SFWRBME 5P06A/B
Integrated Software & Biomedical Engineering Capstone Design Project
Fall/Winter Terms (2025-26)
Course Outline

Course/Calendar Description

A multidisciplinary engineering design project involving design and synthesis that reinforces concepts from both Software Engineering and Biomedical Engineering. This course is a two-term project (Fall/Winter) carried out under the co-supervision of faculty members in biomedical engineering and software engineering. Students will **work in teams** to develop and design a **solution based on stakeholder needs**. Student teams will **identify a project with a significant design element that requires the application of knowledge and skills in biomedical engineering and software engineering**. Teams must meet **monthly with stakeholders** to determine a problem's need and receive feedback and end-use improvements throughout the design process. They must also **meet monthly with the lead instructor and co-disciplinary instructor(s)** to improve and refine their technical and engineering design process.

Pre-Requisites and Anti-Requisites

Prerequisite(s): Registration in Level V of the IBEHS program

Cross-list(s): CIVBME 5P06A/B, ELECBME 5P06A/B, EPHYSBME 5P06A/B, IBEHS 5P06A/B, MATLSBME 5P06A/B, MECHBME 5P06A/B, SFWRBME 5P06A/B, TRONBME 5P06A/B

Course Schedule

Lectures: Wednesdays 16:30 - 18:20. **Location**: ITB AB102

Lectures only occur during the Fall term; there are no lectures in the Winter term. This is an in-person lecture, and attendance is expected. However, the content is captured using Echo360 and available for review should you have to be absent from the lecture. **Note: Two quizzes on 1) Professionalism and 2) Health and Safety invited lectures, worth 2.5% of the final grade each, will be held in the Fall Term.**

Course Instructors

Please direct all general inquiries or emails about grading to prof5p06@mcmaster.ca

Lead Instructor	**Dr. Vincent Leung** Email: leungv@mcmaster.ca Office: JHE A412	Phone: 905-525-9140 x24922 Office Hours: By appointment via email
Lead Instructor	**Dr. Cheryl Quenneville** Email: quennev@mcmaster.ca Office: ABB-C308	Phone: 905-525-9140 x21797 Office Hours: By appointment via email
Lead Instructor	**Dr. Ian Bruce** Email: brucei@mcmaster.ca Office: ITB A213	Phone: 905-525-9140 x26984 Office Hours: By appointment via email

Disciplinary Instructors

Chemical Engineering	**Dr. Boyang Zhang** Email: zhangb97@mcmaster.ca Office: JHE A416	Phone: 905-525-9140 x24537 Office Hours: TBD
Electrical Engineering	**Dr. Telex Ngatched** Email: ngatchet@mcmaster.ca Office: ITB 110	Phone: 905-525-9140 x21238 Office Hours: TBD
Engineering Physics	**Dr. Chang-Qing Xu** Email: cqxu@mcmaster.ca Office: JHE A417 (Lab: JHE 214)	Phone: 905-525-9140 x24314 Office Hours: TBD
Materials Engineering	**Dr. Joey Kish** Email: kishjr@mcmaster.ca Office: JHE 343/B	Phone: 905-525-9140 x 21492 Office Hours: TBD
	Dr. Nabil Bassim Email: bassimn@mcmaster.ca Office: ABB C311	Phone: 905-525-9140 x 24102 Office Hours: TBD
Mechanical Engineering	**Dr. Colin McDonald** Email: cmcdona@mcmaster.ca Office: MDCL 3515D	Phone: 905-525-9140 x24131 Office Hours: TBD
Mechatronics Engineering	**Dr. Alan Wassyng** Email: wassyng@mcmaster.ca Office: ITB 166	Phone: 905-525-9140 x26072 Office Hours: TBD
Software Engineering	**Dr. Spencer Smith** Email: smiths@mcmaster.ca Office: ITB 167	Phone: 905-525-9140 x27929 Office Hours: TBD

Teaching Assistants

TBD

Technical Support Staff

Parmveer Bola
Email: bolap1@mcmaster.ca
Office: ABB C104
Phone: 905-525-9140 x26888

Leela Pilli
Email: pillil@mcmaster.ca
Office: ETB 534
Phone: 905-525-9140 x26888

Andrej Rusin
Email: rusina@mcmaster.ca
Office: HSC 4H13
Phone: TBD

Course Delivery and Communication Policy

Avenue-to-Learn will be the course's online management system. Please check Avenue regularly for updated information and announcements. MS Teams will be used as a virtual space for online communications, collaborations, and (as needed) virtual delivery of course content.

