

Animal Science

ANSC 624 Monogastric Nutrition - Advanced study of the digestion, absorption and metabolism of nutrients in terms of the needs of monogastrics. Application of principles to swine, poultry and equine nutrition. May be cross-listed with NTDT 624. 3 credits.

ANSC 630 Trace Minerals and Vitamins - See NTDT 630 for course description. 3 credits.

ANSC 632 Elements of Pathology - Microscopic and gross changes in cells, tissues and organs as a result of a disease process. 3 credits.

ANSC 633 Poultry Pathology - Study of poultry diseases with emphasis on their causes, prevention, treatment and control. 3 credits.

ANSC 635 Introduction to Virology - Biological properties and processes of animal viruses influencing the pathogenesis, diagnosis and control of disease. Laboratory emphasis on standard methods of detecting viral activity. 3 credits.

ANSC 636 Immunology of Domestic Animals - Comparative study of the immune response of domestic animals including dog, cat, horse, pig, chicken and others. General topics include otogeny of the immune system, reproductive immunity, neonatal immunity, immunodeficiencies and autoimmunity. 3 credits.

ANSC 637 Avian Immunology - Advanced study of the avian immune system covering cellular and humoral immune responses; autoimmunity; neuroendocrine-immune interactions; nutritional effects on the immune system; and immunogenetics. 4 credits.

ANSC 638 Immunological Techniques - Laboratory sessions demonstrating the various types of cellular and humoral immunity in animals and methods of evaluating the immune response. 1 credit.

ANSC 639 Food Microbiology - See FOSS 639 for course description. 4 credits.

ANSC 644 Bioinformatics - Examines computer applications to biological sciences with emphasis placed upon genomics and proteomics applications. No computer programming experience required. 3 credits.

ANSC 654 Advanced Ruminant Nutrition and Metabolism - Basic aspects of nutrition and metabolism of ruminant animals with emphasis on rumen microbiology, lactation, physiology and growth. May be cross-listed with NTDT 654. 3 credits.

ANSC 668 Research 1-6 credits.

ANSC 670 Principles of Molecular Genetics - Uses fundamentals of nucleic acid biochemistry (replication, repair, and recombination) and bacterial genetics to provide background needed for detailed study of selected topics in animal and plant molecular biology. 3 credits.

ANSC 842 Avian Microanatomy - Study of avian histology using microscopy. Examines the

microscopic structure, cytochemical and functional aspects of cells, tissues and organ systems using domestic fowl as the prototype species. Lectures supplemented with laboratory examination of tissue sections. 3 credits.

ANSC 851 Special Topics in Animal Nutrition - Advanced study in selected current topics of ruminant and/or nonruminant nutrition. 1-3 credits.

ANSC 865 Seminar - 1 credit.

ANSC 868 Research 1-9 credits.

ANSC 869 Master's Thesis 1-6 credits.

ANSC 874 Topics in Molecular Biology - Provides a forum for the discussion of current topics in molecular biology, with reading of relevant primary literature. May be cross-listed with PLSC 874. 1 credit.

ANSC 964 Pre-candidacy Study - Research and readings in preparation of dissertation topic and/or qualifying examinations for doctoral students before admissions to candidacy but after completion of all required course work. 3-12 PF credits.

ANSC 969 Doctoral Dissertation 1-12 PF credits.

UNIV 899 Master's Sustaining: Thesis 0 PF credits.

UNIV 999 Doctoral Sustaining 0 PF credits.

Food Science

FOSC 609 Food Processing - Rationale and history of food processing; organizing unit operations; the maintenance of food quality including food palatability and nutritive value; separation technology including initial operations, size reduction and screening, mixing, filtration, centrifugation and crystallization; and preservation methods including fresh food storage, low temperature and high temperature methods. 4 credits.

