MECH ENG 4X04

INDEPENDENT RESEARCH PROJECT

2023-2024

COURSE DESCRIPTION:
Individual research project over two terms to be arranged by mutual consent of a faculty supervisor and the student with approval of the Department Associate Chair (Undergraduate).

PREREQUISITES:
A minimum GPA of 9.5; and registration in Level IV Mechanical Engineering or Level V Mechanical Engineering and Management or Mechanical Engineering and Society.

SUPERVISION:
It is the student's responsibility to secure a supervisor for this course; if interested, please contact a professor for available projects. The supervisor is responsible for the immediate direction and instruction of the student and should commit a minimum of 30 minutes contact time per week, on average.

EVALUATION:

Job Hazard Analysis / safety plan, proposal	5%
Oral progress report	10%
Written progress report	15%
Final oral defense	20%
Final written report	35%
Research grade	15%

JHA/PROPOSAL:
Each student must complete (in consultation with their supervisor) a project proposal outline by end of September. This should also include indication that all required safety training has been completed.

ORAL PROGRESS REPORT:
Each student will deliver a 10-minute oral presentation on their research project at the end of the first semester, to be attended by all students enrolled in the course. This will be followed by 10 minutes of questions, and the presentation will be evaluated by two other supervisors involved in the course.

WRITTEN PROGRESS REPORT:
Each student will submit a written progress report at the end of the first semester (recommendation ~10 pages), to be evaluated by the supervisor.

FINAL ORAL DEFENSE:
Each student will present their research project at the end of their second semester (10-minute presentation) followed by questions (10 minutes), to be evaluated by two other supervisors involved in the course.

FINAL WRITTEN REPORT:
The student will prepare a final report documenting the research project undertaken, relevant literature, major findings, and analysis of the data and limitations (format is up to supervisor, recommendation 15-20 pages). This will be delivered to the research supervisor by the end of the second semester.

RESEARCH GRADE:
Students are expected to maintain a lab notebook, documenting regular meetings with the project supervisor and all work conducted on the project. It should be held to engineering standards for notebook

records and will be submitted to the project supervisor along with the final report. The project supervisor will assign a grade out of 15 on the research skills and involvement of the student.

USE OF AI TOOLS IN THE COURSE:
Generative AI is a tool that may be used in limited context within this course. Please read the article *"Best practices for using AI when writing scientific manuscripts, Buriak et al, ACS Nano 2023, 17(5) 4091-4093".* Students may use generative AI in this course to assist with early drafts, but final text must be in the student's own words, and the output must be checked for correctness and completeness (*e.g.* suggested references must be confirmed). A statement of how AI was used (if at all) **must** be included in all written reports and should be discussed with supervisor. Use of generative AI outside these guidelines or without citation will constitute academic dishonesty.

LEARNING OUTCOMES:
Upon successful completion of the course, the student will be expected to demonstrate the ability to:

1. Critically review and briefly summarize the existing scientific literature on the topic.
2. Identify a research question including formulating a testable hypothesis / hypotheses if applicable.
3. Design a research approach including identifying appropriate tools / techniques and/or apparatus
4. Recognize assumptions and identify uncertainty in research methods
5. Obtain a substantiated conclusion based on the results and recognizing limitations of the methods
6. Effectively communicate results in a written scientific report and in an oral defense.

MAPPING TO GRADUATE ATTRIBUTES:

Graduate Attribute		***Learning Outcomes***
A02 Problem Analysis		
2.1	Identifies and states reasonable assumptions and suitable engineering fundamentals, before proposing a solution path to a problem.	2,3,4
2.2	Proposes problem solutions supported by substantiated reasoning, recognizing the limitations of the solutions.	3,4
A03 Investigation		
3.1	Selects appropriately from relevant knowledge base to plan appropriate data collection methods and analysis strategies.	1,6
3.2	Synthesizes the results of an investigation to reach valid conclusions.	2-5
A05 Use of Engineering Tools		
5.1	Evaluates engineering tools, identifies their limitations, and selects, adapts, or extends them appropriately.	3,4
5.2	Successfully uses engineering tools.	3,4,5
A07 Communication Skills		
7.1	Demonstrates comprehension of technical and non-technical instructions and questions.	1-6
7.2	Composes an effective written document for the intended audience.	6
7.3	Composes and delivers an effective oral presentation for the intended audience.	6
A12 Life-long Learning		
12.2	Seeks and acquires appropriate external information as required, including showing awareness of sources of information and ability to critically evaluate them.	1,6

MCMASTER POLICY REMINDERS:

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons involved, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

The following illustrates only three forms of academic dishonesty:
1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.