

**University of Guelph
College of Biological Science
Department of Human Health and Nutritional Science**

COURSE OUTLINE

**Research Methods in Integrative Biomechanics and Neurophysiology II
HHNS*6820
Winter 2017**

I) COURSE INFORMATION:

Professors:

Dr. Lori Ann Vallis

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Course Description: This course develops a comprehensive understanding of methods and analysis related to research in biomechanics & neuroscience. Critical evaluation and application of kinematic approaches to quantify movement; comparing core instrumentation techniques and modelling approaches is a priority. The course uses labs, assignments, and critical review of primary literature articles to develop a strong research foundation. Scientific writing and oral communication skills are emphasized via written reports and presentations, and numeracy throughout the course in data and lab assignments.

Credit Value:

0.5 credits

Pre-requisites:

HHNS*6810

Course Lecture Schedule:

Wednesday 1-3:50 pm; SSC 3317

Course Lab Schedule:

Tuesday 1-3:50 pm

II) LEARNING GOALS AND RATIONALE:

The goals of these courses are to build critical analysis and application of biomechanics and neuroscience related research methods and analysis, as well as to develop numeracy along with scientific writing and oral presentation skills. The overarching philosophy is to establish research competency by developing tenants of scientific inquiry: critical evaluation and application of research methods and effective scientific writing and presentation; all done in the context of the scientific method. The course methodological focus will be to establish a foundation in the principles of kinematics, using different imaging techniques (ultrasound, magnetic field based systems, video based motion tracking systems) and state of the art instruments (Dual Energy X-ray absorptiometry or DEXA, accelerometers) while exploring different data processing approaches via computer software programming. These methodologies in of

themselves are studied in-depth, and span across the related research dimensions to provide a comprehensive basis in understanding biomechanics & neuroscience inquiry.

The course will have continual and multidimensional assessment. Evaluation will be provided in an ongoing basis for in-lab work, reports, assignments, presentations, and examinations. Labs, lab reports, oral presentations and assignments allow for assessment of the translation of concepts to applications, proficiency in numeracy, as well as written and oral communication skills. The examinations evaluate advanced understanding and critical evaluation of material. Peer evaluation of written assignments and presentations offer an additional dimension of assessment.

Numeracy skills will continue to be developed in both conceptual and applied dimensions. Conceptual underpinnings are provided in lecture material for signal analysis, numerical data methods and programming. Applied numeracy is achieved via analysis of lab data, data processing assignments, and introduction to programming as related to numerical analysis.

Advanced written communication skills will be developed in consideration of logical, concise, and in-depth scientific writing; stylistic aspects will be emphasized in relaying information clearly and in an organized manner. Logic in scientific writing will be developed by 1) critical analysis of primary literature articles, focusing on the scientific method aspects of establishing the research question and hypotheses, the efficacy of methods applied in addressing the scientific question, the interpretation and conclusions drawn from the results, 2) written lab reports based on exploration of analytical techniques, building upon concepts presented and discussed in lecture, 3) development of an individual research proposal, complete with establishing purpose, hypotheses, methods, along with preliminary analysis of data.

Advancing stylistic writing skills will be emphasized throughout the course: all written work will be placed in the context of clear and concise writing. Stylistic feedback on initial submissions of written reports will be provided (via instructor and peers) for follow-up self-evaluation and revision of writing approach. Evaluation of primary literature articles will involve appraisal of grammar and style. Peer assessment will include reflection on one's own writing in the context of considering other's writing styles.

Advanced oral communication skills will be developed in a number of ways. In all cases, the emphasis will be placed upon effectively communicating the material of the presentation. Formal oral presentations will be done in 1) the critical analysis of primary literature article, 2) the research proposal and initial results (both as mentioned above). Presentations will be evaluated by peers, and ensuing discussions and questions student-led. Moreover, lectures are designed in an active learning approach, via

interactive discussion of concepts. Interpersonal communication will be developed via work in lab and assignment groups.

Learning Outcomes:

By the end of this course students will be able to:

1. Critically evaluate and apply the methodologies of the principles of kinematics and programming/modelling.
2. Critically evaluate primary literature, particularly in the context of methods and analysis techniques.
3. Understand and apply numerical analyses, including via mathematical programming.
4. Effectively communicate via formal writing, with an emphasis on scientific writing.
5. Effectively communicate via oral presentation.
6. Work effectively with peers to meet learning goals through collaboration.

