

Status: PENDING

PROGRAM REQUEST
Chemistry M.S.

Last Updated: Myers, Dena Elizabeth
05/26/2011

Fiscal Unit/Academic Org	Chemistry - D0628
Administering College/Academic Group	Mathematical And Physical Sci
Co-administering College/Academic Group	
Semester Conversion Designation	Re-envisioned with significant changes to program goals and/or curricular requirements (e.g., degree/major name changes, changes in program goals, changes in core requirements, structural changes to tracks/options/courses)
Current Program/Plan Name	Chemistry
Proposed Program/Plan Name	Chemistry M.S.
Program/Plan Code Abbreviation	CHEM-MS
Current Degree Title	Master of Science

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		45	30.0	30	0.0
Required credit hours offered by the unit	Minimum	45	30.0	30	0.0
	Maximum	45	30.0	30	0.0
Required credit hours offered outside of the unit	Minimum				
	Maximum				
Required prerequisite credit hours not included above	Minimum				
	Maximum				

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals •

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? No

A full assessment plan has been submitting using the survey form

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Status: PENDING

PROGRAM REQUEST
Chemistry M.S.

Last Updated: Myers,Dena Elizabeth
05/26/2011

Does this Program have a Pre-Major? No

Attachments

- Curriculum Letter.pdf: Letter
(Letter from Program-offering Unit. Owner: Coleman,Robert S)
- statement_MS.pdf: M.S. Program Proposal
(Program Proposal. Owner: Coleman,Robert S)
- Chemistry MS cover letter.doc: NMS Division of Arts and Sciences cover letter
(Letter from the College to OAA. Owner: Andereck,Claude David)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Coleman,Robert S	04/27/2011 04:59 PM	Submitted for Approval
Approved	Coleman,Robert S	04/27/2011 05:00 PM	Unit Approval
Revision Requested	Andereck,Claude David	05/03/2011 01:17 PM	College Approval
Submitted	Coleman,Robert S	05/09/2011 12:32 PM	Submitted for Approval
Approved	Coleman,Robert S	05/09/2011 12:33 PM	Unit Approval
Revision Requested	Andereck,Claude David	05/11/2011 07:03 PM	College Approval
Submitted	Coleman,Robert S	05/12/2011 08:10 AM	Submitted for Approval
Approved	Coleman,Robert S	05/12/2011 08:10 AM	Unit Approval
Revision Requested	Andereck,Claude David	05/12/2011 08:49 AM	College Approval
Submitted	Coleman,Robert S	05/12/2011 09:28 AM	Submitted for Approval
Approved	Coleman,Robert S	05/12/2011 09:29 AM	Unit Approval
Approved	Andereck,Claude David	05/17/2011 12:56 PM	College Approval
Approved	Myers,Dena Elizabeth	05/26/2011 08:56 AM	GradSchool Approval
Pending Approval	Soave,Melissa A Cameron,Erin Marie	05/26/2011 08:56 AM	CAA Approval



Division of Natural and Mathematical Sciences

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May 17, 2011

Dena Myers
Graduate School
250 University Hall
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Campus

Dear Dena:

It is a pleasure to forward to you the proposal for the masters program in Chemistry under semesters. The Department undertook an extensive review of their graduate program. The resulting masters program involved a significant re-envisioning and modernization of the structure of the program, with an emphasis on half-semester topical courses and the establishment of core courses in fundamental areas of chemistry. The masters program requires completion of a thesis.

Beyond my own review of the documents, the proposal has been discussed by colleagues from other NMS units at a meeting on May 3, 2011. Feedback from these discussions has been incorporated in the proposal.

If you have any questions, I would be happy to address them.

Sincerely,

A handwritten signature in black ink, appearing to read "David Andereck".

David Andereck
Professor of Physics
Associate Dean of Natural and Mathematical Sciences, College of Arts and Sciences

To: University Semester Conversion Committees

Re: Conversion of Chemistry Graduate Degree Programs (M.S. and Ph.D.)

