ACADEMIC COUNCIL REPORT

SESSION:

Public ☒

ACTION REQUESTED:

Decision ☐
Discussion/Direction ☐
Information ☒

DATE: **25 June 2019**

FROM: **Glenn Harvel, Chair, Curriculum and Program Review Committee**

SUBJECT: **Minor Program Adjustment: Bachelor of Engineering in Mechanical Engineering**

PREAMBLE:

In November 2018 the Faculty of Engineering and Applied Science presented a Major Program Modification for the Mechanical Engineering - Energy Engineering Specialization. There were two notations, indicated in yellow on page 3 of this document, which indicated a change was also being made to the Mechanical Engineering Major. A motion was not made at that time to approve the minor adjustment to the Major. As this change will directly impact students, the change is being brought forward now to include the modification in the 2019-2020 Academic Calendar.

COMMITTEE/BOARD MANDATE:

The Curriculum and Program Review Committee (CPRC) approved the Minor Program Adjustment to the Bachelor of Engineering in Mechanical Engineering in accordance with its mandate under Section 3, Part B:2 of the University's Institutional Quality Assurance Process (Quality Assurance Handbook).

CPRC is providing this report to Academic Council for information.

RESOURCES REQUIRED:

No additional resources are required.

CONSULTATION AND APPROVAL:

- Faculty Council Approval: November 5, 2018
- Engineering Curriculum Committee: October 29, 2018
- Department Council: October 22, 2018
- The Program Curriculum Committee – Mechanical: May 7, 2018 and October 12, 2018

NEXT STEPS AND TIMELINES:

- This change will be reflected in the 2019-2020 Undergraduate Academic Calendar

- The expected date of implementation is the fall semester of 2019. This will apply to students currently in their second year

SUPPORTING REFERENCE MATERIALS:

- Original Major Program Modification Proposal
- New Course Form
- Mechanical Engineering Calendar Copy

Mechanical Engineering – Energy Engineering specialization

*2019-2020 - UG - Major Program Modification (Modify Existing Calendar Entry)

(A) Proposal summary

Home faculty* Faculty of Engineering and Applied Science

Summary of proposed changes*

The current energy specialization in the Mechanical Engineering program does not meet the Program Nomenclature Guidelines as approved by the University. The Provost has requested that the energy specialization go under review to make the difference between the program and its energy specialization in agreement with the Guidelines. The PCC – Mechanical Engineering has met and reviewed all courses. Some courses have been merged, removed or altered.

- Remove lab component from MECE 2320U – Thermodynamics.
- Change prerequisite for MECE 4450U – Thermal Environmental Engineering from MECE 4240U – Applied Thermal and Fluids Engineering to MECE 3230U: - Thermodynamic Applications.
- Remove AUTE 3450U – Combustion and Engines from semester 3-2 of the Mechanical Engineering – Energy Specialization program map
- Remove MECE 3320U – Fluid Power Systems from semester 3-2 of the Mechanical Engineering – Energy Specialization program map
- Remove MECE 4240U – Applied Thermal and Fluids Engineering from semester 3-2 of the Mechanical Engineering and Mechanical Engineering – Energy Specialization program maps.
- Remove MANE 4380U – Life Cycle Engineering from semester 4-1 of the Mechanical Engineering – Energy Specialization program map
- Remove MECE 4430U – Sustainable and Alternative Energy Technologies from semester 4-1 of the Mechanical Engineering – Energy Specialization program map
- Remove MECE 4410U – Fossil Fuel Energy Conversion from semester 4-1 of the Mechanical Engineering – Energy Specialization program map
- Move MECE 3410U – Electro-Mechanical Energy Conversion from semester 4-2 to semester 3-2 of the Mechanical Engineering – Energy Specialization program map
- Add MECE 3390U – Mechatronics to the Mechanical Engineering - Energy Specialization in 3-2
- Add new course MECE 3230U – Thermodynamic Applications to semester 3-2 of the Mechanical Engineering and Mechanical Engineering – Energy Specialization program maps
- Add new course MECE 4151U: Solar Energy course to semester 4-1 of the Mechanical Engineering – Energy Specialization program map
- Add new course MECE 4153U: Wind and Hydro Energy course to semester 4-1 of the Mechanical Engineering – Energy Specialization program map

