

# MS IN CHEMISTRY

The **research-based MS program** in chemistry increases the professional competence of the chemist beyond the bachelor's degree. Course work, independent research culminating in the defense of an original thesis, and small group discussions are emphasized to achieve these goals. The MS degree can be viewed as an important professional goal or as preparation for study toward the doctoral degree. 30 credit hours are required to earn the research-based MS.

The objective of the **non-thesis MS program** is to provide an alternate pathway for students to obtain an MS degree in chemistry that does not involve an in-depth research project or a thesis. This degree option is intended for area residents whose current work responsibilities, or intellectual property issues with their employer, preclude the possibility of conducting the requisite research for the traditional research-based MS degree. School teachers, non-traditional students, and employees of local industry who want to earn an MS degree for promotions and/or to meet eligibility requirements for teaching positions at regional community colleges may wish to pursue this degree option. 30 credit hours are required to earn the non-thesis MS.

The Department of Chemistry and Biochemistry and the Department of Chemical Engineering, in conjunction with the School of Green Chemistry and Engineering, offer a **concentration in Green Chemistry and Engineering**. The program is designed for students who want to concentrate their studies on principles of green chemistry and green engineering and incorporate aspects of business and other professional skills components into their master's degree and future career.

The concentration in Green Chemistry and Engineering is approved and affiliated with the National Professional Science Master's Association and requires 36 credit hours to graduate. The Green Chemistry and Engineering concentration is a terminal degree that prepares students for immediate employment opportunities in industry, government, and nongovernmental organizations. It is not a research-based degree. The program provides a foundation in chemistry, chemical engineering, toxicology, environmental chemistry, life cycle assessment, chemical alternatives assessment, regulations and policy, and business.

More information on activities of the School of Green Chemistry and Engineering and/or the Green Chemistry and Engineering concentration visit our website at <https://www.utoledo.edu/nsm/sgce/>

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## Requirements for the Thesis-Based Master's Program

For the degree of master of science, students must meet the following departmental requirements:

1. The courses presented must total at least 30 hours of graduate credit, including at least four hours of credit in graduate research.

2. Registration for research seminar is typically required each term the student is enrolled in graduate research.
3. Each candidate must present a thesis.
4. Registration for chemistry colloquium is typically required each term, but no more than four hours of credit may count within the required 30 hours.
5. Each candidate must demonstrate satisfactory performance on a comprehensive oral examination on his or her thesis research, in addition to the public defense of the thesis at a colloquium presentation.
6. Upon choosing a research director, an advisory committee will be appointed to supervise the research, to administer the comprehensive oral examination, and to approve the thesis. Each student, in conjunction with the director of graduate studies, the research director, and the student's advisory committee, will prepare a plan of study listing the courses and other requirements for the degree. Upon approval, the plan of study becomes the list of course requirements for the degree. Students are required to take four or more 6000-level courses covering at least three different subdisciplines of chemistry as part of the plan of study.
7. Each student must register and successfully complete CHEM 6940.

## Requirements for the Non-Thesis Master's Program

For the non-thesis master of science degree, students must meet the following departmental requirements:

1. The courses presented must total at least 30 hours of graduate credit.
2. Each student, in conjunction with the director of graduate studies, will prepare a plan of study listing the courses and other requirements for the degree. Upon approval, the plan of study becomes the list of course requirements for the degree. Students are required to take five or more chemistry 6000-level courses (minimum 20 credit hours) as part of the plan of study. To establish breadth in knowledge, at least one course in each of four (out of six) subdisciplines of chemistry (analytical, biochemistry, inorganic, materials, organic, physical) must be completed. Up to 8 hours of 6000-level courses in other fields may also be applied towards the degree with permission of the director of graduate studies.
3. Registration for chemistry colloquium is required during some terms, but no more than two hours of credit may count within the required 30 hours.
4. Credit for thesis research or research seminar may not be applied towards the required 30 hours.
5. Each candidate must participate in CHEM 6940 and demonstrate satisfactory performance on a departmental literature colloquium presentation.

Requirements for Chemistry - Green Chemistry and Engineering Concentration, MS

1. The courses presented must total at least 36 hours of graduate credit.
2. Each student, in conjunction with the director of graduate studies and the director of the School of Green Chemistry and Engineering, will

prepare a plan of study listing the courses and other requirements for the degree. Upon approval, the plan of study becomes the list of course requirements for the degree. Students are required to take:

| Code                                                                                                             | Title                              | Hours     |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------|
| CHEM 6200                                                                                                        | Green Chemistry                    | 3         |
| CHEM 6210                                                                                                        | Environmental Chemistry            | 3         |
| CHEE 6010                                                                                                        | Green Engineering Principles       | 3         |
| CHEE 6110                                                                                                        | Green Engineering Applications     | 3         |
| BUAD 6600                                                                                                        | Supply Chain Management            | 3         |
| EFSB 6690                                                                                                        | Strategic Management of Innovation | 3         |
|                                                                                                                  | or EFSB 6590 New Venture Creation  |           |
| Select 12 credit hours of elective graduate coursework in traditional areas of chemistry or chemical engineering |                                    | 12        |
| <b>Total Hours</b>                                                                                               |                                    | <b>30</b> |

3. Each student must also complete a graduate industrial internship (CHEM 6970/CHEE 6970). The graduate industrial internship must be completed at an industry, governmental organization, or non-governmental organization in an area relevant to green chemistry and engineering. The program director will assist in identifying internship opportunities and must approve all placements. Students who are working or have worked part or full-time in a relevant job may request internship credit for this work experience. The director will evaluate all such requests and give credit if appropriate.
4. Up to 4 credit hours of 6000-level coursework in a related discipline (e.g., environmental sciences, physics) may be applied to the minimum 12 credit hours of electives if approved by the director of the program and director of graduate studies. Up to 2 credit hours of independent research (CHEM 6980) may also be applied if approved by the director of the program. Research seminar (CHEM 6930) and colloquium (CHEM 6920) cannot be applied towards the 36 hour minimum for the concentration.

#### MS in Chemistry Learning Outcomes

- PLO 1. describe data and results in both written and oral formats
- PLO 2. solve, with the appropriate mathematical techniques, and analyze problems from chemistry in their area of concentration
- PLO 3. conduct a new research project via their design of experimental and/or theoretical techniques
- PLO 4. interpret publications in the literature from their research area