

# Animal Science (ANS)

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## **ANS 101 Introduction to Livestock and Poultry Industries** (3 credit hours)

General introduction to nutrition, reproduction, breeding, management and description of marketing channels of animals and poultry. Equates live animal and carcass characteristics with market specifications. Factors of pre- and post-slaughter treatment are related to the shelf life of fresh and processed meats. MCCRAW/GREGORY

Requisite: Agricultural Institute Only

*Typically offered in Fall only*

## **ANS 102 Animal Feeds and Nutrition** (3 credit hours)

Basics of animal nutrition and feeding. Identification and classification of common feedstuffs, including relative nutritional value for livestock and poultry. General nutrition and changes in requirements as influenced by production and the animal's life cycle. Applied aspects of feeding and nutrition of livestock and poultry. Agricultural Institute Students Only (Class= 01 or 02).

Requisite: Agricultural Institute Only

*Typically offered in Fall only*

## **ANS 103 Beef Production** (3 credit hours)

Genetics, reproduction, nutrition, animal health, forage management and marketing channels as related to beef cattle enterprises.

Requisite: Agricultural Institute Only

*Typically offered in Fall only*

## **ANS 104 Swine Production and Management** (4 credit hours)

Economical, nutritional, genetic, physiological, managerial, and social factors important in the operation of modern swine enterprises will be discussed. Emphasis will be placed on obtaining and analyzing information to solve or "trouble-shoot" common production problems.

R: AGI 01 or 02

*Typically offered in Spring only*

## **ANS 105 Introduction to Companion Animal Science** (3 credit hours)

Companion animals are often considered family members. This course surveys the variation available in companion animals (dog breeds, cat breeds, fish, reptiles, amphibians, rabbits, pet pigs, ferrets, hamsters, gerbils, mice, rats, birds & newer pets such as hedgehogs, prairie dogs & sugar gliders) and then examines related human and animal issues in more depth. Biological explanations are stressed for understanding disease states and normal behaviors of companion animals. These explanations are discussed from the point of view of problem behaviors in the average home housing these animals. This course will help educate the students about companion animals so that both the animals and their human families will be happier and more productive members of society. ANS 105 will enable students to pick the pet or specific breed that is best for them so that pets and owners stay together. Restricted to Freshmen and Sophomores.

Restriction: Freshmen & Sophomores only

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **ANS 110 Introduction to Equine Science** (3 credit hours)

Introduction to Equine Science is a course designed for Freshmen and Sophomores of any major. There are no pre-requisites for this course. We will discuss terminology, impact of horses on history and society, breeds, uses, management, genetics, reproduction, health, nutrition, behavior, and business aspects of the horse industry. Restricted to Freshmen and Sophomores.

Prerequisite: Freshman standing or Sophomore standing

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **ANS 150 Introduction to Animal Science** (3 credit hours)

Introduction to the principles and physiology of animal management, the contributions of animals and animal products to humanity, the application of science to animal production, and issues regarding animal production. The course includes biological aspects of animal science such as animal behavior, anatomical and physiological aspects of reproduction and nutrition, animal breeding and genetics, and human/animal interactions. Normal management and production techniques [including proper terminology] as well as social issues and current events related to livestock, equines, and companion mammals are discussed. Prerequisite: None. Course is 3 credits. Class meets Monday, Wednesday, and Friday 8:30 to 9:20 am in Fall and Spring, Internet only during the Summer. Fall semesters are restricted to new incoming Animal Science Freshmen. Open to all students in Spring and Summer.

*Typically offered in Fall, Spring, and Summer*

## **ANS 151 Introduction to Animal Science Lab** (1 credit hours)

Hands-on experience and demonstrations with livestock and horses; identification of common management equipment and knowledge of proper use; animal tracts, organs, skulls, feeds, breeds, and other animal-related items or topics. The lecture (ANS 150) must be taken concurrently or have been passed previously with a C-minus or higher. This lab course is restricted to the following majors: Animal Science, Ag Extension, Ag Science, and Ag Education. Transportation is provided to the off-campus labs, and students will be returned to campus prior to the end of the scheduled lab period.

Corequisite: ANS 150; R: Animal Science or Ag Extension or Ag Science or Ag Education majors

*Typically offered in Fall and Spring*

## **ANS 201 Techniques of Animal Care** (2 credit hours)

A laboratory course in the applied management of beef cattle, dairy cattle, equine, swine and small ruminants with required participatory assignments of common techniques utilized in livestock production. These techniques include but are not limited to castration, animal ID, and hoof trimming. Most of course will be held at the various Teaching Educational Units and will be held outdoors. Therefore, students should arrive for the course dressed appropriately for the lab activities and weather conditions of each day. Students will be working with animals, which comes with an inherent risk of injury. Students will be instructed on safety measures at the beginning of the semester and before each lab. Transportation will be provided to the scheduled course meetings but students will be required to provide their own transportation to the Teaching Educational Units for required assignments outside of class time.

Prerequisite: ANS 150 and ANS 151 (all ANS Majors) or ANS 101 (Ag Institute Livestock, Poultry Mgmt Program; Restriction: Junior or Senior Animal Science majors

*Typically offered in Fall and Spring*

**ANS 205 Physiology of Domestic Animals** (3 credit hours)

This course is designed to introduce students to mammalian physiology (structure and function) with emphasis on livestock species. Students will gain a basic understanding of body systems including circulatory, muscular, skeletal, digestive, and reproductive systems and functions of those systems with relevance to the whole animal and maintenance of homeostasis.

