195H. Writing: Major Topics in American Thought
Fall, Spring. 4(4-0) P: Designated score on English placement test. Not open to students with credit in MC 111 or MC 112 or LBS 133 or AL 192 or AL 192H or ATL 110 or ATL 115, ATL 120 or ATL 125 or ATL 130 or ATL 135 or ATL 140 or ATL 145 or ATL 150.
Drafting, revising, and editing compositions derived from readings on major topics in American thought to develop advanced skills in narration, persuasion, analysis, and documentation.

290. Independent Study
Fall, Spring, Summer. 1 to 4 credits. R: Open only to freshmen or sophomores. Approval of department.
Special projects arranged by an individual student and a faculty member in areas supplementing regular course offerings.

ANATOMY ANT

Department of Anatomy
College of Human Medicine
College of Osteopathic Medicine
College of Veterinary Medicine

316. General Human Anatomy
Spring. 3(3-0) P: BS 110 or BS 111 or approval of department.
Human structure. Major systems of the human body.

480. Special Problems in Anatomy
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 15 credits in all enrollments for this course. R: Approval of department.
Topics from an anatomical field such as gross anatomy, histology, tissue culture, cytology, neurology, or embryology.

515. Comparative Veterinary Gross Anatomy
Fall. 6(2-10) R: Open only to graduate-professional students in the College of Veterinary Medicine.
Canine anatomy. Comparisons with ruminant, porcine, and equine anatomy.

516. Veterinary Histology and Cell Biology
Fall. 4(3-2) R: Open only to graduate-professional students in the College of Veterinary Medicine.
Principles of developmental, cellular, and molecular biology as related to veterinary medicine.

517. Veterinary Neuroanatomy
Spring. 1(1-0) R: Completion of 1 semester of the graduate-professional program in the College of Veterinary Medicine.
Introduction to the anatomy of the nervous system using the canine species as a model.

551. Medical Gross Anatomy
Fall. 6(4-6) R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine.
Gross anatomy of the human body using prosections, medical imaging, clinical correlations, case studies, video tapes, and computer aided instruction.

552. Medical Neuroscience
Spring. 4(3-2) Interdepartmental with Physiology; Radiology. R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine.
Correlation of normal structure and function of the human nervous system with clinical testing, classical lesions, and common diseases.

562. Medical Histology
Spring. 3(2-2) R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine.
Histology of the human body.

585. Human Gross Anatomy Dissection
Fall, Spring, Summer. 2 to 7 credits. A student may earn a maximum of 15 credits in all enrollments for this course. P: ANT 551. R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine.
Dissection of selected regions of the human body.

610. Veterinary Gross Anatomy Dissection
Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P: ANT 515. R: Open only to graduate-professional students in College of Veterinary Medicine.
Dissection and prosection of selected regions of domestic animals.

611. Research Problems in Veterinary Anatomy
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate-professional students in the College of Veterinary Medicine. Approval of department.
Veterinary gross anatomy, cell biology, histology, or neurobiology.

802. Clinical Surgical Anatomy
Spring. 4(2-4) Interdepartmental with Surgery. Administered by Surgery. R: Open only to Master's students in Surgery.
Review of surgical anatomy. Detailed anatomical information through lecture and dissection sessions. Clinical interpretation of anatomy and surgical approaches.

813. Problems in Anatomy
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. R: Approval of department.
Fields such as gross anatomy, histology, tissue culture, cytology, neurology and embryology.

814. Graduate Seminar
Spring of even years. 1 to 3 credits. R: Open only to graduate students in Anatomy.
Supervised practice in evaluating abstracts and delivering oral presentations of anatomical sciences. Organization, timing and effective illustrations.

820. Advanced Neuroanatomy
Summer of odd years. 1 to 5 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.
Current topics in anatomy and physiology and processes of central nervous system cells.

839. Systems Neuroscience
Spring of odd years. 4(4-0) Interdepartmental with Pharmacology and Toxicology; and Physiology. R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Agriculture and Natural Resources, Natural Science, and Veterinary Medicine.
Anatomy, pharmacology, and physiology of multicellular neural systems. Sensory, motor, autonomic, and chemo-regulatory systems in vertebrate brains.

