Degree Level Expectations for Graduates Receiving the Degree of Bachelor of Applied Science

Faculty of Applied Science and Engineering

University of Toronto

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1 Introduction

This document is prepared based on the model drafted for the Degree Level Expectation Framework being created by the Council of First-Entry Deans for each of the degrees offered by the first-entry divisions at the University of Toronto.

This document addresses the Bachelor of Applied Science degree for all programs in the Faculty except Engineering Science. The Faculty is putting forward a new degree for graduates of the Engineering Science Program, whose Degree Level Expectations will be described in a separate document.

The degree level expectations for graduates of the Faculty of Applied Science and Engineering receiving an Bachelor of Applied Science has been based on the discussion within a working group that began in the Spring of 2007 including: Vice-Dean (Undergraduate) Prof. Grant Allen (Greg Evans till July 1, 2007), First Year Chair Prof Susan McCahan, Prof. Frank Kschischang (Chair of Curriculum Committee), Prof. Gabe D'Eleuterio (Associate Chair, Engineering Science till Dec. 31, 2007), Ms. Lisa Romkey (Engineering Science, Curriculum, Teaching and Learning Specialist). It was presented to the Curriculum Committee in February 2008 for input and it was then sent to the Vice-Provost's office for input. It is being submitted for approval to the Faculty Curriculum Committee in time for approval at the Applied Science and Engineering Council meeting scheduled for May 28, 2008.

2 Degree Learning Objectives and Requirements

2.1 Overall Learning Objectives

The Faculty of Applied Science and Engineering aims to provide all of its undergraduate students with an education that will allow them to be leaders in society in developing solutions to its most pressing problems. Our graduates will be able and inspired to:

- be leading practitioners of engineering and engineering design
- be known for their technical literacy as well as their knowledge of mathematics and the basic sciences and the role of technology in society
- be able to formulate and solve problems in complex systems independently and in teams
- pursue independent lifelong learning within their field of study and more broadly
- be prepared for careers, including graduate programs, that build upon their advanced technical knowledge
- participate meaningfully as leaders in society

In order to achieve this, each graduate will have achieved the following general learning objectives:

a. Depth of knowledge that cultivates critical understanding and intellectual rigour in at least one engineering discipline.
b. Competencies in learning and applying knowledge to solve problems facing society and that are fundamental to responsible and effective participation in the workplace, in the community, in scholarly activity, and in personal life:
    i. Critical and Creative Thinking
    ii. Oral and Written Communication
    iii. Quantitative Reasoning
    iv. Teamwork
    v. Information Literacy
    vi. Ethical Thinking and Decision-Making
c. Breadth of knowledge across mathematics, basic sciences, engineering sciences, engineering economics and engineering design that cut across the engineering disciplines and across a range of nontechnical areas including the humanities and social sciences and an awareness of the impact of technology on society.
d. Integration of skills and knowledge developed in a student's course of study through a capstone experience in the upper years.

2.2 Requirements to Graduate

In order to graduate with a B.A.Sc. degree, each student in the Faculty of Applied Science and Engineering will have completed a full undergraduate program as outlined in the Faculty Calendar within nine calendar years of first registration, exclusive of mandatory absences from his/her program. Current programs include: Chemical, Civil, Computer, Electrical, Industrial, Mineral, Materials and Mechanical Engineering.

The practice of engineering is regulated, by statute, in all Canadian provinces and territories. To become a Professional Engineer, an individual must satisfy the requirements of the licensing bodies. These requirements include a degree from an accredited program, successful completion of a professional practice examination in engineering law and ethics, and suitable experience. At present, all programs in the Faculty of Applied Science and Engineering are accredited and evaluated regularly by the Canadian Engineering Accreditation Board (CEAB) of the Canadian Council of Professional Engineers. Therefore, graduation from the Faculty may lead to registration in the provincial Associations of Professional Engineers, in accordance with individual policies. No student will be permitted to graduate who does not meet these requirements.

