UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

**Report No. 3531 Revised**

# MEMORANDUM

**To:** Executive Committee of Faculty Council (January 23, 2017)
Faculty Council (February 28, 2017)

**From:** Professor Evan Bentz
Chair, Undergraduate Curriculum Committee

**Date:** February 10, 2017

**Re: Major Curriculum Changes for the 2017-2018 Academic Year**

## REPORT CLASSIFICATION

This is a major policy matter that will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for vote as a regular motion (requiring a simple majority of members present and voting to carry).

## BACKGROUND

The Undergraduate Curriculum Committee is tasked with managing the curriculum change process for the Faculty. This report summarizes course changes proposed for the upcoming academic year made since the Faculty Council meeting of December 1, 2016.

## STRUCTURE

The following changes are proposed for the 2017-2018 academic year.

## 1. CHEMICAL ENGINEERING & APPLIED CHEMISTRY

Expanding availability of CHE499Y1Y – Thesis to summer and winter semesters

Enrollment in CHE499Y1Y – Thesis has been in decline. Student feedback has indicated that when paired with CHE430H1Y – Plant Design, a required core course in fourth year fall semester, they found the workload to be too heavy. In response, Chemical Engineering proposes offering Thesis during the summer after third year (CHE499Y1Y) and during fourth year winter semester (CHE499Y1S).

1.1 CHE499Y1Y – Thesis (Summer)

This is a 13-week full credit (1.0) elective that students can take during the summer after completing third year. The course code will be the same as the full year Thesis (CHE499Y1Y), but it will now also be offered in the summer with the expectation it will be 260 hours over 13 weeks.

1.2 CHE499Y1S – Thesis (Fourth Year Winter Semester)

It is proposed to offer the full credit (1.0) Thesis in the winter semester when students have only one mandatory core course (CHE403 – Professional Practice). The new course code would be CHE499Y1S, with the expectation it will be 260 hours over 13 weeks.

For students to be eligible to take CHE499Y1S, they must have already completed at least three of their electives prior to entering into fourth year. In order to restrict enrollment in this course, SWS would be have to be set to "no" to prompt students to get prior approval from the Undergraduate Office.

## 2. CROSS-DISCIPLINARY PROGRAMS

2.1 A proposal for the creation of Minor in Advanced Manufacturing has been submitted to Faculty Council as Report 3530.

2.2 Course change: APS343H1F/S – Foundations of Engineering Leadership

It is proposed to change the delivery structure of APS343 from 2/2/0/0.5 to 1/2/0/0.5. This change will affect all programs.

2.3 Course changes: BME225H1S – Biostatistics for Engineers to BME435H1S Biostatistics

BME225 was originally conceived as an alternative statistics course for students interested in pursuing studies in biomedical engineering. However, the course has been difficult for students to fit into their program at the 200-level. This revision to the course is intended to provide students with an enhanced introduction to core statistical concepts and methods used in biomedical research, including experimental design, which will prepare them for graduate-level research. The topics covered include: i) Importance of being uncertain; ii) Error bars; iii) Significance, p-values and t-tests; iv) Power and sample size; v) Visualizing samples with box plots; vi) Comparing samples; vii) Non parametric tests; viii) Designing comparative experiments; ix) Analysis of variance and blocking; x) Replication; xi) Two-factor designs; xii) Sources of variation; xiii) Split plot designs; xiv) Sampling distribution and the bootstrap; xv) Association, correlation and causation; xvi) Simple linear regression. Pre-requisites: BME225H, CHE223H1, MIE231H, or MSE238H1, (or equivalent)
Course delivery and AUs remain the same.

2.4 Course proposal: BME330 – Patents in Biology and Medical Devices

A new course, BME330 – Patents in Biology and Medical Devices, is proposed affecting Engineering Science's Biomedical Engineering Major and the Bioengineering Minor.

