MECHENG 4CC3 / IBEHS 4XC3
Experimental and Computational Biomechanics

Undergraduate Studies
Winter 2025
Course Outline

CALENDAR/COURSE DESCRIPTION

Introduction to experimental and computational biomechanics including biomechanical testing concepts and application of finite element methods in simulations of biomechanical structures/systems.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in level IV or above of any Engineering program.
Antirequisite(s): none.

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Julia de Lange
JHE 326
delangej@mcmaster.ca

Office Hours:
Fridays 2:00 – 3:00 pm (on MS Teams Channel)
Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Carson Brewer
brewec2@mcmaster.ca

Morgan Pluim
pluimn@mcmaster.ca

Andres Escobar Moya
escoba3@mcmaster.ca

TA Office Hours:
By appointment

COURSE OFFERINGS

Lectures
Tuesdays, 7-10 pm
BSB 119

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn (hereafter: *Avenue*) is used to administer the course. These tools are used to increase efficiency. 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. *Avenue* can be accessed via the following link:

http://avenue.mcmaster.ca/

The course will be delivered in-person. In the event that the course is required to be delivered online, the instructor may modify the course structure and assessment details to more appropriately support an online format. In the event of a poor weather day, the class may be flipped to an online delivery format in relatively short notice. All course information will be communicated through *Avenue* - it is your responsibility to regularly check the course webpage to stay appraised of course news and any changes in our delivery format.

Lectures will be recorded using Echo360. Please note that from time to time there are technical issues that are not within the Instructor's control, including but not limited to sound issues and/or upload errors. I will do my best to address these errors throughout the semester, but the best way to avoid these is to join for in-person lectures.

We will also have a Microsoft Teams page, where I will periodically post announcements, answers to frequently asked questions (FAQ's), and office hours will be hosted here. Further, in the event that an online delivery mode is required – it will be held virtually on Teams.

Office hours are when I am planning to be there and am available to work with any students. You can ask for feedback on assignments, clarification on lecture material, or anything else you would like my help with. If the timing doesn't work for you feel free to reach out at any other point and we can find a time to meet.

I welcome feedback at any point during the semester. If there's a topic that is unclear or you'd like expanded on, if my writing is illegible, if I'm going too fast, if the assignments are too lengthy, etc. Please communicate any and all feedback through the weekly 'muddiest point' slides.

COURSE INTENDED LEARNING OUTCOMES

This course will introduce the students to experimental and computational biomechanics, with a specific focus on the musculoskeletal system. The biomechanics of the musculoskeletal system will be discussed, and students will be introduced to the principles of testing concepts and measurement techniques used regularly in biomechanical research. This includes learning the principles behind various research methodologies, such as in-vivo analysis, cadaveric (in-vitro) simulations, and computational modeling. Students will also be given the opportunity to investigate current research problems related to better understanding the mechanism of injury, improving surgical treatment, and improving both non-surgical and surgical outcomes.

MATERIALS AND FEES

Required Texts:
None

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 1 classroom-based lecture per week (instructed by Dr. de Lange)
- 6 individual assignments
- 5 journal club participations
- 1 in-class midterm test
- 1 final examination

COURSE SCHEDULE

Week: Date	Topic
Week 1: January 7	Introduction & Biomechanics in Forensic Engineering
Week 2: January 14	Kinematics 1
Week 3: January 21	Kinematics 2 & Journal Club 1
Week 4: January 28	Kinetics 1
Week 5: February 4	Kinetics 2 & Journal Club 2
Week 6: February 11	Extra Problems & Midterm Review, Musculoskeletal Models 1
READING WEEK	No class
Week 7: February 25	**In-class midterm examination**
Week 8: March 4	Musculoskeletal Models 2 & Journal Club 3
Week 9: March 11	Cadaveric Testing 1
Week 10: March 18	Cadaveric Testing 2 & Journal Club 4
Week 11: March 25	Numerical Models 1
Week 12: April 1	Numerical Models 2 & Journal Club 5
Week 13: April 8	Review and Final Exam Preparation

ASSESSMENT DETAILS

Component	Due Date	Weight
Individual Assignments	6 throughout the semester	30%
Journal Club Presentation	5 throughout the semester	5%
Midterm Exam	February 25	30%
Final Exam	TBD	35%
Total		**100%**

Assignments

Assignments (6 in total, 5% each) will be released throughout the semester and will be due 1 week after being posted. Assignments are to be submitted INDIVIDUALLY to the associated drop box on Avenue to Learn by the time specified. Graded assignments will be returned via the assignment return box. Once assignments have been returned, late submissions will no longer be accepted.

Test and Final Exam

A 2-hour midterm test (in-class on February 25th) and 2.5-hour final exam will be held in April (date TBD by the registrar). The final exam must be written or else a final grade of 'F' will be awarded with the notation Did Not Write. The standard 'numeric to letter grade' conversion will be used to assign the appropriate letter grade at the end of the course.

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". Should a student need to use the McMaster Student Absence Form (MSAF) for an assignment or in-class activity, the value of that deliverable will be reallocated to the others within that category (e.g., if you miss an assignment, each of the others will now be worth 3.5%). **If you miss the midterm, there will be an additional exam for you to write.**

All MSAF's are to be directed to the instructor at delangej@mcmaster.ca. Sending to another email address will delay processing.

Grading Concerns

Grades for assignments and mid-term exams will be posted to Avenue as soon as possible upon completion. We will aim to have assignments returned within one (1) week. You will have 7 days from the date of your grade being posted to address any concerns you may have with your grading to the appropriate TA. All grading requests that can not be resolved between students and the Tas should go to the instructor, either by email (delangej@mcmaster.ca) or during Office Hours.

COMMUNICATION POLICY

The best way to communicate with the instructor is through email (delangej@mcmaster.ca) or through MS Teams. I will try to respond within 24 hours. Emails must be sent from your McMaster email address, including a subject prefix of "**4CC3**" I will not be responding to communications within 24 hours before the midterm or final exam, so please plan your communications accordingly.

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 Mechanical Engineering 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.

We will gladly honour your request to address you by an alternate name or gender pronoun. Please advise of this preference whenever you wish, and we will make appropriate changes to our records.

MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the Student Wellness Centre.
Talkspot is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

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:
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.

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

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

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.

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.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage (e.g., *Avenue to Learn*) for updates and announcements related to this course.
2. All submissions are due at midnight (specifically, 11:59 PM on the due date)
3. Arrangements be made with the Instructor prior to any missed work/extensions/late submissions. Exceptions may be made regarding unforeseeable situations.
4. Late penalties will be applied at the Instructors discretion.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.
    - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
    - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
    - The MSAF cannot be used for academic work that has already been completed attempted.
    - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
    - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

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.