Please note that the total credit hours for the program have changed from 138 to 132. The total credit hours for year-semester 4-1 and 4-2 have gone from 18 credit hours to 15 credit hours

Is a new course associated with this proposal?* Yes

New courses

MECE 3230U – Thermodynamic Applications to semester 3-2 of the Mechanical Engineering and Mechanical Engineering – Energy Specialization program maps https://uoit.curriculog.com/proposal:1075/form

MECE 4151U: Solar Energy course to semester 4-1 of the Mechanical Engineering – Energy Specialization program map https://uoit.curriculog.com/proposal:1076/form

MECE 4153U: Wind and Hydro Energy course to semester 4-1 of the Mechanical Engineering – Energy Specialization program map https://uoit.curriculog.com/proposal:1077/form

Effective semester* Fall 2019

(B) Program information

Program or shared core name* Mechanical Engineering – Energy Engineering specialization

Program type Bachelor (Honours)

Degree type Bachelor of Engineering (Honours)

Calendar Copy Attached

(C) Detailed proposal information

Introduction
Brief background on existing program*
At the moment, the energy specialization does not meet the Program Nomenclature Guidelines as approved by the University as it has 8 different courses than the mechanical engineering program. The Provost has requested that the program go under review to reduce the number of courses to insure that the difference between the mechanical engineering program and its energy specialization meets the Guidelines. The PCC – Mechanical Engineering has met and reviewed all courses. Some courses have been merged, removed or altered, to eliminate any possible duplication of materials.

The focus of the Energy Specialization is on all aspects of energy, from its generation to its end use, and including energy conversion, storage, transportation and distribution. Energy Engineering increasingly focuses on the efficient and environmentally benign use of energy, as well as energy security and reliability.

In the first year, students study mathematics, sciences, computing and technical communications — courses that represent the foundation building blocks of most engineering programs. The second year covers basic engineering courses like thermodynamics, fluid mechanics, materials properties, electrical circuits, and the mechanics of solids.

In third and fourth years, students study a range of applied and advanced mechanical engineering courses including kinematics and dynamics, control systems, manufacturing and production processes, machine design, mechatronics, etc. In addition, the final year students undertake capstone design projects which show the cumulative knowledge that they have acquired during their studies at UOIT.

State-of-the-art laboratories and facilities have been developed to support the program, including laboratories for a wide range of mechanical and manufacturing technologies.

Complementary studies, including collaborative leadership, economics, and ethics and law for professionals promote a broader understanding of the needs of society and technology's impact on it. Students gain technical expertise along with the understanding of business and humanities required for an integrated approach to the mechanical industry.

Description of how the proposed fits into the broader array of program offerings, particularly those areas of teaching and research strengths and complementary areas of study
This is not a new offering. It is an existing specialization that does not meet the Program Nomenclature Guidelines due to the excessive number of courses that currently exist in the specialization compared to the main mechanical engineering program. The Provost has requested that the program go under review to make the differences between the program and its specialization in agreement with the Guidelines.

Rationale for the modification*
The current energy specialization in the Mechanical Engineering program does not meet Program Nomenclature Guidelines as approved by the University. The Provost has requested that the energy specialization go under review to make the difference between the program and its energy specialization in agreement with the Guidelines. The PCC – Mechanical Engineering has met and reviewed all courses. Some courses have been merged, removed or altered.

Fit with broader array of program offerings*
Please see above

Resource requirement
Faculty members*
The courses will be taught by the current faculty members with no changes to the teaching staff.

Dr. Jana Abo Ziki, Dr. Martin Agelin-Chaab, Dr. Shaghayegh Bagheri, Dr. Ahmad Barari, Dr. Ibrahim Dincer, Dr. Moustafa El-Gindy, Dr. Naglaa Elagamy, Dr. Kamiel Gabriel, Dr. Yuping He, Dr. Sayyed Ali Hosseini, Dr. Anand Joshi, Dr. Amirkianoosh Kiani, Dr. Hossam Kishawy, Dr. Sima Kouhi, Dr. Haoxiang Lang, Dr. Xianke Lin, Dr. Brendan MacDonald, Dr. Atef Mohany, Dr. Amirhossein Monjazeb, Dr. Scott Nokleby, Dr. Dipal Patel, Dr. Remon Pop-Iliev, Dr. Bale Reddy, Dr. Ghaus Rizvi, Dr. Greg Rohrauer, Dr. Marc Rosen, Dr. Carlos Rossa, Dr. Jaho Seo, and Dr. James Yang.

