420. The Military and American Society  
(Fall, 3-0)  
Role of the professional officer in a democratic society; socialization process within the Armed Services; political economy and social constraints upon the national defense structure.

421. Strategy and the Management of Conflict  
(Winter, 3-3-1)  
The formation and implementation of defense policy and strategy. The bureaucratic interplay and impact of nuclear technology. An investigation of limited and insurgency warfare.

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. Juniors 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 Oriental and African Languages.

AGRICULTURAL ECONOMICS

College of Agriculture and Natural Resources

505. Agricultural Production Economics I  
(Fall, 4-4-0) FSM 401 or FAM 401.  

809. Institutions Behavior and Performance  
(Fall, 3-3-0) Approval of department.  
Approach to department. Interdepartmental with the departments of Resource Development and Economics.

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.

Agricultural Economics - Descriptions of Courses

811. Public Program Analysis  
Spring, Summer of odd-numbered years. 3(3-0) FSM 401 or EC 324 or approval of department. Interdepartmental with the departments of Economics and Resource Development.  
Application of benefit-cost analysis to public programs of resources development. Issues and case studies in budgeting, investment criteria, pricing, externalities, and coordination.

830. Data Generation and Analysis  
Winter. 4(4-0) STT 423.  
Organization of information systems in relation to economics of information. Use of published data and samples. Index numbers, regression, hypothesis testing and decision making. Emphasis on social science applications.

831. Advanced Food Processing and Distribution Management  
Fall, Spring. 4(4-0) May reenroll for a maximum of 8 credits. Approval of department. 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.

833. Mathematical Programming  
Spring. 3(3-0) EC 500 or EC 512A. MTH 334. Interdepartmental with the departments of Economics, and Statistics and Probability.  
Linear programming. Theory of linear economic models. Topics in nonlinear programming.

835. Introduction to Econometrics  
Fall, Spring, Summer. 3(3-0) EC 385, STT 422. Interdepartmental with and administered by the Department of Economics.  

837. Applied Operations Research I  
Spring. 4(4-0) MTH 113 or MTH 283. 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. 2(2-0) MTH 113 or MTH 285, 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, Spring. 3(3-0) STT 422 and FSM 401 or EC 325.  
851. Advanced Farm Management
Summar. 3(3-2) FSM 430 or approval of department.
Emphasizes identification, analysis, and methods of solving problems of farm organization and operation, 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.

861. Agricultural Trade Policies
Fall of odd-numbered years, Summer of even-numbered years. 3(3-0) EC 427 or approval of department.
International trade in agricultural products, areas of competition, changes in comparative advantage, interrelationships of national and international policy regional groupings, trade and economic development, current policy proposals.

862. Agriculture in Economic Development
Winter. 3(3-0) FAM 402 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.

868. Data Collection in Developing Countries
Spring of even-numbered years, Summer of odd-numbered years. 3(3-0) AEC 830 or STT 825 or approval of department.
Principles for conducting household/village level studies of production and marketing in developing countries. Preparing research proposals, methodologies for data collection, processing and analysis. Field research administration.

876. Statistical Inference in Economics I
Fall. 3(3-0) EC 812A or EC 801, STT 443 or STT 863, or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability and 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.

877. Statistical Inference in Economics II
Winter. 3(3-0) EC 876 or approval of department. Interdepartmental with the departments of Economics, and Statistics and Probability and administered by the Department of Economics. Specification and estimation of simultaneous equation models. Nonlinear models. Bayesian approach to estimation problems. Recent developments in econometrics.

878. 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 and 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.

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

906. Agricultural Production Economics II
Winter. 4(4-0) AEC 805 or FSM 401. Resource allocation and efficiency in agriculture as related to management under conditions of both perfect and imperfect knowledge of taste, institutional, technological and human change. Advanced topics.

910. Resource Economics Proseminar
Spring. 3(3-0) May reenroll for a maximum of 9 credits. Approval of department. Interdepartmental with the departments of Forestry and Resource Development and 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 421 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) FSM 862, one year of graduate study in agricultural economics or economics approved 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 even-numbered years. Summer of odd-numbered years. 3(3-0) 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 valuations. Critical appraisal of research studies.

990C. Mathematical Economics and Econometrics Workshop
Fall, Winter, Spring. 3 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 participate in workshop and may do so while registered for FSM 990.

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)
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. 3(3-0)
Description and analysis of problems faced by managers of input supply, farm, and packing and handling firms. Emphasis on planning, organization, adjustment to technological change, growth and personnel management.

335. Food Processing and Distribution Management
Winter. 3(3-0) FSM 200 or MTA 200. 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.

340. Managerial Economics
Spring. 3(3-0) EC 201. Interdepartmental with and administered by Public Affairs Management. Production, consumption decisions and their interaction. Pricing of market and non-market goods. Effects of monetary and fiscal policies. Applications to problems in food systems or community management.
370. Applied Statistics
Winter. 3(3-0) Students may not receive credit in both FSN 370 and AEC 380. 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
Spring. 3(3-0) FSN 200 or EC 201. Capital, sources and requirements in the food system. Sources and terms of credit. Credit instruments. Interest rates. Credit policy issues. Principles of financial management and real estate appraisal.

417. Land Economics
Fall, Spring. 4(4-0) Interdepartmental with the departments of Resource Development and Economics and Public Affairs Management and administered by the Department of Resource Development. Factors affecting man's economic use of land and space resources. 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) FSN 200 or EC 201, PAM 320 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.

422. Food System Managers in the Community
Spring. 3(3-0) FSN 421, FSN 430 or FSN 490. Examination of political and social issues affecting individual participants and businesses in the food sector.

