

DEPARTMENT OF CHEMISTRY, PHYSICS AND ATMOSPHERIC SCIENCES

Dr. Mehri Fadavi
Department Chair
Just Hall of Science Building, Room 327

Faculty

F. Han, E. Heydari, G. Hill, A. Hossain, M. Huang, J. Leszczynski, Y. Liu, P. Ray, T. Shahbazyan, J. Watts, L. White; N. Campbell, S. Goupalov, D. Lu, S. Yang; Q. Dai, M. Islam, N. Pradhan, Y. Zhao, A. Khan, J. Zhou, M. Yasir

Mission

- To provide quality education to its diverse undergraduate and graduate students in fundamental, applied, and interdisciplinary areas of the chemical, physical, atmospheric, earth and space sciences.
- To carry out corresponding research activities leading to scientific discovery by its faculty, research personnel, and students in the areas of computational sciences, nanotechnology, material science, theoretical condensed matter, machine learning, renewable energy, optics and photonics, meteorological observations, modeling and forecasting, and science education.
- To use scientific knowledge and technology to serve its surrounding and international communities.

Objectives

- To prepare students to compete globally by offering rigorous quality science programs, that will inspire and prepare them to seek advanced graduate studies and research and become prepared to enter the science, technology, engineering, and mathematics (STEM) workforce, and contribute professional services within the world's scientific community
- To Maintain excellent research programs
- To provide services to the community and the state
- To promote the professional growth and development of the faculty

The Department of Chemistry, Physics & Atmospheric Sciences (CPAS) offers the Bachelor of Science degrees in Chemistry with American Chemical Society Certification and with concentrations in Pre-Health Profession Preparatory Pathway, Biomedical Science, Environmental Science, and Forensic Science; Physics with concentrations in Pre-Health Profession Preparatory Pathway, Management and Physics Teaching; Meteorology; and Earth System Sciences. Pre-Health Profession Preparatory Pathway includes pre-medicine, pre-dentistry, and pre-pharmacy.

Accreditation

The department offers a comprehensive chemistry program, BS in Chemistry with ACS Certification that is accredited by the American Chemical Society. The department certifies certificates to BS graduates who have completed ACS certification requirements. According to ACS accrediting body, graduates must complete introductory, foundational, and in-depth chemistry courses; 400 hours of laboratory experience

beyond the general chemistry laboratory; and undergraduate research. Our accrediting body is ACS Committee on Professional Training (CPT),

American Chemical Society
1155 Sixteenth Street NW
Washington D.C. 20036
202-872-4589
www.acs.org/cpt (<http://www.acs.org/cpt/>)

Placement Exams

For students to be eligible to take (CHEM 141 GENERAL CHEMISTRY I) and (CHML 141 GENERAL CHEMISTRY LAB), a minimum score of 21 on the MATH ACT, or passing the placement exam will be required.

Requirements for the Major

To receive the BS degree, a student must maintain a C or higher grade in all core science and math courses. The total number of hours of coursework for the BS is 124 semester hours including transfer credits. Standardized tests (GRE, MCAT, MFT, PCAT, etc.), the Chemistry Exit Exam, Research Report, and Research Presentation are required before graduation.

Bachelor

- Chemistry (B.S.) American Chemical Society Certified (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-ac/>)
- Chemistry (B.S.) Biomedical Sciences (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-biomedical-sciences/>)
- Chemistry (B.S.) Environmental Sciences (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-environmental-sciences/>)
- Chemistry (B.S.) Forensic Concentration (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-forensic-concentration/>)
- Chemistry (B.S.) Pre-Profession Concentration (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-pre-profession-concentration/>)
- Chemistry (B.S.) Without Certification (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-bs-without-certification/>)
- Earth System Science (B.S.) (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/earth-system-science-bs/>)
- Meteorology (B.S.) (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/meteorology-bs/>)
- Physics (B.S.) General (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/physics-bs/>)
- Physics (B.S.) Pre-Med with Biology (<https://jsu-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/physics-bs-pre-med-with-biology/>)

technology/department-chemistry-physics-atmospheric-sciences/physics-bs-pre-med-biology/)

