

817. Electronics in Agricultural Engineering
Spring. 3(2-3) E E 345 or PHY 419.
Electronic and control circuits for agricultural industry and research. Analysis and development of measurement and control systems.

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.

991. Soil Dynamics
Winter. 3(2-3) Approval of department.
Dynamic soil strength. Soil stress and strain analysis of traction and tillage devices. Experimental techniques for traction and tillage studies.

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

AGRICULTURE AG
College of Agriculture and Natural Resources

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. World Agriculture and Economic Development
Fall. Summer of even-numbered years. 3(3-0) AEC 240 or EC 201. Interdepartmental with and administered by the Agricultural Economics Department.
Food and agricultural problems of the world. Role of agriculture in the process of economic development. Relationships of agricultural trade patterns, farming systems and economic growth.

802. Agriculture Administration
Winter. 3(3-0) AEC 462 or approval of department.
Administrative relationships and principles involved in agricultural development in the world's emerging countries. Case studies used to illustrate the process of change in institutions that serve agricultural economies in transition.

803. Approaches to Accelerated Development
Spring. 3(3-0) 802 or approval of department.
Examination of trained manpower needs and project priorities in agricultural and natural resource sectors. Alternative methods for organizing research and development. Case studies of national planning.

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. ATL 113. 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.

411. Problems in American Civilization
Winter, Spring. 3 credits. Majors must re-enroll for a maximum of 6 credits. 410, Juniors in American Studies or approval of American Studies Committee.
Seminar approach to selected problems in American life employing the objectives and approaches of interdisciplinary studies. Offered by members of relevant departments, for majors in the American Studies program.

AMERICAN THOUGHT AND LANGUAGE ATL
University College

Alternative approaches or tracks are offered on an optional basis all of which meet the course objectives of 111, 112, 113. These are described briefly below and are designated by letters which are used as part of the course number for registration. No student may receive credit for more than one track within a course (111, 112, 113).

100. Comprehensive English
(I S 095.) Fall, Winter, Spring, Summer. 3(4-0) 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.

111. American Thought and Language
Fall, Winter, Spring, Summer. 3(3-0) Satisfactory grade on English proficiency examination or ATL 100.

A. Aims to improve the student's ability to read and write and to acquaint him with his American heritage. Reading is in selected historical, social, and literary documents.
H. Adaptation of the regular program for honors students.

112. American Thought and Language
Fall, Winter, Spring, Summer. 3(3-0) Three credits in a 111 track.
A. Aims to improve the student's ability to read and write and to acquaint him with

his American heritage. Reading is in selected historical, social, and literary documents.
B. Whole books approach to regular program.
C. Emphasizes American humanities approach to regular program.
H. Adaptation of regular program for honors students.

113. American Thought and Language
Fall, Winter, Spring, Summer. 3(3-0) Three credits in a 112 track.

A. Aims to improve the student's ability to read and write and to acquaint him with his American heritage. Reading is in selected historical, social, and literary documents.
B. Whole books approach to the regular program.
C. American humanities approach to the regular program.
H. Adaptation of regular program for honors students.

300. Supervised Individual Study
Fall, Winter, Spring. 1 to 4 credits. 113; approval of department.

Selected students requesting individual study of interdisciplinary problems will work under supervision of University College professors. Variable elective credit will be determined when the student secures instructor, adviser, and department approval.

ANATOMY ANT
**College of Human Medicine
College of Veterinary Medicine**

316. General Anatomy
Fall, Spring. 5(5-0) N S 193.
Designed to impart the basic concepts of the broad field of anatomy. Special requirements of the various disciplines will be met in their respective laboratories.

401. Undergraduate Seminar
Fall, Winter, Spring. 1 credit.

413. Problems in Anatomy
Fall, Winter, Spring, Summer. 1 to 2 credits. May re-enroll for a maximum of 6 credits. Approval of department.

Additional study in one or more of the various fields of anatomy such as gross anatomy, histology, hematology and embryology.

