462. Agricultural and Rural Development in Developing Nations
Fall, 3(3-0) 201 or EC 201; PAM 260 recommended. Interdepartmental with Agriculture and Food Systems Economics and Management and administered by Food Systems Economics and Management.

Principles of systems analysis applied to ecological, physical, economic and social phenomena. Basic studies, interpretation and design of systems models. Systems concepts in decision making.

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. Basic studies, interpretation and design of systems models. Systems concepts in decision making.

AGRICULTURAL ENGINEERING

College of Agriculture and Natural Resources

152. Introduction to Agricultural Engineering I
Fall, 1(1-0) 252.

An introduction to the agricultural engineering profession with an examination of existing problems.

153. Introduction to Agricultural Engineering II
Winter, 1(1-0) 253.

Communication techniques, library use, letter and technical report writing techniques as used in the agricultural engineering profession.

154. Introduction to Agricultural Engineering III
Spring, 1(1-0) 254.

An analysis of the agricultural engineering profession with an examination of educational requirements for employment in various areas of the profession.

200. Computers and Information Processing in Agriculture and Natural Resources
Spring, 3(3-0) 345.

Evaluation of the present and future role and application of electronic computers in the area of agriculture and natural resources.

202. Agricultural Metalworking
Fall, 3(2-2) 352.

Principles, skills and safety for welding, soldering, brazing, cutting, bench work, metalurgy, fastening and shop tools. Maintenance metalworking for farm and agribusiness shops will be emphasized.

239. Housing Conservation
Spring, 3(2-0) 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
Spring, 2(2-0)

The principles and maintenance of engines used in automobiles and recreational vehicles. Fuels, lubricants and emission control. Basic engine principles are developed in a manner that requires no prior technical training.

244. Automotive and Recreational Engines Laboratory
Spring, 1(0-2) 243 or concurrently.

Laboratory experiences in engine maintenance. Ignition principles and testing equipment.

352. Physical Principles of Biological Processes
Fall, 3(3-0) MTH 315, PHY 289.

Basic scientific principles and engineering theory applied to biological systems and products.

353. Physical Principles of Plant Environment
Winter, 3(3-0) 352.

Physical processes and properties of the biosphere as related to engineering the plant environment.

354. Physical Principles of Animal Environment
Winter, 3(3-0) 359.

Interrelationship of environmental factors and physiological responses of animals for planning, design and control of optimum environmental systems.

355. Principles of Structures and Machines
Spring, 3(3-0) MBB 211.

Stress and deflection analysis of simple structures and machines. Emphasis on loads and selection of materials. Course will be oriented towards applications in agricultural engineering.

402. Teaching Agricultural Mechanics
Winter of odd-numbered years, 5(2-0)

Juniors.
Teaching theory and developing skills in agricultural mechanics in secondary and vocational schools. School and farm shop planning and management. Emphasis on equipment and material selection, metalurgy, metal work and welding.

462. Pollution Control
Winter of even-numbered years, 4(3-2)

Application of biological, chemical, physical and engineering principles of pollution control to optimize the production and processing of food and fiber with respect to the quality of the total environment.

471. Electric Power and Control
Winter of odd-numbered years, 4(3-2) E E 345.

Electric motors, controls and circuits; switching logic, devices and circuit design.

474. Processing, Biological Products
Winter of odd-numbered years, 4(3-2) 352.

Engineering principles of unsteady state heat transfer, heat transfer, heat transfer, drying, storage and refrigeration as applied to the processing of biological products.

475. Introduction to Operations Research
Winter, 4(4-0) MTH 315, CPS 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.

476. Food Process Engineering
Spring of odd-numbered years, 4(3-2)

Description and analysis of systems utilized in processing of foods for human consumption.

480. Special Problems
Fall, Winter, Spring, Summer, 1 to 9 credits. May re-enroll for a maximum of 9 credits. Approval of department.

481. Soil and Water Engineering
Spring of even-numbered years, 4(3-2) M E 332 or C E 321.

Engineering analysis, design and construction of drainage, irrigation and erosion control systems.

493. Energy Conversion Systems
Winter of even-numbered years, 4(3-2) M E 311.

Principles of energy conversion with emphasis on the internal combustion engine. Thermodynamic analysis, performance characteristics, and power transmission.

494. Systems of Agricultural Machines
Fall, 4(3-2) 355.

Systems of machines used in field and farmstead operations. Engineering principles for machines dealing with biological materials.

504. Agricultural Mechanization in Developing Countries
Spring, 3(3-0) Approval of department.

805. Environmental Measurements  
Fall. 4(3-3)  
Methods and techniques for accurate measurement and interpretation of environmental parameters. Temperature, humidity, wind and air flow characteristics, radiation, light intensity, gaseous and particulate concentrations in atmospheric microclimates will be discussed.

806. Analysis of Agricultural Systems  
Spring. 3(3-0)  
Identification and definition of systems problems in agriculture. Model formulation and estimation. Several models of current interest are considered.

807. Man-Machine Relationships  
Fall. 3(3-0)  
Approval of department.  
Analysis of machine design, operation and working environment in relation to human limitations and capabilities, analysis of procedures used to develop maximum compatibility between man and machine.

808. Special Problems  
811. Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll 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.

809. Research  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.  
New developments in agricultural engineering. Subjects to be covered include atmospheric turbulence, optimization of agricultural systems, measurement systems, food engineering, agricultural rheology and finite element methods.