- Physics (B.S.) STEMBA (<https://jsums-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/physics-bs-business-management/>)
- Physics Education (B.S.Ed.) (<https://jsums-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/physics-education-bsed/>)

Minor

- Chemistry Minor (<https://jsums-public.courseleaf.com/undergraduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-minor/>)

Course Descriptions

CHEM 131 INTRODUCTION TO CHEMISTRY (3 Hours)

Co-Requisite Mathematics 004 or higher. A study of scientific measurements, mathematic concepts, and basic principles of chemistry to prepare students for General Chemistry (CHEM 141) classes. (F, S, Sum)

CHEM 141 GENERAL CHEMISTRY I (3 Hours)

Prerequisite: A score of 16 or above on the Chemistry Placement Test: MATH 111 or a higher level mathematics course.

A study of the types and properties of matter, measurement, qualitative and quantitative descriptions of chemical reactions, atomic structure, bonding and thermochemistry. (F, S, Sum)

CHEM 142 GENERAL CHEMISTRY II (3 Hours)

Prerequisite: A passing grade in CHEM 141 and CHML 141.

A study of solutions, chemical equilibria, kinetics, thermodynamics, descriptive chemistry. (F, S, Sum)

CHEM 231 INTRO TO ORGANIC CHEMISTRY (3 Hours)

General Chemistry II. A study of scientific measurements, mathematic concepts, nomenclature, chemical bonding, structure and properties of compounds to prepare students for Organic Chemistry.

CHEM 241 ORGANIC CHEMISTRY I (3 Hours)

Prerequisite: CHEM 142 and CHML 142.

Chemistry of carbon compounds, with emphasis on structure, stereochemistry, spectroscopy, and an introduction to synthesis. (F, S, Sum)

CHEM 242 ORGANIC CHEMISTRY II (3 Hours)

Prerequisite: CHEM 241, CHML 241.

Chemistry of carbon compounds, with emphasis on synthesis, and an introduction to biochemistry. (F, S, Sum)

CHEM 310 INTRO TO SCIENTIFIC RESEARCH (2 Hours)

Prerequisite: Consent by advisors.

The course serves as an introduction to scientific research for chemistry students and it is especially important for students entering graduate studies. The course covers scientific literature, scientific writing, scientific presentation, research ethics, and introduction to federal agencies (NSF, NIH, DoD, etc.) and their research focuses, trends, and funding opportunities.

CHEM 320 ANALYTICAL CHEMISTRY (3 Hours)

Prerequisite: CHEM 142, CHML 142, and CHEM 242.

A quantitative study of the equilibrium in aqueous and non-aqueous systems and the application to analytical methods. The application of modern instrumentals techniques is emphasized. (F)

CHEM 340 INORGANIC CHEMISTRY I (3 Hours)

Prerequisite: CHEM 142 and CHML 142.

This course is the first part of a series of two courses. Basic principles, such as chemical equilibrium and reaction kinetics, of inorganic reactions are emphasized in this course. The construction and application of the periodic table of the elements will be discussed. A descriptive discussion of the chemistry of elements will also be included in this course. (S)

CHEM 341 PHYSICAL CHEMISTRY I (3 Hours)

Prerequisite: MATH 231, 232; corequisite prerequisite: PHY 201 or 211.

A study of fundamental concepts; includes structure, properties of gases and thermodynamics. (F)

CHEM 342 PHYSICAL CHEMISTRY II (3 Hours)

Prerequisite: CHEM 341, and CHML 341.

A study of physical chemistry, theory and practice; includes structure of matter, quantum mechanics, electrochemistry and kinetics., (S)

CHEM 371 FORENSIC CHEMISTRY (3 Hours)

This course covers the major forensic sub-disciplines such as firearms and tool mark examination, forensic biology, arson and explosives, questioned documents, and trace evidence. Evidence categories include glass, soil, hairs, fibers, paint (surface coating), and impressions resulting from friction ridge skin, tools, foot wear, etc. (S)

CHEM 380 INDEPENDENT STUDY (1-3 Hours)

Prerequisite: Permission of instructor.

