CHEMISTRY

GRADUATE PROGRAM REGULATIONS

UNIVERSITY OF PUERTO RICO
Rio Piedras Campus
Faculty of Natural Sciences
Department of Chemistry

These rules apply to studies directed toward the degrees of M.S. and PhD in Chemistry. These regulations have been approved by the Faculty of the Chemistry Graduate Program (CGP) on **February 2023** and are consistent with the Certification 95 (2019-20, Policy of Graduate Studies and Research) and the Certification 108 (2020-21, Approval of the Proposal for the Academic Revision of the Master of Science (M.S.) and the Ph.D. in Chemistry Programs) of the Academic Senate of the University of Puerto Rico, Río Piedras Campus.

The cover of this manual was created by Carmen Acosta Fernández.

I. VISION, MISSION, ALUMNUS PROFILE, OBJECTIVES, PHILOSOPHY OF THE GRADUATE PROGRAM IN CHEMISTRY

A. Program Vision

The Chemistry Graduate Program (CGP) aims to become one of vanguard, endowed with human resources (students, researchers, and support staff), the infrastructure and the necessary fiscal resources to achieve and maintain excellence in education and promote innovation, knowledge transfer and scientific research. The Graduate Program is committed to the formation of the student of Chemistry and lifelong learning, creation, and dissemination of knowledge at the national and international level and the training of professionals of chemistry that promote scientific, social, and economic development, to improve the quality of life in Puerto Rico, the Caribbean, and the world.

B. Program Mission

The mission of the CGP is to educate and train professionals with knowledge in the fundamentals of chemistry, while providing an enabling experience in a specific area belonging to one of the classic branches (Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, Physical Chemistry) or emerging interdisciplinary branches such as materials science, bioinorganic chemistry, supramolecular chemistry and nanotechnology, among others. The preparation of professionals in chemistry at an advanced level also seeks to develop in them the importance of creating a safe environment in the work area, the ability to identify major problems in the discipline and to design effective strategies for solving them by encouraging good laboratory practices, interdisciplinarity and collaboration at the departmental, national, and international level. In a broader context, the mission of the Graduate Program is to prepare professionals to practice their profession with the firm intention of advancing knowledge in chemistry, bringing this knowledge to solve problems of daily life and human welfare while instilling in our students hard and soft skills sets that will directly prepare them for post-graduate work and to promote scientific, social, and economic development to improve the quality of life in Puerto Rico, the Caribbean, and the world.

C. Alumnus Profile of the Program

At the end of their graduate studies, students are expected:

a. To conduct creative, critical, and innovative scientific research to offer solutions and generate knowledge framed in an ethical-professional commitment as learned through problem solving based learning strategies in the program.
b. To know and critically evaluate the scientific literature and methodology and use the obtained information in problem solving.
c. To exercise independence of opinion and show creativity and initiative to contribute to the solution of matters and problems related to Chemistry and the sciences, arts, and enterprises related to it.
d. To integrate theories and practical protocols that protect the environment and ethical and security codes in their professional and research endeavors.

e. To know the scientific literature and manage information in a critical, effective, and ethical way for problem solving.
f. To incorporate current instrumentation and technological applications as resource tools in the design of experiments and in problem solving.
g. To communicate effectively the fundamentals of their discipline to the scientific community and to diverse groups in a clear and logical manner.
h. To show commitment with the protection of natural, environmental, and cultural resources through chemistry's best practices and the occupational safety and environmental protection norms.
i. To show respect to human rights through actions of social inclusiveness and commitment to diversity.
j. To demonstrate collaborative research actions through multi-, inter-, and transdisciplinary teamwork.
k. To assume and encourage leadership roles that contribute to individual and collective transformations.
l. To master the fundamental concepts of Chemistry, of its diverse applications in daily life and its relationship with other scientific disciplines.
m. To master the technical skills required for the exercise of their profession as a chemist.
n. To show mastery of knowledge in instrumentation and technical skills within their specialty in Chemistry.
o. To identify important problems inherent to Chemistry and other disciplines to design effective strategies and/or experiments for their solution.
p. To show capacity to apply chemical knowledge, skills, and ethical conduct in the solution of real problems associated with the Chemistry field that promote scientific, social, and economic development to improve the quality of life in Puerto Rico, the Caribbean and the world.

D. Objectives

The CGP is the product of an urgent need to create the intellectual resources needed to make Puerto Rico an attractive place for the development of new technologies and enterprises with capable personnel, who have the capacity of adapting to the changing paradigm of science and technology entrepreneurship while promoting scientific, social, and economic development in Puerto Rico, the Caribbean, and the world. The objectives of the program are:

a. To provide the basic theoretical-practical knowledge required to perform as a competent professional in the area of chemistry.
b. To encourage scientific, creative and critical research, framed in ethical - professional commitment.
c. To contribute to the solution of issues and problems related to Chemistry and the sciences, arts and industries related to it.
d. To advance the knowledge of Chemistry and ensure human well-being by providing ideas for solving problems in society beyond the research laboratory.
e. To link the University with the reality of the world at large to improve the standard of living of the human race.
f. To contribute to the improvement of secondary education and undergraduate programs through research opportunities, exchange of ideas and activities with graduate studies.
g. To offer chemical advice to the community, the country's educational system, the government, and industries.

h. To identify institutional and external funds to provide a physical and administrative infrastructure that allows sustaining and optimizing the operation of the program to efficiently serve a heterogeneous audience of students and professionals.

E. Philosophy

Both the Chemistry Department at UPR-RP and its CGP are dedicated to serve Puerto Rico by developing professionals capable of contributing to the scientific, technological, and socio-economic growth of Puerto Rico and the world.

II. ADMISSION TO THE GRADUATE PROGRAM IN CHEMISTRY

A. Eligibility for Admission

The applicant must have a bachelor's degree or its equivalent with an overall undergraduate grade point average of no less than 3.00 on a 4.00 scale and no less than 2.75 in chemistry. The applicant must have completed a one-year course in general chemistry, organic chemistry and physical chemistry, including laboratory work, and have at least one semester of analytical chemistry (including laboratory) and inorganic chemistry. The applicant must have writing, reading, and conversational abilities in English given that courses are offered in this language.

B. Application Process

To be considered for admission in August of the academic year, the applicant must fulfill and submit the application form located at the website: https://app.applyyourself.com/?id=upr-grad by an established deadline in a given academic year. The applicant will be notified by e-mail from the Office of the Dean of Graduate Studies and Research (DEGI for its abbreviation in Spanish) regarding acceptance to the Program.

a. The applicant must submit an official transcript at the following address: Graduate Programs and Research, University of Puerto Rico, Río Piedras Campus, 17 Ave Universidad STE 1701, San Juan PR 00925-2537.
b. In the application form the student must include two (2) e-mail addresses of professors that will recommend him/her, from the university where the applicant earned the bachelor's degree.
c. The applicant must include a Statement of Purpose document indicating their interests in pursuing graduate studies.
d. The applicant might be requested to attend a Personal interview (virtually or in person) with the Graduate Affairs Committee.

C. Conditional Admission

An applicant who fails to fulfill one or more of the admission requirements, but who otherwise shows promise as a graduate student, may be granted conditional admission to the Graduate Program. To be considered for conditional admission it is required that the student have a general minimum grade point average of 2.75 and a 2.50 in chemistry. In this case, the applicant will be informed of the conditions that they must satisfy to be considered a regular bonafide student. Conditional admission means that the

student will be on probation for a period of one year until they demonstrate academic progress. The Admission Committee will advise the student on the development of a class program that complies with these requirements. The Graduate Affairs Committee will determine if the student has fulfilled all conditions established after the first (1st) year of study. A student who does not satisfy the admission conditions during the allotted time will be removed from the Program.

D. Transfer Credits

Only graduate courses (or their equivalents) approved with A or B, taken within five years prior to the date of entrance to the Graduate Program can be considered for transfer credits. To apply for the acceptance of transfer credits the student should submit to the CGP Coordinator an official copy of their academic record and a copy of the form "Request for Credit Validation", as well as a description of the courses according to the University catalog where the graduate courses were taken. The form "Request for Credit Validation" can be obtained via the Deanship of Natural Sciences. A maximum of a third (1/3) of the course credits required for the corresponding M.S. or Ph.D. that were earned at another institution can be accredited, or as determined by the Academic Affairs Committee. Graduate courses taken at the Río Piedras Campus before admission to the Graduate Program may be counted toward the total number of credits earned. The student must present the CGP Coordinator with a letter from the Registrar in which it is stated that such courses were not used to fulfill the requirements of the B.S. degree.

E. Placement Exams

Once admitted, the student must take placement exams given by the CGP. These exams are used to determine the strengths and possible deficiencies of the incoming graduate student in the five basic areas of chemistry, namely: analytical, inorganic, organic and physical chemistry, and biochemistry. Results will also help the CGP Coordinator in planning the graduate and/or undergraduate courses that the student must take during their first (1st) year of studies. These exams will be offered at the beginning of the first semester. stheyIf there is a deficiency in a given area, the student will have the option to take the undergraduate course (2 semesters) or a graduate class (1 semester) in that area. If the student decides to take the undergraduate course, they must attend classes, and comply with assignments and exams given by the professor. It is not necessary to register in the course or perform the laboratory work. However, the student should get an A or B in the course and they will request the professor to notify the CGP Coordinator by letter of the grade obtained in that course. This course will not count as part of the requirements for advanced degrees. If, instead, the student decides to take any semester of a graduate class it should be passed with either A or B. The graduate course, however, will count as an elective for advanced degrees. The deficiency can also be completed by performing a Teacher Assistant (TA) experience in the division in which the deficiency was presented or if the student's thesis project involves experiments that would provide them proficiency in the division. Using a non-elective course route, the student must request the approval of the Academic Affairs Committee by writing a formal letter of request. The deficiency can be removed at any time during the graduate career, but this should be done at least one semester before graduation. If the student wishes to concentrate in an area where they have a deficiency, they should take a one-year core course in this area and obtain an average grade point average not less than 3.00 between the two semesters.

F. Language Requirements

All students registered in the Program should have a working knowledge of English for coursework but a working knowledge of English and Spanish to serve as a Teacher Assistant (TA). This is recommended since most undergraduate teaching is done in Spanish, while the textbooks, scientific articles and references are in English. A student with a language deficiency can be admitted to the Program with the condition that they take language courses that will help the student surmount this deficiency during their first (1st) year of studies. The committee members Department of Chemistry can coordinate these courses with the College of Humanities and/or General Studies.

III. DEGREE REQUIREMENTS

A. Degree Candidacy

A student who wishes to obtain a graduate degree must first (1st) be admitted as a candidate of the degree by the Chemistry Graduate Faculty. Advancement to candidacy means that the student has demonstrated that they are capable of fulfilling the requirements for the degree and has sufficient training to pursue independent research. For the M.S. is the Academic Affairs Committee and the Coordinator that decides based on the successful completion of coursework and maintaining a GPA ≥ 3.00 out of a 4.00. For the Ph.D., is through successful completion of the Candidacy Exam.

B. Description and Requirements of Master's in Science (M.S.) in Chemistry Program

A M.S. in Chemistry degree can be obtained with a subspecialty in Analytical, Inorganic, Organic, Physical Chemistry, or Biochemistry. The M.S. in Chemistry Program will consist of a minimum of 30 credits to be in compliance with Certification No. 95 of the Academic Senate, 2019-2020 Academic Year (Academic Policy for Graduate Studies of the Río Piedras campus). The expected duration of the program for full-time students will be two (2) years and for part-time students will be three (3) years. The maximum time to complete the program for full-time students will be four (4) years and for part-time students will be 5 years. The expected program duration is two years for full-time students and three years for part-time students. Full-time students must complete the program within a maximum of four years, while part-time students have up to five years.

I. General Requirements
   The M.S. in Chemistry Program candidates must comply with the general graduation requirements that are mandated by the UPR-RP Campus.

II. Curriculum Requirements
   a. Course Work: Complete a minimum of eighteen (18) credits in graduate courses. During their first (1st) year, the graduate student must consult with the CGP Coordinator about which courses to take prior to enrollment. Beyond their first (1st) year, graduate students must consult their thesis advisor about which courses to take prior to enrollment. The thesis advisor might recommend the student to take courses in another discipline, for example, Biology, Physics, Environmental Sciences or Mathematics when these courses are deemed necessary for the student's development as an independent researcher.
      i Six (6) credits of 6000 level core courses in the student's area of specialization.
      ii Three (3) credits of the Scientific Writing Course (See below).

iii Nine (9) credits in graduate level electives at a 6000-8000 level. (See list of courses in Appendix A).

b. Rotations: First year students must enroll in the graduate rotation course (QUIM6999). In this course the student attends the rotating laboratory group meetings and pertinent research activities to gain a better understanding of the group's dynamics and research interests. The student enrolled in the graduate rotation course needs to perform three (3) three-week rotations during their first (1st) semester in the Program. At the end of the first (1st) semester the student will choose a laboratory and therefore a thesis advisor for their M.S. project. This is a zero-credit course.
c. Thesis Research Plan Proposal: A research plan proposal (Form B2-Appendix C andrefer to the Research Proposal tabs of the departmental website graduate program tab) must be successfully defended in front of the student's Thesis Committee. The research plan proposal must be submitted to the student's Thesis Committee two (2) weeks prior to the proposal defense date. This requirement also encompasses an oral exam in the student's area of specialty. If the student fails the research plan proposal defense, he/she will have one semester to repeat it. In the event that a student fails the research plan proposal examination on the second (2nd) attempt, the student will be removed from the program. The research plan proposal should be completed by the end of the first (1st) semester of their second (2nd) year in the program. If the student doesn't complete the research plan proposal by the end of the second (2nd) semester of their second (2nd) year in the program, the student might be removed from the CGP.
d. Graduate Seminars: The student must enroll and attend the graduate seminar course (QUIM 8901-8902) every academic year. The student needs to approve a minimum of two (2) credits.
e. Focused Research Seminars: The student must enroll and attend the focused research seminar of their research group every academic year (commonly referred to as the "group meetings"). The student needs to approve a minimum of four (4) credits. The student needs to approve a minimum of twelve (12) credits in CHEM 800X (X depending on area of specialty).
f. Graduate Research: Enroll in a minimum of six (6) credits of graduate research. Based on their graduate research the student must write and successfully defend a M.S. Thesis.
g. Progress Report Presentation: The candidate must write a two-page progress report of the accomplished research performed during the course of the M.S. and make an oral presentation of it no later than the beginning of the third semester in the graduate program to the Thesis Committee Members.
h. Scientific Writing Course: Enroll in a three (3)-credit scientific writing course. The course will serve to introduce scientific writing tools and methods, as well as develop the student's capabilities to adequately develop a M.S. thesis and defense. The students will take this course during the first (1st) semester of the second (2nd) year in the Graduate Program.
i. Thesis Writing: The student needs to enroll in the course CHEM 6896: Thesis Continuation. Based on their graduate research, the student must write a thesis representative of their contribution to science. This is a zero-credit course.

