

fare economics. Examples drawn from agriculture.

**404. Social Accounts and Community Choice**

Winter. 3(3-0) 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 Expenditures: Theory and Policy**

Fall, Spring. 4(4-0) EC 201 or 210. Interdepartmental with and administered by the Economics Department.

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 Resource Development and Economics Departments and Food Systems Economics and Management and administered by the Resource Development Department.

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.

**460. Location Analysis**

Winter. 4(4-0) 417 or 401 or EC 324. Interdepartmental with the Resource Development and Economics Departments, and Food Systems Economics and Management and administered by the Resource Development Department.

Forces affecting location decisions of firms, households and governments. Applications to agricultural, industrial, and regional developments.

**462. Rural Transformation in Developing Societies**

(AEC 462.) 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.

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.

**480. Independent and Supervised Study**

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

**AGRICULTURAL ENGINEERING**

**A E**

**College of Agriculture and Natural Resources**

**202. Physical Principles of Mechanical Processes**

Fall, Spring. 3(1-4)  
Theory and skills in metallurgy, heat treating, cold metal, sheet metal, plumbing, arc and oxy-acetylene welding and machine operations.

**220. Engineering Principles Applied to Agriculture**

Winter. 4(3-2) MTH 108.  
Physical principles and their application to agricultural production, distribution and processing.

**252. Introduction to Agricultural Engineering I**

Fall. 1(1-0)  
An introduction to the Agricultural Engineering profession with an examination of existing problems.

**253. Introduction to Agricultural Engineering II**

Winter. 1(1-0)  
Communication techniques, library use, letter and technical report writing techniques as used in the Agricultural Engineering profession.

**254. Introduction to Agricultural Engineering III**

Spring. 1(1-0)  
An analysis of the Agricultural Engineering profession with an examination of educational requirements for employment in various areas of the profession.

**352. Physical Principles of Biological Processes**

Fall. 3(3-0) MTH 215, 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**

Spring. 3(2-2) 352.  
Interrelationship of environmental factors and physiological responses of animals for planning, design and control of optimum environmental systems.

**355. Principles of Structures and Machines**

Winter. 3(3-0) MMM 211.  
Stress and deflection analysis of simple structures and machines. Estimation of loads and selection of materials. Course will be oriented towards applications in agricultural engineering.

**402. Teaching Agricultural Mechanics**

Winter, Spring. 5(2-6) 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, metallurgy, metal work and welding.

**416. Agricultural Structures**

Fall, Spring. 4(3-2) Juniors.  
Functional planning and principles of environmental control, cost estimation, structural component analysis and properties of building materials.

**421. Electric Power**

Fall, Spring. 4(3-2) 220.  
Application of electric energy to production and living; selection, installation, operation and control of electrical equipment.

**423. Principles of Processing Equipment**

Winter. 3(2-2) 220.  
Principles of equipment used in the processing and storage of biological products.

**425. Farmstead Materials Handling**

Spring. 3(2-2) Juniors.  
Systems and equipment for handling grain, hay, fertilizer, water and wastes on the farm. Systems design and evaluation.

**431. Principles of Irrigation, Drainage and Erosion Control**

Spring. 4(3-2) SLS 210.  
Use of surveying, design, construction and cost estimates of drainage, irrigation and water control systems.

**432. Introduction to Meteorology**

For course description, see Interdisciplinary Courses.

**433. Introductory Meteorology Laboratory**

For course description, see Interdisciplinary Courses.

**435. Microclimatology**

For course description, see Interdisciplinary Courses.

**437. Principles of Food Engineering**

Winter. 5(5-0) 220.  
Principles and use of electricity, steam, refrigeration and hydraulics in food plants. Emphasis will be placed on specialized processing equipment, their design features, materials of construction and automatic control.

**443. Internal Combustion Engines**

Fall, Spring. 3(2-2) 220.  
Introduction to spark ignition and compression ignition engines with emphasis on principles of operation, combustion, fuels, lubricants and engine performance.

**444. Agricultural Production Machinery**

Spring. 3(2-2) 220.  
Basic principles of agricultural machines. Selection, care and operation of agricultural machinery for obtaining optimum conditions for crop production.