Prerequisite: (BIO 181 or BIO 183) and Sophomore standing

*Typically offered in Fall, Spring, and Summer*

**ANS 206 Anatomy of Domestic Animals Lab** (1 credit hours)

This lab course is designed for Animal Science majors to take with the ANS 205 lectures (Physiology of Domestic Animals). Students will learn to identify major anatomical and cellular structures from domestic animal (livestock) specimens through examination of gross and microscopic anatomy. SAS and IAS majors only.

Corequisite: ANS 205

*Typically offered in Fall and Spring*

**ANS 208/PB 208/AEE 208 Agricultural Biotechnology: Issues and Implications** (3 credit hours)

Trends and issues of agricultural biotechnology in today's society are addressed while covering the basic biological science behind the technology. Applications of and policy issues associated with plant, animal, and environmental biotechnology used in the agricultural industry are examined from an interdisciplinary approach.

Prerequisite: (BIO 105 or BIO 115 or BIO 181 or BIO 183)

*GEP Interdisciplinary Perspectives*

*Typically offered in Spring and Summer*

**ANS 215/HS 215 Agricultural Genetics** (3 credit hours)

To provide an introduction to the science of genetics as applied to agriculture. Emphasis is given to qualitative and quantitative genetics. By the end of this course, students should be able to apply genetic concepts to efficiently solve problems and make predictions necessary for "real-life" agricultural situations.

Prerequisite: BIO 183 or equivalent or instructor's consent

*GEP Natural Sciences*

*Typically offered in Fall only*

**ANS 220 Reproductive Physiology** (3 credit hours)

Biological processes in reproduction and lactation with emphasis on domestic mammals such as cattle, sheep, goats, horses, swine, dogs, and cats. Environmental and genetic factors that affect these processes. Identification, evaluation and solutions of problems in these physiological areas.

Prerequisite: ANS 205 or BIO 250 or ZO 250

*Typically offered in Fall and Spring*

**ANS 221 Reproductive Physiology Lab** (1 credit hours)

ANS 221 is a laboratory course that introduces students to the application of principles of reproduction and lactation in domestic mammals. Students must have either completed or concurrently be enrolled in ANS 220. This course is restricted to Animal Science majors (SAS, IAS).

Corequisite of ANS 220

*Typically offered in Fall and Spring*

**ANS 225 Principles of Animal Nutrition** (3 credit hours)

This online Principles of Animal Nutrition course is designed for non-Animal Science majors and off-campus students. It includes: feed classification, gastrointestinal tract anatomy of domestic mammals, nutrients and their functions, digestion and metabolism, feed regulations, and feeding/nutrition of cattle, small ruminants, horses, swine, poultry, dogs, cats, and rabbits. For on-campus students, ANS 225 counts toward the Animal Science minor but only counts as a Free Elective for Animal Science majors.

*Typically offered in Summer only*

**ANS 230 Animal Nutrition** (3 credit hours)

Introduction to nutrition, digestion, and absorption in domestic mammals. Major nutrient classes and their functions in the body, feed classification and chemical analysis, feed processing, and nutrient requirements.

Prerequisite: ANS 150 or BIO 183; ANS 205 is also recommended.

*Typically offered in Fall and Spring*

**ANS 231 Animal Nutrition Lab** (1 credit hours)

ANS 231 is a laboratory course that introduces students to the application of principles of nutrition and applied feeding of domestic mammals. Students must have either completed or concurrently be enrolled in ANS 230. This course is restricted to Animal Science Majors (SAS, IAS).

Corequisite: ANS 230

*Typically offered in Fall and Spring*

**ANS 240/ANS 240A Livestock Merchandising** (3 credit hours)

This course is designed to acquaint students with different methods for merchandising livestock and with strategies for adding value to products produced from livestock. Students will learn new ways to promote a farming operation. Required visits to Animal Educational Units outside of normal class time and student must provide own transportation. Required visits to Animal Educational Units outside of normal class time and student must provide own transportation. There are two required mandatory Saturday events. The animal auction held on the 3rd Saturday of April (2nd Saturday if Easter occurs on the 3rd weekend) and the Open House held either one or two Saturdays (varies depending on the Easter date) prior to the animal auction.

Prerequisite: ANS 150; Restrictive Statement: Students must be Juniors or Seniors

*Typically offered in Spring only*

**ANS 240A/ANS 240 Livestock Merchandising** (3 credit hours)

This course is designed to acquaint students with different methods for merchandising livestock and with strategies for adding value to products produced from livestock. Students will learn new ways to promote a farming operation. Required visits to Animal Educational Units outside of normal class time and student must provide own transportation. Required visits to Animal Educational Units outside of normal class time and student must provide own transportation. There are two required mandatory Saturday events. The animal auction held on the 3rd Saturday of April (2nd Saturday if Easter occurs on the 3rd weekend) and the Open House held either one or two Saturdays (varies depending on the Easter date) prior to the animal auction.