III. Additional Requirements

a. Placement Exams: Upon acceptance into the CGP, students will be required to take an entrance placement exam to demonstrate basic knowledge in each of these areas: Analytical, Biochemistry, Inorganic, Organic, and Physical Chemistry. The results of the placement exam will be shared with all professors of the CGP so that each division can

assess how to help the student reach the academic standards that are expected for every graduate in the CGP. In addition, the results will be used to help develop the first (1st) annual Individualized Development Plan (IDP) for the student in conjunction with the division(s) and/or the CGP Coordinator.

b. Individualized Development Plan (IDP): Students will be required to prepare a yearly IDP at the end of the second semester of each academic year following their first year of classes. The IDP should be prepared in consultation with the research mentor and support of the graduate student counselor and/or coordinator of the CGP. The annual IDP should be in the ChemIDP format of the American Chemical Society (https:chemidp.acs.org).
c. GPA requirements and optional candidacy exam: If the student wishes to transfer to the Ph.D. program, theyStudents must earn at least a C in each course and an overall GPA of 3.0 in a scale of 4.0 at the completion of the first (1st) year of courses to be in good standing and qualify to take the Ph.D. candidacy exam if the student wishes to transfer to the Ph.D. program. Students who earn more than a 2.5 but below 3.0 GPA and wish to transfer to the Ph.D. program will be allowed to take the first (1st) year Ph.D. candidacy exam but must repeat the course with the deficiency to raise their GPA to 3.0 upon completion of the second (2nd) year. Students who earn less than a 3.0 GPA will be removed from the program after the allotted probation period. The minimum GPA for graduation will be of 3.0. A student that falls below a 3.0 GPA will be in a probation period of one (1) year if the student entered as a regular student, and a probation period of one (1) semester if the student entered the Program conditionally. During the probation period, research or teaching assistantships might not be available. Students that are not in good standing after the allotted academic probation period will be removed from the Graduate Program.
d. Candidacy: The student should be recommended to be a candidate for a M.S. in Science based on their academic achievements. A recommendation letter by the Academic Affairs Committee and the CGP Coordinator will be sent to the Registrar. This promotion should take place within a maximum of two (2) years from the date of admission to the CGP.
e. Public Speaking Workshop: A public speaking workshop will be offered to all graduate students once a year.
f. Thesis Committee: A thesis committee must be composed of three to four members with a Ph.D. or equivalent degree, one of which has to be the candidate's thesis advisor. Two committee members must be of the Chemistry department of the UPR RP CGP. At least one other committee member has to be a person with either academic or industrial expertise in the area of the candidate's dissertation research. The selection of the committee members needs to be approved by the thesis advisor in a prior agreement with the student. At the time of the Thesis Research proposal, one committee member will be assigned as the Chair of the Thesis Committee (this person cannot be the M.S. candidate advisor). If any disputes between the student and the advisor or any member of the thesis committee arise, the Chair of the Thesis Committee will inform the CGP Coordinator to act accordingly. The Chemistry Department Chair will be the point of contact in place of the CGP Coordinator if the problem arises with one of the coordinator's students. All members of the committee need to participate (be present) for the thesis defense to proceed.
g. M.S. Thesis Seminar: Based on their graduate research the student must successfully present and defend their thesis to the Graduate Program. The thesis presentation and defense will be public, although the final deliberations of the Thesis Committee will be private.

C. Description and Requirements of Ph.D. in Chemistry Program

A Doctor of Philosophy (Ph.D.) in Chemistry degree can be obtained with a subspecialty in Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry or Physical Chemistry. The Ph.D. in Chemistry program will consist of a maximum of 59 credits and will be in compliance with Certification No. 95 of the Academic Senate, 2019-2020 Academic Year (Academic Policy for Graduate Studies of the Río Piedras campus). The expected duration of the program for full-time students will be five (5) years. The expected duration of the program for part-time students will be six (6) years. The maximum time to complete the program for full-time students will be seven (7) years and for part-time students will be eight (8) years.

I. General Requirements
   The Ph.D. in Chemistry Program candidates must comply with the general graduation requirements that are mandated by the UPR-RP Campus.

II. Curriculum Requirements
   a. Course Work: Complete a minimum of twenty-one (21) credits in graduate courses (Refer to Appendix A). Students in the Ph.D. program that already have a M.S. degree and pass the placement exam in their proposed area of division specialization will not be required to take the required two core courses of the division. If the student with the M.S. degree fails the placement exam in their proposed area of division specialization, then they are required to take the two core courses in that division. During their first (1st) year, the graduate student must consult with the CGP Coordinator about which courses to take prior to enrollment. Beyond their first (1st) year, graduate students must consult their thesis advisor about which courses to take prior to enrollment. The thesis advisor might recommend the student to take courses in another discipline, for example, Biology, Physics, or Mathematics when these courses are deemed necessary for the student's development as an independent researcher.
      i Twelve (12) credits of 6000 level graduate chemistry courses taken in the first academic year. Six (6) credits at the 6000 level must be of the two core courses of the division of specialization. The exemption to the required two core courses is if a student with a M.S. degree passes the placement exam for the division of specialization.
      ii Three (3) credits of the Scientific Writing Course (See below).
      iii Six (6) credits in graduate level electives at an 8000 level. (See list of courses in Appendix A).
   b. Teaching Assistantship: Enroll in at least one academic year (6 credits) of CHEM 6905-6906 Principles and Practices of Chemistry. If a student participates in an academic, industrial or government sponsored internship during the course of their PhD, the student can write a petition to the Academic Affairs Committee to substitute up to 3 credits for this requirement.

Note: All students who successfully complete all courses in good standing and have a GPA of 3.0 or more, will automatically receive a Master's degree. This degree is not equivalent to the M.S. as it will not contain a thesis component.

c. Rotations: The students can voluntarily enroll in the graduate rotation program during the first (1st) semester of their first (1st) year in the CGP. In this program the student must attend the rotating laboratory group meetings and pertinent research activities to gain a better understanding of the group's dynamics and research interests. The student needs to perform three (3) three-week different rotations during a one-semester period. At the end of the first (1st) semester the student will choose a laboratory and therefore a thesis advisor for their doctoral research project. This is a zero-credit course.
d. Focused Research Seminar: The student must enroll and attend the focused research seminars of their research group every semester (commonly referred as "group meetings"). The student needs to approve a minimum of twelve (12) credits in CHEM 800X (X depending on area of specialty).
e. Graduate Research: Enroll in a minimum of eighteen (18) credits of graduate research (CHEM 8999). Based on their graduate research the student must write and successfully defend a Doctoral Thesis.
f. Candidacy Exam: At the end of the first (1st) year in the Doctoral Graduate Program, the student will take a candidacy exam that will consist of questions administered by the thesis committee based on their expertise and that pertain to the students' field of research interest. The thesis committee will prepare the oral and written components of this exam. The students will write formal responses to the questions and defend their answers in a meeting with the committee. *Students will be given no more than two (2) opportunities to pass the candidacy exam.* A student in good standing that fails this requirement will be allowed to pursue a M.S. degree.
g. Scientific Writing Course: Enroll in a three (3) credit Scientific Writing Course. The course will serve to introduce scientific writing tools that can be applied to the writing of research manuscripts for peer-reviewed publications, fellowship essays, and fellowship proposals. The final product of the course will be the student's Thesis Research Plan proposal. The students will take this Scientific Writing Course during the first (1st) semester of their second (2nd) year in the CGP.
h. Thesis Research Plan Proposal: The student must present a research proposal plan (Form B2-Appendix C; also refer to the Research Proposal tabs of the departmental website graduate program tab) and submit this document to all Thesis Committee Members two (2) weeks prior to the proposal defense date. The research proposal must be successfully defended in front of the student's Thesis Committee Members; each of whom will complete a rubric of the student performance on this requirement for assessment purposes. No preliminary data is required for this proposal, although feasibility of the project should be established with previous work from the laboratory or literature. The Thesis Research Plan Proposal requirement also encompasses an oral exam in the student's area of specialty within the context of the proposed research activities. If the student fails the research plan proposal defense, he/she will have to repeat it. In the event that a student fails the research plan proposal examination on the second (2nd) attempt, the student will be removed from the CGP. The research plan proposal should be completed by the end of the second (2^{nd}) semester of their second (2nd) year in the CGP unless another attempt is required, which should take place during the summer months. The Thesis Committee Members should make an evaluation for the merit of further attempts.

i. Graduate Seminar: The student must enroll and attend the graduate seminar course (QUIM 8901-8902) every academic year **until they present their own Research Seminar as part of the Graduate Seminar Series**. *Students are strongly encouraged to continue participating in the graduate seminars because they contribute to their scientific growth and understanding*.
In year three (3), students will present a research seminar (45 minutes in length) where they will offer a perspective on a field of chemical research chosen jointly between the student and the mentor. An accompanying manuscript will be prepared prior to the seminar presentation with a length of ten (10) single pages, using Times New Roman at a font size of 11 pt, with double line spacing, and 1" margin in all sides. The document in pdf format will be sent to the Graduate Seminar Coordinators at least two (2) weeks before the day of the presentation. The Graduate Seminar Coordinators will send this document to the the students and professors of the CGP. The professors present on the day of the Research Seminar presentation will evaluate the work using the evaluation form (Form B4-Appendix C). The written document could be transformed to a review article to be submitted for peer-reviewed publication. Only two (2) credits of the graduate seminar course (QUIM 8901-8902) will count towards the graduate degree.

j. Original Research Proposal: The student must present an original research proposal plan (Form B2-Appendix C; also refer to the Research Proposal tabs of the departmental website graduate program tab) and submit this document to all Thesis Committee Members except the PhD advisor two (2) weeks prior to the proposal defense date. The student must defend their original research proposal no later than the second (2nd) semester of their fourth (4th) year in the program. The students will be given two (2) opportunities to successfully complete the original research proposal requirement, as a whole or in its parts. If the student doesn't defend their original research proposal no later than the second (2nd) semester of their fourth (4th) year in the program, the student is at risk of being removed from the program.

k. Publications: Students will be required to publish at minimum three (3) peer-reviewed papers, one of which should be a first (1st)-author paper based on their thesis work. One of the other two papers could be a review article.

l. Thesis Writing: The student needs to enroll in the course CHEM 8896: Thesis Continuation. Based on their graduate research, the student must write a thesis representative of their contribution to science. Students that have not completed the defense of their Original Research Proposal will not be allowed to enroll in the Thesis-writing Course, except by consensus of the Academic Affairs committee. A limit of one (1) year will be established for the Thesis Writing Stage and the student must submit a short report on their progress each semester. This is a zero-credit course.

III. Additional Requirements

a. Placement Exams: Upon acceptance into the CGP, students will be required to take an entrance placement exam to demonstrate basic knowledge in each of these areas: Analytical, Biochemistry, Inorganic, Organic, and Physical Chemistry. The results of the placement exam will be shared with all professors of the CGP so that each division can assess how to help the student reach the academic standards that are expected for every graduate in the CGP.
The results of the placement exam will be shared with all professors of the CGP so that each division can assess how to help the student reach the academic standards that are expected for every graduate in the CGP. In addition, the results will be used to help

develop the first (1st) annual Individualized Development Plan (IDP) for the student in conjunction with the division(s) and/or the CGP Coordinator.

b. Individualized Development Plan (IDP): Students will be required to prepare a yearly IDP at the end of the second semester of each academic year. The IDP should be prepared in consultation with the research mentor and support of the graduate student counselor and/or coordinator of the CGP. The annual IDP should be in the ChemIDP format of the American Chemical Society (https:chemidp.acs.org).

c. GPA requirements and candidacy exam: Students must earn at least a C in each course, an average of a B in the two core courses of the division of specialization, and an overall GPA of 3.0 at the completion of the first (1st) year of courses to be in good standing. Students who earn more than a 2.5 but below 3.0 GPA will be on probation for up to one year but will be allowed to take the candidacy exam and must repeat the course with the deficiency to raise their GPA to 3.0 upon completion of the second (2nd) year. Students who earn less than a 2.5 will be placed on probation for one year or one semester if he/she entered the Program conditionally. The minimum GPA for graduation will be of 3.0 in a scale of 4.0. A student that falls below a 3.0 GPA will be in a probation period of one (1) year if the student entered as a regular student, and a probation period of one (1) semester if the student entered the Program conditionally. During the probation period research or teaching assistantships might not be available. Students that are not in good standing after the allotted academic probation period will be removed from the Graduate Program. A student in good standing that fails the candidacy exam requirements will be allowed to pursue a M.S. degree.

d. Candidacy: The student should be recommended to be a candidate for a Doctor's in Philosophy based on their academic achievements and performance in the candidacy exam. A recommendation letter by the Academic Affairs Committee and the CGP Coordinator will be sent to the Registrar. This promotion should take place within a maximum of two (2) years from the date of admission to the CGP.

e. Public Speaking Workshop: A public speaking workshop will be offered to all graduate students once a year.

f. Thesis Committee: A thesis committee must be composed of three (3) to five (5) members with a Ph.D. or equivalent degree, one of which has to be the candidate's thesis advisor. The thesis advisor must be an active member of the CGP at UPR-RP. At least one (1) other committee member has to be a person with either academic or industrial expertise in the area of the candidate's dissertation research. Two of the thesis committee members must be from the Chemistry department from the UPR RP CGP. In the case of a committee of three (3) members, one (1) of them can be a professor of another department or college of the UPR or other recognized institution. In the case of a committee of four (4) or five (5) members, up to two (2) of the members can be professors of other departments or colleges of the UPR or other recognized institutions. The selection of the committee members needs to be approved by the thesis advisor in a prior agreement with the student. At the time of the Thesis Research proposal, one committee member will be assigned as the Chair of the Thesis Committee (this person cannot be the Ph.D. candidate advisor). The Ph.D. candidate will meet yearly with the Chair of the Thesis Committee for evaluation of the student's progress towards completing the Ph.D. If any disputes between the student and the advisor or any member of the thesis committee arise, the Chair of the Thesis Committee will inform the CGP Coordinator to act accordingly. The Chemistry Department Chair will be the point of contact in place of the CGP Coordinator if the

problem arises with one of the coordinator's students. All members of the committee need to participate (be present) for the thesis defense to proceed.

g. Dissertation defense: Based on their graduate research the students must successfully present and defend their dissertation to the Graduate Program. The doctoral thesis document must be submitted to all Thesis Committee Members two (2) weeks prior to the defense date. The dissertation presentation and defense will be public.

