

EDKP 566 Advanced Topics in Biomechanics Fall 2021 Clinical, Ergonomics and Applied Sport Biomechanics

Instructors

Amir Hadid, PhD

email: amir.hadid@mail.mcgill.ca

David Pearsall, PhD, Associate Professor

Office: Currie Memorial Gymnasium, Room A215

Phone: (514) 398-4400 extension 0472

email: david.pearsall@mcgill.ca

COURSE LOCATION and TIME:

Currie 315, 10h05 to 11h25 on Tuesdays and Thursdays

COURSE DETAILS

Learning Format: Lecture, Lab

Contact Hours: 2 hrs Lecture, 2 hrs Lab per week

Semester Length: 13 weeks

Monday	Wednesday	Friday
10am	EDKP 566-001 3272 2 times 1.5 hrs/wk 10:05 am-11:25 am CURRIE 304	EDKP 566-001 3272 2 times 1.5 hrs/wk 10:05 am-11:25 am CURRIE 304
11am		

Please note that all lectures and labs will be delivered in person unless otherwise informed; online communications via Zoom (synchronous and/or asynchronous) may need to be adopted in response to covid health restriction as announced by university will be delivered via Zoom.

Course Description

The course will provide a theoretical basis and hands-on experience for analytical and instrumentation-assisted techniques commonly used for assessment, diagnosis, treatment and research in sport and ergonomics -related topics in biomechanics. The course will introduce clinical and sport-related challenges in biomechanics, and review approaches and instrumentation used to measure and evaluate biomechanical variables for quantitative analysis and mitigation of these challenges. Techniques for recording, processing and analysing digital signals will be introduced in the context of electrophysiological signals, kinetics and kinematics of human movement. The students will acquire hands-on experience, as well as applied-research experience in selected topics.

Goals

- Provide hands-on experience on experimental and clinical ergonomic and applied sport biomechanical tools
- Provide understanding of advanced theory and analytical tools in Biomechanics
- Get exposure to clinical, ergonomic and sport biomechanics problems and solutions
- Provide hands on experience on experimental and clinical, ergo, sport biomechanical tools
- Develop an applied research capabilities in the field of biomechanics

EVALUATION SUMMARY

Evaluation will be carried out in accordance with McGill University policy.

The instructor will present a written course outline with specific evaluation criteria at the beginning of the semester.

Evaluation will be based on the following criteria:

Assignment	Due Date	% of total grade
Homework (calculations, etc)	TBD	20% (4% x 5)
Group Project	Presentation	20%
Final Report	TBD	60%

Proposed revised rubric (31 Oct 2021 DJP)

Assignment		Due Date	% of total grade	Criterion measure(s)
Homework (calculations, etc)	Hadid	TBD	20% (10% x 2)	Submission of calculation solutions
Homework (data analysis)	Pearsall	Nov 10	20%	Running data sEMG, kinematics Submission of sample data evaluation and interpretation
Group Project	Pearsall	Presentation Nov 25 Thursday Nov 30 Tuesday Dec 2 Thursday	20%	project determined by group, involving data collection, analysis and interpretation of one or more biomechanical variables; presentation format: introduction, clearly identify study's rationale / purpose (with support citations) (5%), research design, measurement methods of analysis (5%), anticipated and/or preliminary results (5%); summary interpretation / conclusions (5%)
Final Report	Pearsall, Hadid	TBD Dec 9 th	40%	Written report format: introduction, clearly identify study's rationale / purpose (with support citations) (10%), research design, measurement methods of analysis (10%), anticipated and/or preliminary results (10%); summary interpretation / conclusions (10%)

Home assignments: You are required to submit five home assignments which track your progress in the theoretical part of the course (approximately every week; TBD). They should be submitted via myCourses by the due dates listed on myCourses and in the calendar. Up to 4 points will be awarded per assignment (20%).

Discussion Board Posts: To help facilitate student engagement, we will be using the Discussion Board within myCourses. Each student is expected to write at one brief post. Posts should be brief and can include, for example, (a) insights or information that stand out to you in your course engagement, (b) a brief summary of an academic article you found interesting, (c) a brief summary of a news article or other media to bring to your classmates' attention. Students are encouraged to comment on posts and engage with each other through the Discussion Board, and you are also welcome to write additional posts if you wish.

Group Project: The final group project assesses the students' understanding of key biomechanical concepts, the ability to assess existing scientific literature, and think critically to create a research question. Students will work in groups to create a biomechanical research question related to a selected topic. Students will be responsible for an oral presentation. Presentation should include the following: literature review (including knowledge gap), research question, hypothesis, methods (including participant information, data collection procedures, rationale for biomechanical analysis methods, and limitations). If possible, preliminary results will be presented (20%).

Final Report: In addition to your presentation, each group will submit a final report (up to 2 pages) listing the contributions of each individual group member to the project, and a summary of their research activity: literature review (including knowledge gap), research question, hypothesis, method, results and conclusions. Reports should be typed using Microsoft Word template that is available on myCourses (40%).

