UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3615 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (February 5, 2019)
Faculty Council (February 27, 2019)

From: Professor Evan Bentz
Chair, Undergraduate Curriculum Committee

Date: February 25, 2019

Re: **Major Curriculum Changes for the 2019-2020 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 2019-2020 academic year.

PROGRAMS AFFECTED

The proposed curriculum changes affect cross-disciplinary minors and certificates, and undergraduate programs in the Cross Disciplinary Programs Office, Chemical Engineering & Applied Chemistry, Electrical & Computer Engineering, Mechanical & Industrial Engineering, Engineering Science, Civil & Mineral Engineering, Engineering Communication Program, and Materials Science & Engineering.

CONSULTATION

These changes have been reviewed and approved by the Undergraduate Curriculum Committee, which is comprised of representatives from each undergraduate program; the Vice-Dean, Undergraduate Studies; the Vice-Dean, First Year; the Associate Dean, Cross-Disciplinary Programs; the Director, First Year Curriculum; the Registrar's Office; undergraduate students; the Faculty's Teaching and Learning Specialist; the Faculty's

Scheduling Officer; and representatives from IBBME, UTIAS, the Engineering Communication Program, and the Engineering and Computer Science Library. The Committee meets regularly, and reviews changes to the curriculum. The impact of these changes on students in the relevant programs has been considered.

PROPOSAL/MOTION

THAT the proposed curriculum changes for the 2019-2020 academic year, as described in Report 3615 Revised, be approved.

PROPOSED CURRICULUM CHANGES

1. **CROSS DISCIPLINARY PROGRAMS OFFICE**

1.1. **New Course: APS500H** Negotiations in an Engineering Context

- New Business Minor Elective
- To be piloted as a Civil special topics graduate course, CIV1099

1.2. **Global Engineering Certificate**

- See Report 3617 for details of these changes but, in brief, the existing undergraduate Certificate in Global Engineering will now be included as part of the U of T Global Scholar Program. The following two necessary changes relate to curriculum and thus were considered by the UCC.
- Add transcript notation of "Completed Certificate in Global Engineering (U of T Global Scholar)."
- Add statement to calendar description: "Students who complete the requirements of the Certificate in Global Engineering are considered University of Toronto Global Scholars."

1.3. **JRE420H** People Management and Organizational Behaviour

- Add exclusion: IRE260H1 Organizational Behaviour (Arts & Science course)

2. **CHEMICAL ENGINEERING & APPLIED CHEMISTRY**

2.1. **CHE204H1** Chemical Engineering and Applied Chemistry- Laboratory I & **CHE205H1** Chemical Engineering and Applied Chemistry- Laboratory II

- Laboratories delivery change: Proposed to have rotational "dry-wet-lab" delivery model, with **alternating weeks of 2 hour lecture block, and 6 hour lab portion.** Consultation has shown that fewer labs will provide the same content but that more lecture/tutorial time to enhance the understanding of the material should produce better outcomes with less student time spent.

- Note that the two hour dry phase is still in discussion whether 2 or 3 hours is more appropriate. The report will be updated if required.

3. ELECTRICAL AND COMPUTER ENGINEERING

3.1. **ECE445H1** Neural Bioelectricity

- Change course code/ownership to: BME445H1
- Update description with addition (*italicized*): Generation, transmission and the significance of bioelectricity in neural networks of the brain. Topics covered include: (i) Basic features of neural systems. (ii) Ionic transport mechanisms in cellular membranes. (iii) Propagation of electricity in neural cables. (iv) Extracellular electric fields. (v) Neural networks, neuroplasticity and biological clocks. (vi) Learning and memory in artificial neural networks. Laboratory experiences include: (a) Biological measurements of body surface potentials (EEG and EMG). (b) Experiments on computer models of generation and propagation of neuronal electrical activities. (c) Investigation of learning in artificial neural networks. *This course was previously offered as ECE445H1.*
    - Rationale: This course was initiated in the 1990s when a BME department did not exist in Toronto. Because the course is biomedical engineering focused and is managed by IBBME at the moment (e.g., the lab is being done in BME facility), it would be logical to recode the course as a BME course so that IBBME can take care of the course in the future.

