855.   Agricultural Production Economics
        Spring. 3(3-0)
P: EC 801, EC 805.
Agricultural applications of static production economics, including study of capital inputs that yield services over several time periods. Investment and disinvestment models. Methods for incorporating risk and technological change.
QP: EC 480, EC 805A QA: AEC 805

861.   Agriculture in Economic Development
        Fall. 3(3-0)
Role of agriculture in economic development of low- and middle-income countries. Theories of agricultural growth. Policy issues. Case studies.
QA: AEC 862

865.   Agricultural Benefit-Cost Analysis
        Spring. 3(3-0)
Benefit-cost analysis of agricultural and natural resource projects, including financial and economic analysis. Case studies in project design and appraisal in low and high income countries.
QA: AEC 863

890.   Independent Study
        Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
R: Open only to graduate students in Agricultural Economics. Approval of department.
Independent study of selected topics in agricultural economics.
QA: AEC 882

891.   Topics in Agricultural Economics (MTC)
        Fall, Spring, Summer. 2 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to graduate students in colleges of Agriculture and Natural Resources, Social Science and Business.
Selected topics such as agribusiness management, applied operations research, or rural development policy.

898.   Master's Research
        Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course.
R: Open only to graduate students in Agricultural Economics. Approval of department.
Master's degree Plan B research.
QA: AEC 889

899.   Master's Thesis Research
        Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to graduate students in Agricultural Economics. Approval of department.

QA: AEC 899

923.   Theory of Resource and Environmental Economics
        Spring of odd-numbered years. 3(3-0)
Interdepartmental with Resource Development, Forestry, Park and Recreation Resources, and Economics.
P: AEC 825, EC 805.
Economic theory of environmental change and control. Market and non-market allocation mechanisms. Temporal issues of conservation and growth. Contemporary issues in research and policy.
QP: EC 805A

947.   Analysis of Food Systems Organization
        Summer. 3(3-0)
P: AEC 810, AEC 841, AEC 845.
Public and private policy issues related to the organization and performance of food systems.
QA: AEC 941

991.   Advanced Topics in Agricultural Economics (MTC)
        Fall, Spring, Summer. 2 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to Ph.D. students in the colleges of Agriculture and Natural Resources, Business, and Social Science.
Topics such as international agricultural development, environmental economics, and trade policy.

992.   Seminar in Agricultural Economics
        Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course.
R: Open only to Ph.D. students in Agricultural Economics. Approval of department; application required.
Price analysis, development, risk, trade, dynamic modeling research methods, finance and environmental economics.
QA: AEC 995

999.   Doctoral Dissertation Research
        Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to Ph.D. students in Agricultural Economics. Approval of department.

QA: AEC 999

AGRICULTURAL ENGINEERING   AE

Department of Agricultural Engineering
College of Agriculture and Natural Resources
College of Engineering

152.   Food and Agricultural Engineering
        Spring. 1(2-0)
R: Open only to freshmen and sophomores.
International and national food issues including conservation of natural resources, energy requirements, and effects of political changes on food supplies and American agriculture. Production, processing, and distribution of food.
QA: AE 152

336.   Principles of Agricultural Machines
        Fall. 3(3-0)
P: MSM 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 321, ME 332, CHE 340 QA: AE 374

338.   Principles of Food Processing Equipment
        Spring. 3(3-0)
P: CE 321 or CHE 311 or ME 332; MSM 211. R: Open only to students in College of Engineering.
Principles of design, operation, and performance of equipment for processing raw materials into finished or intermediate products.
QP: MMM 211, CE 321, ME 332, CHE 340 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 310, ME 311, BOT 205, BS 212 QA: AE 353

356.   Electric Power and Control
        Spring. 3(2-2)
P: EE 200 or EE 345. R: Open only to majors in College of 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 345, EE 300 QA: AE 356

430.   Power and Control Hydraulics
        Spring. 3(2-2)
P: CE 321 or CHE 311 or ME 332. R: Open only to majors in College of Engineering.
Hydraulic fluid properties. Pump and motor performance parameters. Control valves and hydraulic circuitry components. Analysis and design of hydraulic systems.
QP: CE 321, CHE 340, ME 332 QA: AE 493

438.   Design of Machinery Structures
        Fall. 3(3-0)
P: MSM 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 321, CHE 311, ME 332 QA: AE 481

486.   Agricultural Engineering Design Fundamentals
        Fall. 3(3-0)
P: AE 336 or AE 353 or AE 356. R: Open only to seniors and graduate students in College of Engineering.
Concepts, methods, and procedures of the total design process from problem identification to final specifications.
QA: AE 495

488.   Agricultural Engineering Design Project
        Spring. 3(0-6)
P: AE 486. R: Open only to seniors in College of Engineering.
Individual or team design project selected in AE 486. Information expansion, development of alternatives, and evaluation, selection, and completion of a design project.
QA: AE 496

490.   Independent Study
        Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
P: AE 152 or ME 391 or MTH 235. R: Open only to College of Engineering majors. Approval of department; application required.
Supervised individual student research and study in agricultural engineering.
QP: AE 152, ME 391, MTH 310 QA: AE 480

491.   Special Topics in Agricultural Engineering
        Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
P: AE 152 or ME 391 or MTH 235. R: Open only to College of Engineering majors. Approval of department.
Special topics in agricultural engineering.
QP: AE 152, ME 391, MTH 310 QA: AE 490

802. Computational Methods in Food and Agricultural Engineering
Fall of odd-numbered years. 3(3-0)
P: MSM 809. R: Open only to graduate students in College of 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.