FOSC 611 Food Science Capstone – A team-taught capstone course for graduate students to advance food science training by participating in a food product development team that simulates the real-world operation and requires integrated knowledge in the areas of general food science, food chemistry, food analysis, food microbiology and food processing. 4 credits.

FOSC 628 Food Chemistry - Composition of food materials, reaction mechanisms leading to deterioration; interaction of food components to form desirable and undesirable products, pigments, characterization of food polymers. Effect of physical and chemical factors on the structure and functionality of food. 4 credits.

FOSC 629 Food Analysis - The application of instrumentation; UV/Vis, FT-IR and fluorescence spectrophotometry, chromatography (ITLC, LC, GC and HPLC), electrophoresis, and enzyme assays for the determination of food constituents and additives. Official AOAC and

AACC methods utilized. 4 credits.

FOSC 639 Food Microbiology - The role and significance of microorganisms in foods with particular reference to food spoilage, preservation, fermentation, sanitation and poisoning. Current methodology used in the microbiological examination of foodstuffs. May be cross-listed with ANSC 639. 4 credits.

FOSC 645 Food Engineering Technology - Engineering fundamentals for processing of food materials, including applied thermodynamics and heat transfer principles and operations. 4 credits.

FOSC 649 Food Biotechnology - Traditional food biotechnology and biotechnology based on genetic engineering are explored through in-depth study of current examples. Technical, economic and social aspects of biotechnology are researched and analyzed through individual and group assignments and lectures. Field trips provide a view of local biotechnology enterprises. 4 credits.

FOSC 665 Seminar 1-3 credits.

FOSC 668 Research 1-6 credits.

FOSC 868 Research 1- 6 credits.

FOSC 869 Master's Thesis 1- 6 credits.

UNIV 869 Master's Sustaining: Thesis 0 PF.

Supporting Courses in Other Departments

Biological Sciences

BISC 601 Immunochemistry - Methods as basic as immunization and as complex as developing monoclonal antibodies. Methods used to investigate the genetics and protein structure of B-galactosidase. Laboratory course (average 12-15 hours/week) with one hour/week lecture. 4 credits.

BISC 602 Molecular Biology of Animal Cells - Examination of eucaryotic genes, synthesis and processing of messenger RNA and control of protein synthesis with emphasis on regulation of normal cellular growth and differentiation and the process of cancer cell transformation. Emphasis on recombinant DNA technology, monoclonal antibody production and tissue culture. 3 credits.

BISC 604 Nucleic Acids Laboratory - Introduces techniques of gene cloning, amplification, manipulation and expression in *Escherichia coli* and *Bacillus subtilis*. 4 credits.

BISC 605 Advanced Mammalian Physiology - Systemic mammalian physiology; neuromuscular, nervous and cardiovascular systems. 3 credits each.

BISC 617 Laboratory Techniques for Electron Microscopy - Techniques of electron

microscopic study of mammalian tissues, including fixation, embedding, ultrathin sectioning, staining, observation and interpretation. 3 credits.

BISC 619 Gene Expression Laboratory - Laboratory course in techniques of molecular biology. Student generates recombinant viruses which can express large amounts of foreign protein. The protein will be purified and characterized functionally and biochemically using such methods as invitro DNA replication, DNA footprinting, DNA melting and/or unwinding and gel retardation. 4 credits.

BISC 641 Microbial Ecology - Principles of microbial interactions in natural environments, including applications to industrial microbiology and certain types of pollution. 3 credits.

BISC 654 Biochemical Genetics - Emphasis on operon theory, feedback mechanisms, control of cell division, mutagenesis, isolation of RNA, somatic cell genetics, gene amplification, lysogeny restriction and modification, and ribosome structure and function. 3 credits.

BISC 673 Topics In Immunogenetics - In-depth discussion of a number of topics in immunogenetics, e.g., genetics of the immunoglobulin molecule, genetics of the cellular immune response, genetic basis of human immunological diseases. 3 credits.

