

# CHEM Chemistry

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**CHEM 1010 Essentials of Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Quantitative survey of chemical sciences emphasizing applications in human physiology, clinical chemistry, inorganic, organic, and biochemistry. Experimental principles illustrated with class-room demonstrations. (Credit in CHEM 1010 may not be applied to the major field requirement in chemistry.)

**Prerequisite(s):** Completion of MATH 1001 or MATH 1111 or MATH 1113 or MATH 1161 or MATH 2072.

**CHEM 1030 Chemistry and Your World****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Introduces students to the many ways in which chemistry affects their lives. Topics include plastics, nutrition, drug design and the many aspects of environmental chemistry. Decision-making activities related to real-world societal issues will help develop critical thinking skills.

**CHEM 1040 Chemistry and the Environment****4 Credit Hours. 0,3 Lecture Hours. 0,2 Lab Hours.**

Students will study the fundamental aspects of chemistry in its political, economic, social, and international context. The laboratory will be a primary component of the course in that some of the course material will be first experienced in the laboratory. The laboratory will stress experimental design and data analysis as applied to environmental science.

**CHEM 1151K Survey of Chemistry I****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

First course in a two-semester sequence covering elementary principles of general, organic and biochemistry designed for allied health professions majors. Topics to be covered include elements and compounds, chemical equations, nomenclature, and molecular geometry. Laboratory exercises supplement the lecture material.

**Prerequisite(s):** A minimum grade of "C" in MATH 1111 or placement eligibility for a higher math course.

**CHEM 1152K Survey of Chemistry II****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

Second course in a two-semester sequence covering elementary principles of general, organic and biochemistry designed for allied health professions majors. Laboratory exercises supplement the lecture material.

**Prerequisite(s):** A minimum grade of "C" in either CHEM 1151K or CHEM 1212K.

**CHEM 1211 Principles of Chemistry I****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

First course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Topics to be covered include composition of matter, stoichiometry, periodic relations, and nomenclature.

**Prerequisite(s):** A minimum grade of "C" in MATH 1111 or placement eligibility for a higher math course (MATH 1112, MATH 1113, MATH 1114), and prior or concurrent enrollment in CHEM 1211L.

**CHEM 1211K Principles of Chemistry I****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

First course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Topics to be covered include composition of matter, stoichiometry, periodic relations, and nomenclature. Laboratory exercises supplement the lecture material.

**Prerequisite(s):** A minimum grade of "C" in MATH 1111 or placement eligibility for a higher math course.

**CHEM 1211L Principles of Chemistry I Laboratory****1 Credit Hour. 0 Lecture Hours. 3 Lab Hours.**

Laboratory exercises supplement the lecture material of CHEM 1211.

**Prerequisite(s):** Prior or concurrent enrollment in CHEM 1211.

**CHEM 1212 Principles of Chemistry II****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Second course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors.

**Prerequisite(s):** A minimum grade of "C" in CHEM 1211.

**Corequisite(s):** CHEM 1212L.

**CHEM 1212K Principles of Chemistry II****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

Second course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Laboratory exercises supplement the lecture material.

**Prerequisite(s):** A minimum grade of "C" in either CHEM 1211K, or CHEM 1211 and CHEM 1211L.

**CHEM 1212L Principles of Chemistry II Laboratory****1 Credit Hour. 0 Lecture Hours. 3 Lab Hours.**

Laboratory exercises supplement the lecture material of CHEM 1212.

**Prerequisite(s):** A minimum grade of "C" in CHEM 1211L.

**Corequisite(s):** CHEM 1212.

**CHEM 1310 Comprehensive General Chemistry****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

Fundamental laws and theories of chemical reactions. Topics include atomic structure, bonding, theory, stoichiometry, properties of matter; chemical thermodynamics, electrochemistry and kinetics. Prior completion of a high school chemistry course is highly recommended.

**CHEM 2099 Special Topics in Chemistry****4 Credit Hours. 0-3 Lecture Hours. 0-3 Lab Hours.**

Course taught on a special topic in chemistry on a one-time basis.

**Prerequisite(s):** Permission of instructor.

**CHEM 2100 Analytical Chemistry****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

The study of modern quantitative determination methods, including volumetric and gravimetric analyses, equilibrium calculations, and acid/base chemistry, as well as the fundamental theory of chromatography, spectroscopy, and electrochemistry.

