Agricultural and Extension Education

Courses

826. Methods of Teaching Agricultural Mechanics
Fall of odd-numbered years. 3(3-0)
Approval of department.
Methods of instruction including program planning, scheduling, use of teaching aids, management of buildings, facilities and equipment; the selection, organization, and evaluation of activities in farm mechanics.

828. Teaching Farmer Classes in Agriculture
Fall of even-numbered years. 3(3-0)
Approval of department.
Objectives of adult education in agriculture, organizing and promoting classes, course planning, instructional procedures, follow-up and evaluation.

830. Effective Communications in Agriculture
Fall, Winter. 3(3-0)
Scientific writing for professional lay agricultural and natural resources publications; grant writing; organizing, preparing and delivery of professional scientific presentations.

851. Program Administration and Supervision
Spring of odd-numbered years. 3(3-0)
ANR 856, EAD 851.
Principles and practices for developing, supervising and administering agricultural and extension educational programs.

858. Leadership Development in Agricultural and Extension Education
Winter. 3(3-0) Approval of department.
Sociological and philosophical bases for leadership development for agricultural and extension education in a democratic society.

860. Program Evaluation
Summer of even-numbered years.
3(3-0) AEE 820 or approval of department.
Principles of evaluating agricultural and extension education programs.

881. Selected Topics
Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.
Topics will be selected to meet needs of graduate students in agricultural and extension education.

883. Readings and Independent Study
Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 8 credits. Approval of department.
Study on an individual and group basis in the various areas of agricultural and extension education.

885. Seminar
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits. Approval of department.
Studies and presentation of research in Agricultural and Extension Education.

899. Master's Thesis Research
Fall, Winter, Spring. 1 to 12 credits. May reenroll for a maximum of 12 credits. Approval of department.

999. Doctoral Dissertation Research
Fall, Winter, Spring. Variable credit. Approval of department.

Agricultural Economics

College of Agriculture and Natural Resources

805. Agricultural Production Economics I
Fall. 4(4-0) EC 324, PAM 370.

809. Institutions: Behavior and Performance
Fall. 3(3-0) EC 324, EC 326; or approval of department.
Conceptual approaches to economic analyses of public policy in programs with emphasis on the relationships among institutions, behavior of participants and performance.

810. Economics of Public Choice
Winter. 3(3-0) Approval of department. Interdepartmental with the departments of Resource Development and Economics.
Economics of alternative institutions for collective action. Emphasis on property rights and natural resources. Public goods, externalities, non-marginal change, commonwealth, income and power distribution, grants, welfare criteria and market failure.

831. Food Marketing Management
Fall, Spring. 4(4-0) May reenroll for a maximum of 6 credits. Interdepartmental with and administered by the Department of Marketing and Transportation Administration.
Food industry adjustment to changing social, economic and internal company environment. Managerial principles and techniques applied to food processing and distribution. Student interaction with industry, labor and government representatives.

835. Introduction to Econometrics
Spring. Summer. 3(3-0) EC 225, STT 422; not open to students with credit in EC 836.
Interdepartmental with and administered by the Department of Economics.

837. Applied Operations Research
Spring. 4(4-0) EC 324, PAM 370. Approval of department.
Use and interpretation of operations research techniques for problems encountered by agricultural economists. Emphasis on linear programming and its various forms such as transportation models, network analysis, spatial equilibrium models.

839. Topics in Dynamic Agricultural Economics
Winter of even-numbered years. 3(3-0) AEC 837, MTH 480; EC 812B or EC 805A, EC 805B.

841. Industrial Organization of Agricultural Markets
Spring. 3(3-0) EC 324, a junior-level course in agricultural marketing.
Conceptual and analytical approaches to identify and assess market performance. Institutions and market processes for coordinating agricultural systems. Issues of organization, control, and public policy.

843. Commodity Market Analysis
Fall. 3(3-0) EC 835 or approval of department.
Projects short- and long-run demand, supply and prices of agricultural commodities. Data collection, model development and use of computers for understanding and measuring market dynamics. Futures and options markets.

