

**150 Writing: The Evolution of American Thought**  
Fall, Spring. 4(4-0) P:M: (ATL 1004) or designated score on English placement test. Not open to students with credit in MC 111 or MC 112 or LBS 133 or AL 192 or AL 192H or ATL 110 or ATL 115 or ATL 120 or ATL 125 or ATL 130 or ATL 135 or ATL 140 or ATL 145 or ATL 195H.

Drafting, revising, and editing compositions derived from American historical, social, and cultural texts to develop skills in narration, persuasion, analysis, and documentation.

**195H Writing: Major Topics in American Thought**  
Fall, Spring. 4(4-0) RB: Designated score on English placement test. Not open to students with credit in MC 111 or MC 112 or LBS 133 or AL 192 or AL 192H or ATL 110 or ATL 115 or ATL 120 or ATL 125 or ATL 130 or ATL 135 or ATL 140 or ATL 145 or ATL 150.

Drafting, revising, and editing compositions derived from readings on major topics in American thought to develop advanced skills in narration, persuasion, analysis, and documentation.

**290 Independent Study**  
Fall, Spring, Summer. 1 to 4 credits. R: Open only to freshmen or sophomores. Approval of department.

Special projects arranged by an individual student and a faculty member in areas supplementing regular course offerings.

**401 Quantitative Human Biology**  
Spring. 3(4-0) Interdepartmental with Bio-medical Engineering; Materials Science and Engineering; Radiology. Administered by College of Engineering. P:M: (MTH 235 and PHY 184) and (PSL 250 or concurrently or PSL 431 or concurrently) and (CEM 141 or CEM 151) and (ANTR 350 or concurrently) RB: (CSE 131 or concurrently or CSE 231 or concurrently or PSL 410)

Qualitative description and quantitative engineering analysis of selected, tractable human-biological systems. Multi-disciplinary problem-solving among medical and engineering professionals.

**480 Special Problems in Anatomy**  
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 15 credits in all enrollments for this course. R: Approval of department. SA: ANT 480

Topics from an anatomical field such as gross anatomy, histology, tissue culture, cytology, neurology, or embryology.

**485 Directed Study in Human Prosection**  
Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 15 credits in all enrollments for this course. P:M: (ANTR 350 or ZOL 328 or KIN 217) R: Open only to juniors or seniors.

Prosection of selected regions and isolated structures of preserved human cadavers.

**200A Introductory Judging of Livestock or Carcasses**  
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. RB: (ANS 211) R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.

Evaluation of functional conformation of beef cattle, sheep and swine and their carcasses. Preparation for intercollegiate competition. Field trips required.

**200C Introductory Judging of Dairy Cattle**  
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.

Evaluation of functional conformation of dairy cattle. Preparation for intercollegiate competition. Field trips required.

**200D Introductory Judging of Horses**  
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D. SA: ANS 200B

Evaluation of functional conformation and performance of horses. Preparation for intercollegiate competition. Field trips required.

**210 Animal Products**  
Fall. 4(3-3) R: Not open to freshmen. Edible animal products. Processing, preservation, storage and distribution of dairy, meat, and egg products.

**211 Animal and Product Evaluation**  
Fall. 3(1-4)  
Evaluation of breeding stock, market animals and carcasses. Production records and soundness of breeding animals. Quality grading, yield grading and pricing of market animals and carcasses.

**212 Merchandising Purebred Livestock**  
Spring of odd years. 2(1-2) RB: (ANS 110)  
Purebred livestock industry. Private treaty and auction sales. Advertising, animal selection and budgeting of purebred livestock sales. Field trips required.

**222 Introductory Beef Cattle Management**  
Spring. 3(2-2) RB: (ANS 110) Not open to students with credit in ANS 422.  
Management practices and systems for beef herds. Feed requirements, reproduction, breeding, performance testing, housing, and diseases. Costs and returns. Field trips required.

**232 Introductory Dairy Cattle Management**  
Fall. 3(2-2) Not open to students with credit in ANS 432.  
Principles and techniques of dairy herd management including calf and heifer care plus lactating and dry cow management.