3.2. **ECE297H1 S** Communication and Design

- Change course name to: **Software Design & Communication**
- Change course description from:
  An introduction to electrical and computer engineering design processes illustrated by the design and implementation of software systems. Creative development with appropriate organizational and reporting and recording activities, both oral and written, is emphasized. The general design cycle and pragmatic strategies used in the creation of small designs and larger systems are presented. These methods are implemented in practical lab work done in teams. Oral skills are developed in seminars and team discussions, by learning to handle questions, and by making formal presentations. Written skills are developed in reports related to the lecture and lab activities.
  To:
  An introduction to **engineering design processes,** illustrated by the design and implementation of **a software system, and to effective oral and written communication in a team context. Principles of software design, project management and teamwork are developed in the lectures and tutorials, and students apply these concepts in the laboratories as they work in a team to design and implement a complex software system. Students learn and practice oral and written communication techniques in lectures and in**

meetings with their communication instructor, and apply these techniques in a variety of documents and presentations, such as short status reports and longer design proposals and design reviews.

- Rationale: Students have pointed out that the current course title is very generic: it isn't clear the course has a large software focus, and with just the course name on a transcript it could even be misinterpreted as a course on electronic (wired/wireless) communication systems design. The current course description also is a bit out of date and generic.

3.3. **ECE330H1 S** Quantum and Semiconductor Physics

- Change CEAB breakdown from 60% Natural Science/40% Engineering Design to **75% Natural Science/25% Engineering Design**
  - Rationale: Better reflects the course content.

4. **MECHANICAL & INDUSTRIAL ENGINEERING**

4.1. Addition of **APS360** to the 3rd year Fall technical elective list.

4.2. Addition of **CSC384** to the 4th year Fall technical elective list.

4.3. Addition of **CSC384, ROB311** to the 4th year Winter technical elective list.

5. **ENGINEERING SCIENCE**

5.1. **ESC101H1** Praxis I

- Hour change from 3/**0**/2 to 3/**1**/2

5.2. **ESC102H1** Praxis II

- Hour change from 3/**0**/2 to 3/**1**/2
- Rationale for ESC101H1 & ESC102H1: With increasingly complex timetables and many commuters, our students are finding it challenging to identify common times to meet with their Praxis design teams, and to access good design workspaces during these times. This additional hour will be blocked in the student schedule, and the students will work in teams with others who have the same designated hour so that there is some assigned but not required meeting and project work time for students.
- Description change: The following note will be added to the end of the existing description:
  - Note: Lecture (3 hours) and Design Studio (2 hours) have required attendance. One additional scheduled hour will give students the opportunity to access extra support with their project team members, but attendance is optional.

5.3. **ROB311H1** Artificial Intelligence

- Change course description from:
  This course introduces the fundamental principles of artificial intelligence, and will explore the subject matter in rigorous mathematical terms. Topics include the history and philosophy of AI, search methods in problem solving, knowledge and reasoning, probabilistic reasoning, decision trees, Markov decision processes, natural language processing and elements of machine learning such as neural-network paradigms.
  To:
  An introduction to the fundamental principles of artificial **intelligence from a mathematical perspective. Traces the historical development of AI and describes key results in the field.** Topics include the **philosophy of AI, search methods in problem solving, knowledge representation and reasoning, logic, planning, and learning paradigms. A portion of the course will focus on ethical AI, embodied AI, and on the quest for artificial general intelligence.**
  - Rationale: New description provides a more accurate description of the course.

6. **<u>CIVIL & MINERAL ENGINEERING</u>**

6.1. **CIV220H1 F** Urban Engineering Ecology

- Remove exclusion: EDV220H1
  - Rationale for Items 6.1-6.15: In 2009 a series of courses that were taken by Civil and Mineral students were renamed from CIV courses to CME courses for Civil and Mineral Engineering. To prevent students from trying to take both the old and newly numbered courses in the same degree, exclusions were added to the new courses indicating that people could not take the old and new course codes in the same degree. Now that 9 years has gone by, the maximum length of an undergraduate degree, this exclusion can be removed. Also, updates prerequisites.

6.2. **CIV280H1 F** Management of Construction

- Remove exclusion: CIV320H1

6.3. **CIV324H1 S** Geotechnical Engineering

- Remove prerequisite: CIV321H1
- Remove exclusion: CIV424H1

6.4. **CIV340H1 S** Municipal Engineering

- Remove prerequisite: EDV250H1

6.5. **CIV342H1 F** Water and Wastewater Treatment Processes

- Remove exclusion: CIV540H1

6.6. **CIV380H1 S** Sustainable Energy Systems
- Remove corequisite: CME368H1

6.7. **CIV521H1 F** Rock Mechanics
- Remove prerequisite: CIV210H1

6.8. **CIV523H1 S** Geotechnical Design
- Remove prerequisite: CIV321H1

6.9. **CIV531H1 F** Transport Planning
- Remove prerequisite: CIV368H1

6.10. **CIV549H1 F** Groundwater Flow and Contamination
- Remove prerequisites: JVM270H1/CIV270H1, EDV250H1

