

## 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 of 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.
- 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. 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. RB: ANS 211  
Evaluation of functional conformation of beef cattle, sheep and swine and their carcasses. Preparation for intercollegiate competition.
- 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. 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. SA: ANS 200B  
Evaluation of functional conformation of dairy cattle. Preparation for intercollegiate competition.
- 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. 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.
- 200E Introductory Animal Welfare Assessment**  
Fall. 1(0-2) A student may earn a maximum of 8 credits in all or any enrollments in 200A, 200C, 200D, 200E, 300A, 300B, 300C, 300D, or 300E. RB: (ANS 305 or ZOL 313) and ANS 110 R: Not open to freshmen.  
Physiological and behavioral indicators of animal welfare. Quantitative measures and ethical issues. Written and oral assessments of animal welfare.
- 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.
- 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.
- 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.
- 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 Engineering. Administered by Agricultural Engineering. SA: AE 061, ATM 261  
Animal environment requirements. Heat and moisture production rates. Psychrometrics of air and building materials. Heat loss and ventilation systems.
- 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.
- 272 Introductory Swine Management**  
Fall. 3(2-2) Not open to students with credit in ANS 472.  
Swine production principles, practices, technologies, and systems.
- 275 Seafood Systems Management**  
Spring. 3(3-0) Interdepartmental with Food Science and Fisheries and Wildlife. Administered by 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.
- 282 Companion Animal Biology and Management**  
Spring. 3(3-0)  
Principles of companion animal management. Breeds, reproduction, feeding, housing, health, and diseases.
- 300A Advanced Livestock Judging**  
Fall of even years. 2 credits. 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. RB: ANS 200A R: Not open to freshmen.  
Evaluation of conformation and performance records of beef cattle, swine and sheep. Represent MSU in intercollegiate competition.
- 300B Advanced Meat Evaluation and Grading**  
Fall. 2(0-4) 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. RB: ANS 200A R: Not open to freshmen.  
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. 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. RB: ANS 200C R: Not open to freshmen.  
Evaluation of conformation of various breeds of dairy cattle. Represent MSU in intercollegiate competition.
- 300D Advanced Horse Judging**  
Fall. 2 credits. 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. RB: ANS 200D R: Not open to freshmen.  
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition.
- 300E Animal Welfare Judging**  
Fall. 1(0-2) A student may earn a maximum of 8 credits in any or all enrollments of ANS 200A, 200C, 200D, 200E, 300A, 300B, 300C, 300D, or 300E. P: ANS 200E RB: ANS 110 and (ANS 305 or ZOL 313) R: Not open to freshmen.  
Enhanced understanding of the physiological and behavioral indicators of animal welfare. Ethical values in the assessment of welfare status. Intercollegiate competition.
- 305 Applied Animal Behavior**  
Spring. 3(2-2) P: 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: ((BS 111) and completion of Tier I writing requirement) and ((CEM 143 or concurrently) or (CEM 251 or concurrently))  
Principles and practices of nutrition for cattle, horses, poultry, sheep and swine. Metabolism of protein, minerals, and vitamins. Diet formulation. Performance prediction. Nutritional maladies.