BISC 679 Virology - Molecular biology of animal viruses. Virus structure and organization; mechanisms of penetration, replication, maturation and transformation. 3 credits.

BISC 806 Advances in Physiology - Colloquium and special studies on a selected aspect of animal physiology. 2 credits.

Chemical Engineering

CHEG 601 Structure and Properties of Polymer Materials. Measurement and control of the microstructure and properties of solid polymers. Structure generation, structure-property models and effects of processing on properties. 3 credits.

CHEG 602 Polymer Process Analysis and Design - Development of the tools of continuum mechanics necessary for the quantitative description of viscoelastic media. Use of principles of chemical kinetics, fluid and continuum mechanics and heat and mass transfer to describe the production and processing of polymeric materials. 3 credits.

CHEG 612 Applied Process Heat Transfer - Principles of heat transfer by conduction, convection and radiation illustrated through the case study approach. Emphasis on analyzing heat balance and heat transfer equations with their proper boundary conditions. 3 credits.

CHEG 615 Special Topics in Mixing - Introduces basic principles of fluid dynamics, rheology and turbulence that dictate the mixing behavior required to implement a desired process result. Agitation in vessels and pipeline and viscous mixing discussed. Emphasis on recent research on the effects of mixing on chemical reactions. 3 credits.

CHEG 616 Chemistry and Physics of Surfaces and Interfaces - Fundamental and engineering

aspects of metal, inorganic and polymer surfaces; their structure and defects, characterization, thermodynamics, adsorption and electronic properties. Applications to catalysis, microelectronics, mechanical properties and environment sensitive behavior. 3 credits.

CHEG 863 Diffusional Operations - Advanced coverage of the latest theoretical and experimental studies in several fields involving mass transfer. These fields include humidification, absorption, extraction, distillation, ion exchange and adsorption. 3 credits.

Chemistry and Biochemistry

CHEM 527 Introductory Biochemistry - A one-semester survey of the fundamentals of biochemistry. 3 credits.

CHEM 620 Analytical Spectroscopy - Experimental aspects of electronic and vibrational spectroscopy. Linear and nonlinear optics; photon counting; Fourier transformation; and topics for the current literature. 3 credits.

CHEM 621 Chemical Separations - Fundamental description of chemical separations. Zone broadening and separation efficiency; and chemistry of separations. Application of fundamental principles to chromatography, electrophoresis, field-flow fractionation and newly emerging techniques. 2 credits.

CHEM 622 Electroanalytical Chemistry - Analytical applications of electrochemistry; dynamic and steady-state methods of potentiometry, coulometry, voltammetry, and ancillary techniques. 3 credits.

CHEM 623 Chemometrics - Provides chemists with an introduction to modern methods of reducing and analyzing chemical data using computers. Covers probability and simple statistics, optimization methods, pattern recognition, factor analysis, regression, time series analysis of chemical data and data transformation methods. 2 credits.

CHEM 624 Interpretation of Mass Spectra - Molecular ions and elemental composition from precise mass and isotopic ratios. Fragmentation mechanisms and the correlations of electron ionization mass spectra with molecular structure. 1 credit.

CHEM 625 Chemical Ionization Mass Spectrometry - Analytical applications of ion/molecule reactions. Mechanisms and thermochemical kinetics of gaseous ionic reactions. Correlations of spectra with molecular structure. Atmospheric pressure ionization mass spectrometry. 1 credit.

CHEM 626 Instrumental Ionization Mass Spectrometry - Experimental techniques in analytical mass spectrometry: ionization methods and applications. 2 credits.

CHEM 627 Practical Mass Spectrometry - Instrumentation and experiments in gas chromatography/mass spectrometry. 1 credit.

CHEM 633 Advanced Organic Chemistry - Stereochemistry and reactivity of organic compounds; and reaction mechanisms, structure and bonding. 3 credits.