**445. Hydraulic Power Transmission**

Winter. 3(2-2) MTH 111, PHY 237.  
Pressures, flows and losses in hydraulic power transmission systems. Operation and performance of pumps, valves, actuators, and complete systems found on agricultural and light industrial mobile equipment.

**459. Special Problems**

Fall, Winter, Spring, Summer. 1 to 5 credits. May re-enroll for a maximum of 5 credits. Approval of department.

**462. Pollution Control**

Winter of even-numbered years. 4(3-2) 352.

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**

Fall. 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, M E 311.  
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 215, 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) 352.  
Description and analysis of systems utilized in processing of foods for human consumption.

**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**  
Spring. 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**  
Spring of even-numbered years. 4(3-2) 355.  
Systems of machines used in field and farmstead operations. Engineering principles for machines dealing with biological materials.

**804. Agricultural Mechanization in Developing Countries**  
Spring. 3(3-0) Approval of department.  
Principles of mechanical equipment selection for organized agricultural enterprises. Machinery specifications and standards, performance efficiency, cost and use, and management factors. Domestic and foreign considerations.

**805. Environmental Measurements**  
Fall. 3(2-2)  
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.

**811. Technical Problems**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 9 credits.

**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 freeze drying of biological products or biological processes.

**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**  
Fall. 3(3-0)  
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**  
Spring. 3(2-2) 493, 494.

Analysis of agricultural machine components and systems. Emphasis on hydraulic power transmission, controls, and management of machinery systems.

**899. Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**990. Advanced Topics in Agricultural Engineering**  
Fall, Winter, Spring. 3(3-0) May re-enroll for a maximum of 9 credits. Approval of department.

New developments in agricultural engineering. Subjects to be covered include atmospheric turbulence, optimization of agricultural systems, measurement systems, food engineering, and agricultural rheology.

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

## AGRICULTURE AG

### College of Agriculture and Natural Resources

**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.

**401. Agriculture and Natural Resources Communications**  
Winter, Spring. 3(2-2) 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.

**402. Agriculture and Natural Resources Communications Internship**  
Fall, Winter, Spring, Summer. 1 to 6 credits. May re-enroll for a maximum of 6 credits. 401, approval of college.  
Internship with professionals in communications field with emphasis on student's areas of interest—writing, radio, TV, publications, etc.

**450. United States Agriculture for Overseas Students**  
Fall. 3(3-0) *Advanced undergraduate or graduate students from countries other than the United States or Canada.*  
Orientation course for overseas students. Development of United States agriculture. Institutions serving agriculture with emphasis on Land Grant University system. Scientific developments and their impact on agriculture. Field trips.

**462. Rural Transformation in Developing Societies**  
Fall. 3(3-0) PAM 201 or EC 201; PAM 260 recommended. *Interdepartmental with Public Affairs Management and Food Systems Economics and Management and 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.

**475. International Studies in Agriculture and Natural Resources**  
Summer. 3 to 9 credits. Approval of the college. *Interdepartmental with Natural Resources.*  
Study-travel experience emphasizing contemporary problems affecting agriculture in the world, national, and local communities. Field trips, case studies, interviews with leading experts, government officials, community leaders. Supervised individual study.

**488. The Impact of Animal Resource Management Upon the World's Developing Nations**  
Winter. 3(4-0)  
For course description, see *Interdisciplinary Courses.*

**865. Rural Development Administration I**  
(802.) Winter. 3(2-2) Approval of department. *Interdepartmental with and administered by the Department of Agricultural Economics.*  
Administrative concepts and their application in the analysis of the processes and structures through which agricultural and rural development activities are formulated and implemented in less developed countries.

**866. Rural Development Administration II**  
(803.) Spring. 3(3-0) 865. *Interdepartmental with and administered by the Department of Agricultural Economics.*  
Comparative analysis of major cases of intensive, purposeful change in less developed countries with emphasis on economic, administrative, political and other relevant factors which help explain program or policy effectiveness.

**880. Soils and Land Use in Tropical and Subtropical Regions**  
Spring. 3(3-0) Approval of department. *Interdepartmental with and administered by Soil Sciences.*  
Problem oriented studies of soils and land use in the tropics and subtropics in relation to their genesis, morphology, taxonomy, and management.

## AMERICAN STUDIES AMS

### College of Arts and Letters

**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. Topics vary.