

## Master of Science in Chemistry

### General Information

|  |                                       |                           |                         |
|--|---------------------------------------|---------------------------|-------------------------|
| <b>Program's Name</b>                                      | <b>Master of Science in Chemistry</b> |                           |                         |
| <b>College</b>   | College of Sciences                   | <b>Department</b>         | Chemistry               |
| <b>Specializations that can be accepted in the program</b> | Chemistry                             |                           |                         |
| <b>Adoption Date</b>                                       | Fall 2019-2020                        | <b>Location</b>           | Sharjah Main Campus     |
| <b>Level</b>   | Masters                               | <b>Total Credit Hours</b> | 34 C.H                  |
| <b>Duration (Min. – Max.)</b>                              | 2-4 Years                             | <b>Language</b>           | English                 |
| <b>Intake</b>  | Fall & Spring                         | <b>Study Mode</b>         | Full-time and Part-Time |

### Study Plan

|  |                                  |                               |         |         |                              |         |
|--|----------------------------------|-------------------------------|---------|---------|------------------------------|---------|
| Study Plan   | Study Plan - Course Distribution |                               |         |         |                              |         |
|  | First Year                       |                               |         |         |                              |         |
|  | Fall                             |                               |         | Spring  |                              |         |
|  | Code                             | Course Title                  | Cr. Hrs | Code    | Course Title                 | Cr. Hrs |
|  | 1420525                          | Advanced Analytical Chemistry | 3       | 1420535 | Advanced Inorganic Chemistry | 3       |
|  | 1420515                          | Advanced Organic Chemistry    | 3       | 1420545 | Advanced Physical Chemistry  | 3       |
|  | 14205xx                          | Chemistry Elective Course     | 3       | 14205xx | Chemistry Elective Course    | 3       |
|  | 1420590                          | Research Methodology          | 1       |         |                              |         |
|  | Total                            |                               | 10      | Total   |                              | 9       |
|  | Second Year                      |                               |         |         |                              |         |
|  | Fall                             |                               |         | Spring  |                              |         |
|  | Code                             | Course Title                  | Cr. Hrs | Code    | Course Title                 | Cr. Hrs |
|  | 14205xx                          | Chemistry Elective Course     | 3       | 1420595 | Thesis                       | 6       |
|  | 14205xx                          | Chemistry Elective Course     | 3       |         |                              |         |
|  | 1420595                          | Thesis                        | 3       |         |                              |         |
| Total  |                                  | 9                             | Total   |         | 6                            |         |
| Total years = 2 / Total semesters = 4 / Total weeks = 64 |                                  |                               |         |         |                              |         |
| Total number of courses = 10 / Total hours = 34          |                                  |                               |         |         |                              |         |

**Course Description:**

|  |  |
|--|--|
| 1420515  | Advanced Organic Chemistry             |
| <p>This advanced course introduces students to reactions, mechanisms, applications, and retrosynthetic analyses in synthesizing target organic molecules. The course explains the theoretical aspects of logical analysis and retrosynthetic methodologies. The framework's mechanisms, scope, and limitations for the target compounds will be investigated. This includes analysis, mechanisms, and reactions used to synthesize simple, complex organic compounds, some natural products, and selected drugs. Propose and write logical, reasonable schemes of synthesis for diverse organic compounds.</p> <p>Prerequisite: Two semesters of undergraduate organic chemistry</p> |  |
| 1420516  | Advanced Heterocyclic Chemistry        |
| <p>This course introduces students to the nomenclature systems used for naming heterocyclic compounds. The students will be familiar with standard heterocyclic systems, Chemistry, reactions, and synthesis methods of heterocyclic ring systems. The course will relate the heterocyclic system and its diversity to biological activity studies and application in medicine.</p> <p>Prerequisite: 1420515</p>   |  |
| 1420517  | Special Topics in Organic Chemistry    |
| <p>This course covers selected topics of contemporary organic chemistry.</p> <p>Prerequisite: 1420515 &amp; consent of the instructor</p>  |  |
| 1420519  | Physical Organic Chemistry             |
| <p>This course covers modern physical organic chemistry, fundamental theories for binding intramolecular and intermolecular bonding, complexes' strain and stability, and complexation thermodynamic parameters. Molecular recognition and supramolecular chemistry, self-assembly. Examples from biological systems and soft materials will be used to link the knowledge that students acquired with applications in real life.</p> <p>Prerequisite: 1420515 or consent of the instructor</p>  |  |
| 1420525  | Advanced Analytical Chemistry          |
| <p>This course surveys selected principles and techniques of modern analytical chemistry, focusing on significant areas, including spectroscopy, separations sciences, and electroanalytical chemistry. Includes material on molecular and atomic spectroscopy, NMR spectroscopy, mass spectrometry, classical and thermal methods, chromatography, and capillary electrophoresis.</p> <p>Prerequisite: Two semesters of undergraduate analytical chemistry</p>  |  |
| 1420526  | Special Topics in Analytical Chemistry |
| <p>This course covers selected topics of contemporary analytical and instrumental chemistry.</p> <p>Prerequisite: 1420525 and consent of the instructor</p>  |  |

|   |                             |
|---|-----------------------------|
| 1420527   | Electrochemistry Techniques |
| <p>This course covers the advanced treatment of analytical techniques and methodology, emphasizing modern methods, basic principles, kinetics, and mechanisms of electrode reactions and surface phenomena, and analytical applications of potentiometry, voltammetry, coulometry, and conductometry.</p> |                             |
| <p>Prerequisite: 1420525</p>  |                             |

