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. 3(3-0) 290.
   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.

438. Internal Combustion Engines
   Fall, Spring. 3(2-2) 290.
   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) 290.
   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.

482. 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 fibers 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)
   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. 3(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)
   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.

805. Environmental Measurements
   Fall. 4(3-2)
   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 micrometeorics 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.

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, forage, 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(3-2) 493, 494.
   Analysis of agricultural machine components and systems. Emphasis on hydraulic power transmission, controls, and management of machinery systems.

999. 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 5 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 — Descriptions

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 potentials; 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 5 credits. Approval of department. Interdepartmental with Natural Resources.

401. Agriculture and Natural Resources Communications
   Winter, Spring. 3(3-2) JRN 503 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.
AMERICAN STUDIES

College of Arts and Letters

301. Issues in American Civilization
Fall, Winter, Spring. 3(3-0) 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.

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.

488. The Impact of Animal Resource Use in the Tropics and Subtropics in Relation to Their Origin, Morphology, Taxonomy, and Management
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.

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.

471. Environmental Topics in Nonmetropolitan Regions
Fall. 4(4-0) Nomination of students by own department and approval 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, non-agricultural uses, rural urban balance, discussion topics and case studies.

492. 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.

AMERICAN THOUGHT AND LANGUAGE

ATL University College

Students may earn credit in only one of the courses in each of the following three groups:
1. 121, 131, 141, 131I, 161, 171, 181, 191H
2. 122, 132, 142, 132I, 162, 172, 182, 192H
3. 123, 133, 143, 133I, 163, 173, 183, 193H

101A. Comprehensive English
Fall, Winter, Spring. 3 credits. May re-enroll for a maximum of 6 credits. 410, seniors 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.

101B. Comprehensive English
Summer. 2(2-0) No student may earn credit in both 101A and 101B. Admission by examination or approval of department.
Instruction and practice in reading and writing. Emphasis upon mastery of fundamental skills needed for a variety of reading and writing assignments.

102. Comprehensive English
Fall, Winter, Spring. 3(3-1) Continuation of 101 with emphasis on writing and reading.

103. Comprehensive English
Fall, Winter, Spring. 3(3-1) Continuation of 102 with emphasis on writing and reading.

117. Use of Libraries
Fall. 1(1-0) The use of libraries, with emphasis on M.S.U. Library. Course will stress knowledge and use of bibliographic and reference resources.

121. American Expression
Fall, Winter, Spring, Summer. 3(3-0) Satisfactory grade on English proficiency examination or in Comprehensive English.
Aims to improve the student's ability to read and write, and to acquaint him with his American heritage. Selected readings and theme topics.

122. American Expression
Fall, Winter, Spring, Summer. 3(3-0) Three credits in the second term of any ATL sequence numbered 121 or above; or satisfactory performance in Comprehensive English.
Aims to improve the student's ability to read and write, and to acquaint him with his American heritage. Selected readings and theme topics.

131. Major Documents in American Experience
Fall, Winter, Spring, Summer. 3(3-0) Satisfactory grade on English proficiency examination or in Comprehensive English.
Aims to acquaint the student with significant works, and to improve his abilities at reading and writing. Selected readings and theme topics.

132. Major Documents in American Experience
Fall, Winter, Spring, Summer. 3(3-0) Three credits in the second term of any ATL sequence numbered 121 or above; or satisfactory performance in Comprehensive English.
Aims to improve the student's ability to read and write, and to acquaint him with his American heritage. Selected readings and theme topics.

141. American Humanities
Fall, Winter, Spring, Summer. 3(3-0) Satisfactory grade on English proficiency examination or in Comprehensive English.
Aims to acquaint the student with his American heritage with emphasis on artistic and literary expression; and to improve his ability to read, write, and understand.

142. American Humanities
Fall, Winter, Spring, Summer. 3(3-0) Three credits in the first term of any ATL sequence numbered 121 or above; or satisfactory performance in Comprehensive English.
Aims to acquaint the student with his American heritage with emphasis on artistic and literary expression; and to improve his ability to read, write, and understand.