<table>
<thead>
<tr>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Credit Hours</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
<th>Format</th>
<th>Prerequisite for</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGEN 100 Introduction to Biological Engineering and Agricultural Engineering</td>
<td>BSEN 100</td>
<td>Description: Description of careers in biomedical, environmental, water resources, food and bioproducts, and agricultural engineering. The human, economic and environmental impacts of engineering in society. Communication, design, teamwork, and the role of ethics and professionalism in engineering work.</td>
<td>BSEN 100/AGEN 100 and high school physics, or permission</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>LEC</td>
<td>AGEN 112, BSEN 112</td>
</tr>
<tr>
<td>AGEN 112 Computer-Aided Problem-Solving</td>
<td>BSEN 112</td>
<td>Description: Problem solving techniques and procedures through the use of Excel, MATLAB, and graphical methods. Emphasis on problem/solution communications with topics and problems from agricultural engineering and biological systems engineering.</td>
<td>AGEN or BSEN 112/112H; or permission</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>LEC</td>
<td>AGEN 212A, AGEN 212B; BSEN 212A, BSEN 212B, AGEN 212E</td>
</tr>
<tr>
<td>AGEN 212A Computational Tools &amp; Modeling for Agricultural &amp; Biological Systems Eng: MATLAB</td>
<td>BSEN 212A</td>
<td>Description: Introduction to tools needed to develop computation-intense solutions for a wide variety of problems relevant to agricultural and biological systems engineering. Advanced problem solving techniques are illustrated using examples of scripts.</td>
<td>AGEN or BSEN 112/112H; or permission</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>LEC</td>
<td>AGEN 324, BSEN 324</td>
</tr>
<tr>
<td>AGEN 212B Computational Tools &amp; Modeling for Ag &amp; Biological Sys Engr: Control Systems</td>
<td>BSEN 212B</td>
<td>Description: Introduction to microcontroller based embedded systems for agricultural and biological applications. Fundamental principles of microcontrollers and embedded systems through binary and hexadecimal number systems, digital logic, programming in integrated development environment, and microcontroller peripherals. Common agricultural and biological microcontroller input and output devices.</td>
<td>AGEN or BSEN 112/112H; or permission</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>LEC</td>
<td></td>
</tr>
<tr>
<td>AGEN 212E Computational Tools &amp; Modeling for Agricultural &amp; Biological Systems Eng: LabVIEW</td>
<td>BSEN 212E</td>
<td>Description: Introduction to tools needed to develop computation-intense solutions for a wide variety of problems relevant to agricultural and biological systems engineering. Advanced problem solving techniques are illustrated using examples of scripts, simulation methods, graphical programming, and their combination.</td>
<td>AGEN or BSEN 112/112H; or permission</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>LEC</td>
<td></td>
</tr>
<tr>
<td>AGEN 225 Engineering Properties of Biological Materials</td>
<td>BSEN 225</td>
<td>Description: Physical properties important to the design of harvesting, storage, and processing systems for agricultural crops; principles and techniques for measurement of properties including frictional effects, particle size, strength, moisture content, specific heat, and thermal conductivity.</td>
<td>MATH 106</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>LEC</td>
<td>AGEN 324, BSEN 324</td>
</tr>
<tr>
<td>AGEN 303 Principles of Process Engineering</td>
<td>BSEN 303</td>
<td>Description: Introduction to performance parameters and characteristics of pumps, fans, presses, and solids handling, size reduction, separation and agitation equipment. Application of the various technologies studied with analysis of example systems.</td>
<td>MATH 221 or permission.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>LEC</td>
<td></td>
</tr>
</tbody>
</table>
AGEN 324 Mechanics of Materials for Agricultural and Biological Systems Engineering  
Crosslisted with: BSEN 324  
Prerequisites: AGEN/BSEN 225, MECH 223  
Description: Development of the concepts of stress and strain relevant to agricultural and biological systems. Stress analysis of axial, torsional, and bending stresses, combined loading analysis, deflection evaluation, static and dynamic failure theory. Practical applications in agricultural and biological systems will be discussed.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 325 Power Systems Design  
Crosslisted with: BSEN 325  
Prerequisites: PHYS 212 or ELEC 211, and MECH/CIVE 310 or CHME 332 or parallel or permission.  
Description: Fundamentals of Power systems for machines. Introduction to fluid power (hydraulics, pneumatics), pumps, motors, cylinders, control devices and system design. Selection of electric motors as power sources, operating characteristics and circuits. Selection of internal combustion engines as power sources.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 344 Biological and Environmental Transport Processes  
Crosslisted with: BSEN 344  
Prerequisites: BSEN 244 or MECH 200; MATH 221; MECH/CIVE 310 or CHME 332 or parallel, or permission  
Description: Introduction to concurrent transport of energy and mass in biological and environmental processes. Modes of heat transfer, steady and non-steady state heat conduction, convective heat transfer, radiative heat transfer, and heat transfer with phase change. Equilibrium, kinetics, and modes of mass transfer, diffusion, dispersion, and convective mass transfer. Soil freezing and thawing, energy and mass balances of crops, diffusivities of membranes, photosynthesis, human and animal energy balances, and respiration.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: AGEN 470, BSEN 470

