

# BIOMECHANICS (BMCH)

## Biomechanics Graduate Courses

### **BMCH 8000 SEMINAR IN BIOMECHANICS (0 credits)**

Required non-credit course for graduate students in biomechanics. Intended to familiarize the graduate student with current ongoing biomechanical research at UNO and other institutions. The seminar will additionally include topics focusing on professional development, job and educational opportunities, and biomechanical methodologies.

**Prerequisite(s):** Must be a student in BMCH graduate program. Not open to non-degree graduate students.

### **BMCH 8006 BIOMATERIALS (3 credits)**

Students will learn the classification, properties, characterization methods, body interactions, applications, and design principles of biomaterials. (Cross-listed with BMCH 4000).

### **BMCH 8016 WEARABLE MATERIALS FOR BIOMECHANICAL PERFORMANCE I (3 credits)**

This course contains lecture and lab components focused on the design and characterization of wearable materials used in biomechanical and biomedical applications for heat management, moisture removal, and respiratory protection. Students will learn the classification, properties, evaluation methods, and design principles of wearable materials. (Cross-listed with BMCH 4010).

**Prerequisite(s):** BMCH 8006 or BMCH 8676 or Department Permission

### **BMCH 8020 WEARABLE MATERIALS FOR BIOMECHANICAL PERFORMANCE II (3 credits)**

This course contains lecture and lab components focused on the design and characterization of wearable materials used in biomechanical and biomedical applications for protection against physical and chemical threats. Students will learn the classification, properties, evaluation methods, and design principles of wearable materials. (Cross-listed with BMKI 9021).

**Prerequisite(s):** BMCH 4010/BMCH 8016 (WEARABLE MATERIALS FOR BIOMECHANICAL PERFORMANCE I) or Department Permission

### **BMCH 8030 BIOSTATISTICS IN BIOMECHANICS I (3 credits)**

The focus of the course is to prepare students to understand and apply research and biostatistical methods needed in the design and analysis of biomechanical investigations. The major topics to be covered include research design and multiple linear regression. (Cross-listed with BMKI 9031)

**Prerequisite(s):** Graduate Standing in Biomechanics program or Department Permission.

### **BMCH 8100 NONLINEAR ANALYSIS FOR MOVEMENT STUDIES (3 credits)**

This course is to introduce different nonlinear methods for the analysis of biological and movement time series. Emphasis will be given on understanding the algorithms behind each nonlinear method. (Cross-listed with BMKI 9101).

**Prerequisite(s):** Instructor Permission.

### **BMCH 8106 BIOINSPIRED ROBOTICS (3 credits)**

The goal of the course is to involve students in an interdisciplinary vision of biomechanics, biology, engineering and architecture by learning how humans and other animals function in their environment. These design principles from nature can be translated into novel devices, structures, and robots. (Cross-listed with BMCH 4100).

### **BMCH 8116 3D PRINTING IN HEALTHCARE (3 credits)**

A study of basic principles and applications of additive manufacturing (i.e., 3D printing) in healthcare settings. This course will incorporate introductory lectures, practical applications, case studies, and hands-on experiences incorporating basic design techniques and 3D printing. Students will be exposed to various 3D printing techniques and approaches. This course will equip students with knowledge and hands-on experience of basic design techniques and 3D printing. Students will demonstrate, evaluate, and apply technical knowledge about computer aided design and 3D printing. The final project includes a presentation of short grant proposal. (Cross-listed with BMCH 4110).

### **BMCH 8200 MATLAB FOR MOVEMENT SCIENCES (3 credits)**

Introduction to Matlab software, plotting data, spectral analysis and the Fourier transform, data smoothing, and image analysis of movement related data. All topics will be implemented using Matlab. (Cross-listed with BMKI 9201).

**Prerequisite(s):** Instructor permission.

### **BMCH 8206 METHODS IN BIOMECHANICS I (3 credits)**

In this course students learn about the methods and equipment used in biomechanics as well as the analysis of data collected from those methods. Course experiences include both lecture and lab based learning. (Cross-listed with BMCH 4200).

**Prerequisite(s):** Department Permission

### **BMCH 8216 METHODS IN BIOMECHANICS II (3 credits)**

In this course students learn about advanced methods and equipment used in biomechanics, as well as the analysis of data collected from those methods. Course experiences include both lecture and lab based learning. This course builds on the experience gained in BMCH 4200/8206, Methods in Biomechanics I. (Cross-listed with BMCH 4210).

**Prerequisite(s):** BMCH 8206 or Department Permission

### **BMCH 8220 METHODS IN CARDIOVASCULAR BIOMATERIALS RESEARCH (3 credits)**

This course contains lecture and lab components focused on cardiovascular biomaterial development and characterization methods used in academia and industry. The lecture component will provide the necessary clinical background of cardiovascular diseases and the theoretical background of cardiovascular biomaterials and state-of-the-art research methods. The lab component will provide practical experience focused on cardiovascular biomaterial design, manufacturing, and characterization methods. (Cross-listed with BMKI 9221).

### **BMCH 8300 STEM TEACHING METHODS FOR DEVICE DESIGN (3 credits)**

STEM Teaching in Biomechanics focuses on principles in teaching including teaching models (Problem-Based, Team-Based, Inquiry-Based teaching), student assessment, classroom logistics/organization, and device design through a mentorship project. (Cross-listed with BMKI 9301, STEM 8300).

