

PE 8450
ADVANCED BIOMECHANICS
Course Outline

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Course Description

This course involves the study of the mechanical principles, analytical methods, and instrumentation systems involved in the analysis of movement.

Texts

- a) Enoka, R.M. (2002). Neuromechanics of human movement. Third Edition. Human Kinetics Publ.
- b) Class Handouts (available at UNO Bookstore)
- c) Readings as assigned

Course Objectives

At the conclusion of this course each student should be able to:

1. Find and utilize sources of information concerning biomechanical research.
2. Describe the systems of instrumentation used in biomechanical research.
3. Apply anatomical and mechanical principles to the description and analysis of human movement.

Potential Student Benefits

1. Increased vocabulary and knowledge of biomechanics allows the student to read, analyze and understand articles and research related to movement analysis.
2. Increased ability to analyze movement allows the student to be more critical of movement taught, the methods of instruction, and the resulting performance.
3. Increased knowledge of mechanical and anatomical principles allows the student to be more critical in evaluating performance and making corrections in movement patterns in order to avoid injury and improve performance.

Evaluation

1. Examinations and written assignments - 60%
2. Project - 200 pts OR 30%.
* Note: 10% of the grade assigned (20 points) per day as a late penalty
3. Power Point Presentation - 10%

This is due at the same time of your project and has the same late penalty fee. Your project will also be submitted to me as Power-Point presentation. In this presentation you will describe your project in such a way that you ask money from a federal agency (NIH, NSF, etc.) to fund your study. So, imagine that you were just invited to Washington to present your proposal. You have to convince the government that you deserve to get money to actually do your study. No more than 20 slides per presentation.

The final letter grade will be determined on the basis of total points for the semester. The grade scale will not be higher than the following percentages of the total points possible for the semester.

A+	= 97.5% - 100%
A	= 92.5% - 97.4%
A-	= 90.0% - 92.4%
B+	= 87.5% - 89.9%
B	= 82.5% - 87.4%
B-	= 80.0% - 82.4%
C+	= 77.5% - 79.9%
C	= 72.5% - 77.4%
C-	= 70.0% - 72.5%
D+	= 67.5% - 69.9%
D	= 62.5% - 67.4%
D-	= 60.0% - 62.4%
F	= 0.0% - 59.9%

Skills and Knowledge Expected Upon Entering the Course

1. Reading and Writing skill
2. Knowledge of anatomical structure
3. Knowledge of basic physics, algebra and trigonometry
4. Basic understanding of biomechanics

Statement of Risk

Inherent risks are associated with participation in any form of physical activity. These risks include but are not limited to: heart attack, heat illness, head injuries, bone fractures, dislocations, sprains, strains, superficial cuts, and bruises. These injuries may be caused by poor physical condition, accidental falls, misuse of equipment, unexpected contact, upset balance, or being hit by a projectile (e.g., ball, frisbee, hoop). If you sustain an injury in class, regardless of the severity, report it to your instructor immediately. If you are aware of any condition that will increase your chance of illness or injury by participation in vigorous physical activity please talk to your instructor. **In accordance with the provisions of the Americans With Disabilities Act (ADA), if you require any special assistance or adaptations to participate in this course, please contact your instructor immediately.**

IMPORTANT DATES TO REMEMBER

*Work to be completed by class time

Date Topic and Work Due

- | | |
|---------------|---|
| Sept 9 | * Have Completed: Introduction for the project with a xerox copy. |
| Sept 23 | * Exam 1 |
| Oct 7 | * Have Completed: Review of Literature and Methods for the project with xerox copy.
* Schedule data collection |
| OCT 21 | NO CLASSES |
| Oct 28 | * Data collection completed |
| Nov 4 | * Exam 2 |
| Dec 2 | * Have Completed: Project is due with a xerox copy |
| Dec 9 | Final exam |

ADVANCED BIOMECHANICS

Semester Project

200 pts

At the present time, videography (video camera motion analysis) and dynamography (force platform) are the most common type of biomechanical research. This project is designed to give you the opportunity to analyze your own data, and by applying anatomical and mechanical principles to evaluate the activity you choose.