IV. DESCRIPTION AND EVALUATION CRITERIA FOR DEGREE REQUIREMENTS

A. Graduate Courses

The Graduate courses at the 6000 level are offered annually while courses at the 8000 level are normally offered every other year, although these are offered in the five divisions of Chemistry. The student should complete a minimum number of graduate courses as described in Section CII. It is very important that the graduate student appropriately plans their years of graduate studies in order to have the course requirements completed at the time of graduation. The general grade point average must be 3.00 or higher in order to apply for graduation.

B. First (1st) Semester Rotations

Students can voluntarily enroll to do rotations in three laboratories during the first (1st) semester of the first (1st) year of study. This will expose them to various research labs and will enable better decisions on which research group to join. Students are strongly encouraged to do one rotation outside of their desired area of specialization but it is optional to do so.

a. Students will register in CHEM6999 (M.S. student, 0 credit) or CHEM 8999 (Ph.D. student 0 credit).
b. During the first two weeks of the first semester, each faculty member of the Program will make an oral or poster presentation of their research interests. The purpose of this activity is to enable the students to make a better decision regarding which three research groups they intend to rotate.
c. Students will fill out and turn in to the Program's office Form C3a- CERTIFICATION OF RESEARCH LAB ROTATIONS (Appendix C). This form requires the signatures of the faculty with whom the students will do the rotations.
d. Duration: The first (1st) three weeks of the month of September, October, and November. The fourth week the student will prepare and turn in Form C3b-ROTATION REPORT (Appendix C) after the rotation advisor signs and assign the grade (PS/PN/PB/NP).
e. The overall grade in the course will be the average of all the three rotations.

C. Graduate Research

All graduate students (M.S. or Ph.D.) should select a research mentor after the completion of the research lab rotations. They must complete (Form C3a) with the signature of the research mentor and submit to the CGP Coordinator. It is an indispensable requirement of the Program that the student begin their research work in the second semester and attend focused research seminar meetings of their

laboratories. For this purpose, all graduate students should register in CHEM6999 (M.S. student) or CHEM8999 (Ph.D.student) and in the focused research seminar course (CHEM8XXX) of their laboratory. Students should select the members of their thesis committee by the end of the second semester and complete FORM C5 with the signature of all thesis committee members. This form must be submitted to the CGP Coordinator.

D. Candidacy Exam (Ph.D. only)

At the end of the first (1st) year in the Doctoral Graduate Program, the student will take a candidacy exam administered by the thesis committee at the end of the first academic year. There will be a written and oral component to the exam, which will consist of questions that the student must answer that are based on the expertise of the committee members and that pertain to the students' field of research interest. The student must provide a one-page overview of their Research Plan Proposal to the thesis committee members in order for each member to prepare two questions. The questions must be related to material assigned by each member of the committee to read and that can help the student to prepare for their doctoral research. The written component will consist of responses to five of the questions, at least one from each committee member. The student will have a maximum of 14 calendar days to respond to the questions. The student may use textbooks and other references to respond to the questions but cannot consult with another person other than to ask the committee members to clarify doubts. The responses to the questions must demonstrate original critical thinking and qualitative/quantitative analysis and must include appropriate citations.

Once the committee receives the responses to the questions, they will have 14 calendar days to evaluate the responses. The oral component of the exam must be scheduled after these 14 days unless agreed by the committee to be sooner. The oral exam must focus on but not be limited to the topics in the questions assigned to the student. The final evaluations are: Pass, Conditional Pass, and Not Pass. If the student receives a Pass, then they will be allowed to continue with their doctoral research. If the student receives a Conditional Pass, then any deficiency that the student presented must be resolved by revising their responses to pertinent questions where they demonstrated deficiency within one month following the oral exam. If the student receives a Not Pass, then they will have to repeat the oral exam in addition to addressing deficiencies demonstrated in their responses to questions. The student will be given a month to repeat the exam. *Students will be given no more than two (2) opportunities to pass the candidacy exam.* A student in good standing that fails this requirement will be allowed to pursue a M.S. degree. The student should apply for this exam by filling out Form C2 (Appendix C). Instructions and evaluation criteria for this exam are found in Form B1a and B1b (Appendix C).

E. Thesis Research Plan Proposal

Before the end of the 2nd semester of the student's first (1st) year of study, M.S. students should present a plan of their research project to the Thesis Committee. Before the end of the 2nd semester of the student's second (2nd) year (4th semester) of study, Ph.D. students, should present a plan of their research project to the Thesis Committee. The proposal has both written and oral components. In preparation for this requirement, students will participate in a proposal writing workshop provided by the CGP Coordinator during the first semester of the seminar series.

a. The written component will include an introduction (e.g. literature background), statement of the problem, methodology, preliminary results, planned experiments and anticipated research

problems with alternatives to resolve them. Refer to the guidelines present in Form B2 (Appendix C) and **refer to the Research Proposal tabs of the departmental website graduate program tab**.

b. The oral component will consist of a 20-minute introduction presentation, after which the Thesis Committee will start the questions. Refer to the guidelines present in Form B2 (Appendix C) and **refer to the Research Proposal tabs of the departmental website graduate program tab**.
c. The deadline to complete the proposal (written and oral components) is no later than the end of the second (2nd) semester for M.S. students and fourth (4th) semester for Ph.D. student.
d. The student must give a copy of the proposal manuscript to each member of their thesis committee and to the CGP Coordinator two weeks before the established date of the oral defense (Form C7 in the Appendix C).
e. The oral presentation should be notified to the CGP Coordinator at least one month prior.
f. The thesis advisor will serve as Chair of the committee and will communicate any suggestions of improvement to the student (Form C8 in the Appendix C). They will also collect the presentation evaluation forms from all thesis committee members and submit them to the CGP Coordinator. The student must keep a copy on his/her records to present before graduation.

The presentation of this proposal has various purposes. Students will become familiar with the literature related to their research project, establish a feasible and well-rationalized research plan, and learn to effectively communicate the significance of the project, the big picture objective, and the innovation of their contributions. Students will receive valuable insight from committee members on finetuning their ideas and optimizing their experimental approach. The proposal also serves to inform the committee that the student possesses the understanding of pertinent fundamental chemistry concepts, has initiated their research and possess basic knowledge of laboratory techniques, and has made necessary arrangements and collaborations to achieve their specific aims. The Thesis Committee and the student will determine if the presentation and defense of the Thesis Research Proposal will be public or private. Instructions for the proposal manuscript and presentation, refer to Form B2 (Appendix C). Form B4 (Appendix C) is the evaluation form for the proposal manuscript and presentation.

F. Research Seminar Presentation (Ph.D. only)

Before the end of the third (3rd) year, students will present a research seminar where they will offer a perspective on a field of chemical research chosen jointly between the student and the mentor. This seminar will be presented in the graduate seminar series. An accompanying manuscript will be prepared prior to the seminar presentation with a length of ten (10) single pages, using Times New Roman at a font size of 11 pt, with double line spacing, and 1" margin in all sides, organized as a perspective review. The document in pdf format will be sent to the Graduate Seminar Coordinators at least two (2) weeks before the day of the presentation. The Graduate Seminar Coordinators will send this document to the the students and professors of the CGP.

a. The professors present on the day of the Research Seminar presentation will evaluate the work using the evaluation forms Form B3b and Form B4 (Appendix C).
b. Any concerns about the written document or presentation by CGP faculty must be raised to the seminar coordinators, who will mediate the situation with students.

The instructions for the manuscript and presentation are found in Form B3a (Appendix C). The evaluations forms for the manuscript and presentation are found in Form B3b and B4 (Appendix C).

G. Original Research Proposal (Ph.D. only)

The student should present and defend an original research proposal no later than the end of the fourth (4th) year of studies (8th semester). The date to meet this requirement will be in accordance with the student, the research advisor, and the thesis committee. It is the student's responsibility to notify the CGP Coordinator of the date agreed upon.

a. The written component will include an introduction (e.g. literature background), statement of the problem, methodology, preliminary results, planned experiments and anticipated research problems with alternatives to resolve them. Please refer to Form B2 (Appendix C) for guidelines.
b. The student has to arrange a date to complete the oral component with the members of their thesis committee. The PhD Advisor will not participate in this oral defense presentation. The oral presentation should be notified to the Committee and the CGP Coordinator at least one month prior.
c. An abstract of the original research proposal should be submitted one month in advance to all the Thesis Committee members.
d. The original research proposal will be presented orally in the form of a 20-min introduction, followed by an oral defense with the Thesis Committee members.
e. The proposal must be submitted to the thesis committee two weeks before the scheduled oral presentation. (Form C7 in the Appendix C).
f. The Thesis Committee will collect the presentation evaluation forms and submit them to the CGP Coordinator and the student. (Form C8 in the Appendix C)
g. The students must keep a copy of the signed form for their records.

The instructions for the proposal manuscript and presentation are found in Form B2 (Appendix C). The evaluation form is Form B4 (Appendix C).

H. Thesis/Dissertation

As a result of this research, the student should write, present, and defend a thesis or dissertation as a final requirement of the degree.

I. Thesis manuscript: Once the student has completed a written draft of their thesis containing an abstract, introduction chapter, research chapters, and conclusion chapters with their corresponding references, they will hand in a copy to their research advisor and to each committee member. The student should prepare a document on the chapters that have been published following peer-review and include their citations and explain which chapters are being prepared for publication and what journal they anticipate to submit the manuscript for peer review. A publication that is not peer reviewed can be accepted for the requirement of publications in special cases and by a unanimous decision from the thesis committee.

II. Oral defense: The date selected for the oral defense of the thesis (or dissertation) will be established by unanimous agreement between the student and their committee. In the oral defense, the student should do a brief presentation of not more than 45 minutes summarizing their research work as well as the results and major contributions to their study area. The student will

be considered an expert in their area and therefore they should be able to demonstrate to the members of the committee their knowledge of chemistry, (particularly related to their research work) present possible solutions to situations, and future ramifications and problems without solutions within their area. If the thesis committee finds that the defense has not been done at the expected level for the M.S. or doctoral degree, the student will be granted one semester to present the defense again. Students will be given two attempts to complete the defense. The dissertation presentation and defense will be public.

I. Program Course Sequence

The CGP offers courses in five areas of Chemistry: Analytical Chemistry, Biochemistry, Physical Chemistry, Inorganic Chemistry, and Organic Chemistry. Students will take core courses, the total number of credits defined based on the M.S. or Ph.D. tracks (Appendix A). Students will also take elective/advanced courses in their area of specialty or from any other area (even from areas outside the Program, say courses from the Graduate Program in Biology, or Physics or Environmental Sciences) depending on whether the student and their mentor deem them necessary to assist the student in their thesis. These elective courses must be at the advanced 8000 level. The 8000 courses in the CGP are typically Special Topics Courses in the five areas of Chemistry.

V. GENERAL PROCEDURES

A. Orientation for New Students

New students should attend the Graduate Program's orientations during the week before classes begin. During this period, the student will receive an academic program designed taking into account the results of the placement exams. Students awarded with a teaching assistantship must attend the training for teaching assistants offered annually in August. Also, all graduate students must attend security trainings for the chemistry laboratories that are offered annually by authorized personnel from the University of Puerto Rico.

B. Registration

The registration of all chemistry graduate students (and other students who are taking chemistry graduate courses) will be done by students via the process of self-enrollment (the instructions will be provided by the Deanship of Natural Sciences). Whenever a student has difficulty enrolling, they must consult with the CGP Coordinator for help. All students in the program should do pre-registration. Before the pre-registration each student will:

a. Discuss their academic program with their research advisor. The CGP Coordinator will serve as an advisor to students that have not selected their research advisor. All questions or problems related with their program should be discussed with the research advisor, the CGP Coordinator and the graduate student counselors.
b. Obtain the pre-registration form from the CGP Coordinator. Students who have started research or who are registered in course Chem 8999 or have a research assistantship should also fill out the form Authorization to Register in the Research and Research Progress Report

from the CGP, (Appendix C, Form C1). On the day assigned for the pre-registration process, each student will submit the requested form to the CGP Coordinator.

c. On the dates announced for registration, students must self-enroll in their courses.
d. Changes in registration: Changes in registration are discouraged. A graduate student should plan their program carefully so that changes will not be necessary. If a student finds that it is essential to make a change to their schedule, they should consult the University calendar for the dates assigned for adding or dropping courses. The CGP Coordinator will make the registration changes. By dropping a core course the student will automatically enter probationary status. The student will remain on probation until they repeat and pass the core course and will have up to one year to do so.

C. Selection of the Research Advisor

During the first (1st) semester, the student should interview researchers from their area of interest as part of their rotations. At the beginning of the second (2nd) semester of the first (1st) year of studies, the student should select their research advisor and attend the group's seminars. Once the student selects the advisor, they should fill out Form C3. (Appendix C, Form C3).

The student should select a research advisor that is a fulltime member of the Faculty of the CGP. A student that wishes to do their research outside the Department of Chemistry must submit a written petition to the Graduate Affairs Committee requesting an authorization to do the research with a non-member of the Chemistry Department. A member of the Faculty of the CGP will have to be selected by the student to serve as the student's co-advisor. The co-advisor will be selected by the student with the approval of the Academic Affairs Committee and the CGP Coordinator.

D. Selection of the Student Thesis Committee

A thesis committee for students pursuing the M.S. must be composed of three (3) to four (4) members with a Ph.D. or equivalent degree. A thesis committee for students pursuing the PhD must be composed of three (3) to five (5) members with a Ph.D. or equivalent degree. In these committees, one member has to be the candidate's thesis advisor. Two committee members must be of the Chemistry department of the UPR RP CGP. At least one other committee member has to be a person with either academic or industrial expertise in the area of the candidate's dissertation research. The selection of the committee members needs to be approved by the thesis advisor in a prior agreement with the student. All members need to be present for the thesis defense to proceed. Any change in the student's committee requires the approval of the CGP Coordinator and the Academic Affair Committee (Appendix Form C6).

In the event that the student or the research advisor requires the participation from an external member of the Graduate Program, this person should be willing to participate in the Committee from the moment of its creation. A member of Student's Committee outside of the Department or Graduate Program should meet the following requirements:

a. Be an active member of the STEM community.
b. Present curriculum vitae with recent publications. The curriculum vitae should evidence experience and activity in the research field.
c. The member of the committee should be aware of all student requirements of the program in which they will participate in their evaluation.
    - A copy of the CGP's Regulations will be provided to this member.

d. The Academic Affairs Committee will approve this member's participation in the Thesis Committee.

