AMERICAN CHEMICAL SOCIETY

Self-Study Questionnaire
Application for ACS Approval
of the Bachelor's Degree Chemistry Program

Careful study of the current ACS Guidelines for bachelor's degree programs in chemistry should precede preparation of this report form. Several sections of the report correspond generally to similar sections in the published guidelines; specific questions and requests for information relate directly to these guidelines. A copy of the guidelines booklet accompanies this report form. The guidelines can also be found on the ACS Committee on Professional Training Web site: http://www.acs.org/cpt .

In a formal evaluation, the Committee considers the adequacy of an undergraduate program in chemistry to prepare baccalaureate students for professional careers as chemical scientists. This report also incorporates some questions and requests for information designed to assist both the institution and the Committee in assessing the extent to which the overall program in chemistry is successful in meeting broader as well as specialized educational objectives. If you used additional sheets of paper in preparing this report, please be sure that each page is numbered, dated, and includes the name of your institution.

College or University: University of Puerto Rico at Cayey Date: Dec. 31th 2012

Department Name: Department of Chemistry

Address: PO Box 372230

City and State: Cayey PR Zip Code: 00737-2230

Phone: (787)738-2161 Fax: ________ Dept. Chair E-mail: wilfredo.resto@upr.edu

Name and Title of Principal Administrative Officer of Institution: Juan N. Varona Echeandia, Chancellor

Name and Title of Chair or Head of Chemistry Department: Wilfredo Resto, Chair

Name and Admin. Title of Person Preparing this Report: José A. Molina, Dean

Check Basis of Academic Year: Quarter: ☐ Semester: ☒ Other (specify): ________

Number of Weeks of Instruction (Not counting final examination period): Per Quarter: ____ Semester: 15
Mini or Interim Term: ____ Other: ____

Check the degrees offered in Chemistry:

BA	☐	BS	☒
MA	☐	MS	☐
PhD	☐	Other	☐

If other, please list: ________________

Signed: ________________

Revised 5/9/2011

(signature of person preparing this report)

Section 1
Goals of Program Approval

1.1 Please provide a **brief** history of your institution and the chemistry program.

Nestled in the green hills of Puerto Rico's Cordillera Central, the University of Puerto Rico at Cayey (UPRC) is the only institution of higher education in Puerto Rico where there is a perfect balance amongst the disciplines of arts, science, education, and business, hence earning its classification as a *Baccalaureate College of Diverse Fields* by the Carnegie Foundation. Since its opening in 1967, this natural setting has been ideal for developing academic excellence, a key component of the institutional mission, promoted through research, community service, and interdisciplinary-centered pedagogical contents and methodologies.

The UPRC is among the top 51 US baccalaureate institutions of Hispanic Science and Engineering doctorate recipients between 2001-2005, according to the *2007 NSF Survey of Earned Doctorates*. Our 3,696 (2011-2012 academic year) students have a variety of programs and research opportunities in which to be involved. Very frequently, our students present their work in national and international forums. Of the total enrollment, almost 50% of the students are enrolled in the natural sciences Thirty two student organizations, contribute to the strengthening of artistic, academic, professional, athletic, social, and cultural skills and interests, reflecting the institution's commitment to provide a well-rounded undergraduate experience at UPRC.

The Chemistry Department at UPRC has been part of the institution since its beginning and has graduated an average of 20 students yearly. Since 2006 the department initiated a curricular revision according to the CPT-ACS guidelines for the approval of chemistry programs. A spiral model to develop information and research skills was implemented across the curriculum, emphasized in one course in each academic year. The reform of the chemistry curriculum, and in particular, laboratory instruction has been achieved by two components: an inquiry-based approach to the teaching of chemistry and the incorporation of modern instrumentation to enrich the current information relevant to real life scientific problems. Some of the laboratory courses were improved providing an inquiry approach for investigation in the curriculum with an emphasis on processes and general concepts as well as real problem solving in laboratory experiments.

Section 1
Goals of Program Approval

1.2 Please describe your reasons for applying to the Committee on Professional Training for ACS approval of your program.

Since 1998 the faculty of the Department of Chemistry made a commitment to work towards the compliance of standards of excellence that will allow the Baccalaureate in Chemistry at UPR-Cayey to be recognized by the American Chemical Society (ACS). The ACS recognition will permit other institutions in the United States and Latin America to recognize that the students graduated from our chemistry program comply with the highest standards of excellence. The direct benefactors of ACS recognition of the chemistry program are the students who will be strongly prepared and have more job opportunities, as well as stronger possiblities to continue graduate studies in universities of prestige.

The work plan initiated in 1998, has allowed the department to currently have a 90% of its faculty with a Ph.D. in chemistry. The curriculum was revised in order to strengthen investigation and problem solving skills in the laboratory courses of organic and instrumental chemistry. Additionally, the areas of information and research skills, as well as oral and written communication, were strenghten through means of a spiral model which integrates the teaching personnel of the library. This model was commended by the visiting team of the Association of College Research Libraries (ACRL) who believed the model was an innovative initiative that should be replicated by other departments in addition to the Chemistry Department.

At the local level, the students who graduate from our program are recognized to be in one of the first three positions within the percent of students who pass the certified chemistry examination. They are also recognized for their capacity to continue graduate studies and successfully complete a terminal degree (Ph.D.). The academic success of our students is what motivates the faculty of the department to let others know about our academic strengths, and to learn from others in order to continually improve our program based on the ACS standards of excellence.

Section 2
Institutional Environment

2.1 Is your institution accredited by a regional accrediting association? Yes X No ☐

Name of Accrediting Association: Middle States Comission on Higher Education

2.2 Describe any special goals or relationships of the chemistry department or program as they pertain to the educational mission of your institution.

The UPR-Cayey mission statement, goals and general objectives identify various aspects of importance for the department. These are to: maintain the curriculum up-to date, provide research experience, develop high-level critical thinking skills, develop effective communication, develop information skills, and to provide an education of excellence. Based on the institutional mission statement, the Department of Chemistry has developed its working document, which expresses the vision, goals and objectives of the program.

Our goal is to form professionals with an integral academic preparation. One who can appreciate the importance and changing character of chemistry as science and its social, economic and political impact in our society. We develop professionals who are competent, honest and committed to life-long learning. We foment in our students responsibility towards the natural and general environment, respect towards differences, and a sense of value towards all human beings. We instill our students to develop skills in order to solve problems, make decisions, work and collaborate in teams, think critically, communicate effectively, and to also master information skills.

Additionally, our departmental objectives are alligned with the document "Habilidades y Contenidos de la Educacion General". This document presents the list of courses which the faculty in each academic area have identified as those that develop skills and content that is relevant to all fields of knowledge. The skills identified in the document which coincide with the skills developed in our curriculum are effective communication, collaborative work, critical, reflective, and creative thinking, and using information.

2.3 Admissions

Are students entering your institution required to take the SAT, ACT, or a similar admission examination? Yes ☒ No ☐

If yes, indicate the examinations and the range and/or average of scores of students accepted. If special admission requirements exist for entering chemistry or science majors, give brief details.

College Board Admission Test; the admission is based on the general admission values ("IGS") that is obtained by a formula that includes the result of this test and the high school GPA. This year the "IGS" average of the accepted students was 3.31 (out of 4.00).

Section 2
Institutional Environment

2.4 Counseling

What services are available to counsel students about career options in chemistry and related sciences, for curriculum guidance, for graduate study, and/or other individual educational needs?

Academic counseling to the students is provided by the Chemistry Faculty twice a year. It includes advice about course selection and its impact on the time to complete the degree and guidance in the selection of elective courses according to the student's aspirations and abilities.

Vocational counseling services including the assessment of vocational needs (by vocational inventories), and strengths are an integral part of CEDE's ("Centro Interdisciplinario de Desarrollo Estudiantil", CE.D.E.) vocational counseling service. CEDE's staff help students in career exploration and planning, identifying information related to institutions and the academic programs of their interest at the undergraduate and graduate level to facilitate the achievement of their vocational goals. This service includes the exploration of programs of study at the graduate level and admissions requirements. Ample information on a diversified number of careers and tendencies of professions are also provided to students. To do this the personnel use various publications, manuals, catalogs, and indexes available at CEDE facilities and the CEDE webpage (www.cayey.upr.edu/cede). The CEDE webpage also has information related to applications to graduate schools, admissions exams, internships and scholarships available.

2.5 Is the chemistry program organized as an independent administrative unit? Yes ☒ No ☐

If not, how is the department or program administered and to whom does the department administrator report?

2.6 Comment briefly about current policies and procedures for chemistry faculty appointments, promotions, and tenure.

The policy for recruitment for a tenured track position is regulated by Certification #64: 2003-04 and Cetification #36 SA, 2011-12. The process initiates with an assessment of the personnel needed in the department. This assessment is prepared by the members of the department's personnel and curriculum committees. The study identifies the characteristics of the new teaching personnel needed, as well as the specialized area to be covered. With the approval of the Academic Dean and the Chancellor a brief description of the position is published. Once resumees are received in the department the candidates are interviewed, and evaluated by the department's personnel committee. The committee's recommendation is shared with the tenured professors of the department for conensus. The recommendation is submitted to the Academic Dean, who in turn submits the recommendation to the Chancellor for the final decision of recruitment.

The candidates competing for tenured positions or full-time contracts are evaluated by the department's personnel committee. The criteria for evaluation used is the following: (1) Quality of the professional academic file, (2) Mastery of the content taught and capacity to integrate related areas, (3) Teaching experience and knowledge of the particular field, (4) Publications and conferences dictated, (5) Committment with the philosophy and objectives of the university, (6) Capacity for scientific investigation and creative work. Permanence is granted to professors in a tenured track position on probation, and who have worked satisfactorilly for five years consecutively.

Promotions are granted to teaching personnel after the evaluation process takes place. The department personnel committee uses the following criteria for promotion: (1) Quality of teaching, investigation or publication, (2) Dedication to the work and service in the university, (3) Compliance of personnel responsibilities, (4) Professional improvement, (5) Collaboration in departmental duties, and academic programs, (6) Investigation and creative work, (7) Conferences in the field of study, (8) Publications, expositions, concerts and other activities and, (8) Recognitions received. The policies for promotions are in Certification OP38 of the Academic Senate.

2.7 What input does the chemistry faculty or department have on matters pertaining to faculty appointments, promotions, and tenure?

University policies establish that for any action related to teaching personnel, the chancellor will consult the faculty through means of the committees or other organisms defined in the Regulations of the UPR. Every year the senior or associate professor who is eligible to be part of the department's personnel committee is elected by means of votes. Through the department's personnel committee, the chemistry faculty actively participate in the process of recruitment, and the evaluation of the teaching personnel competing for permanence or promotion. The personnel committee submits its recommendation for faculty appointment or tendured position to the department chairperson who in turn submits the recommendation to the Academic Dean. If the professor is up for tenured the Academic Dean submits the recommendation to the Chancellor who presides the Administrative Board. The final decision is made by the chancellor who is the maximum authority to nominate or appoint personnel. The whole process is found in the policies for recruitment, evaluation and promotions of teaching personnel. (Cert. #36, Cert #31, and 0P38 of the Academic Senate.

Section 2
Institutional Environment

2.8 Who determines the assignment of teaching responsibilities for chemistry classes?

The permanent faculty of the department select courses each semester, the department chairperson evaluates the selection of courses, and approves or requests changes in consultation with the member of the faculty affected. The department chairperson assigns the courses to the service faculty or part-time contracts.

2.9 Does the chemistry department or program have a separate budget? Yes ☒ No ☐

a. If not, how are program funds provided?

b. If yes, does the chemistry department have full administrative control of the budget? Yes ☒ No ☐

If no, how is the administration and control of the budget handled?

