UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3525 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (November 3, 2016)
Faculty Council (December 1, 2016)

From: Professor Evan Bentz
Chair, Undergraduate Curriculum Committee

Date: November 7, 2016

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 program course changes for the upcoming academic year.

STRUCTURE

The following changes are proposed for the 2017-2018[1] academic year.

1. CHEMICAL ENGINEERING & APPLIED CHEMISTRY

1.1 Changes to Second Year

- CHE204Y1 – Applied Chemistry III – Laboratory. The course is currently a full year core course offered in second year and currently weighted at 0.50. The proposal is to split the course into F and S. The Committee on Examinations prefers to have the program complete all courses in term 2F which makes the

[1] Unless noted otherwise.

calculation of term average and probation status easier to manage. Also, for rare cases where students must pause their undergraduate program at the end of the fall semester, having an f/s combination enables such student to resume.

New course codes: CHE204H1F – Laboratory I and CHE205H1S – Laboratory II. The proposed weighting for each course will be 0.25.

1.2 Changes to Third Year

- CHE311H1S – Separation Processes. This third year core course is currently weighted at 0.75. The proposal is to remove the Unit Op Labs from the course and reduce the weight to 0.50.

- CHE324H1F – Process Design. This third year core course is currently weighted at 0.75. The proposal is to remove the Unit Op Labs and reduce the weight to 0.50.

- Delete CHE326H1F – Thermodynamics and Kinetics Laboratory.

- New course codes: CHE304H1F – Laboratory III and CHE305H1S – Laboratory IV. CHE304H1F – Laboratory III will take the place of the removed lab portions for CHE324H1F and CHE326H1F. The proposed weighting for CHE304H1F is 0.50

- CHE305H1S – Laboratory IV will take the place of the lab portions for CHE311H1S – Separation Processes. The proposed weighting for CHE305H1S is 0.50.

2. CIVIL ENGINEERING

This year the Civil Academic Planning Committee (soon to be Undergraduate Studies Committee via a change to the department's Constitution) decided to make the two existing fourth year undergraduate thesis courses available for Mineral Engineering students as well. A new year-long thesis course is proposed for Civil and Mineral Engineering, based on the Engineering Science model. Two new 500-level courses are also proposed.

2.1 Changes to Course Codes

- CIV499H1F – Individual Project: change code to CME499H1F
- CIV499H1S – Individual Project: change code to CME499H1S

2.2 Add New Elective Courses for Fourth Year in CIV and MIN Programs
- CME499H1Y Individual Project

2.3 Added New Elective Courses for Fourth Year in CIV Program

- CIV580H1S Engineering and Management of Large Projects (see below)
- CIV536H1S Urban Activity, Air Pollution and Health (see below)

Calendar Entry for proposed CIV580H1S:

This technical elective course will investigate the role of stakeholders in major civil engineering projects; the complexities of managing project stages, multiple stakeholders, and technical challenges, and, social and environmental factors. Each week includes a different speaker who can address issues related to technical, social, and environmental challenges in the project and how they were overcome.

Calendar Entry for proposed CIV536H1S:

This is an interdisciplinary course where the challenge of air pollution is introduced with a focus on urban areas. The interdependencies between transportation, air quality, and health are demonstrated. The city and the behaviour of its inhabitants constitute the context for the following course topics: overview of air pollutants in urban areas, urban air quality monitoring networks, mobile source emissions, air pollution and meteorology, atmospheric dispersion, chemical processes specific to cities, personal mobility and exposure to traffic-related air pollution, epidemiology of air pollution.

3. CROSS-DISCIPLINARY PROGRAMS

3.1 Creation of Forensic Engineering Certificate – submitted as Report 3527.
Proposed new course: APS5SXXH1S: Making Sense of Accidents

Summary of proposed course:

Despite the best of engineering practices which include a focus on reliability, human factors and quality improvement, spectacular failures of complex technological systems occur regularly: bridges and buildings collapse, chemical plants catch fire and explode, airplanes crash and nuclear reactors melt down. Traditional engineering explanations for the causes of accidents utilize eventchain models and often blame operators. This course highlights the limitations of such models and shows that accidents in sociotechnical systems can be better understood using systems engineering. Further insights are provided by reviewing various sociological theories that have been advanced to explain and prevent accidents. The course comprises the following: (a) lectures that present and integrate the various theoretical approaches to understanding accidents; (b) demonstration of these concepts using case studies drawn from a range of industries and organizations; and (c) team projects that utilize systems engineering approaches to understand a recent man-made disaster.

