KENTUCKY STATE UNIVERSITY

BIOLOGICAL AND AGRICULTURAL ENGINEERING

BAE 201: Analysis of Bio & Agri Eng Pro
Overview of Biological and Agricultural Engineering discipline through case studies and engineering design problems; introduction to engineering design utilizing computer programming, 3-D computer-aided modeling an 2-D engineering drawings; introduction to manufacturing processes.
Prerequisite: Grade of C or better MFG 208, MAT 131, CHE 101 & 110
Credit Hours: 3
Contact Hours: 4

BAE 301: Bio. & Agri. Eng. Fund. I
Fundamental engineering concepts related to agricultural systems including the environment (soil, water, and air), plant and animal production systems and processing, and associated machines and facilities; application of techniques for data collection and analysis to problems in biological and agricultural engineering; design of experiments and communication of experimental results.
Prerequisite: Grade of C or better in PHY 311 or concurrent enrollment
Credit Hours: 3
Contact Hours: 4

BAE 302: Biol. & Agri. Eng. Fund II
Fundamentals of microbiology and biochemistry as they apply to biological and agricultural engineering systems to produce useful products and/or benign wastes; topics include microbiology, chemistry of biomolecules, microbial metabolism, bioenergetics, kinetics, mass transfer, bioreactor design, bioprocesses, and downstream processing.
Prerequisite: Grade of C or better in BIO111, CHE 200 or concurrent enrollment
Credit Hours: 3
Contact Hours: 4

BAE 321: Mechanics of Materials
Applications of conservation principles and stress/deformation relationships for continuous media to structural members; axially loaded members; thin-walled pressure vessels; torsional and flexural members; shear; moment; deflection of members; combined loadings; stability of columns; nonsymmetrical bending, shear center; indeterminate members; elastic foundations.
Prerequisite: Grade of C or better in PHY 311
Credit Hours: 3
Contact Hours: 3

BAE 355: Engi. Prop. of Biol Materials
Relationships between composition, structure and properties of biological materials; definition and measurement of mechanical, physical, thermal and other material properties; variability of properties; application of properties to engineering analysis and design of biological and agricultural processes and systems.
Prerequisite: Grade of C or better in EGR 220
Credit Hours: 3
Contact Hours: 4

BAE 360: Design Fund for Agri Mach & St
Applications of stress/strain relationships and failure theory to the design of agricultural machines and structures; structural properties of engineering materials; finite element analysis and computer aided engineering design.
Prerequisite: Grade of C or better in PHY 311
Credit Hours: 3
Contact Hours: 3

BAE 365: Unit Oper. for Bio. & Agr. Eng
Theoretical and practical understanding of basic unit operations required to design processes and equipment in the agricultural, biological, environmental, and food industries, with unique constraints presented by biological and agricultural systems considered in design of all units.
Prerequisite: Grade of C or better in PHY 320, BAE 321 junior or senior classification
Credit Hours: 3
Contact Hours: 4

BAE 366: Trans. Proc. in Bio Systems
Basic principles governing transport of energy and mass; application of these principles to analysis and design of processes involving biological, environmental and agricultural systems.
Prerequisite: Grade of C or better in PHY 320, EGR 320, BAE 365 or concurrent enrollment; grade of C or better in MATH 232; junior or senior classification
Credit Hours: 3
Contact Hours: 3

BAE 370: Meas. & Cont. of Bio Sys & Agr
Theory and application of sensors and techniques in the design of systems for automatic control in biological systems and agricultural production and processing; sensor operation; signal processing; control techniques; automation and robotics.
Prerequisite: Grade of C or better in PHY 305
Credit Hours: 3
Contact Hours: 4

BAE 400: Professional Development
Participation in an approved high-impact learning practice; reflection on professional outcomes from the National Society of Professional Engineers' Engineering Body of Knowledge; documentation and self-assessment of learning experience.
Prerequisite: senior classification; or approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 410: Hydraulic Power
Hydraulic power systems; energy and power relationships; hydraulic fluid properties; frictional loses in pipelines; hydraulic pumps, cylinders, valves and motors; servo and proportional valves; circuit design and analysis; conductors, fittings and ancillary devices; maintenance of hydraulic systems; pneumatic components and circuits; electrical controls and fluid logic; electro-hydraulic systems.
Prerequisite: Grade of C or better in EGR 320 or equivalent, or approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 415: Renewable Energy Conversion
Energy/power systems through engineering and technical aspects of quantifying and designing the suitability of several types of renewable energy resources; new insights of vast resources that future engineers can harness to augment diminishing supplies of nonrenewable energy.
Prerequisite: Grade of C or better in PHY 320 or equivalent, or approval of instructor
Credit Hours: 3
Contact Hours: 4