AGEN 350 Soil and Water Resources Engineering  
Crosslisted with: BSEN 350  
Prerequisites: MATH 221 and parallel: MECH/CIVE 310 or CHME 332  
Description: Introduction to soil and water resources and the engineering processes used to analyze watersheds. Soil water relations, evapotranspiration, precipitation, runoff, erosion, flow in natural waterways and through reservoirs, wetland and groundwater hydrology, and water quality. Geographic information system utilized to develop maps and analyze watershed characteristics. A selected watershed is investigated.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: AGEN 957, BSEN 957, CIVE 957, GEOL 957

AGEN 395 Internship in Agricultural and Biological Systems Engineering  
Crosslisted with: BSEN 395  
Prerequisites: Permission  
Notes: Completion of internship approval form is required. The internship proposal is subject to approval by the Department of Biological Systems Engineering.  
Description: Practical experience, directed learning, and career exploration and development in a selected business, industry, agency, or educational institution. Activities must include a significant engineering component.  
Credit Hours: 1-3  
Min credits per semester: 1  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 424 Machine Design in Agricultural Engineering  
Crosslisted with: AGEN 424  
Prerequisites: Senior standing and MECH 325.  
Description: Design of machine elements. Definition, analysis, and solution of a design problem in agricultural engineering.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 431 Site-specific Crop Management  
Crosslisted with: AGRO 431, MSYM 431  
Prerequisites: Senior standing; AGRO/SOIL 153; AGRO 204; or permission.  
Description: Principles and concepts of site-specific management. Evaluation of geographic information systems for crop production practices. Practical experience with hardware and software necessary for successful application of information affecting crop management.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 441 Animal Waste Management  
Crosslisted with: AGEN 441, BSEN 441, BSEN 841  
Prerequisites: Senior standing.  
Description: Characterization of wastes from animal production. Specification and design of collection, transport, storage, treatment, and land application systems. Air and water pollution, regulatory and management aspects.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

AGEN 443 Design of Light-Frame Structures  
Prerequisites: MECH 325  
Description: Engineering design for strength, economy, function and safety of light-frame structures; emphasis on wood, concrete, and steel elements; design project required.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC
AGEN 446 Unit Operations of Biological Processing
Crosslisted with: BSEN 446, BSEN 846, AGEN 846
Prerequisites: AGEN 225 or BSEN 225 and CHEM 332 or equivalent.
Description: Application of heat, mass, and moment transport in analysis and design of unit operations for biological and agricultural materials. Evaporation, drying, distillation, extraction, leaching, thermal processing, membrane separation, centrifugation, and filtration.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

AGEN 453 Irrigation and Drainage Systems Engineering
Crosslisted with: AGEN 853, BSEN 453, BSEN 853
Prerequisites: CIVE 310 or MECH 310; AGEN 344 or BSEN 344; or permission.
Description: Analytical and design consideration of evapotranspiration, soil moisture, and water movement as related to irrigation and drainage systems; analysis and design of components of irrigation and drainage systems including water supplies, pumping plants, sprinkler systems, and center pivots.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3

AGEN 460 Instrumentation and Controls
Crosslisted with: AGEN 860, BSEN 460, BSEN 860
Prerequisites: ELEC 211 or ELEC 215; or permission
Description: Analysis and design of instrumentation and controls for agricultural and biological production, management and processing. Theory of basic sensors and transducers, analog and digital electrical control circuits, and the interfacing of computers with instruments and controls. Emphasis on signal analysis and interpretation for improving system performance.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

AGEN 470 Design I in Agricultural and Biological Systems Engineering
Crosslisted with: BSEN 470
Prerequisites: BSEN or MECH 130 and AGEN or BSEN 344; Prereq or Parallel: AGEN or BSEN 460 and at least two courses from primary emphasis area; or permission
Description: Definition, scope, analysis, and synthesis of a comprehensive design problem within the areas of emphasis in the Department of Biological Systems Engineering. Identification of a client's engineering problem to solve, and development of objectives and anticipated results.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC
Prerequisite for: AGEN 480, BSEN 480

AGEN 480 Design II in Agricultural and Biological Systems Engineering
Crosslisted with: BSEN 480
Prerequisites: BSEN/AGEN 470
Description: Definition, scope, analysis, and synthesis of a comprehensive engineering problem in an engineering area of emphasis within the Department of Biological Systems Engineering. Design activity using the team approach to develop a solution.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LAB
ACE: ACE 10 Integrated Product

AGEN 492 Special Topics in Agricultural Engineering
Crosslisted with: AGEN 892
Prerequisites: Permission
Description: Subject matter in emerging areas of Agricultural Engineering not covered in other courses within the curriculum. Topics, activities, and delivery methods vary.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: LAB

AGEN 496 Independent Study
Crosslisted with: BSEN 496
Prerequisites: Permission
Notes: Topics vary.
Description: Investigation and written report on engineering problems not covered in sufficient depth through existing courses.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: IND

AGEN 499H Honors Thesis
Crosslisted with: BSEN 499H
Prerequisites: Senior or junior standing, admission to the University Honors Program.
Description: Independent project which meets the requirements of the University Honors Program, conducted under the guidance of a faculty member in the Department of Biological Systems Engineering. The project should contribute to the advancement of knowledge in the field. Written thesis and formal presentation required.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: IND