Biological and Agricultural Engineering

(BAEN) Course Descriptions

Required Courses:

201. Analysis of Biological and Agricultural Engineering Problems (3-2). Credit 3. Overview of Biological and Agricultural Engineering discipline through case studies and contemporary problems; introduction to computer programming; engineering analysis and problem solving using computer programming. Prerequisites: ENGR 102; MATH 151; CHEM 107/117 or 102/112

301. Biological and Agricultural Engineering Fundamentals I. (3-2). Credit 3. 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: MEEN 221 or registration therein.

302. Biological and Agricultural Engineering Fundamentals II. (3-2). Credit 3. 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: BIOL 113; CHEM 222 or registration therein.

320. Engineering Thermodynamics. (2-2). Credit 3. 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: MEEN 221, MATH 251 or registration therein; junior or senior classification.

340. Fluid Mechanics. (3-0). Credit 3. Fundamentals of fluid properties; basic conservation principles of momentum, energy and continuity; flow through closed conduits; open channel flow; principles of turbomachines and compressible flow. Prerequisites: MEEN 221; BAEN 320 or registration therein

354. Engineering Properties of Biological Materials. (2-3). Credit 3. 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: MEEN or MSEN 222.

365. Unit Operations for Biological and Agricultural Engineering. (2-3). Credit 3. 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: BAEN 340; CVEN 305 or registration therein; junior or senior classification.

366. Transport Processes in Biological Systems. (3-0). Credit 3. 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: BAEN 320; BAEN 340; BAEN 365 or registration therein; MATH 308; junior or senior classification.

370. Measurement and Control of Biological Systems and Agricultural Processes. (2-2). Credit 3. 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: ECEN 215.

375. Design Fundamentals for Agricultural Machines and Structures. (3-0). Credit 3. 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: CVEN 305.

479. Biological and Agricultural Engineering Design I. (3-0). Credit 3. 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: BAEN 340, 365; BAEN 366 or 370 (must have one of the two); BAEN 354 and BAEN 375 can be taken concurrently with BAEN 479

480. Biological and Agricultural Engineering Design II. (0-6). Credit 3. 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: BAEN 479; senior classification; BAEN 366 or 370 (only one of the two) can be taken concurrently with BAEN 480

Elective Courses:

412. Hydraulic Power. (2-2). Credit 3. 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: BAEN 340 and 375.

414. Renewable Energy Conversions. (2-2). Credit 3. 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 non-renewable energy. Prerequisite: BAEN 320, BAEN 366 or equivalent, or approval of instructor.

417. Fundamentals of Nanoscale Biological Engineering (3-0). Credit 3. 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.

422. Unit Operations in Food Processing. (2-2). Credit 3. 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: CHEN 205 and 304, or CVEN 305. Cross-listed with CHEN 422.

427. Engineering Aspects of Packaging. (3-0). Credit 3. 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: Senior classification or approval of instructor.

431. Fundamentals in Bioseparations. (3-0). Credit 3. Design principles and application of chemical engineering unit operations to the production of therapeutic and bioactive molecules. Prerequisite BAEN 302. Cross-listed with CHEN 431

460. Principles of Environmental Hydrology. (3-0). Credit 3. Hydrologic cycle; precipitation, evaporation, evapotranspiration, infiltration, percolation, runoff, streamflow; groundwater and surface water flow; transport of contaminants in surface water; measurement and analysis of hydrologic data for engineering design. Prerequisites: BAEN 340; senior classification.

464. Irrigation and Drainage Engineering. (2-2). Credit 3. 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: BAEN 340.

465. Design of Biological Waste Treatment Systems. (3-0). Credit 3. 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. Prerequisites: BAEN 365; junior or senior classification.

468. Soil and Water Conservation Engineering. (2-2). Credit 3. 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: BAEN 340; CVEN 305.

469. Water Quality Engineering. (3-0). Credit 3. Nonpoint source pollution processes including transport mechanisms and contaminant fate; design of best management practices for abating nonpoint source pollution. Prerequisites: BAEN 340 or equivalent; CVEN 305.

471. Bioreactor Engineering (3-0). Credit 3. 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 BAEN 302. Cross-listed with CHEN 471.

477. Air Pollution Engineering. (3-0). Credit 3. 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: CVEN 305 or equivalent. Cross-listed with MEEN 477.