Additional academic and non-academic human resources*
No changes will be required.

Physical resource requirements*
No additional physical resources are required

Business plan
Statement of funding requirements*
Funding will be required for the development of a new lab for Solar Energy.

Statement of resource availability*

The proposed changes in the Energy Specialization do not require any additional resources than what are currently available

Transition plan*
The expected date of implementation is the fall semester of 2019.This will apply on students currently in their second year.

(D) Impact and consultation

Does this change include any indigenous content?* No

If you answered yes to the above, please ensure consultation includes the Indigenous Education Advisory Circle.

We have consulted with all impacted areas* Yes radio button selected

Consultation*
The Program Curriculum Committee – Mechanical met on May 7, 2018 and on Friday, October 12, 2018.Department Council met on Monday, October 22, 2018 where they approved all motions brought forward from the PCC-Mechanical Engineering.

MECE - 3230U - Thermodynamic Applications

***2019-2020 - UG - New Course**

(A) Proposal summary

Home faculty* Faculty of Engineering and Applied Science

This new course is associated with the following:*
- ○ A Minor Program Adjustment
- ◉ A Major Program Modification
- ○ A New Program
- ○ None of the above

Will this new course appear anywhere other than the course description section of the calendar?* ◉ Yes ○ No

Program(s) impacted* Mechanical Engineering - Energy Specialization

Effective semester* Fall 2019

Are you attaching any supporting documents?* ○ Yes ◉ No

(B) Course information

Course subject code* MECE

Course number* 3230U

Course title (long form)* Thermodynamic Applications

Subject area* Mechanical Engineering

Course description* Thermodynamic cycles are covered, including: the Carnot cycle, gas power cycles, vapour power cycles, combined power cycles, and refrigeration cycles. Analysis of complex cycles that include reheating, intercooling, regeneration, jet-propulsion, and cogeneration. Design considerations related to the application of

the thermodynamic cycles including: heat engines, refrigeration systems, and power plants. Fundamentals of combustion including an overview of fuels, ignition, chemical reactions, and flame temperature. First and second law analysis of combustion reactions. Applications of combustion including engines and furnaces. An introduction to fuel cells, electrolyzers, batteries, and capacitors.

Credit hours*	3
Lecture hours	3
Lab hours	2 (biweekly)
Tutorial hours	1
Other hours	
Cross-listing(s)	
Prerequisite(s)	MECE 2320U or MECE 2640U
Prerequisite(s) for Banner	
Corequisite(s)	
Prerequisite(s) with concurrency	
Credit restriction(s)	
Is the credit restriction an equivalent course?	
Recommended	
Course restrictions	
Course type*	☑ Core ☐ Elective
Is the course undergraduate or professional?*	☑ Undergraduate ☐ Professional
Grade mode*	◉ N (normal alpha grades) ○ P (pass/fail grade)
CLS (in-class delivery)*	◉ Yes ○ No
HYB (in-class and online delivery)*	○ Yes ◉ No
IND (individual studies)*	○ Yes ◉ No
OFF (off-site)*	○ Yes ◉ No
WB1 (virtual meet time - synchronous)*	○ Yes ◉ No
WEB (fully online - asynchronous)*	○ Yes ◉ No

N/A (not applicable)* ○ Yes ◉ No

Teaching and assessment methods*

Assignments
Quizzes
Course project
Midterm exam
Laboratory reports
Final exam

Laboratory Experiments:

Two- and four-stroke gasoline engines
Diesel engine
Brayton cycle or Gas Turbine unit
Jet turbine
Refrigeration/heat

Course learning outcomes*

Demonstrate a fundamental understanding of thermodynamic cycles and energy conversion.
Demonstrate an understanding of modifications to thermodynamic cycles and how to assess and enhance their performance.
Analyze gas turbine and steam turbine power plants, heat engines, and refrigeration systems and understand the role of operating variables on their performance.
Select fuels for combustion and analyze combustion processes including energy output and flame temperatures.
Demonstrate an ability to apply the combustion analysis to engineering applications.
Demonstrate an introductory understanding of the principles of fuel cells, electrolyzers, batteries, and capacitors.
Generate a project report to implement design concepts for the application of a thermodynamic cycle or combustion process.