1. Each student must:
 - a. Decide on an activity to study. This activity has to be performed in the HPER Biomechanics Laboratory and has to incorporate both the force platform and the video camera (electromyography and accelerometers are optional).
 - b. Review the literature on your chosen activity. The review should include information on the activity itself - "How to" articles, research articles, information on videotaping procedure and force measurement procedure, and video and force data analysis procedures.
 - c. Decide what you want to determine from the videotape and the force data. This might include:

VIDEO (kinematic examples): linear velocity or acceleration of a ball, hand or performer; angular velocity and/or acceleration of any joint of the body; path of the COG during a movement; path of a segmental end point; or other useful information.
Get as much useful information as you can from your video data.

FORCE (kinetic examples): vertical, medial-lateral, or anterior-posterior force curves, impulse information, discrete points such as impact peaks; or other useful information.
 - d. You will collect data from 2 subjects, a skilled performer and an unskilled performer (you must be one of them) doing the same activity. A comparison of the two performers must be made.
 - e. Secure any equipment necessary for the performance of the activity and the background.
NOTE: The graduate assistant will do the actual data collection
 - f. View the video and the force data files after the collection period has been completed.
 - g. From the video, work with the graduate assistant in getting your data from the data acquisition system.
 - h. Compute the values you determined were important and generate the graphs that you think are necessary for your analysis and activity evaluation.
 - i. Report the information you computed, discuss the results, and draw conclusions where warranted.
 - j. Write up your results in the following form.
 - A. Title Page
 - B. Table of Contents Page
 - C. Table of Figures Page
 - D. Introduction - Chapter I

- E. Review of Literature - Chapter II
- F. Methods - Chapter III
- G. Results: Kinematic Analysis - Chapter IV
- H. Results: Kinetic Analysis - V
- I. References
- J. Any Appendices if needed

2. Introduction

The introduction should include at least a definition and a general description of the activity chosen, the reason for choosing this activity (rationale for the study), and the general plan for analyzing the activity including a description of the phases of the activity and the comparisons that are planned. In addition, the activity should be classified based on the Higgins model and the analysis of the activity based on the Kondraske model.

3. Review of Literature

The review of literature should be in depth and well organized and include an introductory paragraph describing the sections that will follow and a summary paragraph for each section and the entire review. It should include technique or "how to" articles, research articles pertinent to the activity, articles on video and force data collection and analysis. The review of literature should support your study and enhance researchers knowledge

To include all pertinent information organize this chapter in four sections: General articles about the activity (injuries, population statistics, etc.), Kinematics (articles on videography related to your activity), Kinetics (articles on dynamography related to your activity), Methodology ("How to" articles).

In the Kinematics and Kinetics section critically review all the pertinent studies. For each study include brief statements regarding: 1) purpose, 2) subjects, 3) results, and 4) conclusions. It is important to state actual results and statistical values, e.g. the 10% decrease in blood pressure was significant ($p < .05$). Studies should all be "tied" together in the review. In the Methodology section review all of your studies by including brief statements regarding only their methods.

4. Methods

The Methods chapter should spell out the procedures used to collect the data for the activity and analyze it. It should also include a description of the subjects and equipment used. To include all pertinent information organize this chapter in four sections: Subjects, Experimental Procedure, Instrumentation, and Parameters.

5. Results: Kinematic Analysis

The Kinematic Analysis chapter should include all your videography (kinematics) information. Specifically, incorporate analysis of joint and segment movement of each performer for each phase, a discussion of pertinent anatomical factors, a comparison of the two performers and a comparison of each performer to the literature values. If used, incorporate electromyography here.

