

Master of Science in Chemistry
Program code: 042010

INTRODUCTION

The Department of Chemistry (College of Science) offers a Master of Science program in **Chemistry**. The program is designed to prepare individuals for a career in: College or University teaching, a leadership role in secondary school science education, employment in government or industrial laboratories, or technically oriented positions in government and business. A wide range of potential areas for research is available for students to choose from. Among the current areas of faculty research are the following: Physical Chemistry, Organic Chemistry, and Inorganic and Analytical Chemistry. Only thesis option is offered.

According to the University Council decision dated 4/2/2007, Thesis students admitted with effect from September 2007 are exempted from the comprehensive examination.

PROGRAM REQUIREMENTS**31 TOTAL COURSE CREDITS****10 COMPULSORY (credits in parenthesis)**

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|----------|------------------------------|-----|
| 0420-512 | Advanced Thermodynamics | (3) |
| 0420-541 | Advanced Inorganic Chemistry | (3) |
| 0420-552 | Advanced Organic Chemistry I | (3) |
| 0420-591 | Seminar | (1) |

12 ELECTIVES* (3 Credits each)

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|----------|--|
| 0420-521 | Surface Chemistry & Heterogeneous Catalysis |
| 0420-522 | Advanced Electrochemistry |
| 0420-523 | Physico-chemical Aspects of Analytical Separations |
| 0420-524 | Advanced Quantum Chemistry |
| 0420-525 | Structure and Properties of High Polymers |
| 0420-530 | Selected Topics in Applied Physical Chemistry |
| 0420-532 | Chemical Application of Group Theory |
| 0420-542 | Selected Topics in Inorganic Chemistry |
| 0420-543 | Selected Topics in Analytical Chemistry |
| 0420-544 | Advanced Environmental Chemistry |
| 0420-561 | The Chemistry of Heterocyclic Compounds |
| 0420-562 | Synthetic Organic Chemistry |
| 0420-563 | Physical Methods in Organic Chemistry |
| 0420-564 | Selected Topics in Organic Chemistry |

0420-565 Topical Organic Chemistry

*Students may substitute up to 6 credit hours from the (400 level) elective chemistry undergraduate courses with the approval of the Program Director.

9 COMPULSORY COURSES

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|----------|--------|-----|
| 0420-597 | Thesis | (0) |
| 0420-598 | Thesis | (0) |
| 2000-599 | Thesis | (9) |

COURSE DESCRIPTION

**0420-512: ADVANCED THERMODYNAMICS
CR: 3**

Equilibria, solution, separation techniques and molecular interpretation of the properties of chemical system. These include: homogeneous and heterogeneous equilibria, thermodynamics of mixtures, activity and fugacity, Raoultian and Henryan scales, distillation and statistical thermodynamics.

**0420-521: SURFACE CHEMISTRY &
HETEROGENEOUS CATALYSIS
CR: 3**

Capillarity; electrical aspects of surface chemistry; long-range forces; surfaces of solids; physisorption and surface texture; spectroscopy and surface structure; chemisorptions and surface catalysis.

**0420-522: ADVANCED
ELECTROCHEMISTRY
CR: 3**

Electrode/electrolyte interface & structure of the double layer; mechanistic information through electrochemical techniques; corrosion & passivation; electrochemical energy conversion & fuel cells.

**0420-523: PHYSICO-CHEMICAL ASPECTS OF
ANALYTICAL SEPARATIONS
CR: 3**

Classification of separation methods; thermodynamic and kinetic aspects; chromatographic methods and selection procedures and optimization.

**0420-524: ADVANCED QUANTUM
CHEMISTRY
CR: 3**

Quantum mechanical aspects of molecular stability; modern concepts of chemical bonds; relations between theoretical predictions and experimental findings.

**0420-525: STRUCTURE AND PROPERTIES
OF HIGH POLYMERS
CR: 3**

Structure and classification of polymers; structure of polymers in condensed states; rheology of polymers; mechanical properties and strength; chemical reactions of macromolecules; possibilities and limitations of chemical modification.