850. Agricultural Production Management in Developing Countries
Winter. 3(3-0) EC 324 or approval of department. Not open to students with credit in FSM 430.
Farm management applications of comparative analysis, forward planning, budgeting, cash flow analysis and computer-aided decision making. Principles illustrated with developing country case studies.

851. Farm Management
Summer of even-numbered years.
3(3-0) FSM 430 or AEC 850 or approval of department.
Managerial processes for problem solving, planning and controlling. Review of decision literature in cognitive and information sciences. Budgeting, optimizing, scenario and stochastic simulation for predictive and prescriptive purposes.

853. Decision Support Systems for Agriculture
Fall of even-numbered years. 3(3-0) AEC 850; AEC 851 recommended.
Development and design of information systems. Database and modelbase systems with emphasis on decision maker/information systems interfaces. Analysis of systems using case studies.

860. Agricultural Policy in Developed Economies
Winter. 3(3-0) FSM 421, EC 324, EC 326; or approval of department.

861. Agricultural Trade Policies
Fall of odd-numbered years. Summer of even-numbered years. 3(3-0) EC 324, EC 326; or approval of department.
International trade in agricultural products, areas of competition, changes in comparative advantage, interrelationship of national and international policy, regional groupings, trade and economic development, current policy proposals.

862. Agriculture in Economic Development
Winter. 3(3-0) EC 324, EC 326. PAM 463; or approval of department.
Agricultural and industrial sector interactions in the development process, examined from both historical and theoretical perspectives. Theories and models of the agricultural development process. Policy issues in agricultural development.
863. Benefit Cost Analysis
Spring, 3(0-0) AEC 805 or AEC 850 or approval of department. Interdepartmental with the Department of Resource Development.
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.

865. Data Collection and Analysis in Developing Countries
Spring of even-numbered years. Summer of odd-numbered years, 3(4-0) STT 422, one year of graduate study; or approval of department. Conducting face-to-face/telephone surveys in production and marketing. Preparing research proposals. Methodologies for data collection, processing, and analysis. Microcomputer applications. Field research administration. Statistical systems in developing countries.

876. Statistical Inference in Economics I
Fall, 3(0-0) EC 812A or EC 805A; STT 443 or STT 863; or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability. Administered by the Department of Economics.

877. Statistical Inference in Economics II
Winter, 3(0-0) EC 876 or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability. Administered by the Department of Economics.

878. Statistical Inference in Economics III
Spring, 3(0-0) EC 877 or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability. Administered by the Department of Economics.
Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and in applied econometric research.

882. Independent and Supervised Study
Fall, Winter, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 12 credits. Approval of department. Arranged seminars initiated by faculty or students; supervised readings; individual study of special problems.

890. Master's Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

899. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

910. Resource Economics Proseminar
Spring of odd-numbered years. 3(0-0) May reenroll for a maximum of 8 credits. Approval of department. Interdepartmental with the departments of Forestry, and Resource Development. Administered by the Department of Forestry.
A seminar wherein advanced graduate students in the fields of resource economics participate with faculty in the joint conduct of a major research project in resource economics and policy.

911. Public Program Analysis
Spring, 3(0-0) AEC 863, EC 805A, EC 890B; or approval of department. Interdepartmental with the departments of Economics and Resource Development.
Policy aspects of nonmarket value estimation, shadow pricing, tax preference, and risk analysis applied to systematic choice of agricultural, natural and human resource regulatory and public investment programs.

916. Development Administration
Fall of odd-numbered years. 3(0-0) Interdepartmental with and administered by the Department of Political Science.
Design and organization of policies, programs and projects for Third World socioeconomic development. Effect of politics and culture on organizational performance. Public management process from planning to evaluation.

