

**AGRICULTURAL ECONOMICS**

**991E\*.** **Dynamic Models in Agricultural Economics**  
*Spring of odd-numbered years. 2(2-0)*  
 P: EC 480, EC 812A

Introduction to methods of dynamic optimization and application to agricultural and natural resources problems. Topics include discrete time dynamic programming, calculus of variations, and discrete time maximum principle.  
 QA: AEC 839

**991F\*.** **Methodological Approaches to Research**  
*Summer of even-numbered years. 2(2-0)*  
 R: None

Selection, planning, and conduct of research. Alternative research approaches. Role of theory, beliefs, and valuations. Critical appraisal of research studies.  
 QA: AEC 972

**991G\*.** **Agricultural Finance**  
*Spring of odd-numbered years. 1 to 2 credits.*  
 P: AEC 855 and 991C

Applications of financial theory and management techniques to problems in agriculture. Topics include asset valuation, portfolio management, capital structure, and risk management.

**991H\*.** **Environmental Economics Research Topic**

*Summer of odd-numbered years. 1 to 2 credits. Interdepartmental with the Department(s) of.*  
 P: AEC 821, EC 805A R: None

Current research in environmental economics including methods for valuing environmental change, temporal analysis of environmental resources, and game-theoretic aspects of market and non-market institutions.  
 QA: AEC 995

**999\*.** **Doctoral Dissertation Research**  
*Fall, Spring, Summer. 1 to 12 credits.*  
 R: X

QA: AEC 999

**AGRICULTURAL ENGINEERING**

**AE**

**152W\*.** **Food and Agricultural Engineering**  
*Spring. 1(2-0)*  
 R: Freshman, Sophomore

Overview of worldwide problems related to food production. Energy issues, food distribution, food processing, conservation of natural resources, food production on an international scale.  
 QA: AE 152

**336\*.** **Principles of Agricultural Machines**  
*Spring. 3(3-0)*  
 P: MMM 211, CE 321 or CHE 311 or ME 332. R: Open only to Engineering majors.

Processes performed by agricultural production machines. Power systems, tillage mechanics, traction, metering, distribution, conveying, fluidization, mixing, separation, and atomization. Machinery management.  
 QP: MMM 211 CE 321ORME 332OR QA: AE 374

**338\*.** **Principles of Food Processing Equipment**  
*Spring. 3(3-0)*  
 P: MMM 211, CHE 311 or CE 321 or ME 332 R: Engineering

Principles of equipment used in processing raw materials into finished or intermediate products in a food processing plant.  
 QP: MMM 211 CE 321ORME 332OR QA: AE 374

**353\*.** **Engineering Principles of the Plant Environment**  
*Fall. 3(3-0)*  
 P: BOT 105 or BS 110; CEM 141, MTH 235, ME 201. R: Open only to Engineering majors.

Analysis of the soil-plant-atmosphere continuum. Thermodynamics effects on plant environment: water, soil heat flow, radiation, and soil water movement.  
 QP: CEM 141 MTH 310ME 311BOT 205OR QA: AE 353

**356\*.** **Electric Power and Control**  
*Spring. 3(2-2)*  
 P: EE 345 or EE 200 R: Juniors and Above Engineering

Alternating current circuits, power distribution, electrical machines, protection, and programmable motor controllers. Design project related to food and agricultural industries.  
 QP: PHY 288 EE 345OREE 300 QA: AE 356

**430\*.** **Power and Control Hydraulics**  
*Spring. 3(2-2)*  
 P: CE 321 or ME 332 or CHE 311 R:

*Engineering*  
 Hydraulic fluid properties. Pump and motor performance parameters. Control valves and hydraulic circuitry components. Analysis and design of hydraulic systems.  
 QP: CE 321 ORCHE 340ORME 332 QA: AE 493

**438\*.** **Design of Machinery Structures**  
*Fall. 3(3-0)*  
 P: MMM 306; AE 336 or AE 338. R: Open only to majors in College of Engineering. Not open to students with credit in ME 471.

Design of structural components and systems in machines. Tension, compression, torsion, bending and combined loadings. Joint connections.  
 QP: MMM 211 QA: AE 461

**481\*.** **Agricultural and Small Watershed Hydrology**  
*Spring. 4(5-0)*  
 P: CPS 130 or CPS 131; CE 321 or CHE 311 or ME 332, AE 353 or CE 312. R: Open only to Engineering majors.