810. Advanced Topics in Agricultural Engineering  
Fall, Winter, Spring. 3(3-0)  
May re-enroll for a maximum of 9 credits. Approval of department.  
Analysis of machine design, operation and planning for mechanical and natural resources. Emphasis on hydraulic power transmission, controls, and management of machinery systems.

811. Dynamics of American Housing  
Fall, Winter, Spring, Summer. 3(3-0)  
Impact of housing on economic and social welfare of America. Analysis of the residential building industry and its problems in providing adequate housing.

812. Structural Design  
Fall. 4(4-0)  
200 or approval of department.  
Consideration of structural design systems as used in light construction.

813. Housing Utilities Design  
Winter. 4(4-0)  
Design of and planning for mechanical and electrical utilities in housing.

814. Residential Construction Systems  
Spring. 4(3-2)  
312 or approval of department.  
Analysis of the primary construction systems employed in the residential building industry, especially the economic and social aspects in meeting the housing goals of the U.S.

815. Building Materials  
Spring. 4(4-0)  
312 or approval of department.  
Properties of building materials pertinent to their application and performance in service.

816. Building Costs  
Winter. 4(3-4)  
Approval of department.  
Methods of cost estimating. Effects of codes and production practices on costs.

817. Residential Finance  
Winter. 4(4-0)  
Juniors.  
Analysis of financial programs for the construction, rehabilitation, and purchase of homes, especially meeting the nation's goals for low to moderate income housing.

Related to design parameters for production, handling and processing machinery.

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

819. Mechanical Systems in Agriculture and Natural Resources  
Winter. 4(4-0)  
PHY 237, 237.  
Phenomenological aspects of the laws of mechanics and their influence on the design of mechanical and structural systems encountered in agriculture and natural resources.
**Agriculture Courses**

**324. Processing Systems for Biological Products**
Spring, 4(4-0) MTH 109 or 111, PHY 238.
Physical processes which influence biological products during production, handling, processing and distribution. Mass and heat balances, fluid flow, steam generation, psychrometrics, heat exchange, refrigeration and dehydration will be discussed.

**416. Light Structural Systems**
(A E 416) Fall, 4(4-0) PHY 238 or approval of department.
Functional planning of animal structures. Properties of building materials and selecting building components to satisfy requirements of light structures.

**421. Electrical Energy Utilization**
(A E 421) Spring, 4(3-2) PHY 238 or approval of department.
Efficient utilization of electrical energy; selection, operation and control of electrical equipment. Design of electrical systems.

**431. Irrigation, Drainage and Erosion Control Systems**
(A E 431) Spring, 4(3-2) CS 210 or approval of department.
Use of surveying, design, construction and cost estimates of drainage, irrigation and water control systems.

**443. Machinery and Tractor Systems**
(A E 443) Fall, Spring, 4(2-2) A E 243 or approval of department.
Characteristics of basic agricultural field machinery. Diesel engine, fuel injection and combustion chamber characteristics. Torque and power transmission, tractor stability and implement hitching.

**480. Special Problems**
Fall, Winter, Spring, Summer. 1 to 5 credits. May re-enroll 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.

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**Agriculture and Natural Resources Courses**

**124A. Introduction to Careers in Vocational and Practical Arts Education—Agriculture**
Fall, 2(1-2) Interdepartmental with and administered by the College of Education.

**275. Exploring International Agriculture**
Spring, 3(3-0) Interdepartmental with Natural Resources.
Exploration of overseas assignments with international agencies; potential world food actualities and potentialities; special problems of the tropics compared with those in temperate regions.

**350. Leadership Development for Agriculture and Natural Resources**
Winter, Spring, 3(3-0) May re-enroll for a maximum of 6 credits. Approval of department. Interdepartmental with Natural Resources.

**399. Agriculture Internship**
Fall, Winter, Spring, Summer. Zero to 10 credits. 10 credits if Juniors and approval of department. Interdepartmental with Natural Resources.
Professionalized experiences in a student's major. Supervision and evaluation by faculty and cooperating agencies.

**401. Agriculture and Natural Resources Communications**
Winter, Spring, 3(3-3) IRN 301 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, radio and production for specialized and general audiences.

**425. Agriculture and Natural Resources Seminar**
Spring, 2(3-0) Interdepartmental with Natural Resources.
Current agricultural, natural resources, and environmental problems and solutions as presented by discussion leaders from various disciplines, arranged by undergraduate students.

**435. Pest Management I: Pesticide Chemistry and Application Systems for Plant Protection**
Fall, 5(3-4) CEM 139. Interdepartmental with Natural Resources and the College of Natural Sciences, administered by the College of Natural Science.
A broad overview of pesticide chemistry, efficient usage, environmental fate, legislation and application techniques.

**436. Pest Management II: Biological Systems for Plant Protection**
Winter, 3(3-0) ENT 406, BOT 405, HRT 408 or CSS 402. Interdepartmental with Natural Resources and the College of Natural Science. Administered by the College of Natural Science.
Management of plant pests utilizing host resistance, cultural practices, legislation, and biological systems.

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**American Studies Courses**

**301. Issues in American Civilization**
Fall, Winter, Spring. 3(3-0) May re-enroll for a maximum of 9 credits. Not applicable to major requirements.
Selected issues in American life past and present, with materials drawn from such disciplines as history, social sciences, philosophy, literature and the arts. Topic vary.

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**College of Arts and Letters Courses**

**410. Perspectives in American Studies**
Fall, 3 credits. Juniors in American Studies or approval of American Studies Committee.
Methods and significant works, for majors in the American Studies program. Offered by members of the relevant departments.