

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 25 credits. A student may earn a maximum of 25 credits in all enrollments for this course.

930. Current Issues in Biomechanical Aspects of Physical Activity
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Interdepartmental with Physical Education and Exercise Science. Administered by Physical Education and Exercise Science.
P: PES 830.
Selected issues of biomechanical analyses of sport and physical activity.

BIOMEDICAL ENGINEERING

BME

College of Engineering

311. Introduction to Biomedical Engineering
Fall. 3(3-0) Interdepartmental with Materials Science and Mechanics, Mechanical Engineering, and Electrical Engineering.
P: BS 111, MTH 235, PHY 184.
Physical and mechanical properties of soft and hard tissues. Biomaterials. Biocompatibility. Biochemical processes, biological transport, and thermodynamics. Bioelectronics and instrumentation.

405. Biomedical Electronics
Fall of even-numbered years. 3(3-0) Interdepartmental with Electrical Engineering.
P: MTH 132, PHY 184.
Electronic components and circuits. Physiological measurements, transduction of physiological events to electrical signals. Ultrasonic techniques, biomedical applications of lasers, x-ray and magnetic resonance imaging.

424. Biomaterials and Biocompatibility
Spring of even-numbered years. 3(3-0) Interdepartmental with Materials Science and Mechanics.
P: BME 311, PSL 250.
Materials science of human implants. Design requirements imposed by the body's milieu and the need to protect the body.

435. Biological Transport Mechanisms
Fall of odd-numbered years. 3(3-0) Interdepartmental with Chemical Engineering and Mechanical Engineering.
P: BME 311, MTH 235.
Mechanisms of transport of momentum, heat and mass. Mathematical description of transport processes in biological systems. Solution of biomedical problems.

441. Tissue Mechanics
Spring of odd-numbered years. 3(3-0) Interdepartmental with Materials Science and Mechanics.
P: BME 311.
Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.

491. Special Topics (MTC)
Fall, Spring. 3 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
P: BME 311.
Special topics in biomedical engineering or bioengineering such as biochemical design, occupational biomechanics, biological surface science, or low temperature biotechnology.

BIOSYSTEMS ENGINEERING

BE

Department of Agricultural Engineering College of Agriculture and Natural Resources College of Engineering

180. Current Issues in Biosystems
Fall, Spring. 2(2-0)
P: MTH 110 or MTH 116. R: Open only to freshmen or sophomores.
The relationship of biosystems engineering to current problems in food production and processing. Environment, natural resources, harvesting, handling, safety, and water quality.

230. Principles of Biosystems Engineering
Fall. 3(3-0)
P: MTH 132. R: Open only to sophomores or juniors in College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.
Concepts of biosystems. Hard and soft systems. Conceptual and computer modeling of components of biosystems.

232. Food Production and Processing Systems
Fall. 1(0-2)
R: Open only to students in College of Agriculture and Natural Resources or College of Engineering.
Crop and animal production systems. Food processing systems. Field trips required.

336. Machinery Systems for Food Production
Fall. 3(3-0)
P: MTH 235.
Processes performed by agricultural production machines. Power systems, tillage mechanics, traction, metering, distribution, conveying, fluidization, mixing, separation, and atomization. Machinery management.
SA: AE 336

350. Heat Transfer in Biosystems
Spring. 2(2-0)
P: MTH 235; CPS 130 or CPS 131. R: Not open to students with credit in CHE 311 or ME 410.
Steady state and transient heat conduction. Radiation and convection heat transfer. Heat exchangers. Application problems in biosystems engineering.

351. Environmental Thermodynamics
Spring. 3(3-0)
P: MTH 235. R: Not open to students with credit in CHE 321 or ME 201.
First and Second Laws of Thermodynamics with applications in food, biosystems, and environmental engineering. Refrigeration cycles. Entropy. Thermodynamic aspects of fluid flow. Psychrometrics.

430. Power and Control Hydraulics
Spring. 3(2-2)
P: CE 321 or CHE 311 or ME 332. R: Open only to majors in College of Engineering.
Hydraulic fluid properties. Pump and motor performance parameters. Control valves and hydraulic circuitry components. Analysis and design of hydraulic systems.
SA: AE 430

438. Design of Machinery Structures
Fall. 3(3-0)
P: MSM 211. R: Open only to majors in College of Engineering. Not open to students with credit in ME 471.
Design of structural components and systems in machines. Tension, compression, torsion, bending and combined loadings. Joint connections.
SA: AE 438

453. Engineering Principles of the Plant Environment
Fall. 3(3-0)
P: BOT 105 or BS 110 or BS 111; CEM 141, BE 350, BE 351. R: Open only to majors in College of Engineering.
Analysis of the soil-plant-atmosphere continuum. Thermodynamics effects on plant environment: water, soil heat flow, radiation, and soil water movement.
SA: AE 353

456. Electric Power and Control
Spring. 3(2-2)
P: EE 200 or EE 345. R: Open only to majors in College of Engineering.
Alternating current circuits, power distribution, electrical machines, protection, and programmable motor controllers. Design project related to food and agricultural industries.
SA: AE 356

481. Agricultural and Small Watershed Hydrology
Spring. 3(2-2)
P: CPS 130 or CPS 131; CE 321 or CHE 311 or BE 350; BE 453 or CE 312. R: Open only to seniors in College of Engineering or graduate students.
Runoff, infiltration, surface and subsurface drainage and soil erosion.
SA: AE 481

486. Biosystems Design Fundamentals
Fall. 3(3-0)
P: BE 350 or BE 336 or BE 453. R: Open only to seniors in College of Engineering or graduate students.
Concepts, methods, and procedures of the total design process from problem identification to final specifications.
SA: AE 486

487. Biosystems Design Project (W)
Spring. 3(0-6)
P: BE 486. R: Open only to seniors in College of Engineering. Completion of Tier I writing requirement.
Individual or team design project selected in BE 486. Information expansion, development of alternatives, and evaluation, selection, and completion of a design project.
SA: AE 488

490. Independent Study
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
P: BE 230 or BE 336 or BE 350 or BE 453. R: Open only to majors in College of Engineering. Approval of department; application required.
Supervised individual student research and study in biosystems engineering.
SA: AE 490

491. Special Topics in Biosystems Engineering
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
P: BE 230, BE 336 or BE 350 or BE 453. R: Open only to majors in College of Engineering. Approval of department.
Special topics in biosystems engineering.
SA: AE 491