Section 2
Institutional Environment

2.10 Provide the annual expenditure of institutional funds for:

	Current Fiscal Year	Five-Year Annual Average
Capital Equipment Acquisitions and Replacements	0	55,514
Supplies		
a. If teaching laboratory and undergraduate research budgets are combined, enter here and skip b and c	____	
b. Undergraduate Research Supplies		
c. Teaching Laboratory Supplies	33325	70070
Library Expenditures for Chemistry: a. Books and Journals	____	____
b. Online Searches	15492	59895
Equipment and Instrumental Maintenance	12146	66375
Travel to Meetings		
Faculty (Total No. of Chemistry Faculty ___)	____	____
Student (Total No. of Students ___)	____	____
Professional Development	____	2490
SUBTOTAL	**60963**	**254344**
Salary Total for:		
a. Faculty		
Tenure-track		____
Non-tenure-track	720504	622624
Instructional Staff	____	____
Temporary	301275	357972
b. Undergraduate & Graduate Teaching Stipends*	____	____
c. Undergraduate & Graduate Research Stipends*	____	____
d. Non-Academic Support Personnel	147000	135615
SUBTOTAL	**1168779**	**1116211**
TOTAL EXPENSES	**1229742**	**1370555**

* Please report only the funding provided by the institution.

Section 2
Institutional Environment

2.11 Does your program receive support from sources beyond your institution? Yes ☒ No ☐

If yes, list below the other principal sources of income and the extent to which each provides continuing support.

	Current Year	Estimated Five-Year Annual Averages	Continuing?
External Research Grants to Faculty Members	370,240	121,140	Yes ☒ No ☐
External Grants to Department	____	____	Yes ☐ No ☐
Internal Research Grants (Institutional Funds)	6,500	18,518	Yes ☒ No ☐
Other (Training/Educational Equipment)	____	____	Yes ☐ No ☐

2.12 Number of students at the beginning of the current academic year:

Entire Campus	3666
All Chemistry Courses	1278
Chemistry Major Seniors	28
Graduate Students	0

2.13 What percentage of chemistry majors transfer from other institutions? 8.1 %

2.14 What are the current trends in your chemistry course enrollments?
The tendency is to have a 100% of enrollment in introductory level courses of general chemistry. The courses of fundamental analytics, organic, inorganic, and chemistry-physics have an enrollment between 73% to 93%. The course in scientific literature has a 100% enrollment. Currently, two courses are offered with in-depth content and have a total enrollment of 15 students.

2.15 Provide the number of bachelor's degrees granted by the chemistry department/program for each of the last five years:

Year	Bachelor's Degrees Granted
2011-2012 (if available)	24
2010-2011	19
2009-2010	15
2008-2009	26
2007-2008	16
2006-2007	26

Section 3
Faculty and Staff

3.1 Provide a Personal History Record (PHR) form for each faculty member. A blank copy of the PHR is provided as a separate document.

3.2 Number of Chemistry Faculty. **(If you have no faculty in a particular category, please record a "0" in the total rows for that category.)**

	Total Faculty	With Ph.D.	Male	Female	African American	Native American	Asian American	Hispanic American
Full-Time Total	**15**	**14**	**6**	**9**	**0**	**0**	**0**	**14**
Tenured	9	8	4	5	0	0	0	9
Pre-Tenured	1	1	0	1	0	0	0	0
Long Term Non-Tenure-Track	0	0	0	0	0	0	0	0
Temporary	5	5	2	3	0	0	0	5
Part-Time Total	**5**	**3**	**2**	**3**	**0**	**0**	**0**	**5**
Tenured	0	0	0	0	0	0	0	0
Pre-Tenured	0	0	0	0	0	0	0	0
Long Term, Non-Tenure-Track	0	0	0	0	0	0	0	0
Temporary	5	3	2	3	0	0	0	5

3.3 Number of Instructional Staff. Please do not include faculty listed in item 2 or teaching assistants. **(If you have no instructional staff in a particular category, please record a "0" in the total rows for that category.)**

	Total Staff	With Ph.D.	Male	Female	African American	Native American	Asian American	Hispanic American
Full-Time	0	0	0	0	0	0	0	0
Part-Time	0	0	0	0	0	0	0	0

Section 3
Faculty and Staff

3.4 Discuss briefly the amount of turnover of chemistry faculty members (including full time, part time, adjunct, and temporary faculty, but excluding teaching assistants) during the last five years and the reasons involved. How much change has occurred in total faculty size during the same period? Use a supplementary sheet if necessary.

In the past five years, the institution assigned two tenured track positions to the department of chemistry in order to reduce the impact of four professors who retired and one on probation who resigned. During this period the temporary faculty with a full-time contract increased from a minimum of two (August 2007) to a maximum of six (August 2010).

When analyzing the data we found that for the last five years we have had an average of 15 professor with full time, regular and temporary contracts, to cover the academic schedule of the chemistry department. However, the number of part-time faculty has been between two to seven during the same period. There is not a tendency to demonstrate if there is a higher or lower dependency on part-time faculty to cover the academic demands of the courses in chemistry.

In the past two years we have been searching for the ideal candidate to fill a tendured track position in the area of inorganic chemistry. We expect to follow-up recruitment in January 2013.

3.5 Salary Information

a. Please check the minimum salary for each rank for chemistry faculty and staff (nine months):

	Professor	Associate Professor	Assistant Professor	Non-tenure Track	Instructional Staff
Below $31K	☐	☐	☐	☐	☐
$31 - $40K	☐	☐	☐	☐	☐
$41 - $50K	☐	☐	☐	☐	☐
$51 - $60K	☐	☐	☒	☒	☐
$61 - $70K	☐	☒	☐	☐	☐
Over $70K	☒	☐	☐	☐	☐

b. If there is no uniform salary policy, state briefly the policy and practice of your administration in determining salaries and salary ranges for the professional ranks of chemistry faculty.

3.6 Professional Development

a. To what extent do faculty members receive support and encouragement from the administration for:

i. Individual scientific research

The faculty receives administrative support to seek external funds through means of workshops to write proposals. The office of external funds is supportive during the whole process of the making, submission and search of funds for the project. The academic deans' office also provides funds for new projects each year. The preliminary results of the projects will permit faculty to request external funds, in the the future. Finally, the Institute of Interdisciplinary Investigations (III) also provides administrative support to their associate investigators, and funds for training, conference, and internships.

ii. Course development

Each department in the institution has a syllabus approved to teach special topics, which permits the faculty to offer a series of varied and actual topics of interest. Each course offered for two consecutive years as a special topic, is assessed, evaluated and taken through the procedures established by the regulations of the university in order to receive a permanent course code. The development of innovative courses is an activity which offers the teaching personnel an opportunity to engage in an active and creative process. Moreover, it helps us maintain a series of actual topics in accordance with current development and scientific discoveries. The act of designing new courses is taken into consideration for the promotion of teneured track personnel.

iii. Involvement with service work for the scientific community and local community

Following Certification 49: the department demands that all students who graduate from the institution must comply with experience in research or community service. The university promotes activities to facilitate the compliance of this requisite. Thus, the chemistry faculty participate in activities pro recruitment, science fairs, and as participants or hosts of local conferences. Some members of the department participate in activities hosted by the professional organization they belong to.

iv. Other

Each semester, the UPRC identifies two days that are dedicated to professional development and departmental activities. The topics selected for each momentum target areas for improving teaching at this level. One of the two days identified for professional improvement activities has traditionally focused on the presentation of the faculty's research projects.

b. Comment briefly on the summer activities of faculty members, especially with respect to opportunities to remain at the institution and pursue research projects.

The summer session allows the faculty to either teach or persue research projects, thus the faculty has freedom to choose the activities they will participate in. Some members of the faculty offer general chemistry courses or laboratory in summer. Each course must offer a maximum of three hours of instruction daily, meaning that during the rest of the day the member of the faculty has time for creative activities which include research. In summmer, the faculty has the option of doing only research with external or institutional funds for investigation. In general, the institution provides the facilities for the faculty who want to dedicate their free time in summer to the development of projects related to investigation or creativity.

c. How many of your undergraduates and faculty carry out research in the summer?

Thirteen students and two professors did research last summer.

d. What are provisions for sabbatical and other professional leaves?

i. Duration

A license for sabbatical leave is granted for one semester, one academic year (two semesters) or 12 months. Release time is granted for administrative service for one semester, and may be renewed for the duration of the service. In general, release time is an equivalent of 50% to 100% of the teaching load but release time granted for investigation is equivalent to 25% to 75% of the professor's regular teaching load. Release time granted for investigation depends on the funds available to cover the cost of teaching personnel needed.

ii. Frequency
Tenured track faculty qualify for sabbatical every five years.

iii. Percentage of salary paid
100% of the regular salary (sabbatical leave).

iv. Conditions for granting

The members of the faculty who are eligible for a sabbatical license must be full professors with five (5) or more years of service, and have submitted a proposal on a topic that will contribute to the development of knowledge in the area of chemistry. The proposal is evaluated by the department's personnel committee, the Institutional Personnel Committee, the Dean of Academic Affairs, and finally by the Administrative Board for the final approval of the sabbatical.

v. Replacement faculty policy

The Deanship of Academic Affairs allocates funds to cover the cost of the professor on sabbatical license through means of compensations or a part-time contract.

e. Number of chemistry department sabbaticals or professional leaves in the last 10 years: Requested 1

Granted 1

f. Discuss briefly where sabbatical or other leaves were spent, the length of each, and the nature of the activities performed (up to 5 individuals).

1. Dr. Ram S. Lamba, sabbatical license for one semester to revise the manual for laboratory of his authorship.
2. Dr. Raúl J. Castro, 13 months license for administrative service as Academic Dean and Interim Chancellor.
3. Dra. Vibha Bansal, release time equivalent to 50% workload for the last three years to develop her project of investigation.
4. Dra. Jannette Gavillán, release time equivalent to 50% workload for four years to develop her project of investiagtion.
5. Dr. Wilfredo Resto, release time equivalent to 50% workload for three years for administrative service promoting the development of an institutional investigation project in the area of health.

g. In what other ways are faculty members encouraged and supported to participate in activities important to scholarly and professional growth?

The chemistry faculty is strongly encouraged to present their work in professional development activities islandwide and abroad. The institution has funds allocated for travel expenses in addition to other seed money (FIDI) and economic support granted by the chancellor's office.

h. Describe the formal mechanisms by which junior faculty are mentored.

The chemistry department has an approved document titled "*Plan for Departmental Chemistry Faculty Development*" which includes mentoring for the new faculty of the department. Thus, a senior professor with the same area of extertise will be the mentor to the new faculty. The function of the mentor is to guide the new faculty in academic, and administrative issues related to teaching and investigation.

As part of the formative evaluation process during the five-year probation period, the teaching personnel is evaluated. Recommendations related to how the professor complies with the departmental goals are offered throughout the process. Annotations about teaching methods and other responsibilities are made along with recommendations on how to improve areas of concern. Follow-up to these recommendations are done once every year during a five-year period.

The chemistry department recently instituted the coordination of courses at the introductory level. This coordination allows the junior faculty to discuss with senior faculty the specific objectives of the course, as well as issues such as the time granted to answer an essay question. An agreement with the Institute of Interdisciplinary Investigation (III) will allow the junior faculty to receive training to write proposals and projects for investigation. This alliance with the **III** will help strenghten our process of formative and summative evaluation.

3.7 Support Staff

a. Number of Support Staff:

	Secretarial	1
	Stockroom	4
	Instrument Technicians	0

b. If the answer to any category above is zero, what provisions exist for providing those services? To what extent are technicians or services available for the maintenance and repair of instruments and other specialized equipment?

The chemistry department has a contract for the maintenance of instruments used in the academic laboratories, and investigation projects. The maintenance contract is offered by the manufacturer or a specialized company. The contract includes a yearly visit to calibrate the instruments, and technical assistance via telephone or in person if an emergency occurs. The faculty who most use the scientific instruments in class or in investigation projects is in charge of them. The laboratory technician assist the faculty in the basic maintenance of the equipment.

