

GRADUATE PROGRAM DESCRIPTION
STATE UNIVERSITY OF NEW YORK, COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY
FACULTY OF CHEMISTRY
(Accepted September 7, 2012)

I Statement of Objectives

The objective of the graduate program in Chemistry is to provide advanced instruction and training to qualified students desiring professional careers as chemists in the fields of polymer chemistry, environmental chemistry, natural products chemistry, ecological chemistry, and biochemistry. Students completing advanced degree requirements are qualified for positions in academe, government service, and private enterprise including, among others, teaching, research, management, and public service. The Chemistry Program seeks to supply highly trained professionals to help meet societal needs in the vital areas of environmental science and forestry within the mandates of the College's mission.

Development of both scholarly and practical attributes is an important aim of the program. Required of all students is extensive schooling in the fundamentals of chemistry, particularly the major areas of organic, physical, and analytical chemistry, as well as related subjects necessary for an understanding of the field, such as elements of physics, mathematics, biology, computer science, engineering, etc. Wide training in current, relevant technological and instrumental techniques is also mandated. Breadth of understanding provides not only a sound platform for current interests, but also enables and encourages flexibility necessary for future growth.

II Areas of Study

Even though only one degree is granted by the Faculty of Chemistry – that in *Chemistry* – several areas of study are available: *polymer chemistry, environmental chemistry, natural products chemistry, ecological chemistry, biochemistry and SB3 (Structural Biology, Biophysics and Biochemistry)*. In these study areas an emphasis on analytical, organic, physical, theoretical chemistry, or biochemistry are available, as is, in some instances, combinations of several emphases. In addition, ecological chemistry can be a joint program with the Faculty of Biology. Formal requirements are, therefore, somewhat different in detail for these study areas, although differences between them are not great.

III Entrance Requirements

A. Undergraduate Training

Students planning to obtain a graduate degree in chemistry at this College should present evidence of having completed the following courses in undergraduate work prior to arrival:

- *Mathematics*: Through integral calculus.
- *Physics*: Two semesters of physics with laboratory.
- *General Biology*: Two semesters.
- *Analytical Chemistry*: Two semesters with laboratory including Quantitative Analysis and Instrumental methods.
- *Physical Chemistry*: Two semesters with at least one semester of laboratory. Calculus must be used in the presentation.

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- *Organic Chemistry*: Two semesters with laboratory.
- *Additional chemistry/biology*: One additional semester of organic, physical, inorganic, analytical, polymer, environmental chemistry, or biochemistry (or biology for those students specializing in *biochemistry*.)

The student's undergraduate preparation will be reviewed by their major professor and steering committee (section IV A). Any deficiencies in the undergraduate coursework must be made up after arrival at the College.

B. Graduate Record Examination and TOEFL

All prospective students will be required to take the three aptitude tests and the advanced test in chemistry (or the student's major field) of the Graduate Record Examination prior to their acceptance as graduate students by the Faculty of Chemistry. The GRE requirement is waived for those applicants who already have completed an M.S. degree. Students whose native language is not English will be required to take the TOEFL test, which measures proficiency in English.

C. Acceptance as a Graduate Student by the Faculty of Chemistry

Students will be accepted for graduate work by the Faculty of Chemistry on the basis of:

1. Undergraduate/Graduate Records
2. At least three recommendation letters from persons who are in a position to judge the student's past performance and professional promise.
3. GRE and TOEFL scores (where applicable).

IV General Requirements

All graduate students are required to complete successfully the prescribed core courses (described later), to present two seminars during their term of study, and to complete a research thesis. Doctoral students must, in addition, pass specified examinations and must demonstrate competence in at least one research tool. The students receiving financial support through the College teaching assistantships are required to serve as teaching assistants, primarily in laboratory courses.

A. Appointment of a Steering Committee

Per College requirements, the student's steering committee is appointed by the Associate Provost for Instruction and Dean of the Graduate School upon the recommendation of the Department Chairperson using form 2A. The steering committee must be established and met by the end of the second semester to review the student's undergraduate course-work and the results of the evaluation examinations. The steering committee for the MS and Ph.D. program consists of the major professor, a second member from the Department of Chemistry and at least one other qualified person. Other qualified people include faculty at other institutions or other recognized professionals. The steering committee for the MPS program consists of the major professor and at least one other faculty member from the Department of Chemistry.

