DEPARTMENT OF CHEMISTRY, PHYSICS AND ATMOSPHERIC SCIENCES

Dr. Mehri Fadavi, Professor and Chair
P. O. Box 17910
Phone: (601) 979-2171 or (601) 979-7012
Fax: (601) 979-3674 or (601) 979-3630
E-mail: mfadavi@jsums.edu

Faculty

Dr. N. Campbell, Associate Professor
Dr. Q. Dai, Associate Professor
Dr. M. Fadavi, Professor
Dr. S. Goupalov, Associate Professor
Dr. F. Han, Professor
Dr. E. Heydari, Professor
Dr. G. Hill, Professor
Dr. Md. Hossain, Professor
Dr. M. Huang, Professor
Dr. M. Islam, Assistant Professor
Dr. K. Lee, Professor
Dr. J. Leszczynski, Presidential Distinguished Professor
Dr. Y. Liu, Professor
Dr. D. Lu, Associate Professor
Dr. I. Ogungbe, Associate Professor
Dr. N. Pradhan, Associate Professor
Dr. P. Ray, Professor
Dr. S. R. Reddy, Professor
Dr. T. Shahbazyan, Professor
Dr. H. Tachikawa, Professor Emeritus
Dr. J. D. Watts, Professor
Dr. L. White, Associate Professor
Dr. S. Yang, Associate Professor
Dr. M. Yasir, Visiting Assistant Professor
Dr. Y. Zhao, Associate Professor
Dr. J. Zhou, Assistant Professor

Program Description

The Department of Chemistry, Physics and Atmospheric Sciences offers both a Doctor of Philosophy (Ph.D.) and a Master of Science (M.S.) degree in Chemistry, and Master of Science Teaching (MST). The Ph.D. degree in chemistry requires evidence of high-quality scientific research leading to peer-reviewed publications with classroom teaching, laboratory supervising, and proposal and manuscript writing experiences. The program covers all modern areas of chemistry including analytical, biochemistry, computational, environmental, inorganic, organic, and physical chemistry, as well as interdisciplinary areas in material, energy, environmental, and biomedical research. The intensive graduate training includes formal lecture courses, hands-on laboratory, and theoretical research experiences, teaching experiences, independent proposal development, preparation of manuscripts and preparation of research thesis/dissertation for publication.

Program Mission

The Department of Chemistry, Physics and Atmospheric Sciences aims to provide a comprehensive graduate education in all areas of modern chemistry and related fields for a diverse student body. These programs aim for national and international distinction and produce high quality chemists for education institutions, governmental agencies, and industrial and business entities.

Program Objectives

- To provide the best education and career opportunity for students from the underrepresented minority groups with a nurturing environment conducive to learning and scholarly activities.
- To provide opportunities in which students can develop methods of independent and systematic investigations leading to scientific discoveries.
- To prepare students for a successful career at academic institutions, industrial and business entities, and governmental agencies.
- To promote professional development and growth of the faculty.

Time Limits

For full-time students working toward an **M.S. degree**, the degree requirements should be completed by the end of the second year following the first semester of study. Students beyond their second year of full-time study will be reviewed by their Graduate Advisory Committee for satisfactory progress every semester. A report of unsatisfactory will result in dismissal from the program. Under special circumstances, MS students must graduate in three years in full time status. Part time students are considered separately.

For full-time students working toward a **Ph.D. degree,** we recommend that the final defense be completed within five years. Under special circumstances, Ph.D. students must graduate in eight years in full time status. Part time students are considered separately. Students beyond their fifth year of full-time study will be reviewed by their Graduate Advisory Committee for satisfactory progress every semester. A report of unsatisfactory will result in dismissal from the program. The student will be allowed to apply for a Master's degree in this case.

Masters

- Chemistry (M.S.) (https://jsums-public.courseleaf.com/graduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-ms-/)

Doctoral

- Chemistry (Ph.D.) (https://jsums-public.courseleaf.com/graduate/college-science-engineering-technology/department-chemistry-physics-atmospheric-sciences/chemistry-phd/)

Course Descriptions

CHEM 523 ADVANCED ANALYTICAL CHEMISTRY (3 Hours)
Prerequisite: Courses in Analytical Chemistry and Physical Chemistry.
Principles and application of selected analytical methods including electrochemistry, spectroscopy and selected topics of unusual current interest.

CHEM 531 BIOCHEMISTRY (3 Hours)
Prerequisite: One year of Organic Chemistry.
The chemical composition of living matter and the chemical mechanics of life processes.

CHEM 532 BIOCHEMISTRY (3 Hours)
Prerequisite: One year of Organic Chemistry.
The chemical composition of living matter and the chemical mechanics of life processes.

CHEM 536 PHYSICAL ORGANIC CHEMISTRY (3 Hours)
Prerequisite: Physical Chemistry and Organic Chemistry.
A study of organic molecular structure, Woodward Hoffmann Rules, substituents effects, intra- and intermolecular forces, kinetics and stereochemistry.