The criteria set out by the CEAB are designed to ensure that each graduate has a foundation in Mathematics and Basic Sciences, a broad preparation in Engineering Sciences and Engineering Design and an exposure to non-technical subjects (Complementary Studies) that complement the technical aspects of the curriculum[1]. Basic Sciences must include physics and chemistry and also may include elements of life sciences and earth sciences; they impart an understanding of

[1] Engineers Canada, "Accreditation Criteria and Procedures: Canadian Engineering Accreditation Board", Canadian Council of Professional Engineers, ISSN 1708-8054 (2007)

natural phenomena[1]. Engineering Sciences normally involve mathematics and Basic Sciences but carry knowledge further to creative applications[1]. Complementary studies include the humanities, social sciences, arts, management, engineering economics and communication skills[1].

Each program in the Faculty consists of a technical component and complementary studies component. The curriculum for students in their early years forms a basis in the fundamental subjects prior to subsequent specialization in the various engineering disciplines. Students are able to choose from a range of technical electives in their senior years. In the senior years, all programs contain a Capstone experience through a design project, which integrates their skills and knowledge and provides students with the opportunity to carry out original work in their chosen fields of study.

There are a set of common requirements, described below, that cut across all programs in the following categories: Coursework; Promotion; English Proficiency; and Practical Experience. In this context, a course is defined as one half-course equivalent, which may consist of a half course ("S", "F" or "H") or half of a full-year "Y" course.

1. **Coursework:** Each program will have courses that provide the following:
    a. Complementary Studies Electives
    b. A basic knowledge of Engineering Economics
    c. Technical Electives
    d. Courses with substantial design content in Years 1, 2 and/or 3
    e. Capstone course(s) in Years 3 and/or 4 with strong integrative, design and independent work elements
    f. Across all four years, programs will provide sufficient opportunities for the development of professional awareness and practice.
2. **Promotion:** All undergraduate programs will consist of eight Fall and Winter Sessions taken in order.
    a. To gain credit for a session a student must:
        i. satisfy the academic regulations to proceed to the succeeding session as described in the calendar and
        ii. not be subsequently required to repeat the session for which credit is to be gained, and
        iii. achieve a course mark of 50% or greater in every course taken as part of the academic load in a session, and
        iv. not have any outstanding designations of 'standing deferred', 'incomplete' or 'No Grade Available' for any course in any session.
    b. To be eligible to graduate, each student must attain a weighted Session Average of 60% or greater in the final session of their program. Any student who does not achieve a weighted Session Average of 60% in their final session (4W), but has attained a weighted Session Average that allows them to proceed to the next session on probation, shall repeat the final session and achieve a weighted Session Average of 60% or greater to graduate.

3. **English Proficiency:** Each student must show an ability to write English coherently and correctly. Every student will also take at least one course that includes a written communication component within their curriculum. Satisfactory completion of the course or courses is required for graduation.
4. **Practical Experience:** The Faculty requires that all students complete a minimum of 600 hours of practical work before graduation.

3 Degree Level Expectations for the Bachelor of Applied Science

The Faculty of Applied Science and Engineering has adopted the six categories of degree level expectations outlined in the OCAV Guidelines. The following section describes how these expectations are met by students meeting the degree requirements outlined in Section 2.2.

3.1 Depth and Breadth of Knowledge

The Faculty ensures that a student has mastered a body of knowledge with appropriate depth by requiring that each student completes the requirements of one of the degree Programs of Study (POSt) as described in the Faculty Calendar. The curriculum for students in First Year forms a common basis in the fundamental subjects, including the natural sciences and mathematics, prior to a subsequent specialization in the various engineering disciplines. Each program consists of a technical component and a complementary studies component.