**Prerequisite(s):** A minimum grade of "C" in either CHEM 1212K or CHEM 1212 and CHEM 1212L.

**CHEM 2400 Fundamentals of Organic Chemistry and Biochemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Fundamentals of organic chemistry applied to the major biochemical pathways. Course designed for allied health majors. (Credit may not be applied to the major field requirement in chemistry.)

**Prerequisite(s):** A minimum grade of "C" in CHEM 1212K or CHEM 1212 and CHEM 1212L.

**CHEM 2900 Principles of Chemistry Research****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course designed to develop basic research and laboratory skills in chemistry majors. Skills to be covered include literature and scientific writing, scientific ethics, report writing, presentation skills, waste handling, chemical labeling, SDS sheets, and appropriate use of common equipment. Additional topics to be covered include career options for chemists and resume/interviewing skills.

**Prerequisite(s):** A minimum grade of "C" in either CHEM 1212K, or CHEM 1212 and 1212L.

**CHEM 3000 Special Topics in Chemistry****5 Credit Hours. 0-3 Lecture Hours. 0-6 Lab Hours.**

An intensive study in a specialized field of chemistry. Provides an in-depth look at an area of special interest which is not a part of the standard coursework in chemistry.

**Prerequisite(s):** Permission of instructor required.

**CHEM 3010 Scientific Glassblowing****2 Credit Hours. 0 Lecture Hours. 6 Lab Hours.**

Develops the fundamental glassblowing skills required for the construction of glassware used in scientific investigations.

**Prerequisite(s):** Junior standing and science major required.

**CHEM 3100 Instrumental Analysis****4 Credit Hours. 0,4 Lecture Hours. 0,3 Lab Hours.**

The study of modern spectroscopy and chromatography methods. The spectroscopic methods to be covered may include mass spectrometry, ultraviolet/visible spectroscopy, fluorescence spectroscopy, atomic spectroscopy, infrared spectroscopy and raman spectroscopy. The chromatographic methods to be covered may include gas chromatography, liquid chromatography, supercritical fluid chromatography, thin-layer chromatography and capillary zone electrophoresis. Students may not receive credit for both CHEM 3100 Instrumental Chemistry and BCHM 3100 Bioinstrumental Chemistry.

**Prerequisite(s):** A minimum grade of "C" in CHEM 2100.**CHEM 3300 Inorganic Chemistry****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

Introduces students to a broad overview of modern inorganic chemistry. Included are considerations of molecular symmetry and group theory, bonding and molecular orbital theory, structures and reactivities of coordination compounds, organometallic chemistry, catalysis and transition metal clusters. Laboratory experiences will include the measurement of several important features of coordination compounds, such as their electronic spectra and paramagnetism, as well as the synthesis and characterization of organometallic compounds. Majors may not receive credit for both CHEM 3300 Inorganic Chemistry and BCHM 3310 Bioinorganic Chemistry.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3402 and CHEM 2100.**Corequisite(s):** CHEM 3300L.**CHEM 3401 Organic Chemistry I****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

Introduces the fundamental concepts of structure and reactivity of organic compounds. Topics covered include the chemistry of alkanes, alkyl halides, alkenes, and alcohols, as well as the concepts of reaction mechanisms, stereochemistry and spectroscopy of organic compounds.

**Prerequisite(s):** A minimum grade of "C" in either CHEM 1212K, or CHEM 1212 and CHEM 1212L.**CHEM 3402 Organic Chemistry II****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

A continuation of CHEM 3401 focusing on alkynes, aromatic compounds, aldehydes, ketones, amines, and carboxylic acids and their derivatives. Emphasizes the synthetic and mechanistic aspects of these compounds and will continue the study of spectroscopy of organic compounds.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3401.**CHEM 3410 Introduction to Molecular Modeling****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course explores the use of computational chemistry models and their application to chemical research. Topics include the computational methods and model chemistries, single-point energy calculations, geometry optimizations, relative energies and stabilities, calculations of NMR chemical shifts, and vibrational frequency calculations among other topics. **Prerequisite(s):** A minimum grade of "C" in CHEM 3401.

**CHEM 3501 Chemical Kinetics and Thermodynamics****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

A survey of chemical kinetics and thermodynamics. Covers the kinetic theory of gases, rates of reaction, integrated rates, rate laws and reaction mechanisms, followed by a development of the three laws of thermodynamics, chemical and phase equilibria and solution thermodynamics. Students may not receive credit for both CHEM 3501 Chemical Kinetics and Thermodynamics and BCHM 3510 Biophysical Chemistry.