BAE 420: Food Rheology
Theoretical and applied learning of rheology of food materials necessary for processing and preservation; topics include viscous liquids, structured materials, and hard solids; fundamental relationships between materials structure and measured properties to observed physical and performance behavior with regard to processing and mouthfeel.
Prerequisite: Junior or senior classification or approval from instructor
Credit Hours: 3
Contact Hours: 3

BAE 422: Unit Oper. in Food Processing
Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control.
Prerequisite: Grade of C or better in BAE 321
Credit Hours: 3
Contact Hours: 4

BAE 425: Engineering Aspects of Packagi
Introduction to properties and engineering aspects of materials for use as components of a package and/or packaging system; principles of design and development of packages; evaluation of product-package-environment interaction mechanisms; testing methods; environmental concerns; regulations; food packaging issues.
Prerequisite: Junior or senior classification or approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 501: Agricultural Systems Analysis
Application of data analytic thinking and data science techniques to the analysis and management of technical systems in agriculture; introduction to supervised and unsupervised methods applied to business problems in the food and agricultural sectors. Credits: 3 Lecture Hours: 3
Credit Hours: 3
Contact Hours: 3

BAE 514: Renewable Energy Conversions
Managing energy/power systems through engineering and technical aspects of quantifying and designing the suitability of several types of renewable energy resources; providing new insights of vast resources that future engineers can harness to augment diminishing supplies of non-renewable energy. Credits: 3 Lecture Hours: 2 Lab Hours: 2
Prerequisite: PHY 320 or approval of instructor
Credit Hours: 3
Contact Hours: 4

BAE 517: Fund of Nanoscale Bio Engineer
Nanostructures, nanofabrication methods, instrumentation and applications pertinent to Biological, Food and Bioenergy systems; provides opportunity to identify and utilize key tools available for fabricating, manipulating and analysis of nanostructures used in Biological Engineering applications. Credits: 3 Lecture Hours: 3
Credit Hours: 3
Contact Hours: 3

BAE 520: Food Rheology
Principles of elasticity, viscous flow and visco-elasticity applied to solid and liquid food materials; experimental determination of rheological properties using fundamental methods and empirical textural measurements ; applications to food engineering research, textural measurement and quality control. Credits: 3 Lectures Hours: 3
Prerequisite: ERG 220 or BAE 422; PHY 211 or equivalent; graduate classification; or approval from instructor
Credit Hours: 3
Contact Hours: 3

BAE 522: Exp Methods in Bio Ag Engineer
Planning and carrying out empirical research with appropriate application of statistical methods for experimental design and analysis; experimental design, data analysis, hypothesis testing, and experimental errors. Credits: 3 Lecture Hours: 3
Prerequisite: MAT 200 or equivalent with approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 525: Food Process Engineering
Application of engineering fundamentals to the design of novel/advanced food processing systems including food irradiation, advances in thermal process, food freezing, food dehydration. Credits 3. Lecture Hours: 3
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 527: Engineering Aspects of Packagi
Introduction to properties and engineering aspects of materials for use as components of a package and/or packaging system; principles of design and development of packages; evaluation of product-package-environment interaction mechanisms; testing methods; environmental concerns; regulations. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 531: Bioproces & Sep in Biotech
Application of engineering principles to recovery and purification of biological compounds derived from cell grown in bioreactors, transgenic animals, and plants. Process development, design, and scale up of downstream processes used in biotechnology and pharmaceutical industry. Emphasis on extraction, sedimentation, membrane filtration, precipitation, and liquid chromatography. Credits :3 Lecture Hours: 2 Lab Hours: 2
Prerequisite: Graduate classification or approval of instructor
Credit Hours: 3
Contact Hours: 4

BAE 542: Water Energy Food Nexus
Principles and application of the Water-Energy-Food nexus to state, national and international Water-Energy-Food securities and the interlinkages between them; exploration of quantitative framework to develop and assess sustainable tradeoffs of resources; hands on experiences; relevant real world projects or case studies. Credits: 3 Lecture Hours: 3
Prerequisite: Strong analytical background; approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 551: Geog Info Sys for Res Mngt
Geographic Information System (GIS) approach to the integration of spatial and attribute data to study the capture, analysis, manipulation and portrayal of natural resource data; examination of data types/formats, as well as the integration of GIS with remote sensing and Global Positioning System; laboratory includes extensive use of GIS applications to conduct analyses of topics in natural resources.
Prerequisite: Graduate classification, Cross Listing: ENV 508 and BAE 551 Credits 3 Lecture Hours: 2 Lab Hours: 2
Credit Hours: 3
Contact Hours: 4

