

**561. Clinical Craniosacral Manipulative Therapy**  
Spring. 1 to 3 credits. Approval of department.

Basic concepts of the craniosacral system, clinical applications.

**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.

**810. Biokinematics**

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

Motion of the human body including detailed studies of body joint and linkage motion.

**811. Biokinetics**

Winter. 3(3-0) BIM 810.

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

**812. Theory of Tissue Mechanics**

Spring. 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.

**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. May reenroll for a maximum of 12 credits. 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.

## **BOTANY AND PLANT PATHOLOGY**

**BOT**

**College of Agriculture and Natural Resources**  
**College of Natural Science**

**201. Plants, People and the Environment (N)**

Fall, Spring. 3(3-0)

Relevance of plants to modern society. Basic botanical concepts and socially significant groups of plants. Natural resource exploitation. Plants as they relate to human population growth, food production, and energy resource depletion.

**205. Plant Biology**

Fall. 3(3-0) High school chemistry and high school algebra.

An introduction to plant science for students seeking a general knowledge of the principles of plant biology as well as for prospective plant science majors.

**301. Introductory Plant Physiology**

Winter, Spring. 4(2-4) CEM 141 or CEM 151; CEM 161; BOT 205 or B S 210 or LBS 141. Introductory organic chemistry recommended.

General principles of plant physiology relating plant structure to function. Topics include cell physiology, water relations, effects of light and temperature, respiration, photosynthesis, mineral nutrition, and hormone action.

**302. Introductory Morphology**

Fall, Winter. 4(2-4) B S 212 or approval of department.

Structures and life cycles of representative plant groups showing progressive evolutionary developments.

**318. Introductory Plant Systematics**

Spring. 4(2-3) BOT 302 or B S 212 or approval of department.

Plant diversity with emphasis on identification, classification, nomenclature, and evolutionary relationships of vascular plants.

**335. Fossil Plants, Their History and Paleocology**

Spring. 3(3-0) One course in geology or botany or biology or approval of department. Interdepartmental with and administered by the Department of Geology.

History of plants through geologic time; their form and evolution; how and where found, identified and reconstructed; their use in determining ancient geographic patterns, paleoenvironments, paleoclimates and community structure. Field trip.

**336. Economic Plants**

Spring. 3(3-0)

Histories, characteristics, and origins of plants used in industrial processes, drug manufacture, and agriculture. Nontechnical to broaden student's cultural interest in plants.

**400. Aquatic Plants**

Fall. 3(2-3) BOT 318 or BOT 302. Students may not receive credit in both BOT 400 and BOT 423.

Aquatic plants, their classification, ecology and economic importance. Relationships to problems in fisheries, in wildlife management, and to role in limnology. Experience for student in plant ecology, aquatic biology, and water sanitation.

**400H. Honors Work**

Fall, Winter, Spring. 3(0-6) Approval of department; Seniors.