

## Agricultural Economics—AEC

**885 Leadership in Natural Resources and Environmental Management**  
Fall. 3(3-0) Interdepartmental with Fisheries and Wildlife; Forestry; Park, Recreation and Tourism Resources. Administered by Department of Fisheries and Wildlife.

Theory and practice of leadership in natural resource and environmental management. Integration across disciplinary and jurisdictional divisions.

**890 Independent Study**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to graduate students in Agricultural Economics. Approval of department.

Independent study of selected topics in agricultural economics.

**891 Topics in Agricultural Economics**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course.

Selected topics in analytical methods, agri-food systems economics and management, and agricultural and natural resource development and policy.

**898 Master's Research**  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to master's students in the Agricultural Economics major. Approval of department.

Master's degree Plan B research.

**899 Master's Thesis Research**  
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to master's students in the Agricultural Economics major. Approval of department.

Master's thesis research.

**923 Advanced Environmental and Resource Economics**  
Fall. 3(3-0) Interdepartmental with Economics; Forestry; Park, Recreation and Tourism Resources; Resource Development. RB: (AEC 829 and EC 812A)

Advanced economic theory of environmental management and policy. Treatment of externalities and market and non-market approaches to environmental improvement. Topics in conservation and sustainable economic growth. Applications to research and policy.

**925 Advanced Natural Resource Economics**  
Spring. 3(3-0) Interdepartmental with Forestry; Resource Development; Park, Recreation and Tourism Resources; Economics. RB: (EC 812A and AEC 829 and FOR 866) SA: AEC 991H

Economic theory of managing nonrenewable and renewable resources, including optimal use, the incentives for use under decentralized markets, and public policy design. Analysis of the co-evolution of economic and ecological systems.

**930 Dynamic Analysis in Agriculture and Natural Resources**  
Spring. 3(3-0) RB: (EC 801 and EC 812A) R: Open only to Ph.D. students in the College of Agriculture and Natural Resources or College of Business or College of Social Science or approval of department. SA: AEC 991E

Methods of dynamic optimization and their application to agricultural and natural resources problems. Discrete time dynamic programming, calculus of variations, and discrete time maximum principle.

**932 Information Economics and Institutions in Agriculture and Natural Resources**  
Fall. 3(3-0) RB: (AEC 800 or AEC 810 or AEC 841) and (EC 812A and EC 812B) R: Open only to Ph.D. students in the Colleges of Agriculture and Natural Resources or Business or Social Science.

Applications to issues in agriculture, agribusiness, the food system, natural resources, and the environment. Asymmetric information, incomplete markets, principal/agent issues, transaction costs, and the design of contracts and other institutions.

**977 Professional Practice in Agricultural Economics**  
Spring. 3(3-0) R: Open only to Ph.D. students in the Department of Agricultural Economics or Department of Economics. SA: AEC 947

Matching appropriate tools to applied problems in agricultural and resource economics. Individual and team preparation, under tight deadlines, of professional analyses and oral presentations for diverse audiences. Use of peer review.

**978 Research Methodologies in Agricultural and Resource Economics**  
Spring. 3(3-0) R: Open only to Ph.D. students in the College of Agriculture and Natural Resources or College of Business or College of Social Science. SA: AEC 991F

Alternative research philosophies, types of knowledge, and kinds of research. Critical appraisal of facts, theories, and values in economic research. Testing and communication of research results. Development of a research proposal.

**991 Advanced Topics in Agricultural Economics**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to Ph.D. students in the colleges of Agriculture and Natural Resources, Business, and Social Science; or with department approval.

Advanced topics such as price analysis, finance, risk and modeling techniques, agri-food systems, environmental economics and management, and agricultural and natural resource development and policy.

**999 Doctoral Dissertation Research**  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Agricultural Economics. Approval of department.

Doctoral dissertation research.

## AGRICULTURAL AT TECHNOLOGY

### Institute of Agricultural Technology College of Agriculture and Natural Resources

**290 Independent Study in Agricultural Technology**  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to freshmen or sophomores in the Institute of Agricultural Technology.

Supervised individual study on experimental, theoretical or applied topics related to agricultural science and technology.

**291 Selected Topics in Agricultural Technology**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to freshmen or sophomores in the Institute of Agricultural Technology.

Selected topics of current interest in agricultural science and technology.

**293 Professional Internship in Agricultural Technology**  
Fall, Spring, Summer. 3 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to freshmen or sophomores in the Institute of Agricultural Technology.

Supervised professional experience in agencies, business and industry related to a student's major field of study.

## AGRICULTURAL ATM TECHNOLOGY AND SYSTEMS MANAGEMENT

### Department of Biosystems and Agricultural Engineering College of Agriculture and Natural Resources

**150 Metal Fabrication Technology**  
Fall. 2(1-2)  
Physical principles and safety techniques for electric and gas welding. Soldering, brazing, cutting, tool use, machine shop equipment use, and hot and cold metalworking.

**195 National Electrical Code Review**  
Fall. 3(3-0) RB: (AE 094 or BCM 230) SA: AE 095  
Electrical installation problems. Principles of and compliance with the National Electrical Code.

**240 Machine Systems and Management**  
Spring. 3(2-2) P: (CSE 101 or CSE 131 or AT 090)  
Principles, analysis, performance, operation, and management of agricultural machines.