Within the first year, the steering committee will submit a written statement to the Department Chair clearly summarizing any deficiency in academic preparation as identified through the student's undergraduate coursework and evaluation exams. The committee will also specify a

recommended course of action, through independent study or additional coursework that will be used to address these deficiencies. The steering committee will assist the student in the development of their program of study (3B), including the development of the student's research or professional experience. A regular yearly meeting with their steering committee is required for the student to stay in good academic standing within the department.

B. Masters Program

Masters requirements are those dictated by Program Alternative 1 of the Graduate Academic Policies (GAP), with a total of 30 credits required, of which a minimum of 18 credits are for coursework and a minimum of 6 credits are awarded for the thesis. Requirements for a Master's Degree in Professional Studies (Alternative 3) through the chemistry department are detailed in Section D.

C. Doctoral Program

The Doctor of Philosophy degree requires a minimum of 60 graduate credits of which a minimum of 30 credits are for coursework and a minimum of 12 credits are awarded for thesis. The successful candidates must take the evaluation exams within their first year of entry into the program and pass their Comprehensive Examination at least one year before graduation. These examinations are described in detail in section V.

D. Masters in Professional Service

The Masters in Professional Studies (M.P.S.) degree in chemistry is intended to be a terminal degree. Application to the MS or Ph.D. program in chemistry does not guarantee admission to the M.P.S. program and nor does admittance to the M.P.S. program guarantee admission to the M.S. and Ph.D. programs in Chemistry. To obtain an M.P.S. degree through the Faculty of Chemistry, the course requirements include 33 credits at the graduate level of which 24 credits must be for graduate level coursework. M.P.S. candidates must present a capstone seminar to the chemistry faculty and to complete an integrative experience. Evaluation exams are not required for M.P.S. candidates.

V Detailed Requirements

A. Master's of Science (M.S.) Program

1. Evaluation Examinations

During the first semester in which a student registers, he or she will be expected to take the American Chemical Society Examinations in at least four of the five areas. The tests are given in (1) Inorganic Chemistry, (2) Quantitative Analysis, (3) Organic Chemistry, (4) Biochemistry and (5) Physical Chemistry. These will be used as a guide by the student's major professor and steering committee to determine the student's future course program. The Steering committee must submit a written recommendation to the department chair as to how the student will address any apparent deficiencies in their course preparation.

2. Course Requirements

Students enrolled in graduate study in the M.S. program are expected to select, in consultation

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with the student's major professor and their steering committee, a program of appropriate chemistry, science, and related courses. The program must total at least 30 hours of credit earned through work designed expressly for graduate students, of which at least 18 credits must be for graduate level coursework (with 12 credits taken in residence), and a minimum of 6 credit hours are awarded for a thesis. The following core courses are required, depending on the student's area of study (Table 1):

Table 1. Required coursework for the Masters of Science degree by Field of Study.

<p><u>Polymer Chemistry</u> Introduction to Polymer Chemistry (FCH 550, 551, 552 or equivalent) – 9 cr. hrs. (if not taken previously) Advanced Physical Chemistry – 3 cr. hrs. Advanced Organic Chemistry – 3 cr. hrs. Advanced Polymer Chemistry – 3-6 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Additional courses to be selected from: Inorganic Chemistry, Organic Chemistry, Biochemistry others.</p>	<p><u>Environmental Chemistry</u> Introduction to Environmental Chemistry (FCH 510, 511, 515 or equivalent) – 9 cr. hrs. (if not taken previously) Introductory Biochemistry -3 cr. hrs. (if not taken previously) Dept. Seminar-- FCH 997 (1 cr. hr.); Seminar class (FCH 797 or equivalent)- 2 cr. hrs. Additional courses to be selected from: Inorganic Chemistry, Organic Chemistry, Biochemistry, others - 6 cr. hrs.</p>
<p><u>Natural Products/Ecological Chemistry</u> Organic mechanisms – 3-6 cr. hrs.) total Synthetic organic chem. – 3-6 cr. hrs.) 9 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Natural Products – 3 cr. hrs. Additional courses to be selected from: Advanced Physical Chemistry, Inorganic Chemistry, Biochemistry, others.</p>	<p><u>Biochemistry</u> Introductory Biochemistry (FCH 530, 531, 532 or equivalent) – 9 cr. hrs. (if not taken previously) Advanced Biochemistry – 3 cr. hrs. Advanced Chemistry – 3 cr. hrs. Seminar class (FCH 797 or equivalent)- 2 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Additional courses to be selected from: Advanced Organic Chemistry, Inorganic Chemistry, Advanced Biology, others.</p>

