

**SCHOOL OF KINESIOLOGY
FACULTY OF HEALTH SCIENCES
WESTERN UNIVERSITY**

BIOMECHANICAL ANALYSIS OF HUMAN LOCOMOTION

KIN 3353A

2017/18

Instructor: Dr. Volker NOLTE
Lectures: Mon 1:30 - 2:30
Wed 1:30 – 3:30
Location: WSC 240
Lab Coordinator: tba
TAs: tba

Office: TH 2142
Office Hours: Open door policy
Phone: 519-661-2111 ext. 88385
Email: vnohte@uwo.ca

Laboratory Sessions:

One of: MON 4:30 – 6:30 a.m.

TUE 2:30 – 4:30 p.m.

TUE 4:30 – 6:30 p.m.

THU 8:30 – 10:30 a.m.

THU 2:30 – 4:30 p.m.

- Biomechanics Lab: Thames Hall 2125
- Computer Lab: Thames Hall 2115

NOTE: All course information including grades, assignment outlines, deadlines, etc. are available via OWL

COURSE DESCRIPTION

The topics of this laboratory-oriented course will include but are not limited to the study of the temporal-spatial description of (kinematics) and the forces involved with (kinetics) human locomotion. Principles of mechanics, first-hand experience in systematic biomechanical analysis, and hands-on experience with instrumentation used in biomechanical analysis will give the students specific understanding in sport movements and techniques.

The course presents a quantitative approach to the study of activities of cyclic or repetitive nature by which individuals propel themselves over ground or through water. The course will focus upon human locomotion broadly defined as ANY ACTIVITY OF A CYCLIC NATURE, specifically upon walking, running, bicycling, swimming and rowing.

COURSE OBJECTIVES

The context of the course is an advanced biomechanical study of cyclic sport skills. By the end of the course students will comprehend kinematical and kinetical concepts in this area of sport. They will be able to apply them in practical research projects.

These goals will be reached by:

1. Familiarizing with related research literature.
2. Comprehension of word processing and spreadsheet software programs.
3. Applying theoretical biomechanics concepts to practical research questions.
4. Evaluating and identifying appropriate research methods.
5. Planning and conducting biomechanical research.
6. Analyzing and evaluating the research data.

STUDENTS' RESPONSIBILITIES AND

You are responsible for ensuring that you have successfully completed all course pre-requisites, and that you have not taken an anti-requisite course.

CONDUCT

Unless you have either the requisites for this course or written special permission from the course department to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

The students are expected to participate in all course meetings (class and laboratory sessions) and to take interest in preparation and execution of all laboratory assignments. Class will begin promptly at the time specified at the top of page one of this syllabus. In the event that you must arrive late, please enter the classroom with a minimal disturbance to the class.

The use of cellular phones, pagers, and text-messaging devices is disruptive. If you must bring these with you, please turn them off during class. Failure to do so may result in your being asked to leave.

Class notes will be published prior to course meetings, need to be printed by the students and brought to class, so that no computers or tablets are needed. Excessive talking during class time or eating food is disruptive, disrespectful, and will not be tolerated. Students engaging in such behaviour may be asked to leave the room.

During the exam, only writing materials (like pens, pencils, erasers, paper, and rulers) and calculators are allowed. All other devices and materials (like books, computers, phones etc.) will not be allowed.

Students are expected to always act in an ethical way (proper behaviour to all involved in course; prohibition of plagiarism or cheating; always refer to all sources that are used etc.). Especially, scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the university website:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_under_grad.pdf

Students must write their assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (link to Turnitin.com website: <http://www.turnitin.com>). Computer marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

REQUIRED COURSE TEXTS

- OWL site: <http://webct.uwo.ca/>
- McGinnis, P.M. (2013), Biomechanics of Sport and Exercise. Human Kinetics, Champaign IL.

RECOMMENDED READINGS

Some relevant journals and websites:

- International Journal of Sport Biomechanics; now called: Journal of Applied Biomechanics (Best source for Sport).

- Exercise and Sport Science Reviews (Excellent reviews on selected topics)
 - Journal of Biomechanics (Good general source but quite technical)
- Math review: <http://www.math.com/>
<http://www.purplemath.com>

GRADING

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| 1) Exercise lab assignment – due: Sep. 18 | 2% |
| 2) Home Projects or Quizzes (tba) | 15% |
| 3) Final Examination – (scheduled by Registrar’s Office)
– Length 3 hrs | 33% |
| 4) Laboratory assignments (four laboratory assignments including reports each 12.5%) | 50% |
- Due dates(at respective lab session):
 Lab #1: Oct. 16 – 19
 Lab #2: Nov. 6 – 9
 Lab #3: Nov. 20 – 24
 Lab #4: Dec. 4 – 7

REQUIRED EQUIPMENT AND SUPPLIES

IMPORTANT:

- Students will need a non-programmable calculator with trigonometric functions. Please, bring your calculator to **ALL** lectures and lab sessions along with binder, ruler, protractor, pencil and eraser!
- Each student needs two dedicated memory sticks (500 MB size is enough!) for this class as electronic storage medium on which to record and backup your computer assignments and lab papers. **The memory stick is needed for all lab sessions. Mark the device clearly with your name and always bring it to the lab sessions!!** This memory stick with all the data and a copy of the assignment report has to be handed in for marking the assignments. Since the memory stick will stay with the assignment, the student may need a second memory stick for their continuous work.

