

# BAEN - BIOLOGICAL & AG ENGR

## BAEN 601 Advanced Agricultural Systems Analysis

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification.

## BAEN 614 Renewable Energy Conversions

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** 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. **Prerequisites:** BAEN 320 or approval of instructor.

## BAEN 617 Fundamentals of Nanoscale Biological Engineering

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification.

## BAEN 620 Food Rheology

**Credits 3. 3 Lecture Hours.** Theoretical and applied learning of rheology of food materials necessary for processing and preservation. Includes viscous liquids, structured materials and hard solids. Fundamental relationships between materials structure and measured properties to observed physical/performance behavior with regard to processing and mouthfeel. **Prerequisites:** Graduate classification.

## BAEN 622 Unit Operations in Food Processing

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control. **Prerequisites:** Graduate classification.

## BAEN 625 Advances in Food Process Engineering

**Credits 3. 3 Lecture Hours.** Application of engineering fundamentals to the design of novel/advanced food processing systems including food irradiation, advances in thermal process, food freezing, food dehydration. **Prerequisite:** Graduate classification.

## BAEN 627 Engineering Aspects of Packaging

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification.

## BAEN 630 Biotechnology Principles and Techniques

**Credits 2. 6 Lab Hours.** Fundamentals of microbiology, biochemistry, molecular biology, and medical biotechnology such as laboratory safety and records keeping, DNA analysis, protein quantitation and analysis of recombinant and environmental systems; includes microbiology, molecular biology, downstream processing, microbiome analysis, bioaerosol collection and testing for antibiotic resistance. **Prerequisites:** Graduate classification and approval of instructor.

## BAEN 631 Bioprocesses and Separations in Biotechnology

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** 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. **Prerequisites:** Graduate classification or approval of instructor.

## BAEN 632 Bioaerosols and Modeling

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Overview of physical, mechanical, fluid dynamical, electrical, optical, and molecular aspects of bioaerosols; bioaerosol generation, sampling and deposition measurements including size distribution, morphology, chemical composition, bioaerosol samplers, sample analysis, dry and wet deposition, and biofilm resuspension; health effects of bioaerosols, antibiotic resistance, ambient sampling in industrial and agricultural fields. **Prerequisites:** Graduate classification.

## BAEN 642/CVEN 642 Water-Energy-Food Nexus: Toward Sustainable Resource Management

**Credits 3. 3 Lecture Hours.** 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. **Prerequisites:** Strong analytical background; approval of instructor. **Cross Listing:** CVEN 642/BAEN 642.

## BAEN 651 Geographic Information System for Resource Management

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** 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. **Prerequisites:** Graduate classification. **Cross Listing:** ECCB 651 and RWF 651.

## BAEN 652/ECCB 652 Advanced Topics in Geographic Information Systems

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** 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. **Prerequisite:** ECCB 651 or BAEN 651. **Cross Listing:** ECCB 652/BAEN 652.

## BAEN 655 Principles of Modern Optical Spectroscopy

**Credits 3. 3 Lecture Hours.** 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. **Prerequisites:** Graduate classification.

## BAEN 662 Statistical Methods in Biological and Agricultural Engineering

**Credits 3. 3 Lecture Hours.** Statistical methods applied to problems in biological and agricultural engineering; parameter estimation; probability distribution fitting; time-series analysis; random variable generation; uncertainty analysis. **Prerequisite:** Graduate classification.

## BAEN 665 Design of Biological Waste Treatment Systems

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification or approval of instructor.

## BAEN 669 Water Quality Engineering

**Credits 3. 3 Lecture Hours.** Nonpoint source pollution processes including transport mechanisms and contaminant fate; design of best management practices for abating nonpoint source pollution. **Prerequisites:** AGEN 350 or equivalent; SCSC 301; ENGR 214; graduate classification.

## BAEN 672 Small Watershed Hydrology

**Credits 3. 3 Lecture Hours.** Apply geographic information systems (GIS) to delineate watersheds and perform spatial analysis as an introduction to hydrologic studies. Study and apply traditional methods for quantifying components of the hydrologic cycle, including precipitation, evaporation, evapotranspiration, infiltration, percolation, runoff and streamflow. Analyze hydrologic data using statistical and computational techniques to support engineering design applications. Conduct literature reviews, formulate research questions and apply advanced analytical or modeling approaches to address complex hydrologic problems. **Prerequisites:** Graduate classification.

## BAEN 673 Modeling Small Watersheds

**Credits 3. 3 Lecture Hours.** Transport of water and chemicals in small agricultural watersheds; simulation using hydrologic models coupled with geographical information systems (GIS); impact of land use on the quality of surface water and groundwater evaluated. **Prerequisites:** Graduate classification.

## BAEN 674 Vadose Zone Hydrology

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification.

## BAEN 675 Hydrology Across Scale

**Credits 3. 3 Lecture Hours.** 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. **Prerequisite:** Graduate classification in any engineering, agricultural science or geoscience program with environmental focus.

## BAEN 681 Seminar

**Credit 1. 1 Other Hour.** Reviews, reports and discussion of ideas, recent advances and current topics.

## BAEN 683 Peer-Review Process and Publication

**Credit 1. 1 Lecture Hour.** Techniques for communicating results of research that are defensible in a peer review process; selection of a research topic, identification of an appropriate target refereed journal; no thesis/dissertation preparation as a writing project accepted; critique of other papers; preparation of paper for review by instructor. **Prerequisites:** Graduate classification in Biological and Agricultural Engineering.

## BAEN 684 Professional Internship

**Credits 1 to 6. 1 to 6 Other Hours.** An on-the-job supervised experience program, conducted on an individual basis in the area of the student's specialization in mechanized agriculture. **Prerequisite:** Graduate classification or approval of instructor.

## BAEN 685 Directed Studies

**Credits 1 to 4. 1 to 4 Other Hours.** Advanced laboratory or field problems not related to student's thesis. **Prerequisite:** Graduate classification.

## **BAEN 689 Special Topics in...**

**Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.** Selected topics in an identified area of agricultural engineering. May be repeated for credit.

## **BAEN 690 Theory of Research**

**Credit 1. 1 Lecture Hour.** 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. **Prerequisites:** Graduate classification.

## **BAEN 691 Research**

**Credits 1 to 23. 1 to 23 Other Hours.** Research for thesis or dissertation.