Date: May 5, 2011

The Department of Chemistry offers graduate programs leading to the Masters of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. Graduate courses and research programs are offered in analytical, biological, inorganic, organic, physical and theoretical chemistry, and affiliated multidisciplinary areas of study. The Department does not formally recruit students into the M.S. program; rather, all students are admitted into the Ph.D. program, whereupon a certain proportion of matriculated students choose to terminate their studies with the M.S. degree. All admitted students, other than those with fellowships, are supported by the department as teaching assistants.

The first year of graduate study is devoted largely to advanced coursework with the opportunity to begin research mid-year. During the second and subsequent years, the major emphasis is given to research for both M.S. and Ph.D. students. Doctoral students begin their examinations for admission to Ph.D. candidacy in their second year. These examinations include both written and oral portions; they are designed to verify the student's competence as an independent scientist.

All graduate research is carried out under the direct supervision of a faculty adviser(s) who serves as the student's preceptor. Many research groups are enriched by the presence of postdoctoral researchers and visiting professors. Graduates of the program are employed by industrial and government laboratories and as research and teaching staff members at colleges and universities across the United States.

The curriculum for graduate programs in Chemistry has remained relatively unchanged for many years, with courses being organized by area of study (divisionally). While new courses have infrequently been added, existing course structure has not evolved to fully meet the needs of the modern graduate student of chemistry. Consequently, the conversion to semesters represented an opportunity for the Department of Chemistry to re-envision the presentation of its curriculum, in order to maximize flexibility for students studying across different sub-areas of chemistry, to provide greater inter-divisional course offerings, to reorganize courses into topical offerings of greater relevance to student interests, and to codify various courses that have not been formally added to the curriculum.

The process for conversion of the graduate curriculum by the Graduate Studies Committee of the Department began in the summer of 2009. (NB. The progress of conversion was significantly delayed until the decision to merge the Departments of Chemistry and Biochemistry was formalized.) An initial strategy was formulated, wherein courses were to be offered in defined topical areas rather than as

sequences of intermediate and advanced courses. These topical areas included new core course offerings in the disciplines of analytical, biological, inorganic, organic, and physical chemistry that would be of general interest to beginning graduate students outside of a specific division. These core courses were viewed as foundational and would provide students with a common knowledge base with which to begin more advanced coursework. The core course structure was also envisioned to foster multidisciplinary interactions between students in different divisions, as these students would take a partially common set of courses during the first autumn session. The majority of topical courses were re-designed as seven-week session courses to further increase flexibility in student curricula by allowing a greater degree of diversity in course offerings.

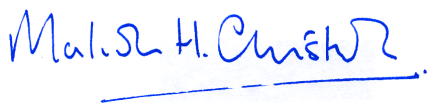
It should be stressed that within this re-envisioned curriculum, the actual informational content would remain constant in the quarter-to-semester conversion, whereas the sequence and organization of informational transfer to students would change. The greater flexibility of course offerings will also reduce any difficulties for the small fraction of students faced with transitioning from quarters to semesters after their first year of study.

The curriculum was discussed extensively by the Graduate Studies Committee in formal meetings and electronically. The divisional representatives to this committee worked with divisional faculty to re-design course structure, to develop syllabi, and to sequence the course offerings. Consequently, all faculty members have had ample opportunity to provide input into the process. In cases where courses crossed divisional boundaries, interdivisional collaboration effectively merged divisional interests and needs. This process is ongoing, and it may be possible to further consolidate course offerings.

The M.S. and Ph.D. program requests and graduate course structure was unanimously approved by the Graduate Studies Committee (6-0), Chaired by the Vice Chair for Graduate Studies, and were approved by the Department of Chemistry tenure-track faculty (28-0) via an on-line, authenticated vote.

Details of the re-designed curriculum are provided in the accompanying documentation.

Sincerely,



Malcolm H. Chisholm
Chair and Distinguished University Professor
Department of Chemistry



Robert S. Coleman
Vice Chair for Graduate Studies
Department of Chemistry

MASTER'S PROGRAM PROPOSAL – DEPARTMENT OF CHEMISTRY

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PROGRAM RATIONALE

The Department of Chemistry has traditionally offered thesis-based M.S. and Ph.D. degrees. In conversion to semesters, the fundamental basis for graduate degrees in Chemistry remains unchanged, although the coursework providing foundational knowledge has been re-designed and the content presentation has been re-envisioned.

