

# CHEMISTRY (MS)

## Master of Science in Chemistry

Unit: College of Arts and Sciences (<http://louisville.edu/artsandsciences/intro/>) (GA)

Department: Chemistry (<http://louisville.edu/chemistry/>)

Program Website (<http://louisville.edu/chemistry/academics/graduate-studies/>)

Academic Plan Code(s): CHEMMS

## Program Information

The Department of Chemistry, in the College of Arts and Sciences, offers graduate programs leading to the Master of Science (thesis and non-thesis options) and Doctor of Philosophy degrees in chemistry with options in analytical chemistry, biochemistry, biomolecular structure and engineering, inorganic chemistry, organic chemistry, physical chemistry, and chemical physics.

The general requirements for admission to the Graduate School, (<http://catalog.louisville.edu/graduate/application-admission/>) for admission to candidacy, and for the master's degree can be found in specific sections of this catalog. The additional provisions listed below apply to the program leading to the Master of Science in Chemistry.

## Program Requirements

The requirements for the Master of Science in Chemistry are as follows:

1. The general requirements as stated in the General Information section of this catalog.
2. Completion of course curriculum as described in the section on program requirements for the PhD degree.
3. Students with a native language other than English must show a proficiency in English. This requirement may be met with a grade of B in ENGL 101 (or equivalent) or an acceptable score on a standardized test (such as the TOEFL, IELTS, Duolingo or Michigan test).
4. Registration in seminar course CHEM 695 for the first three semesters of graduate study and an acceptable presentation of a one-hour literature seminar on a topic of current chemical interest or related to the student's area of research. This seminar must be presented no later than the third semester of graduate studies.
5. Completion of a written MS thesis and an oral defense for the thesis option or completion of an original research proposal (ORP) for the non-thesis option.

## Admission Requirements

Students seeking a graduate degree in chemistry should meet the following requirements:

1. Completion of the graduate application (<https://louisville.edu/graduate/futurestudents/apply-materials/application/>) for admission from the Graduate School and application fee.
2. A BA or BS degree in chemistry or in a related field such as physics, engineering, or mathematics. It is expected that students will have obtained a background in chemistry equivalent to 36 credit hours of undergraduate coursework. Students planning to pursue graduate study in chemical physics may substitute some of the chemistry hours with advanced courses in physics or mathematics beyond those required for a BA or BS in chemistry. Students with inadequate preparation will be required to register for specific courses in the area of deficiency. Some of these courses, subject to approval by

the department, may be accepted for graduate credit. Admission to graduate study in chemical physics is made on the recommendation of the entrance committee for that option.

3. A minimum quality point standing of 3.0 on a 4.0 scale.
4. Submission of Graduate Record Examination scores (students with successful admission generally obtain quantitative and verbal scores totaling 1000 or more with an analytical score of 2.5 or totaling 900 or more with an analytical score of 3.0). Graduate Record Examination (GRE) is recommended but not required.
5. Students with a native language other than English must show a proficiency in English. This requirement may be met with a grade of B or better in ENGL 101 (or equivalent) or an acceptable score on a standardized test (such as the TOEFL, IELTS, Duolingo). A B-minus grade in ENGL 101 is unacceptable.

In individual cases, the conditional admission of a student who does not satisfactorily meet the above requirements may be recommended by the department to the Graduate School. If admission is granted, that student will be subject to those conditions specified by the department or Graduate School as being necessary to remedy the conditional admission.

## Program Requirements

### Master of Science (Thesis) in Chemistry

A minimum of 30 credit hours of graduate credit is required. At least 15 credit hours must be in chemistry courses. An overall GPA of 3.0 must be maintained.