LABORATORY SESSIONS

Laboratories will begin the week of September 11th, 2017. The laboratories include:

- Computer Usage: Word Processing, Spread Sheets, Tables, Graphs
- Linear Kinematics and Kinetics
- Angular Kinematics and Kinetics
- Ground Reaction Force
- Fluid dynamics
- Movement Patterns: Walking, running, cycling, swimming and rowing

LEARNING OBJECTIVES

Upon completion of this course students will be able to:

- Identify and delineate theoretical terms, mechanical concepts, and philosophies related to biomechanics of sport motions
- Plan and conduct basic biomechanical laboratory tests (i.e. develop a research question; choose, set-up and use the proper video system for a kinematic analysis; then identify appropriate digitizing systems, know how to digitize a sport movement from video, compute and analyze the kinematic data regarding displacement, velocity and acceleration; present the data in tables or graphs, and use the results to answer the research question)
- Understand and interpret the effects of forces and torques

- Identify, understand and use biomechanical measurement equipment to analyze sport movements
- Understand the mechanics of specific sports that are based on cyclic movements (walking, running, swimming, rowing) and critique sport techniques used by certain athletes based on the synthesis of mechanical concepts, measurement data and sport rules
- Write laboratory assignment reports and presenting them based on scientific norms

**COURSE/
UNIVERSITY
POLICIES**

1. **Lateness/Absences:** Assignments are due at the beginning of class on the assigned due date and will not be accepted late, except under medical or other compassionate circumstances. Electronic submission of assignments will not be accepted (unless otherwise specified) under any circumstances. Submitting a late assignment without appropriate documentation will result in a zero (0) grade. Appropriate documentation for assignments worth less than 10% should be submitted to the instructor. A missed mid-term examination without appropriate documentation will result in a zero (0) grade. The course policy is not to allow make-ups for scheduled midterms, presentations or final exams, nor to assign a grade of Incomplete without acceptable and verifiable medical (or equivalent compassionate) reasons. Acceptable reasons might include hospital stays, serious illness, family emergencies (like serious accidents or illness, death) or similar circumstances.

2. **Written documentation:** Students who require academic accommodation should provide notification and documentation in advance of due dates, examinations, etc. stating specific reasons and dates. Students must follow up with their professors and their Academic Counselling office in a timely manner. Documentation for any request for accommodation shall be submitted directly, as soon as possible, to the Kinesiology Undergraduate Office **not** to the instructor, with a request for relief specifying the nature of the accommodation being requested. This documentation should be obtained at the time of the initial consultation with the physician or walk-in clinic. An "Accommodation Consideration Request Form" found online or in the Kinesiology Undergraduate Office" for **ALL** such accommodation requests must be submitted into the Kinesiology Undergraduate office. These documents will be retained in the student's file, and will be held in confidence in accordance with the University's Official Student Record Information Privacy Policy. See <https://studentservices.uwo.ca/secure/index.cfm> for specific policy and forms relating to accommodation.

3. **Grades:** Where possible assignment objectives and rubrics will be posted on OWL. Should you have a concern regarding the grade you received for an assignment or feel that it is unfair in any way, you must wait 24 hours from the receipt of the assignment to approach the instructor or TA. In doing so, please make an appointment and prepare in writing, with evidence, why you feel your grade is inappropriate. Please be aware that in requesting a grade reassessment, your grade could go up/down/or stay the same. Note that calculations errors (which do occur!) should be brought to my attention immediately.

15% of course grades will be posted by the last day to drop a course.

4. **Formatting** (*as recommended by the course instructor*): example-APA style is the approved style of writing for all assignments produced for this course. Please refer to Western University Library webpage for information on citation style and format or consult the APA publication manual: Publication manual of the American Psychological Association (6th ed.). (2009). Washington, DC: American Psychological Association.
5. According to the **Examination Conflict policy**, “A student who is scheduled to write more than two examinations in any 24-hour period may request alternative arrangements through the office of their Academic Counsellor.”
6. Audio and/or videotaping of lectures is not permitted unless approval has been sought from the instructor in advance.

