

IBEHS 4E09A/B
Health, Engineering Science and Entrepreneurship Thesis
Course Outline

COURSE DESCRIPTION

Welcome to your senior thesis course! This course is one of the culminating experiences of your undergraduate program where you have the opportunity to intensively explore new uncharted territory. It is a two-term research project carried out under the supervision of a McMaster faculty member in any of the general areas of Health, Engineering Science and Entrepreneurship. The thesis is a self-directed learning experience in a cutting edge, research environment for biomedical research or entrepreneurship. Students will take initiative to practice effective time management, communication, and professionalism to be successful. Students will plan and execute this learning experience with inputs from both the published literature and their research environment. Your research supervisor(s) and co-workers will be very important resources.



IBEHS 4E09 will require at least as much time as the equivalent of three regular 3-unit courses across the full academic year (an average of approximately 10-20 hours per week over two terms, depending on the distribution of the 9 unit course load across each term). Students should aim to spend this amount of time per week, continuously and over two terms, reading relevant background literature, conducting the research work, analysis and writing up their work in a thesis. Students should meet regularly with their supervisor to ensure that their project goals and course expectations are being met. All thesis work should be completed by the end of March in order to submit the final written thesis on time.

COURSE SCHEDULE

Lectures: none
Location: none

COURSE CONTACT INFORMATION

Instructor:

Dr. Michelle MacDonald macdonml@mcmaster.ca

Office Hours: By appointment in MDCL 3515

You are welcome to email, drop by my office, or schedule a meeting in advance. I will post adhoc office hours on Avenue throughout the year so that you can pop by for advice, guidance or a pep talk!

COURSE WEBSITE

<http://avenue.mcmaster.ca/>

MATERIALS AND FEES

None required

ASSESSMENT

Components	Weight
Assessments as agreed upon with the supervisor in the thesis permission form which must include a final written thesis	100%
Total	100%

Required Pre-Thesis Documentation

Students must meet with their supervisor at the beginning of the course to complete the required pre-thesis documentation package posted to Avenue which contains:

1. Initial Meeting Form
2. Safety Documentation Form
3. Acknowledgement of Confidentiality Form

The completed package must be submitted to the Avenue Drop Box before work on the thesis can begin.

Early Assessment Form

This form is posted to Avenue and will serve as early feedback for the student so that they can take measures to improve in areas of concern identified by the supervisor.

Important Course Due Dates*

Item	Due to Avenue Drop Box
Pre-thesis documentation package	September 10 by 11:59 pm (no later than September 20) to Avenue
Early assessment form	January 10 by 11:59 pm to Avenue
Final thesis	April 10 by 11:59 pm to Avenue and to Supervisor

***These are in addition to the deliverables and due dates specified by the supervisor on the thesis permission form.**

Written Thesis

- Students will prepare a written thesis document that makes clear the relevant background, the problem that they are trying to solve, the progress made and analysis of results in the context of the research field.
- Unless otherwise specified by the supervisor, the following formatting guidelines will apply: Maximum 20-pages, double-spaced, Times New Roman (or similar) 12-point font, 2 cm margins. Figures, tables and references do not count in the page limit and can be added at the end of the document (maximum additional 10-pages for all of these combined). A title page, table of contents and acknowledgement page(s) also do not count towards the 20-page maximum.
- The thesis will be assessed on the following criteria:
 - ❖ Criterion 1: Understanding of the problem and relevant background information
 - ❖ Criterion 2: Experimental design/data and carrying out of experiments/analysis
 - ❖ Criterion 3: Interpretation/discussion of results
 - ❖ Criterion 4: Overall impression

Guiding Principles to be Successful in the Thesis Course

****These guiding principles are not meant to be exhaustive, nor the only criteria for success.****

The senior thesis is very different than most courses you will have taken so far during your undergraduate career. Here is a list of principles that you can refer back to during this journey of learning and discovery:

1. **Time management and commitment:** Remember that the thesis is a course, so make sure that you set aside enough hours each week to work on it. This should include time for research/reading, lab work, data collection, lab meetings, meetings with your supervisor, etc. There will be weeks where you are busy with other courses (tests, assignments, etc.), but this does not excuse you from spending time working on your thesis. Life is busy, and you need to balance all aspects. Your thesis should never sit on the back burner. You need to keep it moving forward through Reading Week in October and February, and any down time that you may have during the December exam

period.