3.2 Updates to Environmental Engineering Minor

- Add ENV234 – Environmental Biology as an introductory elective. The Ecology and Evolutionary Biology department has proposed adding this course to our minor following an engineering student's interest in the course. It is an interdisciplinary course offering from the School for the Environment. The minor already utilizes several ENV courses.

- Add CHE475 – Biocomposites: Mechanics and Bioinspiration as an Advanced Elective. This course has a strong focus on environmental sustainability as well as bioengineering where it is already listed.

3.3 Updates to Bioengineering Minor

- Add BME430 – Whole-Body Biomechanics as an Advanced Elective. This course was created last year as an option for the Biomedical Engineering Minor after the main curriculum change cycle. The course is open to all students with the appropriate pre-requisites (CHE353, BME205 or MIE100) so it is suitable for the Bioengineering Minor as well.

- Remove CHE562 – Advanced Polymers. A review of the most recent course syllabus revealed that this course doesn't specifically cover biopolymers or biomaterials. It was felt that organic polymers alone is not sufficient connection to bioengineering. There are many CHE options for students in this minor.

3.4 Updates to Engineering Business Minor

- Add MIE540 – Product Design as an Elective. A student-initiated request, this course is focused on development of a product from need, concept, development, testing and marketing to final product. It is a Technical Elective for fourth year Mech but only requires statistics and probability as pre-requisites, so it is suitable for students from other programs.

3.5 Updates to Course Descriptions

- Add text re assessment to APS444 – Positive Psychology for Engineers. Following exceptional demand for this course (over 200 requesting it in pre-registration) and previous experience with students who were not prepared to fully engage in the course material, enrollment this term was determined through an in-class assessment held during the first class. The calendar description will remain the same but will add the following notation (similar to existing for APS234):

If the number of students electing to take the course exceeds the class size limit, selection of the final group will be made on the basis of an in-class assessment completed during the first class.

- Add new text in red to JRE410 – Markets and Competitive Strategy.

  Introduces the basic concepts, frameworks and methodologies useful to managers in crafting and executing entrepreneurial business strategies in technology-based companies. Students gain an understanding of the external, internal, and dynamic environments of a business and the elements of a superior competitive position. Examine challenges related to industry dynamics, such as industry life cycles, disruptive technologies, and strategic change to enhance competitive advantage; designing and delivering customer value, involving strategic decisions about segmentation, targeting and positioning, and tactical decisions related to product introductions, marketing communications, distribution channels and pricing. Strategic planning and market analysis with topics on innovations and commercialization: intellectual property protection, platform leadership, basic approaches to business start-up, concluding with discussions on entrepreneurship.

4. ELECTRICAL AND COMPUTER ENGINEERING

4.1 CSC444H1 F – Software Engineering I: change the course title to Software Engineering.

4.2 ECE241H1 F – Digital Systems: change the course description as follows:

Digital logic circuit design with substantial hands-on laboratory work. Algebraic and truth table representation of logic functions and variables. Optimizations of combinational logic, using "don't cares." Multi-level logic optimization. Transistor-level design of logic gates; propagation delay and timing of gates and circuits. The Verilog hardware description language. Memory in digital circuits, including latches, clocked flip-flops, and Static Random Access Memory. Set-up and hold times of sequential logic. Finite state machines - design and implementation. Binary number representation, hardware addition and multiplication. Tri-state gates and ~~multiplexors~~ multiplexers. There is a major lab component using ~~Complex Programmable Logic Devices (CPLDs) and~~ Field-Programmable Gate Arrays (FPGAs) and associated computer-aided design software.

4.3 ECE330H1 S – Semiconductor and Device Physics: change the course title to Quantum and Semiconductor Physics. The prerequisites and exclusions remain the same. Change the course description as follows:

Previous description:

Wave and quantum mechanics, the Schrodinger equation, quantum wells and density of states. Quantum statistics, solid-state bonding and crystal structure. Electron waves, dispersion relation inside periodic media, Fermi level and energy bands. Physical understanding of semiconductors at equilibrium, intrinsic and extrinsic semiconductors and excess carriers.