Laboratory investigation on literature research of a topic selected by the student in consultation with the staff. (F, S, Sum)

CHEM 381 CHEMISTRY SEMINAR (0.5 Hours)

Prerequisite: Permission of instructor.

Presentation and discussion of current chemical topics and research by students, faculty and visiting speakers. (F, S)

CHEM 382 CHEMISTRY SEMINAR (0.5 Hours)

Prerequisite: Permission of instructor.

Presentation and discussion of current chemical topics and research by students, faculty and visiting speakers. (F, S)

CHEM 410 ENVIRONMENTAL CHEMISTRY (3 Hours)

Prerequisite: CHEM 320.

Environmental Chemistry is to study of the sources, reactions, transport, effects, and fates of chemical species in water, soil, air, and living environments, and the effects of technology thereon. This course will cover three major areas of environmental chemistry: aquatic chemistry, atmospheric chemistry, and geochemistry. Each one includes organic, inorganic, analytical chemistry and biochemistry for pollutants in the environment, their fates, and analysis. The objectives in the course are to understand how environmental system will behave for the chemical species and to learn how to analyze the pollutants in the system. (F)

CHEM 421 CHEMICAL INSTRUMENTATION (3 Hours)

Prerequisite: CHEM 320, CHML 320 or permission of the instructor.

A lecture course covering the theory and applications of spectroscopic chromatographic and electroanalytical methods. (S)

CHEM 429 Organic Structure Determination by Spectroscopy (3 Hours)

Prerequisite: A passing grade of "C" or higher in Organic Chemistry (CHEM 242)

Using of modern spectroscopic methods, mainly Nuclear Magnetic Resonance, Mass Spectrometry, X-Ray Crystallography, and Infrared Spectroscopy, for elucidation of simple to complex structures of organic compounds. Topics on new developments in modern NMR, X-Ray, MS, and IR will be updated and included.

CHEM 431 BIOCHEMISTRY I (3 Hours)

Prerequisite: CHEM 242.

A study of the chemical composition of living matter and the chemical mechanics of life processes. (S)

CHEM 432 BIOCHEMISTRY II (3 Hours)

Prerequisite: CHEM 431.

A study of the chemical composition of living matter and the chemical mechanics of life processes. (F)

CHEM 436 PHYSICAL ORGANIC CHEMISTRY (3 Hours)

Prerequisite: CHEM 342.

Structure, bonding, and properties of organic compounds.

CHEM 437 ORGANIC SYNTHESIS (2 Hours)

Prerequisite: CHEM 242.

The use of practical organic research techniques in the preparation of organic compounds. (S)

CHEM 439 Introduction to Polymer Chemistry (3 Hours)

Prerequisite: A passing grade of "C" or higher in Organic Chemistry (CHEM 242)

Polymer chemistry is for studying the macromolecules, natural or synthetic polymers, which can be found in everywhere in our life. Understanding the structure and the properties of these polymers with its chemical preparation is imperative for students majoring chemical science. The course will cover the types, properties, how-to synthesize, and application of polymers.

CHEM 441 INORGANIC CHEMISTRY II (3 Hours)

Prerequisite: CHEM 341.

This course is a continuation of the first part of the series. With the knowledge introduced in CHEM 341, a thorough discussion of the atomic properties, the nature of chemical bonds and the symmetry properties of compounds will be included in this course. The chemistry and application of transition metals will be the main theme of this course. The mechanisms of catalysis processes will also be covered. In addition, the function of inorganic elements in living systems will be briefly introduced to keep students updated to the current trends in inorganic research. (F)

CHEM 452 ATOMIC & MOLECULAR STRUCTURE (3 Hours)

Prerequisite: CHEM 342.

An introduction to the concepts and methods of modern molecular spectroscopy. (S)

CHEM 458 QUANTUM MECHANICS (3 Hours)

Prerequisite: CHEM 342.