Prerequisite: ANS 150; Restrictive Statement: Students must be Juniors or Seniors

*Typically offered in Spring only*

**ANS 241 Introduction to Meat and Poultry Processing** (3 credit hours)

Introduction to Meat and Poultry Processing teaches the basic concepts of meat processing operations and technology. The concepts include basic meat science, meat quality factors, and processing operations for the common food animals (poultry, pork, beef).

*Typically offered in Spring only*

**ANS 241A Introduction to Meat and Poultry Processing** (3 credit hours)

Introduction to Meat and Poultry Processing teaches the basic concepts of meat processing operations and technology. The concepts include basic meat science, meat quality factors, and processing operations for the common food animals (poultry, pork, beef).

R: Ag Institute Students Only

*Typically offered in Spring only*

**ANS 242 Value Added Meat and Poultry Processing** (3 credit hours)

Value Added Meat and Poultry Processing teaches the basics of common value added processing operations commonly performed in the meat and poultry processing industry. The concepts include the science and processing operations involved in manufacturing common processed meat products such as: sausage, bacon, ham, etc.

*Typically offered in Fall only*

**ANS 242A Value Added Meat and Poultry Processing** (3 credit hours)

Value Added Meat and Poultry Processing teaches the basics of common value added processing operations commonly performed in the meat and poultry processing industry. The concepts include the science and processing operations involved in manufacturing common processed meat products such as: sausage, bacon, ham, etc.

R: Ag Institute Students Only

*Typically offered in Fall only*

**ANS 260 Basic Swine Science** (2 credit hours)

Basic disciplines and concepts involved in swine production including: industry structure, trends and statistics; production phases and buildings; genetic improvement; reproduction; nutrition; health and biosecurity; nutrient management; marketing, meat quality, and career opportunities in the swine industry.

Restriction: Non-ANS (Animal Science) students only. ANS students cannot take this course for credit.

*Typically offered in Spring only*

**ANS 261 Swine Health and Biosecurity** (1 credit hours)

Introduction and basic overview of the immune system, swine disease transmission and pathobiology, standard biosecurity protocols, identification of disease in pigs, basic treatment administration, and disease prevention.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring only*

**ANS 262 Swine Breeding and Gestation Management** (1 credit hours)

Management principles associated with breeding and gestation in swine. Emphasis on reproductive anatomy and physiology of boars and sows, development of replacement animals, semen production and evaluation, artificial insemination, and use of reproductive records. Extensive use of reproductive case studies.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring only*

**ANS 263 Farrowing Management** (1 credit hours)

Advanced integration and application of factors important in the proper care and management of swine during farrowing and lactation.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring and Summer*

**ANS 264 Swine Nursery and Finishing Management** (1 credit hours)

Overview of the critical management, housing, and financial considerations relevant to the successful operation of a swine nursery, grow-finish, or wean to finish enterprise.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring and Summer*

**ANS 265 Contemporary Issues in the Swine Industry** (1 credit hours)

Overview of current issues affecting pork production in the United States, including, but not limited to: environment, Swine welfare and profitability/market issues. Development of skills to promote animal agriculture when dealing with the media and general public.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring only*

**ANS 266 Swine Environment Management** (1 credit hours)

Course includes response of swine to thermal environment ventilation system design and analysis, heating and cooling, systems and examples of various designs for all phases of production. Troubleshooting and energy analysis will be included as well.

Prerequisite: ANS 150 or equivalent

*Typically offered in Fall only*

**ANS 267 Swine Manure and Nutrient Management** (1 credit hours)

Course includes manure production rates, manure handling systems, storage and manure management planning for land applications. Some odor mitigation technologies will be covered.

Prerequisite: ANS 150 or equivalent

*Typically offered in Spring only*

**ANS 268 Employee Management for the Swine Industry** (1 credit hours)

Effective employee management in swine production units. Principles, policies, and practices related to hiring, development and retention of employees, as well as fundamental organizational management.

Prerequisite: ANS 150 or equivalent

*Typically offered in Fall only*

**ANS 269 Internship in the Swine Industry** (1 credit hours)

Experiential learning in the swine industry through opportunities that provide hands-on experience and exposure to the scope of pork enterprises. Students can expect to apply principles and practices already learned, and add practical experience to their skill sets and knowledge base. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

Prerequisite: ANS 150 or equivalent  
*Typically offered in Summer only*

**ANS 270 Pork Export Markets from a Swine Production Perspective** (1 credit hours)

Introduction to global markets; cultural preferences and customs associated with the global swine industry. International trade regulations and potential impact of foreign animal diseases and bioterrorism affecting the U.S. swine industry.

Prerequisite: ANS 150 or equivalent  
*Typically offered in Summer only*

**ANS 271 Swine Nutrition** (1 credit hours)

Principles involved with developing and implementing a swine feeding program, including fundamentals of feeding pigs, understanding nutrients used in pig diets, factors affecting nutrient recommendations, feeding systems for pigs, feed ingredients, and formulation of swine diets.