Relationships between rainfall, infiltration, runoff, interflow, subsurface drainage, ephemeral streamflow, and soil erosion. Runoff prediction using computer modeling of runoff.  
 QP: CPS 112 CE 321ORCHE 311OR QA: AE 481

**486W\*.** **Agricultural Engineering Design Fundamentals**  
*Fall. 2(2-0)*  
 P: AE 353 or AE 356 or AE 336 R: Seniors and above Engineering

Concepts, methods, and procedures uniquely associated with the design process. Emphasis is on the total design process from problem identification to final specifications.  
 QA: AE 495

**488W\*.** **Agricultural Engineering Design Project**  
*Spring. 3(0-6)*  
 P: AE 486 R: Senior Engineering

Individual or team pursuit of a design project selected in AE 486. Information expansion, developing alternatives, evaluation, selection of a concluding project.  
 QA: AE 496

**490\*.** **Independent Study**  
*Fall, Spring, Summer. 1 to 5 credits.*  
 May reenroll for a maximum of 5 credits.  
 P: AE 152 or ME 391 or MTH 235. R:

Open only to Engineering majors. Approval of department.  
 Supervised individual student research and study in agricultural engineering.  
 QP: AE 152 ORME 391ORMTH 310 QA: AE 480

**491\*.** **Special Topics in Agricultural Engineering**

*Fall, Spring, Summer. 1 to 4 credits.*  
 May reenroll for a maximum of 12 credits.  
 P: AE 152 or ME 391 or MTH 235. R: Open only to Engineering majors. Approval of department.  
 Special topics in agricultural engineering.  
 QP: AE 152 ORME 391ORMTH 310 QA: AE 490

**802\*.** **Advanced Computational Methods in Food and Agricultural Engineering**  
*Fall of odd-numbered years. 3(3-0)*  
 R: Undergraduate Degree in Engineering

Formulation and solution of mathematical equations in food and agricultural engineering. Constitutive equations. Linear and nonlinear problems. Steady state and transient problems. Computer solutions.

**809\*.** **Finite Element Method**  
*Spring. 3(3-0) Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science, Mechanical Engineering.*  
 P: Approval of Department R: Graduate student

Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics and stress analysis.  
 QA: AE 809

**812\*.** **Bio-Processing Engineering**  
*Spring of odd-numbered years. 3(3-0)*  
 R: Undergraduate Degree in Engineering

Thermodynamics, heat and mass transfer, fluid flow, dehydration, materials handling and storage of biological products.  
 QA: AE 812

**815\*.** **Instrumentation**  
*Fall. 3(3-0)*  
 P: MTH 235 R: Graduate students Undergraduate Degree in Engineering

Theory, method and techniques of making engineering measurements (such as temperature, pressure, flow, humidity, and moisture) in biological materials. Recording and indicating equipment.  
 QA: AE 815

**850\*.** **Dimensional Analysis and Similitude Modeling**  
*Fall. 3(2-2)*  
 R: Graduate students Undergraduate Degree in Engineering

Dimensional concepts; systems of measurements and transformation of units; formation of dimensionless groups; development of prediction equations; concepts of similarity; scaling laws; and distortion.  
 QA: AE 850

**882\*.** **Irrigation and Water Management Engineering**

*Spring of even-numbered years. 3(3-0)*  
 P: CE 321, AE 481 R: Senior or above Undergraduate Degree in Engineering  
 Engineering design of irrigation systems in humid areas. System design, management, water supply, water transport, and economic and engineering optimization of irrigation design.  
 QP: AE 481 CE 321 QA: AE 482

**890\*.** **Special Problems**  
*Fall, Spring, Summer. 1 to 4 credits.*  
 May reenroll for a maximum of 9 credits.

R: Graduate students Approval of department; application required.  
 Individual student research and study in Agricultural Engineering.  
 QA: AE 880

**AGRICULTURAL ENGINEERING**

**891\*** **Advanced Topics in Agricultural Engineering(MTC)**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 9 credits.  
 P: Approval of department R: Graduate students Undergraduate degree in Engineering  
 Advanced topics in agricultural engineering.  
 QA: AE 890

**892A\*** **Research Methods in Agriculture Engineering**  
 Spring. 1(1-0)  
 R: Graduate Students Engineering or Agriculture  
 Discussion of procedures and methods for designing and executing research projects.  
 QA: AE 820

**892B\*** **Agricultural Engineering Seminar**  
 Fall. 1(1-0)  
 R: Graduate Students Engineering or Agriculture  
 Current topics in Agricultural Engineering

**899\*** **Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 15 credits.  
 P: Approval of department R: Graduate students AE  
 QA: AE 899

**999\*** **Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 15 credits.  
 P: Approval of department R: Graduate students AE  
 QA: AE 999

**AGRICULTURAL TECHNOLOGY AND SYSTEMS MANAGEMENT ATM**

**315. Occupational and Personal Safety**  
 Spring. 2(2-0)  
 P: CSS 101 or ANS 110 or AEE 101 or HRT 201. R: Open only to College of Agriculture and Natural Resources majors.  
 Principles of safety problem solving. Accident causation and prevention. Laws and regulations. Machinery, electrical, chemical and fire safety. Security. Safety program development.  
 QA: ATM 415

**326. Principles of Animal Environments**  
 Spring. 2(2-0)  
 P: MTH 116 or MTH 120; CPS 100 or CPS 130 or CPS 131. R: Open only to College of Agriculture and Natural Resources majors.  
 Heat and moisture balances for confined livestock. Interior environment and its control. Waste management.  
 QA: MTH 110 CPS 100 QA: ATM 426