**0420-530: SELECTED TOPICS IN APPLIED
PHYSICAL CHEMISTRY
CR: 3**

Colloids and surfaces; Magnetic resonance spectroscopy, Advanced chemical Kinetics; Application of surface active agents; Applied polymer science; Hybrid and composite materials; Applied catalysis Nanomaterials; Material characterization; Other applied topics.

**0420-532: CHEMICAL APPLICATION OF
GROUP THEORY
CR: 3**

Definitions and theorems of group theory; molecular symmetry and the symmetry groups; representations of groups. Applications: Hybrid orbitals and molecular orbitals for AB_n type molecules; ligand field theory; molecular vibrations.

**0420-541: ADVANCED INORGANIC
CHEMISTRY
CR: 3**

Inorganic reaction mechanisms; bioinorganic reactions and nuclear chemistry.

**0420-542: SELECTED TOPICS IN
INORGANIC CHEMISTRY
CR: 3**

Physical methods in inorganic chemistry; advanced aspects in boron chemistry; inorganic chains, rings and metal clusters; crown ethers, macro cycles and cryptands; advanced treatment of solid state chemistry and inorganic photochemistry.

**0420-543: SELECTED TOPICS IN
ANALYTICAL CHEMISTRY
CR: 3**

Equilibria in aqueous and non-aqueous media; instrumental and miscellaneous methods of analysis.

**0420-544: ADVANCED ENVIRONMENTAL
CHEMISTRY
CR: 3**

Chemical pollutants and their effect on the environment; analytical chemistry applied to environmental samples.

**0420-552: ADVANCED ORGANIC
CHEMISTRY I
CR: 3**

Linear free energy relationships; molecular rearrangements: (i) 1,2-shifts to electron deficient carbon, nitrogen and oxygen, (ii) pericyclic rearrangements.

Reduction. Hydroboration. Oxidation.

**0420-561: THE CHEMISTRY OF
HETEROCYCLIC COMPOUNDS
CR: 3**

Nomenclature rules; heterocyclic analogues of cyclopropane, cyclobutane and cyclopenta-dienes; chemistry of pyridine and quinolines; monocyclic compounds; fused ring systems; Compounds with two or more heteroatoms; natural occurrence.

**0420-562: SYNTHETIC ORGANIC
CHEMISTRY
CR: 3**

Functionalization and interconversion of functional groups; formation of carbon-carbon bonds: the principles and reactions of organometallic compounds; use of stabilized carbanions and related nucleophiles; formation of carbon-heteroatom bonds: the principles; ring closure and ring opening; protective groups; phosphorus reagents; silicon reagents; asymmetric synthesis; selected syntheses.

**0420-563: PHYSICAL METHODS IN
ORGANIC CHEMISTRY
CR: 3**

The application of physical methods for the elucidation of structure of organic compounds: U.V., visible, Raman and NMR spectroscopy; mass spectrometry; optical rotation, optical rotatory dispersion and circular dichroism.

**0420-564: SELECTED TOPICS IN ORGANIC
CHEMISTRY
CR: 3**

Carbenes, nitrenes, arynes, carbocations, and carbanions; M.O. method and organic reactions: electrophilic substitutions, sigmatropic rearrangements, electrocyclic and pericyclic reactions; organic electrochemical and polarographic reactions; organometallic reactions, ylides; photophysical processes.

**0420-565: TOPICAL ORGANIC CHEMISTRY
CR: 3**

Molecular recognition processes and supramolecular assemblies; fullerenes; nanotechnology materials and devices; organic reactions in unusual solvents (including room-temperature reactions in ionic liquids and supercritical fluids); solid-supported reagents and catalysts in organic chemistry; green chemistry organic reactions under extreme conditions.

**0420-591: SEMINAR
CR: 1**

Library-based review of an advanced topic or recent development in chemistry to be presented in dissertation form and as a departmental seminar.

**0420-597: THESIS
CR: 0**

**0420-598: THESIS
CR: 0**

**2000-599: THESIS
CR: 9**