CHEM 634 Advanced Organic Chemistry: Synthesis and Reactivity - Reactions of organic compounds, with emphasis on synthetic methods. 3 credits.

CHEM 641 Biochemistry - Structure and function of proteins, enzymes and coenzymes; carbohydrate metabolism and its regulation; and citric acid cycle. 3 credits.

CHEM 642 Biochemistry - Intermediary metabolism of lipids, amino acids, purines and pyrimidines; nucleic acid chemistry; protein and nucleic acid synthesis; molecular basis of genetic regulation; and selected topics. 3 credits.

CHEM 643 Intermediary Metabolism - General principles of intermediary metabolism with emphasis on biosynthetic pathways of amino acids, nucleotides, coenzymes, antibiotics and toxic secondary metabolites. 3 credits.

CHEM 644 Mechanisms of Enzyme Catalysis - Detailed chemical mechanism of enzyme catalysis for several representatives. Emphasis on kinetic and physical organic methods. 3 credits.

CHEM 645 Protein Structure and Function - Overview of structural biology, including how x-ray crystallography, NMR spectroscopy, homology modeling and other techniques are used to solve or model structures of macromolecules. Representative proteins discussed in terms of how a protein's structure relates to its function. 3 credits.

CHEM 648 Membrane Biochemistry - Recent advances in the structure and function of biomembranes and related model systems, with particular reference to molecular and physicochemical mechanisms. 3 credits.

CHEM 649 Molecular Biophysics - Biophysical principles and methods: thermodynamic and kinetic analysis of folding; protein-nucleic acid interactions; ligand binding; spectroscopy; structural methods; modeling; calorimetry; ultracentrifugation; SPR. Problem solving in macro molecular interactions: protein refolding; altering ligand affinity; increasing protein stability; drug design and HTS; protein expression and solubility; protein engineering. 3 credits.

CHEM 651 Advanced Inorganic Chemistry I - Inorganic Chemistry: application of the principles of structure and reactivity, examples from compounds of both the representative elements and the transition metals. 3 credits.

CHEM 652 Organometallic Chemistry - Chemistry of carbon to transition-metal bonds beginning with rules governing structure and stability; effects of metal and ancillary ligand environment; general mechanistic steps; NMR and IR spectroscopy; fluxional processes. Followed by applications in homogenous catalysis and stoichiometric organic synthesis. 3 credits.

CHEM 653 Bioinorganic Chemistry - Overview of our current understanding of the role of metal ions in the structure and function of proteins, enzymes and nucleic acids including applications in medicine. Emphasis is placed on the synergism between biochemical and synthetic model studies with examples provided by the current literature. 3 credits.

CHEM 654 Advanced Inorganic Chemistry II - A group theoretical approach to structure and bonding in inorganic compounds. 3 credits.

CHEM 671 Quantum Chemistry – Basic principles and methods of quantum theory including wave mechanics of simple systems, angular momentum and the hydrogen atom, and approximate methods applied to atomic and molecular structure. 3 credits.

CHEM 672 Advanced Quantum Chemistry - Applications of quantum theory to predictions of molecular structure, energetics, spectra and reactivity; principles of spectroscopy and the interaction of light with molecules; other topics at the instructor's discretion. 3 credits.

CHEM 674 Chemical Dynamics - Experimental methods in chemical kinetics, rate laws and mechanisms, statistical and dynamical theories of reaction rates, and applications of the principles and techniques of kinetics to a variety of systems. 3 credits.

CHEM 677 Chemical Thermodynamics - The elements of classical and statistical thermodynamics and their application to chemical problems. 3 credits.

CHEM 680 Introductory Polymer Science - Provides a broad foundation in the basic concepts of polymer science including synthesis, physical structures and phase transitions, structure/property relationships, material properties, characterization methods and current trends in polymer technology. 3 credits.

CHEM 820 Special Topics in Analytical Chemistry - Advanced topics in analytical methods and techniques from the current literature. 1-3 credits.

