ANIMAL SCIENCE ANS

Department of Animal Science
College of Agriculture and Natural Resources

101 Professional Development in Animal Science I
Fall, Spring. 1(0-2) R: Open to students in the Animal Science major.
Careers in animal science. Job application, portfolio development, interviewing, and resume development.

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.

122A Feedlot Clerkship
Fall. 2(0-4) R: Open to students in the Institute of Agricultural Technology. SA: ANS 024
Clerkship to gain hands-on skills in the management of a working feedlot. Feeding cattle, feed storage, manure management, health programs, evaluation and selection of cattle, facilities maintenance, marketing fed cattle.

122B Beef Cow Calf Clerkship
Spring. 2(0-4) R: Open to students in the Institute of Agricultural Technology. SA: ANS 023
Clerkship to gain hands-on skills in the management of a working cow-calf farm. Feeding, reproduction, genetics, and selection, facilities maintenance, exhibiting cattle for sale and daily management skills.

132 Dairy Farm Management Seminar
Fall. 1(1-0) R: Open to students in the Institute of Agricultural Technology. SA: ANS 054
Challenges and opportunities in the dairy industry.

140 Fundamentals of Horsemanship
Fall, Spring. 2(0-4) A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.
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.

145 Horse Behavior and Welfare
Fall. 1(1-0) R: Open to students in the Institute of Agricultural Technology. SA: ANS 061A
Principles of horse behavior. Training philosophy. Horse welfare issues.

146 Fundamentals of Horse Training
Spring. 3(0-6) R: Open to students in the Institute of Agricultural Technology. SA: ANS 063a
Training and preparing an untrained horse for showing. Sale preparation.

147 Horse Management Placement Seminar
Spring. 1(1-0) R: Open to students in the Institute of Agricultural Technology. SA: ANS 064
Securing a placement training experience. Writing a resume.

148 Methods of Instructing Safe Horsemanship
Spring. 2(2-0) R: Open to students in the Institute of Agricultural Technology. SA: ANS 041
Lesson planning and communication skills for riding instructors. Safety and legal issues. Riding instructor certification. Organizations.

149 Horse Management Clerkship
Spring. 2(0-4) R: Open to students in the Institute of Agricultural Technology. SA: ANS 025
Management of a working horse farm. Feeding, reproduction, genetics, selection, facilities maintenance, and daily management skills.

171 Swine Clerkship
Fall. 2(0-4) R: Open to students in the Institute of Agricultural Technology.
Clerkship to gain hands-on experience in swine care. Nutrition. Housing maintenance. Health. Reproduction. Records management. Environmental management. Personnel management.

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 200C, ANS 200D, ANS 300A, ANS 300C and ANS 300D. P: ANS 211
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. 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. 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. 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.

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.

201 Animal Products
Fall. 3(3-0) R: Not open to freshmen.
Edible animal products. Food safety. Preservation, storage and distribution of dairy, meat and egg products.

201L Animal Products Laboratory
Fall. 1(0-3) P: ANS 201 or concurrently
Processing and evaluation of meat, milk and egg products.

203 Principles of Livestock Feeding
Spring. 2(2-0) RB: ANS 110 or ANS 222 or ANS 232 or ANS 242 or ANS 272 R: Open to students in the Institute of Agricultural Technology. SA: ANS 059
Feed nutrients, digestion and metabolism. Classification of feeds. Nutrient requirements for dairy and beef cattle, sheep, swine and horses.

205 Reproduction in Livestock
Spring. 2(2-0) RB: ANS 110 or ANS 222 or ANS 232 or ANS 242 or ANS 272 R: Open to students in the Institute of Agricultural Technology. SA: ANS 069
Reproductive anatomy and physiology of livestock. Fertility and infertility. Reproductive health. Goals and management for reproduction.

211 Animal and Product Evaluation
Fall. 3(1-4) P: ANS 110
Evaluation of breeding stock, market animals and carcasses. Performance records and structural correctness 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.

215 Growth, Health and Lactation in Dairy Cattle
Fall. 2(2-0) RB: ANS 205 and ANS 232 R: Open to students in the Institute of Agricultural Technology.
Mammary anatomy and growth. Immunization and biosecurity. Lactation and mastitis. Transition into lactation.

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.

225 Horse Behavior and Welfare
Summer. 2(2-0) RB: ANS 242
Natural behavior, senses, training psychology, and common behavioral problems of horses. Equine welfare issues.

230 Dairy Herd Management
Fall. 3(2-2) P: ANS 232 RB: ANS 132 and ANS 205 and ANS 215 R: Open to students in the Institute of Agricultural Technology. SA: ANS 032
Analysis of dairy farm management. Investigation and problem solving. Collecting data and formulating conclusions and recommendations. Oral presentation.

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.

233 Dairy Feed Management
Fall. 3(2-2) RB: ANS 203 R: Open to students in the Institute of Agricultural Technology. SA: ANS 051
Feeding management of dairy cattle with emphasis on milking cows and replacements. Cost considerations of nutrient sources and supplies. Use of home grown feeds. By-product utilization.

235 Dairy Herd Reproduction
Fall. 2(2-0) P: ANS 205 RB: ANS 232 or concurrently R: Open to students in the Institute of Agricultural Technology.
Application of reproductive principles to dairy production.

238 Dairy Health Management
Spring. 3(2-2) P: ANS 232 or concurrently R: Open to students in the Institute of Agricultural Technology.
Detection of dairy cattle disease. Infections and metabolic problems.

