



Faculty of Engineering
Department of Mechanical Engineering
COURSE OUTLINE

MECH 580 A01– Introduction to Musculoskeletal Biomechanics
Term – Spring 2024 (202401)

Instructor	Office Hours
Dr. Josh Giles	Days: R
Phone:	Time: 1-2PM
E-mail: jwgiles@uvic.ca	Location: EOW 515

LECTURE DATE(S)

Section: A01/CRN22157	Days: MR	Time: 11:30AM-12:50PM	Location: COR A229
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LAB SECTIONS

Section:	Days:	Time:	Location:
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TA Name	E-mail	Office
Aren Beagley	abeagley@uvic.ca	NA

Optional Text (do not buy before first lecture)
Title: Orthopaedic Biomechanics: Mechanics and Design in Musculoskeletal Systems
Author: Donald L. Bartel
Publisher/Year: Pearson Prentice Hall Bioengineering/2006

ONLINE LEARNING, TEACHING, AND TOOLS

This course will be taught in-person with the assistance of BrightSpaces.

Lectures:

Lectures will be in-person at the scheduled times. Slides with unfilled information will be posted in advance.

Tutorials:

Tutorials will be conducted in-person on campus, with examples and Q&A.

Office Hours:

Office hours will be conducted in person in EOW 515.

Tools required:

- Software installed on your computer:
 - Web browser to be able to access/run Zoom, BrightSpaces, etc.
 - Pdf viewer
 - Excel, Word, etc might be useful as well
 - Matlab
 - CAD software
 - Scanner/photoscan app for assignment submission

Please make yourself familiar with Zoom, which we will use for live interaction in office hours:

<https://www.uvic.ca/systems/services/avmultimedia/zoomvideoconferencing/index.php>

COURSE OBJECTIVES:

This course will explore how fundamental engineering principles can be applied to the human musculoskeletal (MSk) system to solve biomechanical problems. In addition to establishing an understanding of basic MSk anatomy and nomenclature, students will study the biomechanical effects of muscle, bone, tendons, and ligaments on the overall human MSk system. Biomechanical kinematic and force analysis will also be studied using first principles and spatial transformation methods. As well, throughout the course, technologies commonly used to assess MSk biomechanical variables will be discussed. Finally, applications of these techniques to computer assisted surgery and computational MSk modelling will be introduced.

Tools Required for this Course: computer, scanner/photoscan app, Matlab, CAD software

LEARNING OUTCOMES: At the end of this course, students will be able to:

1. Remember and understand the basic anatomy and function of the MSk system.
2. Apply first principles in force and stress analysis to analyze biomechanical problems.
3. Understand the biomechanical properties of MSk tissues and apply them to analyze problems.
4. Apply concepts from spatial transformations to analyze human joint motion in 3D.
5. Apply concepts from spatial transformations to analyze internal & external 3D loads on the MSk system.
6. Understand and identify optimal methods for collecting biomechanical data.
7. Understand and explain basic concepts used to computationally model the MSk system.
8. Evaluate literature related to MSk Biomechanics including the efficacy of methods, validity of results, and appropriateness of conclusions.

Weight & Date(s) of Assessments:	Weight	Date
Assignments (3)	25%	Multiple
Lab Experiments (2)	30%	Multiple
Term Tests (3)	45%	Multiple

ASSIGNMENTS

Four assignments will be distributed over the course of the term via the BME 448/MECH 448 BrightSpaces site. The assignment problems will be predominantly hand calculations but at least two assignments will involve reading an academic article and creating a 1-2 page review.

Assignment submissions are to be made to the BME 448/MECH 448 BrightSpaces page. Submissions must be completed neatly (preferably on Engineering computation paper) **following the guidelines discussed in the lecture** and submitted using a scanner or photo-scan app. The submissions must be legible or will not be graded.

The below distribution and due dates are approximate and may change with appropriate notice given.

Assignment #	Modules	Start	Due (5pm)
1	1 & 2: Anatomy & Force Analysis	11-01	01-02
2	3: MSk Stress Analysis	01-02	22-02
3	4 & 5: 3D Kinematics & Kinetics	29-02	28-03

LABORATORIES

The below distribution and due dates are approximate and may change with appropriate notice given.

