Agricultural Economics

991E*. Dynamic Models in Agricultural Economics
Spring of odd-numbered years. 2(2-0)
P: EC 459, EC 812A
Introduction to methods of dynamic optimization and application to agricultural and natural resource 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.
QA: AEC 995

991H*. Environmental Economics Research Topic
Summer of odd-numbered years. 1 to 2 credits.
P: Interdepartmental with the Department(s) of:
P: AEC 821, EC 805A: 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 996

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. 3(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 182

336*. Principles of Agricultural Machines
Spring. 3(3-0)
P: MMM 211, CE 321 or CH 311 or ME 322. R: Open only to Engineering majors.
Processes performed by agricultural production machines. Power systems of these machines, friction, traction, metering, distribution, conveying, fluidization, mixing, separation, and atomization. Machinery management.
QP: MMM 211 CE 3210RME 3320R QA: AE 374

338*. Principles of Food Processing Equipment
Spring. 3(3-0)
P: MMM 211, CH 311 or CE 321 or ME 322
Principles of equipment used in processing raw materials into finished or intermediate products in a food processing plant.
QP: MMM 211 CE 3210RME 3320R QA: AE 374

353*. Engineering Principles of the Plant Environment
Fall. 3(3-0)
P: EN 306 or BS 110; CEM 141, MTH 225, ME 201. R: Open only to Engineering majors.
Analysis of the soil-plant-atmosphere continuum. Thermodynamic effects on plant environment, water, soil heat flow, radiation, and soil water movement.
QP: CEM 141 MTH 310ME 311BOT 2050R QA: AE 353

358*. Electric Power and Control System
Spring. 3(2-0)
P: EN 304 or EE 300 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 205 EE 3450REE 300 QA: AE 356

430*. Power and Control Hydraulics
Spring. 3(2-0)
P: CE 321 or ME 332 or CH 311 R: Engineering majors.
QP: CE 321 ORCHE 3400RME 332 QA: AE 483

438*. Design of Machinery Structures
Spring. 3(2-0)
P: MMM 336; ME 338 or CH 311. R: Open only to majors in College of Engineering. Not open to students with credit in ME 471.
QP: MMM 211 QA: AE 451

481*. Agricultural and Small Watershed Hydrology
Spring. 4(0-5)
P: CPS 110 or CPS 131; CE 321 or CH 311 or ME 322, AE 353 or CE 312. R: Open only to Engineering majors.
Relationships between rainfall, infiltration, runoff, interflow, surface drainage, ephemeral streamflow, and soil erosion. Runoff prediction using computer modeling of runoff.
QP: CPS 116 CE 3210RCH 3110R QA: AE 481

485W*. Agricultural Engineering Design Fundamentals
Fall. 3(0-6)
P: AE 358 or AE 336 or AE 338 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 485

485W*. Agricultural Engineering Design Project I
Spring. 3(0-4)
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 6 credits.
May enroll 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 3910R MTH 310 QA: AE 480

491*. Special Topics in Agricultural Engineering
Fall, Spring, Summer. 1 to 4 credits.
May enroll 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 3910R MTH 310 QA: AE 480

502*. Advanced Computational Methods in Food and Agricultural Engineering
Fall of odd-numbered years. 3(3-0)
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 509

512*. Bio-Processing Engineering
Spring of odd-numbered years. 3(0-6)
P: AE 336 or AE 338 R: Students with credit in ME 471.
Thermodynamics, heat and mass transfer, fluid flow, dehydration, materials handling and storage of biological products.
QA: AE 512

515*. Instrumentation
Fall. 3(0-6)
P: MTH 225 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 515

550*. Dimensional Analysis and Similarity Modelling
Fall. 3(0-2)
P: 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 550

582*. Irrigation and Water Management Engineering
Spring of odd-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

590*. Special Problems
Fall, Spring, Summer. 1 to 4 credits.
May enroll for a maximum of 9 credits.
P: Graduate students Approval of department R: Graduate students
Application required.
Individual student research and study in Agricultural Engineering.
QA: AE 590

Courses with an asterisk (*) have not been approved by the University Committee on Curriculum.
### AGRICULTURAL ENGINEERING

**315. Occupational and Personal Safety**  
Spring. 3(2-3)  
P: CSS 101 or ANS 119 or AE 101 or HRT 201. R: Open only to College of Agriculture and Natural Resources majors.  
QA: ATM 415

**326. Principles of Animal Environments**  
Spring. 3(2-3)  
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.  
QA: MTH 110 CPS 100  
ATM: ATM 428

**431. Irrigation, Drainage and Erosion Control Systems**  
Fall, 3(2-3)  
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  
ATM: 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  
Agricultural Technology and Systems Management  
Principles, analysis, design and economic evaluation of agricultural machinery systems considering weather conditions, cultural practices, crop rotation, labor and energy.  
QA: MTH 108 ORMTH 111 CPS 1000R  
ATM: 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 311R  
Juniors and Above  
ATM: ATM 490

**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 311R  
Juniors and above  
ATM: ATM 491

**680. 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 human, animal and mechanical power for the smaller farms. Machine selection, local manufacturing, ownership patterns, increasing production and decreasing labor.  
QA: ATM 804

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

**831. Water and Technology and International Development**  
Spring of even-numbered years. 3(3-0)  
P: ATM 410 or ATM 441 or AE 401 or ANR 399R; R: Seniors and above  
Water resources planning and development for irrigated agriculture. Technological, Agronomic, Environmental, Social and political constraints will be presented and discussed. Case studies from selected areas will be presented.  
QA: ATM 831

**838. Microclimate and Its Measurement**  
Spring. 4(3-3)  
Interdepartmental with the Department(s) of Geography.  
P: MTH 116R; 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 410 to 1 m; and time-span to hours.  
QA: MTH 108 MTH 111  
ATM: ATM 436 ATM 808

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

**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 891

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

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**AGRICULTURE AND NATURAL RESOURCES (ANR)**

**350. Leadership Development for Agriculture and Natural Resources**  
Spring. 2(2-0)  
P: 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(3-0)  
Current agricultural, natural resources and environmental problems and solutions as presented by discussion leaders from various disciplines.  
QA: ANR 425