**Prerequisite(s):** A minimum grade of "C" in CHEM 2100 and MATH 2242 and PHYS 2211K.**CHEM 3502 Introduction to Quantum Chemistry****4 Credit Hours. 0,3 Lecture Hours. 0,3 Lab Hours.**

A development of quantum chemistry and its application in a number of relevant areas. Covers atomic structure, molecular structure, molecular spectroscopy, and statistical mechanics.

**Prerequisite(s):** A minimum grade of "C" in CHEM 2100 and MATH 2242 and PHYS 2212K.**CHEM 3700 Teaching Internship in Chemistry****1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

Student internship in the laboratory component of CHEM 1040 (Chemistry and the Environment) under the mentorship of a faculty member. The student will participate in an introductory workshop immediately prior to the start of the semester, intern in the CHEM 1040 laboratory and meet with the faculty mentor one hour each week. One credit hour per laboratory section of CHEM 1040 in which the student interns.

**Prerequisite(s):** Permission of the instructor and one of the following: CHEM 2900 or CHEM 3401.**CHEM 3901 Chemical Research****1-3 Credit Hours. 0 Lecture Hours. 3-9 Lab Hours.**

Faculty-originated chemical lab-based research project. Written report. Open to transient students only with permission of the Dean of Arts and Sciences at AASU and the student's home college.

**CHEM 4050 Ethical Issues in Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will explore the ethical issues of science integrity and responsibility that have confronted the scientific community in the past and today as it relates to research practices and its impact on the public domain. **Prerequisite(s):** A minimum grade of "C" in CHEM 3402.

**CHEM 4110 Advanced Spectroscopy****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Introduces students to modern chemical structure elucidation using spectroscopic techniques. Details of multi-nuclear one dimensional NMR spectra are discussed in depth, detailing both the background behind the techniques and their use in determining chemical structure. Multi-nuclear two-dimensional NMR spectra are used introduced as well, as well as the use of Fourier Transform IR spectroscopy and UV-Vis region spectroscopy.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3402 and CHEM 2100.**CHEM 4120 Electrochemical Analysis****3 Credit Hours. 0,3 Lecture Hours. 0 Lab Hours.**

Theory and practice of modern electrochemical methods of analysis. These methods include potentiometry, coulometry, voltammetry, computer simulation and other modern forms of electrochemical analysis. **Prerequisite(s):** A minimum grade of "C" in CHEM 2100.

**CHEM 4130 Industrial Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will provide an overview of the chemical industry. In addition to providing a basic understanding of the top 50 industrial chemicals, their manufacturing processes, and raw materials sources, the course will also cover the origin and manufacture of basic petroleum feed stocks and petrochemicals; catalysis; pulp and paper chemistry; polymers and plastics; adhesives, sealants, and glues; agricultural chemistry; pharmaceutical chemistry; and selected topics of importance to the industry.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3300.**CHEM 4140 Principles of Chemical Separations****4 Credit Hours. 3 Lecture Hours. 3 Lab Hours.**

This course will examine theories, and models of separation with applications to the analyses of a wide range of chemical, biological, and environmental samples. Topics include high-resolution gas chromatography and high-performance liquid chromatography. Emphasis is on the theory of reverse-phase, normal-phase, ion-exchange, size-exclusion, and affinity-based separations. Instrumentation such as detectors, pumps, and columns, and data acquisition and analysis are also presented. **Prerequisite(s):** A minimum grade of "C" in CHEM 2100.

**CHEM 4150 Chemometrics****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

The course will cover application of mathematical and statistical techniques for the analysis of complex chemical data set and to support experimental design. Prerequisite(s): A minimum grade of "C" in CHEM 3402 and CHEM 3100.

**CHEM 4160 Forensic Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Introduction to forensic chemistry, which may include utilization of physical evidence in law enforcement, processing a crime scene, the application of chemistry principles to the identification and analysis of physical evidence, toxicology, microscopy, and aspects of arson.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3402 and CHEM 3100.

**CHEM 4210 Biotechnology and Biocatalysis****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course introduces principles and techniques in biotechnology. The biotechnology topics will be used to study the past, present, and future of biocatalysis. Prerequisite(s): A minimum grade of "C" in BCHM 5201. Cross Listing(s): BCHM 4210.

**CHEM 4220 Chemistry of Biofuels****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course introduces the principles of fuels and biofuels. It will also cover the latest in biochemistry and biotechnology and apply this knowledge to current research in biofuels. Prerequisite(s): A minimum grade of "C" in BCHM 5201. Cross Listing(s): BCHM 4220.

