UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3489

MEMORANDUM

To: Executive Committee of Faculty Council (January 18, 2016)
Faculty Council (February 29, 2016)

From: Professor Graeme Norval
Chair, Undergraduate Curriculum Committee

Date: January 5, 2016

Re: Major Curriculum Changes for the 2016-2017 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 program course changes for the upcoming academic year.

STRUCTURE

1. Chemical Engineering

A new elective course, **CHE4XXS Chemical Engineering in Human Health**, is proposed. This course is part of the Bioengineering Minor.

Course description: Life expectancy has consistently increased over the past 70 years due to advances in healthcare and sanitation. Engineers have played key roles in developing technologies and processes that enabled these critical advances in healthcare. This course will provide an overview of areas in which chemical engineers have directly impacted human health. We will study established processes that have had transformative effects in the past, as well as emerging areas being developed by chemical engineers to impact human health. Emphasizing quantitative approaches, we will use engineering tools, especially those derived from transport phenomena and chemical kinetics. Required readings, including scientific papers, will be assigned and industrial visits and/or a hands-on project will be included.

Prerequisite: CHE353H1 and CHE354 or MIE331; or BME205.

Learning outcomes: At the conclusion of this course, students should be able to identify how fermentation, separation processes, kinetics and reactor design have been used to develop processes that impact human health. They should be able to describe microbiome and how it affects human health, and identify how biomaterials have enabled the development of life-saving medical devices. Students should be able to identify common metabolic disorders. When presented with a problem currently challenging healthcare, they should be able to apply knowledge from the presented emerging areas to propose novel solutions, clearly identifying advantages and limitations of those proposed solutions.

2. Materials Science and Engineering

A new elective course, **MSE 4xxF Introduction to Computational Materials Design**, is proposed.

Course description: This course will provide a broad overview of the modern computational materials design approaches at various length scales. At the atomic scale, we will cover density functional theory, molecular dynamics, and atomistic kinetic Monte-Carlo methods. Mesoscale simulations of material behavior will involve dislocation dynamics and phase-field models. At the continuum scale, computational fracture mechanics and plasticity modeling will be covered. Students will be exposed to concepts and case studies pertaining to multi-scale modeling. Hands-on training will be provided on open source software packages such as LAMMPS and Quantum-ESPRESSO.

Prerequisite: A good understanding of materials science and engineering, especially on crystallography and atomic structure of materials, and basic knowledge of MATLAB or any other programming language and Unix commands.

Learning outcomes: At the conclusion of this course, students should be able to recognize, define and describe key concepts and methods used in computational materials design, and describe and apply density functional theory, molecular dynamics, kinetic Monte-Carlo, and dislocation dynamics, conceptually and practically. They should be able to conduct computer simulations using Quantum-ESPRESSO, LAMMPS, ParaView, and ANSYS to investigate physical phenomena of interest to materials science and engineering.

PROCESS AND CONSULTATION

This proposal has been reviewed and approved by the Undergraduate Curriculum Committee, which is comprised of faculty representatives from departments and divisions offering undergraduate programs, undergraduate students, the Dean, the Vice-Dean, Undergraduate Studies, the Chair of First Year, the Associate Dean, Cross-Disciplinary Programs, the Registrar, and a Teaching and Learning Specialist . The Committee meets regularly and reviews changes to the undergraduate curriculum.

PROGRAM

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

PROPOSAL/MOTION

THAT the proposed curriculum changes for the 2016-2017 academic year set out in Report 3489 be approved.