Prerequisite: ANS 150 or ANS 260 or Equivalent Restriction: Restricted to non-ANS (Animal Science) students. ANS students cannot take the course for credit.  
*Typically offered in Fall only*

**ANS 281 Professional Development of PreVeterinary Track Students** (1 credit hours)

This course introduces PreVeterinary track students to the scope of the veterinary profession and to current issues affecting veterinary professionals. The course will help students gain an understanding of the professional requirement of the veterinary school applications. Students will be expected to discuss current animal and public health issues as well as areas of national shortage in the veterinary profession. One Saturday at the NCSU vet school Open House is required (first Saturday in April).

Prerequisite: ZO 160 or BIO 125 or BIO 181 or BIO 183  
*Typically offered in Spring only*

**ANS 290 Professional Development for Animal Science Careers** (2 credit hours)

This course will teach students how to navigate the career decision-making process to make an informed decision and discuss career options in the field of Animal Science. The course will also help students evaluate and develop their professional competencies and skills.

Animal Science Majors Only  
*Typically offered in Fall and Spring*

**ANS 303 Principles of Equine Evaluation** (2 credit hours)

Students will learn about and apply methods for evaluating conformation and function of performance and halter horses, soundness, breed standards, rules and regulations for evaluation, selection, and performance. Guest lecturers and field trips.

Prerequisite: ANS 150 or ANS 110  
*Typically offered in Spring only*

**ANS 304 Dairy Cattle Evaluation** (2 credit hours)

The first half of this course covers basic aspects of dairy cattle breeds, dairy character, form and function including type traits and linear scoring of dairy cattle, interpreting and using judging scorecards, comparing/evaluating dairy cattle, and placing animals in a class. The second half of the course develops the student's ability to correctly evaluate dairy cattle classes, but more importantly to support their opinions through oral communication.

Prerequisite: ANS 150  
*Typically offered in Spring only*

**ANS 309 Livestock Evaluation** (3 credit hours)

Students will be exposed to basic concepts associated with growth, development and value determination of livestock. Familiarization with official USDA grading standards for cattle, sheep, swine and goats is emphasized. Introduction to judging terminology, placing classes of livestock and justification through oral reasons.

Prerequisite: ANS 150  
*Typically offered in Fall only*

**ANS 322/FS 322/PO 322 Muscle Foods and Eggs** (3 credit hours)

Processing and preserving fresh poultry, red meats, seafood, and eggs. Ante- and post-mortem events as they affect quality, yield, and compositional characteristics of muscle foods. Principles and procedures involved in the production of processed meat items.

Prerequisite: ZO 160, BIO 181 or BIO 183  
*Typically offered in Fall only*

**ANS 324/FS 324 Milk and Dairy Products** (3 credit hours)

Introduction to the manufacture of dairy products. Dairy processing procedures from the farm, through the dairy plant, and to the consumer are studied. The course consists of 15 learning modules, three exams, and a project.

Prerequisite: BIO 181 or 183, CH 101  
*Typically offered in Fall only*

**ANS 330 Laboratory Animal Science** (3 credit hours)

A sophomore to senior level course designed to cover the basics of laboratory animal science, a specialty dealing with the use of vertebrate animal species in intensive research. Some topics to be covered are: husbandry, facility management, animal health and welfare, diagnostics, surgical area management, research methods and administrative duties. Students will use the material for studying for the certification as a Laboratory Animal Technician via the American Association For Laboratory Animal Science (AALAS). A separate fee is required for certification; this fee is not covered by tuition for ANS 330. Must hold sophomore standing or higher.

*Typically offered in Spring only*



**ANS 395 Animal Science Study Abroad** (1-6 credit hours)

This course provides an international perspective on animal management, conservation and various animal-related industries by allowing students to study abroad in various locations around the world, with different destinations offered each academic year. Credit hours are variable based on length of travel and classroom instruction pre- and post-travel consistent with NCSU policies and practices. Course may be repeated for credit to visit different destinations only. Significant expenses for travel are involved. Please consult with the instructor or the Study Abroad Office for specific program details.

*GEP Global Knowledge*

*Typically offered in Fall, Spring, and Summer*

**ANS 400 Companion Animal Management** (3 credit hours)

Anatomy, physiology, nutrition, genetics, and health of companion animals including cats, dogs, rabbits, rats, mice, reptiles, amphibians, and fish. Problem solving and enterprise management skills in laboratories.

Prerequisite: ANS 105 and Junior standing

*Typically offered in Spring only*

**ANS 402 Beef Cattle Management** (3 credit hours)

ANS 402 integrates technical information from nutrition, reproduction, genetics, physiology, and animal welfare into management decisions that will enhance a beef cattle operation. Students will engage in beef cattle and environmental management and varied communication formats to explore relationships between sectors of the beef industry from cow-calf to the consumer.

Prerequisite: ANS 150, Junior standing

*Typically offered in Spring only*

**ANS 403 Swine Management** (3 credit hours)

Management principles associated with swine production. Emphasis on interactions of health, equipment, nutrition, reproduction and genetics during nursery, finishing, farrowing and breeding phases of production. Waste management practices and alternatives, development of marketing strategies and economic evaluation of management practices.

Prerequisite: ANS 150; Restrictive Statement: Students must be Juniors or Seniors

*Typically offered in Fall only*

**ANS 404 Dairy Cattle Management** (3 credit hours)

In ANS 404, students will develop a better understanding of dairy cattle management with an emphasis on the impact of decisions on productivity, health, profitability, and the future of the dairy enterprise.