2. **Reading:** You must take initiative to become knowledgeable on the subject matter. This means that you will need to read. You will need to read A LOT! Your supervisor may or may not give you a reading list to get you started. This list will likely only be some of the seminal work in the area, and you should expect to have to do additional research and reading on your own. Take good notes when you are reading, and be sure to cite your sources (right down to the page number) so that this information is at the ready when you begin to write sections of your thesis.
3. **Writing:** Don't wait until the last minute to begin writing. Writing is an iterative process. Your thesis will undergo many rounds of editing before you submit your final product. Don't hesitate to share drafts with peers, friends, family and your supervisor (if they are willing). Budget time to begin writing in January or February! You don't need to wait until every last piece of data is collected before you can begin to write sections of your thesis, or create figures and graphs.
4. **Communication and meetings:** Communication with your supervisor and/or project mentor is key. Every supervisor will have a different approach with their students, so it is up to you to find out the best method and frequency for communication. If your supervisor sends you an email, respond promptly. If your supervisor requests a meeting, make yourself available as soon as possible. Do not request to cancel or reschedule meetings with your supervisor unless there are extraordinary circumstances. Poor time management on your part, is not a valid excuse. They are human, and very busy people. Their time is valuable.
5. **Collaboration and teamwork:** You could end up working in a very large or very small research group. Your project may or may not be collaborative. It is possible that you will work completely independently. If you are working collaboratively, it is important that you are aware and mindful of timelines and expectations around the collaboration. You will be an important cog in the wheel, so don't disappoint by not being fully engaged and available as agreed upon. Your collaborators will also be excellent resources. If you are working completely independently, do not hesitate to reach out to me or a peer for support or advice.
6. **Expectations:** Expectations are key to each of the guidelines described above! Understanding, managing and meeting expectations are the key to your success in many aspects of life. Here are some expectations that you may wish to clarify with your supervisor:
 - a. Do you expect me to be in the lab specific days/times of the week or weekend (if applicable)?
 - b. Do you expect me to be in the lab during Reading Week/December exam period?
 - c. Is there a minimum number of references that I should have in my thesis?
 - d. Would you like to meet weekly or bi-weekly?
 - e. Are you expected to attend and participate in lab meetings (if applicable)?
 - f. Do you prefer that we communicate by email or in person?

If any expectations are ever unclear, it is imperative that you consult with your supervisor as soon as possible. Do not let things slide or fester.
7. **Professionalism:** It is important that you conduct yourself and communicate with professionalism. Remember that your supervisor will likely be one of your most important references. Therefore, be punctual, be mindful and considerate of your peers, and show how much you have to offer.
8. **What you have to offer:** You have taken on a thesis in order to learn new knowledge and skills (and if you are really lucky, you may even co-author a publication!). Try to not only think about what you will get from this experience, but also what you have to offer in return. You have your time, dedication, motivation, perseverance, positive attitude and mindset to contribute to your research project so that we can advance the field of study. Make yourself an asset. Show initiative. Contribute to the team.
9. **Enjoy:** At the end of the day, we hope that you enjoy this unique and unparalleled experience. Research has its ups and its downs, but it is also one of the most rewarding things that you can do in science!

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, MSTeams 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 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 <https://www.mcmaster.ca/academicintegrity/>.

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.

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.

ACADEMIC ACCOMMODATIONS 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: [Policy on Requests for Relief for Missed Academic Term Work](#).

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 us of this preference early in the semester.

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.

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 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.

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. A McMaster University [lab manual](#) is also available to read in every laboratory.

For Standard Operating Procedures (SOPs), Health and Safety videos and other resources, follow [this link](#).

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

TA	The first point of contact for lab supervision	
IBEHS Lab Technician	Leela Pilli	pillil@mcmaster.ca
IBEHS Instructional Assistant	Parmveer Bola	bolap1@mcmaster.ca
IBEHS Wet Lab Tech	Andrej Rusin	rusina@mcmaster.ca
IBEHS Co-Directors	Dr. Colin McDonald Dr. Michelle MacDonald	cmcdona@mcmaster.ca macdonml@mcmaster.ca
IBEHS Program Manager	Alexa Behar-Bannelier	alexa.behar@mcmaster.ca
IBEHS Course Instructor	Please contact your specific course instructor directly	