Please direct all general inquiries or emails about grading to prof5p06@mcmaster.ca. This ensures your email gets directed to the most appropriate individual for the fastest response. Every attempt will be made to

reply within 24 hours (excluding weekends). Please include a subject prefix of "IBEHS 5P06". Emails must be sent from your @mcmaster.ca account. Be sure to include your group number and student names and numbers in your email.

Team Composition

Teams are self-selected and can be **comprised of students from a single discipline *or* from a maximum of *two* disciplines**. Teams from a **single discipline** can be between **2 and 4 students** whereas teams from **two disciplines** can be upwards of **5 students**.

- **Note: An engineering capstone encompasses teamwork as a key learning outcome. To ensure all students enrolled in the course are eligible to meet this outcome, the instructional team reserves the right to add or remove students from a team if necessary.**

Groups should endeavour to work consistently throughout the term, dividing work so that all members are involved in all types of work. Groups should attempt to resolve any conflicts they might have within their group, but the lead instructor(s) can also be approached if a third party is needed. Individual grades can be reduced relative to the group mark as needed. This process is initiated by individuals within the group.

Project Supervisors

All teams will be co-supervised by one of the **Lead Instructors**, **Dr. Vincent Leung, Dr. Cheryl Quenneville, or Dr. Ian Bruace**. The lead instructors are responsible for overseeing your project's biomedical engineering application. Each team will also be co-supervised by the **Disciplinary Co-Instructor(s)** responsible for overseeing your project's disciplinary application. If your team includes students from another discipline (outside your home discipline), an additional co-instructor would be involved as a project supervisor.

Project Requirements

Each project must have a project supervisor(s) and stakeholder, is interdisciplinary and includes a significant design element, which requires the integration of existing knowledge in math, science, and engineering to solve a problem. The design element requires the application of concepts in biomedical engineering and concepts in your home discipline(s). You will spend most of the course working individually and with your group while consulting with your project supervisor(s) and stakeholders.

Teams may propose a self-developed project or request an existing project from a curated list. Self-developed projects must be approved by disciplinary co-instructors and lead instructors. If more than one group is interested in an existing project, project selection is at the discretion of the stakeholder(s). Please note not everyone will get one of their top project choices, and while unfortunate, this should not affect the group's ability to perform to a high standard and to gain value from the course.

Course Objectives and Learning Outcomes

Upon successful completion of the course, the student should be able to:

LO.01	Formulate an engineering problem in a precise manner understanding the approximations and risks.
LO.02	Be able to select and apply appropriate materials and supplies to tackle design problems.
LO.03	Independently acquire knowledge from a variety of sources.
LO.04	Work in a team in an effective and efficient manner.

LO.05	Manage time effectively to achieve project goals.
LO.06	Clearly communicate engineering design work in both written and oral formats.
LO.07	Understand and demonstrate effective design principles and processes.
LO.08	Understand and articulate the impact of their work on society, the environment, and stakeholders.
LO.09	Identify and mitigate risks to project success.

Important Submission Deadlines

Dates are subject to change ***with*** advanced notice.

Date	Deliverable	Format
Sun, Sept 14, 2025	Project Approval	Form
Fri, Sept 19, 2025	Disciplinary Justification	Report
TBD	Fall Term Avenue Quiz 1	Quiz
TBD	Fall Term Avenue Quiz 2	Quiz
Fri, Oct 24th, 2025	Project Report – Chapter 1	Report
Wed Nov 26 / Tues Dec 3, 2025	Proof of Concept Demo	Presentation
Thurs, Dec 4, 2025	Project Report – Chapter 2	Report
Fri, Feb 6, 2026	Project Report – Chapter 3	Report
Wed, April 1, 2026	Final Project Demo	Presentation
Fri, April 10, 2026	Project Report – Final Submission	Report
TBD	Capstone Expo Poster Presentation	Presentation

Assessments

Component	Weight
Project Approval Form	N/A
Justification of Disciplinary Focus	P/F
Project Report – Chapter 1 (User Needs and Design Inputs)	5%
Fall Term Avenue Quiz 1	2.5%
Fall Term Avenue Quiz 2	2.5%
Fall Term Proof of Concept Demo	15%
Project Report – Chapter 2 (Design Configuration)	10%
Project Report – Chapter 3 (Design Prototype and Verification Plans)	5%
Final Project Demo	15%
Final Report ***	35%
Capstone Expo Presentation	10%

*** For the **Final Report** submission, Chapters 1-3 are expected to be ***revised*** from the draft submission, where applicable, based on formative feedback from the evaluators.