420. Microscopic Anatomy and Embryology
(305A.) Fall. 5(2-8) Medical Technology students or approval of department.

Course 420 devoted to microscopic structure of cells and tissues and beginning embryology; 421 to structure of organs and systems and completion of embryology.

421. Microscopic Anatomy and Embryology
(305B.) Winter. 5(2-8) 420.
Continuation of 420.

521. Gross and Microscopic Anatomy
Fall, Spring. 9(4-14) First-term Veterinary Medicine students; approval of department for graduate students.

Gross anatomy of a representative animal, the dog, is studied. Cytology, embryology, comparative histology, neuroanatomy and organology are combined with dissection, demonstration and practical applications to give complete coverage.

522. Gross and Microscopic Anatomy
Winter, Summer. 9(5-11) 521.
Continuation of 521.

523. Anatomy of Areas of Surgical and Clinical Importance in Domestic Animals

Winter, Summer. 8(3-14) Sixth-term Veterinary Medicine students.

Lectures, dissection of fresh material and the study of prosections, models, radiographs and reprints related to areas of surgical and clinical importance in domestic animals.

540. Gross Biomedical Structure

Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 15 credits.

Human Medicine students; approval of department for graduate students.

Human structure, systemic and regional, is studied in self-instructional and dissection sequences. Application of this knowledge to recognition of normal and abnormal structure in appropriate medical contexts is accomplished through self-instructional and clinical sessions.

543. Microscopic Anatomy

Fall. 5(3-6) Human Medicine students; approval of department for graduate students.

The normal structure of cells, tissues and organs as they appear under the light and electron microscope.

801. Seminar

Fall, Winter, Spring. 1(1-0) Approval of department.

813. Problems in Anatomy

Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. Basic disciplines in various areas and approval of department.

Various anatomical fields such as gross anatomy, histology, hematology, tissue culture, cytology, neurology and embryology will be studied.

815. Anatomy of the Nervous System

(415.) Fall. 5(3-5) Approval of department.

Developmental, gross and microscopic anatomy of the nervous system. Organizational and functional aspects of the peripheral and central nervous system are stressed. Gross demonstrations include brain and dog dissections.

899. Research

Fall, Winter, Spring, Summer. Variable credit. Majors.

901. Seminar

Fall, Winter, Spring. 1(1-0) Approval of department.

902. Comparative Histology

Fall of even-numbered years. 5 credits. Approval of department.

Comparative histology of digestive, respiratory, urinary, and integumentary systems of domestic and laboratory animals.

903. Comparative Histology

Winter of odd-numbered years. 5 credits. 902 or approval of department.

Continuation of 902 to include the muscular, skeletal, circulatory, male and female reproductive systems, placentation, and endocrine organs.

999. Research

Fall, Winter, Spring, Summer. Variable credit. Majors.

ANIMAL HUSBANDRY A H

College of Agriculture and Natural Resources

111. Livestock and Meat Industry

Fall, Spring. 4(3-4)

Adaptation, distribution and numbers of livestock throughout the world; significance and

economic importance. Trends in livestock production. Evaluating, grading, classifying and marketing of livestock and meat. Relationship of live animal conformation to carcass merit.

241. Meat Production

(141.) Winter. 4(2-6) 111.

Principles of meat evaluation and selection. Carcass certification programs. Influence of production factors on carcass desirability. Practice in slaughtering, cutting and meat processing.

242. Meats, Poultry and Fishery Products I

Fall. 3(2-2) Interdepartmental with and administered by the Food Science Department.

Principles of evaluation and nutritive value. Identification of grades and cuts of beef, pork, lamb and poultry products.

245. Meat Evaluation and Grading

Fall, Spring. 1 to 3 credits. May re-enroll for a maximum of 6 credits. 241.

Evaluation of carcasses and wholesale cuts of beef, pork, veal and lamb in accordance with federal and commercial grading standards. Inspection trips through large meat packing plants.

