KINE 5350 Applied Biomechanics
Spring 2019

Instructor:	Dr. Mark Ricard	Office Location:	MAC 230
E-Mail:	ricard@uta.edu	Office Phone:	(817) 272-0764
		Biomechanics Lab Phone:	(817) 272-9185

Course Website: elearn.uta.edu

Office Hours: By Appointment

Location & Time: MAC 223, Wednesday 5:00 – 9:50 PM

Course Description: Application of Newtonian mechanics to human movement analysis. Biomechanical models using three-dimensional video and force plate data will be used to analyze human movement.

Required Textbook: Research Methods in Biomechanics, 2nd ed, (2013), Human Kinetics: Champaign, IL, ISBN-13: 9780736093408.

Objectives of the Course:

The student should be able to:

1. Demonstrate knowledge of research techniques in force plate analysis by collecting, analyzing and writing a paper on force plate data collection and answering questions pertaining to force plate techniques on a written exam.
2. Demonstrate knowledge of research techniques in video analysis by collecting, analyzing and writing a paper on video data collection and answering questions pertaining to video techniques on a written exam.
3. Demonstrate knowledge of research techniques in isokinetic force analysis by collecting, analyzing and writing a paper on isokinetic force data collection and answering questions pertaining to isokinetic force techniques on a written exam.
4. Demonstrate knowledge of inverse dynamics by computing joint reaction forces and muscle moments.
5. Demonstrate knowledge of research techniques in EMG force and EMG fatigue relationships by collecting, analyzing and writing a paper one EMG force/fatigue.

Course Content:

Selected Readings on the following topics:
Smoothing and filtering of biomechanical data
Ground reaction forces in running
Vertical jump ground reaction forces
Postural Control using force plate
Electromyographic data collection and analysis
Video data collection methods
Isokinetic data collection and analysis
Power and work dynamometers

Use of goniometers, accelerometers and force transducers

Grading:

Grades in this course will be based on the following percentages:

Homework	10%
Midterm	45%
Final Exam	45%

Attendance Policy: At The University of Texas at Arlington, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this course I will allow students to attend class at their own discretion.

Make-up Exams: If you miss an exam due to illness or a planned trip it is your responsibility to arrange a make-up exam.

Expectations for Out-of-Class Study: Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry

Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online

Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: for semester-long courses**,** a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located at the rear of the classroom and at the front right & left of classroom. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.
http://www.uta.edu/campus-ops/ehs/fire/Evac_Maps_Buildings.php
http://www.uta.edu/police/Evacuation Procedures.pdf)

Students should also be encouraged to subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at https://mavalert.uta.edu/ or https://mavalert.uta.edu/register.php

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.

The IDEAS Center (2nd Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Library Home Page library.uta.edu

Resources for Students

Academic Help

Academic Plaza Consultation Services library.uta.edu/academic-plaza

Ask Us ask.uta.edu/

Library Tutorials library.uta.edu/how-to

Subject and Course Research Guides libguides.uta.edu

Subject Librarians library.uta.edu/subject-librarians

Resources

A to Z List of Library Databases libguides.uta.edu/az.php

Course Reserves pulse.uta.edu/vwebv/enterCourseReserve.do

FabLab fablab.uta.edu/

Special Collections library.uta.edu/special-collections

Study Room Reservations openroom.uta.edu/

Teaching & Learning Services for Faculty

Copyright Consultation library-sc@listserv.uta.edu

Course Research Guide Development, Andy Herzog amherzog@uta.edu or your subject librarian

Data Visualization Instruction, Peace Ossom-Williamson peace@uta.edu

Digital Humanities Instruction, Rafia Mirza rafia@uta.edu

Graduate Student Research Skills Instruction, Andy Herzog amherzog@uta.edu or your subject librarian

Project or Problem-Based Instruction, Gretchen Trkay gtrkay@uta.edu

Undergraduate Research Skills Instruction, Gretchen Trkay gtrkay@uta.edu or your subject librarian.

