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.

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

152. *Introduction to Agricultural Engineering I*

(252.) Fall. 1(1-0)

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

153. *Introduction to Agricultural Engineering II*

(253.) Winter. 1(1-0)

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

154. *Introduction to Agricultural Engineering III*

(254.) 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.

200. *Computers and Information Processing in Agriculture and Natural Resources*

Spring. 3(3-0)

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)

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

239. *Housing Conservation*

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*

Spring. 2(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*

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 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*

Spring. 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 of odd-numbered years. 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.

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.

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*

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, 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.

480. *Special Problems*

(459.) 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.

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.

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. 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) SYS 810.

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.

809. Finite Element Method
Fall. 4(4-0) Approval of department. Interdepartmental with the Department of Metallurgy, Mechanics and Materials Science, and Civil Engineering and 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.

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.

880. 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.

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, agricultural rheology and finite element methods.

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

Building Construction B C

200. Dynamics of American Housing
Fall, Winter, Spring, Summer. 3(3-0)

Impact of housing on the economic and social welfare of America. Analysis of the residential building industry and its problems in providing adequate housing.

312. Structural Design
Fall. 4(4-0) 200 or approval of department.

Consideration of structural design systems as used in light construction.

412. Housing Utilities Design
Winter. 4(4-0)

Design of and planning for mechanical and electrical utilities in housing.

413. 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.

415. Building Materials
Spring. 4(4-0) 312 or approval of department.

Properties of building materials pertinent to their application and performance in service.

416. Building Costs
Winter. 4(2-4) Approval of department.

Methods of cost estimating. Effects of codes and production practices on costs.

417. Residential Finance
Winter. 4(4-0) Juniors.

Analysis of financial programs for the construction, rehabilitation, remodeling and purchase of homes; especially meeting the nation's goals for low to moderate income housing.

418. Special Problems
Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll 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(2-2) 416 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.

835. Research in Building Construction
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

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

Physical Systems in Agriculture and Natural Resources PSA

223. Commercial 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.

258. Technical Skills
Fall, Winter. 2 to 7 credits. May re-enroll for a maximum of 10 credits. Majors and 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 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.

323. Mechanical Systems in Agriculture and Natural Resources
Winter. 4(4-0) PHY 237, 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.

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 237 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) CSS 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(3-2) 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.

AGRICULTURE AG

College of Agriculture and Natural Resources

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.

Leadership development. Preparation for community leadership. Firsthand look at social, economic, and political problems. Series of seminars, interviews, field trips. Emphasis on awareness, action, and involvement. Field trips required.

399. *Agriculture Internship*

Fall, Winter, Spring, Summer. Zero to 10 credits. [10 credits.]† 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(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.

425. *Agriculture and Natural Resources Seminar*

Spring. 2(2-0) 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 132. Interdepartmental with Natural Resources and the College of Natural Science. 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 430, BOT 405, HRT 402 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.

†See page A-2, item 3.

437. *Pest Management III: Systems Management for Plant Protection*

Spring. 4(3-2) NSC 435 and 436, FSM 200 or EC 201. Interdepartmental with Natural Resources and the College of Natural Science. Administered by the College of Natural Science.

Designed to integrate knowledge and improve ability in arriving at pest management decisions of varying complexity involving the fields of agronomy, wildlife, horticulture, entomology, and plant pathology.

462. *Agricultural and Rural Development in Developing Nations*

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.

471. *Environmental Topics in Nonmetropolitan Regions*

Fall. 4(4-0) Nomination of students by own department and approved by participating faculty. Interdepartmental with the College of Natural Science and Natural Resources and administered by Natural Resources.

Environmental topics in nonmetropolitan regions including issues on: production agriculture, service industries, nonagricultural uses, rural urban balance, discussion topics and case studies.

475. *International Studies in Agriculture and Natural Resources*

Spring, 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.

IDC. *The Impact of Animal Resource Management Upon the World's Developing Nations*

For course description, see Interdisciplinary Courses.

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.

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.