### **BMCH 8400 MOTOR LEARNING I (3 credits)**

Discussion and analysis of scientific principles related to the learning of motor skills; review related literature and research in motor learning. The focus of the course is on recent theories of how movements are acquired and performed, and on factors that have implications for motor learning throughout the life span. (Cross-listed with BMKI 9401).

**Prerequisite(s):** Department Permission.

### **BMCH 8410 MOTOR CONTROL I (3 credits)**

The focus of the course is to explore the study of the conditions and factors that influence the control and performance of motor skills from both neurophysiological and psychobiological perspectives. (Cross-listed with BMKI 9411).

**Prerequisite(s):** Department Permission. Not open to non-degree graduate students.

**BMCH 8420 MOTOR DEVELOPMENT (3 credits)**

This course focuses on the study of motor development, the processes that underlie this development and the factors that influence it. Students will gain an understanding of the major theoretical perspectives of motor development across the life span with special emphasis given in child development. (Cross-listed with BMKI 9421).

**Prerequisite(s):** Department Permission.

**BMCH 8450 ADVANCED BIOMECHANICS (3 credits)**

The course will address the biomechanical basis of human performance including mechanical analysis of human gait, fundamental movement patterns and techniques used for collecting biomechanical data. (Cross-listed with BMKI 9451).

**Prerequisite(s):** BMCH 4630 (Biomechanics) [previously PE 4630] or Instructor Permission.

**BMCH 8646 ORTHOPEDIC BIOMECHANICS (3 credits)**

Orthopedic Biomechanics focuses on the use of biomechanical principles and scientific methods to address clinical questions that are of particular interest to professionals such as orthopedic surgeons, physical therapists, rehabilitation specialists, and others. (Cross-listed with BMCH 4640).

**Prerequisite(s):** Department Permission

**BMCH 8666 CLINICAL IMMERSION FOR RESEARCH AND DESIGN (3 credits)**

This course will involve exposure to current clinical practices, identification of unmet clinical needs, and information regarding future career options. In this course, students will be matched with local clinical sites to provide a unique opportunity for innovative and interdisciplinary approaches to problem solving subject to practical constraints. Concepts in clinical rehabilitation, integrated assessments, regulation of medical devices in health care will be covered. This course will review the latest research efforts for rehabilitation in the context of device design and implementation. (Cross-listed with BMCH 4660).

**Prerequisite(s):** Instructor Permission. Not open to non-degree graduate students.

**BMCH 8676 INTRODUCTION TO MECHANICS OF BIOMATERIALS (3 credits)**

In this course students will learn how to analyze the stresses and strains in different structures under complex loading conditions with extensive examples from biomaterials and materials generally used in the medical device field. (Cross-listed with BMCH 4670).

**Prerequisite(s):** BMCH 3000 or Department Permission

**BMCH 8686 SPORTS BIOMECHANICS (3 credits)**

This course is intended to provide students with a foundational knowledge on how to analyze sport movements through biomechanical analytical methods. Students will utilize foundational biomechanical principles and apply them to a variety of sports and associated movements. (Cross-listed with BMCH 4680).

**Prerequisite(s):** BMCH 4630 or KINS 4100 or Instructor Permission

**BMCH 8690 MATHEMATICS OF BIOMECHANICAL DATA PROCESSING (3 credits)**

Biomechanics is a rapidly changing and technologically dependent field of study. A thorough understanding of the factors influencing outcome measures is critical to correctly interpreting results. Students will be exposed to various data acquisition systems, approaches, and choices required to assess the computational aspects of biomechanical data critically. This course will equip students to complete independent processing from raw data to 3D joint angles and forces. (Cross-listed with BMKI 9691).

**Prerequisite(s):** Departmental Permission

**BMCH 8696 CARDIOVASCULAR BIOMECHANICS (3 credits)**

This course will introduce students to cardiovascular biomechanics, emphasizing the integration of analytical and experimental methods to better understand the mechanobiology of tissues. (Cross-listed with BMCH 4690).

**Prerequisite(s):** BMCH 3000, BMCH 4670, or Department Permission

**BMCH 8706 INTERNSHIP IN SPORTS MEDICINE AND BIOMECHANICS RESEARCH (3 credits)**

This course is an on-campus, supervised, educational work experience of at least 150 clock hours at an approved worksite offering programs and experiences in sports medicine or biomechanics. (Cross-listed with BMCH 4700, ATHT 8706).

**Prerequisite(s):** Instructor permission

**BMCH 8900 INDEPENDENT RESEARCH IN BIOMECHANICS (1-6 credits)**

In this course individuals or groups will conduct research projects for the study and analysis of biomechanical topics.

**Prerequisite(s):** Permission of the Department and approval by Faculty Advisor. Not open to non-degree graduate students.

**BMCH 8910 INDEPENDENT STUDY IN BIOMECHANICS (1-6 credits)**

This is a variable credit course designed for graduate students in Biomechanics who would benefit from independent reading assignments and problems. Independent study enables individual students or a small group of students to focus on topics typically not explored in other offerings or to explore topics currently offered in further depth. (Cross-listed with BMKI 9911).

**Prerequisite(s):** Graduate student in BMCH and approval by Faculty Advisor. Not open to non-degree graduate students.

**BMCH 8990 THESIS IN BIOMECHANICS (1-6 credits)**

A research project, designed and executed under the supervision of the chair and approval by members of the graduate student's advisory committee. In this project the student will develop skills in research design, research conduct, data analysis, and reporting. The final product of this course will be an original thesis of independent scientific investigation.

**Prerequisite(s):** Department Permission. Not open to non-degree graduate students.