Courses will continue to be offered in defined areas of specialization, except traditional sequences of intermediate and advanced courses have been re-designed to meet the needs of a modern program in chemical research. Courses are now offered from a topical perspective. These topical areas include foundational core course offerings in the disciplines of analytical, biological, inorganic, organic, and physical chemistry of general interest to beginning graduate students outside of a specific division. The majority of Introductory and Intermediate courses (6000-7000 level) were re-designed as seven-week session courses to further increase flexibility in student curricula by allowing a greater degree of diversity in course offerings and for flexibility in designing multidisciplinary tracks of study. Thus, the student under the new semester system will have a greater ability to take coursework that best suits their research interests, rather than a strictly proscribed curriculum based on divisions. It should be stressed that the overall content of the re-designed coursework is unchanged or modestly enhanced, and more modern topics that have been introduced as Individual Studies courses (693) or have been repeated offerings of advanced topics courses under quarters have been codified as new courses under semesters.

MASTER'S PROGRAM IN CHEMISTRY

Master's Degree The student must have a minimum residence of two semesters at The Ohio State University with completion of at least 30 semester hours of graduate work. The student's course program should be decided in conjunction with the Advisor. A student pursuing the M.S. degree must complete a minimum of 12 hours of coursework at the 5000-7000 level in Chemistry, and complete a minimum of 16 hours of 8999.

Students will carry out a research program that will culminate with the writing of a thesis. The research program should be initiated upon joining a research group. The Department of Chemistry does not award a non-thesis M.S. degree.

The M.S. candidate must pass an oral examination before a committee composed of at least two Chemistry Department faculty members, including the student's research advisor, following rules from the Graduate School Handbook.

The M.S. degree is a research degree, and thus all coursework is taken during the first year. Those courses indicated as electives may include those offered in other areas by the Division (both inside and outside the Chemistry Department) and, in some cases, additional courses in the major field. Students may enroll in research as early as spring semester of their first year, and they must do so by the summer term of their first year in graduate school.

Students in good standing in the graduate school will enroll for Research in Chemistry (CHEM 8999) when they begin their degree research, and during each subsequent term. Each student should enroll every semester (except summer term) for one hour of a divisional Seminar course (889X, where X = 1-6), unless doing so violates the credit hour limits. This course requires regular attendance at departmental and/or divisional seminars.

MASTER'S COURSEWORK UNDER SEMESTERS

Course Structure and Total Contact Hours Chemistry graduate courses under the semester system are either 7- or 14-weeks in length, for 1.5 or 3.0 credits, respectively. The autumn and spring semesters have been divided into two sessions each, designated as AU-1/AU-2 and SP-1/SP-2. The May term will be used primarily for specialized or laboratory courses, and the Department does not teach graduate courses during the summer term.

Recommended Curriculum The following tables indicate the proposed recommended first-year curriculum for students pursuing the M.S. degree in the Department of Chemistry. Students must complete 12 credit hours of coursework. Thus, first-year graduate students will begin introductory-level coursework (6000-level) in the first semester, moving to intermediate-level coursework (7000-level) in the second semester (Table 1). Please note that not all courses are 7-week sessions; some courses are 14-week semester courses, and will take the place of two 7-week session courses (dotted vertical line, Course 1, Table 1).

All instructional content from quarter-based courses will be represented in the semester courses listed at the end of this document (Page 11).

Table 1. Recommended Coursework for First-Year Graduate Students (Credit Hours)					
Year 1	AU-1	AU-2	SP-1	SP-2	SU
Course 1	Introductory Divisional Course (1.5) 6000-level	Introductory Divisional Course (1.5) 6000-level	Intermediate Divisional Course (1.5) 7000-level	Intermediate Divisional Course (1.5) 7000-level	Thesis Research (4) 8999
Course 2	Core Elective (1.5) 6N10*	Introductory Divisional Course (1.5) 6000-level	Intermediate Divisional Course (1.5) 7000-level	Intermediate Course (1.5) 7000-level	
Course 3	Faculty Research (1) 6780	Lab Safety (1) 6781	Ethics (1) 6782		
Course 4	Seminar (1) 889N*		Seminar (1) 889N*		
Course 5	Non-thesis Research (7) 8998		Thesis Research (8) 8999		
Total Credit Hours	16		16		4

*N = 1 (analytical), X = 2 (biological), X = 3 (inorganic), X = 4 (organic), X = 5 (physical), X = 6 (theoretical).