E. Change of Advisor

If a student decides to change research projects and at the same time change their research advisor, the student should complete the form C4 in Appendix C. This must be approved by their previous research advisor. The student has to complete Form C3c in Appendix C. Both forms should be handed in to the CGP Coordinator.

F. Teaching and Research Assistantship

Students can receive institutional assistantships or external funds to serve as Teaching Assistants or as Research Assistants. The student should submit together with the assistantship application two official transcripts of their academic record, the medical examination form, an affidavit certifying that they do not have any debt with the Government of Puerto Rico. Non-resident students should obtain their social security number in the corresponding government agency as soon as they arrive to Puerto Rico. The Office of Exchange Students will send an I-20 form to non-resident students. Each student with a teaching assistantship should register in Chem 6905-6906, and those with a Research Assistantship must register in Chemistry 8999. The evaluation and course grade for the teaching assistantship will be sent to the Graduate Program and the Registrar by the professor in charge of the course. This evaluation will form part of the student's academic record in the Graduate Program's Office. **All graduate students, regardless of assistantship type (including fellowships) are requested to teach at least two academic semesters. Ph.D. are required to teach two semesters.**

The teaching or research assistants perform a combination of research and teaching duties, these include:

1. A research assistantship (without teaching responsibilities) requires a minimum of 20 hours a week of research during each semester of research and fulltime during academic recess.
2. A teaching assistantship requires 18 hours weekly of teaching (including preparation) for two semesters.

The teaching or research assistantships are available only to fulltime graduate student. This means that the student cannot have any other additional job. All graduate students are evaluated each semester by the Academic Affairs Committee. This evaluation includes academic progress, course grades, progress in research and their performance of assistantship duties. If the academic grade point average of the student falls below 3.0, the student will immediately become ineligible for the assistantship in the department. It is the discretion of the thesis advisor to provide research assistantship to a student on probation. Any student that has dropped out of the Program also will be automatically ineligible for any assistantship in the Department. Teaching assistantships available during the summer are limited. These will be given to those bonafide students who have good records as teaching assistants. **The DEGI has established the policy that M.S. students will have a maximum of three years to hold a teaching or research assistantship from university funds and five years for Ph.D. students.** After this time, the student's progress will be evaluated by the DEGI to decide if they should receive an extension, in the event it is needed.

G. Research Thesis/Dissertation

A graduate student, either M.S. or Ph.D., who has fulfilled all the requirements of the degree and has completed the experimental part of their research work, will be able to enroll in the Thesis Continuation course, CHEM 6896 (M.S.) or CHEM 8896 (Ph.D.), in order to maintain fulltime student status.

H. Academic Status

To be considered as a fulltime student, they must be registered in eight credit hours during a regular semester, unless registered in Continuation of Thesis or Dissertation (CHEM 6896 or 8896). The student's academic average is computed using course grades as a base, except those that the student has repeated, in this case the best grade will be used to compute the average. Any course with C, D or F grade can be repeated when the course is offered again. If a student receives a grade less than a C (2.00) in any course, it may not be used to satisfy the graduation requirements, even though the grade is included in their academic average. A student is considered bonafide if their academic average is 3.00 or higher. If the academic average is lower than 3.00 the student automatically goes on probation at the beginning of the next semester. The student is removed from this probationary status as soon as they raise the academic average above 3.00. A student with probationary status will neither be eligible to take the candidacy exam nor be able to fulfill other degree requirements, such as graduate seminar or the research proposals. Nevertheless, the student will be able to continue taking graduate courses, working on research and performing the assistantship depending on the discretion of the advisor. If the student does not meet this condition after having been on probation for one year, they will be removed from the Program. If a student decides to leave the Graduate Program before completing the degree, they must submit a copy of Form C10 (Appendix C) to the CGP Coordinator. If the student resigns from a teaching or research assistantship, they must submit the resignation by letter to the corresponding program or Department. A student who is removed from the Graduate Program due to poor academic performance (GPA below 3.00), may apply for readmission to the Graduate Program only after having satisfied any deficiencies. Therefore, the student can take graduate courses with the approval of the CGP Coordinator and the Graduate Student Affairs Committee. The student should present evidence of the work carried out during the subsequent period from which they were dropped. The student should then follow the normal procedure to apply for readmission.

All readmissions to the Program will be evaluated by the Graduate Affairs Committee. A student with a M.S. degree who has been admitted to the Ph.D. Program should apply for an extension to validate that their M.S. course credits can be counted for the doctoral degree. The student should request the form "Request for Extension to Complete Degree Requirements" from the Deanship of Natural Sciences and present it to the CGP Coordinator along with a letter of justification and research plan. This request will be evaluated by the Coordinator and the Graduate Student Affairs Committee.

Readmission to the Graduate Program will not be considered if the student has been removed from the Program as a result of:

1. Not passing the candidacy exam.
2. Not fulfilling the admission requirements for candidacy in the time limit specified.
3. Not satisfying the thesis requirements in the time limit specified.

Any violation to the dispositions contained in this Regulation manual is sufficient reason to place a student on probation. The probationary status means that the student is not eligible for a teaching assistantship

and will not be allowed to advance in curriculum requirements including the candidacy exams and subsequent requirements. Eventually, if the student does not comply with the conditions of their probation during the time established (usually one year), they will be removed from the Program. If there is a justifiable cause for not meeting the conditions, the student must request a postponement by letter addressed to the Graduate Affairs Committee.

In order to request graduation, students must complete Form A- Academic Status Sheet (Appendix B) and follow the instructions in Form D1a (Appendix C). If a student needs to request an extension to graduate, they need to complete Form D1b (Appendix C).

I. Student Representatives

Two graduate student representatives will attend all departmental and Graduate Faculty meetings. The student representatives will have a voice, but not a vote in the decision in these meetings. They can request at any moment that the topics of interest to the graduate students be included in the agenda for the CGPs future meetings. The student representatives may be asked to leave the meeting when confidential matters pertaining to a graduate student are discussed. Student representatives will be asked to participate in at least one CGP committee but can attend other committee meetings that are relevant to the graduate student issues. An open meeting to all graduate students from the Program will be announced by the CGP Coordinator at the beginning of each academic year. The student representatives will be elected for that year at this meeting. The student representatives may call for graduate student meetings during the year to discuss problems or plan activities.

J. Graduation

The student will fill out the graduation application following the instructions announced by the university. At the time of applying for graduation, the student is responsible for having already completed all program requirements, maintained a GPA ≥ 3.00, and fulfilled any division deficiencies as identified by the Placement Exams. It is recommended that the student requests an evaluation of their academic record and status in the Graduate Program from the CGP Coordinator. Digital copies of the dissertation should be submitted by the deadline announced by the university. A certification of graduation will not be given until the student hands in the bounded copies of the thesis or dissertation. Once the student graduates, they will be asked to complete Form E in order for the program to stay in contact with them.

K. Administration of the Program

The CGP Coordinator administers the M.S. and Ph.D. tracks of the Chemistry Graduate Program. An administrative assistant from the Deanship of the College of Natural Sciences is assigned to provide administrative assistance. The CGP has a Graduate Affairs Committee, an Academic Affairs Committee, a Student Learning Assessment Committee, and a Fundraising Committee. Every five years the CGP undergoes a self-study, which requires the participation of a Self-Study committee.

Faculty: The Chemistry Graduate Program consists of 16 tenure-track and tenured faculty specialized in the different divisions of the Chemistry fields. They serve as research mentors for M.S. and Ph.D. students on interdisciplinary projects in renewable energy, battery development, water purification, natural products, environmental chemistry, drug development and delivery, theranostic agents, sensors, and much more. Refer to Appendix A for the list of faculty.

Graduate Affairs Committee: This committee consists of a minimum of three professors and a student representative. It attends to admissions, student recruitment, course registration, and guidance for student financial aid. This committee is also responsible for organizing professional and social activities for the graduate students and attending to matters of concern (for example, safety) raised by the graduate students.

Graduate Student Counselors: There will be ***two Graduate Student Counselors*** each year, who will be elected by the CGP faculty. These counselors will serve as a support to the CGP Coordinator to help with the professional development of the students. They will provide guidance on the construction and updates of the student Individual Development Plan. They will also help with coordinating activities for professional trainings or job recruitment.

Academic Affairs Committee: This committee consists of a professor from each Division of the CGP Faculty. It is responsible for reviewing academic policies and for proposing either changes or new policies needed to clarify existing practices, improve administrative processes, or otherwise benefit student experience. Such reviews are conducted when requested by the CGP faculty. The committee brings its recommendations to the CGP faculty. If the CGP faculty endorses the recommendation, the CGP Coordinator will forward it to the administration.

Responsibilities-

1. Review and recommend revisions of all academic policies and practices including but not limited to:

    a. Academic appeals
    b. Course add/drop/withdrawal
    c. Course substitutions and waivers
    d. Credit for developmental coursework or to compensate for division deficiencies

2. Academic integrity. The committee will review the policies on student academic integrity. The committee will ensure that students and faculty are informed of the definitions, policies, and practices related to plagiarism, cheating, and fabrication.

3. Academic Appeals. The committee will hear academic appeals for academic suspension and dismissal.

Student Learning Assessment Committee: This committee consists of three professors and a student representative. It is responsible for enforcing the annual and three-year assessment plan as described below (Section P).

Fundraising Committee: There will be no set minimum number of professors. This committee will work to raise funds for the Chemistry Graduate program through an established campaign “Catalizando la

Química" available at the link https://donaciones.uprrp.edu/iniciativas/proyectos-especiales/. Funds will be raised to improve educational offerings and professional development of the students, infrastructure for research, and to provide sponsorship for participation in conferences and workshops and for research materials.

L. Professional Accreditation

Although our campus' B.S. in Chemistry program is accredited by a professional association, the American Chemical Society (ACS), this professional organization does not accredit graduate programs in Chemistry. Therefore, our M.S. and Ph.D. programs are not eligible for accreditation from a professional association. By law, chemists in Puerto Rico working outside of academia but possess at least a B.S. in Chemistry degree can be licensed to practice the profession by the Chemists Examining Board of the Department of State of Puerto Rico.

M. Information Resources

Students and professors in the CGP have access to hundreds of chemistry journals and books through the College of Natural Sciences Library. The University of Puerto Rico has a contract with the American Chemical Society (ACS) that gives free access to papers in the dozens of journals that ACS publishes. In addition, SciFinder is also provided. SciFinder, produced by Chemical Abstracts Service (CAS), a Division of the American Chemical Society, is the most comprehensive database for the chemical literature, searchable by topic, author, substances by name or CAS Registry Number, or by the use of the editor to draw chemical structures, substructures, or reactions.

The CGP, through the Library of the College of Natural Sciences, has access to >1,000 bibliographic resources whose specific subject is Chemistry and >2,000 bibliographic resources whose general subject is related to chemistry. There is also access to the Directory of Open Access Journals (DOAJ) which has hundreds of journals in Chemistry. The Library System catalog provides access to the Catalog of the Medical Sciences Campus with general bibliographic resources in Chemistry and to the Mayagüez Campus catalog with bibliographic resources whose specific subject is Chemistry. We have bibliographic resources of ACS Publications, Annual Reviews, Elsevier, SciFinder, Springer, Web of Science and Wiley, among others.

N. Teaching, Research and Services Infrastructure

The CGP has one assigned classroom available at the Facundo Bueso building (FB-266), one conference room (FB-264), and an office (FB-312). It also has access to classrooms in the College of Natural Sciences building. The research laboratories are located in three different building: the Facundo Bueso building, the building of the College of Natural Sciences and the off-campus Molecular Sciences Research Center. The Molecular Sciences Research Center has one of the most advanced scientific instrumentation facilities in the Caribbean. All laboratories have a current Chemistry Hygiene and Safety Plan and the professors have the required explosives license from the Puerto Rico Police Department.

O. Student Services

1. Student services and support systems: Apart from the student services obtained from the Coordinator of the CGP, all other student services are provided through the Office of Graduate Studies and Research of the College of Natural Sciences (CNS) and the Office of the Department of Chemistry, both located in the CNS building, as well as the DEGI and the different campus-wide offices such as Deanship of Academic Affairs, Deanship of Students, Registrar Office, Students' Ombudsperson, Medical Services Facilities, and the Department of Counseling for the Student Development (DCODE), among others. These services include admissions, enrollment, economic assistance, medical services, professional counseling and psychological services, and library services, among others.
2. Economic assistance: Students in the program are eligible to the Formative Academic Experience Program (PEAF) of the Deanship of Graduate Studies and Research, which provides stipends of $810 monthly for M.S. students and $1,090 for Ph.D. student for 10 months of the academic year. Students are also eligible to apply for fellowships offered by the DEGI and and federal programs sponsored by NSF, NIH, NASA, DOE, some of the research programs on campus funded by federal agencies.

P. Assessment of the Program and Student Learning Assessment Plan

1. Development Plan: Every five years the CGP must submit a five-year development plan. To determine the right course of action for improving the program and aligning it with the current academic, student, workforce, and society needs we administer a questionnaire to current students, alumni, and professors of the program to evaluate the program's courses, research programs, professional development offerings, and infrastructure. We also assess the productivity of all researchers in the program in terms of research output and external funding, the professional placement of all graduates of the program, and the academic merits of the program's curriculum. An external evaluation committee evaluates all of the data compiled in the assessment and provides feedback that is included in the five-year plan.

2. Student Learning Assessment Plan: The Student Learning Assessment Plan of the CGP is based on the development of established learning domains for all students on campus, which currently includes the graduate students in our two programs (M.S. and Ph.D.). The development of those learning domains among the students in these programs will allow them, at the end of their graduate studies, to fulfill the alumnus profile. The assessment plan uses an evaluation model of the UPR Division of Institutional Research and Assessment (DIRA) of the Deanship of Academic Affairs. The assessment is based on certain learning domains with their learning objectives and the courses and program requirements where they will be evaluated to assess student learning in each of those domains. Annual and three-year plans are submitted and approved by the DIRA. We will use the online OLAS system for these assessments. The annual reports will be shared with the entire Program's faculty and an action plan will be established to correct identified problem areas. The student learning assessment information will be used to assess how the program is fulfilling its student learning goals as well as the graduate program development goals.

APPENDIX A

Master of Science in Chemistry: Suggested Study Program for fulltime students (30 credits).