335. Livestock Selection

Fall, Winter, Spring. 1 to 3 credits. May re-enroll for a maximum of 8 credits. 111.

Evaluation of productive merit of individual animals. Comparison of type with a standard. Relationship of form to function. Field trips to prominent livestock breeding establishments and to major livestock events.

415. Special Problems

Fall, Winter, Spring. 1 to 3 credits. May re-enroll for a maximum of 5 credits. Seniors and approval of department.

Special studies in fields not covered by other animal husbandry courses.

451. Swine Production

Spring. 4(3-3) ANS 325 or approval of department.

Historical aspects with emphasis on current trends. Breeds, breeding, selection, nutrition requirements, management practices, marketing, housing and environmental needs, disease and parasite problems. Visits to representative farms.

452. Sheep Production

Winter of even-numbered years. 4(3-3) ANS 325 or approval of department.

History, modern breeds, breeding, selection, nutrition and feeding, management, marketing, housing, diseases and parasites, wool. Visits to farm flocks. Practice in management skills.

453. Beef Production

Spring. 4(3-3) ANS 325 or approval of department.

History, breeds, breeding, selection, nutrition and feeding, commercial systems of production, diseases and parasites. Visits to purebred herds and to feed lots. Practice in management skills.

454. Horse Production

Fall of even-numbered years. 3(2-2) ANS 325 or approval of department.

Selection, breeding, feeding, management, marketing, diseases and parasites. Relationship of body structure to performance.

462. Meat Animal Breeding

Spring. 3(2-2) ANS 461.

Uses and effects of different breeding systems with beef cattle, sheep, and swine. Formulating breeding plans.

825. Techniques in Nutrition Research

Winter of odd-numbered years. 1 to 3 credits. CEM 333; approval of department. Interdepartmental with the Foods and Nutrition Department.

Use of specialized instruments and techniques. Laboratory safety. Management of laboratory

animals. Development of abilities in areas of particular interest to individual students.

890. Advanced Special Problems

Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 8 credits. Approval of department.

Investigation of animal husbandry areas of special interest to individual graduate students.

899. Research

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

912. Seminar

Fall, Winter, Spring. 1 credit.

927. Comparative Nutrition I

Winter. 2 or 4 credits. BCH 402; PSL 502 or concurrently. Interdepartmental with and administered by the Foods and Nutrition Department.

Mammalian nutrition based on biochemical and physiological phenomena. Proteins are studied in the first half of the term; carbohydrates, fats and macro-minerals in the last half.

928. Comparative Nutrition II

Spring. 2 or 4 credits. BCH 402, PSL 502. Interdepartmental with the Foods and Nutrition Department.

Mammalian nutrition based on biochemical and physiological phenomena. Micro-minerals are studied in the first half of the term; vitamins in the last half.

963. Genetics of Breed Improvement

Winter. 3(3-0) ANS 461, STT 421.

Breed improvement. Changing gene frequency. Genetic and environmental subdivision of phenotypic variance.

964. Breeding Systems and Plans

Spring. 3(3-0) 963.

Biometric relations between related animals. Role of selection in changing populations. The effects of different mating systems.

999. Research

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

ANIMAL SCIENCE ANS

College of Agriculture and Natural Resources

101. Animal Science

Fall. 5(4-2)

Survey of the animal industries including history, economic geography, anatomy and physiology, nutrition and feed usage, and systems of commercial livestock and poultry production.

213. Animal Science Seminar

Fall. 1(2-0)

Animal science industries. Industry representatives will be utilized to discuss particular areas.

325. Applied Animal Nutrition

Spring. 5(4-2) CEM 132; BCH 200 recommended.

Livestock feeds and their nutrients. Functions of and requirements for nutrients. Evaluation of feeds. Feeding practices. Formulation of rations for beef and dairy cattle, horses, poultry, sheep and swine.

461. Principles of Animal Breeding

Winter. 3(3-0) CSC 250.

Use and importance of selection, inbreeding and outbreeding in controlling inheritance.