UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3589 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (March 20, 2018)
Faculty Council (April 11, 2018)

From: Professor Evan Bentz
Associate Professor and Chair, Undergraduate Curriculum Committee

Date: March 22, 2018

Re: Major Curriculum Changes for the 2018-2019 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).

SUMMARY

The Undergraduate Curriculum Committee is tasked with managing the curriculum change process for the Faculty. This report summarizes course changes proposed for the 2018-2019 academic year.

PROCESS AND 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 2018-2019 academic year, as described in Report 3589 Revised, be approved.

PROPOSED CURRICULUM CHANGES

1. MECHANICAL AND INDUSTRIAL ENGINEERING

1.1 Change AU Distribution for MIE414H1 S: *Applied Fluid Mechanics* from 60% ES to 75% ES and 40% ED to 25% ED

- To bring the CEAB data into alignment with what is being taught in the course.

1.2 Change AU Distribution for MIE312H1 F *Fluid Mechanics I* from 100% ES to 70% ES and 30% NS

- To bring the CEAB data into alignment with what is being taught in the course.

1.3 Change AU Distribution for MIE270H1 *Materials Science* from 50% ES and 50% ED to 25% ES and 75% NS

- To bring the CEAB data into alignment with what is being taught in the course.

1.4 Change AU Distribution for MIE313H1 S *Heat and Mass Transfer* to 50% ED, 25% ES, and 25% NS

- To bring the CEAB data into alignment with what is being taught in the course.

1.5 Revised course description of MIE258H1 *Engineering Economics and Accounting*

From:

Engineering economic and accounting concepts needed in the design of engineering systems: time value of money, evaluation of cash flows, cost and managerial accounting concepts, defining alternatives, acceptance criteria, replacement analysis, depreciation and income tax, sensitivity and decision analysis, buy or lease, make or buy, production functions and relationship to cost functions. Introduction to financial engineering: fixed income securities, optimal portfolios, mean-variance optimization, portfolio theory, capital asset pricing model (CAPM) and derivatives (options, basic properties, risk management).

To:

Engineering economic and accounting concepts needed in the design of engineering systems. Financial analysis topics include: financial statements, depreciation, income tax, and basic accounting techniques. Project analysis topics includes: time value of money, evaluation of cash flows, defining alternatives, analysis of independent projects,

acceptance criteria, buy or lease, make or buy, replacement analysis, economic analysis in the public sector, project risk and uncertainty. Inflation concepts.

Exclusions: CHE249H1, CHE374H1, CME368H1, ECE472H1, MIE358H1

- To bring the CEAB data into alignment with what is being taught in the course.

1.6 Revised course description of MIE540H1 S *Product Design*

From:

This course takes a 360° perspective on product design: beginning at the market need, evolving this need into a concept, and optimizing the concept. Students will gain an understanding of the steps involved and the tools utilized in developing new products. The course will integrate both business and engineering concepts seamlessly through examples, case studies and a final project. Some of the business concepts covered include: identifying customer needs, project management and the economics of product design. The engineering design tools include: developing product specifications, concept generation, concept selection, FAST diagrams, orthogonal arrays, full and fractional factorials, noises, interactions, tolerance analysis and latitude studies. Specific emphasis will be placed on robust and tunable technology for product optimization and generating product families. Critical Parameters will be developed using the Voice of the Customer (VOC), FAST diagrams and a House of Quality (HOQ). Prerequisite: MIE231H1 F/MIE236H1 F or equivalent.

To:

Integration of both business and engineering concepts through examples, case studies and a final project. Business concepts include identifying customer needs, project management and the economics of product design. Product design engineering tools include developing product specifications, concept generation, concept selection, Product Functional Decomposition (PFD) diagrams, Design of Experiments, noises, interactions, tolerance analysis and latitude studies. Specific emphasis will be placed on product optimization.

Prerequisites: MIE231H1: Probability and Statistics with Engineering Applications or MIE237H1: Statistics or equivalent, and MIE243H1: Mechanical Engineering Design or instructor's permission.

2. CROSS-DISCIPLINARY PROGRAMS

2.1 Creation of APS3XXH1F Artificial Intelligence Fundamentals (3/0/1/0.5)

- This will be a new broad-based, foundational course specifically created for the Artificial Intelligence Certificate and Minor programs which we intend to introduce in the fall.

- Its content will provide a basic introduction to the history, technology, programming and applications of artificial intelligence, with emphasis on fast evolving field of machine learning. Topics to be covered may include linear regression, logistic regression, support vector machines, and neural networks. An applied approach will be taken, where students get hands-on exposure to AI techniques through the use of state-of-the-art machine learning software frameworks. In assignments, students will apply the AI techniques taught to contemporary computing challenges, for example, by applying AI to improve computer decision making, prediction, image/speech recognition, image/speech synthesis, game playing or other tasks.