885. Vertebrate Neural Systems
Spring of odd years. 3(2-2) Interdepartmental with Physiology.
Comparative analysis of major component systems of vertebrate brains. Evolution, ontogeny, structure, and function in fish, amphibians, reptiles, birds and mammals.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Anatomy.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in Anatomy.

ANIMAL SCIENCE ANS

Department of Animal Science
College of Agriculture and Natural Resources

110. Introductory Animal Agriculture
Fall, Spring. 4(3-2)
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.
SA: ANS 112

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. P: ANS 211. R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of functional conformation of beef cattle, sheep and swine and their carcasses. Preparation for intercollegiate competition. Field trips required.

200B. Introductory Judging of Dairy Cattle or Horses
Spring. 1 to 2 credits. A student may earn a maximum of 3 credits in all enrollments for this course. R: A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of functional conformation of dairy cattle or horses. Preparation for intercollegiate competition. Field trips required.

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

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

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

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

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

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

252. Introduction to Management of Avian Species
Fall of odd years. 3(2-2)
Management of commercial poultry flocks and aviaries. Feed requirements, reproduction, breeding, housing and disease.

261. Principles of Animal Environments
Spring. 2(1-2) Interdepartmental with Agricultural Technology and Systems Management. Administered by Agricultural Technology and Systems Management.
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.
SA: AE 061, ATM 326

262. Introductory Sheep Management
Spring. 3(2-2) R: Open only to sophomores or juniors or seniors.
Principles of sheep management: genetics, reproduction, nutrition, marketing, and economics. Field trips required.

272. Introductory Swine Management
Fall. 3(2-2) Not open to students with credit in ANS 472.
Swine production principles, practices, technologies, and systems. Field trips required.

275. Seafood Systems Management
Spring. 3 credits. Interdepartmental with 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.

300A. Advanced Livestock Judging
Fall of even years. 2 credits. P: ANS 200A. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of conformation and performance records of beef cattle, swine and sheep. Represent MSU in intercollegiate competition. Field trips required.

300B. Advanced Meat Evaluation and Grading
Fall. 2(0-4) P: (ANS 200A) R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of beef, pork, and lamb carcasses and wholesale cuts according to industry standards. Federal grading standards. Field trips to meat packing operations required. Represent MSU in intercollegiate competition.

300C. Advanced Dairy Cattle Judging
Fall. 2 credits. P: ANS 200B. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D.
Evaluation of conformation of various breeds of dairy cattle. Represent MSU in intercollegiate competition. Field trips required.

300D. Advanced Horse Judging
Fall. 2 credits. P: ANS 200B. R: Not open to freshmen. A student may earn a maximum of 8 credits from ANS 200A, ANS 200B, ANS 300A, ANS 300B, ANS 300C and ANS 300D
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.

305. Applied Animal Behavior
Spring. 3(2-2) P: (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 (CEM 143 or concurrently or CEM 251 or concurrently) and completion of Tier I writing requirement.
Principles and practices of nutrition for cattle, horses, poultry, sheep and swine. Metabolism of protein, minerals, and vitamins. Diet formulation. Performance prediction. Nutritional maladies. Field trip required.

314. Genetic Improvement of Domestic Animals
Fall. 4(3-2) P: (BS 111) and (MTH 110 or concurrently or MTH 116 or concurrently) and completion of Tier I writing requirement.
Molecular, Mendelian, population, and quantitative genetics of domestic animals.

315. Anatomy and Physiology of Farm Animals
Spring. 4(3-2) P: (BS 111) and completion of Tier I writing requirement.
Gross and microanatomy of farm animals. Structure directed function of tissues. Endocrine integration for homeostasis. Regulation of growth, lactation, and reproduction. Homeorhesis.

320. Muscle Foods
Spring. 3(2-3) Interdepartmental with Food Science. P: (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) P: ANS 313 or ANS 314 or ANS 315. R: Open only to juniors and seniors.
Societal issues related to local, national and international animal agriculture.

404. Advanced Genetics of Farm Animals
Spring. 2(1-2) P: (ANS 314)
Application of molecular genetics techniques to animal breeding. Genome maps for domestic species. Incorporation of genotype data into selection programs.

405. Endocrinology of Reproduction
Fall. 3(3-0) P: ANS 315. R: Not open to freshmen and 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) Interdepartmental with Food Science. P: BCH 200 or BCH 401. R: Not open to freshmen and sophomores.
Fate and effects of chemicals in the food chain. Impact on animal production. Residues in food products. Food safety assessment. Control methods.