Students pursuing the M.S. degree in Chemistry will typically take only a seminar and research course after their first year of study.

Table 2. Recommended Coursework for Second- (and Third-) Year Students (Credit Hours)					
Year 2-3	AU-1	AU-2	SP-1	SP-2	SU
Course 1	Seminar (1) 889N*		Seminar (1) 889*		Thesis Research (4) 8999
Course 2	Thesis Research (7) 8999		Thesis Research (7) 8999		
Total Credit Hours	8		8		4
*N = 1 (analytical), X = 2 (biological), X = 3 (inorganic), X = 4 (organic), X = 5 (physical), X = 6 (theoretical).					

Students terminating their studies with the M.S. degree would have sufficient credits after their first year of study to meet the 30 credit hour requirement for this degree.

Curricular Requirements While each division (sub-discipline) in the Department of Chemistry has specific courses that are recommended, some of which proceed in a specific sequence, the Department does not consider that courses are formally “required” in the sense that a student cannot receive a graduate degree without successfully completing a given course. Students follow divisional guidelines and requirements for coursework, but exceptions are usually allowed and substitutions for introductory and intermediate courses are common. In the case of elective courses, some divisions have lists of approved electives, whereas other divisions allow the student considerable flexibility in choosing such courses. Ultimately, it is the student’s advisor and the Graduate Studies Committee who have final approval for a proposed curriculum.

REQUIREMENTS OF THE CHEMISTRY MASTER'S PROGRAM

The following information is taken from the document "Summary of Procedures and Requirements for Graduate Degrees (2010-2011)." No significant changes to this document are envisioned upon semester conversion.

Admission to the Master's Program in Chemistry The Department of Chemistry does not admit students directly into the M.S. degree program. Students may elect to terminate their studies with the M.S. degree after matriculation or may be directed by the faculty towards a terminal M.S. degree based on performance in the graduate program.

Duration of Master's Programs in Chemistry Typically, an M.S. student will spend two years in residence, but may spend no more than three years.

Placement Exams At the time students enroll in the Graduate School the department will administer a series of written examinations that are used to gauge competence at the undergraduate level in analytical, biological, inorganic, organic, and physical chemistry. The purpose of these examinations is to aid the student and faculty advisors in planning a suitable progression of course work leading to the advanced degree. Students who are considered "not proficient" in an area will be provided with advice on how to strengthen competency in that area. Such advice may include suggested course work and/or a course of independent study.

Safety Seminar Program (CHEM 6781 – Laboratory Safety) Every graduate student is required to attend a complete series of Safety Seminars during their first year of study. The purpose of the series is to maintain high safety standards in the departmental teaching and research laboratories. The series of lectures, given weekly by the departmental safety coordinator, covers topics ranging from the handling of corrosive and toxic chemicals to fire fighting. Failure to attend any of these lectures will constitute an unsatisfactory performance as a Graduate Associate and may result in loss of departmental support during the summer of the first year. In addition to the Safety Seminars, each student must become familiar with the department's Chemical Hygiene Plan and the Standard Operating Procedures associated with their work.

Financial Support for Graduate Students Most graduate students receive financial support as Graduate Associates, either Teaching Associates (GTA) or Research Associates (GRA), or as Fellows during their tenure in the department. Graduate students supported by any of these appointments may not hold additional employment of any kind without express permission of the Vice Chair for Graduate Studies. The Graduate School sets minimum requirements of eligibility for GA appointments to students who are in a degree program. Until passing the Candidacy Exam, students must register for at least eight (8) credit hours during autumn and spring semesters and at least four (4) credit hours during the summer term. Students who hold fellowships or traineeships must register for twelve (12) credit hours during each term. Each of these registration requirements qualifies the student to be considered "full-time" for purposes such as visas, health insurance, etc.