Prerequisite: ANS 150, Junior standing

*Typically offered in Spring only*

**ANS 407 Livestock Grazing Management** (3 credit hours)

This course is an overview of scientific principles applied in managing grazing livestock species (e.g., beef cattle, horses, sheep and goats) with an emphasis on promoting animal health, plant health and production efficiency. Topics include grazing behavior of livestock, nutritional aspects of pasture, effect of grazing on plant and soil health, plant identification, pasture allocation, pasture systems for each livestock species (beef cattle, horse, sheep and goats), multi-species grazing systems, watering systems, fencing, and economics of grazing. The course will be conducted as hybrid using asynchronous online lectures and one three-hour lab per week. Students will be required to provide their own transportation to lab. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

P: ANS 150 and ANS 151 and ANS 230

*Typically offered in Fall only*

**ANS 408 Small Ruminant Management** (3 credit hours)

Principles and practices of production, management, and marketing of sheep and goats. Role of genetics, nutrition, reproduction and animal health. Hands-on experience and field trips during labs.

Prerequisite: ANS 150, Junior standing

*Typically offered in Fall and Spring*

**ANS 410 Equine Breeding Farm Management** (3 credit hours)

Equine anatomy, physiology, nutrition, genetics and health. Laboratory emphasis on reproductive management, breeding, problem solving, and management skills. Field trips required.

Prerequisite: ANS 110 and Junior standing

*Typically offered in Spring only*

**ANS 411 Management of Growing and Performance Horses** (3 credit hours)

This course is an overview of scientific applications used in management of growing and performance horses. Topics include: nutrition and feeding, disease prevention, exercise conditioning, and methods of evaluation and selection. Students required to provide their own transportation to labs. Must hold junior or senior standing.

Prerequisite: ANS 110

*Typically offered in Fall only*

**ANS 415/NTR 415/PO 415/PO 515/NTR 515/ANS 515 Comparative Nutrition** (3 credit hours)

Principles of nutrition, including the classification of nutrients and the nutrient requirements of and metabolism by different species for health, growth, maintenance and productive functions.

Prerequisite: ANS 225 or ANS 230 or CH 220 or CH 223 or CH 227

*Typically offered in Fall, Spring, and Summer*

**ANS 425/FM 425/PO 425/NTR 525/FM 525/ANS 525/PO 525/NTR 425 Feed Manufacturing Technology** (3 credit hours)

Feed mill management, feed ingredient purchasing, inventory, storage, and quality evaluation, computerized feed formulation, feeding programs for poultry and swine, feed mill design, equipment, maintenance, operation, safety, state and federal regulations pertaining to feed manufacture.

Prerequisite: ANS(NTR,PO) 415 or ANS 230 or ANS 225

*Typically offered in Fall, Spring, and Summer*

**ANS 435/ANS 535 Stress Physiology in Animals** (3 credit hours)

Stress Physiology in Animals is a course focusing on the mechanism whereby stress impacts multiple physiological systems throughout the body in animals (human and non-human models). Physiological systems discussed will include the hypothalamic-pituitary-adrenal axis, the nervous system, the cardiovascular system, the respiratory system, the immune system, the metabolic system, and the reproduction system.

Prerequisite: ANS 205 or ZO 250

*Typically offered in Spring only*

**ANS 437/ANS 537 Precision Livestock Farming Systems** (3 credit hours)

Precision Livestock Farming (PLF) is a multidisciplinary approach to producing safe, quality animal products by improving animal health, welfare, and production while reducing environmental impact and input resources. This course introduces students to the common structure and terminology of PLF systems and provides an overview of PLF concepts. Multiple types of technologies, sensors, and camera systems for various animal species will be covered with hands-on activities for software and hardware applications.

Prerequisite: ST 311

*Typically offered in Fall only*

**ANS 439/ANS 539 Comparative Animal Exercise Physiology** (3 credit hours)

This course will discuss aspects of exercise physiology with a focus on equine and canine species, also with some discussion on humans, other athletic mammals, aquatic and avian species. The course will cover elements of bioenergetics and exercise metabolism, cardiovascular, respiratory and muscular adaptations to exercise and training, thermoregulation, performance evaluation, biomechanics and lameness, and exercise-related health conditions, with a comparative nature.

P: ANS 205 or BIO 240 & BIO 245 or ZO 250

*Typically offered in Fall only*

**ANS 440/ANS 540 Animal Genetic Improvement** (3 credit hours)

Modern evaluation and selection procedures for domestic animals; selection goals, estimation of breeding values and performance testing; their impact on genetic changes.

Prerequisite: (ANS/HS 215 or GN 311) and (ST 311 or ST/BUS 350) and Junior standing

*Typically offered in Fall only*

**ANS 452/ANS 552/PHY 552/PHY 452 Comparative Reproductive Physiology and Biotechnology** (3 credit hours)

Comparative approach to examining aspects of reproductive physiology in selected vertebrate species. Detailed examination of current reproductive biotechnologies and ethical issues associated with the application of reproductive biotechnologies. Credit will not be given for both ANS 452 and ANS (PHY) 552.

