TO: The Engineering Faculty

FROM: The Faculty of the School of Mechanical Engineering

DATE: July 22, 2003

RE: New Course Approval ME 577 Human Motion Kinetics

The Faculty of the School of Mechanical Engineering has approved the following course for a permanent course number. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ME 577 **Human Motion Kinetics**, Sem. 2 (alternate years), Class 3, cr. 3. Prerequisite: ME 352, or equivalent, or instructor permission.

Study of kinetics related to human motion. Review of human anatomy and anthropometric data. Planar and three-dimensional kinematic analysis of gross human motion. Detailed kinematic studies of human joints. Newton-Euler and Lagrangian methods for joint torques. Muscle force and power analysis. Studies on walking, jumping, cycling and throwing exercises.

Reason: This course provides a foundation for students wanting to learn how to analyze the kinematics and kinetics of gross human motion. This course is intended to provide the dynamics and force analysis background needed for ME and BME students to engage in academic and industrial research and design activities in the growing areas of prosthetics, artificial joints and biomechanics in general.

The course has been offered three times with enrollments of 15 students in spring 1999, 4 students in spring 2001, and 15 students in spring 2003.

Details of the course are provided below in the one-page ABET document and course map.

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E. Daniel Hirleman, Head
School of Mechanical Engineering

ME 577 – Human Motion Kinetics
Spring Semester

2002-2003 Course Desc.: ME 577 Human Motion Kinetics, Sem. 2, Class 3, cr. 3. Prerequisite: ME 352 (Machine Design I), or equivalent, or instructor permission.

Study of kinetics related to human motion. Review of human anatomy and anthropometric data. Planar and three-dimensional kinematic analysis of gross human motion. Detailed kinematic studies of human joints. Newton-Euler and Lagrangian methods for joint torques. Muscle force and power analysis. Studies on walking, jumping, cycling and throwing exercises.

Textbook: V.M. Zatsiorsky, *Kinematics of Human Motion*, Human Kinetics, 1998.
V.M. Zatsiorsky, *Kinetics of Human Motion*, Human Kinetics, 2002.

Reference: D.A. Winter, *Biomechanics and Motor Control of Human Movement, Second Edition*, Wiley-Interscience, 1990.

Coordinators: C.M. Krousgrill and G.R. Pennock

Course Objectives:

1. Provide an introduction into the study of the *physics of human motion*.
2. Relate studies of human motion to design of *machine-human interfaces*.
3. Provide background for *experimental methods* in the study of human motion.

Prerequisites by Topic: Planar kinematics of mechanisms, static and dynamic force analysis.

Computer Usage: Matlab problems on some homework sets.

Laboratory Projects: none

Assessment Methods: Course grade based on: 20% weekly homework, 20% term paper, 30% midterm exam, 30% final exam.

Prepared by:_____ July 2003
C.M. Krousgrill

ME 577
HUMAN MOTION KINETICS

Course Objectives

1. To provide an introduction into the study of the *physics of human motion*.
2. To relate studies of human motion to *design of machine-human interfaces*.
3. Provide background for *experimental methods* in the study of human motion.

Overview of Human Anatomy
(3 wks)

1. Skeletal system
2. Muscular system
3. Anthropometric data

Kinematics of Human Motion
(6 wks)

1. Planar displacement analysis
2. Planar velocity analysis
3. Planar acceleration analysis
4. Three-dimensional velocity and acceleration analysis
5. Detailed kinematics of human joints

Kinetics of Human Motion
(6 wks)

1. Newton-Euler formulation
2. Lagrangian formulation
3. Jacobian methods for joint torque analysis
4. Force and power analysis in muscles
5. Case studies