There are further requirements imposed by the Graduate School. A Master's degree requires at least 30 graduate credit hours. Audited courses do not count toward these minima.

Departmental policies coincide with these guidelines for the most part:

- (1) Students with a GPA below 3.00 lose their right to a summer term Graduate Research Associate appointment from the department (dGRA), and may lose future support as a GA.
- (2) Students intending to take a terminal M.S. degree are expected to defend their thesis by the end of their third year. Students failing to defend their M.S. thesis by the end of their third year must petition the Vice Chair for Graduate Studies for continuation of support.
- (3) Every faculty member is required to evaluate their Graduate Teaching Assistants each term with ratings of Excellent (E), Satisfactory (S+, S, or S-), or Unsatisfactory (U). Evaluations are based on overall performance as a teaching associate, but also include punctuality, attendance of staff meetings, and attitude toward students. Students receiving an unsatisfactory (U) teaching evaluation will be suspended from their teaching appointment for one term and must petition the Vice Chair for Graduate Studies for subsequent reinstatement. No TA support will be available during such a suspension. Two S- ratings are regarded as equivalent to one U rating. Any subsequent U will lead to dismissal from the teaching program. No further TA support will be available. A further S- rating will result either in complete dismissal from the teaching program or a one-term suspension, as appropriate.

Faculty Research Presentations Students are required to attend a series of weekly Faculty Research Presentations during first session of the autumn semester (AU-1) of their first year in the program (CHEM 6780). The purpose of these presentations is to provide students with an overview of the types of research being conducted in various research groups, and to help students identify the faculty members that he/she wishes to interview. The point of attending presentations in the areas of interest to the student is obvious. The Department also hopes that attending presentations from other disciplines will provide students with points of reference, should they need help during the course of their graduate studies, for topics in which their advisor is not an expert.

Advisor Selection and Initiation of Research Thesis research is initiated when a student has selected a research adviser, and has been admitted into a research group. The selection of an advisor is a major step in a student's program. The process involves a formal system of interviews. To initiate the procedure, the student will obtain a "Selection of Research Advisor Form" from the Graduate Office and designate a minimum of four (4) faculty members that he/she wishes to interview. Students are encouraged to interview as many faculty as they feel may provide research programs of interest. The Vice Chair will assign additional faculty members for Graduate Studies in accordance with departmental and divisional guidelines, and provide the student with an "Interview Record Sheet." All faculty

members on the "Interview Record Sheet" must sign the sheet after they have been interviewed. Students then submit a rank-ordered list of their top three choices for advisor ("Choice of Preceptor" form) to the Graduate Office by the last day of final exams in autumn semester. The Graduate Studies Office provides the list of student advisor preferences to the division secretaries and faculty. Following any formal discussion between faculty that may be required by a division, the faculty member listed as the first choice must decide whether or not to serve as advisor to the student. The faculty member notifies the division secretary and Graduate Studies Office of his/her decision. If a faculty decides not to serve as advisor, the faculty member who is the second choice makes a similar decision. This process is repeated until the student has an advisor. In the event a student is not accepted by one of their top three choices, the Vice Chair for Graduate Studies becomes active in helping the student find an advisor, in a manner left to the discretion of the Vice Chair. Once the list of advisor preferences has been distributed, it is a goal of the department to place students in research groups within a two-week period. The process of selecting an advisor must be completed by the end of the second semester in order to qualify for a summer term dGRA appointment.

A student may complete their M.S. research under the supervision of an advisor from outside the Department of Chemistry with a co-advisor on the Chemistry faculty. All such arrangements must be collaborative in nature with the Chemistry faculty member serving as the Principal Investigator on the research project, and are subject to approval by the Vice Chair for Graduate Studies, who will request a description of the proposed research and consider whether it is suitable for an M.S. thesis in Chemistry.

After selection of an advisor and in consultation with the student and their advisor, the Vice Chair for Graduate Studies will appoint an advisory committee for each student. The purpose of the advisory committee is to provide each student with support and guidance during their graduate career. Students should meet with their advisory committee during the autumn semester of each year to discuss their progress in course work, examinations and research. In addition, students are free to meet with any committee member at any time during the year. The department hopes that this process will provide a mechanism for forging closer ties between students and faculty, both before and after graduation.

