422. National Defense Policy and Military Justice
Spring. 3(3-1)
Broad range of American civil-military relations and the environmental context in which defense policy is formulated. Military justice and the laws of war.

499. Independent Study
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Junior and approval of instructor. Investigation of an aspect of aerospace activities of specific interest to the student and a faculty member.

AFRICAN LANGUAGES
See Linguistics and Germanic, Slavic, Asian and African Languages.

AGRICULTURE AND EXTENSION EDUCATION AEE
(Name change effective July 1, 1983. Formerly Agriculture and Natural Resources Education Institute.)

College of Agriculture and Natural Resources

Agriculture and Natural Resources

360. Developing Concurrent Work-Ed Programs
Fall. 1(2-0) Approval of department.
Planning, organizing and implementing effective concurrent work-education programs for secondary vocational agribusiness and natural resource education students.

361. FFA in Agribusiness and Natural Resources Education
Winter. 1(2-0) Approval of department.
Planning and organizing an effective FFA program as an integral part of a secondary vocational agribusiness and natural resources education program.

362. Developing a Five-Year Plan
Spring. 1(2-0) Approval of department.
Developing and organizing a five-year plan for a comprehensive secondary vocational agribusiness and natural resources education program.

368. Agriculture and Natural Resources Communications
(ANR 401.) Fall, Winter, Spring. 3(2-0) JRN 201 or other writing course and approval of department.
Techniques, strategies and practices in development of agricultural and natural resources information programs. Including writing, public relations, TV and radio production for specialized and general audiences.

401. Agriculture and Natural Resources Communications Internship
(ANR 403.) Fall, Winter, Spring. Summer. 1 to 6 credits. May reenroll for a maximum of 6 credits. AEE 401, approval of department. Internship with professionals in communications field with emphasis on student's areas of interest—writing, radio, TV, publications, etc.

483. Readings and Independent Study
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 6 credits. Junior; approval of department. Study on an individual basis in the various areas of emphasis in agricultural and extension education.

826. Methods of Teaching Agricultural Mechanics
(ED 820G, ANR 826.) Fall of odd-numbered years. 3(3-0) Approval of department.
Methods of instruction including program planning, scheduling, use of teaching aids, management of teaching situations, the selection, organization, and evaluation of activities in farm mechanics.

828. Teaching Farmer Classes in Agriculture
(ED 828B, ANR 828.) 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.

AGRICULTURAL ECONOMICS AEC

College of Agriculture and Natural Resources

805. Agricultural Production Economics I
Fall. 4(4-0) PAM 340 or EC 335.

809. Institutions; Behavior and Performance
Fall. 3(3-0) Approval of department.

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.

811. Public Program Analysis
Spring. Summer. 3(3-0) EC 324 or approval of department.
Application of benefit-cost analysis to public programs of resource development. Issues and case studies in budgeting, program criteria, pricing, externalities, and coordination.

831. Food Marketing Management
Fall, Spring. 4(4-0) May reenroll for a maximum of 8 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 325, STT 422; not open to students with credit in EC 835. Interdepartmental with and administered by the Department of Economics.

837. Applied Operations Research I
Spring. 4(4-0) MTH 113 or MTH 228. Approval of department.
Use and interpretation of operations research techniques for problems encountered by agricultural economists. Emphasis on linear programming and its variations such as transportation models, network analysis, spatial equilibrium models.

838. Applied Operations Research II
Summer. 3(3-0) MTH 113 or MTH 228, STT 422. Approval of department.
Use and interpretation of operations research techniques for problems encountered by agricultural economists. Emphasis on techniques such as Markov processes, dynamic programming, cohort analysis, queuing, Monte-Carlo techniques, elementary simulation.

841. Industrial Organization of Agricultural Markets
Fall. 3(3-0) Approval of department.

843. Commodity Market Analysis
Winter. 3(3-0) STT 422, EC 335.

851. Advanced Farm Management
Summer. 3(2-0) FSM 430 or approval of department.
Emphasizes identification, analysis, and methods of solving problems of farm organization and production; new technology, specialization and scale. Farm case studies, role-playing, computer games and farm business simulation.