Principles and applications of quantum theory. (F)

CHEM 471 FORENSIC TOXICOLOGY (3 Hours)

Pre-Requisites: CHEM 320 and CHEM 371. This course covers the major concepts of toxicology that include drug or toxin absorption, distribution, and excretion as well as binding to receptors. The processes and reactions, which transform a drug or toxin into a water soluble substance, also will be discussed. (S)

CHEM 475 FORENSIC PRACTICUM (3 Hours)

Prerequisite: Departmental approval and CHEM 371 and CHML 371.

Students will have an internship at a local or regional crime laboratory to satisfy the practice component of the program and spend a minimum of 8 hours per week at the laboratory for 14 weeks. (S)

CHEM 481 CHEMISTRY SEMINAR (0.5 Hours)

Prerequisite: Permission of instructor.

Presentation and discussion of current chemical topics and research by students, faculty and visiting speakers. (F, S)

CHEM 482 CHEMISTRY SEMINAR (0.5 Hours)

Prerequisite: Permission of instructor.

Presentation and discussion of current chemical topics and research by students, faculty and visiting speakers. (F, S)

CHML 131 INTRODUCTION TO CHEMISTRY LAB (0 Hours)**CHML 141 GENERAL CHEMISTRY LAB (1 Hour)**

Prerequisite: or co-requisite: CHEM 141.

Experiments in the areas covered in CHEM 141. (F, S, Sum)

CHML 142 GENERAL CHEMISTRY II LAB (1 Hour)

Prerequisite: CHML 141, co-requisite: CHEM 142.

Laboratory experiments in the areas covered in CHEM 142. (F, S, Sum)

CHML 241 ORGANIC CHEMISTRY I LAB (1 Hour)

Prerequisite: CHEM 142, CHML 142.

Co-requisite: CHEM 241. Laboratory experiments in the areas covered by CHEM 241. (F, S, Sum)

CHML 242 ORGANIC CHEMISTRY II LAB (1 Hour)

Prerequisite: CHEM 241, CHML 241.

Co-requisite: CHEM 242. Laboratory experiments in the areas covered by CHEM 242. (F, S, Sum)

CHML 243 QUALITATIVE ORGANIC ANALYSIS L (1 Hour)

Prerequisite: CHEM 241, CHML 241; Co-requisites: CHEM 242, 243, UV/Vis and mass Spectroscopy for the elucidation of structure of organic compounds by CHEM 243. (S)

CHML 320 ANALYTICAL CHEMISTRY LAB (1 Hour)

Co-requisite: CHEM 320. Laboratory experiments in the areas covered by CHEM 320.

CHML 340 INORGANIC CHEMISTRY LAB (1 Hour)**CHML 341 PHYSICAL CHEMISTRY I LAB (1 Hour)**

Co-requisite: CHEM 341. Laboratory experiments on physical chemistry phenomena. (F)

CHML 342 PHYSICAL CHEMISTRY II LAB (1 Hour)

Prerequisite: CHEM 341; Co-requisite: CHEM 342.

Laboratory experiments on Physical Chemistry phenomena. (S)

CHML 371 FORENSIC CHEMISTRY LAB (1 Hour)

This course covers the theory and practice of techniques commonly used in forensic science including examination of biological evidence (DNA fingerprinting, bloodstains, etc.), fingerprinting, and impressions resulting from friction ridge skin, tools, foot wear, etc. (S)

CHML 421 CHEMICAL INSTRUMENTATION LAB (1 Hour)

Prerequisite: CHEM 320, CHML 320; co-requisite: CHEM 421.

A laboratory course covering the use of spectroscopic, chromatographic and electrochemical instrumentation for the analysis of materials.

CHML 431 BIOCHEMISTRY I LAB (1 Hour)

Co-requisite: CHEM 431. Basic purification and characterization techniques in biochemistry. (S)

CHML 432 BIOCHEMISTRY II LABORATORY (3 Hours)

Co-requisite: CHEM 432. Basic purification and characterization techniques in biochemistry. (F)

MET 200 INTRO TO METEOROLOGY (3 Hours)

Non-mathematical treatment of the fundamentals of meteorology, effects of weather and climate on man and his activities.