**242 Introductory Horse Management**  
Fall. 3(2-2) Not open to students with credit in ANS 442.  
Principles of horse management. Reproduction, nutrition, herd health, genetics, economics, marketing. Field trips required.

## ANIMAL SCIENCE      ANS

### Department of Animal Science College of Agriculture and Natural Resources

**110 Introductory Animal Agriculture**  
Fall, Spring. 4(3-2) SA: ANS 112  
History of animal agriculture and its relationship to human needs, production systems, marketing, and environmental considerations. Current goals and limitations affecting U.S. farm animal production.

**140 Fundamentals of Horsemanship**  
Spring. 2(0-4) A student may earn a maximum of 4 credits in all enrollments for this course.  
Safe horse handling skills. Riding skills. Riding aids and working with the horse at the beginner, intermediate or advanced level.

**141 Draft Horse Basics**  
Fall, Spring. 2(0-4)  
Safe handling, hitching and driving of draft horses. Care and maintenance of harness and horse drawn equipment.

**142 Horse Training for Competition**  
Summer. 2(0-4) RB: (ANS 140) R: Approval of department.  
Training techniques to prepare horses for competition. Exhibiting horses. Field trips required.

## HUMAN      ANTR ANATOMY

### Department of Anatomy College of Human Medicine

**350 Human Gross Anatomy and Structural Biology**  
Fall, Spring. 3(4-0) P:M: (BS 111 or LBS 149H or LBS 145) R: Not open to freshmen or approval of department. SA: ANT 316, ANTR 316

Survey of human systemic gross anatomy with clinical illustrations. Introduction to the language of medicine. Structural basis of physiological principles. Designed for pre-professional students entering health-care disciplines.

**381 Human Gross Anatomy Laboratory**  
Spring, Summer. 2(0-6) P:M: (ANTR 350) R: Approval of department. Not open to students with credit in KIN 217 or ZOL 328.  
Structured survey of human regional gross anatomy using prosections, cross-sections, medical imaging, multimedia, and hypermedia.