240 Horse Farm Management
Fall. 3(2-2) RB: ANS 203 and ANS 205 and ANS 242 and ABM 130 R: Open to students in the Horse Management major. SA: ANS 066
Integration of principles and skills into a farm management system. Managerial qualities, goal setting, facilities management. Health programs.

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.

243 Horse Nutrition and Feeding
Fall. 2(2-0) P: ANS 203 R: Open to students in the Institute of Agricultural Technology. SA: ANS 078
Nutrient requirements of the horse, selection and evaluation of feedstuffs, balancing diets by hand and by computer, pasture management.

245 Horse Exercise Physiology
Fall. 2(2-0) RB: ANS 242 R: Open to students in the Institute of Agricultural Technology. SA: ANS 068
Horse body systems, physiology of exercise and conditioning programs. Goals of various conditioning programs. Common ailments of sport horses.

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. 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.

280 Introduction to International Animal Agriculture
Spring. 3(3-0) RB: ANS 110
Globalization of animal agriculture. Issues and future challenges.

282 Companion Animal Biology and Management
Fall, Spring. 3(3-0)
Principles of companion animal management. Breeds, reproduction, feeding, housing, health, and diseases.

290 Independent Study 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 to students in the Institute of Agricultural Technology. SA: ANS 057
Independent study in agricultural technology.

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.

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. Field trip required.

301 Professional Development in Animal Science II
Fall. 2(1-2) P: (ANS 101 and ANS 110) and completion of Tier I writing requirement R: Open to juniors or seniors in the Department of Animal Science.
Career preparation in animal science. Job interviewing skills. Oral presentation, written communication, and critical evaluation of science literature.

305 Applied Animal Behavior
Spring. 3(2-2) P: BS 161 or LB 145 or BS 181H
Techniques for assessing health and welfare of domestic animals based on their behavior.

309 Health and Hygiene of Livestock
Fall. 3(3-0) P: ANS 110
Normal and abnormal physical parameters. Common diseases. Role of housing, husbandry, sanitation, and animal treatment in health.

313 Principles of Animal Feeding and Nutrition
Fall. 4(3-2) P: ((BS 161 or LB 145 or BS 181H) 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.

314 Genetic Improvement of Domestic Animals
Fall, Spring. 4(4-0) P: ((BS 161 or BS 181H or LB 145) and completion of Tier I writing requirement) and (STT 200 or STT 201 or STT 421 or STT 464 or STT 231)
Molecular, Mendelian, population, and quantitative genetics of domestic animals.

315 Anatomy and Physiology of Farm Animals
Spring. 4(3-2) P: (BS 161 or LB 145 or BS 181H) 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.

390 Animal Science Practicum
Fall, Spring, Summer. 2(0-6) A student may earn a maximum of 4 credits in all enrollments for this course. P: ANS 110 and (ANS 222 or ANS 232 or ANS 242 or ANS 252 or ANS 262 or ANS 272) RB: Institutional Animal Care and Use Training. Personal health insurance. R: Approval of department.
Farm animal production and management. Animal care. Farm management decisions.

401 Ethical Issues in Animal Agriculture
Spring. 1(0-2) RB: ANS 313 or ANS 314 or ANS 315 R: Open to juniors or seniors.
Ethical issues related to local, national, and international animal agriculture.

404 Advanced Animal Genetics
Spring of odd years. 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) P: 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 161 or LB 145 or BS 181H 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: (BS 161 or LB 145 or BS 181H) and (CEM 143 or CEM 251) RB: 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. Field Trips required.

425 Animal Biotechnology
Spring. 3(3-0) P: (BS 161 or BS 181H or LB 145) and (CEM 143 or CEM 251) RB: na
Application of molecular biology concepts to the improvement of domestic animals. Transgenic animal production, molecular genetics and marker assisted selection, animal cloning, Epigenetics, Assisted Reproductive Technologies (ART).

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.

435 Mammary Physiology
Spring. 4(3-2) P: BS 161 or LB 145 or BS 181H RB: ANS 315 R: Not open to freshmen and not open to sophomores.
Anatomy of the mammary gland and physiology of lactation in domestic and laboratory mammals. Mammary gland health and factors affecting lactation. Dairy herd milking management.

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. Field Trips required.

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.

482 Advanced Companion Animal Management
Spring. 3(2-2) P: ANS 282 RB: ANS 305 or ZOL 313
Animal behavior, training, housing, and showing. Diseases and genetics of companion animals.

483 Ruminant Nutrition
Spring. 3(3-0) P: ANS 313 RB: (ANS 315 or concurrently) and ((BMB 200 or concurrently) or (BMB 401 or concurrently)) R: Not open to freshmen or sophomores.
Nutrition, 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.

492 Undergraduate Research in Animal Science
Fall, Spring, Summer. 3(0-6) A student may earn a maximum of 6 credits in all enrollments for this course. P: (BS 161 or LB 145 or BS 181H) and (CEM 143 or CEM 251) and (ANS 313 or ANS 314 or ANS 315) R: Not open to freshmen or sophomores.
Faculty supervised research in selected areas of animal science.

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.

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.

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.

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.

892 Food Science and Animal Science Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Food Science. Administered by Food Science. R: Open to graduate students in the Department of Animal Science or in the Department of Food Science and Human Nutrition.
Critical review of literature. Organization and communication of scientific data in food science and animal science.

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.

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.