941. Seminar in Food Systems Organization and Policy
Summer, 3(0-0) AEC 809, AEC 841, AEC 843; or approval of department. Professional role simulation. Analysis under time pressure. Oral and written presentations in defense of positions on problems of market organization and related policy issues confronting agricultural economists.

972. Methodological Approaches to Research
Fall of even-numbered years, Summer of odd-numbered years. 3(0-0) Two terms of graduate study in social science or approval of department. Interdepartmental with the Department of Economics.
Selection, planning and conduct of research. Alternative research approaches. Role of theory, beliefs and values. Critical appraisal of research studies.

990C. Mathematical Economics and Econometrics Workshop
Fall, Winter, Spring, 1 to 16 credits. EC 812A, EC 832, or approval of department. Interdepartmental with and administered by the Department of Economics.
Critical evaluation of research reports by staff and other students. Students writing doctoral dissertations in the appropriate areas are encouraged to enroll in the workshop.

995. Advanced Topics
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Approval of department. Topics include agricultural marketing and price analysis, farm management, international agricultural development, production economics, public policy and resource economics.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Agricultural Economics — Descriptions of Courses

Food Systems Economics and Management
FSM

200. Introduction to Food Systems Management
Fall, 4(4-0)
Organization of modern industrialized food production and distribution systems. Problems faced by managers of firms in food systems. Application of economic and management principles in the solution of these problems.

330. Food Production Management
Fall, Spring, 3(3-0)
Problems encountered by managers of farms and input firms in food systems. Case studies in project design and research proposals. Methodologies for data collection, processing, and analysis. Microcomputer applications. Field research administration. Statistical systems in developing countries.

350. Fruit Marketing Economics
Fall of odd-numbered years. 3(3-0).
Fruit grower marketing-management decisions; fruit marketing systems; pricing, marketing problems, improved marketing; demand expansion, marketing orders, bargaining, processing, marketing co-operatives; other policy alternatives.

370. Applied Statistics
Winter, 3(3-0) One course in statistics, one course in food systems economics and management or public affairs management. Interdepartmental with and administered by Public Affairs Management. Interpretation and use of statistical results in decision making. Sampling, index numbers, tabular analysis, trend estimation, regression models, decision theory.

412. Financing the Food System
Winter, 3(0-0) FSM 330.

417. Land Economics
Fall, Spring, 4(4-0) EC 201. Interdepartmental with Public Affairs Management and the departments of Economics, and Resource Development. Administered by the Department of Resource Development.
Factors affecting the economic use of land. Input-output relationships, development, property rights, zoning and land use controls, public land. Application of economic principles to selected land use policies.

418. Livestock Product Marketing
Spring, 4(3-3) ANS 110, FSM 200. Interdepartmental with and administered by the Department of Animal Science. Structure and product values in livestock market channels. Field study analysis of alternative marketing strategies, futures marketing, and the components of the livestock marketing chain. Field trips required.

A-11
421. Public Policy and the Food System  
Spring. 3(3-0) FSM 200 or EC 201, PAM 320 recommended. Interdepartmental with Public Affairs Management.  
Policy issues identified and analyzed in relation to performance goals of society and groups within the food system. Emphasis on price and income policies and regulations affecting the food system.

430. Advanced Food Production Management  
Spring. 3(3-0) FSM 412. Management applied to farms and input supply firms; computerized applications of budgeting and forward planning, income tax management, estate management, insurance, and risk and uncertainty.

439. Advanced Food Processing and Distribution Management  
Fall. 3(3-0) MTA 335. Interdepartmental with and administered by the Department of Marketing and Transportation Administration.  
Managerial principles and techniques applied to food processing and distribution. Emphasizes adjustment to changing social, economic, and internal company environment. Student interaction with industry, labor and government representatives. Field trips, special projects.

441. Commodity and Futures Marketing  
Spring. 3(3-0) STT 201, EC 201; FSM 370 or STT 317 recommended. Commodity pricing and use of marketing alternatives. Special emphasis on the future markets and the institutional arrangements useful to farmers, elevator operators and commodity traders.