## Animal Science—ANS

- 252 Introduction to Management of Avian Species**  
Fall of odd years. 3(2-2)  
Management of commercial poultry flocks and aviaries. Feed requirements, reproduction, breeding, housing and disease.
- 261 Principles of Animal Environments**  
Spring. 2(1-2) Interdepartmental with Agricultural Technology and Systems Management. 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.
- 262 Introductory Sheep Management**  
Spring. 3(2-2) R: Open only to sophomores or juniors or seniors.  
Principles of sheep management: genetics, reproduction, nutrition, marketing, and economics. Field trips required.
- 272 Introductory Swine Management**  
Fall. 3(2-2) Not open to students with credit in ANS 472.  
Swine production principles, practices, technologies, and systems. Field trips required.
- 275 Seafood Systems Management**  
Spring. 3(3-0) Interdepartmental with Fisheries and Wildlife; Food Science. Administered by Department of Fisheries and Wildlife.  
Domestic and international perspectives on major aquatic foods. Cultural and nutritional value; wild harvest; aquaculture; processing technology; food handling and food safety.
- 300A Advanced Livestock Judging**  
Fall of even years. 2 credits. RB: (ANS 200A) R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.  
Evaluation of conformation and performance records of beef cattle, swine and sheep. Represent MSU in intercollegiate competition. Field trips required.
- 300B Advanced Meat Evaluation and Grading**  
Fall. 2(0-4) RB: (ANS 200A) R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.  
Evaluation of beef, pork, and lamb carcasses and wholesale cuts according to industry standards. Federal grading standards. Field trips to meat packing operations required. Represent MSU in intercollegiate competition.
- 300C Advanced Dairy Cattle Judging**  
Fall. 2 credits. RB: (ANS 200C) R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.  
Evaluation of conformation of various breeds of dairy cattle. Represent MSU in intercollegiate competition. Field trips required.
- 300D Advanced Horse Judging**  
Fall. 2 credits. RB: (ANS 200D) R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 200C, ANS 200D, ANS 300A, ANS 300B, ANS 300C and ANS 300D.  
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.
- 305 Applied Animal Behavior**  
Spring. 3(2-2) P:M: (BS 111)  
Techniques for assessing health and welfare of domestic animals based on their behavior.
- 313 Principles of Animal Feeding and Nutrition**  
Fall. 4(3-2) P:M: (BS 111) and (CEM 143 or concurrently or CEM 251 or concurrently) and completion of Tier I writing requirement.  
Principles and practices of nutrition for cattle, horses, poultry, sheep and swine. Metabolism of protein, minerals, and vitamins. Diet formulation. Performance prediction. Nutritional maladies. Field trip required.
- 314 Genetic Improvement of Domestic Animals**  
Fall. 4(3-2) P:M: (BS 111) and (MTH 110 or concurrently or MTH 116 or concurrently) and completion of Tier I writing requirement.  
Molecular, Mendelian, population, and quantitative genetics of domestic animals.
- 315 Anatomy and Physiology of Farm Animals**  
Spring. 4(3-2) P:M: (BS 111) and completion of Tier I writing requirement.  
Gross and microanatomy of farm animals. Structure directed function of tissues. Endocrine integration for homeostasis. Regulation of growth, lactation, and reproduction. Homeorhesis.
- 320 Muscle Foods**  
Spring. 3(2-3) Interdepartmental with Food Science. P:M: (ANS 210 or FSC 211 or HNF 150)  
Structure of muscle. Meat technology and merchandising concepts.
- 401 Issues in Animal Agriculture**  
Spring. 1(2-0) RB: (ANS 313 or ANS 314 or ANS 315) R: Open only to juniors or seniors.  
Societal issues related to local, national and international animal agriculture.
- 404 Advanced Genetics of Farm Animals**  
Spring. 2(1-2) P:M: (ANS 314)  
Application of molecular genetics techniques to animal breeding. Genome maps for domestic species. Incorporation of genotype data into selection programs.
- 405 Endocrinology of Reproduction**  
Fall. 4(3-2) RB: (ANS 315) R: Not open to freshmen or sophomores.  
Endocrine regulation of reproduction. Cellular and molecular aspects of gametogenesis, folliculogenesis, sexual cycles, fertilization, sex differentiation, gestation, and parturition. Technology to regulate reproduction.
- 407 Food and Animal Toxicology**  
Fall. 3(3-0) P:M: (BMB 200 or BMB 401 or BMB 461) and (PSL 250) R: Not open to freshmen or sophomores.  
Fate and effects of chemicals in the food chain. Impact on animal production. Residues in food products. Food safety assessment. Control methods.
- 407L Toxicology Methods Laboratory**  
Fall. 2(0-4) Interdepartmental with Food Science. RB: (ANS 407 or concurrently) R: Not open to freshmen or sophomores.  
Laboratory techniques for evaluating potential toxicity of chemicals to living systems. Field trip to industrial toxicology laboratory required.
- 413 Non-Ruminant Nutrition**  
Spring. 4(3-2) RB: (ANS 313) R: Not open to freshmen or sophomores.  
Nutrition of horses, swine and poultry. Digestive and metabolic development and nutrient requirements. Relationships of genetics, endocrinology, immunology, and environment to nutrition.
- 414 Advanced Animal Breeding**  
Spring. 2(2-0) P:M: (ANS 314) R: Not open to freshmen or sophomores.  
Application of selection principles and mating systems within and among breeds of livestock. Selection index, expected progeny differences, animal models, crossbreeding systems, multiple ovulation and embryo transfer schemes, multiple trait selection, simulated populations.
- 415 Growth and Musculoskeletal Biology**  
Spring. 3(3-0) RB: (ANS 315) R: Not open to freshmen or sophomores.  
Principles of growth in mammalian and avian species. Regulation of bone, cartilage, connective tissue, fat, and muscle metabolism. Extracellular matrix proteins and their function. Introduction to musculoskeletal diseases.
- 416 Meat Science and Muscle Biology**  
Fall. 2(2-0) RB: (ANS 315) R: Not open to freshmen or sophomores.  
Structure, composition, development and function of muscle and its conversion to meat. Properties of fresh and processed meat. Microbiology, preservation, palatability, inspection and sanitation, nutritive value, and by-products.
- 417 Topics in Toxicology**  
Spring. 1(1-0) RB: (ANS 407) R: Not open to freshmen or sophomores.  
Selected topics including regulatory toxicology, risk assessment, environmental toxicology, food safety, and safe handling of toxic substances.
- 418 Comprehensive Nutrient Management Planning**  
Fall. 3(2-2) Interdepartmental with Biosystems Engineering. P:M: (CSS 210)  
Comprehensive nutrient management plans (CNMP) for animal feeding operations. Trends in animal production, environmental issues, and diet formulation and their impact on manure production. Development of CNMP for a specific animal feeding operation.
- 422 Advanced Beef Cattle Feedlot Management**  
Fall. 3(2-2) P:M: (ANS 222)  
Feedlot management systems and issues. Feed systems, manure management, health maintenance, and cattle marketing. Field trips required.