|   |                              |
|---|------------------------------|
| 1420535   | Advanced Inorganic Chemistry |
| <p>This course covers the chemistry of transition and inner transition elements, theories of bonding in coordination compounds, applications of the ligand field theory to the interpretation of spectra and magnetochemistry, structure and reactivity, and coordination compounds in biological systems and industry.</p> |                              |
| <p>Prerequisite: Two semesters of undergraduate inorganic chemistry.</p>  |                              |

|  |                          |
|--|--------------------------|
| 1420536  | Advanced Organometallics |
| <p>The course explores selected area(s) of organometallics through updated discussion of lecture material and research articles. Topics of current organometallic chemistry are offered, reflecting new developments in various areas of chemistry and the changing needs of students and faculty.</p> |                          |
| <p>Prerequisite: 1420535</p>   |                          |

|  |                                       |
|--|---------------------------------------|
| 1420537  | Special Topics in Inorganic Chemistry |
| <p>This course covers selected topics of contemporary inorganic chemistry.</p> |                                       |
| <p>Prerequisite: 1420535 &amp; consent of the instructor</p>                   |                                       |

|   |   |
|---|---|
| 1420538   | Physical Methods in Inorganic Chemistry |
| <p>This course covers theoretical principles and applications of the standard physical methods used in the characterization of inorganic and organometallic compounds, introduction to group theory leading to the understanding of symmetry in chemistry, application of symmetry considerations to theories of bonding in coordination compounds, electron absorption, vibration, and Raman spectroscopy; nuclear magnetic resonance, electron paramagnetic resonance, nuclear quadrupole resonance, Mössbauer effect, optical rotary dispersion and circular dichroism and photoelectron spectroscopy.</p> |   |
| <p>Prerequisite: 1420535</p>  |   |

|   |                             |
|---|-----------------------------|
| 1420545   | Advanced Physical Chemistry |
| <p>This course covers classical and statistical thermodynamic concepts with emphasis on application to chemical species in solution, consideration of theories of chemical reaction rates, kinetic studies of simple and complex systems, and fundamental principles and procedures of quantum chemistry with applications to atomic and molecular systems.</p> |                             |
| <p>Prerequisite: Two semesters of undergraduate physical chemistry</p>  |                             |

|   |                                      |
|---|--------------------------------------|
| 1420546   | Special Topics in Physical Chemistry |
| This course covers selected topics of contemporary physical chemistry.  |                                      |
| Prerequisite: 1420545 & consent of the instructor   |                                      |
| 1420547   | Advanced Spectroscopy                |
| This course introduces modern molecular spectroscopy with an emphasis on the concepts and methods needed to understand the interaction of radiation with matter. Topics include atomic, rotational, vibrational, and electronic spectra of molecules and radio frequency spectroscopy.  |                                      |
| Prerequisite: 1420545 & 1420525   |                                      |
| 1420550   | Special Topics in Applied Chemistry  |
| This course covers selected topics of contemporary Applied Chemistry.   |                                      |
| Prerequisite: 1420515 & 1420535   |                                      |
| 1420551   | Advanced Polymer Science             |
| This course covers polymer synthesis, conformation, solution thermodynamics, and molecular-weight determination, solid-state and viscoelasticity properties, polymer degradation and the environment, additives, blends, and composites, naturally occurring polymers, commodity thermoplastics and fibres.   |                                      |
| Prerequisite: 1420515 & 1420535   |                                      |
| 1420554   | Green Chemistry                      |
| This course covers the principles of green chemistry and the effect of humans laying the groundwork for applying green. It covers the principles of designing safer chemicals and less hazardous chemical syntheses, using catalysis to avoid unnecessary waste, using safer solvents and auxiliaries, reducing unnecessary chemical derivatives, designing for energy efficiency, designing for degradation, developing real-time analysis for pollution prevention, and using renewable feedstocks. |                                      |
| Prerequisite: 1420525 & 1420535   |                                      |
| 1420555   | Advanced Biochemistry                |
| This course covers the biochemical functions of biomolecules, including proteins, carbohydrates, lipids, and nucleic acids. Protein's structure, folding/miss-folding. Role of enzymes and coenzymes in metabolism and biosynthesis. Membrane structure and function. Photosynthesis and bioenergetics.   |                                      |
| Prerequisite: 1420515   |                                      |
| 1420556   | Advanced Material Science            |
| This course introduces modern materials' properties, structures, and uses in various applications. Introduction to microstructure and physical properties of metals, ceramics, polymers, composites, and amorphous materials. Also includes elementary mechanical behaviour and the impact of material selection on their performance. Establishes a foundation in materials science and nanoscience and how these fields are related to modern materials.  |                                      |
| Prerequisite: 1420535 and 1420515   |                                      |

|         |                      |
|---------|----------------------|
| 1420590 | Research Methodology |
|---------|----------------------|

This course introduces students to scientific project design, analysis, and presentation. It covers the main methods used in scientific research, including hypothesis testing, essential features of experimental design, and laboratory safety. Important concepts in statistics focus on standard error, and the use of elementary statistical tests are also covered. It covers accessing scientific literature, preparing papers, presentations, and ethical guidelines in chemical and scientific research.

Prerequisite: Consent of the instructor

|         |                  |
|---------|------------------|
| 1420591 | Research Project |
|---------|------------------|

This course is carried out under the supervision of a faculty. Student undertaking original lab-based research in an area of their interest. The supervisor is responsible for approving the writing and submission of a report.

Prerequisite: Approval of the academic advisor

|         |        |
|---------|--------|
| 1420595 | Thesis |
|---------|--------|

The student pursues an individual investigation under a Faculty member's supervision. To complete the MSc work, the student must pass his/her Thesis defense.

Prerequisite: Approval of the academic advisor