** In all cases, grades may be adjusted based on individual contributions.

Reimbursement

Review the "IBEHS Project Expense Reimbursement Guidelines" on Avenue

- Teams may claim expenses up to $1,000 CAD, including taxes
- All claimed expenses must align with the list of eligible items provided in our information package and lecture materials posted on avenue
- Expenses will be reviewed by a lab tech or IA for compliance with the policy posted on avenue
- Each student team must appoint a "main contact" responsible for submitting and claiming expenses on behalf of the group
    - All expenses must be submitted collectively as a group
    - Individual reimbursement claims will not be processed
    - Reimbursement checks will be mailed to the "main contact's" provided mailing address
    - The "main contact" is responsible for disbursing the funds among group members as per agreed-upon arrangements
- Items may be shipped to either a personal address (or to the supervisor's lab address, with prior permission). Do NOT ship items to the design studio
- Invoices and receipts submitted must exclusively include capstone-related expenses, excluding any personal expenses (e.g., groceries, items for other projects/courses).
    - Expenses must be incurred by team members, supervisors will not be reimbursed
- Every purchase must be converted to CAD
    - Proof of conversion is required for foreign purchases
- Use the 'Reimbursement Form' worksheet (posted on Avenue) to summarize and submit expenses for reimbursement to the IBEHS Reimbursement MS Form (posted on avenue)
- All documents must be clear and legible. If we can't read them, we cannot process the reimbursement.
    - Itemized receipts (not summary receipts)
    - Avenue has instructions for retrieving invoices from Amazon
    - Mock submissions have been posted on Avenue
- Reimbursement claims must be submitted by the specified deadline(s). No requests will be accepted after the last day of the 2026 Winter term (please see McMaster important dates)
- If you have any questions about reimbursement eligibility, email ibehs@mcmaster.ca

Accreditation Learning Outcomes

The Graduate Attributes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's actual grade in the course. For more information on Accreditation, please visit: https://www.engineerscanada.ca. Mapping of the course **Learning Outcomes (LO)** to the Canadian Engineering Accreditation Board (CEAB) **Graduate Attributes (GA)** are outlined in the table below:

Indicator	Graduate Attribute Indicator Description	LEARNING OUTCOME(S)
4.4	Justifies and reflects on design decisions, considering limitations, assumptions, constraints, and other relevant factors.	LO.01, LO.07, LO.09
5.1	Evaluates engineering tools, identifies their limitations, and selects,	LO.02

	adapts, or extends them appropriately.	
7.3	Composes and delivers an effective oral presentation for the intended audience.	LO.06
8.1	Describes the duty of a Professional Engineer to the public, client, employer, and the profession.	LO.08
9.1	Evaluates the environmental impact of engineering activities, identifies uncertainties in decisions, and promotes sustainable design	LO.08
10.1	Applies ethical frameworks and reasoning, including in situations where there are possible conflicting interests among the stakeholders.	LO.08
11.3	Identifies, characterizes, assesses, and manages risks to project success.	LO.01, LO.09
12.2	Seeks and acquires appropriate external information as required, including showing awareness of sources of information and ability to critically evaluate them.	LO.03

For more information on Accreditation, please visit: https://www.engineerscanada.ca

CEAB Accreditation Units: Engineering Design 100%

Inclusive Environment Statement

We consider this classroom to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. We will gladly honour your request to address you by an alternate name or gender pronoun. Please advise of this preference early in the semester so that we may make appropriate changes to our records.

McMaster Approved Policy 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., submission of work not one's own or which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

Generative AI: Some Use Permitted

Students may use generative AI in this course in accordance with the guidelines outlined for each assessment, so long as the use of generative AI is referenced and cited following posted citation instructions (https://libguides.mcmaster.ca/cite-gen-ai/mla). Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use for each assessment, to be clear on the expectations for citation and reference, and to do so appropriately. Examples of acceptable use of generative AI include working through in-class examples during lectures or brainstorming preliminary ideas for the design project. Examples of unacceptable use of generative AI include during a graded in-class assignment or quiz or towards the completion of any final project deliverable, such as technical submissions, written work (e.g., Chapters), or scripts for a presentation.