**CHEM 4310 Polymer Materials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will introduce the world of polymer materials, which have become ubiquitous in daily life. The course will cover how polymers are synthesized and characterized, the unique properties of polymers, and how polymer materials are used. Important concepts on polymer structure, molecular weight and its distribution, glass transition, and amorphous versus crystalline state will be introduced. Prerequisite(s): A minimum grade of "C" in CHEM 3401.

**CHEM 4320 Green Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course focuses on understanding the basic principles of green chemistry and applying them to make organic reactions and processes environmentally benign. Other course topics will include the study of the earth and its atmosphere, the concept of atom economy, catalysis, and enzyme catalysis, as well as green reaction media and the use of various renewable energy sources in organic reactions.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3402.

**CHEM 4330 Solid State Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This is an introductory course in solid state chemistry. It will cover synthesis, structure-property relationships and common characterization techniques for solid materials. The lab component will cover select syntheses and characterization techniques of extended solids, focusing on Single crystal and Powder X-ray diffraction structure determinations, and Rietveld Refinement techniques.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3300 and CHEM 3100.

**CHEM 4340 Materials Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will be an introduction to materials chemistry, with emphasis on the interdisciplinarity of material research. It will overview various classes of materials, including synthesis and characterization, their structural and physical properties, and how those properties relate to their potential applications.

**Prerequisite(s):** A minimum grade of "C" in CHEM 3300 and CHEM 3402.

**CHEM 4410 Food Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Explores the chemistry associated with the production and processing of food. Includes an examination of the primary literature. Prerequisite(s): A minimum grade of "C" in CHEM 3402.

**CHEM 4510 X-ray Crystallography****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Diffraction and crystal structure with identification from single crystal and powder patterns. Lattice parameters and crystal orientation.

**Prerequisite(s):** A minimum grade of "C" in CHEM 2100 and CHEM 3402.

**CHEM 4790 Chemistry Internship****1-4 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

Intended primarily for students who plan to seek employment in the chemical industry after graduation rather than going on to graduate or professional studies, this course will provide students with practical experience in industry and business. Students will secure employment on their own, earning academic credit and possible compensation, and gain practical experience and technical training. Students must complete a minimum of 120 hours of on-site work for each credit hour earned.

**CHEM 4900 Chemical Research Experience****1-4 Credit Hours. 0 Lecture Hours. 3-12 Lab Hours.**

An independent research experience in which a student will investigate a research problem under the direction of a faculty member. All laboratory.

**Prerequisite(s):** Permission of instructor required.

**CHEM 4990 Independent Study****1-3 Credit Hours. 1-3 Lecture Hours. 3-9 Lab Hours.**

Supervised individual research or study.

**CHEM 5110 Environmental Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A survey of the current environmental issues and the underlying chemistry associated with them, including stratospheric chemistry, air pollution, global climate change, toxic organic chemicals, natural water systems, soil chemistry, and energy production. Prerequisite(s): A minimum grade of "C" in CHEM 2100 and CHEM 3402.

**Cross Listing(s):** CHEM 5110G.

**CHEM 5110G Environmental Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A survey of the current environmental issues and the underlying chemistry associated with them, including stratospheric chemistry, air pollution, global climate change, toxic organic chemicals, natural water systems, soil chemistry, and energy production. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.

**Cross Listing(s):** CHEM 5110.

**CHEM 5410 Advanced Organic Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course designed to build upon the knowledge gained in CHEM 3401 (Organic I) and CHEM 3402 (Organic II). Topics covered may include considerations of structural and mechanistic organic chemistry, synthetic organic chemistry and bioorganic chemistry. Prerequisite(s): A minimum grade of "C" in CHEM 3402.

**Cross Listing(s):** CHEM 5410G.

**CHEM 5410G Advanced Organic Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course designed to build upon the knowledge gained in CHEM 3401 (Organic I) and CHEM 3402 (Organic II). Topics covered may include considerations of structural and mechanistic organic chemistry, synthetic organic chemistry and bioorganic chemistry. Graduate students will complete assignments beyond the scope of the undergraduate requirements. These assignments require higher-level mastery of the subject matter and additional deliverables representative of graduate-level work, as determined by the instructor.

