Consultation Group – Engineering Instruction and Accreditation

Consultation Document

Note: this is essentially the same document as was provided for the December 4, 2015 webinar with edits for clarity

Introduction

Accreditation is the cornerstone of the Canadian system. It identifies Canadian engineering programs that meet high standards. Accreditation confirms the quality of education through review by a neutral, external party. It ensures that graduates have the body of knowledge required to enter professional practice.

The criteria for accreditation provide a broad basis for identifying acceptable undergraduate engineering programs, to prevent over-specialization in curricula, to provide sufficient freedom to accommodate innovation in education, to allow adaptation to different regional factors, and to permit the expression of the institution's individual qualities, ideals, and educational objectives. They are intended to support the continuous improvement of the quality of engineering education.

This document provides background information on engineering education and accreditation. It provides suggestions for changes to accreditation criteria. The curriculum measurement criteria are of particular interest in this consultation.

Short and long-term issues that have been raised regarding accreditation

Several issues were raised by NCDEAS deans with regards to the curriculum content measurement methodology and workloads. Examples of issues include inadequate flexibility for educational innovation and alternative forms of program delivery (such as active independent learning, experiential learning, project based learning, MOOCs, etc.); insufficient ability to adequately complement technology-focused studies with other studies (e.g., management, social sciences, entrepreneurship, research, etc.); an over-constrained dual model of input / output based assessment that hinders innovation; and excessive workloads for all involved in preparing for and conducting accreditation visits.

It should be noted that some members of the stakeholder groups feel confident that the criteria are sufficiently flexible to allow for innovation. However, not all stakeholders have the same level of expertise regarding the criteria and interpretive statements.

Accreditation Board members have been working to find ways to make the accreditation process less onerous on programs and on accreditation volunteers. Both the Deans and the Accreditation Board are faced with significant workload issues that need to be addressed.

Decision of the Engineers Canada Board to establish a consultation group

The Accreditation Board Chair and the Chair of the National Council of Deans of Engineering and Applied Science are advisors to the Engineers Canada Board. Both attend Engineers Canada Board meetings and

provide updates on current issues. In December 2014, the Chair of the NCDEAS, at the request of the Engineers Canada President, outlined concerns about accreditation.

In May 2015, the President of Engineers Canada convened a workshop to discuss accreditation concerns. The initial report on the outcomes of that workshop included that the next steps for the Accreditation Board were to recommend changes to the accreditation system, a process for ongoing face-to-face consultation, and an achievable but expeditious schedule for implementing change. An approach to change and next steps should be in place before the end of 2015.

At the September 30, 2015, Engineers Canada Board meeting, the Consultation Group was established. The group is to make recommendations to the Engineers Canada Board at its February 2016 meeting. The composition of the Consultation Group is follows:

Name	Stakeholder Group
Larry Staples (chair) Zaki Ghavitian	Engineers Canada Board
Gerard Lachiver Wayne McQuarrie	Accreditation Board
Greg Naterer Ishwar Puri	National Council of Deans of Engineering & Applied Science
Grant Koropatnick Gerard McDonald	Constituent Associations

Purpose of the consultation process

On September 30, 2015, the Engineers Canada Board established the *Consultation Group on Engineering Education and Accreditation* to make recommendations on proposed criteria changes.

The consultation process provides stakeholders with an opportunity to comment on proposed changes to accreditation criteria. There will be two webinars for stakeholder groups to receive information and provide feedback. One webinar will be on December 4, 2015 and the second will be on January 7, 2016. Stakeholders may also submit comments in writing (consultation@engineerscanada.ca).

The Consultation Group's report is due January 13, 2016. The Consultation Group will make recommendations to the Engineers Canada Board. It is the Engineers Canada Board that approves accreditation criteria.

The principles to address the short term issue

The overarching principles:

- the overall quality of the engineering degree will remain unchanged or improve
- engineering programs will continue to be 4 years / 8 semesters (or equivalent)
- the core engineering curriculum requirements (math, natural science, engineering science, engineering design, complementary studies) and the requirement for licensure of certain faculty will remain unchanged

- maintain the purpose of accreditation as outlined in the accreditation criteria (see Appendix A)

The most common way to measure curriculum content is by using the Accreditation Unit (AU) measure. Currently, the overall program requirement is 1950 AUs, comprised of:

- engineering science and engineering design minimum 900 AUs
- math and natural science minimum 420 AUs
- complimentary studies minimum 225 AUs
- additional curriculum components that support a 4 year / 8 semester program

An amendment has been proposed to a minimum of 1545. This would serve as an interim transition until a sustainable long-term solution is found. The minimum curriculum components in Engineering Science, Engineering Design, Mathematics, Natural Sciences, and Complimentary Studies (totaling 1545 AUs) would remain unchanged. The Deans recognize that programs must satisfy the basic components of the engineering program, and there must be evidence of sufficient additional content for a program to be accredited.