443. Cooperatives: Group Action in Marketing  
Spring. 3(3-0) EC 201 or EC 202, Juniors or approval of department. Organization and operation of cooperatives. Emphasis on economics, legal foundations, and feasibility of cooperatives and other forms of group action in the U.S. food system.

460. Regional Economics  

461. Regional Economics Laboratory  
Spring. 10(2-0) R D 400 and approval of department. Interdepartmental with Public Affairs Management and the departments of Economics and Resource Development. Administered by the Department of Resource Development. Evaluation and use of analytical models designed to solve regional economic problems.

462. Agriculture and Rural Development in Developing Nations  
Fall. 3(3-0) PAM 201 or EC 201; PAM 260 recommended. Interdepartmental with Public Affairs Management and Agriculture and Natural Resources.  
Traditional agricultural systems and the incentives leading to economic growth in rural areas. Adjustment to technological, institutional and human change. Strategies for rapid agricultural transformation.

480. Independent and Supervised Study  
Fall, Winter, Spring, Summer. 1 to 9 credits. May reenroll for a maximum of 9 credits. Approval of department.

Public Affairs Management PAM  

201. Introduction to Community Economics  
Fall, Spring. 3(3-0)  
Identification and analysis of problems faced by public decision makers in managing public revenues and services and governing private resource use. Impact of political and economic structures on resource use.

260. World Food, Population and Poverty  
Winter. 3(3-0)  
Description, analysis and alternative solutions of food, technology transfer, population and poverty problems, emphasizing trade and aid programs and the role of multinational firms in low income nations.

306. Government Programs for Workers  
Winter, Spring. 4(4-0) EC 201, Interdepartmental with and administered by the Department of Economics.  
Economics of selected government institutions and programs for workers. Social security, worker's compensation, Unemployment Insurance, OSHA, employment and training programs, wages and hours legislation, anti-discrimination programs.

320. Economic Policy Processes I  
Fall. 3(3-0) PAM 201 or EC 201.  
Analysis of processes by which public economic policy is established at various levels of government. Role of economic interests and pressures. Alternative processes for economic policy formulation. Case studies.

321. Economic Policy Processes II  
Winter. 3(3-0) PAM 320 or approval of department.  
Analysis of socioeconomic forces as they affect the public decision processes for economic policy. Means of increasing effectiveness of staff persons in the decision process. Case studies.

345. Methods in Policy Analysis  
Spring. 3(3-0) PAM 320, PAM 370; PAM 346 concurrently.  
Analytical techniques in economics, mathematics, operations research, and systems analysis for problem solving in public affairs management.

346. Computer Application in Policy Analysis  
Spring. 1(1-0) CPS 100; PAM 345 concurrently.  
Application of computer software to problems in public affairs management.

363. Economic Development of Tropical Africa  
Winter. 3(3-0) EC 201, EC 202 or EC 210. Interdepartmental with and administered by the Department of Economics.  

370. Applied Statistics  
Winter. 3(3-0) One course in statistics, one course in food systems economics and management or public affairs management. Interdepartmental with Food Systems Economics and Management.  
Interpretation and use of statistical results in decision making. Sampling index numbers, tabular analysis, trend estimations, regression models, decision theory.

404. Public Program Evaluation  
Winter. 3(3-0) PAM 320 or approval of department.  
Design and use of program evaluations in public management and budgeting. Social indicators and measures of quality of life.

406. Public Expenditure: Theory and Policy  
Fall, Spring. 4(4-0) EC 201 or EC 310. Interdepartmental with and administered by the Department of Economics.  
Expenditure theory: objectives and rationale of government activity in the market system; efficiency criteria in government decision making; planning, programming, budgeting systems and cost-benefit analysis.

417. Land Economics  
Fall, Spring. 4(4-0) EC 201. Interdepartmental with Food Systems Economics and Management and the departments of Economics, and Resource Development. Administered by the Department of Resource Development. Factors affecting the economic use of land. Input-output relationships, development, property rights, zoning and land use controls, public land. Application of economic principles to selected land use policies.