ACADEMIC STATEMENTS:

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This right applies to all written work that is to be graded, from one-word answers to dissertations. Instructor addition: French/English dictionaries will be permitted during exams (however, supplemental notes marked within the dictionary will not be tolerated, see following statement of academic integrity).

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see: www.mcgill.ca/students/srr/honest/ for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter: www.mcgill.ca/students/srr/honest/).

Instructors who may adopt the use of text-matching software to verify the originality of students' written course work must register for use of the software with Educational Technologies (support.ist@mcgill.ca) and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.

ACADEMIC EXPECTATIONS:

- *Check MyCourses for notes prior to attending lecture*
- *Please read the recommended text. It will add to the framework of class slides.*
- ***If you do not understand something, please ask!***
- *Requests for supplemental assignments to raise grades will NOT be accepted*

LAND ACKNOWLEDGEMENT:

McGill University is situated on the traditional territory of the Kanien'kehà:ka, a place which has long served as a site of meeting and exchange amongst many First Nations including the Kanien'kehà:ka of the Haudenosaunee Confederacy, Huron/Wendat, Abenaki, and Anishinaabeg.

I. Academic integrity

McGill University values academic integrity. <http://www.mcgill.ca/integrity> Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/ for more information).

L'université McGill attache une haute importance à l'honnêteté académique. <http://www.mcgill.ca/integrity> Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/

For religious holidays please consult McGill policy. <http://www.mcgill.ca/importantdates/holy-days-0/policy-holy-days>

Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights (The Handbook on Student Rights and Responsibilities is available at www.mcgill.ca/files/secretariat/Handbook-on-Student-Rights-and-Responsibilities-2010.pdf).

II. **Health and safety guidelines**

Please note that this format for the delivery of this course is unusual and must respect the guidelines of health and safety ([General health guidelines | Coronavirus information - McGill University](#)). It is explained by our current extraordinary circumstances, and aims to allow you, as students, to complete this term with the requisite knowledge for this course, and to succeed in your assessments. I ask for everyone's collaboration and cooperation in ensuring that these guidelines are respected. On August 6, the Government of Quebec announced the government directives for the start of the Fall term, including no distancing in classrooms. Based on this announcement and our previous planning, McGill developed directives, which are detailed on the University's Coronavirus website. Please note that these condition may change at anytime following new directives from the government or the University.

DISTANCING

The status of physical distancing is now:

- No distancing in classrooms,
- One metre in common areas, including shared research spaces, laboratories, offices, and other workplaces.
- Two metres required when eating or drinking, working out in fitness centres.

MASKS

Procedural masks **are required in all indoor spaces at McGill**, including classrooms.

However, Professor or presenters do not need to wear a mask if you are teaching and remain at least two metres away from others. When students are in class on campus, i.e., in person, they are required to wear masks.

DAILY HEALTH CHECK FORM

The daily health check form is still a requirement for all McGill staff before you come to campus. Students are strongly encourage to assess their health using the self-assessment found in [General health guidelines | Coronavirus information - McGill University](#)

CLASSROOM VENTILATION

- All centrally booked classrooms that are being used in the Fall 2021 term have been assessed to ensure ventilation follows the Government's COVID-19 guidelines.

VACCINATION

- Proof of vaccination is not required for students and instructors to engage in teaching activities on our campuses.
- McGill have been promoting vaccination to the members of our community, including through regular emails and a social media campaign, and will host a walk-in vaccination clinic on the downtown campus at the start of term.
- Information on vaccinations (booking appointments, registering vaccines received outside of Quebec, resources) can be found on the Get Vaccinated webpage.

© Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

Topics

Week		Topics	Type	Instructor	Comments
1	Sept 2 Thursday	Kinematics: Dynamics (movement) <ul style="list-style-type: none"> • Linear • Angular • Linkage systems 	In Person	Amir Hadid	Analytical and quantitative tools
	Sept 7 Tuesday		In Person	Amir Hadid	
2	Sept 9 Thursday	Kinetics: Dynamics (movement) <ul style="list-style-type: none"> • Moment of inertia • Translational and rotational motions 	In Person	Amir Hadid	
	Sept 14 Tuesday		In Person	Amir Hadid	
3	Sept 16 Thursday	<ul style="list-style-type: none"> • Viscoelasticity • Sport Equipment interactions (running shoes, protective gear, bicycle, etc) 	In Person	Amir Hadid	
	Sept 21 Tuesday *		In Person	Amir Hadid	* Open session/discuss projects- last 30 minutes
4	Sept 23 Thursday	Clinical application: Load Carriage <ul style="list-style-type: none"> • Biomechanical theory • Mechanophysiology • Problems/challenges • Testing methods • Modeling • Training • Compare to unloaded activities 	In Person	Amir Hadid	Weeks 4 and 5 will be dedicated to real life examples: review a clinical/sport science issues from the background through methodologies, testing and solutions
	Sept 28 Tuesday		In Person	Amir Hadid	
5	Sept 30 Thursday	Clinical Application: Bone Biomechanics and Health <ul style="list-style-type: none"> • Bone properties • Mechanobiology • Adaptations to exercise • Pathological conditions (overuse, disuse) • Modeling • Intervention/Metabolism aspects • Returning to activity after injury 	In Person	Amir Hadid	
	Oct 5 Tuesday		In Person	Amir Hadid	
6	Oct 7 Thursday	Open session/discuss projects- TBD	In person	David Pearsall, Amir Hadid	
	Oct 12 Tuesday	No class (fall reading week)			
7	Oct 14 Thursday	Motion Capture	LAB	David Pearsall	
	Oct 15 Friday	Introduction to Matlab / Biomech Zoo	LAB	David Pearsall	
	Oct 19 Tuesday	Gait lab with Force plate measurements	LAB	David Pearsall	