STUDENT CODE OF CONDUCT

The purpose of the Code of Student Conduct is to define the general standard of conduct expected of students registered at Western University, provide examples of behaviour that constitutes a breach of this standard of conduct, provide examples of sanctions that may be imposed, and set out the disciplinary procedures that the University will follow. For more information, visit

<http://www.uwo.ca/univsec/board/code.pdf>

ENGLISH PROFICIENCY FOR THE ASSIGNMENT OF GRADES

Visit the website <http://www.uwo.ca/univsec/handbook/exam/english.pdf>

SUPPORT SERVICES

There are various support services around campus and these include, but are not limited to:

1. Student Development Centre -- <http://www.sdc.uwo.ca/ssd/>
2. Student Health --
<http://www.shs.uwo.ca/student/studenthealthservices.html>
3. Registrar's Office -- <http://www.registrar.uwo.ca/>
4. Ombuds Office -- <http://www.uwo.ca/ombuds/>


Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

PRELIMINARY TIMETABLE:

2017

SEP/OCT

KIN 3353

MON		WED
 <h2 style="color: purple;">Kinesiology 3353</h2> <p>Biomechanical Analysis of Human Locomotion</p>		
<p>11</p> <p>Introduction, Formalities; Usage of Computers, Tables, Graphs; Explain Exercise Lab</p> <p>⇒ See Course Website</p>	<p>Exercise Lab: REPORT PREPARATION</p> <p>Word Processing, Spreadsheet, Tables, Graphs</p>	<p>13</p> <p>Physics and Mathematics Fundamentals; Coordinate System; Projectiles</p> <p>⇒ See Course Website; McGinnis, Introduction</p>
<p>18</p> <p>Exercise Lab Due!!!</p> <p>Lab Organization, Report and Journal Writing</p> <p>⇒ See Course Organization</p>	<p>LAB #1: Data collection</p>	<p>20</p> <p>Biomechanics, Kinematics & Kinetics Position, Displacement, Velocity, Acceleration</p> <p>⇒ McGinnis: Introduction, Chapter 2</p>
<p>25</p> <p>Position, Displacement, Velocity, Acceleration</p> <p>⇒ McGinnis: Chapter 2</p>	<p>LAB #1: Data reduction</p>	<p>27</p> <p>Projectile Motion</p> <p>⇒ McGinnis: Chapter 2</p>
<p>2</p> <p>Introduction Kinetics: Newton's Laws; Ground Reaction Force</p> <p>⇒ McGinnis: Chapter 1 & 3</p>	<p>LAB #1: Write-up</p>	<p>4</p> <p>Free Body Diagram; Equation of Motion</p> <p>⇒ McGinnis: Chapter 3</p>
<p>NOTES:</p> <ul style="list-style-type: none"> - Class presentations will always be published on OWL ahead of time - Print out presentation and mark possible questions - Take notes during class 		

2017

KIN 3353 OCT/NOV

MON		WED
9		11
Thanksgiving	FALL READING WEEK	
16	<p>Internal & External Forces; Centre of Gravity & Influences on GRF ⇒ McGinnis: Chapter 1 & 3</p> <p>Lab Report #1 Due!!! LAB #2: Data collection</p>	18
23	<p>Connecting Kinetics and Kinematics; Calculation of Velocity and Acceleration ⇒ McGinnis: Chapter 2 & 3</p> <p>LAB #2: Data reduction</p>	25
30	<p>Angular Kinetics; Torques, Moment of Force; Centre of Gravity; CoG Models ⇒ McGinnis: Chapter 5 & 7</p> <p>LAB #2: Write up</p>	1
		NOTES:

2017

KIN 3353 NOV/DEC

MON		WED
6	<p>Work, Power & Energy ⇒ McGinnis: Chapter 4</p> <p>Lab Report #2 Due !!! LAB #3: Data collection</p>	8
13	<p>Fluid Dynamics Pressure, Drag & Lift ⇒ McGinnis: Chapter 8</p> <p>LAB #3: Data reduction & Write up</p>	15
20	<p>Mechanics of Biological Materials ⇒ McGinnis: Chapter 9</p> <p>Lab Report #3 Due!!! LAB #4: Data collection</p>	22
27	<p>Loads on the body and its Adaptations ⇒ McGinnis: Chapter 9, 10 & 11</p> <p>LAB #4: Data reduction & Write up</p>	30
4	<p>Selected topics of Biomechanics in Sport – Summary Students' Interest in Sport-Biomechanics</p> <p>Lab Report #4 Due!!!</p>	6
<p>EXAM PERIOD Dec. 10 - 21, 2017</p>		<p>Conclusions and Questions Last day of classes</p>
NOTES:		