3.8 Student Assistants

Number (per Academic Year)	Degree Sought	Hours Per Week	Direct Contact with Students?	Type of Work Performed	Other Comments
0	B.S.		Yes ☐ No ☐		
0	M.S.		Yes ☐ No ☐		
0	Ph.D.		Yes ☐ No ☐		

a. i. Review briefly the nature and extent of training given to student assistants prior to assignment.
n/a

ii. Is training required for all assistants? Yes ☐ No ☐

iii. How is the performance of student assistants supervised and evaluated?

b. In which undergraduate laboratories, if any, are undergraduate student assistants used?

3.9 Are maximum and minimum teaching loads established as an institutional policy? Yes ☒ No ☐.
If yes, explain briefly.

According to UPR bylaws, the department chairperson is who schedules the faculty's academic workload. The chairperson has the responsibility of scheduling a workload equivalent to 12 credit hours to each full-time professor. The amount of credit hours may be less if the professor has release time for investigation, special projects or administrative responsibilities. To schedule courses the chairperson takes into consideration first the concentration courses, and than the service courses, which may also be taught by specialist in each area. The professor's involvement in research projects and other types of projects are taken into consideration at the moment of scheduling the faculty workload. A load of 15 credtis is granted only when the professor officially requests to do so. In the majority of cases, the non-tenured faculty is used to cover the demand of courses offered to other programs (General Chemistry and Organic Chemistry). It is important to mention that the maximum workload at UPRC is regulated by a certification of the Adiministrative Board (Cert. #XX, JA) which establishes a maximum of 18 contact hours, and a maximum of 3 academic preparations. In extraordinary cases, and with the autorization of the academic dean one could offer an additional course (3 credits) for a maximum of 21 credit hours. In the Chemistry Department, in particular, the maximum workload is 15 credit hours.

Section 3
Faculty and Staff

3.10 How much contact hour credit (release time) is allowed for:

Faculty supervision of student research	3
Committee assignments	0
Administration	6
Course development	0

Section 3
Faculty and Staff

College and University University of Puerto Rico at Cayey
Date 12/31/12

Table 3.1 List the names and ranks of all faculty and instructional staff members according to rank.

Name and Rank	Birth Year	Baccalaureate Degree		Masters Degree		Doctoral Degree		Chemical Specialization	Year Joined Staff	Status			Tenured/ Pre-tenured	Long Term/ Non-tenure-track
		School	Year	School	Year	School	Year			FT	PT	Temp		
Juan Estévez [illegible]fessor)	1941			Univ. Concepción Chile	1972	UPR-Rio Piedras Campus	1978	Physical	1978	x			x	
Mercedes-Rivera Borrero (Professor)	1954	UPR-Rio Piedras Campus	1974			UPR-Rio Piedras Campus	1980	Physical	1981	x			x	
Luz Torres-Colón (Professor)	1960	UPR-Rio Piedras Campus	1982			UPR-Rio Piedras Campus	1986	Organic	1986	x			x	
Jannette Gavillán-Suárez (Professor)	1957	UPR-Rio Piedras Campus	1977			UPR-Rio Piedras Campus	1982	Organic	2000	x			x	
Wilfredo Resto (Professor)	1966	UPR-Cayey Campus	1989			University of Florida	1993	Analytical	1993	x			x	
[illegible]úl J. Castro-Santiago (Professor)	1966	UPR-Rio Piedras Campus	1988			UPR-Rio Piedras Campus	1996	Analytical	1996	x			x	
Jairo Pardo-Palma (Associate Professor)	1950	Universidad del Atlántico, Colombia	1973	UPR-Rio Piedras Campus	1984			Analytical	1983	x			x	
Elba D. Reyes-Pérez (Associate Professor)	1968	UPR-Rio Piedras Campus	1991			UPR-Rio Piedras Campus	1997	Organic		x			x	

Mayra Pagán-Ortiz (Associate Professor)	1972	UPR-Cayey Campus	1994			UPR-Río Piedras	2001	Organic	2001	x			x	

Section 3
Faculty and Staff

College and University University of Puerto Rico at Cayey

Date 12/31/12

Table 3.1 (cont'd) List the names and ranks of all faculty and instructional staff members according to rank.

Name and Rank	Birth Year	Baccalaureate Degree		Masters Degree		Doctoral Degree		Chemical Specialization	Year Joined Staff	Status			Tenured/ Pre-tenured	Long Term/ Non-tenure-track
		School	Year	School	Year	School	Year			FT	PT	Temp		
Vibha Bansal (Assistant Professor)	1977	Panjab University, India	1998	Panjab University, India	2000	Indian Institute of Technology, India	2006	Biochemistry	2008	x			x	
Edgardo Rivera Tirado (Assistant Professor)	1979	UPR-Humacao Campus	2002			University of Akron, Ohio	2007	Analytical	2008	x		x		
Claudia Ospina Millán (Assistant Professor)	1974	Universidad del Valle, Colombia	1996			UPR-Rio Piedras Campus	2006	Organic	2006	x		x		
Zuleika Medina (Assistant Professor)	1976	UPR-Mayaguez Campus	1999	University of Massachusetts at Amherst	2005	University of Massachusetts at Amherst	2008	Inorganic/ Physical	2010	x		x		
ann O'Neill (Assistant Professor)	1981	UPR-Rio Piedras Campus	2002			UPR-Rio Piedras Campus	2009	Organic	2010	x		x		
Carlos M. Torres-Díaz (Assistant Professor)	1954	UPR-Rio Piedras Campus	1976			UPR-Rio Piedras Campus	2000	Physical	2012	x		x		
Zulma Santiago (Instructor)	1956	UPR-Mayaguez Campus	1977	University of Akron, Ohio	1982	Purdue University, Indiana	1992	Biochemistry	2011		x	x		

Lisandra Arroyo-Ramírez (Instructor)	1982	UPR-Rio Piedras Campus	2004			UPR-Rio Piedras Campus	2012	Analytical	2012		x	x		
William Ortiz (Instructor)	1980	University of Cartagena, Colombia	2003	UPR-Mayaguez Campus	2008	UPR-Mayaguez Campus	2008				x	x		

Section 3
Faculty and Staff

College and University University of Puerto Rico at Cayey

Date 12/31/12

T[illegible]e 3.1 (cont'd) List the names and ranks of all faculty and instructional staff members according to rank.

Name and Rank	Birth Year	Baccalaureate Degree		Masters Degree		Doctoral Degree		Chemical Specialization	Year Joined Staff	Status			Tenured/ Pre-tenured	Long Term/ Non-tenure-track
		School	Year	School	Year	School	Year			FT	PT	Temp		
Wildeliz Torres (Assistant Professor)	198?	UPR-Cayey Campus	199			UPR-Rio Piedras Campus	200?	Organic	2009		x	x		
Nelson Granda (Instructor)	197?		200	UPR-Mayaguez Campus	199?			Analytical	2011		x	x		

Revised 5/9/2011

Section 3
Faculty and Staff

Table 3.2 TEACHING CONTACT HOURS. Provide the teaching contact hours (actual hours per week) for all courses taught by each faculty member involved in undergraduate instruction for the most recent academic year. Use all available space, listing multiple faculty members per page. Please list non-tenure-track faculty, temporary faculty, and instructional staff last and **identify them with asterisks**. Do not include graduate or undergraduate teaching assistants.

	Fall Semester or First Quarter: Year 2011					Spring Semester or Second Quarter: Year 2012				
Faculty Member (indicate rank)	Catalog Number and Course Title	1*	2*	3*	4*	Catalog Number and Course Title	1*	2*	3*	4*
Juan G. Estévez-Delgado (Professor)	CHEM3133- Lab. of Gen Chem I	0	6	6	6	CHEM3134-Lab Gen Chem II BIOL4990-Undergraduate research (Biology)	0	9	9	9
Mercedes Rivera-Borrero (Professor)	CHEM3131 –Gen Chem I CHEM4041-Phys Chem I CHEM4101-Lab Phys Chem I	6	8	8	14	CHEM3132-Gen Chem II CHEM4042-Phys Chem II CHEM4101-Lab Phys Chem II	9	4	4	13
Luz Torres-Colón (Professor)	CHEM3006-Seminar CHEM3123-Lab Org. Chem I CHEM3153-Lab Org Chem I (major)	2	12	12	14	CHEM3124-Lab Org Chem II CHEM3154-Lab Org Chem II (major)	0	12	12	12
Jannette Gavillán-Suárez (Professor)	CHEM3123-Lab Org Chem I CHEM4999-Undergraduate Research	0	8	17	17	CHEM3124-Lab Org Chem II CHEM499-Undergraduate research BIOL4990- Undergraduate research (Biology)	0	9	11	11
Jairo Pardo-Palma (Associate Professor)	CHEM3133-Lab Gen Chem I CHEM3025-Lab Analytical Chem	0	15	15	15	CHEM3134-Lab Gen Chem II CHEM3015-Lab Analytical Chem	0	15	15	15

Wilfredo Resto-Otero	CHEM3025-Analytical Chem. CHEM3025-Lab. Analytical Chem. CHEM3133-Lab Gen Chem I	3	12	12	15	Chem4015-Instrumental Analysis CHEM4015L-Lab Instrumental Analysis	3	12	12	15
Raúl J. Castro-Santiago (Professor)	CHEM3131-Gen. Chem. I CHEM3133-Lab Gen Chem I	6	9	9	15	CHEM3132-Gen Chem II CHEM3134-Lab Gen Chem II	6	9	9	15
Elba D. Reyes-Pérez (Associate Professor)	CHEM3151-Org Chem I (major) CHEM3123- Lab Org Chem I QUIM4999-Undergraduate research	3	9	6	9	CHEM3152-Org. Chem II (major) CHEM3124-Lab Org Chem II	3	12	12	15
Mayra Pagán-Ortiz (Associate Professor)	CHEM3153-Lab Org Chem I (major) CHEM3121-Org Chem I CHEM3123-Lab Org Chem I	3	12	12	15	CHEM3122-Org Chem II CHEM3124-Lab Org Chem II CHEM3154-Lab Org Chem II (major)	3	12	12	15
Vibha Bansal (Assistant Professor)	CHEM4065-Biochemistry	3	0	12	15	CHEM4166-Special Topics	3	0	12	15

1* Number of classroom hours scheduled per week.
2* Number of contact hours of laboratory scheduled per week.
3* Indicate in this column the approximate number of hours per week actually spent in the laboratory supervising students.
4* Total of columns 1 and 3 for a grand total for each faculty member.