419. Special Topics in Resource Economics and Policy (MTC)  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 15 credits if different topics are taken. EC 201, EC 202, approval of department. Interdepartmental with and administered by the Department of Resource Development. Theoretical and applied topics in natural resource economics and policy.

421. Public Policy and the Food System  
Spring. 3(3-0) FSM 200 or EC 201, PAM 320 recommended. Interdepartmental with and administered by the Department of Resource Development.  
Policy issues identified and analyzed in relation to performance goals of society and groups within the food system. Emphasis on price and income policies and regulations affecting the food system.

431. Law and Social Change  
Fall. Spring. 3(3-0) GBL 430 or approval of department. Interdepartmental with and administered by the Department of Resource Development.  
Law as applied to urban and rural context of social change. A review of both formal and informal aspects of system accessibility, institutional formation, government, civil rights, and human service.

453. Women and Work: Issues and Policy Analysis  
Winter. 3(3-0) PAM 201 or EC 201 or EC 202 or approval of department. Interdepartmental with the Department of Economics.  
Quantity and quality of labor force participation by women, current status and past trends. Issues analyzed include differential earnings and occupations of men and women, employment discrimination and labor legislation.
460. Regional Economics
Winter. 4(4-0) R D 417 or EC 324.
Forces affecting location decisions of firms, households and governments. Applications to agricultural, industrial, and regional development.

461. Regional Economics Laboratory
Evaluation and use of analytical models designed to solve regional economic problems.

462. Agricultural and Rural Development in Developing Nations
Fall. 3(3-0) PAM 201 or EC 201; PAM 260 recommended. Interdepartmental with Agriculture and Natural Resources, and Food Systems Economics and Management. Administered by Food Systems Economics and Management.
Traditional agricultural systems and the incentive environment for economic growth in rural areas. Adjustment to technological, institutional and human change. Strategies for rapid agricultural transformation.

463. Digital Logic and Combinatorial Analysis
Spring. 3(3-0) Senior majors.

464. Agricultural and Rural Development in Developing Nations
Fall. 3(3-0) PAM 201 or EC 201; PAM 260 recommended. Interdepartmental with Agriculture and Natural Resources, and Food Systems Economics and Management. Administered by Food Systems Economics and Management.
Traditional agricultural systems and the incentive environment for economic growth in rural areas. Adjustment to technological, institutional and human change. Strategies for rapid agricultural transformation.

480. Independent and Supervised Study
Fall, Winter, Spring, Summer. 1 to 9 credits. May reenroll for a maximum of 9 credits. Approval of department.

490. Supervised Field Experience
Fall, Winter, Spring, Summer. 3 to 9 credits. May reenroll for a maximum of 9 credits. PAM Juniors, approval of department.
Supervised field work to federal, state, or local government or organizations dealing with government.

495. Senior Seminar in Policy Analysis
Spring. 2(2-0) PAM 320, PAM 321, PAM 494.
Practicum on planning, performing and presenting studies of public policy issues. Supervised group projects on current local or state policy issues.

AGRICULTURAL ENGINEERING
A E

College of Agriculture and Natural Resources
College of Engineering

152. Introduction to Agricultural Engineering
Winter. 1(4-0)
An introduction to the agricultural engineering profession with an examination of existing problems.

352. Heat and Mass Transfer in Biological Processing
Winter. 4(4-0) CEM 361 or M E 311 or CHE 311.
Basic scientific principles and engineering theory applied to biological systems and products.

353. Engineering Principles of Plant Environment
Fall. 4(4-0) CPS 112, MTH 310; CEM 152 or CEM 143.
Physical processes and properties of the biosphere as related to the engineering the plant environment.

354. Thermodynamic Applications in Biological Processes
Spring. 3(3-0) A E 352.
Psychrometrics and refrigeration. Engineering applications in animal production and food processing. Environmental control.