MET 209 INTRO TO PROFSNL METEOROLOGY (1 Hour)

Pre- or Co-requisite: MET 200. A seminar course in which a variety of professional specialties within the area of the atmospheric sciences will be explored by the students. Wherever possible, visiting professionals will be invited to present materials about their specialty in the meteorology curriculum.

MET 210 CLIMATOLOGY (3 Hours)**MET 270 COMPUTAL DATA ANALYS VISUALI (3 Hours)**

This course is an introduction to scientific data analysis and visualization. It focuses on Fortran programming language and MatLab and NCAR Command Language (NCL) visualization software. This course will be helpful for students who are research oriented or intend to pursue graduate studies! The goal of this class isto provide a hands-on experience of an understanding of statistical analysis of environmental data, both in the space, time and special domain. Ideally at the end of the course students will have developed a series of computer programming skills and statistical skills that will aid them in their abilityto analyze, interpret, and model research data. This course is structured around two tracks: computer programming and data visualization. Some knowledge of probability and statistics, and linux commands would be beneficial. However, a background review of concepts and notations will be provided.

MET 303 MEASUREMENTS & OBSERVATIONS (3 Hours)

Prerequisite: MET 200.

Practical experiences in weather observing, gathering and coding meteorological data.

MET 311 GENERAL METEOROLOGY (3 Hours)

Pre- or Co-requisite: MATH 231. Terrestrial energy budget; general circulation; atmospheric motion, fronts and cyclones, mesoscale dynamics, application to weather forecasting and modifications.

MET 321 ATMOSPHERIC THERMODYNAMICS (3 Hours)

Prerequisite: MET 311.

Thermodynamic properties of the atmosphere, hydrostatic equilibrium and stability.

MET 341 DYNAMIC METEOROLOGY (3 Hours)

Prerequisite: MET 311, 321, and MATH 232.

Physical and Mathematical models of atmospheric motion are developed from the basic equations of motion.

MET 411 PHYSICAL METEOROLOGY (3 Hours)

Prerequisite: MET 311, and 321.

Transmission of electromagnetic and sound waves in the atmosphere; the physics of clouds and precipitation; electrical properties of the atmosphere.

MET 421 INTRO TO SYN METEOROLOGY (3 Hours)**MET 431 NUMERICAL METHODS (3 Hours)****MET 435 MESOSCALE METEROLOGY (3 Hours)****MET 472 RES METHD IN METEOROLOGY (1 Hour)**

Prerequisite: Consent of department.

Special problems in meteorology based on research or literature survey terminating with a comprehensive written report. (D)

MET 487 PHYL & DYNMC CLIMATOLOGY (3 Hours)

Prerequisite: MET 341, and 411.

Physical principles underlying the variations and changes in climate; climate controls; elements of microclimatology; interpretation of selected regional climates. (D)

MET 491 HYDROLOGY (3 Hours)**MET 492 SEMINAR IN METEOROLOGY (1-3 Hours)**

Prerequisite: Consent of department.

Meetings for presentation and discussion of topics in meteorology by staff members and students of recent contributions published in current periodicals and of original research. (D)

MET 499 SEMINAR IN ATMOSPHERIC SCIENCE (1 Hour)

Various topics will be discussed and presented by students, faculty, and visitors. All meteorology majors are expected to enroll in the appropriate course numbers as assigned by their advisors.

METL 200 ATMOSPHERIC PROC & PTTNRS LAB (1 Hour)**METL 219 WEATHER ANALYS/FORECASTG LAB I (1 Hour)****METL 299 WEATHER ANALS/FORECASTG LAB II (1 Hour)****METL 303 MEASUREMENTS & OBSRVTNS LAB (1 Hour)****METL 399 WEATHER ANAL/FORECASTG LAB III (1 Hour)****METL 421 SYNOPTIC METEOROLOGY LAB (2 Hours)****PHY 151 INTRODUCTION TO PHYSICS (3 Hours)**

An introduction to some of the basic concepts of physics, intended both for non-science majors seeking scientific literacy and also for students who desire some experience in physics before taking PHY 201 or 11. This course satisfies the Core II physical science requirement.