First (1st) Year					
First (1st) Semester			**Second (2nd) Semester**		
Course Code	**Description**	**Credits**	**Course Code**	**Description**	**Credits**
CHEM 6905	Principles and Practices	3	CHEM 6906	Principles and Practices	3
CHEM 6XXX	Chemistry Graduate Core Course at the 6000 level	3	CHEM 6XXX	Chemistry Graduate Core Course at the 6000 level	3
CHEM 6XXX-8XXX	Elective Course	3	CHEM 6XXX-8XXX	Elective Course	3
CHEM 6XXX-8XXX	Elective Course	3	CHEM 8XXX	Focused Research Seminar	2
CHEM 8901	Graduate Seminar	1	CHEM 8902	Graduate Seminar	1
CHEM 6999	Laboratory Rotations	0	CHEM 6999	Graduate Research	2
			Milestone 1: **Thesis Research Proposal**		
	Total	*10/13*		*Total*	*11/14*
Second (2nd) Year					
Third Semester			**Fourth Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Principles and Practices	3	CHEM 6905	Principles and Practices	3
CHEM 8000	Scientific Writing Course	3	CHEM 6999	Graduate Research	1
CHEM 8XXX	Focused Research Seminar	2	CHEM 6896	Thesis Continuation	0
CHEM 6999	Graduate Research	3			
Milestone 2: **Progress Report**			**Milestone 3**: **Thesis Defense**		
	Total	*8/11*		*Total*	*1/4*

For parttime M.S. students, a study program will be developed in an agreement with the student, the CGP Coordinator, and the Academic Affairs committee.

Doctor of Philosophy in Chemistry: Suggested Study Program for fulltime students with a BA/BS (59 credits).

First (1st) Year					
First (1st) Semester			**Second (2nd) Semester**		
Course Code	**Description**	**Credits**	**Course Code**	**Description**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3	CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3
CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3	CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3
CHEM 8999	Laboratory Rotations	0	CHEM 8902	Graduate Seminar	1
CHEM 8901	Graduate Seminar	1	CHEM 8000	Focused Research Seminar	2
			Milestone 1: Candidacy Exam (Summer)		
Total		10	*Total*		12
Second (2nd) Year					
Third Semester			**Fourth Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Scientific Writing	3	CHEM 8000	Chemistry Elective Course	3
CHEM 8000	Chemistry Elective Course	3	CHEM 8000	Focused Research Seminar	2
CHEM 8000	Focused Research Seminar	2	CHEM 8999	Graduate Research	3
CHEM 8999	Graduate Research	3			
			Milestone 2: Thesis Research Proposal		
Total		11/14	*Total*		8/11
Third Year					
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Focused Research Seminar	2	CHEM 8000	Focused Research Seminar	2
CHEM 8999	Graduate Research	6	CHEM 8999	Graduate Research	6
Milestone 3: Research Seminar Presentation			**Milestone 4**: Original Research Proposal		
Total		8/11	*Total*		8/11
Fourth Year and Beyond					
Seventh Semester			**Eight Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8895	Dissertation Continuation	0	CHEM 8896	Dissertation Continuation	0
CHEM 8000	Focused Research Seminar	2			
Total		2/5	*Total*		0/3
CHEM 8895/8896: Dissertation Continuation (beyond the fifth year) – 0 credits **Milestone 5:** Thesis Presentation and Defense					

For parttime Ph.D. students, a study program will be developed in an agreement with the student, the CGP Coordinator, and the Academic Affairs committee.

Doctor of Philosophy in Chemistry: Suggested Study Program for fulltime students with a M.S. but who does not pass the placement exam in their area of specialization (53 credits).

First (1st) Year					
First (1st) Semester			**Second (2nd) Semester**		
Course Code	**Description**	**Credits**	**Course Code**	**Description**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3	CHEM 6000	Chemistry Graduate Core Course at the 6000 level	3
CHEM 6000-8000	Chemistry Elective Course	3	CHEM 8000	Focused Research Seminar	2
CHEM 6000-8000	Chemistry Elective Course	3	CHEM 8999	Graduate Research	2
CHEM 8999	Laboratory Rotations	0	CHEM 8902	Graduate Seminar	1
CHEM 8901	Graduate Seminar	1	**Milestone 1:** Candidacy Exam		
Total		13	*Total*		11
Second (2nd) Year					
Third Semester			**Fourth Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Scientific Writing	3	CHEM 8000	Focused Research Seminar	2
CHEM 8000	Focused Research Seminar	2	CHEM 8999	Graduate Research	3
CHEM 8999	Graduate Research	1			
			Milestone 2: Thesis Research Proposal		
Total		6/9	*Total*		5/8
Third Year					
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Focused Research Seminar	2	CHEM 8000	Focused Research Seminar	2
CHEM 8999	Graduate Research	6	CHEM 8999	Graduate Research	6
Milestone 3: Research Seminar Presentation			**Milestone 4**: Original Research Proposal		
Total		8/11	*Total*		8/11
Fourth Year and Beyond					
Seventh Semester			**Eight Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8895	Dissertation Continuation	0	CHEM 8896	Dissertation Continuation	0
CHEM 8000	Focused Research Seminar	2			
Total		2/5	*Total*		0/3
CHEM 8895/8896: Dissertation Continuation (beyond the fifth year) – 0 credits **Milestone 5:** Thesis Presentation and Defense					

Doctor of Philosophy in Chemistry: Suggested Study Program for fulltime students with a M.S. but who does pass the placement exam in their area of specialization. (47 credits)

First (1st) Year					
First (1st) Semester			**Second (2nd) Semester**		
Course Code	**Description**	**Credits**	**Course Code**	**Description**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 6000-8000	Chemistry Elective Course	3	CHEM 8000	Focused Research Seminar	2
CHEM 6000-8000	Chemistry Elective Course	3	CHEM 8999	Graduate Research	2
CHEM 8999	Laboratory Rotations	0	CHEM 8902	Graduate Seminar	1
CHEM 8901	Graduate Seminar	1	**Milestone 1:** Candidacy Exam		
Total		10	*Total*		8
Second (2nd) Year					
Third Semester			**Fourth Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Scientific Writing	3	CHEM 8000	Focused Research Seminar	2
CHEM 8000	Focused Research Seminar	2	CHEM 8999	Graduate Research	3
CHEM 8999	Graduate Research	1			
			Milestone 2: Thesis Research Proposal		
Total		6/9	*Total*		5/8
Third Year					
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8000	Focused Research Seminar	2	CHEM 8000	Focused Research Seminar	2
CHEM 8999	Graduate Research	6	CHEM 8999	Graduate Research	6
Milestone 3: Research Seminar Presentation			**Milestone 4**: Original Research Proposal		
Total		8/11	*Total*		8/11
Fourth Year and Beyond					
Seventh Semester			**Eight Semester**		
Course Code	**Course Name**	**Credits**	**Course Code**	**Course Name**	**Credits**
CHEM 6905	Teaching Assistantship	3	CHEM 6906	Teaching Assistantship	3
CHEM 8895	Dissertation Continuation	0	CHEM 8896	Dissertation Continuation	0
CHEM 8000	Focused Research Seminar	2			
Total		2/5	*Total*		0/3
CHEM 8895/8896: Dissertation Continuation (beyond the fifth year) – 0 credits **Milestone 5:** Thesis Presentation and Defense					

List of Graduate Level Courses

Core courses:

CHEM 6011 – Theory of Inorganic Chemistry I

Credits: 3

Prerequisites: CHEM 4041-4042 or its equivalent

Atomic structure and electronic configuration of the elements in relation to the periodic system, theory of the chemical bond; theory of acids and bases and coordination compounds.

CHEM 6012 – Theory of Inorganic Chemistry II

Credits: 3

Prerequisites: CHEM 4041-4042 or its equivalent

Continuation of the bonding theories underlying coordination compounds and organometallic compounds. The course alse explores the kinetics and reaction mechanism of ligand exchange processes and different spectroscopic and magnetic properties of metal compounds.

CHEM 6215 – Theory of Analytical Chemistry

Credits: 3

Prerequisites: CHEM 3255, 4042 or its equivalent

Theoretical study of chemical equilibrium, separations and electrochemical methods. Discussion of statistical methods in measurement and experimental work.

CHEM 6225 – Theory of Instrumental Analysis

Credits: 3

Prerequisites: CHEM 3255, 4041 or its equivalent

Theory of instrumental analysis methods and techniques including discussion of visible and ultraviolet, infrared, atomic absorption spectroscopies and nuclear magnetic resonance, mass spectrometry, gas chromatography, high performance liquid chromatography, potentiometry, polarography, voltammetry, surface analysis and automated analysis.

CHEM 6411 – Theory of Organic Chemistry I

Credits: 3

Prerrequisite: CHEM 3032 or its equivalent

Study and description of mechanisms of organic reactions. Chemical bond and molecular structure. Hückel and frontier molecular orbitals. Pericyclic reactions, Woodward-Hoffmann rules, organic photochemistry and radical reactions. Stereochemistry. Linear free energy relationships. The Hammet equation and transition state theory. Isotopic effects.

CHEM 6412 – Theory of Organic Chemistry II

Credits: 3

Prerrequisite: CHEM 3032 or its equivalent

A student that approves this course should be able to: Identify common structural and reactivity patterns of complex organic molecules like natural products (e.g., terpenes); correctly classify broad chemical transformations (e.g., C–C couplings, cyclizations, oxidations, reductions, functional group interconversions) and synthons in retrosynthetic analysis; describe

stereochemical relationships and predict the stereochemical outcome of asymmetric organic reactions including those involved in asymmetric catalysis; recognize the main types of organic reactions and propose reasonable mechanistic hypotheses for such transformations; understand and critically analyze the peer-reviewed articles reporting organic synthesis and related subjects.

CHEM 6611 – Theory of Physical Chemistry I (3 credits)

Credits: 3
Prerrequisite: CHEM 4042
Study of the laws and principles of theoretical chemistry.

CHEM 6612 – Theory of Physical Chemistry II

Credits: 3
Prerrequisite: CHEM 4042
Continuation of the study of the laws and principles of theoretical chemistry.

CHEM 6811 – Advanced Biochemistry I

Credits: 3
Prerrequisite: CHEM 4042
Study of the chemistry and reactions of the constituents of living matter and the mechanisms and regulation of the most important biological processes. This course focuses on important biomolecules including amino acids, proteins, nucleic acids, lipids, and more.

CHEM 6812 – Advanced Biochemistry II

Credits: 3
Prerrequisite: CHEM 4042
Continuation of the study of the chemistry and reactions of the constituents of living matter and the mechanisms and regulation of the most important biological processes. This course places an emphasis on key cellular metabolic processes.

Advanced and Elective Courses in Chemistry

CHEM 6235 – Instrumental Analysis Laboratory

Credits: 2
Prerequisites: CHEM 3255, 6225 or taking them concurrently
Analytical techniques and methods. Series of illustrative experiments of the methods whose theoretical foundations have been discussed in QUIM 6225.

CHEM 6813 – Biochemistry Techniques

Credits: 3
Discussion and application of the fundamental techniques in the field of biochemistry.

CHEM 6825 – Biochemistry of Organized Systems

Credits: 3
Prerequisites: CHEM 4041 or its equivalent. CHEM 4055 or its equivalent is recommended.

The chemical and physical properties of macromolecules and their interactions in biological systems. Reaction kinetics and mechanism in biochemical systems.

CHEM 6896 – Continuation of M.S. Thesis

Credit: 0

This course will allow those M.S. students who have completed all of their course credits to maintain active status in the Program while completing their thesis work.

CHEM 6905 – Chemical Principles and Practices I

Credits: 3

Limited to graduate students from the Department of Chemistry.

Discussion of chemical principles with special emphasis on their application to laboratory work and its evaluation.

CHEM 6906 – Chemical Principles and Practices II

Credits: 3

Limited to graduate students from the Department of Chemistry.

Discussion of chemical principles with special emphasis on their application to laboratory work and its evaluation.

CHEM 6999 – M.S. Thesis Research

Credits: 1-6

Research work, under the direction of a research advisor.

CHEM 8005 – Seminar in Inorganic Chemistry I

Credits: 2

Discussion of recent advances in Inorganic Chemistry.

CHEM 8006 – Seminar in Inorganic Chemistry II

Credits: 2

Discussion of recent advances in Inorganic Chemistry.

CHEM 8015 – Physical Inorganic Chemistry

Credits: 3

Prerrequisite: CHEM 6012

Mechanism of reactions in inorganic systems, with emphasis on coordination compounds.

CHEM 8025 – Ligand Field Theory

Credits: 3

Prerrequisite: CHEM 6012

Bond theory and spectra in coordination compounds.

CHEM 8035 – Structural Methods in Inorganic Chemistry

Credits: 3

Prerrequisite: CHEM 6011

Study of spectroscopic, diffraction and magnetic resonance methods for determining the structure of inorganic and organometallic compounds.

CHEM 8045 – Organometallic Compounds of Main Group Elements

Credits: 3

Prerequisites: CHEM 6012, 6412

Presentation of the structure and properties of the main organometallic compounds, their preparation, reactions and applications to organic synthesis.

CHEM 8046 – Organometallic Compounds of Transition Metals

Credits: 3

Prerequisites: CHEM 6011, 6411

Presentation of the structure and reactions of transition metal complexes, within the context of catalysis in organic synthesis.

CHEM 8205 – Seminar in Analytical Chemistry I (2 credits)

Credits: 2

Discussion of recent advances in Analytical Chemistry.

CHEM 8206 – Seminar in Analytical Chemistry II (2 credits)

Credits: 2

Discussion of recent advances in Analytical Chemistry.

CHEM 8211 – Advance Analytical Chemistry I

Credits: 3

Prerrequisito: CHEM 6225

Study of the applications of chemical and instrumental methods to the analysis of chemical problems.

CHEM 8212 – Advance Analytical Chemistry II

Credits: 3

Prerrequisito: CHEM 6225

Study of the applications of chemical and instrumental methods to the analysis of chemical problems.

CHEM 8405 – Seminar in Organic Chemistry I

Credits: 2

Discussion of recent advances in Organic Chemistry.

CHEM 8406 – Seminar in Organic Chemistry II

Credits: 2

Discussion of recent advances in Organic Chemistry.

CHEM 8415 – Physical Organic Chemistry

Credits: 3

Prerequisites: CHEM 6411-6412, 6611-6612.

The methods of thermodynamics, kinetics and quantum chemistry are treated in detail and applied to mechanisms of organic reactions. These include linear free energy relationships, substituent effects, isotopic effect, surface energy, electronic structure of reaction intermediates, and symmetry arguments for molecular orbitals.

