

THE UNIVERSITY OF WESTERN ONTARIO
HEALTH STUDIES 3091A: BIOMECHANICS
2010

Lecturer: Dr Jim Dickey, jdickey@uwo.ca
x87834

Lectures: Tuesdays, 1:30 – 2:30 pm., TC 203
Thursdays 1:30 – 2:30 pm., TC 141

Teaching Assistant: Amanda McIntyre amcint7@uwo.ca

Office Hours: arranged with the instructor or TA as required. Email to arrange a meeting time.

Prerequisite: RESTRICTED TO YRS 3 & 4 BHSC. TOPIC: BIOMECHANICS.

Mandatory Course Resources:

Lecture notes will be distributed through WebCT

Course Description: This course will explore and discuss the application of biomechanical principles to analyze, understand and evaluate human movement. The overall aim of the course is to stimulate an appreciation for the importance of biomechanical principles. There are 2 lecture hours per week. Demonstrations to reinforce the material will be built into lecture times

Course Objectives:

1. To provide students with an understanding of basic biomechanical principles.
2. To give students an opportunity to explore how mechanics of the body changes in response to stimuli such as training and ageing.
3. To enable students to critically evaluate and discuss articles related to biomechanics.
4. To prepare students for post-graduate professional programs (OT, PT, Medical School) that include biomechanics.

COURSE CONTENT

Introduction

- Definitions, relevance and applications of biomechanics
- Review of physics and math

The Human Biological System

- Strength of human tissues
- Skeletal muscle mechanics
- Anthropometry and body segment data

Statics

- static equilibrium
- free body diagrams
- bone-on-bone forces (compression, shear, etc.)

Kinematics (motion that results from forces)

- linear vs. angular motion
- quantifying segment motion
- absolute vs. relative motion

Kinetics (forces that cause motion)

- muscle mechanics revisited
- $F = ma$ approach
 - Dynamic equilibrium
 - inverse vs. forward solutions
 - free body diagrams and bone-on-bone forces revisited

Demonstrations

- Demonstrations will complement and reinforce the lecture material, and will be built into the lecture timeslots.

Background Readings: Note that all of these resources are available through the library or through WebCT

- Terminology/Overview
 - Rodgers, M.M., Cavanagh, P.R. Glossary of Biomechanical Terms, Concepts, and Units. *Physical Therapy*, 64, 1886-1902, 1984.
- Journal Article Critique:
 - Lunsford, T.R., Mse, C.O., Lunsford, B.R. How to Critically Read a Journal Research Article. *Journal of Prosthetics and Orthotics*, 8, 24-31, 1996.
 - Pieper, B. Basics of critiquing a research article. *Journal of ET nursing: official publication, International Association for Enterostomal Therapy*, 20(6):245-250, 1993.
- Bone, Cartilage and Fracture Mechanics:
 - McGee, A.M., Qureshi, A.A., Porter, K.M.. Review of the biomechanics and patterns of limb fractures. *Trauma*. 6: 29-40, 2004.
- Muscle Mechanics:
 - Knudson, D. Chapter 3: Anatomical Description and Its Limitations. In: *Fundamentals of Biomechanics*. 2nd Edition, Boston, MA : Springer Science+Business Media, 2007 (available online through the library).
 - Knudson, D. Chapter 4: Mechanics of the Musculoskeletal System. I In: *Fundamentals of Biomechanics*. 2nd Edition, Boston, MA : Springer Science+Business Media, 2007 (available online through the library).
- Free-Body Diagrams:
 - <https://repo.vanth.org/portal/Members/rroselli/free-body-diagram-assistant>
- Linear and Angular Kinematics and Kinetics:
 - Knudson, D. Chapter 5: Linear and Angular Kinematics. In: *Fundamentals of Biomechanics*. 2nd Edition, Boston, MA : Springer Science+Business Media, 2007 (available online through the library).
 - Knudson, D. Chapter 6: Linear Kinetics. In: *Fundamentals of Biomechanics*. 2nd Edition, Boston, MA : Springer Science+Business Media, 2007 (available online through the library).
 - Knudson, D. Chapter 7: Angular Kinetics. In: *Fundamentals of Biomechanics*. 2nd Edition, Boston, MA : Springer Science+Business

Media, 2007 (available online through the library).

- Standing Balance and Gait:
 - Winter, D.A. Human Balance and Postural Control during Standing and Walking. *Gait & Posture*. 3: 193-214, 1995.
 - Whittle, M.W. Clinical gait analysis: A review. *Human Movement Science*, 15, 369-387, 1996.

EVALUATION

First Midterm Exam (in class October 14th)	15%
Second Midterm Exam (in class November 18th)	20%
Journal Article Critiques (Nov 2 nd and Dec 2 nd)	15%
Final Exam	50%

JOURNAL CRITIQUES:

You will prepare two journal critiques, on biomechanics research articles of your choice, during the term. Note that the articles must be focused on some aspect of biomechanics and must be pre-approved by Dr Dickey. Each student must pick unique papers –the same paper can not be selected by more than one student. The journal critiques will be short (2 pages max) and include a summary paragraph describing the general approach and findings of the paper. The remainder of the content will comprise a list of pros and cons which describes the feature and includes some insight into why you have identified this as a pro/con, or what would be better. The two background readings provide some background on critical reading of journal articles, and the “journal club” class experiences will provide additional insight as well. You must attach a printout of your journal article along with the two pages of your journal critique.

LATE MATERIAL

Non-medical absences from the midterms or the final exam will be dealt with on a case by case basis and may receive a zero grade, reweighting of other grade components or rewriting/resubmission. Late assignments, such as the Journal Critiques, will be subject to a 10% per day penalty.

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth less than 10% of their final grade will be dealt with on a case by case basis and may receive a zero grade, reweighting of other grade components or rewriting/resubmission.

PLAGIARISM

Students must write their assignments in their own words. Whenever students

take an idea, or a passage from another author/site, they must acknowledge their debt both by using quotation marks where appropriate (ie for direct quotations) 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

(<http://www.turnitin.com>).

STUDENTS' RESPONSIBILITIES AND CONDUCT

The students are expected to participate in all course meetings. During any of the course meetings, students are NOT allowed to eat, use electronic devices (like phones, Blackberry, cameras, audio recorders etc.) or to use the internet for communication (like e-mail, MSN etc.). During quizzes and 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 following Web site:

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

SUPPORT SERVICES

Should you need to access student support services, please refer to the Office of the Registrar website:

(<http://www.registrar.uwo.ca/index.cfm/student-services-organizational-units/student-services-support-group/>) or the student services website:

<https://studentservices.uwo.ca/secure/webteam.cfm> , or the School of Health

Studies website (http://www.uwo.ca/fhs/health_studies/index.html).