6.11. **CIV550H1 F** Water Resources Engineering
- Remove prerequisite: EDV250H1

6.12. **CME210H1 F** Solid Mechanics I
- Remove prerequisite: CIV101H1
- Remove exclusion: CIV210H1

6.13. **CME263H1 S** Probability Theory for Civil and Mineral Engineers
- Remove exclusion: CIV263H1

6.14. **CME270H1 F** Fluid Mechanics I
- Remove exclusion: CIV270H1

6.15. **CME368H1 F** Engineering Economics and Decision Making
- Remove exclusion: CIV368H1

6.16. **New Course: CME525H1 Tunneling and Urban Excavations, 0.5 credit weight, 3/0/1, 70% Engineering Science, 30% Engineering Design**
- Description: Introduces fundamental concepts of underground tunneling and its impact on surrounding urban environment. Topics: role of geology on the choice of tunneling methodology; classical and mechanized tunneling excavation methods; interaction between tunnel and surrounding structures; tunnel support methodologies; innovation and current research in tunneling and underground construction.

6.17. **Remove Course: CIV513H1 Collaborative Engineering and Architectural Design Studio**

- Rationale: When the course was developed an architecture firm supported the course, which involved engineering and architecture students working closely on a project. Since then the firm is no longer involved with the course and the priorities of the Faculty of Architecture have shifted, and the course hasn't been as effective.

7. ENGINEERING COMMUNICATION PROGRAM

7.1. **New Course: APS327H1 Engineering and Law, 0.5 credit weight, 1/0/2, 100% CS, TEAL classroom**

- Description: Contract and tort law, trademarks and copyright, contract negotiation, dispute resolution, insurance. Research and analysis of fact situations using case law, statutes, and regulations. Simulations of contract negotiation, dispute resolution, provision of expert opinion, professional examination.
- Maximum enrolment: 45 students
- Approved as an elective.

7.2. **New Course: APS326H1 Special Topics in Creative Writing, 0.5 credit weight, 2/0/2, 100% CS**

- Description: Explore the creative writing process, with an emphasis on giving and receiving critical feedback. Reinforce the iterative principles of the engineering design process and provide flexible and transferable tools for engineering work. Examine up to two genres of creative writing (fiction, science fiction, poetry, creative non-fiction, screenwriting, playwriting, etc.) to hone creative and critical thinking skills. Introduce relevant elements of craft, analyze representative literary examples, create original creative work, give, receive, and apply feedback.
- Maximum enrolment: 35 students

7.3. **APS281H1** Language and Meaning

- Hour change from 2/0/2 to 4/0/0 (2 two hour lecture blocks)

7.4. **APS445H1** The Power of Story

- Increase offering: offer course once in Fall term, and once in Winter term.

8. MATERIALS SCIENCE & ENGINEERING

8.1. **MSE301H1** Mineral Processing

- Hour change from: 3/1.5/**2** to 3/1.5/**1**

8.2. **MSE401H1** Materials Selection in Design II

- Change course name to: Materials Selection in Design

8.3. **MSE432H1** Macromolecular Materials Engineering

- Change course name to: **Polymers and Composites Engineering**
- Change course description from:
  This broad overview course begins with an introduction to polymer synthesis, followed by discussion of molecular structure, microstructure and material macrostructure of polymers leading to an understanding of polymer properties and performance. The important processing operations which are used to convert raw polymers into finished products will be discussed and some quantified. Brief consideration will be given to product design/material selection issues and the environmental implications of polymers. Several leading edge examples from the electronics, transportation and medical industries are introduced during the course.
  To:
  This course covers the most important issues related to polymer and composites materials and engineering including: synthesis, structure, characterization, mechanical and physical properties, processing, selection and design. Topics include structure of macromolecular solids, structure, mechanical, thermal, electrical and optical properties; viscoelasticity; mechanical and failure properties; dependence of properties on structure; design of fillers reinforcements and matrices reinforcements, reinforcement forms, testing and properties, manufacturing processes, modeling of composite systems; composites in automotive, aerospace and electronic packaging and new applications of composites in various sectors.

8.4. **MSE438H1** Computational Materials Design

- Hour change from 3/**2**/0 to 3/**1**/0
  - Rational: To correct an error.