III) RESOURCES

Primary review articles

Required textbook: Essential MATLAB for Engineers and Scientists 6th edition, Hahn BH, Valentine DT, Associated Press

Required software: MATLAB Student (unbundled)

IV) ASSESSMENT

Weight of Assessment	Activity	Learning Outcome Addressed
Vallis		
5%	Assignment: <i>Kinematics + Kinetics</i>	2,3,6
10%	Kinematic Laboratory Report – Part A	1,2,3,4,6
10%	Oral Presentation of Research Article	1,2,5
25%	Midterm Exam	1,3,4
Zettel		
5%	Project Proposal - Written	1,2,3,4,6
15%	Project Report - Written	1,2,3,4,6
10%	Flip the class - Teaching	2,3,6
20%	Term Assignments (5% each)	1,2,5

HHNS*6820 **Tentative** Schedule – Winter 2017

Week	Topic	Date
Vallis		
Week 1	Welcome - Course Overview Intro to Kinematics (Definitions, Accelerometers, Electromagnetic)	Jan 10: NO Lab Jan 11: Lecture
Week 2	Motion Capture Videography (Marker systems; DLT theory, Global/Local coordinate systems)	Jan 17: Overview Assmt Jan 18: Regular Lecture
Week 3	Calculation of Angles I (Rotational Transformation matrices; Carden/Euler Angles)	Jan 24: Kinematics Lab Jan 25: Regular Lecture
Week 4	Calculation of Angles II (Joint Coordinate System; Helical Axis System)	Jan 31: NO Lab Feb 1: Regular Lecture
Week 5	Anthropometrics (Dual-energy X-ray absorptiometry <i>DXA</i>) Research Paper Presentations	Feb 7: Research Paper Presentations I Feb 8: Research Paper Presentations II
Week 6	Midterm Examination Prep/Examination	Feb 14: Review Session Feb 15: Midterm Exam
READING WEEK - February 20-24		
Zettel		
Week 6	MATLAB Introduction & Fundamentals, Program Design	Feb 28: NO Lab March 1: Lecture
Week 7	MATLAB Functions, Function M-Files; Vectors, Matrices, Arrays	March 7: MATLAB Assignment #1 March 8: Lecture Project Proposals Due
Week 8	MATLAB Loops; Graphics	March 14: MATLAB Assignment #2 March 15: Lecture
Week 9	MATLAB Applications I	March 21: MATLAB Assignment #3 March 22: Lecture
Week 10	MATLAB Applications II	March 28: MATLAB Assignment #4 March 29: Lecture
Week 11	Final Examination Prep/Examination	April 4: Review Session April 5: Final Exam

VI) **Course and University Policies**

a. University Policies

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the graduate calendar for information on regulations and procedures for Academic

Consideration: <https://www.uoguelph.ca/registrar/calendars/graduate/2015-2016/pdffiles/genreg.pdf>

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: <http://www.csd.uoguelph.ca/csd/>

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Graduate Calendar:
<https://www.uoguelph.ca/registrar/calendars/graduate/2016-2017/pdffiles/genreg.pdf>

E-mail Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly. E-mail is the official route of communication between the University and its students.

Drop Date

The last date to drop one-semester courses, without academic penalty, is the 40th class day. To confirm the actual date, please see the schedule of dates in the Graduate Calendar. For regulations and procedures for Dropping Courses, see the Graduate Calendar:

<https://www.uoguelph.ca/registrar/calendars/graduate/2016-2017/sched/index.shtml>

Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

b. INSTRUCTOR POLICIES:

Technology in the classroom

Feel free to bring your laptop to lectures, but only use it in a manner that will not disturb those around you. Please do not use your laptop for anything other than activities related to this physiology course. Turn your cell phones off, or put them on silent, and do not text-message during class.

VII) Campus Resources

If you are struggling to succeed academically:

- There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.uoguelph.ca/~ksomers/>

If you have a documented disability or think you may have a disability:

- The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: <https://www.uoguelph.ca/csd/>