New description:

This course introduces the principles of quantum physics and uses them to understand the behaviour of semiconductors. Topics to be covered include wave-particle duality, Schrodinger's equation, energy quantization, quantum mechanical tunnelling, electrons in crystalline semiconductors, and other physical concepts that form the basis for nanotechnology, microelectronics, and optoelectronics.

4.4 ECE331H1 S – Analog Electronics: delete spring section.

4.5 ECE345H1 F/S – Algorithms and Data Structures: change the course description as follows:

Design and analysis of algorithms and data structures that are essential to engineers in every aspect of the computer hardware and software industry. Recurrences, asymptotics, summations, trees and graphs. Sorting, search trees and balanced search trees, amortized analysis, hash functions, dynamic programming, greedy algorithms, basic graph algorithms, minimum spanning trees, shortest paths, introduction to NP completeness and new trends in algorithms and data structures.

4.6 ECE360H1 F – Electronics: change the course description as follows:

An introduction to electronics. Basic electronic circuits: introductory frequency-domain analysis, operational amplifiers, diodes, field-effect transistors, bipolar junction transistors, small-signal analysis, ~~frequency response of~~ single-stage ~~circuits~~ amplifiers.

4.7 ECE417H1 S – Digital Communication: move to the fall term.

4.8 ECE431H1 F – Digital Signal Processing: add the EngSci postcodes to this course.

4.9 ECE437H1 F – VLSI Technology: add ECE534H1 and ECE535H1 as exclusions.

4.10 ECE448H1 F: move to the spring term and change the course description as follows:

Modern technologies in the biosciences generate tremendous amounts of biological data ranging from genomic sequences to protein structures to gene expression. Biocomputations are the computer algorithms used to reveal the hidden patterns

within this data. Course topics include basic concepts in molecular cell biology, pairwise sequence alignment, multiple sequence alignment, fast alignment algorithms, deep learning approaches, phylogenetic prediction, structure-based computational methods, gene finding and annotation.

4.11 Delete ECE450H1 S – Software Engineering II.

4.12 Delete ECE451H1 S – VLSI Systems and Design.

4.13 Delete ECE455H1 F – Digital Signal Processing (EngSci students to take ECE431H1)

4.14 ECE464H1 S – Wireless Communication: add the prerequisite of ECE417H1 F for both ECE and EngSci.

4.15 Delete ECE510H1 F – Introduction to Lighting Systems.

4.16 Delete ECE525H1 S – Lasers and Detectors.

4.17 Delete ECE527H1 F – Photonic Devices. This course is to become a 400-level course. The course description is as follows:

This course introduces concepts for analyzing and designing photonic devices that serve a wide range of applications, such as communications, sensing, and energy harvesting. Topics to be covered include light propagation in uniform and periodic media; optical waveguides; power splitters and couplers; wavelength filters; interferometers and resonators; amplifiers and lasers; photonic integration. Prerequisite: ECE318H1 or ECE320H1 or ECE357H1.

4.18 Delete ECE540H1 S – Optimizing Compilers.

4.19 Delete PHY335H1 S – Introduction to Quantum Mechanics.

5. ENGINEERING COMMUNICATION PROGRAM

5.1 Change to Calendar Descriptions for HSS Courses

- APS321 Science and Engineering in the Popular Media
  - Minor changes to calendar descriptions; major change is to remove prerequisites from both courses.

- APS322 Language and Power
  - Minor changes to calendar descriptions; major change is to remove prerequisites from both courses.

6. ENGINEERING SCIENCE

6.1 Foundation Curriculum Changes

- CHE260H1 – Thermodynamics and Heat Transfer: change course description.

  Old description

  Classical thermodynamics and its applications to engineering processes. Concepts of energy, heat, work and entropy. First and second laws of thermodynamics. Properties of pure substances and mixtures. Phase equilibrium, and chemical equilibrium.

  New description

  Classical thermodynamics and its applications to engineering processes. Concepts of energy, heat, work and entropy. First and second laws of thermodynamics. Properties of pure substances and mixtures. Phase equilibrium. Ideal heat engines and refrigerators. Mechanisms of heat transfer: conduction, convection and radiation. Steady state heat transfer. Solution of conduction equation. Convective heat transfer coefficients. Momentum and heat transfer analogies. Basics of radiative heat transfer.

6.2 Change to Biomedical Systems Option

- Delete BME510H1: Regenerative Medicine.

- Create new course: BME4XXH1 – Regenerative Engineering.