Lab #	Modules	Start	Due
1	Bone Stress Experiment	12-02	14-03
2	Functional Biomechanics Experiment	18-03	08-04

NOTES:

NOTES ON WORK COMPELETION

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

NOTES

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Course Schedule

Module	Topics	Date/Week
0	<i>Basic MSk Anatomy.</i> Provide an introduction to basic MSk anatomy, including anatomical directions, planes, motions, joint types, etc	Tutorial#1 & 2
1	<i>Muscle.</i> Introduce the structure and biomechanical functions of muscle.	08-01 (2 Lec's)
2	<i>Force Analysis in the MSk System.</i> Review first principles of force analysis and apply them to application in the MSk system.	18-01 (3 Lec's)
3	<i>Bone & Cartilage.</i> Introduce the structure and biomechanical functions of bone and cartilage.	29-01 (3 Lec's)
4	<i>Stress Analysis in the MSk System.</i> Review first principles of stress analysis and apply them to the MSk system. Discuss specific application in joint replacement.	08-02 (3 Lec's)
5	<i>Kinematic Joint Analysis.</i> (Re)Introduce homogeneous transformation matrices and their application in describing kinematics. As well, introduce Euler angles for the description of joint rotations. Discuss applications in computer assisted surgery.	26-02 (4 Lec's)
6	<i>Tracking Technologies.</i> Discuss spatial tracking technologies and applications in computer assisted surgery.	11-03 (2 Lec's)
7	<i>Ligaments & Tendons.</i> Introduce the structure and biomechanical functions of ligaments and tendons.	18-03 (2 Lec's)

General Information

Note to Students: Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Assistant to the Chair to set up an appointment.

Centre for Accessible Learning (CAL) <https://www.uvic.ca/accessible-learning/index.php>

Accommodation of Religious Observance (AC1210) Read it [here](#)

Discrimination and Harassment Policy (GV0205) Read it [here](#)

Sexualized Violence Prevention and Response at UVic:

UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting <https://www.uvic.ca/sexualizedviolence/>. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out:

Where: Sexualized violence resource office in EQHR; Sedgewick C119

Phone: 250.721.8021

Email: svpcoordinator@uvic.ca

Web: <https://www.uvic.ca/sexualizedviolence/>

Office of the Ombudsperson:

The Office of the Ombudsperson is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations.

Phone: 250-721-8357

Email: ombuddy@uvic.ca

Web: <https://uvicombudsperson.ca/>

Electronic devices in labs and lectures: No unauthorized audio or video recording of lectures is permitted.

Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests unless explicitly authorized.

Faculty of Engineering, University of Victoria Standards for Professional Behavior

It is the responsibility of all members of the Faculty of Engineering, students, staff, and faculty, to adhere to and promote standards of professional behavior that support an effective learning environment that prepares graduates for careers as professionals...

You are advised to read the Faculty of Engineering document <https://www.uvic.ca/ecs/assets/docs/student-forms/professional-behaviour.pdf> which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Graduate Students' Society

The Graduate Students' Society (GSS) serves all students registered in a Graduate degree program. For information on GSS activities, events and services navigate to <https://gss.uvic.ca/>

Grading System

The University of Victoria follows a percentage grading system in which the instructor will submit grades in percentages. The University will use the following Senate approved standardized grading scale to assign letter grades. Both the percentage mark and the letter grade will be recorded on the academic record and transcripts. Read the policy [here](#)

Course Experience Survey (CES)

We value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to the <http://ces.uvic.ca>

You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. I will remind you closer to the time, but please be thinking about this important activity, especially the following three questions, during the course.

- What strengths did your instructor demonstrate that helped you learn in this course?
- Please provide specific suggestions as to how the instructor could have helped you learn more effectively.
- Please provide specific suggestions as to how this course could be improved.

Attendance

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time...

An Instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from the course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course. Read the policy [here](#).

Academic Integrity

Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offences.

The responsibility of the institution Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the student's transcript, or a suspension.

It is your responsibility to understand the University's policy on [Academic Integrity](#)

Equality

This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning (formerly the Resource Centre for Students with a Disability) located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.