Prerequisite: ANS 220

*Typically offered in Fall only*

**ANS 453/ANS 553 Physiology and Genetics of Growth and Development** (3 credit hours)

Introduction to the basic concepts of growth with emphasis on domestic mammals. Growth of the major classes of animal tissues and regulation by endogenous and exogenous factors. Relationship to efficiency of animal production. Credit will not be given for both ANS 453 and 553.

*Typically offered in Fall only*

**ANS 454/NTR 454/ANS 554 Lactation, Milk and Nutrition** (3 credit hours)

Nutritional properties of milk as a high-quality food with nutritional diversity. Principles of physiology, biochemistry and cell biology in the mammary gland. Procedures of milk production and milk collection for milk quality and nutrition. Human lactation vs. that of domestic animals. Impacts of biotechnology and food safety on dairy production. Credit will not be given for both ANS 454 and 554.

Prerequisite: ANS 230 or FS/NTR 400; BCH 451 or ZO 421

*Typically offered in Spring only*

**ANS 480 Judging Team** (1 credit hours)

Students practice judging techniques for livestock, horses, or dairy animals, including ranking animals and providing oral reasons to defend the rankings. Students meet weekly with a coach to practice locally and will also travel to compete in one or two regional or national competitions. Each team (livestock, horse, dairy) is expected to raise funds to finance the trips. Students earn 1 credit for being on a team, and can earn up to 3 credits of Free Elective for ANS 480 by serving on the judging team for different species. Field trips that last several days are required. Departmental Approval Required. Course may be taken up to 3 times (once per species).

Prerequisite: ANS 303 or ANS 304 or ANS 309

*Typically offered in Fall only*

**ANS 492 Professional Internship Experience in the Animal Sciences** (1-3 credit hours)

This course provides an opportunity for students to gain real-world experience relevant to their academic and career goals. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience. The experience must be arranged by the student and approved by the Department of Animal Science prior to the start of the experience. To gain approval, a student must submit the completed ANS 492 contract and have it approved by his/her experience supervisor, academic advisor and the ANS 492 coordinator. In addition to the work described in the contract, a student will complete a series of reflective assignments during and at the end of the experience.

*Typically offered in Fall, Spring, and Summer*

**ANS 493 Research Experience in the Animal Sciences** (1-3 credit hours)

This course provides an opportunity for students to gain real-world experience in a scientific research program. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience. The experience must be arranged by the student and approved by the Department of Animal Science prior to the start of the experience. To gain approval, a student must submit the completed ANS 493 contract and have it approved by his/her research supervisor, academic advisor and the ANS 493 coordinator. In addition to the work described in the contract, a student will complete a series of reflective assignments during and at the end of the experience.

*Typically offered in Fall, Spring, and Summer*

**ANS 494 Teaching Experience in the Animal Sciences** (1-3 credit hours)

This course provides an opportunity for students to gain experience with some aspect of teaching, including: leading or facilitating lessons, producing educational resources, or education research. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience. The experience must be arranged by the student and approved by the Animal Science Department prior to the start of the experience. To gain approval, a student must submit the completed ANS 494 contract and have it approved by his/her research supervisor, academic advisor and the ANS 494 coordinator. If the experience involves education research, the research mentor is encouraged to require a research paper or poster presentation as part of the work expectations when appropriate. In addition to the work described in the contract, a student will complete a series of reflective assignments during and at the end of the experience.

*Typically offered in Fall, Spring, and Summer*

**ANS 495 Special Topics in Animal Science** (1-3 credit hours)

Offered as needed to present material not normally available in regular course offerings or for offering of new courses on a trial basis.

*Typically offered in Fall, Spring, and Summer*

**ANS 515/ANS 415/NTR 415/PO 415/PO 515/NTR 515 Comparative Nutrition** (3 credit hours)

Principles of nutrition, including the classification of nutrients and the nutrient requirements of and metabolism by different species for health, growth, maintenance and productive functions.

Prerequisite: ANS 225 or ANS 230 or CH 220 or CH 223 or CH 227

*Typically offered in Fall, Spring, and Summer*

**ANS 525/PO 525/NTR 425/ANS 425/FM 425/PO 425/NTR 525/FM 525 Feed Manufacturing Technology** (3 credit hours)

Feed mill management, feed ingredient purchasing, inventory, storage, and quality evaluation, computerized feed formulation, feeding programs for poultry and swine, feed mill design, equipment, maintenance, operation, safety, state and federal regulations pertaining to feed manufacture.

Prerequisite: ANS(NTR,PO) 415 or ANS 230 or ANS 225

*Typically offered in Fall, Spring, and Summer*

**ANS 535/ANS 435 Stress Physiology in Animals** (3 credit hours)

Stress Physiology in Animals is a course focusing on the mechanism whereby stress impacts multiple physiological systems throughout the body in animals (human and non-human models). Physiological systems discussed will include the hypothalamic-pituitary-adrenal axis, the nervous system, the cardiovascular system, the respiratory system, the immune system, the metabolic system, and the reproduction system.

Prerequisite: ANS 205 or ZO 250

*Typically offered in Spring only*

**ANS 537/ANS 437 Precision Livestock Farming Systems** (3 credit hours)

Precision Livestock Farming (PLF) is a multidisciplinary approach to producing safe, quality animal products by improving animal health, welfare, and production while reducing environmental impact and input resources. This course introduces students to the common structure and terminology of PLF systems and provides an overview of PLF concepts. Multiple types of technologies, sensors, and camera systems for various animal species will be covered with hands-on activities for software and hardware applications.

