UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3766

MEMORANDUM

To: Executive Committee of Faculty Council (March 26, 2024)
Faculty Council (April 15, 2024)

From: Professor Lisa Romkey
Chair, Engineering Graduate Education Committee (EGEC)

Date: March 12, 2024

Re: **Engineering Graduate Education Committee Update**

REPORT CLASSIFICATION

This is a routine or minor policy matter that has been approved by the Engineering Graduate Education Committee (EGEC). It will be considered by the Executive Committee for approval and forwarding to Faculty Council for information.

NEW COURSES APPROVED

MIE1135	**Thermal Phenomena, Performance and Management of Electric Vehicles**: This course describes the thermal phenomena in Electric Vehicles (EVs), including the primary cooling/heating circuits associated with the power train, cabin, and battery. The major focus is on thermal performance and thermal management of batteries, power electronics and electric motors, and it also includes thermal issues related to cabin electronic systems. Emphasis is on Lithium-ion batteries (LIB), which are expected to continue to be the most widely used battery for EVs in the next decade. This course will cover LIB cells and their fundamentals; principles of operation; electrochemical and heat transfer formulation, modelling and simulation; thermal-related effects on LIB performance and longevity, including aging, degradation, safety, and thermal runaway; thermal modelling of EV system- and component-level, LIB, electric drivetrain, cabin, and fast charger. Students in this course are expected to have a basic understanding of electrochemistry terminologies and undergraduate-level fundamental knowledge of fluid mechanics, thermodynamics, heat transfer and numerical methods.

AER1404	**Aerospace Materials**: This course focuses on materials used under extreme conditions for aerospace applications, mainly high-temperature materials (e.g. Ni-based superalloys), coating systems (especially thermal and environmental barrier coating systems), and lightweight materials (e.g. Al, Ti, and composites). These material systems for extreme conditions are compared to standard materials, which are already familiar to the students. The focus will be on materials for turbines, (reusable) rocket engines, and structural components for aerospace structures. For these applications, material selection is discussed, manufacturing routines are highlighted, and the understanding of fundamental material behaviour is deepened. In detail, creep mechanisms, diffusion, oxidation, high-temperature corrosion, failure mechanisms, and thermal stability of the microstructure are covered in this course.
CIV1323	**Pathways to Net-Zero Greenhouse Gas Emissions**: Faced with climate change and the necessity to reduce and ultimately eliminate human-generated GHG emissions, society must now drive the action mandated via the net-zero policies enacted by governments worldwide. This overarching goal can however only be implemented via individual sector policies that reflect the technical, economic and political realities of the day. Further, such actions can only take place and be effective once the impacted natural climate and biogenic systems are understood. This course will provide an overview of climate science before examining the technical, economic and political realities of potential climate change interventions across six major climate sectors. These range from energy to industry to farming and forestry. Students will apply this knowledge both via individual study efforts and by a group project tasked with setting a pathway to net zero for a chosen country.
CIV1231	**Indoor Air Quality – Moisture, Microbes and Materials**: We spend most of our time indoors exposed to a variety of organic and inorganic compounds. Accounting for and minimizing potentially harmful exposures is critical to indoor air quality. Through this course, students will gain new knowledge in the field of indoor air quality and develop skills to engineer solutions to create healthy, sustainable and equitable indoor environments. Focus will be given to moisture transport through materials, water activity, impact of moisture on organic indoor contaminants such as bioaerosols, and methodologies to prevent, remediate and monitor indoor mould growth. Further, this course will investigate tools, such as next-generation sequencing and bioinformatics, used to characterize indoor microbiomes and bioaerosols. Interest will also be given to issues in indoor environmental quality specifically in Indigenous housing as well as low-socioeconomic communities in Canada. Through a course project, students will engineer a solution using resources and skills developed throughout the course for a particular issue of interest in indoor air quality.

RECOMMENDATION FOR FACULTY COUNCIL

For information.