**MCMASTER UNIVERSITY**

**Department of Kinesiology**

**Kinesiology 4A03: Advanced Biomechanics**

**Term** Fall 2015

**Instructor:** Jim Dowling

**Office:** IWC 206

**Telephone:** ext 23572

**E-mail :** dowlingj@mcmaster.ca

**Office Hours:** TBA

**DESCRIPTION:**

This course is an In-depth study of the mechanics of human movement including the topics of multi-linked segment analysis, individual muscle force estimation, 3-D forces and moments, fluid resistance, optimization, efficiency and power flow.  The laboratory component covers the scientific method, data acquisition, instrumentation and numerical methods

**OBJECTIVES:** To further the understanding of the biomechanics of human movement by:

1) Introducing the concept of multi-linked segment analysis of the musculoskeletal system for whole body motion analysis.

2) Examining the various methods of kinematic, kinetic and electromyographical data collection and data processing.

3) Estimating individual muscle forces and examining power flow and human movement efficiency.

4) Using forward dynamics and simulation of human movement.

**TOPICS TO BE COVERED:**

- Kinematic and kinetic data acquisition methods

- Scientific method, measurement chain, properties of transducers

- A/D conversion, spectral analysis, filtering, precision and accuracy

- Review of Free Body Diagrams and Static Equilibrium

- Review of Dynamic Equilibrium, Joint Reaction Forces and Net Joint Moments

- Linked Segment Mechanics and interpretation of moments during gait

- Joint Reaction Forces versus Bone-on-Bone Forces

- Review of Work, Energy, Power

- A Physiologist's view of Human Efficiency

- Energy Transfer and Power Flow (interpretation of muscle power during gait)

- A Biomechanist's view of Efficiency of Human Movement

- Review of Electromyography and Muscle Mechanics

- Prediction of Individual Muscle Forces using EMG

- EMG and Muscular Fatigue

- Prediction of Individual Muscle Forces using Optimization

- Inter-segmental Dynamics (Forward Solutions and Computer Simulation)

**EVALUATION**: Midterm Exam ..........……30%

Lab Exam ………………..20%

Final Examination.......…...50%

**POLICY REGARDING DEFERRED TESTS AND EXAMS**

Students who miss the final exam for legitimate reasons such as illness may be allowed to write a deferred or "make-up" test. In all instances, appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science.

Students who miss a Registrar-scheduled final exam can apply to the Associate Dean’s office for permission to write in the deferred final exam schedule. In all cases, appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science, for consideration of deferred examination permission. Under no circumstances will the instructor re-schedule a final exam for individual students.

**ACADEMIC INTEGRITY**

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences (e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript reading "Grade of F assigned for academic dishonesty", and/or suspension or expulsion from the university). It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf>

The following illustrates only three forms of academic dishonesty:

• Plagiarism (e.g. the submission of work that is not one's own or for which other credit has been obtained),

• Improper collaboration in group work.

• Copying or using unauthorized aids in tests and examinations.

**MODIFICATIONS TO COURSE**

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

**FEEDBACK**

It really helps us improve our services when we hear from our students, faculty and staff about what we can do better. A feedback process brings to our attention situations in which we may not have adequately considered accessibility and allows us to better plan for accessibility in the future.