**Cross Listing(s):** CHEM 5410.

**CHEM 5420 Principles of Drug Design****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course designed to introduce the chemistry of drug design and development, as well as drug actions and their impacts on society. Topics include drug discovery, receptor site theory, neurotransmitters, pharmacokinetics, federal drug laws, drugs in sports and individual classes of drugs. Prerequisite(s): A minimum grade of "C" in CHEM 3402. Cross Listing(s): CHEM 5420G.

**CHEM 5420G Principles of Drug Design****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

A course designed to introduce the chemistry of drug design and development, as well as drug actions and their impacts on society. Topics include drug discovery, receptor site theory, neurotransmitters, pharmacokinetics, federal drug laws, drugs in sports and individual classes of drugs. Graduate students will complete assignments beyond the scope of the undergraduate requirements. These assignments require higher-level mastery of the subject matter and additional deliverables representative of graduate-level work, as determined by the instructor. **Cross Listing(s):** CHEM 5420.

**CHEM 5430 Carbohydrate Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course provides students with an introduction to the chemistry of carbohydrates. Topics include structural aspects, stereochemistry, synthesis, conformational analysis, polysaccharides, and vaccine development. Prerequisite(s): A minimum grade of "C" in CHEM 3402. Cross Listing(s): CHEM 5430G.

**CHEM 5430G Carbohydrate Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course provides students with an introduction to the chemistry of carbohydrates. Topics include structural aspects, stereochemistry, synthesis, conformational analysis, polysaccharides, and vaccine development. Graduate students will complete assignments beyond the scope of the undergraduate requirements. These assignments require higher-level mastery of the subject matter and additional deliverables representative of graduate-level work, as determined by the instructor. Cross Listing(s): CHEM 5430.

**CHEM 6130 Industrial Science****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will provide an overview of the chemical industry, focusing on the chemistries located in the Southern US. Topics to be covered will be the origin and manufacture of basic petroleum feedstocks and petrochemicals; catalysis; pulp and paper chemistry; polymers and plastics; adhesives, sealants, and glues; agricultural chemistry, green chemistry, and nuclear chemistry. Financial analysis, costs, and intellectual property will be discussed. The impact of these industries on the economy of the Southern United States will also be addressed.

**CHEM 6131 Solid State Materials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course is an introduction to the physical and chemical properties of solids. Topics may include: periodic structure, symmetry of crystals, diffraction, reciprocal lattice, chemical bonding, lattice dynamics, phonons, thermal properties, and free electron gas. Bloch theorem, band structure, nearly free electron approximation, tight binding method, Fermi surface, semiconductors, electrons, holes, impurities, optical properties, excitons, and magnetism will be introduced.

**Prerequisite(s):** A minimum grade of "C" in MATH 2242.

**Cross Listing(s):** CHEM 6131.

**CHEM 6133 Photonics Plasmonics & Metamat****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

The course offers an introduction into theory and models related to photonics and electronics of photonic crystals, plasmonic metal nanostructures, metal-dielectric metamaterials and metasurfaces, localized scatterers and emitters. Students will improve their overall understanding of how these methods and models apply to practical systems related to spectroscopy, imaging, excitation and control over condensed, chemical and biological nano- and microstructures. The course covers a broad range of topics including: dielectric properties of materials in relation to their electronic structure, propagation and emission of radiation in strongly inhomogeneous and anisotropic materials, introduction into plasmonics, properties of photonic crystals and metamaterials, Mie theory of light scattering and near-fields at micro and nanoparticles, optical forces and tweezers, energy and momentum transfer in light-matter interactions and others.

**CHEM 6230 Scientific Inquiry and Ethics****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will provide a foundation in modern research methods, data handling and analysis, and a grounding in the current standards for scientifically ethical behavior and publishing.

**CHEM 6530 Professional Science Communication****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course is designed to prepare professional scientists and science academicians in the skills of effective communication in order to convey scientific principles and knowledge to others in the sciences. It will also create awareness of the need to write promoting science understanding in lay people.

**CHEM 6730 Master of Science in Physical Science Internship****3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

This course is the required internship for the Master of Science in Physical Science (MSPS) degree. Students will apply their skills and knowledge to a current problem in a professional setting, either on campus or at the site of a participating sponsor.

**CHEM 6940 Special Topics in Chemistry****1-4 Credit Hours. 0-4 Lecture Hours. 0-12 Lab Hours.**

Topics chosen from all fields of chemistry dependent on instructor and student interest. Offered by special arrangement.