8	Oct 21 Thursday	Wearable sensors in sports performance analysis (e.g., Xsens IMUs, OPAL): <ul style="list-style-type: none"> ● Balance ● Sway ● Gait ● Performance tests 	LAB- field test	David Pearsall	
	Oct 26 Tuesday	Electromyography (EMG)	Theory and LAB	Julie Coté	
9	Oct 28 Thursday	Electromyography (EMG)	Theory and LAB	Julie Coté	
	Nov 2 Tuesday	Project testing		David Pearsall	Explain scope/format/expectations
10	Nov 4 Thursday	Project testing			
	Nov 9 Tuesday	Project testing			
11	Nov 11 Thursday	Project testing			
	Nov 16 Tuesday	Project testing			
12	Nov 18 Thursday	Project testing			
	Nov 23 Tuesday	Project testing			
13	Nov 25 Thursday	Presentations 1-3 groups	15 min presentations	David Amir	Can shift to online if needed
	Nov 30 Tuesday	Presentations 4-6 groups		David Amir	
14	Dec 2 Thursday	Presentations 7-8 groups		David Amir	

Textbooks

1. Ozkaya N, Nordin M. *Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation*, 3rd Edition, Springer Verlag, NY, 2012.
2. Duane Knudson. *Fundamentals of Biomechanics*, 2nd Edition, 2007.
3. *Fung YC. *Biomechanics: Motion, Flow, Stress, and Growth*, Springer-Verlag, NY, 1990.
4. *Fung YC. *Biomechanics: Mechanical Properties of Living Tissues*, Springer-Verlag, N.Y, 1993.

*Optional/Additional reading

Holidays

Labour Day	September 6
Thanksgiving	October 11
Christmas and New Year	December 23 – January 2

IMPORTANT DATES AT MCGILL: <https://www.mcgill.ca/importantdates/key-dates>

Fall Term

- **Classes begin:** [Wed Sept 1](#)
- **Thanksgiving:** Mon Oct 11
- **Fall Reading Break:** [Tues Oct 12 and Wed Oct 13](#)
 - **Makeup Days:** Thurs Oct 14 = Mon; Fri Oct 15 = Tues
- **Classes end:** [Mon Dec 6](#)
- **Study Day:** Fri, Dec 4 and 5
- **Exams begin:** [Tues Dec 7](#)
- **Exams end:** [Tues Dec 21 \(11 days, including evening exams\)](#)

NB: On Thurs, Dec 3, the normal Thursday schedule of course lectures, labs and conferences will be replaced by a Monday schedule to make up for Labour Day.

Other important dates built around the Key Academic Dates include:

- **Deadline to register for at least one course** to avoid registration penalties: [Friday, August 14](#)
- **Deadline to cancel registration:** [Monday, August 31](#)
- **Add/Drop deadline:** [Tuesday, September 15](#)
- **Course or University Withdrawal with refund deadline:** [Tuesday, September 21](#)
- **Course or University Withdrawal with NO REFUND deadline:** [Tuesday, October 26](#)

Posted on mycourses 16 Nov 2021

Hello

For each project group, **please send me an email outlining your project's title and your names.**

I will then schedule each group's presentation over three days (Nov 25 Thursday, Nov 30 Tuesday, and Dec 2 Thursday).

Each presentation will be 20 minutes long (maximum) followed by 5 minutes for questions/answers.

That will allow us to have 3 to 4 group presentations per day.

Your presentation (20% of final grade) must include:

- introduction, clearly identify study's rationale / purpose (with support citations) (5%),
- research design, measurement methods of analysis (5%),
- anticipated and/or preliminary results (5%);
- summary interpretation / conclusions (5%)

You are expected to attend each others presentation and participate in questions/answers section.

Final Report: In addition to your presentation, each group will submit a final report (up to **4 pages of written text, single spaced**, not including figure, references) briefly listing the contributions of each individual group member to the project, and a summary of their research activity:

literature review (including knowledge gap), research question, hypothesis, method, results and conclusions (**40% final grade**).

Your group's **final report is due no later than Dec 9th**, and should include:

- introduction, clearly identify study's rationale / purpose (with support citations) (10%),
- research design, measurement methods of analysis (10%),
- anticipated and/or preliminary results (10%);
- summary interpretation / conclusions (10%)

David