370. *Applied Statistics*

Winter. 3(3-0) Students may not receive credit in both FSM 370 and AEC 830. 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 Choice*

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.

406. *Public Expenditure: 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; effeciency 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 the economic use of land and space resources by people. 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*

Fall, Spring. 3(3-0) BOA 440 or approval of department. Interdepartmental with and administered by the Department of Resource Development.

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 D 417 or EC 324. Interdepartmental with Food Systems Economics and Management 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*

Spring. 1(0-2) R D 460 and approval of department. Interdepartmental with Food Systems Economics and 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 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.

480. *Independent and Supervised Study*

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

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.

490. *Supervised Field Experience*

Fall, Winter, Spring, Summer. 3 to 9 credits. May reenroll for a maximum of 9 credits. PAM Juniors, 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. 1(1-0) Interdepartmental with Agricultural Engineering Technology.

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

352. *Physical Principles of Biological Processes*

Winter. 4(4-0) A E 353.

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

353. *Physical Principles of Plant Environment*

Fall. 4(4-0) CPS 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(2-2) 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*

Winter. 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*

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*

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.

410. *Professional Ethics and Responsibilities*

Spring. 1(2-0) Senior majors.

Personal and professional ethics and social responsibilities will be addressed as related to the professions of engineering and engineering technology.

461. *Design of Agricultural Structures*

Fall. 4(4-0) MMM 211, MMM 215.

The analysis of structural systems and the design of components and connections. Examples selected from agricultural machinery and buildings.

474. *Processing Biological Products*

Spring. 3(3-0) A E 352, M E 311 or CEM 361.

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

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(5-0) C E 321, A E 353.

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

482. *Irrigation Design Management*
Spring. 4(3-2) A E 481.
Water supply including wells, water transport, pumping and pump selection, water requirements, power supplies and irrigation equipment with emphasis on sprinkler and trickle methods and design for agricultural application.

492. *Tractors and Power Transmission Systems*
Winter. 4(4-0) A E 394.
Functional requirements, operational characterisitics, analysis and design of tractors including power trains, hydraulics, traction, hitches, vehicle dynamics and operator comfort.

493. *Power and Control Hydraulics*
Winter. 4(3-2) CPS 120, C E 321.
Properties of hydraulic fluids; performance parameters of fixed and variable displacement pumps and motors; characteristics of control valves and components; analysis and design of hydraulic systems.

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 Laboratory*
Fall, Winter, Summer. 1 to 4 credits. May reenroll for a maximum of 4 credits. A E 495.
Individual or team pursuit of the design project selected in A E 495. Activities include information expansion, developing alternatives, evaluation and selection, and concluding project.

809. *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.

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*
Spring. 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*
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.

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

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

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.

201. *Technical Agricultural Mechanics Skills*
(A E 402.) Fall. 3(2-3) Major or minor in vocational agriculture or major or minor in Agribusiness and Natural Resources Education or approval of department.
Basic principles, applications, techniques, tools, materials, and resources in agricultural mechanics skills.

202. *Agricultural Metalworking*
Winter. 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.

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) 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.

324. *Processing Systems for Biological Products*
Winter. 4(4-0) MTH 109 or MTH 111, PHY 237.
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.

329. *Unit Operation and Food Processing I*
Fall. 4(3-2) PHY 237, MTH 109. Interdepartmental with Food Science.
Engineering concepts related to the unit operations found in the food industry. Fluid mechanics, heat transfer and rate processes including psychrometrics and refrigeration.

341. *Energy in the Food System*
Winter. 3(3-0) Juniors or approval of department. Interdepartmental with Agriculture and Natural Resources.
Energy flow in the food system. Conversion principles and processes—solar, engines, fertilizers, pesticides, electrical, waste heat utilization. Environmental considerations, economic and social implications related to the food system. Alternatives. Conservation.

401. *Teaching Agricultural Mechanics*
(A E 402.) Spring. 3(2-3) AET 201; AET 202 or AET 243 and AET 244; ED 327A.
Teaching techniques in agricultural mechanics for secondary and vocational schools. Shop planning and management.

415. *Agricultural and Natural Resources Safety*
Winter. 3(3-0) Juniors.
Principles of safety problem solving. Accident causation and prevention; laws and regulations; machinery, electrical, chemical, livestock, shop and fire safety; security; and safety program development.

416. *Light Structural Systems*
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*

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*

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.

436. *Microclimatology*

Winter. 3(3-0) MTH 108; GEO 351 recommended. Interdepartmental with the Department of Geography.

Physical environment in the lower few hundred meters of the atmosphere and within the biosphere.

443. *Machinery and Tractor Systems*

Fall. 4(3-2) AET 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 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.

804. *Agricultural Mechanization in Developing Countries*

Spring. 3(3-0) Approval of department.

Appropriate agricultural mechanization with emphasis on hand, animal, and mechanical equipment for the smaller farms. Machine selection, local manufacturing, public and private costs, ownership patterns; increasing production and decreasing post production losses.

806. *Analysis of Agricultural Systems*

Winter. 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. *Human Factors Engineering*

(A E 807.) 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 people and machine.

808. *Environmental Measurements*

(AET 805.) Spring. 4(3-3) Approval of department. Interdepartmental with the Department of Geography.

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.

899. *Master's Thesis Research*

Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 15 credits. Approval of department.

999. *Doctoral Dissertation Research*

Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 36 credits. 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.

215. *Architectural Drafting I*

Fall, Summer. 4(2-4)

Residential design including site plans, floor plans, foundation plans, elevations, sections and details.

216. *Architectural Drafting II*

Winter, Summer. 4(2-4) B C 215.

Light commercial design including site plans, floor plans, foundation plans, elevations, sections and details, barrier free accessibility.

239. *Housing Conservation*

(AET 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.

312. *Structural Design*

Winter. 4(5-0) PHY 237.

Consideration of structural design systems as used in light construction.

412. *Housing Utilities Design*

Winter. 4(4-0) PHY 238, EGR 463 or approval of department.

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

413. *Residential Construction Systems*

Spring. 4(3-2) PHY 239, B C 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) PHY 239, B C 312 or approval of department.

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

416. *Building Costs*

Fall. 4(2-4) EGR 364 or approval of department.

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

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 low to moderate income housing.

418. *Special Problems*

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 11 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.

835. *Research in Building Construction*

Fall, Winter, Spring, Summer. 1 to 16 credits. May reenroll for a maximum of 16 credits. Approval of department.

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 land acquisition and development, design, construction, management, finance, marketing, and structural analysis.

899. *Master's Thesis Research*

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

AGRICULTURAL ENGINEERING TECHNOLOGY

See Agricultural Engineering.

AGRICULTURE AND NATURAL RESOURCES ANR

College of Agriculture and Natural Resources

220. *Plants and Their Environment*

(N R 220.) Winter. 3(3-0) Interdepartmental with and administered by the Department of Forestry.

Relationships between plants and fundamental climatic, edaphic, and biotic factors; structure and function of different ecosystems in relation to environmental factors.

275. *Exploring International Agriculture*

(AG 275.) Spring. 3(3-0)

Exploration of overseas assignments with international agencies; potential world food actualities and potentialities; special problems of the tropics compared with those in temperate regions.

280. *Selected Topics*

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 6 credits if different topics are taken. Approval of department.