**CHEM 6971 Independent Study I****1-4 Credit Hours. 0-4 Lecture Hours. 0-12 Lab Hours.**

Qualified students perform literature searches and supervised laboratory experimentation and write acceptable research reports. Proposed work must be approved in writing by supervising faculty and department head prior to initiation.

**CHEM 7020 Chem for Secondary Sci Teacher****1-4 Credit Hours. 0-4 Lecture Hours. 0-12 Lab Hours.**

Topics in chemistry with emphasis on their application to the secondary science classroom. Hands-on activities may include demonstrations, laboratory experiments and computer technology.

**CHEM 7090 Selected Topics/Chemistry****1-6 Credit Hours. 0-6 Lecture Hours. 0-6 Lab Hours.**

A course taught on a one time basis. Lecture only courses will be three credit hours while courses with a laboratory will be four credit hours.

**CHEM 7130 Sustainability in the Physical Sciences****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will provide an overview of sustainability, including current standards of sustainability, quantitative methods of measurement, and current applications of sustainable practices. The twelve Principles of Green Chemistry and Engineering will form the foundation of this course. Case studies, analysis of sustainability trends and common practices, and future research will be covered. Lifecycle analysis, current best practices in sustainability, the triple bottom line, social impacts of sustainability, and other topics will be discussed.

**CHEM 7231 Theoretical Chemistry****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

Chemistry research is increasingly supported by quantum chemical computations. This course will provide students with a complete understanding of ab initio quantum chemistry. Students are exposed to Hartree-Fock, MP2, and Coupled Cluster Theory in addition to basis sets and practical computational approaches. Upon completion, students will be able to choose a proper computational method, to diagnose issues that may arise within such computations, and also to compare methods from mathematical arguments. Prior knowledge in quantum chemistry and/or mechanics is highly recommended.

**CHEM 7232 Toxicology of Nanomaterials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course covers concepts related to the toxicity of nanomaterials. Students will design methods for studying nanomaterial toxicity as well as for profiling various classes of nanomaterials.

**CHEM 7334 Polymer Materials****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will introduce students to the world of polymer materials, which are ubiquitous in daily life around the world. It will cover the chemistry of hard and soft polymers, applied polymer science, and the analysis of polymeric materials. This course will also cover how polymers are synthesized and characterized, what unique properties polymers have, and how polymer materials are used. Material covered will include different ways of synthesizing polymers, including step, chain (free radical, "controlled" free radical, ionic), catalytic, and ring opening polymerizations. Important concepts on polymer structure, molecular weight and its distribution, glass transition, and amorphous versus crystalline state will be introduced. Various physical properties and applications of polymers, including mechanical and electrical properties, will also be briefly described.

**CHEM 7335 Coatings Technology****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will introduce the fascinating field of coatings technology, which is widely applied in daily life. The course will cover what a coating is typically composed of, what typical coating binders are and how they are made, how to formulate a coating (different coating categories), and how typical coatings properties are affected by various ingredients.

**CHEM 7531 Chemistry of Biomolecules I****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course covers the fundamental structure and function of the three major classes of biomolecules: proteins, lipids, and carbohydrates, as well as signal transduction, DNA technologies, and membrane transport.

**CHEM 7532 Chemistry of Biomolecules II****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course covers the catabolism and anabolism of biomolecules of proteins, lipids, and amino acids and examines nucleic acid chemistry, including DNA replication, transcription, translation, and recombinant DNA technology.

**CHEM 7630 Graduate Seminar****3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.**

This course will consist of formal seminars and informal sessions on current topics of interest to the program as presented by visiting lecturers, local researchers, and students. All MS-APS students must attend a set number of seminars each term they are enrolled in the program. Thesis track students in their final semester will prepare a comprehensive presentation on their thesis research as well as submit a report reviewing the topics covered during the seminar series.

**CHEM 7895 Research****1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

Graduate students will pursue, under the direction of their advisory committee, a program of independent research in a particular area of physical science. Results of the research will be presented as a thesis in partial fulfillment of the Master of Science in Applied Physical Science degree.

**CHEM 7940 Chem for Middle Grades Teacher****1-4 Credit Hours. 0-4 Lecture Hours. 0-12 Lab Hours.**

Topics in chemistry with emphasis on their application to the middle grades classroom. Hands-on activities may include demonstrations, laboratory experiments and computer technology.

**CHEM 7999 Thesis****1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.**

Results of an individual, independent research project will be presented as a thesis in partial fulfillment of the Master of Science in Physical Science degree. The thesis requires defense of the design, execution, analysis, and interpretation of the research project.