Add description:

The course encompasses the new multidisciplinary area of Regenerative Engineering by integrating various components of Regenerative Medicine, Clinical Engineering, Human Biology & Physiology, Advanced Biomaterials, Tissue Engineering, and Stem Cell and Developmental Biology, bringing all these disciplines into the clinical perspective of translational medicine. The course starts with the key concepts of stem cell biology and their properties at the cellular and subcellular levels working our way to complex tissues and organs. In the first half of the course, 2D and 3D tissue and organ formation will be our main focus. In the second half, we will discuss the integration of medical devices, technologies and treatments into healthcare as well as clinical trial logistics, ethics and processes. The course materials will integrate cutting-edge research in regenerative medicine and current clinical trials by inviting scientists and clinicians as guest lecturers. Students will be given the rare opportunity to incorporate into their written assignments experiment-based learning via participation in workshops, tours of research facilities, seminars and independent projects integrated into the course during the semester.

Add delivery hours: 3 / - / 1 / 0.5 (LEC / TUT / PRA / WGT)

- Remove Technical Elective
  Sensors, Nano/Microsystems and Instrumentation
  MSE358H1: Structure and Characterization of Nanostructured Materials

- Change Technical Elective – move from fall to spring term
  Systems and Synthetic Biology
  ECE448H1: Biocomputation

6.3 Changes to Aerospace Option

- AER501H1 – Advanced Mechanics of Structures: change course name from "Advanced Mechanics of Structures" to "Computational Structural Mechanics and Design Optimization".

- AER501H1 – Advanced Mechanics of Structures: change AU values from 50% Engineering Science / 50% Engineering Design to 75% Engineering Science / 25% Engineering Design.

- AER304H1: Aerospace Laboratory II: change AU values from 100% Engineering Science to 50% Engineering Science / 50% Engineering Design.

6.4 Changes to Nanoengineering Option

- Remove Nanoengineering option from calendar.

- Delete CHE390H1 – Physical and Inorganic Chemistry.

- Delete MSE358H1: Structure and Characterization of Nanostructured Materials.

6.5 Changes to Engineering Mathematics, Statistics, and Finance Option

- Remove Technical Elective ECE537H1 – Random Processes.

- Add technical electives MIE465H1: Analytics in Action and MIE469H1: Reliability and Maintainability Engineering.

6.6 Changes to Energy Systems Engineering Option

- Remove Technical Elective

  Fall Session – Year 4
  ECE510H1: Introduction to Lighting Systems

- Change Technical Elective

- Fall Session – Year 4
  ECE527H1: Photonic Devices (Change Course Code to ECE4XXH1 until ECE course created)

6.7 Changes to Electrical and Computer Engineering Option

- Remove ECE Electives:

  Photonics and Semiconductor Physics
  ECE525H1: Lasers and Detectors

  Control, Communications, Signal Processing
  ECE455H1: Digital Signal Processing

  Electromagnetics and Energy Systems
  ECE510H1: Introduction to Lighting Systems

  Analog and Digital Electronics
  ECE451H1: VLSI Systems and Design

Software
ECE450H1: Software Engineering II
ECE540H1: Optimizing Compilers

- Remove Technical Elective:

  MSE358H1: Structure and Characterization of Nanostructured Materials

- Change ECE Electives:

  Control, Communications, Signal Processing
  ECE417H1: Digital Communication (from spring to fall term)

  Photonics and Semiconductor Physics
  ECE527H1: Photonic Devices (change course code to ECE4XXH1 until ECE course created)

  Software
  CSC444H1 – Software Engineering I: change the course title to Software Engineering.

- Add ECE Elective:

  Control, Communications, Signal Processing
  ECE431H1: Digital Signal Processing

6.8 Changes to Engineering Physics Option

- PHY408H1 – Time Series Analysis. Change AU values from 100% Mathematics to100% Engineering Science.

- Add Technical Electives:

  Group A
  CHE507H1: Data-based Modelling for Prediction and Control
  ECE355H1: Signal Analysis and Communication
  ECE431H1: Digital Signal Processing

- Remove Technical Elective:

  Group A
  MSE358H1: Structure and Characterization of Nanostructured Materials

ECE455H1: Digital Signal Processing
ECE525H1: Lasers and Detectors

- Change Group A Elective:

  Photonics and Semiconductor Physics
  ECE527H1: Photonic Devices (change course code to ECE4XXH1 until ECE course created)

6.9 Changes to Robotics Engineering Option

- Add Technical Electives:

  Functional Courses
  CHE507H1: Data-based Modelling for Prediction and Control
  ECE431H1: Digital Signal Processing

- Remove Technical Elective:

  Functional Courses
  ECE455H1: Digital Signal Processing

The following are curriculum changes for 2016-2017.