All students are required to present a seminar by enrolling in FCH 997 (1 cr. hr.); this seminar will be in an area outside the student's research ("*Topic Seminar*"). All students will also present a seminar on the student's research topic ("*Capstone Seminar*"). The latter seminar should be presented during the semester in which the student will defend his/her thesis.

3. Thesis Requirement

A student will be required to demonstrate ability to complete a substantial research problem and to describe this research problem and to describe this research in the form of a M.S. thesis. The thesis will be reviewed by the student's Steering Committee after which the student will defend the thesis orally before an examining committee of four to six members.

4. Residence Requirements

A candidate for the M.S. degree must complete two semesters in residence as a full-time graduate student (excluding summer sessions), or the equivalent if registered as a part-time student.

5. Time Limit

By ESF policy, students must complete all requirements for the M. S. degree within three years of matriculating in the graduate program.

6. Teaching Assistance

Each student who receives a College Teaching Assistantship will serve as laboratory instructor or assist in other instructional duties.

B. Doctoral Program

1. Evaluation Examinations

During the first semester in which a student registers, he or she will be expected to take the American Chemical Society Examinations in at least four of the five areas in which the student has undergraduate coursework. The tests are given in (1) Inorganic Chemistry, (2) Quantitative Analysis, (3) Organic Chemistry, (4) Biochemistry and (5) Physical Chemistry. These will be used as a guide by the student's major professor and steering committee to determine the student's future course program. The Steering committee must submit a written recommendation to the department chair as to how the student will address any apparent deficiencies in their course preparation.

2. Course Requirements

Students enrolled in graduate study in the Ph.D. program are expected to select, in consultation with the student's major professor, a program of appropriate chemistry, science, and related courses. They must complete a program of at least 60 credit hours earned through work designed expressly for graduate students, of which at least 30 credits must be for graduate level coursework and a minimum of 12 credits are awarded for a thesis. The following core courses as described in Table 2 are required, depending on the student's area of study

All students are required to present a seminar by enrolling in FCH 997 (1 cr. hr.); this seminar will be in an area outside the student's research ("*Topic Seminar*"). All students will also present a seminar on the student's research topic ("*Capstone Seminar*"). The latter seminar should be presented during the semester in which the student will defend his/her thesis.

3. Doctoral Candidacy Examinations

Candidacy exam committees in Chemistry may choose to use ESF candidacy examination Forms 2 or 3. Form 1 is not allowed. The examination consists of two parts: the preparation of a written paper followed by its oral defense.

For Form 2, the student is assigned a problem, which is not directly related to the thesis research. The problem will, however, be within the area of the student's specialization. The student will have approximately four weeks to complete the paper and must furnish each member of the examining committee with a copy of it one week prior to the oral examination.

For Form 3, the student prepares and defends a written proposal of future research likely to be carried out during their Ph. D. project. This research prospectus must be presented to the examining committee two weeks prior to the oral exam and should include preliminary studies

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supporting the feasibility of the proposed research.

The exam will test the candidate's understanding of concepts directly related to his/her own immediate area of research, knowledge of prior related research that has been conducted by others, their ability to design and interpret experiments in this area, and capacity to think and write independently and to present work plans orally in a clear and rational manner. The oral examination will be administered by the examining committee and will last approximately two hours. At the end of the examination, the committee will immediately determine whether the student should be admitted to candidacy for the Ph.D. degree. In the event of failure, the student will have one more chance to pass the examination. Two failures will require the student's termination from the Ph.D. program.