Prerequisite: ST 311

*Typically offered in Fall only*

**ANS 539/ANS 439 Comparative Animal Exercise Physiology** (3 credit hours)

This course will discuss aspects of exercise physiology with a focus on equine and canine species, also with some discussion on humans, other athletic mammals, aquatic and avian species. The course will cover elements of bioenergetics and exercise metabolism, cardiovascular, respiratory and muscular adaptations to exercise and training, thermoregulation, performance evaluation, biomechanics and lameness, and exercise-related health conditions, with a comparative nature.

P: ANS 205 or BIO 240 & BIO 245 or ZO 250

*Typically offered in Fall only*

**ANS 540/ANS 440 Animal Genetic Improvement** (3 credit hours)

Modern evaluation and selection procedures for domestic animals; selection goals, estimation of breeding values and performance testing; their impact on genetic changes.

Prerequisite: (ANS/HS 215 or GN 311) and (ST 311 or ST/BUS 350) and Junior standing

*Typically offered in Fall only*

**ANS 550/NTR 550 Applied Ruminant Nutrition** (3 credit hours)

Applied concepts in ruminant nutrition for the practicing agricultural professional. Protein, energy, vitamin and mineral nutrition in relation to the nutritional needs and practical feeding of beef cattle, dairy cattle, sheep, and goats. New developments in feeding systems, feed additives and the prevention and treatment of metabolic disorders. Emphasis on solving problems in case studies. Permission given to undergraduates

Prerequisite: ANS 230 or ANS(NTR,PO) 415. Permission given to undergraduates

*Typically offered in Fall only*

**ANS 552/PHY 552/PHY 452/ANS 452 Comparative Reproductive Physiology and Biotechnology** (3 credit hours)

Comparative approach to examining aspects of reproductive physiology in selected vertebrate species. Detailed examination of current reproductive biotechnologies and ethical issues associated with the application of reproductive biotechnologies. Credit will not be given for both ANS 452 and ANS (PHY) 552.

Prerequisite: ANS 220

*Typically offered in Fall only*

**ANS 553/ANS 453 Physiology and Genetics of Growth and Development** (3 credit hours)

Introduction to the basic concepts of growth with emphasis on domestic mammals. Growth of the major classes of animal tissues and regulation by endogenous and exogenous factors. Relationship to efficiency of animal production. Credit will not be given for both ANS 453 and 553.

*Typically offered in Fall only*

**ANS 554/ANS 454/NTR 454 Lactation, Milk and Nutrition** (3 credit hours)

Nutritional properties of milk as a high-quality food with nutritional diversity. Principles of physiology, biochemistry and cell biology in the mammary gland. Procedures of milk production and milk collection for milk quality and nutrition. Human lactation vs. that of domestic animals. Impacts of biotechnology and food safety on dairy production. Credit will not be given for both ANS 454 and 554.

Prerequisite: ANS 230 or FS/NTR 400; BCH 451 or ZO 421

*Typically offered in Spring only*

**ANS 561/NTR 561 Equine Nutrition** (3 credit hours)

This course explores concepts in equine nutrition including digestive physiology of horses, nutrient requirements for different classes of horses and feed management. Ration evaluation and balancing, as well as problem solving will be a core component to this course.

Prerequisite: NTR 500 or NTR/FS 501 or NTR/PO 515

*Typically offered in Spring only*

**ANS 565/NTR 565 Advanced Canine and Feline Nutrition** (3 credit hours)

This course is about the advanced principles of nutrition within canines and felines. The course focuses on the unique gastro-intestinal tracts for the two species as well as their specific nutrient requirements and how the animal industry addresses these needs.

Restriction: Graduate Student or Senior with 3.35 GPA; Prerequisite: 400-level Nutrition Course

*Typically offered in Fall only*

**ANS 571/BCH 571 Regulation of Metabolism** (3 credit hours)

Study of hormonal, enzymatic and molecular-genetic regulation of carbohydrate and lipid metabolism; emphasis on mammalian species.

Prerequisite: BCH 451, GN 311, a course in physiology, cell biology

*Typically offered in Fall only*

**ANS 590 Topical Problems in Animal Science** (1-3 credit hours)

Selection or assignment of special problems in various phases of animal science.

*Typically offered in Fall and Spring*

**ANS 591 Special Topics in Animal Science through AG Idea** (1-3 credit hours)

Special topics in various aspects of animal science offered via Great Plains AG Idea.

*Typically offered in Fall, Spring, and Summer*

**ANS 600 Professional Development for Graduate Students** (1 credit hours)

This course is designed to assist graduate students with the preparation of professional information that they may be required to provide as they seek opportunities following graduate school. Course topics will include preparation of personal statements, resumes or curriculum vitae, investigation of the types of careers available to Animal Science graduates, and preparation of multimedia presentations that may be used in formal interviews.