The main objective of the course is to teach students the logic of patenting a new technology or finding in biology. Students will be able to discern patentable subject matter and the indicators of weak patent positions, even in cases of complex technology. This course will help prepare students for Biomaterial and Medical Device Product Development (BME460H1F). Case examples will involve medical devices, drugs, biologics and hybrid products.

Course Description: The emphasis of the course is on applying the logic of patents to diverse cases of products through biology and biomedical engineering. A commercial context will be ever present the case studies. Students will work in teams on these problems in class. Students will learn to apply tests for obviousness, inventiveness, novelty and enablement based on the use of these tests in technology patents in the past. Claim construction will be introduced towards the end of the course to learn how technologies can be protected in considering a patent. There will be papers for reading in this course but no textbook. This course is designed for senior undergraduate students (3-4 year). Prerequisite: BME205H1 or CHE353H1; 0.5 credits in statistics.

## 3. ENGINEERING COMMUNICATION PROGRAM

3.1 Course proposal: APS3XX – Engineering and Social Justice

The purpose of this course is to develop a relationship between engineering students and the concepts of social justice to, as Donna Riley puts it in the abstract to her book on Engineering and Social Justice, "develop the skill and knowledge set needed to take practical action for change within the profession." While compatible with the aims of courses currently available in Leadership and in Global Engineering, this course fills a gap in developing personal responses to ideas of justice, bias and marginalization as it affects engineers and engineering in general, domestically as well as globally, in projects as well as in contexts such as the workplace and academic environment.

The course will have current readings from prominent writers on engineering and social justice, Engineering to Help, and engineering and sustainable community development. But the course will go beyond conventional response essays and exams, to foster discussion and rehearse action through techniques developed by Augusto Boal and David Diamond in their work using theatre techniques to practice and critique action.

*Topics to be covered*

- Concepts of social justice
- The meaning of "help" in Engineering to Help
- Engineering mindsets

- Colonialism and globalization
- Racism
- Sexism, homophobia and heterosexism
- Communication for social justice
- Critical thinking for social justice

*Learning objectives*

The following learning objectives correlate with those defined by the Faculty for CEAB graduate attributes (2011). By the end of the term, students will demonstrate the understanding of the relationships among technology and the social, cultural, economic and environmental conditions of society, locally and globally, in both the short- and long-term, by:

- Identifying the hidden complexities in idealistic ideas
- Identifying relevant viewpoints and stakeholders in an engineering activity
- Explaining the interconnectedness of social and technological development, including historical injustices and their continuing consequences
- Identifying bias, critically analysing conventional viewpoints and strategizing for a balanced approach to technological planning for society
- Identifying and evaluating the potential risks (likelihood and consequences) to human health and the environment of an engineering product or activity relevant to the student's discipline
- Self-evaluating and determining engineering goals which incorporate social awareness in decision-making

In the development of communication skills, students will demonstrate the ability to:

- Write clear, correct and cohesive sentences and paragraphs
- Deliver oral communications effectively to an intended audience

*Course structure*

2 lecture hours, 2 tutorial hours per week

The lecture/seminar sessions will be set up as partially lecture, partially group discussion of readings and case studies leading to individual response papers, as well as the essays in the midterm and final exam. The tutorial/studio hours will be set up as interactive sessions in which scenarios related to social justice case studies are re-enacted with improvised interventions that are then analysed for their feasibility in relation to issues that have emerged in the readings.

*Marking scheme*

First response paper – 10%
Midterm – 15%
Second response paper – 20%
Final exam – 35%
Studio activities/presentations – interventions and analysis – 20%

### 3.2 Course proposal: APS3XY – Writing Lab

In this course, students strengthen their communication skills by exploring different expressive voices, each with a different potential to uncover previously unsuspected ideas. Unlike technical writing, academic writing or creative writing courses, all of which isolate particular skills and voices, this course would show how a synthesis of various voices strengthen each of them. Hence, by exploring one's own poetic, story-telling, scientific and analytic voice, one becomes a better analytic, scientific or creative writer.