CHEM 541 ADVANCED INORGANIC CHEMISTRY (3 Hours)
Prerequisite: An undergraduate course in Physical Chemistry.
A study of inorganic compounds with the application of Physical Chemistry principles to thermodynamic, kinetic and structural problems.

CHEM 558 QUANTUM CHEMISTRY (3 Hours)
Prerequisite: Physical Chemistry.
Principles and applications of quantum theory.

CHEM 580 THESIS RESEARCH (1-6 Hours)
Prerequisite: Permission of adviser.
Selected topics arranged in consultation with the staff; includes literature, research, and laboratory investigation of a problem.

CHEM 711 CHEMISTRY SEMINAR (0.5 Hours)
Presentation and discussion of current chemical topics and research by visiting speakers, faculty and students.

CHEM 721 ADVANCE INSTRUMENTAL ANALYSIS (3 Hours)
Prerequisite: Analytical Chemistry and Physical Chemistry (two semesters).
Theoretical principles and laboratory techniques involved in characterization of chemical systems using instrumental methods. This one semester course will present the following topics of interest: absorption and emission spectrometry, mass spectrometry, liquid and gas chromatography, and electrophoresis. A laboratory series on spectro-photometry, fluorometry, atomic absorption spectrometry, inductively coupled plasma atomic emission spectrometry, FT-IR, gas chromatography-mass spectroscopy, and high performance liquid chromatography are included in this course.

CHEM 723 ADVANCE ANALYTICAL CHEMISTRY (3 Hours)
Prerequisite: Analytical Chemistry and Physical Chemistry (two semesters).
Principles and application of analytical methods including acid-base titrations, redox titrations, titrations which involve metal-ligand complexes, gravimetric analysis, separation methods (chromatography), and electroanalytical chemistry.

CHEM 729 SPECTROSCOPIC METHODS (3 Hours)
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 731 ADVANCED BIOCHEMISTRY (3 Hours)
Prerequisite: Organic Chemistry (two semesters).
Comprehensive coverage of major areas of biochemistry. Topics covered include proteins, enzymology, bioenergetics, the chemistry and intermediary metabolism of carbohydrates, lipids, proteins and nucleic acids.

CHEM 734 PHYSICAL BIOCHEMISTRY (3 Hours)
Characterization of macromolecules, hydrodynamic methods, multiple equilibria, maromolecule-ligand interactions.

CHEM 736 PHYSICAL ORGANIC CHEMISTRY (3 Hours)
Prerequisite: Organic Chemistry (two semesters).
A study of organic molecular structure, Woodward Hoffmann Rules, substituents effects, intra- and intermolecular forces, kinetics and stereochemistry.

CHEM 738 ORGANIC SYNTHESIS (3 Hours)
Prerequisite: Organic Chemistry (two semesters).
The course covers the formation of carbon-carbon and carbon-heteroatom bonds, functionalization and interconversion of functional groups, reactions of organic reagents, protective groups, total synthesis and asymmetric synthesis in organic synthesis.

CHEM 741 ADVANCED INORGANIC CHEMISTRY (3 Hours)
Prerequisite: Advanced Inorganic Chemistry (CHEM 441).
A study of symmetry and group theory, bonding and structures of inorganic compounds, coordination chemistry and acid-base chemistry.

CHEM 744 RADIOCHEMISTRY (3 Hours)
A study of natural radioactivity, nuclear systematics and reactions, radioactive decay processes, the transuranium elements, nuclear reactors and nuclear power energy, radiation detection and measurement, radiation biollogy/medicine, radiation safety and security, and nuclear forensics, etc.

CHEM 745 NUCLEAR WASTE CHEMI & SAFETY (3 Hours)
This course studies chemistry of radioactive waste, advanced separation chemistry, and nuclear safety. It covers radioactive sources, decay, radiation shielding, separation chemistry, and emerging and innovative treatment techniques for fuel reprocessing and radioactive waste treatment. Handling and disposal of nuclear waste, and technical and regulatory aspects of waste management will be reviewed. It will also study nuclear countermeasures and nuclear security, nuclear event and incidents, radiological incidient management and planning, medical treatment of radiological injures, cleanup and decontamination after a radiological incident.

CHEM 746 RADIATN DECTN AND MEASUREMENT (3 Hours)
This course studies the principals of radiation detection, instrumentation systems and their application. This prepares our students to seek job opportunities on nuclear energy, radiological sciences, nuclear medical science and pharmacy, industrial safety and control systems, and radiation protection etc.

CHEM 748 ACTINIDE CHEMISTRY (3 Hours)
This course studies the fundamental chemistry of actinide elements from Ac through Lr: the structures, physical and chemical properties. This course examines their chemistry (speciation/transport) in the environment including geological, biological metrics as well as nuclear wastes. Finally the separation chemistry and safe handling and storage are reviewed. This better prepares students to seek job opportunities on nuclear energy/radiological/sciences/nuclear medical science/pharmacy/industrial safety and control systems etc.

