### 410. *Terrestrial Ecology*

*Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the departments of Botany and Plant Pathology and Zoology.*

Factors determining distribution and abundance. Interrelationship of plants, animals, and environment. Extensive field investigations of several types of terrestial communities in light of current theory.

### 420. *Seminar in Recent Advances in Biological Science*

*Fall, Winter ,Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topic is taken. Approval of department.*

A series of lectures by senior faculty of topics on the history, development, the most recent advances and the possible future and limits of the Biological Sciences.

### 440. *Man and Environment Workshop for Teachers*

*Summer. 3 credits. Approval of department. Given at W. K. Kellogg Biological Station.*

Discussions and practical work sessions concerning the development of ideas and activities for environmental studies in and outside the classroom. Designed for intermediate and secondary inservice teachers.

### 450. *Outdoor Environmental Studies*

*Summer. 3 credits. May reenroll for a maximum of 9 credits when new topics are given. Teaching experience or approval of department. B S 451 must be taken same summer. Given at W. K. Kellogg Biological Station.*

Emphasis on environmental understanding. Planning and developing interdisciplinary program for elementary and intermediate children.

### 451. *Outdoor Environmental Studies: Laboratory*

*Summer. 2 to 5 credits. May reenroll for a maximum of 15 credits when new topics are given. Teaching experience, B S 450. Given at W. K. Kellogg Biological Station.*

Testing instructional materials and strategies developed in B S 450 with elementary and middle school children in an outdoor environmental education program.

### 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. Variable credit. B.S. degree in biological Science.*

### 999. *Doctoral Dissertation Research*

*Fall, Winter, Spring. Variable credit. M.S. degree in biological science or equivalent.*

Research in some phase of biological science, data to form the basis for the thesis required for the doctoral degree in biological science.

## BIOMECHANICS BIM

### College of Osteopathic Medicine

### 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.

### 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.

### 880. *Athletic Medical Systems*

*(581.) Fall, Spring. 3(3-0) Bachelor's degree and involvement with secondary school athletics.*

Health care systems for athletes in growth years. Physiological and psychological concepts applied to human development, training and care. Injury preventions, emergency medicine and rehabilitation stressed.

### 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.

## 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. Subthreshold 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.

## BIOPHYSICS BPY

### College of Human Medicine
### College of Natural Science
### College of Osteopathic Medicine

### 400H. *Honors Work in Biophysics*

*Fall, Winter, Spring, Summer. 3 to 6 credits. May reenroll for a maximum of 6 credits. Approval of department.*

Independent study and investigation under the direction of a faculty member.

### 402. *Introductory Biophysics: Molecular and Thermal*

*Spring. 3(3-0) One year organic chemistry or biochemistry; 1 year biology, PHY 239, PHY 259, MTH 113, or approval of department.*

Salient features of biophysics; principles and methods. Structure, function, and organization of biologic molecules; molecular biophysics; thermal biophysics; bioenergetics and photobiology.

### 403. *Introductory Biophysics: Membranes and Electrical*

*Fall. 3(3-0) One year organic chemistry or biochemistry, PHY 239, PHY 259; MTH 113 or approval of department.*

Salient features of biophysics, principles and methods; radiation biophysics; membrane biophysics; bioelectric phenomena; neurobiology; and psychophysics.

### IDC. *Biological Membranes*

*For course description, see Interdisciplinary Courses.*

### 480. *Special Topics in Biophysics*

*Fall, Winter, Spring, Summer. 2 to 4 credits. Approval of department; BPY 402 recommended.*

Special topics within five areas of biophysics: structure-function correlation, neurobiophysics, membrane biophysics, molecular biophysics, or theoretical biophysics.