PHY 198 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 199 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 201 BASIC PHYSICS I (3 Hours)

Prerequisite: MATH 111 and 112, or MATH 118.

Introduction to mechanics, wave motion, sound, and heat, for science majors whose curricula may not include calculus.

PHY 202 BASIC PHYSICS II (3 Hours)

Prerequisite: PHY 201.

A continuation of PHY 201. Introduction to electricity, magnetism, optics, and modern physics.

PHY 205 BASIC PHYSICS (3 Hours)**PHY 211 General Physics I (3 Hours)**

Prerequisite: Minimum grade of C in MATH 241.

Introduction to mechanics, wave motion, sound, and heat. Calculus-based and more intensive than PHY 201.

PHY 212 General Physics II (3 Hours)

Prerequisite: Minimum grade of C in MATH 241 and PHY/L 211.

A calculus-based continuation of PHY 211. Introduction to electricity, magnetism, optics, and modern physics.

PHY 216 MODERN PHYSICS (3 Hours)

Prerequisite: PHY 212.

An introduction to relativity and quantum effects including atomic structure and spectra, nuclear structure and reactions, and high-energy physics.

PHY 241 INTRODUCTN TO ASTRONOMY (4 Hours)

An introductory survey of the solar system, stars, nebulae, and galaxies, with discussion of cosmology, life in the universe, and the space program. Includes weekly observatory sessions. This course satisfies the Core II physical science requirement.

PHY 251 COSMOLOGY FOR NON-SCIENTISTS (4 Hours)

A study of the structure, origin, and evolution of the universe. Includes relevant basic astronomy and discussion of fundamental observations.

PHY 297 Research Methods in Physics (2 Hours)

Prerequisite: Sophomore or Junior and consent of instructor.

This course reinforces concepts learned in advanced science, technology, engineering, and mathematics (STEM) courses helping students to develop critical thinking, writing, research, presentation and analysis skills. The problems presented are analyzed by the class and solutions proposed. Both individual and team development of the solutions proceed.

PHY 298 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 299 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 311 THEORETICAL MECHANICS I (3 Hours)

Prerequisite: PHY 211, and MATH 232.

A modern treatment of classical mechanics including single-particle dynamics, oscillations, gravitation, the calculus of variations. Lagrangian and Hamiltonian dynamics, and central-force motion.

PHY 312 THEORETICAL MECHANICS II (3 Hours)

Prerequisite: PHY 311.

A continuation of PHY 311 including study of systems of particles, noninertial reference frames, rigid-body dynamics, coupled oscillations, continuous systems, the wave equation, and the special theory of relativity.

PHY 330 METHODS OF EXPERIMENTAL PHYSICS (3 Hours)

Prerequisite or Corequisite: PHY 216.

Primarily a laboratory course, comprised of lectures and advanced experiments in electronics, optics, modern physics, and astronomy. Satisfies writing across the curriculum requirements.

PHY 342 OPTICS SPECTRA & LASERS (3 Hours)

Prerequisite: PHY 216.

A lecture course in modern optics covering geometrical, wave, and quantum optics, and modern optical technology, with applications to atomic spectroscopy and lasers.

PHY 351 THERMAL PHYSICS (3 Hours)

Prerequisite: PHY 212.

A study of equations of state, the laws of thermodynamics, thermodynamic potentials, statistical thermodynamics, kinetic theory, and elementary statistical mechanics.

PHY 361 MATH MET OF PHYSICS & CHEMISTRY (3 Hours)

Prerequisite: PHY 212.

An introduction to advanced techniques of applied mathematics used in physics and chemistry, including applied linear algebra, ordinary differential equations, and Laplace's equation.

PHY 362 MATH MET OF PHYSICS & CHEMISTRY (3 Hours)

Prerequisite: PHY 361.