  Prerequisites: Introductory course in computer programming (e.g., APS105/6 or CSC180/90)
  Exclusions: MIE324

  AU: 75% ES, 25% ED

3. ENGINEERING SCIENCE

3.1 Limiting ROB313 *Introduction to Learning From Data* Participants to Robotics Major students

- For the introductory year of ROB313H1, the instructor has requested that it be restricted to EngSci Robotics Major students only. The course may be opened to other Majors and/or Minors in subsequent years, as the course becomes more established, but this will require further discussion. At this point, the instructor is customizing the content for Robotics students, based on their other courses and robotics applications. It's important to note that initially, the course was conceptualized for the new MI Major, but it was ultimately decided that those students would take an ECE course instead. When we brought it forward to Undergraduate Curriculum Committee, we were confident there would be an audience for the course, but we (EngSci) weren't altogether certain who that audience would be, so we proposed it as an EngSci-only course for the Robotics Minor. Subsequently, the course was added to the Robotics Major, and the request was made by UTIAS and the instructor to keep it restricted to those students only.

3.2 Changes to Capstone Design courses

- Electrical and Computer Major: The proposal is the removal of two Capstone courses (ECE470H1S *Energy Systems Capstone Design* and ECE532H1S *Digital Systems Design*) from the ECE Major.
  - ECE532H1S *Digital Systems Design* does not fully meet the CEAB requirements for a capstone design course, nor our program's Graduate Attribute needs for a capstone design experience.
  - With respect to ESC470H1S *Energy Systems Capstone Design*,

students will still be given the option to make a special request to take the course if they are particularly interested in energy systems, however this year we experienced a higher than expected "migration" of ECE Major students to this course, given some issues with the main capstone design course for the ECE Major (ECE472 *Electrical and Computer Capstone Design*). We would prefer to make appropriate updates to the ECE Capstone Design course (ECE472 *Electrical and Computer Capstone Design*) and encourage students to take it instead.

- Engineering Physics Major: To better accommodate the diversity of student interests in the Physics Option, their Capstone (ESC471 *Engineering Science Capstone Design*) will be offered in both terms allowing them more flexibility when selecting technical electives. Given the structure of the course (regular team meetings with the instructor), there are minimal workload implications for offering it in both semesters.

3.3 Revised course code and description for CSC180H1 *Introduction to Computer Programming*

From:

CSC180H1 *Introduction to Computer Programming*
The first of two courses that introduces students to programming and computational thinking, and prepares them for additional study across a breadth of programming fields. Students will learn to use the Python programming language to design and implement computational solutions to problems drawn from their 1F courses, with specific focus on algorithms, data structures, problem decomposition, and the use of programming paradigms appropriate to the problems being solved. Specifically, this course aims to have students work with and understand profiling and runtime analysis, searching and sorting algorithms, and the use of recursion.
Exclusion: APS105H1, APS106H1 or CSC192H1

To:

ESC180H1 *Introduction to Computer Programming*
The first of two courses that introduces students to programming and computational thinking from an engineering perspective, and prepares them for additional study across a breadth of programming fields. Students will learn to use multiple introductory programming languages to design and implement computational solutions to relevant problems, with specific focus on algorithms, data structures, problem decomposition, and the use of programming paradigms appropriate to the problems being solved.
Exclusion: APS105H1, APS106H1 or CSC192H1

- Engineering Science intends to administer this course moving forward, providing more stability for Program Accreditation, with course set to be taught by a qualified PEng to assist with registered AU counts. Updated description better reflects what is taught in class.

3.4 Revised course code and description for CSC190 *Computer Algorithms and Data Structures*

From:

CSC190H1: *Computer Algorithms and Data Structures*
The second of two courses that introduces students to programming and computational thinking, and prepares them for additional study across a breadth of programming fields. Students will learn to use the C programming language to design and implement computational solutions to problems drawn from their 1S courses, and will explore new programming paradigms, algorithm design techniques, and data structures appropriate to these challenges. Specifically, this course aims to have students work with and understand linked lists, stacks, queues, trees, heaps, hashing, pointers (including function pointers) and arrays, data types and bit operations, and dynamic memory management.
Prerequisite: CSC180H1
Exclusion: APS106H1, CSC192H1, ECE244H1 or MIE250H1

To:

ESC190H1: *Computer Algorithms and Data Structures*
The second of two courses that introduces students to programming and computational thinking, and prepares them for additional study across a breadth of programming fields. Students will develop an understanding of data structures and fundamental algorithms. The emphasis will be on (a) further refining their programming language skills, and (b) understanding why diverse data structures exist, and how algorithms can be analyzed for their time and space complexity.

Specifically, this course aims to have students work with and understand the list, stack, queue, tree, hash table, and graph data structures; a look at searching, sorting, and analysis of complexity will complement the presentation on the algorithms side.
Prerequisite: ESC180H1
Exclusion: APS106H1, CSC192H1, ECE244H1 or MIE250H1

- Engineering Science intends to administer this course moving forward, providing more stability for Program Accreditation, with course set to be taught by a qualified PEng to assist with registered AU counts. Updated description better reflects what is taught in class.

4. IBBME

4.1 Redistribution of hours for BME430 *Human Whole Body Mechanics* from 3|2|0 to 2|3|0s

- Increase the weighting of the laboratory component, and concomitantly reduce the weighting of the lecture component, to reduce the current overlap in theory that exists with other courses and improve the experiential learning component.