	---------- Tentative Course Schedule ----------
1-16	Analog – Digital Conversion Laboratory Device Introduction Collect Pezzack similar data. Create a Matlab function to compute derivatives and plot position, velocity & acceleration.
1-23	Chapter 1 Wood, and Pezzack PDFs Analyze position, velocity & acceleration of our Pezzack data. Cavanagh: Ground reaction forces Munro: Ground reaction force Wood Smoothing & Filtering Pezzack Data
1-30	Read Chapter 3, Anthropometrics Read pages 92 – 102, Cavanagh PDF, Munro PDF Introduction to Force Plate Methods AMTI Force Plate
2-6	Read Chapter 5 Link Segment Model Introduction 2D Video Data Collection Techniques: Capture Volume & Camera Calibration. Vertical Jump Data Collection in 2D
2-13	Chapter 5 Link Segment Model II Interpretation of Joint Moments Link Segment and Biodex Torque
2-20	Chapter 2 and 7 3D Video Data Collection Techniques: Model Selection & Marker Tracking
2-27	Chapter 2 and 7 3D Video Data Collection Techniques: Model Selection & Marker Tracking
3-6	Data Analysis using Visual 3D
3-9 to 3-17	Spring Break
3-20	Read Chapter 8 EMG Methods Deluca, Merletti EMG – Force/Fatigue Relationships
3-27	Biodex Data Collection & Analysis, Read p 104-108 Torque-Angular Velocity (Force – Velocity) Torque – Angle (Force – Length)
4-3	Mid Term Exam
4-10	Research Project Data Collection
4-17	Research Project Data Collection
4-24	Research Project Data Analysis
5-3	Research Presentations
5-10	Final Exam

Selected Readings

Bosco, C., Belli, A., Astrua, M., Tihanyi, J., Pozzo, R., Kellis, S., et al. 1995. A dynamometer for evaluation of dynamic muscle work. *Eur. J. Appl. Physiol., 70*, 379-386.

Cavanagh, P.R., & Lafortune, M.A. 1980. Ground reaction forces in distance running. *J. Biomech., 13*, 397-406.

Cormie, P., McBride, J.M., & McCaulley, G.O. 2008. Power-time, force-time, and velocity-time curve analysis during the jump squat: Impact of load. *J. Appl. Biomech., 24*(2).

De Luca, C.J. 1997. The use of surface electromyography in biomechanics. *J. Appl. Biomech., 13*, 135-163.

Hasan, S.S., Lichtenstein, M.J., & Shiavi, S.G. 1990. Effect of loss of balance on biomechanics platform measures of sway: influence of stance and method for adjustment. *J. Biomech., 23*(8), 783-789.

Komi, P.V., & Bosco, B. 1978. Utilization of stored elastic energy in leg extensor muscles by men and women. *Med. Sci. Sports, 10*(4), 261-265.

LaRoche, D.P., Cremin, K.A., Greenleaf, B., & Croce, R.V. 2010. Rapid torque development in older female fallers and nonfallers: A comparison across lower-extremity muscles. *J. Electromyogr. Kinesiol., 20*(3), 482-488.

Lay, A.N., Hass, C.J., Richard Nichols, T., & Gregor, R.J. 2007. The effects of sloped surfaces on locomotion: An electromyographic analysis. *J Biomech, 40*(6), 1276-1285.

Merletti, R., Rainoldi, A., & Farina, D. 2001. Surface electromyography for noninvasive characterization of muscle. *Exerc Sport Sci Rev, 29*(1), 20-25.

Moritani, T., Nagata, A., & Muro, M. 1982. Electromyographic manifestations of muscular fatigue. *Med. Sci. Sports Exerc., 14*(3), 198-202.

Munro, C.F., Miller, D.I., & Fuglevand, A.J. 1987. Ground reaction forces in running: A reexamination. *J. Biomech., 20*(2), 147-155.

Pezzack, J.C., Norman, R.C., & Winter, D.A. 1977. An assessment of derivative determining tecniques used for motion analysis. *J. Biomech., 10*, 377-382.

Ricard, M.D., Ugrinowitsch, C., Parcell, A.C., Hilton, S., Rubley, M.D., Sawyer, R., et al. 2004. Effects of rate of force development on EMG amplitude and frequency. *Int J Sports Med, 25*, 1-5.

Vaughan, C.L., Davis, B.L., & O'Connor, J.C. 1999. *Dynamics of Human Gait*. Cape Town: Kiboho.

Wood, G.A. 1982. Data smoothing and differentiation procedures in biomechanics. In R.J. Terjung (Ed.), *Exerc. Sport Sci. Rev.* (Vol. 10, pp. 308-362). Lexington: Collamore Press.