**431. Irrigation, Drainage and Erosion Control Systems**  
 Fall. 3(2-2)  
 P: MTH 116 or MTH 120; CSS 210. R: Not open to freshmen and sophomores.  
 Principles of soil and water conservation engineering including: land and soil surveying, basic hydraulics, hydrology, soil moisture, and soil and water conservation practices with applications to irrigation, drainage and erosion control systems.  
 QA: MTH 111 CSS 210 QA: ATM 231 ATM 431

**440\*. Agricultural Machinery Systems**  
 Fall. 3(3-0)  
 P: CSS 210; MTH 110 or MTH 116; CPS 100 or CPS 130 or CPS 131 R: Juniors and Above Agriculture and Natural Resources  
 Principles, analysis, management, and economics of agricultural machinery systems considering weather conditions, cultural practices, crop rotation, labor and energy.  
 QP: MTH 108 ORMTH 111CPS 100OR QA: ATM 440

**490\*. Independent Study**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 8 credits.  
 P: ATM 231 or ATM 240 or BCM 311 R: Juniors and above ATM Approval of department; application required  
 Supervised individual student research and study in Agricultural Technology and Systems Management.  
 QP: ATM 231 ORATM 240ORATM 311 QA: ATM 480

**491\*. Special Topics in Agricultural Technology and Systems Management**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 8 credits.  
 P: ATM 231 or ATM 240 or BCM 311 R: Juniors and above ATM  
 Special Topics in Agricultural Technology and Systems Management.  
 QP: ATM 231 ORATM 240ORATM 311 QA: ATM 490

**804\*. Appropriate Agricultural Mechanization in Developing Countries**  
 Fall of odd-numbered years. 3(3-0)  
 R: Seniors and Above  
 Appropriate agricultural mechanization in developing countries including humane, animal and mechanical power for the smaller farms. Machine selection, local manufacturing, ownership patterns, increasing production and decreasing losses.  
 QA: ATM 804

**807\*. Human Factors Engineering (Ergonomics)**  
 Fall of even-numbered years. 3(3-0)  
 R: Seniors and above  
 Analysis of machine designs, operation and working environment in relation to human limitations and capabilities. Study of procedures to develop maximum human-machine compatibility and performance.  
 QA: ATM 807

**831\*. Water, Technology and International Development**  
 Spring of even-numbered years. 3(3-0)  
 P: CSS 210 or ATM 431 or AE 481 or ANR 399 R: Seniors and above  
 Water resources planning and development for irrigated agriculture. Technological, Agronomics, Environmental, Social and political constraints will be presented and discussed. Case studies from selected areas will be presented.  
 QA: ATM 890

**836\*. Microclimate and Its Measurement**  
 Spring. 4(3-3) Interdepartmental with the Department(s) of Geography.  
 P: MTH 116 R: Juniors and Above  
 Introductory course in microclimatology and the principles of instrumentation required to adequately quantify this environment. The primary study region will be: area-field scale & smaller; height-surface +10 to-1 m; and time-sec to hours.  
 QP: MTH 109 MTH 111 QA: ATM 436 ATM 808

**840\*. Analysis of Physical Systems**  
 Fall. 3(3-0)  
 P: ATM 440 or BCM 311 or MGT 306 R: Seniors and above ANR  
 Identification and definition of systems problems in the agriculture and construction industries. Model formulation and estimation. Consideration of current approaches and models.  
 QA: ATM 806

**845\*. Process Network Theory Applied To Agroecosystems**  
 Spring of odd-numbered years. 4(4-0)  
 P: 1 Year of Calculus R: Seniors and above  
 Process network theory providing a numerical framework for the technical, economic and environmental analysis of agricultural and biological systems.  
 QA: ATM 890

**890\*. Special Problems**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 6 credits.  
 P: Approval of department R: Graduate students  
 Individual study or research on selected topics.  
 QA: ATM 880

**891\*. Advanced Topics in Agricultural Technology and Systems Management**  
 Fall, Spring, Summer. 2 to 4 credits.  
 May reenroll for a maximum of 12 credits.  
 R: Seniors and above  
 New developments in agricultural technology and systems management.  
 QA: ATM 890

**899\*. Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 8 credits.  
 May reenroll for a maximum of 15 credits.  
 P: Approval of department R: Graduate students ATM  
 QA: ATM 899

**999\*. Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 24 credits.  
 May reenroll for a maximum of 48 credits.  
 P: Approval of department R: Graduates ATM  
 QA: ATM 999

**AGRICULTURE AND NATURAL RESOURCES ANR**

**350\*. Leadership Development for Agriculture and Natural Resources**  
 Spring. 2(2-0)  
 R: Not open to Freshmen and Sophomores  
 Approval of college: application required  
 Leadership development. Preparation for community leadership. Firsthand look at social, economic and political problems. Emphasis on awareness, action and involvement. Series of seminars and interviews. Field trips required.  
 QA: ANR 350

**392\*. Agriculture and Natural Resources Seminar**  
 Spring. 1(2-0)

Current agricultural, natural resources and environmental problems and solutions as presented by discussion leaders from various disciplines.  
 QA: ANR 425