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 of certain 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 sector. Impact of values, beliefs, costs, benefit distributions, political power and other factors on policy.

306. Government Programs for Workers
(485.) Winter. 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, antidiscrimination 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.

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.

363. Economic Development of Tropical Africa
Spring. 3(3-0) or concurrently.

370. Applied Statistics
Winter. 3(3-0)
Students may not re­ ceive credit in both PAM 370 and ARC 380. 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 estimation, regression models, decision theory.

404. Social Accounts and Community Change
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.

460. Public Expenditures: 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 Resource Development, and Economics. 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.

419. Law and Social Change
Fall, Spring. 4(4-0) BOA 440 or approval of department. Interdepartmental with the departments of Resource Development and, and Urban and Metropolital Studies. Administered by the Department of Urban and Metropolital 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) RD 417 or EC 324. Interdepartmental with Food Systems Economics 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
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.

473. Introduction to Systems Analysis
Spring. 3(3-0) 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.

490. Supervised Field Experience
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Approval of department.

492. Supervised Field Experience
Fall, Winter, Spring, Summer. 2 to 9 credits. May reenroll for a maximum of 12 credits if different topics are taken. Approval of department.

Agricultural Engineering  A E

College of Agriculture and Natural Resources

152. Introduction to Agricultural Engineering
Fall, Spring. 1(1-0) Interdepartmental with Agricultural Engineering Technology.
An introduction to the agricultural engineering profession 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 352.  
Basic scientific principles and engineering theory applied to biological systems and products.

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

354. Physical Principles of Animal Environment  
Spring. 3(2-2) A E 356.  
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 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.

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  
(464.) 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.

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  
(385.) Spring. 3(3-0) MMM 211, MMM 215.  
Deflection analysis of machinery structures including plane frames and plane grids.

461. Design of Agricultural Structures  
Fall. 3(3-0) MMM 211, MMM 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 E M 361.  
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) MTH 310, CPS 120, Interdepartmental with Systems Science.  
Methodology and basic 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  
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 354.  
Functional requirements, operational characteristics, analysis and design of tractors including power trains, hydraulics, tractor, 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  
Fall, Winter, Summer. 2(0-4) A E 465.  
Individual or team pursuit of a design project. Project log and completion of preliminary specifications.

497. Design Project Completion Laboratory  
Fall, Winter, Spring. 3(3-0) A E 496.  
Completion of design project including submission of final design report.

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.

814. Physical Properties of Agricultural Products  
Winter. 3(3-0) Approval of department.  
Physical and mechanical behavior of fruits and vegetables, forages, grains and other agricultural products under constant and dynamic loading. Related to design parameters for production, handling and processing machinery.

815. Instrumentation for Agricultural Engineering Research  
Spring. 3(0-0).  
Theory, method and techniques of measuring temperature, pressure, flow, humidity, and moisture for biological materials. Associated recording and indicating equipment.

820. Research Methods in Agricultural Engineering  
Fall. 1(1-0)  
Discussion of procedures for initiating, developing, carrying out, and completing research projects.

822. Seminar  
Spring. 1(1-0).

840. Advanced Power and Machinery  
Winter of even-numbered years. 3(2-2) A E 394, A E 492.  
Analysis of agricultural machine components and systems. Emphasis on hydraulic power transmission, controls, and management of machinery systems.

880. Special Problems  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 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.

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

Agricultural Engineering - Descriptions of Courses

Agricultural Engineering Technology AET

152. Introduction to Agricultural Engineering  
Fall, Spring. 1(1-0) Interdepartmental with and administered by the Department of Agricultural Engineering.  
An introduction to the agricultural engineering profession with an examination of existing problems.

200. Computers and Information Processing in Agriculture and Natural Resources  
(A E 200.) Spring. 3(3-0).

Evaluation of the present and future role and application of electronic computers in the area of agriculture and natural resources.
201. Technical Agricultural Mechanics Skills
   (A E 402) Fall: 3(2-3) Major or minor in vocational agriculture or major or minor in Agriculture and Natural Resources Education or approval of department.
   Basic principles, applications, techniques, tools, materials, and resources in agricultural mechanics skills.

202. Agricultural Metalworking
   (A E 201) Winter: 3(2-2)
   Principles, skills and safety for welding, soldering, brazing, cutting, bench work, metalurgy, fastening and shop tools. Maintenance metal-working for farm and agribusiness shops will be emphasized.

