

**BIOMEDICAL  
ENGINEERING**

**BME**

**College of Engineering**

**324 Biomaterials and Biocompatibility**  
Spring. 3(3-0) Interdepartmental with Materials Science and Engineering. Administered by Department of Chemical Engineering and Materials Science. P:M: (PSL 250 or concurrently) and (MSE 250) R: Open only to students in the College of Engineering. SA: MSM 424

Materials science of human implants. Design requirements imposed by the human body. Need for bodily protection.

**401 Quantitative Human Biology**  
Spring. 3(4-0) Interdepartmental with Materials Science and Engineering; Radiology; Human Anatomy. P:M: (MTH 235 and PHY 184) and (PSL 250 or concurrently or PSL 431 or concurrently) and (CEM 141 or CEM 151) and (ANTR 350 or concurrently) RB: (CSE 131 or concurrently or CSE 231 or concurrently or PSL 410)

Qualitative description and quantitative engineering analysis of selected, tractable human-biological systems. Multi-disciplinary problem-solving among medical and engineering professionals.

**490 Independent Study**  
Fall, Spring. 3 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.

Individualized reading and research in biomedical engineering or bioengineering.

**490A Independent Study in Clinical Biomechanics**  
Fall. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.

Individualized reading and research in the application of biomechanics to clinical cases.

**490B Independent Study in Biomaterials**  
Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.

Individualized reading and research in the application of biomaterials.

**491 Special Topics**  
Fall, Spring. 3 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course.

Special topics in biomedical engineering or bioengineering.

**495 Tissue Mechanics**  
Spring. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Department of Mechanical Engineering. P:M: (ME 222) SA: MSM 441

Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.

**496 Biodynamics**  
Fall. 3(2-2) Interdepartmental with Mechanical Engineering. Administered by Department of Mechanical Engineering. P:M: (ME 361) R: Open only to students in the Engineering Mechanics major.

Fundamentals of motion analysis of human movement and its application to the study of function and dysfunction of the musculoskeletal system. Solution methods of the inverse dynamics problem.

**497 Biomechanical Design**  
Spring. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Department of Mechanical Engineering. R: Open only to juniors or seniors in the College of Engineering. SA: BME 491A, MSM 445

Biomechanical product design with application to people or animals. Synthesis, prototyping, and analysis of designs. Project management. Market research.

**BIOSYSTEMS  
ENGINEERING**

**BE**

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

**130 Engineering Design Fundamentals for Biological Systems**  
Fall. 2(1-2) P:M: (MTH 132 or concurrently or MTH 114 or concurrently or MTH 116 or concurrently or LBS 117 or concurrently or LBS 118 or concurrently or MTH 152H)

Professional and fundamental methods of biosystems engineering. Basic engineering methods. Analysis and design. Interdisciplinary design.

**230 Principles of Biosystems Engineering**  
Spring. 3(3-0) P:M: (MTH 132 or MTH 152H or LBS 118)

Biosystems modeling of growth and dynamic interactions. Conservation of mass, and sustainability. Steady-state and stability analysis. Ecological concepts. Life-cycle analysis. Design for environment.

**232 Food Production and Processing Systems**  
Fall. 1(0-2)

Crop and animal production systems. Food processing systems. Field trips required.

**329 Fundamentals of Food Engineering**  
Spring. 3(3-0) Interdepartmental with Food Science. P:M: (FSC 229) and (MTH 126 or LBS 118) and (PHY 231 or LBS 164) RB: (FSC 211) SA: FE 329

Unit operations in food industry: fluid mechanics, heat transfer, rate processes, refrigeration, freezing, and dehydration. Thermal process calculations.

**331 Machinery Principles in Biosystems Engineering**  
Fall. 3(3-0) P:M: (MTH 235 or MTH 255H or LBS 220) and (MSM 206 or MSM 211 or concurrently) and (CE 321) RB: Upper division standing in the College of Engineering

Functional processes of machines used in biosystems engineering, including pumping, blowing, conveying, mixing, separation, atomization, size reduction and mobility. Power requirements, efficiency and failure modes

**333 Biosystems Engineering Laboratory**  
Fall. 1(0-3) P:M: (BS 110 or BS 111 or BOT 105 or ENT 205 or MMG 205 or MMG 301 or PSL 250 or ZOL141) R: Open only to students in the Biosystems Engineering major.

Measurement of physical, chemical and biological parameters and properties that characterize engineered biosystems. Data collection and analysis. Experiment design.

**337 Machinery Systems for Food Processing**  
Spring. 3(3-0) P:M: (BE 230) and (LBS 220 or concurrently or MTH 235 or concurrently or MTH 255H or concurrently) SA: AE 338, FE 338

Principles of design, operation, and performance of equipment for processing raw materials into finished or intermediate products.

**350 Heat and Mass Transfer in Biosystems**  
Spring. 3(3-0) P:M: (MTH 235 or MTH 255H or LBS 220) and (CSE 131) and (CE 321 or concurrently or CHE 311 or concurrently or ME 332 or concurrently) and (CEM 143 or concurrently) R: Open only to students in the College of Engineering. Not open to students with credit in ME 410.

Steady state and transient heat conduction. Radiation and convection heat transfer. Heat exchangers. Mass transfer application problems in biosystems engineering.

**351 Environmental Thermodynamics**  
Fall. 3(3-0) P:M: (MTH 235 or MTH 255H or LBS 220) 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.

**402 Agricultural Climatology**  
Fall of even years. 3(3-0) Interdepartmental with Geography. Administered by Department of Geography. P:M: (MTH 104 or MTH 110 or MTH 116) R: Not open to freshmen or sophomores. SA: AE 402

Relationships between climate and agriculture in resource assessment, water budget analysis, meteorological hazards, pests, crop-yield modeling, and impacts of global climate change.

**418 Comprehensive Nutrient Management Planning**  
Fall. 3(2-2) Interdepartmental with Animal Science. Administered by Department of Animal Science. P:M: (CSS 210)

Comprehensive nutrient management plans (CNMP) for animal feeding operations. Trends in animal production, environmental issues, and diet formulation and their impact on manure production. Development of CNMP for a specific animal feeding operation.

**419 Applications of Geographic Information Systems to Natural Resources Management**  
Spring. 4(2-4) Interdepartmental with Fisheries and Wildlife; Forestry; Geography; Park, Recreation and Tourism Resources; Resource Development. Administered by Department of Fisheries and Wildlife. RB: (GEO 221)

The application of geographic information systems, remote sensing, and global positioning systems to integrated planning and management for fish, wildlife, and related resources.