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- 314 Genetic Improvement of Domestic Animals**  
Fall. 4(3-2) P: ((BS 111) and completion of Tier I writing requirement) and ((MTH 103 or concurrently) or (MTH 116 or concurrently) or (MTH 110 or concurrently) or (MTH 124 or concurrently) or (LBS 117 or concurrently))  
Molecular, Mendelian, population, and quantitative genetics of domestic animals.
- 315 Anatomy and Physiology of Farm Animals**  
Spring. 4(3-2) P: (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. Administered by Animal Science. P: 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 Animal Genetics**  
Spring. 2(1-2) P: (ANS 314 or concurrently) or ZOL 341  
Application of molecular genetics and genome technologies to animal breeding. Genome maps for agricultural, aquacultural, and companion animal 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: (BS 111 and CEM 143) 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.
- 413 Monogastric Animal Nutrition**  
Spring. 3(3-0) P: ANS 313 RB: BMB 200 or BMB 401 R: Not open to freshmen or sophomores.  
Digestive processes and nutrient metabolism in monogastric animals. Metabolic basis for nutrient requirements.
- 414 Advanced Animal Breeding**  
Spring. 2(2-0) P: 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. Administered by Animal Science. P: 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: ANS 222  
Feedlot management systems and issues. Feed systems, manure management, health maintenance, and cattle marketing.
- 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 and Sociology. Administered by Animal Science. 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: ANS 232 RB: ANS 313 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.
- 442 Advanced Horse Management**  
Spring. 3(2-2) P: 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.
- 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.
- 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 Statistics for Biologists**  
Fall. 3(3-0) Interdepartmental with Crop and Soil Sciences and Statistics and Probability. Administered by Statistics and Probability. RB: STT 421  
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression. Analyses of counted and measured data to compare several biological groups including contingency tables and analysis of variance.
- 472 Advanced Swine Management**  
Spring of even years. 3(2-2) P: 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.
- 475 Aquaculture**  
Spring. 3(3-0) Interdepartmental with Fisheries and Wildlife. Administered by 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. 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, CMP 493, CSS 493, EEP 493, FIM 493, FSC 493, FW 493, HRT 493, PKG 493, PLP 493, PRR 493, and ESA 493. R: Open to juniors or seniors in the Animal Science major. Approval of department; application required.  
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.
- 511 Animal Science for Veterinarians**  
Fall. 2(2-0) R: Open only to graduate-professional students in the College of Veterinary Medicine.  
Husbandry of domestic, laboratory, and zoo animals. Managerial systems in animal agriculture. Production and management goals.
- 513 Animal Nutrition for Veterinarians**  
Spring. 2(2-0) R: Open only to graduate-professional students in the College of Veterinary Medicine.  
Nutrition for domestic animals and wildlife. Comparative nutrient digestion and metabolism. Nutritive requirements for maintenance, growth, reproduction, lactation, and work.
- 805 Animal Welfare Assessment**  
Fall, Spring. 3(3-0) Interdepartmental with Zoology. Administered by Animal Science. RB: (ANS 305 or ZOL 313) or background in animal science or zoology including exposure to topics such as animal behavior, physiology, management, and husbandry  
Multidisciplinary online computer-based instruction in animal welfare science and related issues including physiology, behavior, human-animal interactions, suffering and pain, ethics, health, assessment and standards, and economics.
- 810 Gastrointestinal Microbiology of Domestic Animals**  
Fall. 3(3-0)  
Microbial ecology of gastrointestinal tract. Microbial role in nutrition, health, and productivity. Environmental applications. Livestock species emphasized.
- 811 Integrated Nutrient Metabolism**  
Fall of odd years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Animal Science. RB: (BMB 200 or BMB 401) or or approval of department.  
Comparative physiology of the absorption and metabolism of carbohydrates, lipids, protein, minerals, and vitamins and their regulation and integration. Basis for applied nutrition of humans, livestock and companion animals.
- 814 Advanced Statistics for Biologists**  
Spring. 4(3-2) Interdepartmental with Crop and Soil Sciences and Statistics and Probability. Administered by Statistics and Probability. RB: STT 464  
Concepts of reducing experimental error for biological and agricultural research. Covariance, randomized block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs. Analyses using statistical software.
- 816 Integrative Toxicology: Mechanisms, Pathology and Regulation**  
Fall of odd years. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Pathobiology and Diagnostic Investigation and Pharmacology and Toxicology. Administered by Pharmacology and Toxicology. P: PHM 819  
Biochemical, molecular, and physiological mechanisms of toxicology. Functional and pathological responses of major organ systems to chemical insult. Mechanisms of mutagenesis, carcinogenesis, and reproductive toxicology. Concepts in risk and safety assessment.
- 824 Methods of Quantitative and Molecular Genetics for Livestock**  
Spring of odd years. 3(2-2) RB: ANS 404  
Quantitative and molecular methods for animal geneticists. Identification and evaluation of molecular markers, genome maps, linkage and segregation analyses, optimal mating designs, and marker-quantitative trait loci associations in livestock species.
- 825 Animal Biotechnology**  
Spring of even years. 3(3-0) R: Approval of department; application required.  
Basic concepts in animal biotechnology. Application of molecular biology to animal studies. Current topics in animal biotechnology and use of animals in pharmaceutical development.
- 827 Integrated Risk Assessment of Environmental Hazards**  
Spring of odd years. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Animal Science. R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Human Medicine or College of Natural Science or College of Osteopathic Medicine or College of Veterinary Medicine.  
Alternative approaches to assessing environmental and health risk. Analyzing, interpreting, and using scientific data from ecology, agriculture, environmental chemodynamics, biology, geological sciences, and toxicology in the risk assessment process.
- 842 Population Genetics, Genealogy and Genomics**  
Fall. 3(3-0) Interdepartmental with Crop and Soil Sciences and Forestry and Fisheries and Wildlife and Genetics and Horticulture. Administered by Forestry. RB: Pre-calculus, basic genetics  
Population genetic processes underlying patterns of molecular genetic variation. Genealogical approaches to the study of genomic diversity, phylogenetic reconstruction, and molecular ecology.
- 870 Techniques of Analyzing Unbalanced Research Data**  
Spring. 4(4-0) Interdepartmental with Crop and Soil Sciences and Forestry and Fisheries and Wildlife and Horticulture. Administered by Animal Science. RB: STT 464 R: Open only to graduate students in the College of Agriculture and Natural Resources. SA: ANS 943  
Linear model techniques to analyze biological research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Prediction of breeding values and estimation of population parameters from variance and covariance components.
- 890 Advanced Independent Study**  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department; application required.  
Investigation of topics of special interest.
- 898 Master's Research**  
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 10 credits in all enrollments for this course. R: Open only to master's students in the Department of Animal Science. Approval of department; application required.  
Scholarly project for non-thesis (Plan B) master's degree.
- 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 Department of Animal Science. Approval of department.  
Master's thesis research.
- 901 Selected Topics in Animal Breeding and Genetics**  
Fall, Spring, Summer. 1 to 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course.  
Selected topics of current interest and importance in animal breeding and genetics.
- 935 Nutrition: Lipid and Carbohydrate Metabolism**  
Fall of even years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Human Nutrition and Foods.  
Regulatory aspects of lipid and carbohydrate metabolism as influenced by nutritional status.
- 936 Protein Nutrition and Metabolism**  
Spring of odd years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Animal Science.  
Nutritional and endocrine regulation of protein synthesis and degradation, protein quality assessment, protein status, and protein-energy malnutrition. Protein metabolism during exercise. Metabolism, digestion, and absorption of amino acids and proteins.

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### 937 Mineral and Vitamin Nutrition and Metabolism

Spring of even years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Animal Science. P: BMB 461 and BMB 462

Forms and locations of mineral elements in the body, metabolic functions, deficiencies, and toxicities, interrelationships and quantitative requirements. Significant vitamins and mineral interrelationships relative to bone metabolism, antioxidant health and erythropoiesis.

### 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 doctoral students in the Department of Animal Science. Approval of department.

Doctoral dissertation research.