The course uses writing in various modes as an exploratory process, which is in contrast to how many people view writing – some see it as after-the-fact reporting or documentation and even begin creative writing with predetermined values and an outline. However, other writers actually begin without a predetermined idea about where their writing is going to lead, with merely a few words or sentences in their minds and a question about what those words or sentences mean or where they might lead. For them, writing is a path of discovery – it is through brainstorming, creating the initial rough drafts and then refining the work through revision that the writers come to understand what their message – the solution to the question that caused them to write in the first place.

Through readings drawn from significant communication theoreticians, the course goes beyond exploration and creativity. Students use the analysis of communication to examine their own and other people's communication so that their choices becomes more effective in that they combine knowledge, creativity and understanding of the communication situation.

*Learning objectives*

By the end of the course, the student should demonstrate the ability to:

- Select appropriate content and approach for audience and purpose
- Communicate in poetic, story, analytic or scientific modes
- Create elegant and efficient transitions between sections and paragraphs
- Utilize clear, correct and cohesive sentence and paragraph structures
- Deliver engaging oral presentations in at least two modes
- Use communication theory to analyse communication in specific cases

*Course structure*

2 lecture hours, 2 tutorial hours per week

The lecture/seminar sessions will be set up as partially lecture, partially group discussion of readings and case studies leading to individual assignments as well as the essays in the midterm and final exam. Tutorials will be taken up with oral presentations in which students build their story-telling skills from anecdotes and examples to the incorporation of story elements in a technical talk.

*Marking scheme*

Journal – 10%
Poetry assignment – 10%
Story presentation – 10%
Midterm – 15%
Major presentation – technical talk with story elements – 20%
Final exam – 35%

## 4. ENGINEERING SCIENCE

### 4.1 Changes to the Robotics Option

In the original Robotics Engineering option, students were required to take both MIE342 – Circuits with Applications to Mechanical Engineering Systems and MIE346 – Analog and Digital Electronics for Mechatronics as preparation for the capstone course MIE443.

Following the first year of the program in 2015-2016, it was found that the Engineering Science students had too much background in electric circuits for MIE342 to be a suitable course; ECE355 – Signal Analysis and Communication was added to the 2016-2017 program as an interim measure until a new course could be developed.

For 2017-2018, the new course MIE3XX will be created, effectively replacing MIE342 and MIE346. MIE438 – Microprocessors and Embedded Microcontrollers has been added as a core course in the winter term to give the students a second practical course in electronics.

## 5. MECHANICAL AND INDUSTRIAL ENGINEERING

### 5.1 Moving MIE519 – Advanced Manufacturing Technologies

This course will be moved from winter term to fall term. It will be a core course for the Minor in Advanced Manufacturing, and scheduling it in the fall term will allow students to take it before taking other courses in manufacturing.

5.2 Giving MIE258 – Engineering Economics and Accounting and MIE358 – Engineering Economics and Accounting the same course number

MIE258 and MIE358 refer to the same course, "Engineering Economics and Accounting". Industrial Engineering students take the course in second year and Mechanical Engineering students take it in third year. It was originally decided to give the two groups of students separate course numbers to differentiate between second and third year students, but this has led to difficulties in scheduling classes and exams since the two course numbers are scheduled separately. Giving the course only one course number (258) will make administration easier.

**PROGRAM(S)**

All relevant programs are involved in these changes, and the impact on students in the various programs has been considered.

**PROCESS AND CONSULTATION**

This proposal has been reviewed and approved by the Undergraduate Curriculum Committee, which is comprised of faculty representatives from each undergraduate program; undergraduate students; the Vice-Dean, Undergraduate Studies; the Chair of First Year; the Associate Dean, Cross-Disciplinary Programs; and the Registrar. The Committee meets regularly and reviews proposed changes to the undergraduate curriculum.

**PROPOSAL/MOTION**

THAT the proposed curriculum changes for the 2017-2018 academic year set out in Report 3531 Revised be approved.