

**418. Field Biology for Teachers**

Fall, Winter, Spring, Summer. 4 credits. Biology course or approval of department. Field investigation and interpretation of prairie, dune, forest and wetland communities. An ecosystem approach to ecological concepts. Natural history and identification of key species. Field trips required.

**460. Ornithology for Teachers**

Summer. 3 credits. A course in biology or approval of department. Not open to Zoology majors. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.

Distribution, breeding cycles, migration, food and feeding habits, voice and other important areas of avian biology. Emphasis on field identification and natural history.

**499. Research**

Fall, Winter, Spring. 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of director of biological science program and student's adviser.

Undergraduates are invited on an individual basis into research laboratories of faculty in biological departments of the college. After three terms of research, a presentation in thesis form is produced and defended.

**800. Problems in Biological Science**

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 18 credits. B.S. degree in biological science.

**805. Outdoor Environmental Studies**

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits if different topics are taken. B S 418 or ZOL 460 or approval of department.

Emphasis on environmental understanding. Development of educational materials through team research and testing. Trials of materials with elementary, middle, secondary school or college students.

**899. Master's Thesis Research**

Fall, Winter, Spring. Variable credit. Approval of department.

**BIOMECHANICS BIM**

**College of Osteopathic Medicine**

**500. Basic Concepts in Biomechanics**

Winter. 2(2-0) Admission to a college of medicine or approval of department. Interdepartmental with the College of Osteopathic Medicine.

Basic concepts of biomechanics and their relationship to functional anatomy and osteopathic manipulative therapy.

**590. Special Problems in Biomechanics**

Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 32 credits. Approval of department.

Each student will work under direction of a faculty member on an experimental, theoretical or applied problem.

**601. Osteopathic Manipulative Medicine Clerkship**

Fall, Winter, Spring, Summer. 6 credits. May reenroll for a maximum of 12 credits. Grade P in all courses offered in terms 1 through 8.

Advanced training in the diagnosis of musculoskeletal dysfunctions and application of osteopathic manipulative techniques in patient care.

**620. Directed Studies**

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 24 credits. Approval of department.

Individual or group work on special problems related to biomechanics, neuromusculoskeletal system primarily.

**800. Special Topics**

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits. Approval of department.

Independent study in topics of biomechanics.

**805. Biomechanical Analysis**

Fall. 3(3-0) Approval of department.

Methods for analysis of biokinematic and biokinetic data.

**810. Biokinematics**

Spring. 3(3-0) BIM 805 or approval of department.

Size, position and mobility of the human body as a mechanical linkage system. Detailed study of body joints and kinematic models.

**811. Biokinetics**

Winter. 3(3-0) BIM 805 or approval of department.

Application of Newtonian mechanics to problems of force transmission and related motions in the muscular-skeletal system.

**812. Theory of Tissue Mechanics**

Fall. 3(3-0) Approval of department.

Introduces the concepts of stress and strain in tissue and the dependency of mechanical parameters on biological factors.

**850. Research Seminar**

Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits. Approval of department.

Discussion of current research topics in biomechanics with strong clinical application.

**871. Research Methods in Biomechanics I**

Fall. 2(1-3) BIM 812 or concurrently or approval of department.

Measurement of responses of biological tissues to internal and external demands. Techniques include visual, palpatory, electrophysiological, and mechanical assessment methods.

**872. Research Methods in Biomechanics II**

Winter. 2(1-3) BIM 810 or concurrently or approval of department.

Measurement of body geometry and mass distribution. Measurements include anthropometry, goniometry, volume and inertial properties of the human body.

**873. Research Methods in Biomechanics III**

Spring. 2(1-3) BIM 811 or concurrently or approval of department.

Measurements of dynamics of human motion. Measurements include force plate and photogrammetric kinematic assessment methods.

**890. Independent Study**

Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 32 credits. Approval of department.

Individual or group work related to biomechanics and/or neuromusculoskeletal system.

**899. Master's Thesis Research**

Fall, Winter, Spring, Summer. Variable credit. Approval of department. Conduct research for master's thesis.

**BIOMEDICAL ENGINEERING BME**

**College of Engineering**

**410. Electronic Instrumentation in Biology and Medicine**

Fall. 4(4-0) MTH 112, PHY 238 or approval of instructor.

Electronic components and circuits. Physiological measurements. Transduction of physiological events to electrical signals. Detection of physiological events by electrical impedance measurements. Ultrasonic techniques in biomedical systems. Biomedical applications of lasers.

**411. Electric Theory of Nerves**

Winter of odd-numbered years. 4(4-0) MTH 310; PHY 288.

Neurophysiology: basic organization, structure, function and electrical activity of neurons. Sub-threshold membrane phenomena: Nernst-Planck equations, constant field membrane model, electrotonus. Membrane action potentials: voltage clamp experiments, Hodgkin-Huxley equations, computer simulation.

**414. Clinical Instrumentation**

Winter of even-numbered years. 3(3-0) BME 410.

Ultrasound theory and applications in medicine. Photoelectric, piezoelectric and temperature transducers. Detection of physiological events by impedance measurements. Radiology and x-ray techniques. Isotopes and nuclear medicine. Lasers in medicine. Field trips required.

**424. Materials in Biomedical Engineering**

Winter. 3(3-0) PSL 240 or PSL 431 or approval of department.

Basics of materials science. Biocompatibility of metals, polymers and ceramics. Internal and external prosthetic materials.

**431. Biological Transport Mechanisms**

Spring. 3(3-0) MTH 215.

Mechanisms which govern transport or momentum, heat and mass. Application to mathematical description of transport processes in biological systems and to solution of biomedical problems.

**481. Tissue Biomechanics**

Fall. 3(3-0) ANT 316 or approval of department.

Fundamentals of continuum mechanics in relation to morphological classification of tissue. Mechanical properties of connective and muscle tissue.

**499. Independent Study**

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits. Approval of instructor.

Individual reading and research under the supervision of a member of the Biomedical Engineering Committee.