Section 3
Faculty and Staff

Table 3.2 (cont'd) Fall Semester or First Quarter: Year 2011 Spring Semester or Second Quarter: Year 2012

Faculty Member (indicate rank)	Catalog Number and Course Title	1*	2*	3*	4*	Catalog Number and Course Title	1*	2*	3*	4*
Edgardo Rivera Tirado (Assistant Professor)	CHEM3131-Gen. Chem. I CHEM3133-Lab. Gen. Chem. I. CHEM4999-Undergraduate research	12	5	9	21	CHEM3132-Gen Chem II CHEM3134-Lab Gen Chem II CHEM3025-Analytical Chem CHEM3006-Seminar CHEM4999-Undergraduate research	11	5	9	20
Claudia Ospina Millán (Assistant Professor)	CHEM3121-Org. Chem. I. CHEM3123-Lab. Org. Chem. I. QUIM4999-Undergraduiates research	9	6	16	15	CHEM3122-Org Chem II CHEM3124-Lab Org Chem II CHEM4999-Undergraduate reserach	6	9	9	15
Rosann O'Neill (Assistant Professor)	CHEM3121-Org. Chem. I CHEM3123-Lab. Org. Chem.I	6	8	8	14	CHEM3121-Org Chem I CHEM3122-Org Chem II	15	0	0	15
Zuleika Medina (Assistant Professor)	CHEM3131-Gen. Chem. I CHEM4000-Inorganic Chem	15	0	0	15	CHEM3132-Gen Chem II CHEM3133-Lab Gen Chem I CHEM400-Inorganic Chem	12	3	3	15
Laura Santiago (Assistant Professor)	CHEM3131-Gen. Chem. I CHEM3133-Lab. Gen. Chem. I	3	12	12	15	CHEM3131-Gen Chem I CHEM3134-Lab Gen Chem II	3	12	12	15
Nelson Granda (Instructor)	CHEM3133-Lab Gen. Chem. I	0	9	9	9	CHEM3133-Lab Gen Chem I CHEM3134-Lab Gen Chem II	0	9	9	9
Luz S. Betancourt (Instructor)	CHEM3133-Lab. Gen. Chem. I	0	9	9	9	CHEM3134-Lab Gen Chem II	0	9	9	9
Miriam Romero (Instructor)	CHEM3133-Lab. Gen. Chem. I	0	3	3	3					

Michelle Cartagena (Instructor)	CHEM3123-Lab. Org. Chem. I	0	8	8	8					
Edgardo Ortiz (Instructor)	CHEM3133-Lab. Gen. Chem. I	0	9	9	9					
Leonardo C. Pacheco (Instructor)	CHEM3153-Lab. Org. Chem. I (major) CHEM3133-Lab. Gen. Chem. I	0	7	7	7					
Marcia Balaguera (Instructor)	CHEM3131-Gen Chem. I	6	0	0	6					
Brenda Montalvo (Instructor)						CHEM3131-Gen Chem I CHEM3134-Lab Gen Chem II	6	3	3	9
Zulma Santiago-Rivera (Instructor)						CHEM3134-Lab Gen Chem II	0	3	3	3
David Sanabria (Instructor)						CHEM3123-Lab Org Chem I	0	3	3	3
Marilyn Pérez-Valentín (Instructor)						CHEM3123-Lab Org Chem I CHEM3124-Lab Org Chem II CHEM3134-Lab Gen Chem II	0	11	11	11

1* Number of classroom hours scheduled per week.
2* Number of contact hours of laboratory scheduled per week.
3* Indicate in this column the approximate number of hours per week actually spent in the laboratory supervising students.
4* Total of columns 1 and 3 for a grand total for each faculty member.

Section 3
Faculty and Staff

Table 3.2 (cont'd) Third Quarter: Year _____ Fourth Quarter or Summer: Year 2012

Faculty Member (indicate rank)	Catalog Number and Course Title	1*	2*	3*	4*	Catalog Number and Course Title	1*	2*	3*	4*
Raúl J. Castro-Santiago (Professor)						CHEM3132-Gen Chem II	15	0	0	15
Jairo Pardo-Palma (Associate Professor)						CHEM3131-Gen Chem I	15	0	0	15

1* Number of classroom hours scheduled per week.
2* Number of contact hours of laboratory scheduled per week.
3* Indicate in this column the approximate number of hours per week actually spent in the laboratory supervising students.
4* Total of columns 1 and 3 for a grand total for each faculty member.

3.11 Provide any clarification you wish relating to the policy for assigning course responsibilities and calculation of actual teaching contact hours.

In the case of professors who offer undergraduate investigation courses (CHEM4999) the number of hours of supervision per credit in which the student is enrolled is estimated as 3 contact hours per credit of the student.

3.12 What is the extent of the service responsibility of the chemistry department with respect to students majoring in subjects or fields other than chemistry?

The chemistry department offers general chemistry I and II (CHEM 3131-32) and laboratories (CHEM 3133-34) to students in the natural sciences program, and the departments of biology, mathematic and elementary and secondary pedagogy in science. Also, the organic chemistry course (CHEM 3121-3124), and laboratory is offered to the natural science and biology students.

3.13 Diversity

a. Does your department have a diversity plan? Yes ☐ No ☒ If no, skip to 3.13e.

b. If yes, how often is it evaluated and updated? ____________________

c. If yes, indicate whether your department's plan addresses diversity at the following levels:

	Yes	No
Undergraduate students	☐	☐
Graduate students (if applicable)	☐	☐
Faculty	☐	☐

d. Briefly describe your department's (not institutional) diversity plan.

e. Briefly describe your activities and successes in expanding faculty diversity over the last five years.

The chemistry department is diverse in gender, ethnic origin and academic formation. The faculty is 60% female. Also, 30% of the faculty is from another ethnic background. Within our faculty there are colleagues from Chile, Colombia, India and Puerto Rico.

Section 4
Infrastructure

4.1 Space

a. Check the appropriate column that best describes the space available to the chemistry program.

	Adequate	Inadequate	Not Available
Classrooms	☒	☐	☐
Laboratories:			
Introductory Chemistry	☒	☐	☐
Analytical	☒	☐	☐
Inorganic	☐	☐	☒
Organic	☒	☐	☐
Biochemistry	☒	☐	☐
Physical	☒	☐	☐
Instrumental Analysis	☒	☐	☐
Student Research	☒	☐	☐
Faculty Research	☒	☐	☐
Computer (labs or facilities)	☒	☐	☐
Offices			
Faculty			
Tenured/Pre-tenured	☒	☐	☐
Long Term Non-tenure-track	☒	☐	☐
Instructional Staff	☒	☐	☐
Temporary	☒	☐	☐
Student	☐	☐	☒
Other			
Meeting Space	☒	☐	☐
Support Services	☒	☐	☐
Major Instrumentation	☒	☐	☐

b. If any areas are checked as inadequate or not available, please comment.

The inorganic course is not part of our academic offering, yet lab 310 NEC is adequate for teaching this course.

Students are not assigned office space in the science building.

c. To what extent would your present facilities accommodate increased enrollments in chemistry courses?

The ten (10) academic laboratories allow for the growth of up to 50% of the actual number of students in the department. We have three (3) classrooms. The classrooms are utilized 75% of the time. There is space available for additional sections, and we are currently preparing one more classroom (MMM311) for maximum capacity of 50 students.

4.2 Service Facilities
Indicate whether or not the following facilities are available, where located, and if adequate.

a. Stockroom

Available, in the basement of NEC and in adequate conditions.

b. Electrical and instrumental equipment maintenance and repair

Available, external maintenance, adequate.

c. Other service facilities

Audiovisual or CADI- information technology and computer center, and classroom to offer courses, Library, all adequate.

4.3 a. The maintenance of instrumentation is handled through:
Faculty ☐ Support staff ☐ Contracts with outside vendors ☒ Both support staff and contracts ☐

b. If the maintenance of instrumentation and computer equipment is handled by support staff and by contracts with outside vendors, indicate the percentage handled by each: Support Staff 0 % Contracts 100 %

c. What percentage of teaching contact hours is being used to maintain equipment? 0 %

d. What percentage of support staff duties (e.g. ordering supplies, installing/maintaining computer workstations, etc.) is supplied by faculty? 0 %

Section 4
Infrastructure

Table 4.1 If you have more than one of a particular instrument or specialized apparatus, please list it in the space directly under the first.

Instrument/Apparatus	**Used by Chemistry Majors**		**Year of Acquisition**	**Manufacturer and Model**
	In Chemistry Course Work	in Research		
NMR Spectrometer(s)	X	X	2008	Anasazi, EM360A
NMR Spectrometer	X	X	2007	Anasazi, EM360A
UV-Vis Spectrometer(s)	X	X	2007	Perkin Elmer, Lamda 35
UV-Vis Spectrometer	X		2001	JASCO, V-550
Fluorimeter	X		2003	Shimadzu, RF1501
Gas Chromatograph(s)	X		2007	Perkin Elmer, Claurus 500
Gas Chromatograph	X		2006	Perkin Elmer, Claurus 500
Gas Chromatograph	X		2002	Shimadzu, GC17A
Liquid Chromatograph(s)	X	X	2007	Perkin Elmer, Series 200
Liquid Chromatograp	X		2001	JASCO, UV-1575
Ionic Chromatograph	X		2002	Metrohm, IC 761
IR Spectrometer(s)	X	X		
FTIR	X		2007	JASCO, 4200
Mass Spectrometer(s)				
Radiochemistry (including counting equip. and sources)				
Atomic Absorption, Flame Emission	X		1999	Buck Scientific, AA210
Thermal Analysis Equipment				
Gel Electrophoresis				
Electrochemical Instrumentation	X		2003	BAS, C-3
Karl Fisher Titrator				
GC-Mass Spectrometer(s)		X	2007	Perkin Elmer, Claurus 500MS
Schlenk line and Dry Box Apparatus				
Imaging Microscopy				
Additional Instruments (over $10,000 in cost):				
Lyophilizer		X	2010	Labconco

Section 4
Infrastructure

4.4 Library

a. Is the chemistry library collection accessible from the chemistry building? Yes ☒ No ☐. If no, please explain.

b. Approximate number of bound books and volumes related to chemistry (chemical texts and journals): 1772

c. Number of current chemistry journal titles to which students have access on campus:

In chemistry library	
In college library	994

d. What types of access do you have to *Chemical Abstracts*? (check all that apply.)

Hard copy	☒
Online through SciFinder Scholar	☒
Online through STN	☐
Online through STN Easy	☐
Other	☐

i. Report the number of searches or the expenditure for searches of *Chemical Abstracts* per year.
3,093 searches during 2011-12

ii. Describe briefly how undergraduate students and faculty access titles and abstracts on a regular basis (offices, library, other).
In the library they search visiting the Journal's collection, searching the print Chemistry journals and CAS hard copy, also they use the library computers accessing the Chemistry and Science databases (Sciefinder, ACS, CRCnetBase, Ebsco, Proquest, Science Direct) and the digital reserve. The 2011-12 statistics available are: hit count for ACS searches is 5,048; for Chemistry digital reserve searches are 663; the Circulation statistics for Chemistry books was 236 titles borrowed.

e. Are other extensive chemistry library facilities available in the community? Yes ☐ No ☒.
If yes, discuss briefly.

f. Are reading room facilities available in the chemistry building? Yes ☐ No ☒.
If yes, describe briefly the library resources in the reading room.

Section 4
Infrastructure

Table 4.2 JOURNAL SUBSCRIPTIONS. Please indicate the periodicals to which students have print or online access.

Journal		Journal	
Accounts of Chemical Research	☒	Journal of the American Society for Mass Spectrometry	☒
Advanced Functional Materials	☐	Journal of Applied Polymer Science	☐
Advanced Materials	☐	Journal of Biological Chemistry	☒
Advanced Synthesis and Catalysis	☐	Journal of Biological Inorganic Chemistry	☒
Advances in Heterocyclic Chemistry	☐	Journal of Catalysis	☒
Advances in Protein Chemistry	☐	Journal of Chemical Ecology	☒
Analyst	☐	Journal of Chemical Education	☒
Analytical and Bioanalytical Chemistry	☐	Journal of Chemical Information and Modeling	☒
Analytical Biochemistry	☒	The Journal of Chemical Physics	☐
Analytical Chemistry	☒	Journal of Chemical Theory and Computation	☒
Angewandte Chemie International Edition	☐	Journal of Chromatography A	☒
Applied Catalysis A: General	☒	Journal of Chromatography B	☒
Applied Spectroscopy	☐	Journal of Combinatorial Chemistry	☒
Biochemical Journal	☒	Journal of Medicinal Chemistry	☒
Biochemistry	☒	Journal of Molecular Biology	☒
Bioconjugate Chemistry	☒	The Journal of Organic Chemistry	☒
Biomacromolecules	☒	Journal of Organometallic Chemistry	☒
Bioorganic Chemistry	☒	Journal of Physical Chemistry A	☒
Catalysis Reviews: Science and Engineering	☐	Journal of Physical Chemistry B	☒
Chemical Biology (ACS)	☒	Journal of Physical Chemistry C	☒
Chemical Communications	☐	Journal of Polymer Science Part A: Polymer Chemistry	☐
The Chemical Educator	☐	Journal of Proteome Research	☒
Chemical Physics Letters	☒	Langmuir	☒
Chemical Reviews	☒	Macromolecular Chemistry and Physics	☐
Chemical Society Reviews	☐	Macromolecules	☒
Chemistry-A European Journal	☐	Molecular Cell	☒
Chemistry Education: Research and Practice	☒	Nano Letters	☒
Chemistry Letters	☐	Nature	☒
Chemistry of Materials	☒	Nature Chemical Biology	☒
Combinatorial Chemistry and High Throughput Screening	☐	Nature Structural and Molecular Biology	☒
		New Journal of Chemistry	☐
Coordination Chemistry Reviews	☒	Organic and Biomolecular Chemistry	☐