The examination is generally taken after the completion of the majority of coursework. By ESF policy, the Ph.D. Candidacy exam must be taken within no more than three years from the first date of matriculation in the Ph. D. program, and it must be taken at least one year before the student defends the Ph.D. thesis.

Table 2. Ph.D. Course Requirements (Minimum 30 credits)

<p><u>Polymer Chemistry</u> Introductory Polymer Chemistry – 6-8 cr. hrs. (if not taken previously) Advanced Physical Chemistry – 6 cr. hrs. Advanced Organic Chemistry – 6 cr. hrs. Advanced Polymer Chemistry – 6 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Additional courses to be selected from: Biochemistry, Inorganic Chemistry, Organic Chemistry, others.</p>	<p><u>Environmental Chemistry</u> Intro. Env. Chemistry (and lab) – 9 cr. hrs. (if not taken previously) Intro. Biochemistry -3 cr. hrs. (if not taken previously) Seminar class (FCH 797 or equivalent) 5 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Advanced Chemistry – 9 cr. hrs. Additional courses to be selected from: Inorganic Chemistry, Organic Chemistry, Biochemistry, others - 9 cr. hrs.</p>
<p><u>Natural Products/Ecological Chemistry</u> Organic Mechanisms – 6 cr. hrs. Synthetic Organic Chemistry – 6 cr. hrs. Natural Products – 3 cr. hrs. Advanced Physical Chemistry – 3 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Additional courses to be selected from: Inorganic Chemistry, Biochemistry, others</p>	<p><u>Biochemistry</u> Introductory Biochemistry, (FCH 530, 531, 532, or equivalent – 9 cr. hrs.) (if not taken previously) Advanced Biochemistry – 3-6 cr. hrs.)total 9 Advanced Chemistry – 3-6 cr. hrs.)cr. hrs. Advanced Molecular Biology – 3 cr. hrs. Seminar class (FCH 797 or equivalent) 5 cr. hrs. Dept. Seminar-- FCH 997 (1 cr. hr.); Additional courses to be selected from: Advanced Organic Chemistry, Inorganic Chemistry, Advanced Biology, others.</p>

SB3

Biomolecular Modeling - 3 cr. hrs.

Biochemistry, Cell and Molecular Biology I and II 6-8 cr. hrs. (if not taken previously)

Introduction to Genetic Engineering - 3 cr. hrs.

Introduction to SB3 Research (3 rotations) - 6 cr. hrs.

Issues and Principles Directing Scientists - 1 cr. hr.

Introduction to SB3 Faculty - 1 cr. hr.

SB3 Seminar/Journal Club - 4 cr. hrs. (1/semester)

others - 6 cr. hrs. with advisor's approval

4. Thesis Requirements

A student will be required to demonstrate ability to complete a substantial research problem and to describe this research in the form of a Ph.D. thesis. The thesis will be reviewed by the student's Steering Committee after which the student will defend the thesis orally before an examining committee of four to six members.

5. Tool Requirements

Doctoral students must demonstrate competence in at least one research tool as a requirement for graduation. Such tools include, but are not limited to, statistics, *information literacy*, or the *ability to translate technical articles* in a language other than English commonly used in chemistry.

6. Residence Requirements

A candidate for the Ph.D. degree must complete four semesters in residence as a full-time graduate student (excluding summer sessions), or the equivalent if registered as a part-time student.

7. Time Limit

By ESF policy, students must complete all requirements for the Ph. D. degree within three years of passing the doctoral Candidacy Exam.

8. Teaching Assistance

Each student who receives a College Teaching Assistantship will serve as laboratory instructor or assists in other instructional duties.