223. Commerical Food Processing Systems
   Fall: 3(3-0) Interdepartmental with the Department of Food Science and Human Nutrition.
   Processes and systems used in handling, processing and distribution of food; the need for processing systems and their influence on food quality.

239. Housing Conservation
   (A E 239) Spring: 3(3-0) Interdepartmental with the Department of Human Environment and Design.
   Skills and techniques in conserving, repairing and remodeling existing housing. Structural components of housing and evaluation of housing structure.

243. Automotive and Recreational Engines
   (A E 243) Spring: 3(2-0)
   The principles and maintenance of engines used in automobiles and recreational vehicles. Fuels, lubricants and emission control. Basic engineering principles are developed in a manner that requires no prior technical training.

244. Automotive and Recreational Engines Laboratory
   (A E 244) Spring: 1(0-2) AET 243 or concurrently.
   Laboratory experiences in engine maintenance. Ignition principles and testing equipment.

258. Technical Skills
   Fall, Winter, Spring: 1 to 7 credits. May reenroll for a maximum of 10 credits. Majors or approval of department.
   Selection, operation, and maintenance of physical components of electrical, mechanical, environmental and water management systems in agriculture and natural resources industries, including system design and component installation.

322. Systems Analysis in Agricultural Production
   Fall: 3(3-0) MTH 111 or MTH 109, CPS 110 or CPS 120.
   Simulation of processes and operations for food, feed, fiber and energy flow in agriculture and natural resources. Analysis of interrelationships between physical systems.

323. Mechanical Systems in Agriculture and Natural Resources
   Winter: 4(4-0) PHY 237, PHY 257.
   Phenomenological aspects of the laws of mechanics and their influence on the design of mechanical and structural systems encountered in agriculture and natural resources.
230A. Introduction to Careers in Vocational and Practical Arts Education; Agriculture and Natural Resources
(AG 275.) Spring. 3(3-0)
Exploration of overseas assignments with international agencies, potential world food activities and potentialities; special problems of the tropics compared with those in temperate regions.

341. Energy in the Food System
(AG 341.) Winter. 3(3-0) Juniors or approval of department. Interdepartmental with and administered by Agricultural Engineering Technology.

399. Professional Internships in Agriculture and Natural Resources
(AG 369.) Fall, Winter, Spring, Summer. 1 to 10 credits [10 credits]: Juniors and approval of department. Professional experiences in a student's major. Supervision and evaluation by faculty and cooperating agencies.

Agricultural and Natural Resources - Descriptions of Courses

417. Residential Finance
Winter. 4(4-0) AFA 395 or approval of department.
Analysis of financial programs for the construction, rehabilitation, remodeling and purchase of homes, especially meeting the nation's goals for lower to moderate income housing.

418. Special Problems
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Written approval of department.
Special problems in the areas of acquisition and development of residential land, design, construction technology, building materials, finance, marketing, construction management and land use codes and regulations.

420. Construction Management
Spring. 4(4-0) Senior majors or approval of department.
Systems management techniques for residential building organizations inclusive of organization development, operations, planning, scheduling and control, and administrative systems and procedures.

425. Agriculture and Natural Resources Seminar
(AG 425.) Spring. 2(2-0)
Current agricultural, natural resources, and environmental problems and solutions as presented by discussion leaders from various disciplines, arranged by undergraduate students.

444. Pest Management I: Systems Management for Plant Protection
(AG 437, AG 444.) Fall. 4(3-2) FSM 200 or EC 201, Interdepartmental with and administered by the College of Natural Science. Designed to integrate knowledge and improve ability in pest management decisions of varying complexity involving the fields of agronomy, wildlife, horticulture, entomology, and plant pathology.

445. Pest Management II: Pesticide Chemistry and Application Systems for Plant Protection
(AG 435, AG 445.) Winter. 3(3-4) CEM 152, Interdepartmental with and administered by the College of Natural Science. A broad overview of pesticide chemistry, efficient usage, environmental fate, legislation and application techniques.

446. Pest Management III: Biological Systems for Plant Protection
(AG 436, AG 446.) Spring. 3(3-0) ENT 425, BOT 405, HRT 402 or CSS 402, Interdepartmental with and administered by the College of Natural Science. Management of plant pests utilizing host resistance, cultural practices, legislation, and biological systems.

450. Natural Resource Administration
(N R 450.) Fall. 4(4-0) Seniors; not open to forestry majors. Interdepartmental with the departments of Fisheries and Wildlife, Forestry, Park and Recreation Resources and Resource Development. Administered by the Department of Forestry.