Critical Reviews in Biochemistry and Molecular Biology	☒	Organic Letters	☒
Current Opinion in Chemical Biology	☒	Organometallics	☒
Current Organic Chemistry	☐	Physical Chemistry Chemical Physics	☐
Dalton Transactions	☐	Polymer	☐
Electroanalysis	☐	Proceedings of the National Academy of Science of the USA	☒
Electrophoresis	☐	Science	☒
Environmental Science and Technology	☒	Supramolecular Chemistry	☒
European Journal of Inorganic Chemistry	☐	Synlett	☐
European Journal of Organic Chemistry	☐	Synthesis	☐
FEBS Journal	☒	Tetrahedron	☒
Green Chemistry	☐	Tetrahedron Letters	☒
Inorganic Chemistry	☒	Trends in Biochemical Science	☒
Journal of the American Chemical Society	☒		

4.5 Additional Learning Resources

a. Are classroom demonstration facilities available and adequate? Yes ☒ No ☐.
If no, explain.

b. Describe briefly the use and availability of:

i. Technology-enabled classrooms (e.g., computer-aided projection)

The chemistry department has three classrooms equipped with a computer, a digital data projector and access to the internet and Wifi. The eight (8) academic laboratories have the same equipment.

ii. Other learning resources

In the building of information technology (CADI) there is a computer room available for the students to do their assignments and to use online services such as the virtual library. Also there are laboratories with specialized computer software available to the students to help them visualize better the concepts presented in class.

c. Describe the computing facilities and computational chemistry and molecular modeling software available to undergraduates for instructional purposes.

4.6 Safety

a. Are the following laboratory facilities **adequate** for your instructional program:

Safety Showers	Yes ☒	No ☐	Hoods	Yes ☒	No ☐
Eye Washes	Yes ☒	No ☐	Ventilation	Yes ☒	No ☐
Fire Extinguishers	Yes ☒	No ☐			

b. If marked no for any item above, please explain.

c. Please answer the following questions related to your lab safety practices.

	Yes	No
Does the department/university have established safety rules?	☒	☐
Does the department/university have emergency reporting procedures?	☒	☐
Does your department have a written chemical hygiene plan?	☒	☐
Are there adequate facilities and arrangements for disposal of chemical waste?	☒	☐
Are safety information and reference materials (e.g. MSDS) readily available to all students and faculty?	☒	☐
Is personal protective equipment available and used by all students and faculty?	☒	☐

d. If no is checked for any of the above, please explain.

4.7 Please outline any significant changes in facilities, planned or completed, in the last five years.

The physical facilities of the chemistry department improved significantly since the innauguration of the new building of natural sciences (NEC). The NEC has eight (8) new academic labs to teach the laboratory of the introductory and foundation courses. The building also has a laboratory dedicated to investigation, and another lab for the preparation of chemical reaction solutions. Additionally, there is a new administrative area designated to the department office. These facilities substitute the old laboratories and science building, and has increased the capacity of the academic labs to a 60% (8 labs vs. 5 labs). The new facilities have allowed us to to open two new laboratories for investigation located in the old science building, which has increased the number of labs dedicated to investigation in a 200% (from one lab to three labs for investigation).

In the near future, we expect to have a new academic classroom for enrollment capacity of 50, and equipped with modern technology in order to carry out innovative pedagogy in the field of science.

Section 5
Curriculum

College or University: University of Puerto Rico at Cayey

Date: 12/31/2012

A chemistry student wishing to be certified to the Society at the time of receiving the baccalaureate degree should have completed successfully a curriculum as defined in the current edition of the ACS Guidelines (available at http://www.acs.org/cpt).

In the following tables, list all courses students would complete to satisfy certification requirements. The total hour figures should be the total classroom and laboratory hours for the entire period of the course, excluding examination periods.

Submit copies of syllabi and exams for all courses listed in Table 5.1, Table 5.2, and Table 5.3.

Table 5.1 INTRODUCTORY COURSES

List all introductory chemistry courses certified students may use to prepare for the foundation courses listed in Table 3.2. Do list any courses that appear in other tables in the Curriculum Section.

Dept. & Course Number	Course Title	Total Hours[1]		Textbook and Author	CH[2]	Frequency of Offering	Required or Elective[3]
		Class	Lab				
CHEM 3131	General Chemistry I	45	0	Tro, N. J. *Chemistry, A Molecular Approach*, 2nd ed.; Pearson Prentice Hall: New Jersey, 2011.	3	Fall semester	R
CHEM 3133	General Chemistry I Laboratory	0	39	Beran, J. A. *Selected Experiments from Laboratory Manual for Principles of General Chemistry*, 9th ed.; Wiley & Sons: Massachusetts, 2011.	1	Fall semester	R
CHEM 3132	General Chemistry II	45	0	Tro, N. J. *Chemistry, A Molecular Approach*, 2nd ed.; Pearson Prentice Hall: New Jersey, 2011.	3	Spring semester	R
CHEM 3134	General Chemistry II Laboratory	0	39	Beran, J. A. *Selected Experiments from Laboratory Manual for Principles of General Chemistry*, 9th ed.; Wiley & Sons: Massachusetts, 2011.	1	Spring semester	R
							–
							–
							–

1. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week.
2. Indicate the credit hours (CH) for each course listed.
3. Using the dropdown menus, please indicate whether each course is required (R) or an elective (E).

Table 5.2 FOUNDATION COURSE WORK

List below all courses students may use to satisfy the FOUNDATION requirements in the sequence suggested for certification. Do not include courses listed in Tables 5.1 and 5.3 or courses that are not used for ACS certification. Refer to section 5.3 of the current ACS Guidelines for the ACS definition of FOUNDATION courses.

Dept. & Course Number	Course Title	Total Hours[1]		Textbook and Author	CH[2]	Frequency of Offering	FOUNDATION Material % Breakdown[3]					Required or Elective[4]
		Class	Lab				A	B	I	O	P	
CHEM 3025	Analytical Chemistry	40.5	87	Skoog, D. A.; West, D. M.; Holler, F. J.; Crouch, S. R. *Fundamentals of Analytical Chemistry*, 8th ed.; Thomson Learning: California, 2004.	4	Both semesters (depends on enrollment)	100					R
CHEM 3151	Organic Chemistry	45	0	Bruice, P. Y. *Organic Chemistry*, 6th ed.; Prentice Hall: New York, 2011.	3	Fall semester				100		R
CHEM 3153	Organic Chemistry Laboratory	0	52	Pavia, D. L.; Lampman, G. M.; Kriz, G. S.; Engel, R.G. *A Small Scale Approach to Organic Laboratory Techniques*, 3rd ed.; Brooks/Cole: California, 2011.	1	Fall semester				100		R
CHEM 4000	Inorganic Chemistry	41	0	Miessler, G. L.; Tarr, D. A. *Inorganic Chemistry*, 4th ed.; Pearson Prentice Hall: New Jersey, 2004.	3	Both semesters (depends on enrollment)			100			R
CHEM 4041	Physical Chemistry I	41	0	Levine, I. N. *Physical Chemistry*, 6th ed.; McGraw-Hill: New York, 2009.	3	Fall semester					100	R
CHEM 4101	Physical Chemistry I Laboratory	0	56	Laboratory Manual of Physical Chemistry, UPR	1	Fall semester					100	R
CHEM 4042	Physical Chemistry II	41	0	Levine, I. N. *Physical Chemistry*, 6th ed.; McGraw-Hill: New York, 2009.	3	Spring semester					100	R
CHEM 4102	Physical Chemistry II Laboratory	0	56	Laboratory Manual of Physical Chemistry, UPR	1	Spring semester					100	R
CHEM 4065	Biochemistry	42	0	Nelson, D. L.; Cox, M. M.; *Lehninger Principles of Biochemistry*, 5th ed.; W. H. Freeman: New York, 2008.	3	Both semesters (depends on enrollment)		100				R

1. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week.
2. Indicate the credit hours (CH) for each course listed.
3. Please apportion for each course the approximate content to the five areas: Analytical and Instrumental (A), Biochemistry (B), Inorganic (I), Organic (O), and Physical (P). This is particularly useful if course titles are ambiguous or if courses cover more than one FOUNDATION area.

4. Using the dropdown menus, please indicate whether each course is required (R) or an elective (E).

Table 5.2 FOUNDATION COURSE WORK (cont'd)

List below all courses students may use to satisfy the FOUNDATION requirements in the sequence suggested for certification. Refer to the current ACS Guidelines for the ACS definition of FOUNDATION courses.

Dept. & Course Number	Course Title	Total Hours[1]		Textbook and Author	CH[2]	Frequency of Offering	FOUNDATION Material % Breakdown[3]					Required or Elective[4]
		Class	Lab				A	B	I	O	P	
CHEM 4066	Biochemistry Laboratory	0	52	Boyer R. *Modern Experimental Biochemistry*, 3rd ed.; Benjamin Cummings: San Francisco, 2000.	1	Both semesters (depends on enrollment)		100				R
CHEM 3006	Bibliography, Chemical Literature and Seminar	30	0	Coghill, A. M.; Garson, R. E., Eds. *The ACS Style Guide: Effective Communications of Scientific Information*; 3rd ed.; ACS: Washington DC, 2006.	2	Both semesters						R
												–
												–
												–
												–
												–
												–
												–
												–

1. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week.
2. Indicate the credit hours (CH) for each course listed.
3. Please apportion for each course the approximate content to the five areas: Analytical and Instrumental (A), Biochemistry (B), Inorganic (I), Organic (O), and Physical (P). This is particularly useful if course titles are ambiguous or if courses cover more than one FOUNDATION area.
4. Using the dropdown menus, please indicate whether each course is required (R) or an elective (E).

Use separate sheets listing the same information if needed for additional courses

Table 5.3 IN-DEPTH COURSE WORK

Courses Used for Certification. List below the courses students may use to satisfy the IN-DEPTH requirement for certification. Do not include courses previously listed in Tables 5.1 and 5.2. Refer to section 5.4 of the current ACS Guidelines for the ACS definition of IN-DEPTH courses.

Dept. & Course Number	Course Title	Total Hours[1]		Textbook and Author	Foundation Prerequisite. Course #	CH[2]	Frequency of Offering	Required or Elective[3]
		Class	Lab					
CHEM 3152	Organic Chemistry	45	0	Bruice, P. Y. *Organic Chemistry*, 6th ed.; Prentice Hall: New York, 2011.	CHEM3151	3	Spring semester	R
CHEM 3154	Organic Chemistry Laboratory	0	52	Pavia, D. L.; Lampman, G. M.; Kriz, G. S.; Engel, R.G. *A Small Scale Approach to Organic Laboratory Techniques*, 3rd ed.; Brooks/Cole: California, 2011.	CHEM3153	1	Spring semester	R
CHEM 4015	Instrumental Analysis	45	90	Skoog, D. A.; Holler, F. J.; Crouch, S. R. *Principles of Instrumental Analysis*, 6th ed.; Thomson Brooks/Cole: California, 2007.	CHEM3025	4	Both semesters (depends on enrollment)	R
CHEM 4999	Undergraduate Research 2014	0	135	Assigned material by the professor.	CHEM3025 CHEM3152 CHEM3154	3	Both semesters	R
	Students should take one elective course out of the following:							
CHEM 4025	Methods of Organic Chemistry (Spectroscopy) 2014 indepth	42	0	Pavia, D. L.; Lampman, G. M.; Kriz, G. S.; *Introduction to Spectroscopy*, 4th ed.; Brooks/Cole: California, 2009.	CHEM3152 CHEM3154	3	Both semesters (depends on enrollment)	E
CHEM 4017	Industrial Training	20-30	100-150	Prepared material from the personal of the industry.	CHEM3025 CHEM4015	2-3	Both semesters (depends on enrollment)	E
CHEM 4166	Special Topics In Chemistry	15-45	0	It will be subjected to the nature of the thematic content of the course.	CHEM 3152 CHEM 3154 CHEM 4015	1-3	Both semesters (depends on enrollment)	E
CHEM 4166	Special Topics In Chemistry: Medicinal Chemistry	39	0	Williams, D. A.; Lemke, T. L.; Foye, W. O. *Foye's Principles of Medicinal Chemistry*, 6th ed.; Lippincott Williams & Wilkins: Philadelphia, 2008.	CHEM3152 CHEM3154	3	Both semesters (depends on enrollment)	E

1. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week.
2. Indicate the credit hours (CH) for each course listed.
3. Using the dropdown menus, please indicate whether each course is required (R) or an elective (E).

