
Optical, Photonics			✓											Optical, Photonics
Petroleum													✓ (..geological formations..)	Petroleum
Software						✓								Software
Surveying													✓	Surveying
Systems													✓	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.

CREDENTIALS EVALUATIONS SERVICES

The table below is based on Zana Raybon's survey to NCEES Member Boards.
Compiled by M Roddenberry on 10/8/2014.

EVALUATORS for Education Equivalency	Florida	Louisiana	Texas	Alaska	North Carolina	Maryland	North Dakota
NCEES Credentials Evaluations							
Josef Silny & Associates, Inc.							
Foreign Credentials Service of America							
Span Tran Evaluation Services, Inc.							
Educated Choices, LLC							
Center for Applied Research, Evaluation & Education, Inc.							
Education Evaluators International, Inc.							
Education International, Inc.							
Educational Credential Evaluators, Inc.							
Educational Perspectives, nfp.							
Educational Records Evaluation Service, Inc.							
Evaluation Service, Inc.							
Foreign Academic Credential Service, Inc.							
Foreign Educational Document Service							
Foundation for International Services, Inc.							
Global Credential Evaluators, Inc.							
Global Services Associates, Inc.							
International Academic Credential Evaluators, Inc.							
International Education Research Foundation, Inc.							
World Education Services, Inc.							
International Consultants of Delaware, Inc.							
AACRAO International Education Services							
ECEI							

More to come, if the Educational Advisory Committee wishes. Perhaps contact evaluation services and ask about their process and what states they evaluate for. Perhaps contact MBAs and ask who the best services are.