**252 Gasoline and Diesel Engine Technology**  
 Fall. 3(2-2) SA: AE 052  
 Operating principles of gasoline and diesel engines and their systems. Operation and maintenance requirements.

**254 Fluid Power Technology**  
 Spring. 2(2-2) R: Open only to students in Agriculture and Natural Resources. SA: AE 054

Fluid power in mobile equipment. Operation and characteristics of system components and circuits. Component disassembly. System testing and diagnosis. Offered first ten weeks of semester.

**261 Principles of Animal Environments**  
 Spring. 2(1-2) Interdepartmental with Animal Science. SA: AE 061, ATM 326

Animal environment requirements. Heat and moisture production rates. Psychrometrics of air and building materials. Heat loss and ventilation systems. Offered first ten weeks of semester.

**431 Irrigation, Drainage and Erosion Control Systems**  
 Fall. 3(2-2) RB: (MTH 116 and CSS 210) R: Not open to freshmen or sophomores.

Principles of soil and water conservation engineering including: land and soil surveying, basic hydraulics, hydrology, soil moisture, and soil and water conservation practices with applications to irrigation, drainage and erosion control systems.

**490 Independent Study**  
 Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. RB: (ATM 240 or BCM 311) R: Open only to majors in Agricultural Technology and Systems Management. Approval of department; application required.

Supervised individual student research and study in agricultural technology and systems management.

**890 Special Problems**  
 Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.

Individual study of selected topics.

**899 Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to master's students in Agricultural Technology and Systems Management.

Masters thesis research.

**999 Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Agricultural Technology and Systems Management.

Doctoral dissertation research.

## AGRICULTURE AND NATURAL RESOURCES

## ANR

### College of Agriculture and Natural Resources

**101 Preview of Science**  
 Fall. 1 credit. Interdepartmental with Natural Science; Engineering; Social Science. Administered by College of Natural Science. R: Approval of college.

Overview of natural sciences. Transitional problems. Communications and computer skills. Problem-solving skills. Diversity and ethics problems in science. Science and society.

**101A Academic and Career Decision Making**  
 Fall, Spring. 2(2-0)  
 Exploration of the career possibilities in agriculture, natural resources and related areas.

**110 New Student Seminar: Issues and Ideas in Agriculture and Natural Resources**  
 Fall. 1(0-2) R: Open only to freshmen or sophomores or juniors in the College of Agriculture and Natural Resources  
 Issues in agriculture and natural resources. Personal and professional development through discussion and interactive experiences.

**192 Environmental Issues Seminar**  
 Fall, Spring. 1 credit. A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Natural Science; Engineering; Social Science; Communication Arts and Sciences. Administered by College of Natural Science. R: Open only to students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science or College of Communication Arts and Sciences or College of Social Science. Approval of college.

Environmental issues and problems explored from a variety of perspectives, including legal, scientific, historical, political, socio-economic, and technical points of view.

**202 Michigan's Agricultural and Natural Resources Heritage**  
 Fall. 2(2-0) Interdepartmental with ANR Education and Communication Systems. P: Completion of Tier I writing requirement.

Michigan's historical agricultural and natural resources. Orientation to sources for research and learning. Self-directed study integrating agricultural and natural resources heritage to family, community and careers.

**210 Pathways in Connected Learning**  
 Fall, Spring. 3(2-2) R: Approval of college.  
 Active, self-directed, and reflective learning associated with agriculture and natural resource issues, self and social development, and ethical choice making. Development of a learning plan and design of a learning portfolio. Individual and group presentations.

**292 Applications in Environmental Studies**  
 Fall. 2(1-2) Interdepartmental with Natural Science; Engineering; Communication Arts and Sciences; Social Science. Administered by College of Natural Science. P: (NSC 192) R: Open only to students in the Specialization in Environmental Studies.

Community engagement project. Projects vary depending on student's major and area of environmental interest.

**310 Connected Learning Seminar I**  
 Fall, Spring, Summer. 3(3-0) P: (ANR 210)  
 Learner-directed critical analysis of contemporary issues in agriculture and natural resources. Communication of outcomes to professional communities. Collaborative learning integrated with individual experiences.

**311 Connected Learning Seminar II**  
 Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. P: (ANR 310)  
 Advanced analysis and presentation of contemporary issues in agriculture and natural resources.

**392 Agriculture and Natural Resources Seminar**  
 Spring. 1(2-0) R: Not open to freshmen or sophomores.  
 Current agricultural, natural resources and environmental problems and solutions. Discussion leaders from various disciplines.

**410 Connected Learning Transitions**  
 Fall, Spring. 3(3-0) P: (ANR 310)  
 Synthesis and analysis of structured experiences in agriculture and natural resources. Personal and interpersonal development, personal and professional integrity, communication competence, and critical and reflective thinking.

**475 International Studies in Agriculture and Natural Resources**  
 Fall, Spring, Summer. 2 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of college; application required.

Study-travel experience. Contemporary problems affecting agriculture and natural resources in world, national and local communities. Case studies and interviews with officials, community leaders and leading professionals.

**490 Independent Study in Agriculture and Natural Resources**  
 Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to sophomores or juniors or seniors or graduate students in the College of Agriculture and Natural Resources.

Supervised individual study in topics related to agriculture and natural resources.

**491 Selected Topics**  
 Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Not open to freshmen or sophomores.  
 Special topics in agriculture and natural resources.