Table 5.4 PHYSICS AND MATHEMATICS COURSES

List the physics and mathematics courses that would satisfy the requirements for certification. Refer to Section 5.7 of the ACS Guidelines.

Dept. & Course Number	Course Title	Total Hours[1] Class	Total Hours[1] Lab	Department	Credit Hours
PHYS 3011	College Physics I	45	0	MATH-PHYSICS	3
PHYS 3013	Laboratory of College Physics I	0	45	MATH-PHYSICS	1
PHYS 3012	College Physics II	45	0	MATH-PHYSICS	3
PHYS 3014	Laboratory of College Physics II	0	45	MATH-PHYSICS	1
MATH 3052	Calculus I	45	0	MATH-PHYSICS	3
MATH 3053	Calculus II	45	0	MATH-PHYSICS	3
MATH 3054	Calculus III	45	0	MATH-PHYSICS	3

. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week.

Section 5
Curriculum

5.1 How would your ACS-certified graduates **in each degree** track meet the in-depth course requirements? List the names and course numbers. If a course is listed here, ensure it is also entered in Table 5.3.

Our department has only one degree track in chemistry. In order for the ACS-certified graduates in this degree track to meet the in-depth course requirements the students need to obtain at least 12 credits in the following courses:

Core courses

- Organic Chemistry Class (CHEM 3152, 3 CH) and Laboratory (CHEM 3154, 1 CH)
- Instrumental Analysis (CHEM 4015, 4 CH)
- Undergraduate Research (CHEM 4999, 3 CH)

Elective courses (one of the following)

- Methods of Organic Chemistry (Spectroscopy) (CHEM 4025, 3 CH)
- Industrial Training (CHEM 4017, 2-3 CH)
- Special Topics In Chemistry (CHEM 4166, 1-3 CH)
- Special Topics In Chemistry: Medicinal Chemistry (CHEM 4166, 3 CH)

5.2 How would your ACS-certified graduates **in each degree** track meet the laboratory requirement of 400 hours? Include the subdisciplinary area (ABIOP) covered by each course, the course name, the course number, and the number of lab hours devoted to each area. Do not include lab hours from general or introductory lab courses. If a course is listed here, ensure it is also entered in Table 5.2 or 5.3.

In order for the ACS-certified graduates to meet the 400 laboratory hours requirements, the students need to take the following laboratories:

1. Organic Chemistry, CHEM 3153 (52 hr), CHEM 3154 (52 hr) – 104 hr (O)
2. Physical Chemistry, CHEM 4101 (56 hr), CHEM 4102 (56 hr) – 112 hr (P)
3. Analytical Chemistry, CHEM 3025 (87 hr)
   Instrumental Analysis, CHEM 4015 (90 hr) – 177 hr (A)
4. Biochemistry, CHEM 4066 – 52 hr (B)

Our laboratory course work of 445 hours covers as required, four of the five foundation areas of chemistry. These are distributed between courses at both the foundation and in-depth levels. Undergraduate research hours (135) do not need to be used to meet the 400 laboratory hours required for student certification.

Final Comments

Please outline and comment on (in as much detail as you wish) changes over the last five years in faculty, diversity initiatives, professional development, support personnel, facilities, capital equipment, curriculum, and any other items related to your program that you believe would be of interest to CPT. Attach additional sheets, if necessary, but please do not attach actual self-evaluation documents or other reports to your administration.

Table 5.5

2012-2013 (First semester)
RECORD OF COURSE OFFERINGS

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

	Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	27
Biochemistry	4065	Biochemistry	45		No	N/A
	4066	Biochemistry Laboratory		60	No	N/A
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	22
Organic Chemistry	3151	Organic Chemistry	45		No	N/A
	3153	Organic Chemistry Laboratory		60	No	N/A
Physical Chemistry	4041	Physical Chemistry I	45		Yes	25
	4101	Physical Chemistry I Laboratory		60	Yes	28
	4042	Physical Chemistry II	45		No	N/A
	4102	Physical Chemistry II Laboratory		60	No	N/A
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	12

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3152	Organic Chemistry	45		No	N/A

3154	Organic Chemistry Laboratory		60	No	N/A
4015	Instrumental Analysis	60	90	No	N/A
4025	Methods of Organic Chemistry (Spectroscopy)	45		Yes	12
4017	Industrial Training	30	150	No	N/A
4166	Special Topics in Chemistry:Medicinal Chemistry	45		No	N/A

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
4999	Undergraduate Research		135	Yes	3

Table 5.6

2011-2012
RECORD OF COURSE OFFERINGS

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

	Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	41
Biochemistry	4065	Biochemistry	45		Yes	19
	4066	Biochemistry Laboratory		60	No	N/A
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	39
Organic Chemistry	3151	Organic Chemistry	45		Yes	37
	3153	Organic Chemistry Laboratory		60	Yes	37
Physical Chemistry	4041	Physical Chemistry I	45		Yes	29
	4101	Physical Chemistry I Laboratory		60	Yes	29
	4042	Physical Chemistry II	45		Yes	14
	4102	Physical Chemistry II Laboratory		60	Yes	13
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	33

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3152	Organic Chemistry	45		Yes	20

3154	Organic Chemistry Laboratory		60	Yes	20
4015	Instrumental Analysis	60	90	Yes	18
4025	Methods of Organic Chemistry (Spectroscopy)	45		No	N/A
4017	Industrial Training	30	150	No	N/A
4166	Special Topics in Chemistry:Medicinal Chemistry	45		No	N/A

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
4999	Undergraduate Research		135	Yes	27

2010-2011

Table 5.7 **RECORD OF COURSE OFFERINGS**

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

	Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	52
Biochemistry	4065	Biochemistry	45		No	
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	17
Organic Chemistry	3121	Organic Chemistry I	45		Yes	33
	3123	Organic Chemistry I Laboratory		60	Yes	33
Physical Chemistry	4041	Physical Chemistry I	45		Yes	25

	4101	Physical Chemistry I Laboratory		60	Yes	25
	4042	Physical Chemistry II	45		Yes	18
	4102	Physical Chemistry II Laboratory		60	Yes	16
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	25

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3122	Organic Chemistry II	45		Yes	15
3124	Organic Chemistry Laboratory II		60	Yes	15
4015	Instrumental Analysis	45	90	Yes	28
4166	Special Topics in Chemistry: Medicinal Chemistry	45		Yes	24

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
4999	Undergraduate Research		90 - 135	Yes	18

Table 5.8

2009-2010
RECORD OF COURSE OFFERINGS

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term	Taught (Yes or No)	Course Enrollment

			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	57
Biochemistry	4065	Biochemistry	45		Yes	14
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	36
Organic Chemistry	3121	Organic Chemistry I	45		Yes	36
	3123	Organic Chemistry I Laboratory		60	Yes	36
Physical Chemistry	4041	Physical Chemistry I	45		Yes	29
	4101	Physical Chemistry I Laboratory		60	Yes	29
	4042	Physical Chemistry II	45		Yes	19
	4102	Physical Chemistry II Laboratory		60	Yes	19
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	33

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3122	Organic Chemistry II	45		Yes	19
3124	Organic Chemistry II Laboratory		60	Yes	19
4015	Instrumental Analysis	45	90	Yes	19
4017	Industrial Training	20-30	100-150	Yes	1

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term	Taught (Yes or No)	Course Enrollment

		Class	Lab		
4999	Undergraduate Research		90 - 135	Yes	11

Table 5.9

2008-2009
RECORD OF COURSE OFFERINGS

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

	Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	59
Biochemistry	4065	Biochemistry	45		Yes	11
	4066	Biochemistry Laboratory		60	No	N/A
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	49
Organic Chemistry	3121	Organic Chemistry I	45		Yes	53
	3123	Organic Chemistry I Laboratory		60	Yes	53
Physical Chemistry	4041	Physical Chemistry I	45		Yes	26
	4101	Physical Chemistry I Laboratory		60	Yes	26
	4042	Physical Chemistry II	45		Yes	23
	4102	Physical Chemistry II Laboratory		60	Yes	19
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	28

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3122	Organic Chemistry II	45		Yes	36
3124	Organic Chemistry II Laboratory		60	Yes	36
4015	Instrumental Analysis	45	90	Yes	23
4025	Methods of Organic Chemistry (Spectroscopy)	45		Yes	9
4017	Industrial Training	30	150	Yes	3
4166	Special Topics in Chemistry:Medicinal Chemistry	45		No	N/A

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
4999	Undergraduate Research		135	Yes	17

2007-2008

Table 5.10 **RECORD OF COURSE OFFERINGS**

a. Foundation Courses

List the course(s) that would be used to satisfy the requirement for foundation course work. Please refer to the 2008 ACS Guidelines, pages 9-10 for a more detailed description. If a course contributes to more than one foundation area, please apportion the contact hours.

	Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
			Class	Lab		
Analytical Chemistry	3025	Analytical Chemistry	45	90	Yes	53
Biochemistry	4065	Biochemistry	45		Yes	19
	4066	Biochemistry Laboratory		60	No	N/A
Inorganic Chemistry	4000	Inorganic Chemistry	45		Yes	34

Organic Chemistry	3121	Organic Chemistry I	45		Yes	46
	3123	Organic Chemistry I Laboratory		60	Yes	46
Physical Chemistry	4041	Physical Chemistry I	45		Yes	31
	4101	Physical Chemistry I Laboratory		60	Yes	31
	4042	Physical Chemistry II	45		Yes	27
	4102	Physical Chemistry II Laboratory		60	Yes	22
Chemical Literature	3006	Bibliography, Chemical Literature and Seminar	30		Yes	46

b. In-Depth Courses

List the courses that would be used to satisfy the requirement for in-depth course work for the certification of students. In-depth courses build on prerequisite foundation course work. Please refer to the 2008 ACS Guidelines, pages 10-11 for a more detailed description.

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
3122	Organic Chemistry II	45		Yes	33
3124	Organic Chemistry II Laboratory		60	Yes	33
4015	Instrumental Analysis	45	90	Yes	25
4025	Methods of Organic Chemistry (Spectroscopy)	45		No	N/A
4017	Industrial Training	30	150	Yes	1
4166	Special Topics in Chemistry:Medicinal Chemistry	45		No	N/A

c. Research

Course Catalog Number	Course Title	Total Contact Hours Per Academic Term		Taught (Yes or No)	Course Enrollment
		Class	Lab		
4999	Undergraduate Research		135	Yes	10

5.3 Are all courses taught annually? Yes ☐ No ☒
If no, describe how a student could complete the requirements for certification in four years.

Not all elective courses are taught annually, however at least one elective course (see table 5.3) is offered annually to enable the students to complete the requirements for certification in four years.

5.4 Does your institution require a minimum enrollment or class size before a course can be given? Yes ☐ No ☒
If yes, explain.

