

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.
 QP: 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.
 QP: 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