BAEN - BIOLOGICAL & AG ENGR (BAEN)

BAEN 201 Analysis of Biological and Agricultural Engineering Problems

Credits 3. 1 Lecture Hour. 4 Lab Hours. 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 and 2-D engineering drawings; introduction to manufacturing processes. **Prerequisites:** Grade of C or better in ENGR 102; grade of C or better in MATH 151; grade of C or better in CHEM 107 and CHEM 117, or CHEM 102 and CHEM 112, or CHEM 120.

BAEN 281 Professional Development Seminar

Credit 1. 1 Lecture Hour. Familiarization with engineering design process used in professional environments where BAEN and AGSM graduates are employed; discussion of professional development topics; improvement of technical communication skills. May be taken 4 times for credit.

BAEN 284 Internship

Credits 0. 0 Lecture Hours. 0 Lab Hours. 0 Other Hours. No Credit. Practical experience working in a professional biological and agricultural engineering setting. May be taken three times. **Prerequisite:** Freshman or sophomore classification; approval of the instructor.

BAEN 285 Directed Studies

Credits 0 to 4. 0 to 4 Other Hours. Selected problems in any phase of agricultural engineering; credit and specific content dependent upon background, interest, ability and needs of student enrolled; individual consultations and reports required. **Prerequisites:** Freshman or sophomore classification; approval of department head.

BAEN 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of agricultural engineering. May be repeated for credit. **Prerequisite:** Approval of instructor.

BAEN 291 Research

Credits 0 to 3. 0 to 3 Other Hours. Research conducted under the direction of faculty member in biological and agricultural engineering. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

BAEN 301 Biological and Agricultural Engineering Fundamentals I

Credits 3. 2 Lecture Hours. 3 Lab Hours. 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 MEEN 221 or concurrent enrollment.

BAEN 302 Biological and Agricultural Engineering Fundamentals II

Credits 3. 2 Lecture Hours. 3 Lab Hours. 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. **Prerequisites:** Grade of C or better in BIOL 113 or BIOL 111; Grade of C or better in CHEM 222 or CHEM 227 or concurrent enrollment.

BAEN 320 Engineering Thermodynamics

Credits 3. 2 Lecture Hours. 2 Lab Hours. First and second laws of thermodynamics; properties of pure substances; analysis of closed and open systems; applications to steady-flow and non-flow processes; power and refrigeration cycles; psychrometrics. **Prerequisites:** Grade of C or better in MEEN 221 or CVEN 221; grade of C or better in MATH 251 or MATH 253 or concurrent enrollment.

BAEN 340 Fluid Mechanics

Credits 3. 3 Lecture Hours. The course is devoted to the study of fundamentals of fluid properties, basic conservation principles of momentum, energy and continuity, flow through closed conduits and open channel hydraulics. The course will discuss applications to biological, environmental and agricultural engineering. **Prerequisites:** Grade of C or better in MEEN 221; grade of C or better in BAEN 320 or concurrent enrollment.

BAEN 354 Engineering Properties of Biological Materials

Credits 3. 2 Lecture Hours. 3 Lab Hours. 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 MEEN 222/MSEN 222 or MSEN 222/MEEN 222.

BAEN 365 Unit Operations for Biological and Agricultural Engineering

Credits 3. 2 Lecture Hours. 3 Lab Hours. 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. **Prerequisites:** Grade of C or better in BAEN 340; junior or senior classification.

BAEN 366 Transport Processes in Biological Systems

Credits 3. 3 Lecture Hours. Basic principles governing transport of energy and mass; application of these principles to analysis and design of processes involving biological, environmental and agricultural systems. **Prerequisites:** Grade of C or better in BAEN 320, BAEN 340, and BAEN 365 or concurrent enrollment; grade of C or better in MATH 308; junior or senior classification.

BAEN 370 Measurement and Control of Biological Systems and Agricultural Processes

Credits 3. 2 Lecture Hours. 2 Lab Hours. 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 ECEN 215.

BAEN 375 Design Fundamentals for Agricultural Machines and Structures

Credits 3. 3 Lecture Hours. 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 CVEN 305.

BAEN 399 Professional Development

Credits 0. 0 Other Hours. 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. **Prerequisites:** Junior or senior classification; or approval of instructor.

BAEN 401 Bioprocess Systems Design

Credits 3. 2 Lecture Hours. 2 Lab Hours. . Application of engineering and biological principles in bioprocess systems design; design and scale up of upstream and downstream unit operations including bioreactors, sedimentation, centrifugation, membraned filtration, adsorption and produce formulation; bioprocess integration, scale up and sustainability assessment. **Prerequisites:** Grade of C or better in BAEN 302 and BAEN 365; grade of C or better in BAEN 320 or concurrent enrollment.

BAEN 412 Hydraulic Power

Credits 3. 2 Lecture Hours. 2 Lab Hours. 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. **Prerequisites:** Grade of C or better in BAEN 340 or equivalent, or approval of instructor.

BAEN 414 Renewable Energy Conversions

Credits 3. 2 Lecture Hours. 2 Lab Hours. 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 BAEN 320 or equivalent, or approval of instructor.

BAEN 417 Fundamentals of Nanoscale Biological Engineering

Credits 3. 3 Lecture Hours. Nanostructures, nanofabrication methods, instrumentation and applications pertinent to Biological, Food and Bioenergy systems; identification and utilization of key tools available for fabricating, manipulating and analysis of nanostructures used in biological engineering applications. **Prerequisite:** Senior classification in engineering or approval of instructor.

BAEN 420 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:** Junior or senior classification or approval of instructor.

BAEN 422/CHEN 422 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:** Grade of C or better in CHEN 205 and CHEN 304, or MEEN 221. **Cross Listing:** CHEN 422/BAEN 422.