A continuation of PHY 361, including vector calculus, Fourier series and orthogonal expansions, Fourier integrals, complex variables and conformal mappings, complex integration, and the heat and wave equations.

PHY 380 INDEPENDENT STUDY (1-6 Hours)**PHY 398 PHYSICS STUDENT SEMINAR (0.5 Hours)**

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 399 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 411 ELECTROMAGNETIC THEORY I (3 Hours)

Prerequisite: PHY 362.

A study of static electric and magnetic fields including Gauss's Law, Ampere's Law, and the solution of Laplace's equation.

PHY 412 ELECTROMAGNETIC THEORY II (3 Hours)

Prerequisite: PHY 411.

A continuation of PHY 411 including study of time-dependent fields, Maxwell's equations, electromagnetic wave and radiation.

PHY 422 QUANTUM MECHANICS (3 Hours)

Prerequisite: PHY 216 and 362.

An introduction to quantum mechanics wave functions, and the Schrodinger equation, including solution of the Schrodinger equation for a box, barrier, square well, harmonic oscillator, and the hydrogen atom.

PHY 431 ATOMIC & NUCLEAR PHYSICS (3 Hours)

Prerequisite: PHY 422.

A lecture course comprising a study of the properties of atoms and nuclei, and review of classic experiments, and an investigation of related applications of quantum mechanics.

PHY 433 SOLID STATE PHYSICS (3 Hours)

Prerequisite: PHY 216 and 422.

An introduction to solid state physics including crystal structures, electron and mechanical waves in crystals, semiconductors, electric and magnetic properties of solids, and point defects in crystals.

PHY 449 SPECIL TOPICS IN PHYSICS (3 Hours)

Prerequisite: Approval of instructor.

Advanced specialized topic courses selected on the basis of faculty and student interest. This course may be repeated for credit.

PHY 480 RESEARCH PROJECT (3 Hours)

Prerequisite: Approval of instructor.

Supervised original research by the individual student on a problem selected in consultation with the faculty. This course may be repeated for credit.

PHY 481 PHYS. SCI. FOR SEC. TEACHERS I (3 Hours)**PHY 482 PHY SCI FOR SEC TEACHERS II (3 Hours)****PHY 498 PHYSICS STUDENT SEMINAR (0.5 Hours)**

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHY 499 PHYSICS STUDENT SEMINAR (0.5 Hours)

Presentation and discussion of current physics topics and research by students, faculty and visiting speakers. All physics majors are expected to participate.

PHYL 201 BASIC PHYSICS LAB I (1 Hour)

Corequisite: PHY 201.

Weekly laboratory experiments in the areas covered in PHY 201.

PHYL 202 BASIC PHYSICS LAB II (1 Hour)

Prerequisite: PHYL 201.

Corequisite: PHY 202.

Weekly laboratory experiments in the areas covered in PHY 202.

PHYL 211 GENERAL PHYSICS LAB I (1 Hour)

Corequisite: PHY 211.

Weekly laboratory experiments in the areas covered in PHY 211.

PHYL 212 GENERAL PHYSICS LAB II (1 Hour)

Prerequisite: PHYL 211.

Corequisite: PHY 212.

Weekly laboratory experiments in the areas covered in PHY 212.

SCI 201 PHYSICAL SCIENCE (3 Hours)

A study of the universe and natural events in the environment.

SCI 204 GENERAL SCIENCE FOR TEACHERS (3 Hours)

Topics in astronomy, biology, chemistry, geology and physics are studied.

Laboratory work provides for experiments and projects.

SCI 205 EARTH & SPACE SCIENCE (3 Hours)

A geophysical study of the earth with emphasis on the major scientific discoveries about the earth and its relation to the universe.

SCI 215 GLOBAL CHANGE (3 Hours)**SCI 228 SCIENCE SOCIETY & TECHNOLOGY (3 Hours)**

An overview of contemporary topics in science technology and environment.