860. Rural Welfare and Development Policy
Spring. 3(3-0) Approval of department.

Agricultural Economics — Descriptions of Courses
861. Agricultural Trade Policies
Fall of even-numbered years. Summer of odd-numbered years. 3(3-0) EC 428 or approval of department.

International trade in agricultural products, areas of cooperation, changes in comparative advantage, and relationships of national and international policy, regional groupings, trade and economic development, current policy proposals.

862. Agriculture in Economic Development
Winter. 3(3-0) PM 462 or approval of department.

Agricultural and industrial sector interactions in the development process. Theories and models of the agricultural development process. Transformation of agriculture in less-developed countries.

865. Rural Development Administration
Winter. 3(3-0) Approval of department.

Concepts and principles of development administration and their application in the analysis of the processes and structures through which rural development activities are formulated and implemented in less-developed countries.

866. Data Collection in Developing Countries
Spring of even-numbered years. Summer of odd-numbered years. 3(3-0) AC 830 or STT 825 or approval of department.

Principles for conducting household/village level studies of production and marketing in developing countries. Preparing research proposal, methodologies for data collection, processing and analysis. Field research administration.

867. Statistical Inference in Economics I
Fall. 3(3-0) EC 812A or EC 805A; STT 443 or STT 865; or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability. Administered by the Department of Economics. Review and extension of single-equation regression models. Properties of least-squares estimators under alternative specifications. Problems of analyzing nonexperimental data. Errors in variables, autoregressive and heteroscedastic models.

872. Statistical Inference in Economics III
Spring. 3(3-0) 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. 2 to 12 credits. May enroll for a maximum of 12 credits. Approval of department. Arranged seminars initiated by faculty or student; supervised readings; individual study of special problems.

884. Selected Topics
Fall, Winter, Spring. Summer. 1 to 4 credits. May enroll for a maximum of 12 credits if different topics are taken. Approval of department.

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

906. Agricultural Production Economics II
Winter. 4(4-0) AC 895.

Resource allocation efficiency in agriculture as related to management under conditions of both perfect and imperfect knowledge of price, institutional, technological and human change. Advanced topics.

910. Economic Analysis in Forestry, Resource Development
Spring. 3(3-0) May enroll for a maximum of 12 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.

941. Seminar in Food Systems Organization and Policy
Spring of odd-numbered years. Summer of even-numbered years. 3(3-0) Approval of department.

Alternative methods of organization and control of food systems. Policy and program analysis. Development and presentation of position papers.

960. Agricultural Policy in Developed Economies
Winter. 3(3-0) FSM 422 and one year of graduate work in social science or approval of department. Sectoral interrelationships and the impact of economic policies relating to agriculture in advanced economies. Public decision processes. Current issues in food and fiber policy.

962. Development Planning and Agricultural Sector Analysis
Spring. 3(3-0) AC 862; one year of graduate study in agricultural economics or economics or approval of department. Seminar in development planning with special reference to sectoral interrelationships. Agricultural sector analysis. Project preparation and appraisal.

972. Methodological Approaches to Research
Fall of odd-numbered years. Summer of odd-numbered years. 3(3-0) Two terms of good standing in social science or approval of department. Interdepartmental with the Department of Economics.

Selection, planning and conduct of research. Alternative research approaches. Robustness of theory, beliefs and valuations. Critical appraisal of research studies.

990C. Mathematical Economics and Econometrics Workshop
Fall, Winter, Spring. 3 to 16 credits. EC 812A, EC 852, 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 participate in workshop and may do so while registered for AEC 995.

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

Food Systems Economics and Management

200. Introduction to Food Systems Management
Fall. 4(4-0) FSM 200 or MTA 300.

Interdepartmental with and administered by the Department of Marketing and Transportation Administration. Analysis of problems faced in the food processing and distribution system. Includes functional interrelationships, consumer orientation and future development.

370. Applied Statistics
Winter. 3(3-0) Students may not receive credit in both FSM 370 and AEC 830. 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(3-0) FSM 339 or PM 340.