Critical analysis and thinking and analytical skills are emphasized through the student's exposure to an increasingly sophisticated understanding of their program of study. Specialization within the discipline is developed through technical electives taken in the 3rd and 4th years of study. A detailed knowledge of and experience in design is ensured through the Design Course requirements, beginning with courses in the first three years as well as the Capstone course(s) in each program. Opportunity to further develop these skills is provided through a research thesis that is available in most POSts.

The Faculty assures that students have breadth of knowledge in a number of ways. Breadth across engineering is assured through a First Year of study that prepares a student for any of the programs of study. Breadth beyond engineering is developed through the Complementary Studies Electives as well as the Engineering Economics requirement.

3.2 Knowledge of Methodologies

Every POSt has requirements which demonstrates a student's understanding of the methods of engineering design. Students in all engineering programs must successfully complete courses with substantial design in their first three years and a Capstone design course in their senior years. These courses require students to evaluate the appropriateness of various approaches to analyze and solve the design problem and also to devise and sustain arguments for their design. In most POSts, students have the opportunity to participate in a research thesis course that familiarizes them with the specific methodologies currently in use in the development of knowledge in their discipline.

3.3 Application of Knowledge

The application of science and mathematics to solve problems is fundamental to all programs in Engineering and therefore is required in many of the courses within all POSt. A minimum level of instruction in Engineering Science and Engineering Design is required, both of which directly involve the application of knowledge.

3.4 Communication Skills

The Faculty requires students to communicate information, arguments and analysis accurately and reliably, orally and in writing, to specialist and non-specialists audiences. The requirement for courses with substantial engineering design that are required across all programs require a series of technical reports and presentations with direct involvement with our Engineering Communication Program. In addition, our Capstone Design Courses and research theses all involve a written report and most involve oral presentations. The course requirements for instruction in Complementary Studies also adds to the education our students receive in communication skills. Also, the English Proficiency requirement insures a minimum level of writing ability for all graduates.

3.5 Awareness of Limits of Knowledge

Each POSt develops, through a sequence of courses starting at the 100-series or 200-series and culminating at the 300-series or 400-series or 500-series of courses, an understanding of a discipline as it is currently appreciated by educators who are at the same time involved in original scholarship in the subject area. The course content at the upper series level is designed, in part, to provide students with an appreciation of the uncertainties, ambiguities and limitations of knowledge in the specific area.

3.6 Autonomy and Professional Capacity

The development of an awareness and understanding of professional practice is required for all POSt. The required design courses require students to work in teams and also accept responsibility for their own contributions. Students are required to make their own decisions for their own learning through selection of their technical and nontechnical electives. Finally, in completing their course requirements, the Faculty expects strict adherence by students to the Code of Behaviour on Academic Matters, which requires students to not tolerate or encourage the creation of an environment of cheating, misrepresentation or unfairness.

3.7 Other Degree Level Expectations

The Faculty requires all students to have developed competency in several areas of learning and applying knowledge not identified explicitly in the previous sections. In particular, the Faculty requires students to have developed competencies in quantitative reasoning and in information literacy.

Quantitative reasoning is considered the ability to identify, assemble and interpret quantitative information and make and test hypotheses based on such data. Development of this competency is an explicit part of all POSts offered by the Faculty.

The Faculty requires all students to develop an advanced understanding of how to obtain information, manipulate and evaluate it and bring diverse sources together to develop a comprehensive understanding of specific issues, solve problems or apply the scientific method to

create further knowledge in the discipline. These advanced information literacy skills are developed through the studies in their concentration(s) and are demonstrated in the advanced courses required in each POSt.

4 Implementation

The Faculty Council of the Faculty of Applied Science and Engineering, has overall responsibility for ensuring that the degree level expectations are implemented consistently across the Faculty. All changes to curriculum are approved through the Faculty Council's Curriculum Committee, a standing committee with representatives from each program. In proposing changes or new programs, an analysis of the implications of the change(s) for CEAB accreditation are required. Each program within the Faculty is reviewed by the CEAB a minimum of once every six years.