C. Master's in Professional Studies

1. Prerequisites

Students are accepted into our programs with a variety of backgrounds. Deficiencies in undergraduate-level chemistry, physics, mathematics or biology will have been identified in the letter of admission. If not completed prior to matriculation, appropriate classes must be taken during residence. Either undergraduate or graduate courses may be taken to remedy deficiencies, depending on the circumstance, and as approved by the steering committee. Undergraduate courses (400 level and below) do not count toward the minimum number of required graduate credit hours. Students planning on obtaining an M.P.S. degree in chemistry should have completed the undergraduate coursework detailed in section IIIA.

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2. Transfer Credit (Up to 6 credits of graduate coursework)

Courses in which a minimum grade of "B" was earned from an accredited institution and was not used to complete another degree may be accepted towards completion of the M.P.S. degree if approved by the steering committee. Coursework credit will also be given for courses successfully completed before entry into the Chemistry M.P.S. program, as long as the college requirement for 24 credits of course work taken in residence at ESF is met. For those students who are transferring from a thesis-based program, thesis credits (FCH899, FCH999, or equivalent) cannot be used to meet credit requirements for the M.P.S. degree in chemistry. Up to 6 independent research credits (FCH 798), if approved by the steering committee can be used towards the 33 credit requirement but cannot be used to meet the 24 credits of graduate level coursework. Seminar credits can be transferred as long as the total number of transferred seminar credits does not exceed 3 credits.

3. Coursework Requirements and Guidelines

The minimum total credits for the M.P.S. degree within the faculty of chemistry is 33 credits. In addition to those requirements detailed in section A, the student must complete 24 credits of graduate level course work. This must be distributed as follows:

- 15 credits of advanced chemistry courses. This must include at least 3 credits of coursework in three of the four subject areas: Polymer Chemistry, Environmental Chemistry, Biochemistry, and Natural Products/Organic Chemistry.
- 3 credits of seminar. This requirement should be met by three 1-credit seminar courses where the student presents a seminar to an audience. At least one credit of this requirement must be for FCH 997 where a student presents a seminar to the Chemistry Faculty as a whole. This is usually done in the last semester in residence at ESF and serves as the student's capstone seminar.
- 6 credits of additional graduate level coursework. These courses can be in chemistry if so desired, but can also be in any area of Science, Math or Engineering as approved by the student's steering committee.

In addition to the 24 credits specified above, the student must also complete an additional 9 credits of graduate level course work to give a minimum of 33 credits. At least 3 credits will be given for the integrative experience as specified in the student's form 3B-MPS. The remaining 6 credits may be drawn from additional graduate level coursework, seminars, internships and research experience as approved by their steering committee.

4. Communication and Integrative Experience

All students entering graduate programs at ESF are expected to be proficient in communication skills, including technical writing and library skills. Students are required to have completed at least one course in technical writing and one course in library usage or information literacy, either as an undergraduate or graduate student. Credits for undergraduate level courses taken during the graduate program to meet the communication requirements are not counted towards degree requirements. Credits for graduate level courses used to meet the technical writing and library usage requirements can be counted towards the 33 credit total if approved by the student's steering committee. Graduate students can also meet the requirement for competency in writing and library skills by demonstrating the equivalent in experience as defined by their committee.

All Chemistry M.P.S. degree candidates must demonstrate competence in oral expression as it relates to chemistry. This competency will usually be demonstrated by completion of at least 3 credits of seminar. At least one credit must be for a seminar given to the chemistry faculty as a whole (FCH 997). This latter seminar serves as the student's capstone seminar and forms part of the student's integrative experience. The remaining credit(s) can be met by topical seminars where the student presents a seminar. This latter requirement can be fulfilled, with approval, by seminars taken in other departments at ESF, SUNY-Upstate Medical University or Syracuse University. Graduate-level seminar courses where the student does not present a seminar can be used to meet the 24 credits of graduate coursework but do not meet the 3 credits of seminar experience.

In addition to their communication skills, all candidates must complete an integrative experience as approved by their steering committee. One common form of this experience is to prepare a written report on a topic or problem assigned by an examining committee. The candidate must have a thorough understanding of the assigned topic and demonstrate that understanding in both written and oral expression. Other forms of integrative experiences are possible, but all must be approved by the steering committee and indicated on the Form 3B-MPS in advance of their commencement.