CHEM 830 Special Topics in Organic Chemistry - Topics from natural product chemistry (alkaloids, terpenes, steroids), organic nitrogen and phosphorus compounds, alicyclic and heterocyclic compounds, stereochemistry, organometallic chemistry, photochemistry and theoretical organic chemistry. 1-3 credits.

CHEM 840 Modern Topics in Biochemistry - Detailed examination of a number of problems of current research interest in biochemistry. 1-3 credits.

CHEM 850 Special Topics in Inorganic Chemistry - Advanced topics selected from the chemistry of the less common elements, metal hydrides, organometallic compounds and coordination compounds. 1-3 credits.

CHEM 874 Special Topics in Physical Chemistry - 1-3 credits.

Food and Resource Economics

FREC 608 Statistical Research Methods - Experimental design and plot plans, collection, analysis and presentation of data in agricultural and biological research. 3 credits.

FREC 806 Research Techniques and Procedures - Planning research projects with emphasis on methods of collecting and analyzing data, and the presentation of results. A problems course. 3 credits

FREC 810 International Agricultural Trade Special Topics - Advance theory, issues and policies in international agricultural trade emphasizing international finance and agriculture, agricultural trade and development, empirical and methodological issues and international market modeling. 3 credits.

Mechanical Engineering

MEEG 803 Convection Heat Transfer - Forced convection heat transfer in laminar and turbulent boundary layers including viscous dissipation effects. Forced convection heat transfer in pipes and external boundary layers. Free convection boundary layers. 3 credits.

Plant and Soil Sciences

PLSC 804 Plant Molecular Biology - Fundamental and applied aspects of plant molecular biology, including organization of plant genes, genomes, gene expression, gene transfer and genetic engineering. 3 credits

Physics

PHYS 624 Introduction to Solid State Physics - X-ray defraction, structure and properties of metals, insulators and semiconductors, and band theory of solids; includes electrical, optical, magnetic and thermal properties. 3 credits.

PHYS 646 Instrumentation for Scientists - Electronic measurements and instrumentation with emphasis on applications in science. Amplification, noise, low-level signal recovery, lock-in amplifiers, digital signal averaging, frequency and time measurements, transducers, bridges, interfacing to laboratory computers and automation of experiments. 3 credits

Statistics

STAT 615 Design & Analysis of Experiments - Fundamental principles of design, randomized designs, Latin squares, sources of error, components of error. Factorial designs, response surfaces, models for design. 3 credits.

STAT 616 Design & Analysis of Experiments - Planning of experiments, designs for specific problems, fractional factorials, quasifactorial experiments, balanced and unbalanced designs, confounding, introduction to linear estimation. 3 credits.

STAT 635 Statistical Quality Control - Process variation, sequence plotting, control charts, cumulative sum process control procedures; process capability studies, acceptance sampling, quality management and organization, and trouble shooting using graphical techniques.

Mathematics

MATH 611 Introduction to Numerical Analysis and Scientific Computing - Introduction to numerical computing, analysis and solution of systems of linear equations, linear least-squares, eigenvalue problems, methods for unconstrained optimization, solution of systems of nonlinear

equations. Experience with standard computer packages, code development and simulations of applied problems. 3 credits.

MATH 612 Introduction to Numerical Methods for Partial Differential Equations – Basic finite difference schemes for standard model problems. Schemes for integrating time dependent problems (including ordinary differential equations). Curved boundaries. Dispersion and Von Neumann analysis. Lax equivalence theorem and the CFL condition. 3 credits.

Nutrition and Dietetics

NTDT 630 Trace Minerals and Vitamins - Recent advances in knowledge of the nutritional significance of trace minerals and vitamins; their physiological function(s); factors affecting needs and utilization; assessment of requirements; occurrence in food supply; and current issues and concerns. Primary focus on human nutrition with comparative aspects in other living systems utilized to illustrate significant similarities and/or differences.