BAEN 427 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; food packaging issues. **Prerequisite:** Junior or senior classification or approval of instructor.

BAEN 431 Fundamentals in Bioseparations

Credits 3. 2 Lecture Hours. 2 Lab Hours. Design principles and application of chemical engineering unit operations to the production of therapeutic and bioactive molecules. **Prerequisite:** Grade of C or better in BAEN 302, BMEN 282, CHEN 282, or CHEN 482.

BAEN 432 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:** Senior classification or approval of instructor.

BAEN 460 Principles of Environmental Hydrology

Credits 3. 3 Lecture Hours. Hydrologic cycle; precipitation, evaporation, evapotranspiration, infiltration, percolation, runoff, streamflow; groundwater and surface water flow; analysis of hydrologic data for engineering design. **Prerequisites:** Grade of C or better in BAEN 340.

BAEN 464 Irrigation and Drainage Engineering

Credits 3. 2 Lecture Hours. 2 Lab Hours. Engineering principles and design of both surface and pressurized irrigation systems; introduction to the design of surface and subsurface drainage systems including crop water requirements, soil moisture, irrigation scheduling, surface irrigation, sprinkler irrigation, trickle irrigation, pumps, pipelines, irrigation canals, irrigation wells, and surface and subsurface drainage. **Prerequisite:** Grade of C or better in BAEN 340, EVEN 311/CVEN 311, or CVEN 311/EVEN 311.

BAEN 465 Design of Biological Waste Treatment Systems

Credits 3. 3 Lecture Hours. Management and treatment of high organic content wastes, with emphasis on agricultural and food processing wastes; engineering design of biological waste treatment processes; regulatory aspects affecting management of agricultural wastes. **Prerequisite:** Grade of C or better in BIOL 111 and CHEM 222 or CHEM 227, or BAEN 302, or EVEN 320; or approval of instructor.

BAEN 468 Soil and Water Conservation Engineering

Credits 3. 2 Lecture Hours. 2 Lab Hours. Engineering principles of soil and water conservation; open channel flow principles, hydraulic grade stabilization, erosion control, storm water management, design of structures for floodwater routing, culvert design, design of waterways and agricultural reservoirs, stream bank protection, water quality assessment, groundwater flow, surface water modeling. **Prerequisites:** Grade of C or better in BAEN 340, EVEN 311/CVEN 311, or CVEN 311/EVEN 311.

BAEN 469 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. **Prerequisite:** Grade of C or better in BAEN 340, CVEN 311/EVEN 311, or EVEN 311/CVEN 311.

BAEN 471/CHEN 471 Bioreactor Engineering

Credits 3. 3 Lecture Hours. Fundamentals of microbial and enzyme kinetics; basic biochemical reaction theory and reactor systems; heterogeneous reactions and transport considerations in enzyme and cell reactors, and immobilized systems; bioreactor design considerations in bioprocessing. **Prerequisite:** Grade of C or better in CHEN 282, CHEN 482, or BAEN 302; junior or senior classification or approval of instructor. **Cross Listing:** CHEN 471/BAEN 471.

BAEN 477/MEEN 477 Air Pollution Engineering

Credits 3. 3 Lecture Hours. Design of air pollution abatement equipment and systems to include cyclones, bag filters and scrubbers; air pollution regulations; permitting; dispersion modeling; National Ambient Air Quality Standards. **Prerequisite:** Grade of C or better in BAEN 340, CVEN 311/EVEN 311, EVEN 311/CVEN 311, or MEEN 344. **Cross Listing:** MEEN 477/BAEN 477.

BAEN 479 Biological and Agricultural Engineering Design I

Credits 3. 3 Lecture Hours. Capstone design project selection from problems posed by biological and agricultural engineers in industrial practice; completion of project feasibility study and outline; design philosophy, teamwork and communication; economics; product liability and reliability; use of standards and codes; goal setting, professional development, and time management; project to be completed in BAEN 480. **Prerequisites:** Grade of C or better in BAEN 340 and BAEN 365; grade of C or better in BAEN 366 or BAEN 370; grade of C or better in BAEN 354 or concurrent enrollment.

BAEN 480 Biological and Agricultural Engineering Design II

Credits 3. 6 Lab Hours. Continuation of engineering design experience through team solution of design problem developed in BAEN 479; preparation of design solution under supervision of biological and agricultural engineering staff and clients; critical evaluation of results by students; staff and industrial consultants. **Prerequisites:** Grade of C or better in BAEN 479.

BAEN 481 Seminar

Credit 1. 1 Other Hour. Review of current literature dealing with agricultural engineering problems presented by staff members and students. **Prerequisite:** Senior classification.

BAEN 484 Internship

Credits 0. 0 Lecture Hours. 0 Lab Hours. 0 Other Hours. No Credit. Practical experience working in a professional biological and agricultural engineering setting. May be taken three times. **Prerequisite:** Junior or senior classification; approval of the instructor.

BAEN 485 Directed Studies

Credits 0 to 4. 0 to 4 Other Hours. Selected problems in any phase of agricultural engineering. Credit and specific content dependent upon background, interest, ability and needs of student enrolled. Individual consultations and reports required. **Prerequisites:** Junior or senior classification and approval of department head.

BAEN 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours. Special topics in an identified area of agricultural engineering. May be repeated for credit. **Prerequisite:** Approval of department head.

BAEN 491 Research

Credits 0 to 3. 0 to 3 Other Hours. Research conducted under the direction of faculty member in biological and agricultural engineering. May be repeated 2 times for credit. Registration in multiple sections of this course are possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisites:** Junior or senior classification and approval of instructor.