(C) Impact and consultation

Does this course contain any indigenous content?* ○ Yes ◉ No

We have consulted with all impacted areas* ○ Yes ◉ N/A

Consultation*

na

(D) Financial implications

Financial implications*	This course will replace MECE 4240U, so there is no additional teaching load or TA requirements. All labs already exist, so no additional equipment is required.

Mechanical Engineering

General information

Mechanical engineering overlaps with other engineering disciplines – electrical, chemical, civil, computer and software, to name a few. It is interdisciplinary and one of the broadest engineering disciplines and graduates are in high demand by various industries and employers.

Students have the option to specialize in Energy Engineering within the four-year Mechanical Engineering program.

Admission requirements

Admission is competitive. The specific average or standing required for admission varies from year to year. Students are selected by taking into consideration a wide range of criteria including school marks, distribution of subjects taken, and performance in subjects relevant to the academic program. Possession of the minimum requirements does not guarantee acceptance. Preference will be given to applicants with the best qualifications.

Current Ontario secondary school students must complete the Ontario Secondary School Diploma (OSSD) with six 4U or 4M credits including English (ENG4U) with a minimum average of 60 per cent, Advanced Functions (MHF4U), Calculus and Vectors (MCV4U), Chemistry (SCH4U), and Physics (SPH4U). In addition, a combined minimum 70 per cent average in math and science courses is required, with no grade below 60 per cent. All other applicants should refer to admissions for the requirements for their specific category of admission.

Work placement/internship/co-op opportunities

The university's proximity to some of the largest automotive, electrical, manufacturing and software companies in Canada provides many opportunities for work placements. In addition, a 12- to 16-month optional Engineering Internship program is available for students completing third year, and students may participate in two- to four-month work placements through the Engineering Co-op program. See course descriptions for ENGR 0998U – Engineering Internship Program and ENGR 0999U – Engineering Co-op Program for details.

Professional designation

All of our undergraduate engineering programs in the Faculty of Engineering and Applied Science have been fully accredited by the Canadian Engineering Accreditation Board. (Note: The new Mechatronics Engineering program will be reviewed for accreditation in 2019-2020, to coincide with the first graduating class, as per CEAB requirements.) Each graduate is eligible to apply for

licensing as a professional engineer (PEng) in any province or territory in Canada. Agenda Item 10(b)

Program details and degree requirements

To be eligible for an honours Bachelor of Engineering degree in Mechanical Engineering, students must successfully complete 132 credit hours, including all courses outlined here. For elective options, see the following list.

All courses in Year 1, except SSCI 1470U, are prerequisites to all non-elective courses in Year 3.

All courses in Years 1 and 2, except SSCI 1470U, are prerequisites to all non-elective courses in Year 4.

Approved students may undertake a co-op work term at any time before completing the program, and do so by registering in the course ENGR 0999U – Engineering Co-op Program.

Although reasonable efforts will be made to adhere to the order and timing of courses as indicated, course requirements and term offerings may change. For the most up-to-date list of course offerings, please visit the faculty website at engineering.uoit.ca.

Year 1

Semester 1 (15 credit hours)

- COMM 1050U – Technical Communications
- ENGR 1015U – Introduction to Engineering
- MATH 1010U – Calculus I
- MATH 1850U – Linear Algebra for Engineers
- PHY 1010U – Physics I

Semester 2 (18 credit hours)

- CHEM 1800U – Chemistry for Engineers
- ENGR 1025U – Engineering Design
- ENGR 1200U – Introduction to Programming for Engineers
- MATH 1020U – Calculus II
- PHY 1020U – Physics II
- SSCI 1470U – Impact of Science and Technology on Society

Year 2

Semester 1 (15 credit hours)

- MANE 2220U – Structure and Properties of Materials
- MATH 2860U – Differential Equations for Engineers
- MECE 2230U – Statics

- MECE 2310U – Concurrent Engineering and Design
- MECE 2320U – Thermodynamics

Semester 2 (18 credit hours)