CHEM 750 PRACTICUM IN COLLEGE CHEM TEAC (1 Hour)
This course is designed to provide Graduate Teaching Assistants (TAs) with information which can be used to enhance and improve their teaching effectiveness and to learn about teaching approaches that are effective at the college level and to practice and discuss aspects of their teaching assignments.

CHEM 752 ATOMIC & MOLECULAR SPECTROSCRO (3 Hours)
Prerequisite: Physical Chemistry (two semesters).
A comprehensive course covering concepts and methods of modern atomic and molecular spectroscopy. Subjects covered include electric phenomena, absorption and emission of radiation, atomic spectroscopy, rotational spectroscopy, vibrational spectroscopy, electronic spectroscopy, and magnetic resonance spectroscopy.

CHEM 758 QUANTUM CHEMISTRY (3 Hours)
Prerequisite: Physical Chemistry (two semesters).
(Computational Chemistry) Important concepts of quantum chemistry at the intermediate level, including angular momentum, perturbation theory, electronic structure of molecules, and radiation matter interaction. Applications will vary from year to year.

CHEM 768 MOLECULAR QUANTUM MECHANICS (3 Hours)
Prerequisite: Quantum Chemistry (CHEM 758) or equivalent.
Theoretical, algorithmic, and practical aspects of the methods of molecular quantum mechanics and their application to chemical systems. Topics covered include Hartree-Fock theory, perturbation theory, configuration interaction, coupled cluster theory, and density-function theory.

CHEM 780 DISSERTATION RESEARCH (1-9 Hours)

CHEM 782 SPCL TOPICS IN ANALYTICAL CHEM (3 Hours)
Selected topics not covered in regularly scheduled courses, and current research topics in analytical chemistry.

CHEM 783 SPECIAL TOPICS IN BIOCHEMISTRY (3 Hours)
Selected topics not covered in regularly scheduled courses, and current research topics in biochemistry.

CHEM 784 SPCL TPCS IN ORGANIC CHEMSTRY (3 Hours)
A course in a specific area of organic chemistry such as structure determination in organic chemistry, or current research subject not covered in regularly scheduled courses presented to fit the interests of advanced students.

CHEM 786 SPCL TPCS IN PHYSICAL CHEM (3 Hours)
Topics vary from year to year will include subjects such as photochemistry, solid state, surface chemistry, and radiation chemistry.

CHEM 787 NANOSCIENCE AND NANOTECHNOLOGY (3 Hours)
This course will provide a comprehensive introduction to the rapidly developing field of Nano-science and Nano-technology with the special emphasis on bio, physical and material chemistry. This is a three credit hour course in nano-science and will cover many of the recent topics in this new and exciting field including, synthesis, characterization and properties of individual nano particles, nanotubes, wires and dots; and their applications in biological and environmental science.

CHEM 788 MEDICINAL CHEMISTRY (3 Hours)
This course will introduce students to in-depth description of organic and biological compounds used as medicinal agents. The principles and practice of contemporary drug discovery and design will be emphasized. Sources, chemical properties, structure-activity relationships, molecular modeling, structure-based drug design, drug-like properties, compound library generation, optimization of high-throughput screening (HTS) hit using efficient synthetic reactions/transformations, metabolism, molecular target, modern chemical biology methods used to study drug actions, and specific mechanism of action studies will be covered.

SCI 502 GENERAL SCIENCE FOR TEACHERS (3 Hours)
A study of topics in astronomy, chemistry, geology, meteorology and physics.

SCI 513 COMPUT APPS N THE TCHNG OF SCI (3 Hours)
This course includes computer concepts; programming in the Basic language; building modules for computer assisted instruction and computer aided instruction; problem solving on a microcomputer system.

SCI 515 EARTH AND SPACE SCIENCE (3 Hours)
This course is the study of Earth Science, Geology, and Meteorology.

SCI 516 PHY SCI I FOR MIDDLE SCH TEACH (3 Hours)
This course is the study of properties and reactions of matter.

SCI 522 ENVIRONMENTAL SCIENCE (3 Hours)
A general study of environmental problems created by various kinds of pollution and the effects of man's bio-physical environment.

SCI 563 PROBLEMS & ISSUES IN SCIENCE (3 Hours)
Content in elementary science; aims and methods of instruction, new curricular developments.

SCI 581 OPERATIONS PHYSICS I (3 Hours)
This course is the study of mechanics that includes: measurement, force and motion, simple machines and forces, and fluids.

SCI 583 OPERATION PHYSICS III (3 Hours)
This course addresses the conceptual understanding and teaching of topics related to physics, space science and meteorology. The curriculum reflects the broader effort to be more inclusive of all the topics that teachers cover in the K12 area. Objectives for the course are correlated to the Mississippi Science Curriculum Structure.

SCI 584 OPERATION SCI OF TEACHERS II (3 Hours)

SCI 603 SPECIAL TOPICS IN SCIENCE (3 Hours)
Topics of current interest, both theoretical and experimental.