430. Advanced Food Production Management
Fall. 3(3-0) FSN 330. Management principles and techniques applied to food production firms including farms, input suppliers, packers and handlers. Emphasis on planning, growth, finance and decision processes. Case studies and gaming.

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. Management 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.

443. Group Action in Marketing
Spring. 3(3-0) FSN 200. Characteristics, problems and strategies of cooperatives, unions, bargaining groups, trade associations and other voluntary organizations. Effects of group action on farmers, marketing firms and consumers. Legal restraints and facilitation of group action.

460. Regional Economics
Winter. 4(4-0) R D 417 or FSN 401 or EC 324. Interdepartmental with the departments of Resource Development and Economics, and Public Affairs Management and administered by the Department of Resource Development. Forecasts affecting location decisions of firms, households and governments. Applications to agricultural, industrial, and regional developments.

461. Regional Economics Laboratory

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 enroll for a maximum of 9 credits. Approval of department.

Public Affairs Management

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, population and poverty problems, especially in relation to trade and aid programs. Special emphasis on problems of 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.

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 making 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 200 and EC 201, or EC 210. Interdepartmental with and administered by the Department of Economics. African economic development in historical perspective. Analysis of contemporary economic development problems faced by tropical African countries. Alternative strategies for African economic development.

370. Applied Statistics
Winter. 3(3-0) Students may not receive credit in both PAM 370 and AEC 380. One course in statistics, one course in food systems economics and management or public affairs management. Interdepartmental with Food Economics and Resource Development. Interdepartmental with Food Economics and Resource Development. Application of statistics, one course in food systems economics and management or public affairs management.

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

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 the departments of Resource Development and Economics and Food Systems Economics and Management and administered by the Department of Resource Development. Factors affecting man's economic use of land and space resources. 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  
(450.) Fall, Spring. 3(3-0) BOA 440. Interdepartmental with the departments of Resource Development and Urban and Metropolitan Studies and administered by the Department of Urban and Metropolitan Studies. 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 200 or EC 201 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 647 or FSM 402 or EC 324. Interdepartmental with the Department of Resource Development and Economics and Food Systems Economics and Management and 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 490 and approval of department. Interdepartmental with Food Systems 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. Agricultural and Rural Development in Developing Nations  
Fall. 3(3-0) PAM 201 or EC 201, PAM 200 recommended. Interdepartmental with Agriculture and Natural Resources and Food Systems Economics and Management and administered by the 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.

473. Introduction to Systems Analysis  
Spring. 3(2-0) MTH 111. Interdepartmental with Food Systems Economics and 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.

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

AGRICULTURAL ENGINEERING A E

College of Agriculture and Natural Resources

152. Introduction to Agricultural Engineering  
Fall, Spring. 3(1-0) Interdepartmental with Agricultural Engineering Technology. An introduction to the agricultural engineering problems with an examination of existing problems.

250. Introduction to Agricultural Engineering Problems  
Fall. 2(1-2) MTH 214 or concurrently. Examination and solution of problems chosen from typical areas of agricultural engineering.

352. Physical Principles of Biological Processes  
Winter. 3(3-0) A E 353. Basic scientific principles and engineering theory applied to biological systems and products.

353. Physical Principles of Plant Environment  
Fall. 3(3-0) C PS 120, MTH 310, CEM 152 or CEM 132. Physical processes and properties of the biosphere as related to engineering the plant environment.

354. Physical Principles of Animal Environment  
Spring. 3(2-1) A E 352. Interrelationship of environmental factors and physiological responses of animals for planning, design and control of optimum environmental systems.

356. Electric Power and Control  
(471.) Fall. 4(3-2) PHY 285. 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.

376. Food Process Engineering  
(475.) 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  
(494.) Fall. 3(3-0) MMM 306. 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.

IDC. Introduction to Meteorology  
For course description, see Interdisciplinary Courses.

IDC. Introduction to Meteorology Laboratory  
For course description, see Interdisciplinary Courses.

IDC. Microclimatology  
For course description, see Interdisciplinary Courses.

452. Communication Techniques for Agricultural Engineers  
Spring. 1(1-0) Third-term junior majors or approval of department. The storage, retrieval, and transmission of technical information.

455. Principles of Structures and Machines  
(355.) Spring. 3(3-0) M MM 211, M MM 215. Deflection analysis of machinery structures including plane frames and plane grids.

461. Design of Agricultural Structures  
Fall. 3(3-0) M MM 211, M MM 215. The design of components and connections with examples selected from agricultural machinery and buildings.

474. Processing Biological Products  
Spring. 3(3-0) A E 352, M E 311 or C EM 461. Engineering principles of unsteady-state heat transfer, heat exchangers, drying, storage and refrigeration as applied to the processing of biological products.

475. Introduction to Operations Research  
Winter. 4(4-0) M TH 310, C PS 120. Interdepartmental with Systems Science. Methodology and basics of operations research; formulation and analysis of probabilistic models of inventory, waiting line, and reliability processes; random process simulation and network planning models.

480. Special Problems  
(459.) 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 machines and tractors, waste management, food processing structures and environment, materials processing and handling, water management, meteorology and climatology, agricultural systems analysis.

481. Soil and Water Conservation Engineering  
Winter. 4(4-0) C E 321, A E 353. Engineering analysis, design and construction of drainage, irrigation and erosion control 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, hydraulics, tractors, hitches, vehicle dynamics and operator comfort.

495. Fundamentals of Design  
Spring. 3(3-0) Third-term junior majors or approval of department. Problem identification, working media, models, procedures, and developing specifications. Selection of individual design problem for A E 496 and A E 497.

496. Design Project Investigation Laboratory  
Winter. 2(1-0) A E 495. Individual or team pursuit of a design project. Project log and completion of preliminary specifications.