6.10 Changes to Robotics Engineering Option

- Replace in Year 3 Fall Core Curriculum "MIE342H1: Circuits with Applications to Mechanical Engineering Systems" with "ECE355H1: Signal Analysis and Communication".

7. MATERIALS SCIENCE & ENGINEERING

The new MSE curriculum, which is currently being phased in, is a result of recommendations made by the MSE Task Force on Curriculum Renewal and Industrial Relations. This task force was appointed by Dean Amon in September of 2013 following the recommendations by the last MSE Chair Advisory Committee. The task force members are U. Erb (Chair), G. Hibbard, M. Barati, K. Lian, and D. Perovic. The objectives of the task force were:

- To carry out a complete renewal of the undergraduate MSE curriculum with the intent that changes can be implemented by September 2016.
- To enable increased engagement of the Department with industry in all aspects of the curriculum and student experience (PEY, thesis projects, advancement, summer and post-graduation employment).

Both areas were identified by the external review team as requiring attention and improvement.

The bulk of the new second year MSE curriculum was approved by the Faculty in the fall of 2015 and is now in the 2016-2017 calendar. There are some further minor adjustments required in the second year curriculum for 2017-2018. This year, the new third-year MSE curriculum is introduced to the Faculty for approval, to be effective September 2017. This includes significant changes. The task force is now working on the new fourth-year curriculum, which will be introduced to the Faculty in 2017 for implementation in 2018.

Proposed changes for 2017-2018 requiring approval:

7.1 Second Year Courses

- Delete MSE290S.
- MSE202F: new course description and name change to (Thermodynamics I).
- MSE298Y – Communications: new course for 2017/2018 (replacing MSE290 and MSE390)
- MSE222 is replacing MIE222 as MIE would not have resources to accept MSE students; having the course operated by MSE also would allow more control over the contents suitable for Materials Engineering students.

7.2 Third Year Courses

- MSE342F – Nanomaterials: deleted.
- MSE354S – Materials in Manufacturing: deleted.
- MSE315S – Environmental Degradation of Materials: deleted (a fourth-year course will take its place starting 2018-2019.
- MSE316S – Mechanical Behaviour of Materials, and MSE318F – Phase Transformations will switch terms. Now MSE316F, MSE318S.
- MSE302 – Thermodynamics II: new course starting 2017-2018.
- MSE398Y – Materials Manufacturing and Design Laboratory: new course starting 2017-2018.
- MSE343F – Biomaterials: category change from Core to Technical Elective. Weight change from 0.25 to 0.50.

- MSE355S – Materials Production: course name change; revised course description; weight change from 0.25 to 0.50.

Proposed changes for 2017-2018 requiring calendar updates only:

7.3 Fourth Year Theme Name Changes

- Materials for Manufacturing Theme name change to Manufacturing with Materials
- Materials Processing for Sustainable Development Theme name change to Sustainable Materials Processing
- Nanomaterials Theme name change to Design of Materials
- Biomaterials Theme name remains Biomaterials

Third-year students now have the option to take either one HSS/CS <u>or</u> one Technical Elective in third-year fall and winter sessions.

7.4 Third Year Themes (New)

- Biomaterials
- Manufacturing with Materials
- Sustainable Materials Processing
- Design of Materials

7.5 Proposed Third-Year Technical Elective List – Fall

<u>Biomaterials</u>

- MSE343 Biomaterials
- CHE353 Engineering Biology

<u>Sustainable Materials Processing</u>

- CHE324 Process Design
- CHE332 Reaction Kinetics

<u>Manufacturing with Materials</u>

- MIE303 Mechanical and Thermal Energy Conversion Processes
- MSE342 Circuits with Applications to Mechanical Engineering Systems
- MIE243 Mechanical Engineering Design

<u>Design of Materials</u>

- MSE459 Synthesis of Nanostructured Materials

7.6 Proposed Third-Year Technical Elective List – Winter

Biomaterials
- MIE331 Physiological Control Systems
- CHE354 Cellular and Molecular Biology