If a student leaves a group, or the faculty advisor resigns his/her position as preceptor, the student will have up to one semester to find a new advisor. After this time, support will be withdrawn.

First-Year Oral Examination All students pursuing either an M.S. degree or Ph.D. degree must take an oral examination in the summer of their first year of study. The focal point of this examination is a paper that is related to the student's research topic, and which is selected jointly by the student and their advisor. The purpose of this exam is to evaluate the student's progress within the context of an activity that is relevant to their research interests, and to determine whether the student is ready to proceed with further requirements of the Ph.D. program.

Repeat exams or extra chances at cumulative exams will only be given in exceptional cases. The student must clearly state the grievance and proposed redress in a petition to the

Graduate Studies Committee, who will act on the petition in consultation, and based on the recommendation, of the division(s) administering the exam.

Thesis The thesis resulting from the student's master's research must represent a significant contribution to knowledge in chemistry. A reading committee composed of the adviser and at least one graduate faculty member consider the merit of the thesis. The student's advisor selects this committee.

Final Oral Exam The M.S. candidate must pass an oral examination before a committee composed of at least two Chemistry Department faculty members, including the student's research advisor, following rules from the Graduate School Handbook.

MASTER'S PROGRAM UNDER QUARTERS

The following table outlines the suggested M.S. curriculum for graduate students under the current quarter system (Tables 4 and 5). All courses are three (3) credit hours. The specific recommendations or requirements vary slightly by area of specialization, with variation existing largely in the balance of major subject/elective courses.

Table 4. Recommended Coursework for First-Year Students (Credit Hours)				
Year 1	AU	WI	SP	SU
Course 1	Major Subject (3)	Major Subject (3)	Major Subject (3)	Thesis Research (7) 999
Course 2	Major Subject (3)	Major Subject (3)	Elective (3)	
Course 3	Colloquium (1) 885	Colloquium (1) 885	Colloquium (1) 885	
Course 4	Faculty Research (1) 693	Lab Safety (2) 685		
Course 5	Research (12) 999	Research (11) 999	Research (13) 999	
Total Credit Hours	20	20	20	7

Table 5. Recommended Coursework for Second- (and Third-Year) Students (Credit Hours)				
Year 2-3	AU	WI	SP	SU
Course 1	Colloquium (1) 885	Colloquium (1) 885	Colloquium (1) 885	Thesis Research (7) 999
Course 2	Research (8) 999	Research (8) 999	Research (8) 999	
Total Credit Hours	9	9	9	7

All instructional content from quarter-based courses will be represented in the semester courses listed at the end of this document (Page 11). The non-coursework requirements under the quarter system will remain unchanged under the semester system, and are detailed above.

TRANSITION PLAN

As indicated above, the vast majority of graduate students in the Department of Chemistry finish their basic coursework during their first year of study. Exceptions to this are largely due to some courses being offered in alternate years, and these alternate year courses will still be offered in the same order so as not to delay students. Thus, for the cohort of 55-60 students entering the graduate program in AU11 quarter, there will be a few (< 10%) who have not taken all their required coursework by the time semester conversion is implemented in the AU12 semester. The Vice Chair for Graduate Studies will manage individual advising of this remnant group of students, in concert with their research advisors. The greater flexibility of course offerings will also reduce any difficulties for the small fraction of students faced with transitioning from quarters to semesters after their first year of study.