BAE 552: Adv Topics in Precision Ag Sys
Advanced GIS topics with a focus on modeling actual GIS applications including relational and database theory, design and implementation and its connection to GIS; surface analysis with digital terrain models; and an introduction to spatial statistics. Cross Listing: ENV 585/BAE 552. Credits: 3 Lecture Hours: 2 Lab Hours: 2
Prerequisite: BAE 551
Credit Hours: 3
Contact Hours: 4

BAE 555: Prin of Modern Optical Spectro
Optical spectroscopic techniques-their principles, based on the fundamentals of electromagnetism, interaction of light with matter and modern physics; Laser Induced Fluorescence; fluorescence correlation spectroscopy—single molecule spectroscopy; Raman spectroscopy ; optical coherence tomography; low coherence speckle interferometry; optical tweezers; imaging and microscopy beyond diffraction limit.
Prerequisite: Graduate classification Credits: 3 Lecture Hours: 3
Credit Hours: 3
Contact Hours: 3

BAE 561: Unit Operations in Food Proces
Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control. Credits:3 Lecture Hours: 2 Lab Hours: 2
Prerequisite: EGR 320, PHY 320
Credit Hours: 3
Contact Hours: 4

BAE 562: Statis Methds in Bio Ag & Eng
Statistical methods applied to problems in biological and agricultural engineering; parameter estimation; probability distribution fitting; time-series analysis; random variable generation; uncertainty analysis. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 565: Design of Bio Waste Treat Sys
Management and treatment of high organic content waste streams, with emphasis on agricultural; municipal, and agro-Industry wastewater; engineering design of biological waste treatment processes: resource recovery from waste streams: recycle and reuse of finished effluents. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification or approval of instructor
Credit Hours: 3
Contact Hours: 6

BAE 569: Water Quality Engineering
Nonpoint source pollution processes including transport mechanisms and contaminant fate; design of best management practices for abating nonpoint source pollution. Credits: 3 Lecture Hours: 3
Prerequisite: graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 570: Air Pollution Engineering
Current topics in air pollution engineering including design and operation of air pollution abatement systems (cyclone, bag filters and scrubbers), emission factors, dispersion modeling, permitting, odor sensing and control, EPA/State Air Pollution Regulatory Agency (SAPRA), TSP, PM10, and PM2.5. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification or approval of instructor
Credit Hours: 3
Contact Hours: 6

BAE 572: Small Watershed Hydrology
Hydrology of small agricultural watersheds; precipitation frequency analysis; infiltration; runoff; erosion theory; sediment transport theory; evapotranspiration, and use of hydrological models. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 574: Vadose Zone Hydrology
Fundamental concepts and advanced mathematical and experimental techniques for quantifying water, chemical, microorganism, and heat transport in the vadose zone (between soil surfaces and groundwater); provides a common platform for addressing issues related to soil and water resources, hydrology, geochemistry, microbiology, ecology, hydrogeology, and environmental engineering. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3

BAE 575: Hydrology Across Scale
Advanced concepts of surface and subsurface hydrologic processes, measurements, and modeling techniques across different spatio-temporal scales; contemporary issues related to the soil and water resources, hydrogeology, geochemistry, microbiology, ecology, hydrology, and environmental engineering. Credits: 3 Lecture Hours: 3
Prerequisite: Graduate classification in any engineering, agricultural science or geoscience program with environmental focus
Credit Hours: 3
Contact Hours: 3

BAE 584: Professional Internship
An on-the-job supervised experience program, conducted on an individual basis in the area of the student's specialization in mechanized agriculture. Credits: 3 Lecture: 1 to 3
Prerequisite: Graduate classification or approval of instructor
Credit Hours: 3
Contact Hours: 3

BAE 589: Special Topics
Selected topics in an identified area of agricultural engineering. May be repeated for credit. Credits :1 to 3 Lecture Hours: 1 to 3 Lab Hours: 0-3
Credit Hours: 1-3
Contact Hours: 1-3

BAE 600: Research
Development of research inquiry and discussion of applicable experimental design, theoretical techniques and methodological principles of conducting original research; evaluation of current research of faculty and students and in engineering and scientific literature. Communication of research proposals and results. May be repeated for credit. Credit 1 to 3. 1 to 3 other hours
Prerequisite: Graduate classification
Credit Hours: 1-3
Contact Hours: 1-3

BAE 601: Thesis
Research for thesis or dissertation. Credits: 3
Credit Hours: 3
Contact Hours: 3

BAE 699: Directed Study/Capstone
Advanced laboratory or field problems not related to student's thesis. Credits 3. 3 Other Hours.
Prerequisite: Graduate classification
Credit Hours: 3
Contact Hours: 3