The concept of removing the overall program requirement has been considered previously by the Accreditation Board. In September 2013, the following motions were passed (excerpt from the September 2013 Accreditation Board minutes, pages 10-11):

> *That the members of the Accreditation Board support the concept of revision of criteria 3.4.2 and 3.4.6 such that the total program requirement of 1800 AU (1950 effective 2014) is removed but the concept of a minimum 16 years total education is retained.*
>
> *That the members of the Accreditation Board support the concept of having the curriculum quantification criteria removed from the main criteria and instead included in an interpretive statement.*

Those motions were passed but action was not immediately taken as agreement on the way of measuring the additional content needed further study. The Deans' primary objective, as delivered at the November 2015, NCDEAS meeting, is to maintain and improve upon the current quality of the engineering degree.

Strategy to address the short term issue including implementation plans

The proposed changes to the criteria that are the main focus of the consultation are:

3.4.2	Minimum curriculum components: An engineering program must include the following minima ~~minimum for the entire curriculum and~~ for each of its components. ~~* The entire program must include a minimum of 1,950 AU~~ Engineering science and engineering design: Minimum 900 AU *Which includes a minimum 225 AU in each of Engineering science and Engineering design* Mathematics and natural sciences: Minimum 420 AU *Which includes a minimum 195 AU in each of Mathematics and Natural sciences.* Complementary Studies: Minimum 225 AU Laboratory experience and safety procedures instruction	Change to accommodate new definition of total program load
3.4.5	A minimum of 225 AU of complementary studies: Complementary studies include humanities, social sciences, arts, management, engineering economics and communications that complement the technical content of the curriculum.	Minor editorial change
3.4.5.1	While considerable latitude is provided in the choice of suitable content for the complementary studies component of the curriculum, some areas of study are essential in the education of an engineer. Accordingly, the curriculum must include studies in the following: a. Subject matter that deals with central issues, methodologies, and thought processes of the humanities and social sciences b. Oral and written communications c. Professionalism, ethics, equity and law d. The impact of technology on society e. Health and safety f. Sustainable development and environmental stewardship g. Engineering economics and project management	Minor editorial changes to better align with terminology used in graduate attributes
3.4.6	The program must have a minimum of ~~1,950 Accreditation units~~ eight semesters (or four years) of full-time (or equivalent) appropriate content ~~that are~~ at a university level.	New text
	It is expected that the curriculum content required to satisfy the minima specified criterion 3.4.2 will comprise no more than 80% of the total learning workload involved in an engineering program, the remaining 20% to comprise additional relevant learning activity at a university level. To evaluate this criterion, the Accreditation Board will rely on the *Interpretive statement on minimum program content,* which is attached as an appendix to this document.	Details in interpretive statement. Total institutional credits not to be less than currently accredited program(s)

The agreed upon principles to address the longer term issues

Two longer term issues include:

- Developing alternate methodologies for assessing curriculum content
- Continual efforts to streamline the accreditation visit process for both higher education institutions and for the Accreditation Board

While these issues are not within the mandate of the Consultation Group, the Accreditation Board recognizes that the transition to a new system needs to be completed in a reasonable time. To this end, the Deans and the Accreditation Board are committed to working together towards resolving the long-term issues for the good of the profession.

The Accreditation Board will continue to identify, in consultation with the Deans, measures to address both programs and Accreditation Board workload issues. Please see Appendix B for an initial outline.

A set of Questions and Answers are provided in Appendix C. If you have additional questions regarding this consultation, please forward them to consultation@engineerscanada.ca.

Appendix A – Purpose of accreditation (excerpt from Accreditation Criteria)

The purpose of accreditation is to identify to the constituent associations of Engineers Canada those engineering programs whose graduates are academically qualified to begin the process to be licensed as professional engineers in Canada. The process of accreditation emphasizes the quality of the students, the academic and support staff, the curriculum and the educational facilities.

The engineering profession expects of its members competence in engineering as well as an understanding of the effects of engineering on society. Thus, accredited engineering programs must contain not only adequate mathematics, science, and engineering curriculum content but must also develop communication skills, an understanding of the environmental, cultural, economic, and social impacts of engineering on society, the concepts of sustainable development, and the capacity for life-long learning.

The criteria for accreditation are intended to provide a broad basis for identifying acceptable undergraduate engineering programs, to prevent over-specialization in curricula, to provide sufficient freedom to accommodate innovation in education, to allow adaptation to different regional factors, and to permit the expression of the institution's individual qualities, ideals, and educational objectives. They are intended to support the continuous improvement of the quality of engineering education.