- ELEE 2790U – Electric Circuits
- MATH 2070U – Numerical Methods
- MECE 2420U – Solid Mechanics I
- MECE 2430U – Dynamics
- MECE 2860U – Fluid Mechanics
- STAT 2800U – Statistics and Probability for Engineers

Year 3

Semester 1 (18 credit hours)

- Liberal Studies elective*
- MANE 3190U – Manufacturing and Production Processes
- MECE 3030U – Computer-Aided Design
- MECE 3270U – Kinematics and Dynamics of Machines
- MECE 3350U – Control Systems
- MECE 3420U – Solid Mechanics II

Semester 2 (18 credit hours)

- ENGR 3360U – Engineering Economics
- MECE 3210U – Mechanical Vibrations
- MECE 3220U – Machine Design
- MECE 3230U - Thermodynamic Applications
- MECE 3390U – Mechatronics
- MECE 3930U – Heat Transfer
- ~~MECE 4240U – Applied Thermal and Fluids Engineering~~

Approved students may opt to spend 12 to 16 months as an intern in an engineering setting in industry or elsewhere after Year 3, and do so by registering in the course ENGR 0998U – Engineering Internship Program.

Year 4

Semester 1 (15 credit hours)

- Engineering elective*
- ENGR 4760U – Ethics, Law and Professionalism for Engineers
- ENGR 4950U – Capstone Systems Design for Mechanical, Automotive, Mechatronics and Manufacturing Engineering I

- MANE 4280U – Robotics and Automation
- MECE 4210U – Advanced Solid Mechanics and Stress Analysis

Semester 2 (15 credit hours)

- Three Engineering electives*
- Liberal Studies elective*
- ENGR 4951U – Capstone Systems Design for Mechanical, Automotive, Mechatronics and Manufacturing Engineering II

*Electives

Engineering electives

Courses selected for the engineering elective must be approved by the Faculty of Engineering and Applied Science. Engineering courses from other engineering programs may be allowed as engineering electives provided students have the prerequisites and the courses extend the students' knowledge through greater depth in an advanced area, or greater breadth in a complementary field. Not all of the listed engineering electives will necessarily be offered each year.

The following are approved courses as engineering electives:

- AUTE 3010U – Introduction to Automotive Engineering
- ENGR 3160U – Engineering Operations and Project Management
- ENGR 4540U – Energy Efficiency, Management and Simulation
- MANE 3120U – Thermo-mechanical Processing of Materials
- MANE 3300U – Integrated Manufacturing Systems
- MANE 3460U – Industrial Ergonomics
- MANE 4045U – Quality Control
- MANE 4160U – Artificial Intelligence in Engineering
- MANE 4190U – Principles of Material Removal Processes
- MANE 4380U – Life Cycle Engineering
- MECE 3260U – Introduction to Energy Systems
- MECE 3410U – Electro-Mechanical Energy Conversion
- MECE 4250U – Advanced Materials Engineering
- MECE 4290U – Finite Element Methods

Liberal Studies electives

Complementary studies, including courses in humanities, social sciences, arts, management, engineering economics, ethics and communication, are included in engineering programs to complement the technical content of the curriculum and thereby provide graduates with a broader perspective of their role in society. Inclusion of complementary studies also satisfies several accreditation criteria of the Canadian Engineering Accreditation Board. Courses or parts of courses covering engineering economics, ethics, and the impact of technology on society, as well as courses that develop the student's capability to communicate orally, visually and in writing, are essential to the education of an engineer and therefore are included in all of our engineering

programs.

Liberal studies electives are included in each engineering program to ensure adequate coverage of subject matter that deals with central issues, methodologies and thought processes of the humanities and social sciences. Such material is required in the education of an engineer. Liberal studies electives can include, but are not limited to, courses dealing with cultural analysis; historical analysis; literature and the arts; knowledge, cognition, and moral reasoning; and social and behavioural analysis.

Foreign language and business courses may not be used as liberal studies. Courses can be approved as liberal studies electives for students in engineering programs at the university by the dean of the Faculty of Engineering and Applied Science (or designate), in accordance with these principles.

Courses selected for the liberal studies electives must be approved by the Faculty of Engineering and Applied Science. Liberal studies electives are subject to change. An updated list of liberal studies electives will be maintained online at engineering.uoit.ca.