Sustainable Materials Processing
- CHE333 Chemical Reaction Engineering
- MSE301 Mineral Processing

Manufacturing with Materials
- MIE320 Mechanics of Solids II
- MIE364 Quality Control and Improvement

Design of Materials
- ECE350 Semiconductor Electronic Devices
- CHM325 Introduction to Inorganic and Polymer materials Chemistry

8. MECHANICAL AND INDUSTRIAL ENGINEERING

8.1 New Courses

- MIE5xx – Heating, Ventilating and Air Conditioning (HVAC) Fundamentals. Introduction to the fundamentals of HVAC system operation and the relationship between these systems, building occupants and the building envelope. Fundamentals of psychrometrics, heat transfer and refrigeration; determination of heating and cooling loads driven by occupant requirements and the building envelope; heating and cooling equipment types and HVAC system configurations; controls and maintenance issues that influence performance; evaluation of various HVAC systems with respect to energy and indoor environmental quality performance.

- MIE5xx Fluids of Biological Systems.
  This course will teach students how to apply fundamental fluid mechanics to the study of biological systems. The course is divided into three modules, with the focus of the first two modules on the human circulatory and respiratory systems, respectively. Topics covered will include blood rheology, blood flow in the heart, arteries, veins and microcirculation, the mechanical properties of the heart as a pump; air flow in the lungs and airways, mass transfer across the walls of these systems, the fluid mechanics of the liquid-air interface of the alveoli, and artificial mechanical systems and devices for clinical aid. The third and final module will cover a range of other fluid problems in modern biology.

- MIE3xx Introduction to Quality Control.
  Introduction to quality engineering. Quality standards and certification. TQM. Modeling processes with simulation. Making inferences about product quality from real or simulation output data. Introduction to statistical process control. Control charts for variables and attributes. Process capability analysis. Lot Acceptance Sampling.

- MIE498H0 F/S Summer Research Thesis IV
  AEINDBASC, IV-AEMECBASC -/-/4/0.50
  An independent research project conducted in an engineering laboratory under the supervision of an MIE faculty member for 8 weeks in the summer term. This course is intended for students who will have completed their 3rd year of study by the time they take the course. Admission to the course requires the approval of a project proposal by the Undergraduate office. The proposal must: 1) Explain how the research project builds upon one or more aspects of engineering science introduced in the student's academic program, 2) provide an estimate of a level of effort not less than 130 productive hours of work per term, 3) specify a deliverable in each term to be submitted by the last day of lectures, 4) be signed by the supervisor, and 5) be received by the Undergraduate Office one week prior to the last add day. Prerequisite: Approval to register for the fourth-year summer thesis course must be obtained from the Associate Chair – Undergraduate and is normally restricted to students with an overall average of at least B in their second and third years. Exclusion: MIE498Y0, MIE498Y1

- MIE498Y0 F/S Summer Research Thesis IV
  AEINDBASC, IV-AEMECBASC -/-/4/0.50
  An independent research project conducted in an engineering laboratory under the supervision of an MIE faculty member for 16 weeks in the summer term. This course is intended for students who will have completed their 3rd year of study by the time they take the course. Admission to the course requires the approval of a project proposal by the Undergraduate office. The proposal must: 1) Explain how the research project builds upon one or more aspects of engineering science introduced in the student's academic program, 2) provide an estimate of a level of effort not less than 130 productive hours of work per term, 3) specify a deliverable in each term to be submitted by the last day of lectures, 4) be signed by the supervisor, and 5) be received by the Undergraduate Office one week prior to the last add day. Prerequisite: Approval to register for the fourth-year summer thesis course must be obtained from the Associate Chair – Undergraduate and is normally restricted to students with an overall average of at least B in their second and third years. Exclusion: MIE498H0, MIE498H1, MIE498Y1.

8.2 Revised Course Descriptions

- MIE 459 – the calendar description is to be updated to better reflect the material taught.

  New description

  MIE459H1 S Organization Design IV-AEINDBASC 4/-/-/0.50
  Study of work systems design in new and existing organizations. Consideration will be given to sociotechnical systems design methodology, division of labour, change management, teams, incentives, project management, safety culture, automation, equity and union-management relations. Prerequisites: APS111/112 or Praxis, engineering economics.