355. Electric Power and Control
Winter. 4(3-2) PHY 288.
Alternating current calculations; sizing conductors of single- and three-phase loads; electric motors, their control and protection; switching logic; microprocessor applications. Examples drawn from agricultural applications.

374. Principles of Food and Agricultural Machines
Spring. 4(3-2) C E 321 or CHE 340; MMM 306.
Physical properties of biological materials. Soil tillage. Metering, distribution, atomization, separation, conveying fluidization, and other physical processes performed by food and agricultural machines.

376. Food Process Engineering
Spring. 3(2-2) A E 352, C E 321.
Analysis of unit processes involved in handling, processing, and distribution of liquid and solid biological materials. Flow of liquids, heating and cooling, freezing, concentration, dehydration, and separation.

394. Systems of Agricultural Machines
Fall. 4(3-2) MMM 211.
Functional requirements and operational characteristics of agricultural machines. Engineering principles of machines dealing with soil and plant materials. Aspects of agricultural machinery management and economics.

410. Professional Ethics and Responsibilities
Spring. 1(2-0) Senior majors.
Personal and professional ethics and social responsibilities will be addressed as related to the engineering profession.

461. Design of Agricultural Structures
Fall. 4(4-0) MMM 311, MMM 315.
The analysis of structural systems and the design of components and connections. Examples selected from agricultural machinery and buildings.

474. Processing Biological Products
Spring. 3(3-0) A E 352, M E 311 or CEM 361.
Engineering principles of unsteady-state heat transfer, heat exchangers, drying, storage and refrigeration as applied to the processing of biological products.

480. Special Problems
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 5 credits. Approval of department.
Individual student research and study in agricultural engineering and design of tractors, power transmission, farm machinery, highway design, irrigation, soil and water systems.

492. Irrigation Design Management
Spring. 4(3-2) A E 491.
Water supply including wells, water transport, pumping and pump selection, water requirements, power supplies and irrigation equipment with emphasis on sprinkler and trickle methods and design for agricultural application.

496. Fundamentals of Design Methodology
Fall. 2(2-0) A E 374, Seniors.
Concepts, methods, and procedures uniquely associated with the design process. Emphasis is on total design process from problem identification to final specifications.

499. Special Topics in Agricultural Engineering
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits if different topics are taken. Approval of department.
Design topics in agricultural engineering such as food process engineering, machinery systems, structures, soil and water systems.

492. Tractors and Power Transmission Systems
Winter. 4(4-0) A E 394.
Functional requirements, operational characteristics, analysis and design of tractors including power trains, hydraulic systems, tractor, hitches, vehicle dynamics and operator comfort.

493. Power and Control Hydraulics
Winter. 4(3-2) CPS 112, C E 321.
Properties of hydraulic fluids; performance parameters of fixed and variable displacement pumps and motors; characteristics of control valves and components; analysis and design of hydraulic systems.

494. Food Process Engineering
Fall. 3(3-0) C E 321, A E 378.
Design of fluid handling equipment, mixers, and freezing systems for food.

495. Fundamentals of Design
Fall. 3(3-0) Senior majors or approval of department.
Problem identification, working media, models, procedures, and developing specifications. Selection of individual design problems for A E 496.

496. Design Project Laboratory
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 4 credits. A E 495.
Individual or team pursuit of the design project selected in A E 495. Activities include information expansion, developing alternatives, evaluation and selection, and concluding project.

500. Finite Element Method
Fall, Winter, Spring. 4(4-0) Approval of department. Interdepartmental with the departments of Metallurgy, Mechanics, and Materials Science; and Civil Engineering. Administered by the Department of Metallurgy, Mechanics, and Materials Science.
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics and stress analysis.

812. Bio-Processing Engineering
Winter. 3(3-0) Approval of department.
Topics will be presented pertaining to thermodynamics, heat and mass transfer, thermal processing, fluid flow, dehydration and freezing, and biological processes or biological products.