407L. Toxicology Methods Laboratory
Fall. 2(0-4) Interdepartmental with Food Science. P: ANS 407 or concurrently. R: Not open to freshmen and sophomores.
Laboratory techniques for evaluating potential toxicity of chemicals to living systems. Field trip to industrial toxicology laboratory required.

413. Non-Ruminant Nutrition
Spring. 4(3-2) P: ANS 313. R: Not open to freshmen and sophomores.
Nutrition of horses, swine and poultry. Digestive and metabolic development and nutrient requirements. Relationships of genetics, endocrinology, immunology, and environment to nutrition.

414. Advanced Animal Breeding
Spring. 2(2-0) P: (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) P: 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) P: ANS 315. R: Not open to freshmen and 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) Interdepartmental with Food Science. P: ANS 407. R: Not open to freshmen and sophomores.
Selected topics including regulatory toxicology, risk assessment, environmental toxicology, food safety, and safe handling of toxic substances.

422. Advanced Beef Cattle Feedlot Management
Fall. 3(2-2) P: (ANS 222) and (ANS 313 or concurrently or ANS 314 or concurrently or ANS 315 or concurrently)
Feedlot management systems and issues. Feed systems, manure management, health maintenance, and cattle marketing. Field trips required.

425. Principles of Animal Biotechnology
Fall of odd years. 3(3-0) P: (BS 111) and (CEM 143 or concurrently or 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 Civil and Environmental Engineering; and Sociology. P: (ISB 200 or ISB 202 or ISB 204 or ISB 206H or BCH 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) R: Not open to freshmen or sophomores.
Management techniques for operating a dairy herd. Mastitis control, reproductive and nutrition management, records, and general herd health. Field trips required.

442. Advanced Horse Management
Spring. 3(2-2) P: (ANS 242) R: Not open to freshmen or sophomores.
Management of stables and breeding farms. Pedigree and conformational selection, reproduction. Promotion, marketing, economics. Nutrition and feeding, facilities, and herd health. Field trips required.

445. Equine Exercise Physiology
Fall. 4(3-2) P: ANS 315
Research in equine exercise science. Physical, physiologic, metabolic and mental adaptation to athletic training. Nutrition and bioenergetics of muscle metabolism. Field trip required.

455. Avian Physiology
Spring. 4(3-3) P: ANS 315. R: Open only to juniors, seniors and graduate students.
Systemic and comparative physiology of birds: respiration, reproduction, endocrinology, digestion, urination, and the senses.

464. Statistical Methods for Biologists I
Fall. 3(3-0) Interdepartmental with Statistics and Probability; and Crop and Soil Sciences. Administered by Statistics and Probability. P: STT 421.
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression (prediction). Analyses of counted and measured data to compare several biological groups (contingency tables and analysis of variance).

465. Statistical Methods for Biologists II
Spring. 3(3-0) Interdepartmental with Statistics and Probability; and Crop and Soil Sciences. Administered by Statistics and Probability. P: STT 464.
Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.

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

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. P: (ANS 313 or ANS 314 or ANS 315) R: Not open to freshmen. Approval of department; application required.
Animal systems in various global regions. Output, land and resource conservation, and socioeconomic factors.

483. Ruminant Nutrition
Spring. 3(3-0) P: ANS 313, ANS 315. R: Not open to freshmen and 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. P: ANS 210; ANS 313 or ANS 314 or ANS 315. R: Open only to juniors and seniors. Approval of department; application required.
Independent study in genetics, nutrition, physiology, toxicology, meat science, or management of poultry, livestock, or horses.

493. Professional Internship in Animal Science
Fall, Spring, Summer. 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors in the Animal Science major. Approval of department; application required. A student may earn a maximum of 6 credits in the following courses: AEE 493, ANR 493, ANS 493, FW 493, PKG 493, PRM 493, PRR 493, and RD 493.
Supervised professional experience in the animal industry.

499. Senior Thesis in Animal Science
Fall, Spring, Summer. 3 to 9 credits. A student may earn a maximum of 9 credits in all enrollments for this course. P: ANS 313, ANS 314, 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.

807. Advanced Food Toxicology
Fall of even years. 3(3-0) Interdepartmental with Food Science; and Human Nutrition and Foods. Administered by Food Science. R: Approval of department.
Toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, and chemical carcinogenesis. Risk assessment.