Authenticity / Plagiarism Detection
In this course, we will be using a web-based service (Turnitin.com) to reveal the authenticity and ownership of student-submitted work. Students will be expected to submit their work electronically either directly to Turnitin.com or via Avenue to Learn (A2L) plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish to submit their work through A2L and/or Turnitin.com must still submit an electronic and/or hardcopy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com or A2L. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). To see the Turnitin.com Policy, please go to the following website: www.mcmaster.ca/academicintegrity.

Courses with an On-Line Element
In this course, we will be using **Avenue-to-Learn** and **Microsoft Teams**. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, usernames 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 this course 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 Accommodations for 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. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Academic Accommodations for Relief for Missed Academic Work: McMaster Student Absence Form
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." Please note that each student in a group is required to submit an MSAF.

Academic Accommodation for Religious, Indigenous, or Spiritual Observations (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 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.

Reference to Research Ethics
The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to https://reo.mcmaster.ca/.

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.

Notice Regarding Possible Course Modification
The instructors and university reserve the right to modify elements of the course during the term. In extreme circumstances, the university may change the dates and deadlines for any or all courses. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with an explanation and the opportunity to comment on changes. The student is responsible for checking their McMaster email and course websites weekly during the term and noting any changes.

Integrated Biomedical Engineering & Health Sciences (IBEHS) Labs/Design Studio Safety

Information for Laboratory Safety and Important Contacts

This document is for users of IBEHS instructional laboratories at the following locations:

- ABB C104 (Design Studio)
- ETB 533 (Medical Imaging/Biomaterials Lab)
- ETB 534 (Medical Instrumentation/Robotics Lab)
- HSC 4N72 (Genetic Engineering Lab)

This document provides essential information for the healthy and safe operation of IBEHS instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in IBEHS. It is expected that revisions and updates to this document will be done continually. At McMaster University, HR maintains Health & Safety information that is also available at https://hr.mcmaster.ca/employees/health_safety_well-being/our-safety/lab-safety/.

Details on Standard Operating Procedures (SOPs), Health and Safety videos and other resources can be found online at the iBioMed Health and Safety webpage.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

- Food and beverages are not permitted in the instructional laboratories.
- A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
- Laboratory equipment should only be used for its designed purpose.
- Proper and safe use of lab equipment should be known before using it.
- The lab tech or course TA leading the lab should be informed of any unsafe conditions.
- The location and correct use of all available safety equipment should be known.
- Potential hazards and appropriate safety precautions should be determined, and the sufficiency of existing safety equipment should be confirmed before beginning new operations.

- Proper waste disposal procedures should be followed.
- Personal ergonomics should be practiced when conducting lab work.
- Current University health and safety issues and protocols should be known.

Location of Safety Equipment

Fire Extinguisher: on walls in halls outside of labs or within labs

First Aid Kit: ABB C104, ETB 533, ETB 534, HSC 4N72 or dial "88" after 4:30 p.m.

Telephone: on the wall of every lab near the door

Fire Alarm Pulls: Near all building exit doors on all floors

Who to Contact?

Emergency Medical / Security:

On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.

Hospital Emergency Medical / Security:

For McMaster HSC, call Security at extension **5555** or **905-521-2100** from a cell phone.

Non-Emergency Accident or Incident: Immediately inform the Lab Tech, TA on duty or Course Instructor.

University Security (Enquiries / Non-Emergency):

Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.

See Lab Tech, TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs.

Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.

IBEHS Specific Instructional Laboratory Concerns: For non-emergency questions specific to the IBEHS laboratories, please contact appropriate personnel below from a McMaster phone:

- Leela Pilli, Laboratory Technician – 26888
- Parmveer Bola, Instructional Assistant – 23521
- Andrej Rusin, Wet Laboratory Technician – 28347
- Alexa Behar-Bannelier, Program Manager – 24548

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.

3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people.

1. Douse with water from safety shower immediately or
2. Roll on the floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if a blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents. Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

1. Immediately discontinue use of the equipment.
2. In Power Lab, press the wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you are not sure, ask!

Defined Roles

IBEHS Lab Technician	Leela Pilli, pillil@mcmaster.ca
IBEHS Instructional Assistant	Parmveer Bola, bolap1@mcmaster.ca

IBEHS Wet Lab Technician	Andrej Rusin, rusina@mcmaster.ca
IBEHS Co-Directors	Dr. Colin McDonald, cmcdona@mcmaster.ca Dr. Michelle MacDonald, macdonml@mcmaster.ca
IBEHS Program Manager	Alexa Behar-Bannelier, alexa.behar@mcmaster.ca
IBEHS Course Instructor	Please contact your specific course instructor directly