## ANR EDUCATION AND COMMUNICATION SYSTEMS

### Department of ANR Education and Communication Systems College of Agriculture and Natural Resources

**100 Public Speaking in Agriculture and Natural Resources**  
Fall, Spring, 2(2-0) R: Open only to students in the Institute of Agricultural Technology.

Public speaking skills for agriculture and natural resource professionals. Organizing and delivering effective speeches for diverse audiences.

**105 Agricultural Industries Seminar**  
Fall, 1(2-0) R: Open only to freshmen in the Institute of Agricultural Technology.  
Issues of agricultural industries. Preparation for a successful academic career.

**110 Foundations of ANR Communications: Learning and Leadership**  
Fall, 2(1-2) R: Open only to students in Agriculture and Natural Resources Communications major or Agriscience major or the Agriculture and Natural Resources - No Preference undergraduate program. SA: AEE 101

Basic information systems applied to ANR communications, learning, and leadership. Communications skills, research techniques, learning theory, technology, and personal and professional development.

**111 Applications of ANR Communications: Learning and Leadership**  
Spring, 2(1-2) RB: (AEE 110) R: Open only to students in the Agriculture and Natural Resources Communications major or Agriscience major or Agriculture and Natural Resources - No Preference undergraduate program. SA: AEE 101

Application of information systems theory, communications skills, research techniques, learning theory, and technology to agriculture and natural resource problems. Issue identification, critical thinking, problem solving, team building, and working with diversity.

**120 Current Issues in Agriculture and Natural Resources**  
Fall, 3(3-0) R: Open only to freshmen or sophomores in the Institute of Agricultural Technology. Not open to students with credit in AT 040 or AT 057 or ABM 400.

Implementation and interpretation of public law related to agricultural and environmental policy. Role of government in regulating technological and economic change related to agriculture and the environment. Non-governmental organizations.

**202 Michigan's Agricultural and Natural Resources Heritage**  
Fall, 2(2-0) Interdepartmental with Agriculture and Natural Resources. Administered by College of Agriculture and Natural Resources. P:M: 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.

**425 Principles of Animal Biotechnology**  
Fall of odd years. 3(3-0) RB: (BS 111) and (CEM 143 or concurrently and CEM 251 or concurrently)

Application of molecular biology concepts to the improvement of domestic animals. Transgenic animal production, molecular genetics and marker assisted selection.

**427 Environmental Toxicology and Society**  
Spring of odd years. 3(3-0) Interdepartmental with Environmental Engineering; Sociology. RB: (ISB 200 or ISB 202 or ISB 204 or ISB 206H or BMB 200 or BS 111 or BS 110)

Impact of environmental chemicals on health and modern society. Cellular and organ functions and their interface with the environment. Limitations of scientific investigation and environmental regulations.