CHEM 8425 – Synthetic Organic Chemistry

Credits: 3

Prerequisites: CHEM 6411-6412

Study of the multistep synthesis of both natural and non-natural products. General strategies using retrosynthetic analysis and synthetic equivalents for molecular construction are examined. The stereochemical control is examined from the standpoint of the substrate and the reactant. Select transformations are studied from a mechanistic point of view, particularly within the context of chirality transfer in asymmetric processes.

CHEM 8435 – Natural Products

Credits: 3

Prerequisites: CHEM 6411-6412

Structure elucidation, partial and total synthesis and biogenesis of natural products. Specific examples of terpenes, steroids, alkaloids, proteins, lipids and pigments. The elucidation of the structures involves classical methods as well as modern spectroscopic methods.

CHEM 8445 – Structural Problems in Organic Chemistry

Credits: 3

Prerequisites: CHEM 6411-6412

Study of the spectroscopic elucidation of the structure of organic compounds and reaction intermediates. The spectroscopic methods presented are visible ultraviolet, infrared, nuclear and electronic magnetic resonance, and diffraction methods. The basis and application of these are discussed and practiced with specific examples. The course does not delve into aspects of quantum mechanics.

CHEM 8605 – Seminar in Physical Chemistry I

Credits: 2

Discussion of recent advances in Physical Chemistry.

CHEM 8606 – Seminar in Physical Chemistry II

Credits: 2

Discussion of recent advances in Physical Chemistry.

CHEM 8615 – Chemical Kinetics

Credits: 3

Prerrequisite: CHEM 4042

Study of the theory and applications of the kinetics of chemical reactions in the gas and liquid phase.

CHEM 8625 – Introduction to Molecular Spectroscopy

Credits: 3

Prerequisites: CHEM 6611-6612.

Molecular and quantum mechanical spectroscopy, with particular attention to the molecular structure and the deduced symmetry of the vibrational and rotational spectra. Includes the calculation of thermodynamic functions starting from spectroscopic data.

CHEM 8635 –Statistical Thermodynamics

Credits: 3

Prerequisites: CHEM 6611-6612

Introduction to statistical mechanics. Study of the relationships between the thermodynamic functions of gases, liquids and solids and their molecular structures.

CHEM 8645 – Quantum Chemistry

Credits: 3

Prerequisites: CHEM 6611-6612

The basic principles of quantum mechanics and its applications to chemical problems. It includes wave motion, matrices, atomic and molecular structure and spectra, the quantum theory of valence, and the phenomenon of resonance.

CHEM 8801 – Seminar in Biochemistry I

Credits: 2

Discussion of recent advances in Biochemical Chemistry.

CHEM 8802 – Seminar in Biochemistry II

Credits: 2

Discussion of recent advances in Biochemical Chemistry.

CHEM 8885 – Enzymatic Catalysis

Credits: 3

Prerrequisite: CHEM 6811

The study of protein chemistry with an emphasis on conformations and their effect on enzymatic catalysis. It includes inhibition of enzymatic catalysis, modifications and mechanisms.

CHEM 8896 – Continuation of Doctoral Dissertation

Credit: 0

This course allows those students who have completed all of their course credits to remain active as students in the Doctoral Program while completing their thesis work.

CHEM 8896 – Candidacy Exam

Credits: 0

CHEM 8901 – Graduate Seminar I

Credits: 1

Seminar on topics of interest in chemistry presented by students, faculty members, and visiting professors.

CHEM 8902 – Graduate Seminar II

Credits: 1

Seminar on topics of interest in chemistry presented by students, faculty members, and visiting professors.

CHEM 8990 – Special Topics in Inorganic Chemistry

Credits: 1-4

Study and discussion of various topics in the field of inorganic chemistry. These include bioinorganic chemistry and symmetry rules for inorganic reactions.

CHEM 8992 – Special Topics in Analytical Chemistry

Credits: 1-4

Advanced study of specialized topics in analytical chemistry such as signal processing, interfaces, environmental analysis and electrode processes.

CHEM 8994 – Special Topics in Organic Chemistry

Credits: 1-4

Advanced study of specialized topics in organic chemistry, such as the biosynthesis of natural products, boron compounds in organic synthesis and total synthesis.

CHEM 8996 – Special Topics in Physical Chemistry

Credits: 1-4

Advanced study of specialized topics in physical chemistry such as photochemistry, photophysical processes, dynamics of molecular reactions and resonance spectroscopy.

CHEM 8998 – Special Topics in Biochemistry

Credits: 1-4

Advanced study of specialized topics in biochemistry such as lipids in membranes, protein conformation and signal transduction.

CHEM 8999 – Research for the Doctoral Dissertation

Credits: 1-12

Students will work on their dissertation under the supervision of their thesis advisor(s).

List of Professors in the CGP

Names	Academic preparation (Ph.D.)	Teaching specialty	Lines of Research
Marvin Bayro	MIT, 2010	Physical Chemistry, Biophysics	Protein Structure and Dynamics, Solid-state NMR Spectroscopy, Biophysical Chemistry, Protein Assemblies, HIV Structure
Néstor M. Carballeira	University of Würzburg, 1983	Medicinal Chemistry	Lipid Chemistry and Marine Natural Products: Isolation and Synthesis of New Fatty Acids of Marine Origin; New Antiplasmodial and Antifungal Lipids.
Zhongfang Chen	Nankai University, 2000	Thermodynamics Molecular Structure and Chemical Bonding	Computational Chemistry, Computational Nanomaterials Science, Physical Organic Chemistry.
Jorge Colón	Texas A&M University, 1989	Inorganic Chemistry, Chemistry of Materials, Bioinorganic Chemistry	Inorganic, Bioinorganic, and Materials Chemistry; Layered Inorganic Compounds; Artificial Photosynthesis; Amperometric Biosensors; Drug Delivery Systems; Electrocatalysis of the OER Reaction.
Lisandro Cunci	UPR-RP, 2013	Analytical and Instrumental Chemistry	Biosensors, Neurochemistry, Electrochemistry, Materials Science, Synthesis and Characterization of Electrocatalysts for Energy Applications.
Liz M. Díaz Vázquez	UPR-RP, 2005	Chemical Education, Renewable energy & Sustainability	Chemical Education, Renewable Energy & Sustainability
Kai Hans Griebenow	MIT, 1996 University of Duesseldorf, 1992	Advance Biochemistry	Structure-guided Protein Encapsulation, Non-aqueous Enzymology, Protein Formulation, Protein Stability, Protein Glycosylation, Relationship between Protein Structural Dynamics and Enzyme Activity, PEG Modification of Proteins, Bio-fuel cells.
Ingrid Montes	UPR-RP, 1985	Organic Chemistry	Organometallic Chemistry, Chemical Education.
Eduardo Nicolau	UPR-RP, 2012	Analytical applications of bio-nanomaterials	Preparation of Interfaced Bionanomaterials for Reactive Water Purification Membranes; Development of Point-of-Use Sensors for the Detection of Emerging Contaminants in Water; Synthesis and Characterization of Nanomaterials for Electrooxidation of High-density Fuels; Development of Analytical Methodology through Chemometrics.
Dalice M. Piñero	UPR-RP, 2009	Coordination Chemistry	Synthesis of Metal Complexes and Multidimensional Networks for their Application in Materials Science and Nanomedicine.
José M. Rivera	MIT, 2000	Organic Chemistry	Supramolecular Chemistry, Molecular Recognition, Organic Synthesis, Nanotechnology, Bioorganic Chemistry, Medicinal Chemistry.
Abimael D. Rodríguez	The Johns Hopkins University, 1983	Spectrometric Identification of Organic Compound	Organic Chemistry: Isolation, Structure, Elucidation and Synthesis of Marine Natural Products.
Arthur D. Tinoco	Yale University, 2007	Inorganic and Bioinorganic Chemistry	Bioinorganic Chemistry, Proteomics, Metal-based therapeutics in Anticancer, Antidiabetes, and Antibacterial Applications
Brad Weiner	University of California, 1986	Physical Chemistry	Physical Chemistry: Gas Phase Molecular Reaction Dynamics; Laser Photochemistry and Photophysics; Gas Phase Kinetics of Reactive Intermediates; Non-Linear Photoprocesses; Molecular Energy Transfer; Mechanisms of Laser Ablation.
Xianyong Wu	Wuhan University, 2016	Analytical and Inorganic Chemistry	Electrochemistry, Rechargeable Batteries for Energy Storage, Synthesis and Characterization of Inorganic Materials, Understanding of Ion-electrode Insertion Reactions.

APPENDIX B

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form A-Academic Status Sheet

Student Name _____ Student Number _____

Date _____ Date of entrance into the CGP _____

Classification: □ M.S. □ Ph.D.

Specialization: □ Analytical □ Biochemistry □ Inorganic □ Organic □ Physical Chemistry

Placement Exam (Deficiencies):
□ Analytical □ Biochemistry □ Inorganic □ Organic □ Physical Chemistry

Teaching Assistantship Requirement: □ Yes □ No

Candidacy Exam: Presentation Date _____

Committee Members:

1. _____
2. _____
3. _____
4. _____
5. _____

Thesis Research Proposal: Presentation Date _____

Research Seminar: Presentation Date _____

Original Research Proposal: Presentation Date _____

Thesis Dissertation: Presentation Date _____

Courses Passed:

APPENDIX C

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form B1a-Candidacy Exam

At the end of the first (1st) year in the Doctoral Graduate Program, the student will take a candidacy exam administered by the thesis committee at the end of the first academic year. The objective of the candidacy exam is to examine the student's fundamental comprehension of their doctoral project. The exam consists of a written and oral component based on questions assigned to the student by the thesis committee members within their respective expertise. These questions will be fundamental in nature, focusing on the research field of the student's doctoral project and relevant chemistry concepts. The student must provide a one-page overview (or a one-page Specific Aims) of their Research Plan Proposal to the thesis committee members in order for each member to prepare two questions. The thesis committee members may provide supplemental reading material to accompany the two questions that they assign to the student. The questions must be emailed to the Director of the Committee, who will make sure there are no duplicate questions and who will deliver all of the questions to the student. The student will choose five questions to prepare written responses. They will have a maximum of 14 calendar days to respond to the questions. The student may use textbooks and other references to respond to the questions in addition to any supplementary reading but cannot consult with another person other than to ask the committee members to clarify doubts. The responses to the questions must demonstrate original critical thinking and qualitative/quantitative analysis and must include appropriate citations.

Once the committee receives the responses to the questions, they will have 14 calendar days to evaluate the responses. The oral component of the exam must be scheduled after these 14 days unless agreed by the committee to be sooner. The oral exam must focus on but not be limited to the topics in the questions assigned to the student. The final evaluations are: Pass, Conditional Pass, and Not Pass. If the student receives a Pass, then they will be a Doctoral Candidate and be allowed to continue with their doctoral research. If the student receives a Conditional Pass, then any deficiency that the student presented must be resolved by revising their responses to pertinent questions where they demonstrated deficiency within one month following the oral exam. If the student receives a Not Pass, then they will have to repeat the oral exam in addition to addressing deficiencies demonstrated in their written responses to questions. *Students will be given no more than two (2) opportunities to pass the candidacy exam.* A student in good standing who fails this requirement will be allowed to pursue a M.S. degree. The student should apply for this exam by filling out Form C2 (Appendix C)

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form B1b-Candidacy Exam Evaluation

_____ _____
Name Student Number

Pass_____ Conditional Pass____ No Pass_____

If the student received a conditional pass, then describe the condition that the student completed: _____

Committee Director	Signature	Departament
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

Certification of the completion of the candidacy exam.

_____ _____
Coordinator of the Chemistry Graduate Program Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form B2-Proposal Manuscript and Presentation Guidelines

These guidelines are adapted from the National Institutes of Health (NIH) research grant application instructions with some minor input from the National Science Foundation (NSF) research grant application instructions (see the link to the instructions on the website).

Both the Thesis Research Proposal and Original Research Proposal are an organized and innovatice workplan to feasibly address an important scientific problem by applying fundamental chemical principles and using appropriate instrumentation and techniques. The expected duration of the project is a minimum of two years allotting for additional time where necessary for scientific communication of the project accomplishments.

In the proposal you will:

1. Present and contextualize a scientific problem
   - Explain why the problem is significant.

2. Define your contribution toward tackling the scientific problem
   - Explain what you intend to do.
   - Explain whether your endgoal is to complement or improve on “gold standard” approaches.

3. Establish 3 specific aims

4. Determine short-term and long-term deliverables
   - Intellectual Merit and Broad Impact

Proposal Manuscript Format

Use single space Times New Roman, 12 pt font or Arial, 11 pt font. Make sure to incorporate high resolution figures and tables in the document near the point of mention in the manuscript. The manuscript must be submitted to the committee two weeks prior to the presentation.

1. Title Page (1 page)

2. Table of Contents (1 page)

3. Project Summary/Abstract (0.5 page)

4. Specific Aims (1 page)

5. Research Strategy (12 pages)

6. Timeline (1 page)

7. References/Literature Cited (No page limit)

8. Facilities, Equipment, and Other Resources (No page limit)

For specific guidance on each section and for the use or construction of figures, please refer to the attached pdf document titled “CGP Preparation of the Research Proposal and Presentation.”

Proposal Presentation Format

The Thesis Research Proposal must be presented only to the members of the thesis committee whereas the Original Research Proposal must be presented during the Chemistry Seminar Series. Prepare your presentation for a duration of 30 minutes.

Section	Suggested Time (minutes)
1. Background and Significance	5 – 10
2. Innovation and briefly introduce all of your specific aims	
3. Approach Discuss each specific aim. a. Describe the experimental plan (Methodology, analysis) b. Briefly discuss relevant parts of your facilities, equipment, and other resources c. Present preliminary data d. Discuss expected outcomes e. Establish benchmarks for success and alternative plans	20
4. Intellectual Merit	Be brief
5. Broader Impact	
6. Timeline	

Chemistry Graduate Program
Research Seminar Presentation
Form B3a-Instructions for the Manuscript and Presentation
Chemistry 8901-8902

As part of the graduate seminar series, you are required to deliver a research seminar that provides a comprehensive perspective on the current state of a research field. The presentation can be related to, but must be distinct from, your research thesis project. The selected topic should align with your broader field of study (such as, Analytical Chemistry, Biochemistry, Organic Chemistry, Inorganic Chemistry, or Physical Chemistry), allowing you to demonstrate the wider impact and contributions of your research. The purpose of your seminar is to educate the audience on the chosen topic by offering a thorough overview that includes sufficient background information to orient and engage them. This presentation should move beyond the scope of an extended group meeting and serve as an opportunity to deepen the audience's understanding of the field. In conjunction with your seminar presentation, you are also required to prepare a manuscript formatted as a perspective review, which should be submitted in accordance with the provided guidelines.