5.5 If an enrollment minimum exists, explain how the regular offering of the required FOUNDATION and IN-DEPTH chemistry courses as specified in Tables II and III could be assured when enrollments for any particular course were less than the minimum.
N/A

5.6 What is the minimum total number of formal chemistry classroom and laboratory hours that you would require for a graduate to be certified based upon the courses listed in Tables 5.1, 5.2, and 5.3?

Semester	☒	Quarter	☐	FOUNDATION Classroom Hours *	280.5 = 281
				IN-DEPTH Classroom Hours *	129 to132 ?
				Total Laboratory Hours *	580

*Hours are defined as contact hours with the student per term. Do not record credit hours or hours per week.

5.7 List the courses and experiences in which certified graduates would gain experience in:

Synthesis of Molecules	Measurement of Chemical Properties, Structure, and Phenomena
CHEM 3153 1. Fermentation Biosynthesis of Ethanol.	CHEM 3153 1. Nucleophilic Substitutions Reactions: Competing Nucleophiles.
CHEM 3154 1. Synthesis of Alkyl Esters. 2. Synthesis of Substituted Chalcones. 3. Epoxidation of Chalcones. 4solation of Natural Products: optimization or derivatization.	CHEM 3154 1. Synthesis of Alkyl Esters. 2. Synthesis and Epoxidation of Substituted Chalcones. 3. Development of research skills: Biocombustibles or Isolation of Natural Products: optimization or derivatization.
	CHEM 3025 1. Determination of CaO content in an unknown sample by complex formation titration methods. 2. Determination of an acid content in an unknown sample by an acid-base potentiometric analysis. 3. Quantitative analysis of manganese in steel by the spectrophotometric technique.
	CHEM 4015 1. Simultaneous determination of caffeine and acetyl salicylic acid in an analgesic sample using the UV-Vis technique. 2. Quantitative analysis of calcium in a food sample using Atomic Absorption. 3. Qualitative and quantitative analysis of quinine in a tonic water sample using molecular fluorescence spectroscopy.
	CHEM 4066 1. Determination of pKa value of an amino acid from its titration curve. 2. Study of the effect of changes in reaction parameters on the rate of an enzyme catalyzed reaction. 3. Study of the effect of inhibitors on enzyme activity and identification of the type of inhibition.

	CHEM 4101 1. Determination of the heat of combustion and heat of formation of naphthalene by bomb calorimetry. 2. Measuring the vapor pressure of a liquid as a function of temperature to determine its heat of vaporization, normal boiling point, and entropy of vaporization. 3. Determination of the heat of neutralization of strong and weak acids by a calorimetric method. 4. Determination of the viscosity of a liquid as a function of temperature to calculate its activation energy of viscosity. 5. Construction of a binary liquid-vapor phase diagram and determination of the azeotropic composition. 6. Determination of an acid ionization constant by a spectrophotometric method.
	CHEM 4102 1. NMR determination of keto-enol equilibrium constants of β-diketone and β-ketoester compounds. 2. Determination of the rate law and the rate constant for the iodination of acetone. 3. Study of the effect of temperature on the rate constants for the hydrolysis of methyl acetate and the determination of the energy of activation for the reaction. 4. Comparison of the photodestruction quantum yields of two DNA bases: adenine and thymine. 5. Determination of the rate law and the rate constant for an oxidation-reduction reaction under various experimental conditions. 6. Analysis of the infrared spectrum of a diatomic molecule.

Section 5
Curriculum

5.8 List the major instrumentation with which students have hands-on experience, the courses in which students use the instruments, and how students are instructed in their use.

Instrumentation	Course In Which Used	How Students Are Instructed
FT-NMR Spectrometer	CHEM 3154, CHEM 4102, CHEM 4999	The students are given a short conference about the spectroscopic technique followed by a demonstration on how to use the instrument, the instrument components and the use of software for data collection and analysis. A short guide on how to operate the NMR spectrometer is made available to all students.
UV-VIS Spectrophotometer	CHEM 4015, CHEM 4101, CHEM 4102, CHEM 4066, CHEM 4999	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
FT-IR Spectrometer	CHEM 4015, CHEM 3154, CHEM 4999	The students are given a short conference about the spectroscopic technique followed by a demonstration on how to use the instrument, the instrument components and the use of software for data collection and analysis. In CHEM 4015, students receive a hands-on training using standard solutions and then they use the instrument to study the test samples.
Atomic Absorption Spectrophotometer	CHEM 4015	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
Spectrofluorometer	CHEM 4015	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
HPLC	CHEM 4015, CHEM 4066, CHEM 4999	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.

Gas Chromatograph	CHEM 4015, CHEM 3153, CHEM 3154, CHEM 4999	The students are given a short conference about the chromatographic technique followed by a demonstration on how to use the instrument, the instrument components and the use of software for data collection and analysis. In CHEM 4015, students receive hands-on training using standard solutions and then they use the instrument to study the test samples.
Conductivity Meter	CHEM 4015	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
Potentiometer	CHEM 4015	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
GC-Mass Spectrometer	CHEM 4999	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
Voltametric Analyser	CHEM 4999	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section using standard solutions. The students then use the instrument to study test samples.
Gel Electrophoresis Instrument	CHEM 4066 CHEM 4999	Students receive hands-on training under direct supervision of the professor-in-charge of the laboratory section and then use the instrument to study their samples.

5.9 Describe how students learn to use computers for data analysis and modeling.

The students are trained in use of computers for data analysis and modeling in several courses as described below.

- Laboratory of General Chemistry I (CHEM 3133). A training in MS-EXCEL and MS-WORD programs or Google drive (word processor and spreadsheet) is given to the students at the beginning of the semester. The students learn and practice how to use these programs to prepare tables and graphs from the experimental data. They learn to use MS-EXCEL to calculate the mean value, standard deviation, and relative standard deviation as a measure of accuracy. The skills so acquired are used by the students in the experiments of calorimetry, determination of percent composition of a mixture of salts, and the determination of the chemical formula of a hydrated salt. During the semester, students can further consult the professors in the use of these programs during the concerned faculty's office hours.
  Basic molecular modeling aspects are also introduced in this laboratory where the students learn how to do semi-empirical calculations using PM3 and/or PM6 methods. This is used to determine the most stable molecular geometry for several compounds, establish the difference between the ideal versus optimized angles, and to determine the hybridization of atoms in these compounds. To this end we use the software programs available for free, ArgusLab and MOPAC running as a WebMO computational engine. This experience helps the students to visualize better the 3-D molecular geometries, understand the effect of electron repulsions on molecular geometry, and determine the enthalpy of formation for the assigned compounds. This enthalpy of formation is used to predict how resonance structures influence the enthalpy change for isodesmic reactions. A handout for this experience guides the students on how to run the program, draw the structures, get the ideal structure, study this structure, optimize the ideal structure and get and study the final structure. MOPAC automatically provides the enthalpy of formation through a PM6 calculation when run as a WebMO computational engine, while ArgusLab requires a basic setup to run a PM3 calculation.
- Laboratory of General Chemistry II (CHEM 3134). The second part of General Chemistry laboratory re-emphasizes the use of spreadsheets in MS-EXCEL computation and the development of more complex graphics such as the titration curves for a weak acid. Students exercise these skills further in the experiments of determination of molar mass of solid, factors affecting reaction rates, rate law and activation energy, and galvanic cells - the Nernst equation. Use of EXCEL is discussed in the respective laboratory periods as well as in office hours subject to individual student's needs.
- Analytical Chemistry Laboratory (CHEM 3025). Students are offered a workshop to enhance their knowledge in preparing graphs in MS-EXCEL and/or Google spreadsheet, and introduced to the use of formulae for repetitive computations. The experiments involved are: potentiometric titration for determining the acid-base equivalence point by Gran method and the quantitative analysis of manganese in steel by the spectrophotometric technique. The Gran method requires more complex computations such as logarithmic functions and linear regression. The students are taught to perform these computations and analysis of data using MS-EXCEL program.
  Besides the basic training an autoinstructional handout, prepared by the instructor, for the use of the Google

spreadsheet is given to the students in the first laboratory period.

- Biochemistry Laboratory (CHEM 4066). In the experiments of enzyme kinetics and enzyme inhibition studies, the students are required to use programs such as MS-EXCEL to prepare linear plots and determine linear correlation coefficients for estimation of the enzyme activity parameters. Students who have passed analytical chemistry before registering for this course are already familiar with the use of this program. However there are usually several other students in this course who have not yet taken analytical chemistry. Hence a basic training is given on the use of such programs for data analysis.
- Instrumental Analysis (CHEM 4015). In general, students use the MS-EXCEL software in almost all experiments to do repetitive calculations and construct graphs. It is not necessary to train students in this software because they already learned how to use it in Analytical Chemistry.
- Physical Chemistry Laboratory I (CHEM 4041). In general, students use the MS-EXCEL software in almost all experiments to do repetitive calculations and construct graphs. It is not necessary to train students in this software because they already learned how to use it in Analytical Chemistry. For the experiment of partial molar volume, students use LoggerPro software to construct a graph, draw tangents at several points of the curve and determine the corresponding intercepts. Students receive training beforehand in the use of this software in College Physics Laboratory (PHYS 3013-3014).
- Physical Chemistry Laboratory II (CHEM 4042). In the second part of physical chemistry laboratory, two periods are dedicated to molecular modeling in which a workshop is given to students where molecular modeling methods are discussed. They are trained on the use of the HyperChem software, and then they practice the skills so acquired in the experiments: (1) minimizing the energy of a system (cyclohexane) and measuring its structural properties, and (2) vibrational analysis of the infrared spectrum of ammonia. The theoretical aspects of the workshop cover the following topics: basis sets, single point calculations, geometry optimization, local minima, global maximum, etc.
  The workshop handout describes the procedure for the use of the software translated and summarized from the HyperChem7 Manual. The document consists of the following modules: i) Construction of molecules; ii) Minimization of the energy of a system (cyclohexane) - geometry optimization using the molecular-mechanics (MM) method, and; iii) Measurement of structural properties. The handout includes a worksheet for the modules (ii) and (iii).
  In addition, the students perform a vibrational analysis of the infrared spectrum of ammonia using the *Ab Initio* method. Since the students have already learnt to use the software, they directly follow the procedure given in the software manual and fill a questionnaire provided to them.

5.10 EXAMINATIONS

If ACS standardized final examinations are used in lieu of or in addition to final examinations prepared by the faculty members responsible for the courses, list below all such courses and types of examinations used. Provide profiles of performance in each for the past two academic years (e.g., average percentile rank and range of students compared to national norms). N/A

Name of Course	Examination Used	Required of All Students?		Pattern of Performance
		Yes ☐	No ☐	
		Yes ☐	No ☐	
		Yes ☐	No ☐	
		Yes ☐	No ☐	

5.11 Indicate any courses in Tables 5.1, 5.2, and 5.3 taught by faculty members not holding the Ph.D. degree.

With the exception of General Chemistry Laboratory and Analytical Chemistry Laboratory only a small fraction of the sections, and only in some semesters, are taught by non-PhD faculty.
CHEM 3131 General Chemistry I
CHEM 3132 General Chemistry II
CHEM 3133 General Chemistry I Laboratory
CHEM 3134 General Chemistry II Laboratory
CHEM 3025 Analytical Chemistry Laboratory
CHEM 3153 Organic Chemistry Laboratory
CHEM 4041 Physical Chemistry I (once in last 5 years)

5.12 Indicate any courses in Tables 5.1, 5.2, and 5.3 offered and taught by adjunct or part-time faculty.

Adjunct faculty:
This course was taught by a Faculty member of the Medical Sciences Campus of the UPR.
CHEM 4166 Special Topics in Chemistry: Medicinal Chemistry

Part Time Faculty:
With the exception of General Chemistry Laboratory only a small fraction of the sections, and only in some semesters, are taught by part-time faculty.
CHEM 3131 General Chemistry I
CHEM 3132 General Chemistry II
CHEM 3133 General Chemistry I Laboratory
CHEM 3134 General Chemistry II Laboratory
CHEM 3153 Organic Chemistry Laboratory
CHEM 4041 Physical Chemistry I

5.13 Service Courses

a. List below all the undergraduate chemistry courses taught by the chemistry faculty for majors such as biology, engineering, physics, agriculture, health-related fields, etc. Attach additional pages if necessary.