6. Results: Kinetic Analysis

The Kinetic Analysis chapter should include all your dynamography (kinetics) information.

Specifically, a discussion of pertinent mechanical factors, a comparison of two performers and, a comparison of each performer to the literature for each phase of the activity. If used, incorporate info from other transducers (accelerometers) here.

7. Appendices
Raw data should be put in an appendix.
8. Reference Page
Cite all references and include a reference page.
9. Style
The American Psychological Association (APA) style is required. See an APA style manual if in doubt about this procedure.
10. Additional Information
 - a. Every activity is so different they each require a separate plan for analysis. If you have any questions concerning the activity or analysis see me.
 - b. All work must be turned in when due and must be typed neatly. **TWO** copies of each paper are to be turned to me. One of them has to be an electronic copy. I will return to you the hardcopy with my comments. The hardcopy must be submitted in a three ring binder. When submitting the introduction, a title page, table of contents page, table of figures page, and reference page must be included. When submitting each subsequent section, all previous sections must be submitted and the table of contents, table of figures, and reference page must be revised as necessary.

Point Values for each Section

Introduction	20
Review of Literature	40
Methods	40
Kinematic Analysis	50
Kinetic Analysis	<u>50</u>
Total	200

* NOTE: 20 points per day as a late penalt

Spacing

*Double space all lines without exception.

Margins

*Leave 1-11/4" at top, bottom, right, and left of every page

*Pica = 60 characters

*Elite = 72 characters

Paragraphs

*Indent 5 spaces with each new paragraph.

*Type remaining lines to uniform left.

Pages

*Cover sheet

*Abstract

*Pages of Text

*References

*Tables

Page Numbering

*Number them consecutively

*Begin with abstract

*Use arabic numerals

*Place in right hand corner

Spacing with Punctuation

*One after commas and semicolons

*Two after colons (except ratios)

*Two after periods

*One after periods of initials in personal names

*No spaces after internal periods in abbreviations (i.e., a.m., U.S.)

Quotations

*Fewer than four lines part of regular paragraph with quotation marks

*Longer than four lines block without quotation marks. Do not indent.

*Indent for succeeding paragraphs if there are any.

Abstract

*Begin on new page

*Type the word "Abstract"

*Capital and lower case

*Centered

*Single paragraph

*Blocked format (no indentation)

Text pages

*Begin on new page

*Type title at top of page - capital and lower case

*Double space

Reference List

*Cite only work that supports article

*Begin on new page

*Type the word "References"

*Capital and lower case

*Centered

*Double space

*Start entry flush at left

*Second and succeeding lines of each entry indent three spaces

Examples of Reference Citations

Journal

Last Name, Initials. (Year). Title. Journal Name, Volume, pages.

*Title - Capitalize first letter only.

*Journals upper and lower

*Two authors: Last Name, Initials, & Last Name, Initials

*Example:

Smith, J.A. & Jones, R.T. (1993) The effects of meditation on reducing stress levels. Journal of Health Promotion, 10, 234-237.

Book

Last Name, Initials. (Year) Book Title, City, State: Publisher.

*Book title - Capitalize first letter only.

*Example:

Emmerson, R.A. & Dustman, R.E. (1992) Administration of urban recreation programs, Winona, MN: University Press, Inc.

Reference Citations in Text

*Author, date, method of citation

*Examples:

Smith (1990)

(Smith, 1990)

In 1990, Smith compared

*Two authors - cite both names every time. Use word "and" if not in parenthesis and "&" if in parenthesis.

*More than two - cite all authors first time. Then first and words "et al."

*Examples:

(Williams et al., 1990)

Williams et al. (1990)

*Arrange alphabetically

*Separate by semicolons

*Example:

(Brown & Smith, 1995; Smith, 1992; Williams, 1991)

*Put period after citation if not a quote.

*Always give page numbers for quotations.

Example: (Jones, 1989, pp. 10-18)

* et al., may be used the first time if six or more authors.