Definition and Scope: Comprehensive Review and Seminar Preparation

A. Comprehensive Review: A comprehensive review involves a thorough and critical analysis of the current state of research within a specific field of chemistry, such as, Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry or Physical Chemistry. The presentation can be related to, but must be distinct from, the student's thesis topic. The review should:

1. **Identify Key Themes and Advances:** Critically analyze a minimum of ten recent research papers (published within the last 10 years) to highlight the most significant developments in your chosen field. Your review should synthesize the findings from these papers to identify key trends, breakthroughs, methodologies, and current challenges faced by researchers. Remember, the focus is on providing a comprehensive overview of the topic, rather than directly presenting the content of the selected articles.
2. **Provide a Contextual Perspective:** Situate these developments within the broader context of the field, explaining their relevance and impact on ongoing research. The student should provide their perspective on the direction in which the field is heading, the potential applications of recent discoveries, and the gaps or limitations that future research needs to address.
3. **Adopt a Critical Approach:** Critique the methodologies, findings, and conclusions of the selected studies, identifying their strengths and limitations. Offer a balanced view that incorporates different perspectives, and suggest potential directions for future research.

B. Manuscript Preparation Guidelines

The manuscript accompanying your research seminar should provide a comprehensive review and critical analysis of recent developments in a selected field of chemistry (such as Analytical

Chemistry, Biochemistry, Inorganic Chemistry, or Physical Chemistry) which can be related to, but must be distinct from, your thesis topic. This document will showcase your understanding of the field, highlight key advancements, and position your own contributions within the broader scientific context.

1. **Manuscript Structure:**
   i. Title: Choose a concise and informative title that accurately reflects the focus of your review.
   ii. Abstract: Write a brief, original abstract (150–250 words) that provides an overview of your perspective on the topic. The abstract should summarize the main points, significance, and your unique analysis of the chosen field.
   iii. Introduction: Introduce the research field, providing background information to help readers understand the context. Clearly state the scope and objectives of your review, and explain why this field is important.
   iv. Review Topics: Organize the main body of the manuscript into coherent sections that discuss key topics or themes within the chosen field. Highlight recent advancements, emerging trends, significant findings, and ongoing debates. Ensure that each section provides a critical analysis of the research, including a comparison of different studies, methodologies, and findings.
   v. Discussion: Offer a deeper analysis of the findings presented in the review. Discuss the implications of the recent research, identify gaps or limitations in the current knowledge, and suggest potential directions for future research.
   vi. Conclusion and Reflections on Future Directions: Summarize the key points of your review, emphasizing the most important findings and their relevance to the field. Reflect on possible future developments and how your research contributes to these advancements.
   vii. References: Include a comprehensive reference list, formatted according to the style guidelines of the Journal of the American Chemical Society (J. Am. Chem. Soc.). Ensure that all sources cited in the manuscript are listed, and provide in-text citations throughout the document as needed.

2. **Formatting Requirements:**

   i. Length: Ten (10) single-spaced pages, excluding references.
   ii. Font: Times New Roman, 12-point size.
   iii. Spacing: Double line spacing.
   iv. Margins: 1-inch margins on all sides.
   v. Figures: Include only the most essential figures; if using figures from published articles, use high-resolution versions and properly credit the source. Creating original figures is highly encouraged.

3. **Citation and Plagiarism:**

   a) ***Proper Citation:*** All information, data, and ideas drawn from external sources must be accurately cited in accordance with the Journal of the American Chemical Society (J. Am.

Chem. Soc.) guidelines. This includes providing in-text citations for every reference used within your manuscript and a corresponding entry in the reference list. Make sure all references are formatted correctly and comprehensively, covering all necessary details such as authors, title, journal, volume, pages, and year of publication.

b) **Avoiding Plagiarism:** Plagiarism, which involves presenting another's work, ideas, or expressions as your own without proper acknowledgment, is a serious academic offense. To avoid plagiarism:

- Do not copy text directly from other sources, including articles, books, or online content, without using quotation marks and providing the appropriate citation.
- Paraphrase information in your own words and cite the original source to give proper credit.
- Use plagiarism detection tools (such as Turnitin or Grammarly) to check your manuscript for any unintended duplication or similarity with existing literature before submission.
- Ensure that your manuscript represents your original work, ideas, and analysis, even when discussing existing literature.

4**. Use of AI Tools:**

a) ***Appropriate Use of AI Tools:*** You are encouraged to use AI-based grammar and writing tools, such as, Grammarly or Microsoft Editor, to enhance the clarity, grammar, and overall style of your manuscript. These tools can help you identify errors, suggest improvements, and ensure that your writing is concise and coherent.

b) **Limitations and Responsibilities:** While AI tools can be beneficial for refining your writing, they should not be used to generate content or replace your original ideas, critical thinking, or analysis. The substance of your manuscript, its arguments, interpretations, and contributions, must be entirely your own. Be mindful to review and verify all suggestions made by AI tools to ensure they are accurate and contextually appropriate. Remember, you are ultimately responsible for the integrity and quality of your work.

5. **Submission:** The completed manuscript must be submitted in PDF format to the Graduate Seminar Coordinators at least two (2) weeks before your scheduled presentation date. The coordinators will distribute the document to students and faculty in the Chemistry Graduate Program for review.

C. **Seminar Presentation Instructions**

1. Consider the seminar as a talk that is supposed to present the most important findings of a current topic.
2. The seminar is not an extended group meeting. It is meant to educate the audience on the topic and should feature sufficient background material to orient the audience on the subject matter.
3. The length of the presentation should be 45 minutes. Use your slides in a one minute per slide rule with just a few exceptions. If you wish to use figures from articles, use the high-resolution HTML versions of the figures and do not copy/paste directly from an article. It is highly recommended to prepare your own figures. Remember to include the appropriate references.
4. It should keep the regular pattern of a presentation: Title, Overview, Introduction, Discussion, Conclusion and Reflections on Future Directions, and Acknowledgements.
5. Use references within each slide.
6. Prepare additional slides to explain difficult concepts. These additional slides will come in handy during the question session.
7. Your presentation will be evaluated by your committee members. However, in the absence of several of your committee members, other faculty will be appointed to evaluate your work. It is of utmost importance to make sure that all of your committee members will be able to attend

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form B3b-Evaluation Form for Research Seminar Presentation
Chemistry 8901-8902

Student Name_____

Seminar Title:

_____

_____

Date of seminar_____

Evaluator_____

Signature of evaluator_____

I. Manuscript (20 pts) ***Grade*** _____/ 20

Evaluation criteria:

1. Was the theme pertinent to the assignment?
2. Was the theme appropriate for a general audience?
3. How well does the summary represent the oral presentation?
4. Do the style, orthography, organization, and format comply with ACS standards?
5. Are appropriate references used and is proper acknowledgement given to the work of others?
6. Is the writing original and does it not feature any examples of plagiarism?

Comments or recommendations regarding the evaluation criteria. Please denote which criteria you are refering to:

_____

_____

_____

_____

_____

II. Presentation (60 pts)

Evaluation criteria:

A. Introduction and Background _____/ 20

1. Clearly and precisely expressed the problem or subject matter of the seminar?
2. The topic was discussed with an adequate perspective?
3. Did the student demonstrate sufficient knowledge of the background of the subject?
4. Were the objectives of seminar presented clearly?

B. Description of topic _____/ 20

1. Was the presentation organized and coherent?
2. Was there a clear and logical presentation of the methodology of the experiments and the results from the literature presented?
3. Was there a critical analysis of the results that demonstrated an extensive knowledge of the topic?
4. Were conclusions clearly presented and demonstrated the student's comprehension of the topic?

C. Presentation techniques _____/ 20

1. Was emphasis placed on important points and concepts?
2. Was there a clear and organized presentation of diagrams, schemes, figures, tables, graphics? Did he or she explain their significance and relevance to the subject?
3. Was there a good use of audiovisual resources, if at all?
4. Did the presenter capture the audience's attention?
5. Did the presenter establish eye contact with the audience?
6. Did the presenter adequately use the time? (No less than 45 minutes for the presentation)

Comments or recommendations regarding the evaluation criteria. Please denote which section or criteria you are refering to:

_____

_____

_____

_____

_____

III. Questions (20 pts) _____/ 20

Evaluation criteria:

1. Did the student answer questions in a satisfactory way or did the responses demonstrate a lack of comprehension of the material?

2. Did the student expand more in the answers than what was provided in the presentation by using other examples or other methods?

3. Did the student display confidence when responding to questions?

Comments or recommendations regarding the evaluation criteria. Please denote which criteria you are refering to:

_____

_____

_____

_____

_____

TOTAL POINTS EARNED **_____/ 100**

Evaluation total:

100-90	A	(Excellent)
89-80	B+	(Very Good)
79-70	B	(Satisfactory)
<69		(Failed)

Note for the evaluator: Please consider the following: (Numbered from low to high)

Level of subject's difficulty:	1	2	3	4	5
Knowledge or experience that the evaluator has on the subject:	1	2	3	4	5

The answer to these two questions will be considered as supplementary information for the coordinators of the seminar (Chemistry 8901-02) not necessary criteria for the final grade that the student will obtain. Therefore, the answer is optional.

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form B4-Rubric of Learning Domains

Student Name_____

Date _____

Evaluator_____

Check the box for the applicable requirement:

☐ Thesis Research Plan Proposal
☐ Research Seminar Presentation
☐ Original Research Proposal
☐ Thesis/Dissertation Defense

Evaluation Grade	Definition
N/A	Not applicable
1	Beginning
2	In Progress
3	Good
4	Excellent

Effective Communication		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. Provides sufficient background on the subject matter		
b. Effectively defines the significance and innovation of their work		
c. Summarizes conclusions well		
d. Engages the audience		
Information Competency		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. Reflects mastery of the subject matter and includes proper references		
b. The work is organized in a coherent manner		
c. The work displays high quality of figures/tables and depth of information		
d. The writing is proficient and clear with minimal grammatical/syntax errors		
Content of the Discipline		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. The format complies with high standards of the field		

b. Properly describes techniques and instrumentation		
c. Applies the most appropriate techniques and instrumentation to complete research objectives		
d. Applies fundamental chemical concepts in the analysis of data and does not feature misconceptions		
Research and Development		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. Objectives/specific aims and corresponding hypotheses are well-defined		
b. Provides a clear and logical presentation of the methodology of experiments		
c. Provides strong data analysis/interpretation and relevant statistical analysis (where applicable)		
d. Displays high potential for research success		
Critical Thinking		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. The work reveals the ability to interconnect and extend knowledge from multiple studies/disciplines		
b. The student displays own perspective of the subject matter		
c. Provides strong quantitative/qualitative correlations		
d. Conclusions in the work demonstrate mature critical thinking for future research directions of the field. For instance, the student offers creative solutions to related real-world problems.		
e. Responses to questions reveals the ability to interconnect and extend knowledge from multiple studies/disciplines		
Social Responsibility		
Criteria	Evaluation Grade	
	Manuscript	Presentation
a. The work is an original creation of the student and does not feature any examples of plagiarism		
b. Proper acknowledgement is given to the work of others that serves as a prelude to this work		
c. The work takes into consideration chemical and biohazardous waste generation and disposal		
d. The work includes the appropriate protocols for work that involves animal and/or human subjects		

Comments:

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C1a-Quim6999/8999 First Semester Research

A. Authorization for registration in the research course

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Academic Year and Semester:_____

Number of Credits Requested: _____

Research Project Title _____

_____

Advisor's Name and Signature _____ Date _____

B. Safety Rules

1. All students should use safety glasses at all times in the laboratory. Regular glasses are not acceptable. Neither should contact lenses be used in the laboratory.

2. Students should use closed-toe shoes when working in the laboratory.

3. Students should wear appropriate protective clothing (PPE) in the laboratory. (Note: Wearing shorts in the laboratory is prohibited.)

4. Not less than two people are allowed to work in the laboratory.

5. Students working with toxic, flammable, or irritating substances must use the safety hood/aspirator.

6. Students should notify the supervisor and laboratory manager of any incident in the laboratory immediately.

This is to certify that I have read and understood the rules of the laboratory described and I agree to obey these rules and others that are specified (for example: the Chemistry Hygiene Plan of the laboratory) as a condition to continue in the laboratory. I understand that a deliberate violation is a sufficient reason for my removal from the course.

Student's Signature _____ Date _____

Form C1b-Quim6999/8999 First Semester Research Report

Due: Second Friday of December

Student Name _____ Student Number _____

Research Project Title _____

_____

1. Abstract- Provide a 200-word summary of the highlights of your semester accomplishments.

_____

2. Background and significance- Define the research problem that you are focusing on and its significance. Provide a brief background to contextualize the problem.

_____

3. Specific Aims- Define the specific aims that were the focus of your semester plan.

_____

4. Methodology and Analysis- Describe the experimental approach that you took for each aim. Provide key (preliminary) conclusions.

_____

5. Content Image- Please provide at least one key figure and/or table that summarizes the work you accomplished.

6. Semester Deliverable(s)-

Publications: Provide reference in ACS citation format.

Presentation: Provide authors, presentation name, conference name, location, and date of presentation.

Patent Awarded: Provide authors and title.

Curriculum Requirement Completed (For example, proposal A): If it is a proposal or seminar presentation, then provide the name.

7. References- Please provide your list of references using the ACS citation format.

Mentor approval: _____

GRADE: PS___ PN___ PB___ NP___

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C1a-Quim6999/8999 First Semester Research

A. Authorization for registration in the research course

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Academic Year and Semester:_____

Number of Credits Requested: _____

Research Project Title _____

_____

Advisor's Name and Signature _____ Date _____

B. Safety Rules

1. All students should use safety glasses at all times in the laboratory. Regular glasses are not acceptable. Neither should contact lenses be used in the laboratory.

2. Students should use closed-toe shoes when working in the laboratory.

3. Students should wear appropriate protective clothing (PPE) in the laboratory. (Note: Wearing shorts in the laboratory is prohibited.)

4. Not less than two people are allowed to work in the laboratory.

5. Students working with toxic, flammable, or irritating substances must use the safety hood/aspirator.

6. Students should notify the supervisor and laboratory manager of any incident in the laboratory immediately.

This is to certify that I have read and understood the rules of the laboratory described and I agree to obey these rules and others that are specified (for example: the Chemistry Hygiene Plan of the laboratory) as a condition to continue in the laboratory. I understand that a deliberate violation is a sufficient reason for my removal from the course.