Restriction: Graduate Standing

*Typically offered in Spring only*

**ANS 601 Animal Science Seminar** (1 credit hours)

Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

*Typically offered in Fall and Spring*

**ANS 603 Reproductive Physiology Seminar** (1 credit hours)

Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

*Typically offered in Spring only*

**ANS 604 Animal Breeding and Genetics Seminar** (1 credit hours)

Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

*Typically offered in Fall and Spring*

**ANS 610 Topical Problems in Animal Science** (1-6 credit hours)

Selection or assignment of special problems in various phases of animal science.

*Typically offered in Fall, Spring, and Summer*

**ANS 641 Practicum in Animal Science** (1-3 credit hours)

*Typically offered in Fall and Spring*

**ANS 685 Master's Supervised Teaching** (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Master's student

*Typically offered in Fall and Spring*

**ANS 690 Master's Exam** (1-9 credit hours)

For students in non-thesis master's programs who have completed all other requirements of the degree except preparing for and taking the final master's exam.

Prerequisite: Master's student

*Typically offered in Spring and Summer*

**ANS 693 Master's Supervised Research** (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Master's student

*Typically offered in Fall, Spring, and Summer*

**ANS 695 Master's Thesis Research** (1-9 credit hours)

Thesis research.

Prerequisite: Master's student

*Typically offered in Fall, Spring, and Summer*



**ANS 696 Summer Thesis Research** (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Master's student  
Typically offered in Summer only

**ANS 699 Master's Thesis Preparation** (1-9 credit hours)

For students who have completed all credit hour requirements and full-time enrollment for the master's degree and are writing and defending their thesis.

Prerequisite: Master's student  
Typically offered in Fall, Spring, and Summer

**ANS 701/NTR 701 Protein and Amino Acid Metabolism** (3 credit hours)

Study of protein and amino acid metabolism, regulation, dietary requirements and techniques for their investigation in human and other animals.

Prerequisite: BCH 453, ZO 421, a 400-level nutrition course  
Typically offered in Spring only

**ANS 702/PHY 702 Reproductive Physiology of Mammals** (3 credit hours)

Survey of reproductive strategies among vertebrates; in-depth coverage of mammalian reproductive physiology; gametogenesis, fertilization, embryonic and fetal development, parturition, puberty, neuroendocrine control mechanisms in male and female mammals.

Prerequisite: ZO 421  
Typically offered in Fall and Spring

**ANS 713/GN 713 Quantitative Genetics and Breeding** (3 credit hours)

Quantitative and population genetic theory of breeding problems; partitioning of genetic variance, maternal effects, genotype by environment interaction and genetic correlation; selection indexes; design and analysis of selection experiments; marker-assisted selection.

Prerequisite: GN 509, ST 512  
Typically offered in Spring only

**ANS 726/FOR 726/CS 726 Advanced Topics In Quantitative Genetics and Breeding** (3 credit hours)

Advanced topics in quantitative genetics pertinent to population improvement for quantitative and categorical traits with special applications to plant and animal breeding. DNA markers - phenotype associations. The theory and application of linear mixed models, BLUP and genomic selection using maximum likelihood and Bayesian approaches. Pedigree and construction of genomic relationships matrices from DNA markers and application in breeding.

Prerequisite: ST 511, Corequisite: ST 512  
Typically offered in Spring only

**ANS 790 Advanced Special Topics in Animal Science** (1-6 credit hours)

Selection or assignment of advanced special problems in various disciplines of animal science.

Prerequisite: Graduate Standing  
Typically offered in Fall and Spring

**ANS 803 Reproductive Physiology Seminar** (1 credit hours)

Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

Typically offered in Spring only

**ANS 804 Animal Breeding and Genetics Seminar** (1 credit hours)

Weekly seminars on topics of current interest given by resident faculty members, graduate students and visiting lecturers.

Typically offered in Fall and Spring

**ANS 810 Topical Problems in Animal Science** (1-6 credit hours)

Selection or assignment of special problems in various phases of animal science.

Typically offered in Fall, Spring, and Summer

**ANS 811 Safety and Ethics in Animal Science** (1 credit hours)

ANS 811 is 1 credit hour course focused on safety and ethics in the Department of Animal Science.

P: Graduate Standing  
Typically offered in Fall only

**ANS 841 Practicum in Animal Science** (1-3 credit hours)

Typically offered in Fall and Spring

**ANS 885 Doctoral Supervised Teaching** (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment

Prerequisite: Doctoral student  
Typically offered in Fall and Spring

**ANS 890 Doctoral Preliminary Examination** (1-9 credit hours)

For students who are preparing for and taking written and/or oral preliminary exams.

Prerequisite: Doctoral student  
Typically offered in Fall, Spring, and Summer

**ANS 893 Doctoral Supervised Research** (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Doctoral student  
Typically offered in Fall, Spring, and Summer

**ANS 895 Doctoral Dissertation Research** (1-9 credit hours)

Dissertation research

Prerequisite: Doctoral student  
Typically offered in Fall, Spring, and Summer

**ANS 896 Summer Thesis Research** (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Doctoral student  
Typically offered in Summer only

**ANS 899 Doctoral Dissertation Preparation** (1-9 credit hours)

For students who have completed all credit hours, full-time enrollment, preliminary examination, and residency requirements for the doctoral degree, and are writing and defending their dissertations.

Prerequisite: Doctoral student

*Typically offered in Fall, Spring, and Summer*