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.

813. Techniques in Animal Biotechnology
Summer of odd years. 3(2-2) P: BCH 462 or BCH 472. R: Approval of department; application required.
Basic molecular biology procedures with emphasis on mammalian systems.

824. Methods of Quantitative and Molecular Genetics for Livestock
Spring of odd years. 3(2-2) P: (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 deptartment; 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.

826. Livestock Immunogenetics
Fall of odd years. 4(3-2) P: (ANS 404 or ANS 425)
Evaluation and exploration of indicator traits and candidate genes of immunocompetence that contribute to resistance or susceptibility to infectious diseases of livestock.

827. Integrated Risk Assessment of Environmental Hazards
Spring of odd years. 3(3-0) 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.

841. Advanced Endocrine Physiology and Pharmacology
Fall. 4(4-0) Interdepartmental with Physiology; Pharmacology and Toxicology; and Psychology. Administered by Physiology. P: BCH 461, PSL 432. R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources.
Basic and advanced concepts of endocrine and reproductive physiology and pharmacology.

842. Population Genetics, Genealogy and Genomics
Fall. 3(3-0) Interdepartmental with Forestry; Crop and Soil Sciences; Genetics; and Fisheries and Wildlife; 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.

883. Applied Ruminant Nutrition
Summer. 3(2-2) P: (ANS 313 or ANS 513 or PSL 511) RB: (ANS 483)
Nutritional and metabolic principles for dairy and beef cattle and sheep. Diet formulation. Nutritional assessment and feeding management. Field trips required.

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 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 Animal Science. Approval of department.

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 even years. 3(3-0) Interdepartmental with Human Nutrition and Foods.
Nutritional and endocrine regulation of protein synthesis and degradation, protein quality assessment, protein status, protein-energy malnutrition. Protein metabolism during exercise. Metabolism, digestion, and absorption of amino acids and proteins.

937. Mineral Nutrition and Metabolism
Fall of even years. 3(3-0) Interdepartmental with Human Nutrition and Foods.
Forms and locations of mineral elements in the body, metabolic functions, deficiencies, and toxicities, interrelationships and quantitative requirements.

938. Nutrition: Metabolism and Function of Vitamins
Spring of odd years. 3(3-0) Interdepartmental with Human Nutrition and Foods. Administered by Human Nutrition and Foods.
Regulatory roles of vitamins at cellular and molecular levels.

943. Techniques of Analyzing Unbalanced Research Data
Spring. 4(4-0) Interdepartmental with Crop and Soil Sciences; Forestry; Fisheries and Wildlife; and Horticulture. P: STT 464. R: Open only to graduate students in the College of Agriculture and Natural Resources.
Linear model techniques to analyze research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Estimable comparisons. Hypothesis testing. Computational strategies. Variance and covariance components. Breeding values.

976. Multivariate Methods in Agriculture and Natural Resources
Spring. 4(4-0) Interdepartmental with Forestry; and Fisheries and Wildlife. Administered by Forestry. P: STT 422, MTH 314. R: Open only to graduate students in the College of Agriculture and Natural Resources and in the Interdepartmental Graduate Specializations in Ecology and Evolutionary Biology.
Application of multivariate methods to research problems. Hotelling's T-test, profile analysis, discriminant analysis, canonical correlation, principal components, principal coordinates, correspondence analysis, and cluster analysis.

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 Animal Science. Approval of department.

ANTHROPOLOGY ANP

Department of Anthropology
College of Social Science

101. Introduction to Anthropology
Fall, Spring, Summer. 3(3-0)
Human culture worldwide and throughout human history. Major subfields, methods, theories, and issues. World cultural diversity. Culture and world problems.

201. Sociocultural Diversity
Fall, Spring, Summer. 3(3-0)
Origins and diversity of cultural systems. Theories of culture. Patterns of kinship. Religious, economic, and political institutions.

202. Biocultural Evolution
Fall, Spring, Summer. 3(3-0)
Nature and function of culture and its relationship to human biology. Principles of change from hominid origins to present.

203. Introduction to Archaeology
Fall. 3(3-0)
Theory, methodology, and techniques of archaeology. Applications to questions about past human behavior. History and concepts of archaeology as an anthropological subdiscipline.
SA: ANP 360