**432 Advanced Dairy Cattle Management**  
Fall, 3(2-2) P:M: (ANS 232) R: Not open to freshmen or sophomores. SA: ANS 498

Management techniques for operating a dairy herd. Mastitis control, reproductive and nutrition management, records, and general herd health. Field trips required.

**442 Advanced Horse Management**  
Spring, 3(2-2) P:M: (ANS 242) RB: (ANS 313) R: Not open to freshmen or sophomores. SA: ANS 498

Management of stables and breeding farms. Pedigree and conformational selection, reproduction. Promotion, marketing, economics. Nutrition and feeding, facilities, and herd health. Field trips required.

**445 Equine Exercise Physiology**  
Fall, 4(3-2) RB: (ANS 313 and ANS 315)

Research in equine exercise science. Physical, physiologic, metabolic and mental adaptation to athletic training. Nutrition and bioenergetics of muscle metabolism. Field trip required.

**455 Avian Physiology**  
Spring, 4(3-3) RB: (ANS 315) R: Open only to juniors or seniors or graduate students.

Systemic and comparative physiology of birds: respiration, reproduction, endocrinology, digestion, urination, and the senses.

**464 Statistical Methods for Biologists I**  
Fall, 3(3-0) Interdepartmental with Statistics and Probability; Crop and Soil Sciences. Administered by Department of Statistics and Probability. RB: (STT 421)

Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression (prediction). Analyses of counted and measured data to compare several biological groups (contingency tables and analysis of variance).

**465 Statistical Methods for Biologists II**  
Spring, 3(3-0) Interdepartmental with Statistics and Probability; Crop and Soil Sciences. Administered by Department of Statistics and Probability. RB: (STT 464)

Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.

**472 Advanced Swine Management**  
Fall of even years. 3(2-2) P:M: (ANS 272) R: Not open to freshmen or sophomores. SA: ANS 498

Management techniques for operating a swine herd. Management of reproduction and nutrition, records, and general herd health. Integration of husbandry and business principles for decision making. Field trips required.

**475 Aquaculture**  
Spring, 3(3-0) Interdepartmental with Fisheries and Wildlife. Administered by Department of Fisheries and Wildlife. RB: (ANS 313 or ZOL 355)

Propagation and rearing of aquatic organisms used for food, bait and recreational fisheries management. Culture principles and techniques for important aquatic species. Commercial potential.

**480 Animal Systems in International Development**

Fall, Spring, Summer, 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. R: Not open to freshmen. Approval of department; application required.

Animal systems in various global regions. Output, land and resource conservation, and socio-economic factors.

**483 Ruminant Nutrition**  
Spring, 3(3-0) RB: (ANS 313 and ANS 315) R: Not open to freshmen or sophomores.

Physiology and metabolism in ruminants. Prehension, digestion, metabolism, absorption, and distribution of nutrients for productive functions. Feeding management strategies and diet formulation. Field trip may be required.

**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: (ANS 210) and (ANS 313 and ANS 314 and ANS 315) R: Open only to juniors or seniors. Approval of department; application required.

Independent study in genetics, nutrition, physiology, toxicology, meat science, or management of poultry, livestock, or horses.

**493 Professional Internship in Animal Science**

Fall, Spring, Summer, 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors in the Animal Science major. Approval of department; application required. A student may earn a maximum of 6 credits in all enrollments for any or all of these courses: ABM 493, AEE 493, ANR 493, ANS 493, CSS 493, EEP 493, FIM 493, FW 493, HRT 493, PKG 493, PLP 493, PRR 493, and RD 493.

Supervised professional experience in the animal industry.

**499 Senior Thesis in Animal Science**  
Fall, Spring, Summer, 3 to 9 credits. A student may earn a maximum of 9 credits in all enrollments for this course. RB: (ANS 313 and ANS 314 and ANS 315) R: Open only to seniors. Approval of department; application required. Maximum of 10 credits may be earned in ANS 499 and ANS 490.

Individual studies in an area of choice with both oral and written final communications. Topic to be determined by student and guidance committee.