SCI 310 EARTH HISTORY (3 Hours)**SCI 320 SEDIMENTARY ENVIRONMENTS (3 Hours)****SCI 325 MINERALOGY PETROLOGY (3 Hours)****SCI 331 INTRO TO GIS & REMOTE SENSING (3 Hours)**

This course is open to any undergraduate student who has an interest in learning the basic theory of Geographic Information System (GIS) and Remote Sensing (RS). The course also demonstrates the application of RS and how to use GIS as an analytic tool. We will also discuss theoretical and methodological issues associated with the integration of remote sensing and geographic information systems. GIS is a specialized computer database program designed for the collection, storage, and manipulation, retrieval, and analysis of spatial data. It is a hands-on course in which students are given beginning-level opportunities to process, analyze, and visualize spatial data and information using commercially-available GIS software. In the process, they are introduced to the principles of GIS and its usefulness as an analytical tool and as an effective communication technique in addressing global, environmental, and social science questions. GIS analysis is used in public and private sectors in areas as wide-ranging as policy making, public health, community/regional/state planning, environmental science, sociology, crime analysis, terrorism, agriculture, engineering, business, and marketing. GIS is an analytic tool that many of our majors should learn how to use. One of the primary purposes of the course is to generate enthusiasm and interest in using GIS to make environmental assessments and to analyze social, political, geographic, and economic issues. In addition, in this course, we will also focus on the basic concepts of remote sensing, airborne and space borne sensors, digital image processing, and the principles and practices of remote sensing. We will survey the basic atmospheric radiation and understand imagery interpretation. The course will cover electronic-magnetic frequencies from visible to microwave, descriptions of important satellite orbits and sensors, the retrieval of atmosphere variables from active and passive systems, and basic principles of interpretation.

SCI 401 SCIENCE FOR CHILDREN (3 Hours)

Prerequisite: Junior standing.

Designed to familiarize students with materials, techniques and unifying principles of science with laboratory exercises emphasized.

SCI 403 SEMINAR IN SCIENCE (3 Hours)

Prerequisite: Senior standing.

Provides an opportunity for the student to discuss the most pertinent trends in the fields of science.

SCI 410 MET&CUR MAT FOR SCIENCE CR (3 Hours)

Curriculum materials designed to train the students in the selection, preparation and use of curriculum materials in the teaching of science at the secondary level.

SCI 415 GEOCHEMISTRY (2 Hours)**SCI 420 STRUCTURAL GEOLOGY (3 Hours)****SCI 425 ENVIRONMENTAL GEOLOGY (2 Hours)****SCI 431 APPLIED GIS AND SPATIAL ANALYSIS (3 Hours)**

This course emphasizes geographic information systems (GIS) applications and spatial data analysis in atmosphere-related sciences. Students learn through hands-on case studies, and in-class thinking exercises. GIS is the computerized system designed for the storage, retrieval, and analysis of geographically referenced data. GIS uses advanced analytical tools to explore spatial relationships, patterns, and processes of cultural, biological, demographic, economic, geographic, and physical phenomena. This course covers underlying geographic concepts (world coordinate system and projections, vector map topology, tiled and layered maps, etc.), map design and outputs, geodatabases, attribute data, digitizing, geocoding, spatial data processing, and advanced spatial analysis in atmosphere-related sciences. This course will teach students the core functionality of ArcGIS Desktop software: how to make maps, carry out spatial analysis, and build and edit spatial databases in the context of realistic projects. The technical focus of the course includes computer lab exercises and case studies using the Desktop GIS software, ArcGIS from ESRI. The applications covered in this course include tornado density mapping, tornado siren analysis, hurricane track visualization, social vulnerability mapping for atmospheric disasters, gridded surface temperature (Net CDF) visualization, housing assessment, land use changing, census population and demographic studies, and business applications.

SCI 432 HYDROLOGY (3 Hours)**SCI 480 EARTH SCIENCE SEMINAR (1 Hour)****SCIL 201 PHYSICAL SCIENCE LAB (0 Hours)****SCIL 205 EARTH & SPACE SCIENCE LAB (1 Hour)****SCIL 310 EARTH HISTORY LAB (1 Hour)**