417. Land Economics
Fall, Spring. 4(4-0) Interdepartmental with Public Affairs Management and the departments of Resource Development, and Economics. Administered by the Department of Resource Development. Factors affecting the economic use of land and space resources by people. Input-output relationships; development, investment, and enterprise location decisions. Land markets, property rights, area planning, zoning and land use controls.
421. Public Policy and the Food System
Winter, 3(3-0) FSM 300 or EC 201, PAM 260 recommended.
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 futures markets and the institutional arrangements useful to farmers, elevator operators and commodity traders.

443. Cooperatives: Group Action in Marketing
Spring, 3(3-0) EC 200, 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
Winter, 4(4-0) R D 417 or EC 324. Interdepartmental with Public Affairs Management and the departments of Economics, and Resource Development. Administered by the Department of Resource Development.
Forces affecting location decisions of firms, households and governments. Applications to agricultural, industrial, and regional developments.

461. Regional Economics Laboratory
Spring, 1(0-2) R D 460 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 incentive environment for economic growth in rural areas. Adjustment to technological, institutional and human change. Strategies for rapid agricultural transformation.

473. Introduction to Systems Analysis
Spring, 3(3-0) MTH 111. Interdepartmental with and administered by Public Affairs Management.
Principles of systems analysis applied to ecological, physical, economic and social phenomena. Case studies. Interpretation and design of systems models. Systems concepts in decision making.

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

484. Selected Topics
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits if different topics are taken. 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, 4(4-0)
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.

303. Welfare, Health and Education Policy
Fall, 3(3-0) PAM 201 or EC 200.
Evaluation of selected welfare, health and education policies and alternatives. Role of public and private sectors. Impact of values, beliefs, costs, benefit distributions, political power and other factors on policy.

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 300 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.

340. Managerial Economics
Spring, 3(3-0) EC 201.
Production, consumption decisions and their interrelation. Pricing of market and non-market goods. Effects of monetary and fiscal policies. Applications to problems in food system or community management.

Spring, 3(3-0) EC 200 and EC 210. Interdepartmental with and administered by the Department of Economics.

370. Applied Statistics
Winter, 3(3-0) Students may not receive credit in both FSM 370 and AEC 330. One course in statistics, one course in food systems economics and management or public affairs management. Interdepartmental with and administered by the Department of Economics.
Interpretation and use of statistical results in decision making. Sampling index numbers, tabular analysis, trend estimation, regression models, decision theory.

404. Social Accounts and Community Choice
Winter, 3(3-0) PAM 303 or approval of department.
Social accounting as a framework for problem definition and measurement of policy effectiveness. Conceptualization of social accounts. Use of selected social indicators in policy formulation and decision making.

406. Public Expenditure: Theory and Policy
Fall, Spring, 4(4-0) EC 201 or EC 210. 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) Interdepartmental with Food Systems Economics and Management and the departments of Economics, and Resource Development. Administered by the Department of Economics.
Factors affecting the economic use of land and space resources by people. Input-output relationships; development, investment, and enterprise location decisions. Land markets, property rights, area planning; zoning and land use controls.

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.
Agricultural Engineering

512. Introduction to Agricultural Engineering
Fall, Spring. (3-0) Interdepartmental with Agricultural Engineering Technology. An introduction to the agricultural engineering profession with an examination of existing problems.

532. Physical Principles of Biological Processes
Winter. (4-0) A E 353.
Basic scientific principles and engineering theory applied to biological systems and products.

535. Physical Principles of Plant Environment
Fall. (4-0) CPS 120, MTH 310, CEM 152 or CEM 153.
Physical processes and properties of the biosphere as related to engineering the plant environment.

534. Physical Principles of Animal Environment
Spring. (2-0-2) A E 352.
Interrelationship of environmental factors and physiological responses of animals for planning, design and control of optimum environmental systems.

536. Electric Power and Control
Winter. (4-0-2) 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.

576. Food Process Engineering
Spring. (3-2-0) 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, dehydation, and separation.

304. 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 professions of engineering and engineering technology.

461. Design of Agricultural Structures
Fall. (4-0-2) MMM 211, MMM 225.
The analysis of structural systems and the design of components and connections. Examples selected from agricultural machinery and buildings.

474. Processing Biological Products
Spring. (3-0-2) A E 353, M E 311 or CEM 381.
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.

509. Finite Element Method
Fall. 4(4-0) Approval of department. Interdepartmental with the Department 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.