  Old description

  MIE459H1 S Organization Design IV-AEINDBASC 4/-/-/0.50
  Study of design, innovation, change and implementation issues in both new and existing organizations. Consideration will be given to sociotechnical systems design methodology, work teams, support systems, project management, and union-management relations.

- MIE563 - remove lab currently listed in the calendar.

- MIE563H1 F Engineering Analysis II 3/3/2/0.50.

  This course explores exact solution techniques for common engineering Partial Differential Equations (PDEs), such as separation of variables, superposition, eigenfunctions, orthogonal functions, complex functions. Other topics include: derivation of common engineering PDEs, introduction to methods of weighted residuals for deriving finite element formulations and limitations of exact solutions relative to approximate solutions.

- MIE519 – include in the list of design Technical Electives for ME.

  MIE519H1 S Advanced Manufacturing Technologies
  IV-AEINDBASC, IV-AEMECBASC 3/-/-/0.50
  This course is designed to provide an integrated multidisciplinary approach to Advanced Manufacturing Engineering, and provide a strong foundation including fundamentals and applications of advanced manufacturing AM. Topics include: additive manufacturing, 3D printing, micro and nanomanufacturing, intelligent manufacturing, Advanced Materials, lean manufacturing, AM in machine design and product development, process control technologies. New applications of AM in sectors such as automotive, aerospace, biomedical, electronic, food processing.

- MIE440 – add to the IE list of pre-approved Technical Electives.

  MIE440H1 F Design of Innovative Products
  IV-AEESCBASET, IV-AEMECBASC 2/2/1/0.50
  Recently developed methods applied at different stages of the design process include: Identification of unmet/underserved user needs through a modified definition of lead users (those who experience needs in advance of the mainstream population) including identifying/studying lead users, identifying which lead-user needs are relevant to the general population; Roles of function and affordance in successful products; Obstacles of fixation and cognitive bias to creativity; Concept generation methods including TRIZ/TIPS (Theory of Inventive Problem Solving, use of unrelated stimuli and analogy (e.g., from biology); Configuration design methods including design for transformation, design for assembly and end-of-life, e.g., reuse, repair and recycling. Hands-on experience of these topics in lectures, tutorials, and labs support successful application of the methods for the course project, as well as future design activities.

- MIE498 – modify the descriptions of the existing research thesis courses to exclude the summer research thesis.

  MIE498H1 F/S Research Thesis
  IV-AEINDBASC, IV-AEMECBASC -/-/4/0.50
  An opportunity to conduct independent research under the supervision of a faculty member in MIE. Admission to the course requires the approval of a project proposal by the Undergraduate office. The proposal must: 1) Explain how the research project builds upon one or more aspects of engineering science introduced in the student's academic program, 2) provide an estimate of a level of effort not less than **130** productive hours of work per term, 3) specify a deliverable in each term to be submitted by the last day of lectures, 4) be signed by the supervisor, and 5) be received by the Undergraduate Office one week prior to the last add day. Prerequisite: Approval to register for the fourth-year thesis course must be obtained from the Associate Chair – Undergraduate and is normally restricted to students with an overall average of at least B in their second and third years. **Exclusion: MIE498Y0, MIE498Y1.**

  MIE498Y1 Y Research Thesis
  IV-AEINDBASC, IV-AEMECBASC -/-/4/1.00
  An opportunity to conduct independent research under the supervision of a faculty member in MIE. Admission to the course requires the approval of a project proposal by the Undergraduate office. The proposal must: 1) Explain how the research project builds upon one or more aspects of engineering science introduced in the student's academic program, 2) provide an estimate of a level of effort not less than **130** productive hours of work per term, 3) specify a deliverable in each term to be submitted by the last day of lectures, 4) be signed by the supervisor, and 5) be received by the Undergraduate Office one week prior to the last add day.

Note: Approval to register for the fourth-year thesis course must be obtained from the Associate Chair – Undergraduate and is normally restricted to students with an overall average of at least B in their second and third years. Prerequisite: Approval to register for the fourth-year thesis course must be obtained from the Associate Chair – Undergraduate and is normally restricted to students with an overall average of at least B in their second and third years. **Exclusion: MIE498Y0, MIE498H0, MIE498H1**

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 changes to the undergraduate curriculum.

PROPOSAL/MOTION

THAT the proposed curriculum changes for the 2017-2018 academic year set out in Report 3525 be approved.