Code	Title	Hours
<b>Chemistry MS - Thesis Option</b>		
CHEM 691	Research	1-15
CHEM 692	Research	1-15
CHEM 695	Seminar <sup>1</sup>	1-3
Research Areas (6 courses from at least 3 of 6 divisions) <sup>2</sup>		18-20
Thesis Option		0
<b>Minimum Total Hours</b>		<b>30</b>

<sup>1</sup> Enrollment in the chemistry research course for the first three semesters of graduate study is required.

<sup>2</sup> Research areas are: Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, and Physics.

### Chemistry Requirements

- a. **Courses:** Students must pass a minimum of six graduate courses from at least three of six divisions (or research areas) with a minimum grade of C in any one course (a C-minus grade is considered unacceptable). The areas are: Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, and Physics. An overall GPA of 3.0 or greater is required by the Graduate School. In addition, a GPA of 3.0 or greater is required in lecture courses by the department.
- b. **Mentor:** The research mentor must be selected during the first semester. Students are required to interview a minimum of three chemistry faculty (more are recommended) and have them sign the Mentor Selection Form. The student may choose a mentor after obtaining three signatures. If the mentor agrees to accept the student, the mentor will initial the Mentor Selection Form and the

student should submit it for final approval by the department Director of Graduate Studies.

- c. **Research:** Research credit will be taken through courses CHEM 691 and CHEM 692 with the graduate mentor listed as the instructor.
- d. **Seminar:** Enrollment in the chemistry research course CHEM 695 for the first three semesters of graduate study is required. The student must present a literature seminar related to their research or on a topic of current chemical interest in the second or third semester of his/her program (excluding summer).
- e. **Thesis Committee:** The student will select his/her Thesis Committee in consultation with the research mentor during the first three semesters of study. The committee consists of the research mentor, a chemistry faculty in the same division, a chemistry faculty in a different division and a faculty member from a different department. Students must have each committee member sign the Thesis Committee Form and submit it the chemistry office.
- f. **Publication:** Scientific publication is an important element of graduate education and research. Therefore, it is normally expected that a manuscript based on the student's research would have been submitted to a peer-reviewed journal by the time of his/her thesis defense. The student's contribution must be significant to both the scientific content and the manuscript drafting.
- g. **Thesis:** A written thesis describing the research program is submitted a minimum of seven days before the defense. The defense consists of a seminar open to the public on the thesis project followed by an oral examination with the Thesis Committee.

Chemistry, and Physics. An overall GPA of 3.0 or greater is required by the Graduate School. In addition, a GPA of 3.0 or greater is required in lecture courses by the department.

- b. **Language:** Students with a native language other than English must show a proficiency in English. This requirement may be met with a grade of B in ENGL 101 (or equivalent) or an acceptable score on a standardized test (such as the TOEFL or "Michigan test"). A B-minus in ENGL 101 is considered unacceptable.
- c. **Mentor:** The research mentor must be selected during the first semester. Students are required to interview a minimum of three chemistry faculty (more are recommended) and have them sign the Mentor Selection Form. The student may choose a mentor after obtaining three signatures. If the mentor agrees to accept the student, the mentor will initial the Mentor Selection Form and the student should submit it for final approval by the department Director of Graduate Studies.
- d. **Research:** Research credit will be taken through courses CHEM 691 and CHEM 692 with the graduate mentor listed as the instructor.
- e. **Research Proposal:** The research proposal serves as the capstone project for the non-thesis MS degree. Students must develop, explain, and defend a research proposal. The proposal can be based on recent literature or the student's research project (if applicable). The student's mentor from the chemistry graduate faculty should oversee the proposal committee. The committee consists of the mentor plus two additional chemistry faculty selected by the student in consultation with the mentor.

## Master of Science (Non-Thesis) in Chemistry

A minimum total 30 credit hours of graduate credit is required. At least 15 credit hours must be in chemistry courses. An overall GPA of 3.0 must be maintained.