812. Bio-Processing Engineering
Spring of even-numbered years. 3(3-0)
R: Open only to graduate students in College of Engineering.
Thermodynamics, heat and mass transfer, fluid flow, dehydration. Handling and storage of biological products.
QA: AE 812

815. Instrumentation for Food and Agricultural Engineering
Fall. 3(3-0)
R: Open only to graduate students in College of Engineering.
Theory and techniques of measuring temperature, pressure, flow, humidity, and moisture in biological materials.
QA: AE 815

820. Research Methods in Agricultural Engineering
Fall. 1(1-0)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Procedures and methods for designing and executing research projects.
QA: AE 820

850. Dimensional Analysis and Similitude Modelling
Fall. 3(2-2)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Dimensional concepts, systems of measurements and transformation of units, and formation of dimensionless groups. Development of prediction equations, concepts of similarity, and scaling laws. Distortion.
QA: AE 850

882. Irrigation and Water Management Engineering
Spring of odd-numbered years. 3(3-0)
P: AE 481, CE 321.
Design and management of systems for supplemental irrigation. Water supply and transport. Economic and engineering optimization of irrigation design.
QP: AE 481, CE 321 QA: AE 482

890. Special Problems
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Approval of department; application required.
Individual study in agricultural engineering.
QA: AE 880

891. Advanced Topics in Agricultural Engineering
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to graduate students in College of Engineering. Approval of department.
Agricultural engineering topics not covered in regular courses.
QA: AE 890

892. Agricultural Engineering Seminar
Spring. 1(1-0)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Current topics in agricultural engineering.
QA: AE 822

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 10 credits in all enrollments for this course.
R: Open only to graduate students in Agricultural Engineering. Approval of department.

QA: AE 899

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.
R: Open only to graduate students in Agricultural Engineering. Approval of department.

QA: AE 999

AGRICULTURAL TECHNOLOGY AND SYSTEMS MANAGEMENT ATM

Department of Agricultural Engineering
College of Agriculture and Natural Resources
College of Engineering

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: Open only to majors in College of Agriculture and Natural Resources.
Principles, analysis, management, and economics of agricultural machinery systems. Consideration of weather conditions, cultural practices, crop rotation, labor, and energy.
QP: MTH 108, MTH 111, CPS 100, CPS 112, CPS 115, CSS 210 QA: ATM 440

490. Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: ATM 231 or ATM 240 or BCM 311. R: Open only to majors in Agricultural Technology and Systems Management. Approval of department; application required.
Supervised individual student research and study in agricultural technology and systems management.
QP: ATM 231, ATM 240, ATM 311 QA: ATM 480

491. Special Topics in Agricultural Technology and Systems Management
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: ATM 231 or ATM 240 or BCM 311. R: Open only to majors in Agricultural Technology and Systems Management.
Special topics in agricultural technology and systems management.
QP: ATM 231, ATM 240, ATM 311 QA: ATM 490

804. Agricultural Mechanization in Developing Countries
Fall of odd-numbered years. 3(3-0)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Human, animal and mechanical power for smaller farms. Machine selection, local manufacturing, ownership patterns.
QA: ATM 804

807. Human Factors Engineering
Fall of even-numbered years. 3(3-0)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Ergonomics. Analysis of machine designs, operation, and working environment in relation to human limitations and capabilities. Procedures to develop maximum human-machine compatibility and performance.
QA: ATM 807

831. Water, Technology and International Development
Spring of odd-numbered years. 3(3-0)
P: AE 481 or ANR 489 or ATM 431 or CSS 210. R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
Water resources planning and development for irrigated agriculture. Technological, agronomic, environmental, social and political constraints. Case studies.
QP: CSS 210, ATM 431, AE 481, ANR 399 QA: ATM 890

836. Microclimate and Its Measurement
Spring. 4(3-3) Interdepartmental with Geography.
The climate near the Earth's surface. Energy balance, thermal radiation exchange, heat fluxes, temperature sensors, wind speed and direction, humidity and evapotranspiration and their measurement.
QA: ATM 436, ATM 808

840. Analysis of Physical Systems
Fall. 3(3-0)
P: ATM 440 or BCM 311 or MGT 306. R: Open only to graduate students in College of Agriculture and Natural Resources.
Identification and definition of systems problems in agricultural and construction industries. Model formulation and estimation.
QP: ATM 440, ATM 311, MGT 306 QA: ATM 806

845. Process Network Theory Applied to Agroecosystems
Spring of even-numbered years. 4(4-0)
R: Open only to graduate students in College of Agriculture and Natural Resources or College of Engineering.
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. A student may earn a maximum of 4 credits in all enrollments for this course.
R: Approval of department.
Individual study of selected topics.
QA: ATM 880