Student's Signature _____ Date _____

Form C1b-Quim6999/8999 First Semester Research Report

Due: Second Friday of December

Student Name _____ Student Number _____

Research Project Title _____

_____

1. Abstract- Provide a 200-word summary of the highlights of your semester accomplishments.

_____

2. Background and significance- Define the research problem that you are focusing on and its significance. Provide a brief background to contextualize the problem.

_____

3. Specific Aims- Define the specific aims that were the focus of your semester plan.

_____

4. Methodology and Analysis- Describe the experimental approach that you took for each aim. Provide key (preliminary) conclusions.

_____

5. Content Image- Please provide at least one key figure and/or table that summarizes the work you accomplished.

6. Semester Deliverable(s)-

Publications: Provide reference in ACS citation format.

Presentation: Provide authors, presentation name, conference name, location, and date of presentation.

Patent Awarded: Provide authors and title.

Curriculum Requirement Completed (For example, proposal A): If it is a proposal or seminar presentation, then provide the name.

7. References- Please provide your list of references using the ACS citation format.

Mentor approval: _____

GRADE: PS___ PN___ PB___ NP___

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C1a-Quim6999/8999 Second Semester Research

A. Authorization for registration in the research course

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Academic Year and Semester:_____

Number of Credits Requested: _____

Research Project Title _____

_____

Advisor's Name and Signature _____ Date _____

B. Safety Rules

1. All students should use safety glasses at all times in the laboratory. Regular glasses are not acceptable. Neither should contact lenses be used in the laboratory.

2. Students should use closed-toe shoes when working in the laboratory.

3. Students should wear appropriate protective clothing (PPE) in the laboratory. (Note: Wearing shorts in the laboratory is prohibited.)

4. Not less than two people are allowed to work in the laboratory.

5. Students working with toxic, flammable, or irritating substances must use the safety hood/aspirator.

6. Students should notify the supervisor and laboratory manager of any incident in the laboratory immediately.

This is to certify that I have read and understood the rules of the laboratory described and I agree to obey these rules and others that are specified (for example: the Chemistry Hygiene Plan of the laboratory) as a condition to continue in the laboratory. I understand that a deliberate violation is a sufficient reason for my removal from the course.

Student's Signature _____ Date _____

Quim8999 Second Semester Research Report

Due: Second Friday of May

_____ _____

Complete Name Student Number

Research Project Title _____

_____

1. Abstract- Provide a 200-word summary of the highlights of your semester accomplishments.

_____

2. Background and significance- Define the research problem that you are focusing on and its significance. Provide a brief background to contextualize the problem.

_____

3. Specific Aims- Define the specific aims that were the focus of your semester plan.

_____

4. Methodology and Analysis- Describe the experimental approach that you took for each aim. Provide key (preliminary) conclusions.

_____

5. Content Image- Please provide at least one key figure and/or table that summarizes the work you accomplished.

6. Semester Deliverable(s)- In this section, you should only report deliverables from this current academic semester. Do not write about a deliverable from before this semester.

Publications: Provide reference in ACS citation format.

Presentation: Provide authors, presentation name, conference name, location, and date of presentation.

Patent Awarded: Provide authors and title.

Curriculum Requirement Completed (For example, proposal A): If it is a proposal or seminar presentation, then provide the name.

7. References- Please provide your list of references using the ACS citation format.

---

8. Individual Development Plan- One of the main metrics for measuring the success of a graduate program is the professional outcome of its students. For this reason, our program is fully embracing providing the necessary resources for students to be able to reach their career aspirations. To facilitate this process, it is important that students see their growth as scientists and the implementation of their graduate thesis work as part of a bigger picture of their overall development. I ask that you provide an individual development plan (IDP) of **short-term goals** that will lead to a longer term outcome. Please describe the set of personal and professional goals that you wish to tackle during the next academic year and how you envision tackling these goals either by taking courses, through your research studies, engaging in a workshop, participating in conferences, etc. You can format your IDP according to the ChemIDP format provided by the American Chemical Society.

https://chemidp.acs.org/

Mentor approval: _____

GRADE: PS___ PN___ PB___ NP___

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C2- Application for Candidacy Exam

Student Name _____ Student Number _____

Anticipated Date of Exam:_____

Notes:

1. This application should be filled out by all doctoral students who wish to take the candidacy exam.

2. An absence at a candidacy exam that is not an emergency and without permission from the thesis committe will translate to a zero on the exam and will count as one of the two opportunities that the student has to pass the exam.

_____ _____

Student's Signature Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C3a- Certification of Research Lab Rotations (Quim8999)

Due:_____

_____ _____

Student Name Student Number

Classification: □ M.S. □ Ph.D.

I certify that I have contacted the following professors to participate in a three-week rotation in their respective research laboratories:

Rotation #1 (Dates-)

Professor's Name: _____

Report due date:

Rotation #2 (Dates-)

Professor's Name: _____

Report due date:

Rotation #3 (Dates-)

Professor's Name: _____

Report due date:

Approved by:

_____ _____

Chemistry Graduate Program Coordinator Date

FINAL GRADE: PS___ PN___ PB___ NP___

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C3b- Research Lab Rotation Report (Quim8999)

Student Name _____ Student Number _____

Date:_____ Rotation: [ ]#1; [ ]#2; [ ]#3

A. Describe your rotation experience in the space below (Continue on the back of this form if necessary.)

B. Comment on the student's performance during their rotation in your research group.

GRADE: PS___ PN___ PB___ NP___

_____ _____

Professor's Name and Signature Date

Parts A & B are to be completed by the student and the rotation professor, respectively. This form is due at the coordinator's office one week after the completion of the rotation..

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C3c- Certication of the Graduate Research Mentor Selection

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Specialization: □ Analytical □ Biochemistry □ Inorganic □ Organic □ Physical Chemistry

I have decided to do my graduate research with _____
Professor's Name

Thesis Title: _____

_____

Thesis Description: _____

_____

_____

_____

_____ _____
Student's Signature Date

Approved by:

_____ _____
Advisor's Signature Date

_____ _____
Signature of the Chemistry Graduate Program Coordinator Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C4- Resignation from Research Advisor

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Entrance date into the CGP:_____

Advisor:_____

Project Initiation Date:_____

Resignation Effective Date:_____

Reasons:

_____

_____

_____

_____

_____

_____

_____

Student's Signature _____ Date _____

Advisor's Signature _____ Date _____

CGP Coordinator Signature _____ Date _____

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C5- Constitution of the Student Committee

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Specialization: □ Analytical □ Biochemistry □ Inorganic □ Organic □ Physical Chemistry

Preliminary Proposal Title:_____

_____

Proposal composition for the thesis committee-
Signing this form indicates that you commit to serve on the student's thesis committee for all requirements.

Committee Director	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

Student's Signature _____ Date _____

Signature of the Chemistry Graduate Program Coordinator _____ Date _____

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C6- Change in Constitution of the Student Committee

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Change requested and justificaiton: _____

_____

_____

Proposal composition for the thesis committee-
Signing this form indicates that you commit to serve on the student's thesis committee for all requirements.

Committee Director	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

Student's Signature _____ Date _____

Signature of the Chemistry Graduate Program Coordinator _____ Date _____

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program

Form C7- Application for Program Requirement

Student Name _____ Student Number _____

Classification: □ M.S. □ Ph.D.

Check the box for the applicable requirement:
□ Thesis Research Plan Proposal
□ Research Seminar Presentation
□ Original Research Proposal
□ Thesis/Dissertation Defense

Student's Committee members:

We have received a copy of this student's manuscript and request that the presentation of this program requirement be set for:

Date/Time/Location: _____

Committee Director	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

Application approved by:

_____ _____
Signature of the Chemistry Graduate Program Coordinator Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C8_Certification of Program Requirement
Manuscript and Presentation

_____ _____
Student Name Student Number

Classification: □ M.S. □ Ph.D.

Check the box for the applicable requirement:
□ Thesis Research Plan Proposal
□ Research Seminar Presentation
□ Original Research Proposal
□ Thesis/Dissertation Defense

Title: _____

_____

A. Presentation:

Date of the Presentation: _____

Approved_____ Not Approved_____

If the presentation was not approved, indicate the date to repeat the presentation: _____

Committee Director	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

B. Final Manuscript

The student must submit a revised version of the manuscript that includes the corrections and suggestions made by members of the committee. The director of the committee must evaluate the revised manuscript and decide whether the student fulfilled the expectation of the revision and of the program requirement. If necessary, the rest of the committee may evaluate the revised document but only the director of the committee has to sign this part of the form.

Approved_____ Not Approved_____

Evaluation: □ Outstanding □ Very Good □ Good □ Fair

_____ _____

Committee Director Signature Date

C. Certification of completion of the program requirement.

_____ _____

Signature of the
Chemistry Graduate Program Coordinator

Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C8_Certification of Program Requirement
Manuscript and Presentation

_____ _____
Student Name Student Number

Classification: □ M.S. □ Ph.D.

Check the box for the applicable requirement:
□ Thesis Research Plan Proposal
□ Research Seminar Presentation
□ Original Research Proposal
□ Thesis/Dissertation Defense

Title: _____

_____

A. Presentation:

Date of the Presentation: _____

Approved_____ Not Approved_____

If the presentation was not approved, indicate the date to repeat the presentation: _____

Committee Director	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department
Committee Member	Signature	Department

B. Final Manuscript

The student must submit a revised version of the manuscript that includes the corrections and suggestions made by members of the committee. The director of the committee must evaluate the revised manuscript and decide whether the student fulfilled the expectation of the revision and of the program requirement. If necessary, the rest of the committee may evaluate the revised document but only the director of the committee has to sign this part of the form.

Approved_____ Not Approved_____

Evaluation: □ Outstanding □ Very Good □ Good □ Fair

_____ _____

Committee Director Signature Date

C. Certification of completion of the program requirement.

_____ _____

Signature of the
Chemistry Graduate Program Coordinator

Date

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C9_Application to Drop Graduate Courses

Student Name _____ Student Number _____

Advisor _____

Classification: □ M.S. □ Ph.D.

Type of assistantship: □ Teaching □ Research

Course(s) to drop:

Course Name	Course Code	Section	Credits	Instructor

Reason for dropping course(s):

_____

_____

_____

_____

Student's Signature _____ Date _____

Advisor's Signature _____ Date _____

Chemistry Graduate Program Coordinator's Signature _____ Date _____

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form C10_Resignation from the Graduate Program

Student Name _____ Student Number _____

Advisor _____ Entrance Date _____

Classification: □ M.S. □ Ph.D.

Type of assistantship: □ Teaching □ Research

Effective date of resignation: _____

Reason for resignation:

_____

_____

_____

_____

Student's Signature _____ Date _____

Advisor's Signature _____ Date _____

Chemistry Graduate Program Coordinator's Signature _____ Date _____

Contact Information:

1. Postal Address

_____

_____

_____

_____

2. Phone _____

3. E-mail _____

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form D1a-Instructions to
Request Graduation and to Completing the Graduation Requirements

The time to graduation for graduate students at the Masters and Doctoral levels permitted by the university is defined by the Certificate that was active when you officially became a candidate of either program. At present, we have students under three different certificates (Certificate 72, Certificate 38, and Certificate 95). The most current certificate is Certificate 95. Please refer to each certificate to know your time to graduation. Students can petition to graduate in either December or May of a given academic year. That being said, there is a formal process to request graduation and complete the terms of the graduation requirements.

1. You must first obtain the approval of your research mentor to request graduation and must make your committee aware of your intent to graduate at the beginning of the semester.

2. You must consult with the CGP coordinator about your intent to graduate at the beginning of the semester and submit to them the A3-Academic Status Sheet and an unofficial transcript. The coordinator will review this material and will let you know if you have fulfilled the requirements. Make sure you have all of your certificates for the completion of different requirements stored in case the coordinator needs to see them. They will use the information provided to prepare the Certificate for Completion of All Requirements.

3. The deadline to request graduation and to pay for graduation dues is published in the semester calendar. It is important to submit your request by the deadline.

4. You must submit your thesis manuscript to your committee two weeks before your defense.

5. All thesis defenses must be completed by the last day of the academic semester. This last day is reported in the semester calendar.

6. All committee members must sign the Certificate for Completion of All Requirements and must complete the evaluation of the thesis defense presentation. These documents and all thesis corrections must be completed and submitted to the coordinator before the start of the summer academic session, the date of which can be found in the summer academic session calendar.

7. A digital form of the thesis committee-approved thesis must be submitted to the digital repository by a date established by the DEGI. The coordinator will provide that deadline as it becomes available.

8. Instructions will be provided for students to obtain their graduation tickets/toga.

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form D1b-Instructions to
Request for Graduation Extension "Prorroga"

The time to graduation for graduate students at the Masters and Doctoral levels permitted by the university is defined by the Certificate that was active when you officially became a candidate of either program. At present, we have students under three different certificates (Certificate 72, Certificate 38, and Certificate 95). The most current certificate is Certificate 95. Please refer to each certificate to know your time to graduation. If you are in final year permitted by the university and know that you will not be able to graduate then you must formally petition for a graduation extension referred to as a "prorroga" in Spanish. Below are the list of steps that you must follow for this process.

1. Complete the DEGI prorroga form.

2. Write a letter to the Chemistry Graduate Program (CGP) Academic Affairs Committee. In this letter you will explain everything you have accomplished thus far in the program and justify why an extension is needed. You will need to provide a detailed workplan, which includes specific objectives (for example, completion of the graduate seminar, completion of the proposals, thesis writing and defense) and estimated dates when these objectives will be completed. The letter must be signed by you and your research advisor.

3. Submit the letter to CGP Coordinator via e-mail correspondence.

4. The CGP Academic Affairs Committee will decide if they will support your petition and then the petition is sent to the Associate Dean of Graduate Studies and Investigation for their evaluation. If the Associate Dean supports the petition, the petition is then forwarded to the DEGI, who will make the final decision as to whether the request is approved.

University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Chemistry
17 Ave. Universidad STE 1701
San Juan PR 00925-2537

Chemistry Graduate Program
Form E- Questionnaire for Graduate Students to Update Personal Data

Alumni Name _____ Student Number _____

Advisor _____ Thesis Defense Date _____

Degree obtained: □ M.S. □ Ph.D.

Specialization: □ Analytical □ Biochemistry □ Inorganic □ Organic □ Physical Chemistry

Postal Address

_____

_____

_____

_____

Phone _____

E-mail _____

Comments:

_____

_____

_____

_____

Please email your updated information to the address uprrpchemgrad@gmail.com.