Appendix B – AB's strategy to address the longer term issues

(Note: Not part of this consultation process)

Curriculum content issues

Consider the possibility of alternative measurements

- July-September 2016: research on identifying options for alternate curriculum measurement methodologies
- September-October 2016: discussions by the Accreditation Board
- November 2016: discussions with NCDEAS to finalize methodologies
- January-April 2017: consultation with the regulators
- May- July 2017: finalize the report in order to present recommendations
- October 2017: Engineers Canada board approval

Workload issues

More collaborative/transparent process with stakeholders

- Refine sampling methodologies
- Streamline the on-site visit schedule
- Prior review of visit materials (online review by visiting teams)
- Development of training materials and enhanced training for all participants
- Ongoing consultation with NCDEAS on bringing greater efficiencies to the process
- Accreditation related workloads will be reduced to prior levels in the early 2010s, or lower, i.e. before the introduction of dual input and outcomes accreditation criteria

APPENDIX C – Questions & Answers

The following are anticipated questions. Please forward any additional questions you may have to consultation@engineerscanada.ca.

1. **Does this consultation cover all of the accreditation criteria?**

   No, the consultation is limited to the measurement of curriculum content. Institutions are required meet the standards established in the following area:

   a. **Graduate attributes** - institutions must demonstrate that the graduates of a program possess the attributes 12 distinct areas.

   b. **Continual improvement** - Engineering programs are expected to continually improve. There must be processes in place that demonstrate that program outcomes are being assessed in the context of the graduate attributes, and that the results are applied to the further development of the program.

   c. **Students** - Accredited programs must have functional policies and procedures that address quality, admission, counselling, promotion and graduation of students.

   d. **Curriculum content and quality** - All students must meet all curriculum content and quality criteria designed to assure a foundation in mathematics and natural sciences, a broad preparation in engineering sciences and engineering design, and an exposure to non-technical subjects that supplement the technical aspects of the curriculum

   e. **Program environment** – AB considers the overall environment, in which an engineering program is delivered, including moral, accessibility of facilities, qualifications, expertise and availability of faculty, and financial resources.

2. **Do other accreditation systems around the world that use outcome measures also measure curriculum content** (i.e. two systems – graduate attributes and curriculum content)?

   Yes, all systems have a measure of curriculum content. For example, section C.2.2.6 of the Washington Accord states: provide the criteria for accreditation/recognition (general, program specific; curriculum content technical and non-technical; incorporation of practical experience; length of the program; naming of the program; faculty requirements).

3. **The document mentions that workload is a long-term issue and out of scope for this consultation. How do I pass along my suggestions to streamline accreditation processes?**

   We are always looking for ways to improve the processes. Please email your suggestions to consultation@engineerscanada.ca

4. **What is an Accreditation Unit? Why was it developed?**

   Section 3.4.1 *Approach and methodologies for quantifying curriculum content* of the Accreditation Criteria and Procedures Report 2014 fully defines Accreditation Units

   3.4.1.1 **Accreditation units** (AU) are defined on an hourly basis for an activity which is granted academic credit and for which the associated number of hours corresponds to the actual

contact time between the student and the faculty members, or designated alternates, responsible for delivering the program:

- one hour of lecture (corresponding to 50 minutes of activity) = 1 AU
- one hour of laboratory or scheduled tutorial = 0.5 AU

This definition is applicable to most lectures and periods of laboratory or tutorial work. Classes of other than the nominal 50-minute duration are treated proportionally. In assessing the time assigned to determine the AU of various components of the curriculum, the actual instruction time exclusive of final examinations should be used.

The sections 3.4.1.2, 3.4.1.3 and 3.4.1.4 set out how methods for determining an equivalent measure in AU is a calculation on a proportionality basis for content that is not measured in contact hours.

The system of using AUs to measure curriculum content is unique to Canada. Institutions have a variety of ways of measuring curriculum content. A simple term like credit hours means have different meaning. Semester lengths range from 12 -15 weeks. Credit hours range from 120 to 150 hours for equivalent programs. The system of AU was developed to normalize the measurement of curriculum content.

5. The document refers to "concept of a minimum 16 years total education". What does this mean?

The 16 years refer to totally schooling that includes four years post-secondary. In some jurisdictions, it means grade 1 through to grade 12 + 4 years at university. In Quebec, it means grade 1 through to grade 11, plus two years at CEGEP and 3.5 years at university.

6. I understand that the AU system has a K factor to provide flexibility to the institutions. How does it work?

The details are set out in the accreditation criterion.

3.4.1.3 One method for determining an equivalent measure in AU is a calculation on a proportionality basis. This method relies on the use of a unit of academic credit defined by the institution to measure curriculum content. Specifically, a factor, K, is defined as the sum of AU for all common and compulsory courses for which the computation was carried out on an hourly basis, divided by the sum of all units defined by the institution for the same courses. Then, for each course not accounted for on an hourly basis, the number of AU is obtained by multiplying the units defined by the institution for that course by K.

$$K = \frac{\Sigma \text{ AU for all common and compulsory courses for which the computation was carried out on an hourly basis}}{\Sigma \text{ units defined by the institution for the same courses}}$$

Pages 65 to 68 of the Accreditation Criteria and Procedures 2014, provides a further explanation and illustrative examples of the use of the K-factor.