SEMESTER COURSE LIST

Semester Course Number	Course Title	Semester Credit Hours	Quarter Course Basis	Quarter Credit Hours
5193	Individual Studies	1.0-10	693	0-15
5194	Group Studies	1.0-10	694	1.0-5.0
5420	Spectroscopy of Organic Compounds	1.5	632	3.0
5430	Carbohydrate Chemistry	1.5-3.0	635	3.0
5440	Introduction to Computational Chemistry	1.5-3.0	644	3.0
5520	Nanochemistry	3.0	611	3.0
6110	Survey of Instrumental Methods	1.5	new	
6120	Analytical Data Treatment	1.5	720	3.0
6210	Chemistry at the Interface of Biology	1.5	new	
6310	Fundamentals of Coordination Chemistry	1.5	new	
6320	Synthetic Principles in Inorganic Chemistry	1.5	753	3.0
6330	Group Theory and Bonding	1.5	851	3.0
6340	Physical Methods in Inorganic Chemistry	1.5	752	3.0
6410	Basic Organic Reaction Mechanisms	1.5	new	
6420	Stereochemistry and Conformational Analysis	1.5	730	3.0
6430	Introduction to Organic Synthesis	1.5	832/833	3.0/3.0
6440	Introduction to Physical Organic Chemistry	1.5	731/831	3.0/3.0
6510	Quantum Mechanics and Spectroscopy	1.5	new	
6520	Thermodynamics	1.5	775	3.0
6530	Kinetics	1.5	775	3.0
6540	Introduction to Electronic Structure	1.5	866	3.0
6550	Atmospheric Chemistry	1.5	641	3.0
6780	Faculty Research Presentations	1.0	new	
6781	Laboratory Safety	1.0	685	2.0
6782	Ethics in Scientific Research	1.0	new	
7120	Electrochemistry	3.0	821	3.0
7130	Fundamentals & Techniques of Separation Science	3.0	822	3.0
7140	Analytical Spectroscopy	3.0	823	3.0
7150	Mass Spectrometry	3.0	825	3.0
7160	Nuclear Magnetic Resonance	3.0	824	3.0
7170	Analytical Surface Science	1.5-3.0	new	
7320	Organometallic Chemistry	1.5	751	3.0
7330	Solid State Chemistry	1.5	754	3.0
7340	Diffraction Methods	1.5	new	
7350	Inorganic Photochemistry	1.5	995	3.0

7360	Bioinorganic Chemistry	1.5	752	3.0
7370	Nanochemistry	1.5	995	3.0
7380	Inorganic Materials	1.5	995	3.0
7390	Advanced Inorganic Laboratory	1.5	755	3.0
7430	Advanced Organic Synthesis	1.5	832/833	3.0/3.0
7440	Kinetics, Catalysis, and Transition State Theory	1.5	731/831	3.0/3.0
7450	Metals in Organic Synthesis	1.5	833	3.0
7460	Advanced Organic Reaction Mechanisms	1.5	731/831	3.0/3.0
7470	Computational Chemistry	1.5	944	3.0
7480	Advanced Organic Synthesis Laboratory	3.0	835/836	3.0-5.0
7520	Advanced Molecular Quantum Mechanics	3.0	862/863	3.0/3.0
7530	Spectra and Structure of Molecules	3.0	863/866	3.0/3.0
7540	Chemical Dynamics	3.0	876	3.0
7550	Statistical Thermodynamics	3.0	880	3.0
7560	Introduction to Astrochemistry	3.0	740	3.0
7570	Aerosol Science	1.5	new	
7580	Lasers, Optics, and Optical Instrumentation	1.5-3.0	997	3.0
7590	Molecular Simulation of Materials	3.0	996	3.0
8199	Advanced Topics in Analytical Chemistry	1.5-3.0	991	3.0
8299	Advanced Topics in Biochemistry	1.5-3.0	990	3.0
8399	Advanced Topics in Inorganic Chemistry	1.5-3.0	995	3.0
8499	Advanced Topics in Organic Chemistry	1.5-3.0	941/942/943	3.0
8599	Advanced Topics in Physical Chemistry	1.5-3.0	997	3.0
8699	Advanced Topics in Theoretical Chemistry	1.5-3.0	996	3.0
8891	Analytical Seminar	1.0	885	1.0
8892	Biochemistry Seminar	1.0	885	1.0
8893	Inorganic Seminar	1.0	885	1.0
8894	Organic Seminar	1.0	885	1.0
8895	Physical Seminar	1.0	885	1.0
8896	Theoretical Seminar	1.0	885	1.0
8899	Doctoral Seminar	1.0	new	
8998	Non-thesis Research	1.0-15	new	
8999	Thesis/Dissertation Research	1.0-15	999	1.0-15