Code	Title	Hours
<b>Chemistry MS - Non-Thesis Option</b>		
CHEM 691	Research	1-15
CHEM 692	Research	1-15
CHEM 695	Seminar	1-3
Research Areas (6 courses from at least 3 of 6 divisions)		18-20
Non-Thesis Option		0
<b>Minimum Total Hours</b>		<b>30</b>

<sup>1</sup> Enrollment in the chemistry research course for the first three semesters of graduate study is required.

<sup>2</sup> Research areas are: Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, and Physics.

**Note:** Students in the PhD program will be awarded an MS degree (non-thesis) after successful completion of the Original Research Proposal and other previous requirements.

## Chemistry Requirements

- a. **Courses:** Students must pass a minimum of six graduate courses from at least three of six divisions (or research areas) with a minimum grade of C in any one course (a C-minus grade is considered unacceptable). The areas are: Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, Physical

## Chemistry Courses

Code	Title	Hours
<b>Analytical Division</b>		
CHEM 620	Optical Spectrochemical Methods of Analysis	3
CHEM 621	Electroanalytical Chemistry	3
CHEM 622	Analytical Separations	3
CHEM 625	Advanced Analytical Chemistry	3
CHEM 626	Special Topics in Analytical Chemistry	1-3
CHEM 628	Special Topics in Synthesis and Analysis	1
CHEM 630	Advanced Topics in Chemical Analysis	1
<b>Biochemistry Division</b>		
CHEM 645	Advanced Biochemistry I	4
CHEM 647	Advanced Biochemistry II	4
CHEM 648	Systems Biochemistry: Principles and Practices	3
CHEM 681	Modern Biochemistry I	3
CHEM 682	Modern Biochemistry II	3
CHEM 684	Biophysical Chemistry	3
CHEM 685	Special Topics in Biochemistry	1-3
<b>Inorganic Division</b>		
CHEM 550	Group Theory and its Chemical Applications	3
CHEM 653	Main Group Chemistry	3
CHEM 654	Advanced Coordination Chemistry	3
CHEM 655	Special Topics in Inorganic Chemistry	1-3
CHEM 656	Special Topics in Inorganic Chemistry	1-3
CHEM 659	Materials Chemistry and Methods	3
<b>Organic Division</b>		
CHEM 557	Bio-Organic Phenomena	3

CHEM 670	Chemistry of Heterocyclic Compounds and Alkaloids	3
CHEM 671	Advanced Polymer Chemistry	3
CHEM 675	Special Topics in Organic Chemistry	1-3
CHEM 677	Mechanisms and Theory in Organic Chemistry	3
CHEM 678	Advanced Organic Chemistry: General Survey	3
CHEM 679	Advanced Organic Synthesis	3
<b>Physical Chemistry Division</b>		
CHEM 555	Theory and Application of Computational Chemistry	3
CHEM 660	Advanced Physical Chemistry	3
CHEM 661	Chemical Thermodynamics	3
CHEM 665	Special Topics in Physical Chemistry	1-3
CHEM 666	Special Topics in Physical Chemistry	1-3
CHEM 667	Reaction Kinetics	3
CHEM 672	Quantum Chemistry	3
CHEM 684	Biophysical Chemistry	3
CHEM 687	Molecular Spectroscopy	3
<b>Physics</b>		
PHYS 605	Theoretical Mechanics	3
PHYS 611	Electromagnetic Theory I	3

The following courses are not offered by a specific division or are common to all divisions. CHEM 651 and CHEM 652 can count towards the course requirements with approval of the Chemistry Department Director of Graduate Studies.

<b>Code</b>	<b>Title</b>	<b>Hours</b>
CHEM 503	Special Topics in Chemistry	1-3
CHEM 591	Chemistry for Teachers I	3
CHEM 632	Chemical Education	3
CHEM 651	Independent Study	1-3
CHEM 652	Independent Study	1-3
CHEM 688	X-Ray Crystallography and Its Application to Molecular Structure	3
CHEM 691	Research	1-15
CHEM 692	Research	1-15
CHEM 695	Seminar	1-3