CHEM-3131 General Chemistry I
CHEM-3132 General Chemistry II
CHEM-3133 General Chemistry I Laboratory
CHEM-3134 General Chemistry II Laboratory
CHEM-3121 Organic Chemistry I
CHEM-3122 Organic Chemistry II
CHEM-3123 Organic Chemistry I Laboratory
CHEM-3124 Organic Chemistry II Laboratory

b. Do undergraduate chemistry majors take any of the preceding courses for credit? Yes ☒ No ☐.
If yes, which courses?

Most of the Chemistry majors are enrolled together in the same section of class and laboratory.
CHEM 3131 General Chemistry I
CHEM 3132 General Chemistry II
CHEM 3133 General Chemistry I Laboratory
CHEM 3134 General Chemistry II Laboratory

Section 5
Curriculum

5.14 Discuss briefly any features of your undergraduate chemistry program and curriculum that you consider to be notable with respect to educational innovation or especially effective techniques that improve and advance the educational process.

The Project-based Model in which the students develop, in a coherent and integrated manner, chemical information skills as well as communication skills is what make different our chemistry program in term of educational innovation. This Project-based Model is distinguished by the use of: team teaching between a chemistry professor and a librarian, modern pedagogical strategies (collaborative learning, demonstrations, use of different online resources, active learning and case studies), assessment of the learning outcomes and an effective feedback of the learning process. In this model the students are instructed and gain experience in effective retrieval and use of chemical literature for research projects in three courses at different levels.

At the first level the students are trained to access primary literature and secondary sources using the ACS Database and Internet. At this level, students begin with the use of SciFinder database to access Chemical Abstracts. In the next level, the students have to select a relevant chemistry topic, define a problem to investigate, complete a comprehensive topic search and retrieve the relevant primary information, synthesize and integrate the information in a mini-review paper and an oral presentation. Finally, at the third level, the students have to carry out a final research project in which they apply the knowledge and skills learned in the previous two courses. The results of the research project are presented in the form of a research report and an oral presentation.

5.15 Please provide two complete copies of the current college catalog.

See attached.

Section 6
Undergraduate Research

6.1 Student Undergraduate Research

Would you use faculty-supervised individual undergraduate research to meet the in-depth course or lab hours requirement?

Yes ☒ No ☐ If no, skip to item 2.

If yes, complete items a-i.

a. If undergraduate research would be used for certification, please submit a sampling of comprehensive research reports or theses prepared by students, representative of multiple disciplines and faculty, with the grade the student received indicated on each.

Number submitted: 6 Should we return these reports? Yes ☒ No ☐

b. Please specify the number of undergraduates who participated in research during the last five years.

Number of Chemistry Students Involved: 87

Number of Chemistry Faculty Members Involved: 6

c. How are students counseled in the selection of a mentor and research project?

The students are provided an orientation at the beginning of the academic year by the Director of the Department about the faculty members involved in research in the Department. Additional undergraduate research programs in the institution such as NIH-RISE (National Institutes of Health - Research Initiative for Scientific Enhancement), NIH-BRIC (National Institutes of Health - Building Research Infrasctructure and Capacity) organize similar orientations to guide students about research opportunities in the different Departments. The students are then free to contact any of these researchers and learn in depth about their respective research projects. Several faculty members offer laboratory workshops in their respective areas of research to the Freshmen (under the NIH-RISE Freshmen skills' workshops). This provides the students a very good opportunity to learn about the research projects of the different faculty members and approach them in case they are interested in joining their research groups.

d. What is the nature of faculty supervision of student research?

The students are mentored in laboratory safety issues, literature review and analysis, experimental design, laboratory techniques, use of basic and advanced instrumentation, data analysis, problem solving, and preparing written and oral presentations and reports.

e. Are students required to prepare final written reports on the results of the project? Yes ☒ No ☐

If yes, what standards are used to determine acceptability of the report?

The reports must be in the format of a peer reviewed scientific journal (in accordance with the American Chemical Society (ACS) guidelines). The reports account for 15% of the final grade.

Section 6
Undergraduate Research

f. Have the results of recent undergraduate research projects been published? Yes ☒ No ☐
If yes, attach a list of publications from the last five years.

1. Luciano, E. M.; Idializ, D.; Pérez, M.; Sanabria, D.; Pagán, M.; Ospina, C. "Antimicrobial and Anticancer Properties of the Puerto Rican Plant Simarouba tulae". PRHSJ 2012, 31, 7.
2. Ospina-Millán, C. A.; Pagán-Ortiz, M.; Carvajal, A.; Claudio, K.; Rivera, J.; Ortiz, I.; Hernández, J. Cytotoxic Screening of Tropical Plants Using Brine Shrimp Lethality Test; Cuadernos de Investigación, Vol. 7; Instituto de Investigaciones Interdisciplinarias UPR-Cayey: Puerto Rico, 2009.
3. TRAMIL Ethnophramacological Survey: Knowledhe Distribution of Medicinal Plant Use in the Southeast Region of Puerto Rico, PRHSJ 2009.

g. Describe the opportunities that students have to present their research.

1. Symposiums at UPR Cayey:
    a. RISE Program Simposium (once per semester)
    b. BRIC Symposium (once per semester)
    c. Semester research symposium in the Dept. of Chemistry
2. Foro Annual de Investigacion (UPR-Medical Sciences)
3. AGMUS (Ana G Mendez University System)Research Symposium
4. SACNAS (Society for Advancement of Chicanos and Native Americans in Science) Annual meetings
5. ACS meetings (PR-LSAMP (Puerto Rico Louis Strokes Alliance for Minority Participation) Technical Meetings; SERMACS (The Southeastern Regional Meeting of the American Chemical Society))
6. IUPAC (International Union of Pure and Applied Chemistry) Meetings
7. ABRCMS (Annual Biomedical Research Conference for Minority Students)

h. How is academic credit awarded for undergraduate research (no credit, limited to a certain number of credit hours, no credit for summer research activities, etc.)?

1. Students can register for the Research course in chemistry (Quim 4999) for upto 3 credits.
2. Students can request (upto 3) credits for summer research experiences on- or off- campus through Quim 4999.

Section 6
Undergraduate Research

i. Describe how undergraduate research is funded.

1. Students receive stipends and funds for purchase of materials from:
   a. NIH-RISE program
   b. Research grants of individual faculty members
   c. NSF-PRLS-AMP Program
   d. Amgen-Bio-Minds (Biotechnology Mentorship Initiative to Develop Scientists) Program
   e. Institutional research grants (FIDI - Programa de Investigaciones del Fondo Institucional para el Desarrollo de la Investigación)
2. Students can receive money for travel to scientific meetings to present their work from:
   a. NIH-RISE program
   b. Research grants of individual faculty members
   c. Amgen-Bio-Minds Program *
   d. Office of the Dean of students
   e. Chancellor's Office

6.2 Cooperative Work

a. Does the chemistry program offer any off-campus cooperative or internship type of work? Yes ☒ No ☐
If yes, provide brief details of the arrangement.

The course of Industrial training (Quim 4017) provides the Chemistry major students with an opportunity to receive on-site training in any of the local industries in areas of Quality control, Good safety practices in laboratory environment, and some specific industrial manufacturing & analytical process. The students also receive theoretical information related to their industrial project from the faculty–in-charge of the course in the Department. The topic and duration of project vary in accordance with the industrial partner and the type of work assigned to each student. The number of credits awarded to the students vary depending upon the agreement between the industrial partner, the faculty–in-charge of the course, and the student concerned. A minimum of 150 h/ 100 h of industrial traning and 30/20 h of consultaion are required for 3/2 credits.

b. Are semester credit hours given for off-campus study? Yes ☒ No ☐
If yes, what is the maximum credit allowed for:

Classroom Work N/A

Laboratory Work 2-3

How much credit would be counted toward ACS certification for classroom N/A ; laboratory 2-3

Section 6
Undergraduate Research

c. How is the nature and extent of off-campus study determined and supervised for each student?

1. The students are required to discuss their work, performed at the industrial site, at least once every week with the faculty–in-charge at the home institution. This accounts for 10% of the final grade.
2. The students are required to submit one mid-term report (10% of the final grade) and another report at the end of the training (20% of the final grade).
3. The students are required to make an oral presentation at the home institution which accounts for 20% of the final grade. This presentation is attended by the faculty–in-charge, other students enrolled in the course, and the supervisor at the industrial site.
4. The evaluation by the industrial supervisor accounts for 40% of the final grade.

d. Are written reports or final examinations required for each off-campus assignment? Yes ☒ No ☐
If yes, provide brief details.
The student is required to submit one mid-term report (10% of the final grade) and another report at the end of the training (20% of the final grade). The reports are evaluated by the faculty–in-charge as well as the industrial supervisor.

e. Total number of students involved in cooperative work for the: current academic year 0
previous academic year 0

Section 7
Student Skills

7.1 Communications

Describe briefly any curricular requirements for other programs designed to assist undergraduate chemistry majors in acquiring competency in:

a. Technical report writing

The chemistry department uses a sequence of three courses ending with Instrumental Analysis. During the course of Instrumental Analysis, the student, as a requirement of the laboratory must do research project in which he or she applies, and integrates the knowledge acquired in the courses of Organic Chemistry II and the Seminar. After completion of the research project the student must present a written report in which technical writing skills are put into practice.

b. Oral presentations

The students who take Instrumental Analysis are also required to present an oral report of the results obtained in the research done in the laboratory. The oral report permits the students to demonstrate the oral communication skills acquired in the seminar course, and Organic Chemistry II.

7.2 Describe how your students are instructed and gain experience with the effective retrieval and use of chemical literature.

We developed and implemented a Project-based Model in which the students develop, in a coherent and integrated manner, chemical information skills as well as communication skills. This Project-based Model is distinguished by the use of: team teaching between a chemistry professor and a librarian, modern pedagogical strategies (collaborative learning, demonstrations, use of different online resources, active learning and case studies), assessment of the learning outcomes and an effective feedback of the learning process. In this model the students are instructed and gain experience in effective retrieval and use of chemical literature for research projects in three courses at different levels.

In the first course, Organic Chemistry Laboratory II, the students carry out a mini-research project (20h) on an assigned topic. As part of the project the students are trained to access primary literature and secondary sources using the ACS Database and Internet. At this level, students begin with the use of SciFinder database to access Chemical Abstracts. They have to be able to efficiently locate chemical and physical properties of substances used in the experiments, including spectra. Also they have to retrieve and use at least three research articles in order to present the research proposal. In the experimental part of the project, the students have to search for additional research articles and use the information to resolve experimental problems. The research findings are presented in the form of a written report and an oral presentation.

Section 7
Student Skills

In the second course, Chemical Literature Seminar (30h), the complete course is dedicated to the development and assessment of chemical information skills. The students have to select a relevant chemistry topic, define a problem to investigate, complete a comprehensive topic search and retrieve the relevant primary information, synthesize and integrate the information in a mini-review paper and an oral presentation

The course includes topics such as: primary literature (research papers, patents, technical reports, thesis, and dissertations), access to primary literature and secondary sources using databases (ACS, Science Direct, Ebsco Host, ProQuest and SciFinder), instruction in different searching strategies, evaluation of the retrieval information as well as online sources, the correct use of the chemical information, preparation of the list of references using the ACS Style Guide and how to prepare an effective oral presentation.

Weekly assignments with different levels of difficulty are used to promote critical reading and use of primary information in the writing of a mini-review paper.

In the third course, Instrumental Analysis Laboratory, the students have to carry out a final research project (26 h) in which they apply the knowledge and skills learned in the previous two courses. The results of the research project are presented in the form of a research report and an oral presentation.

7.3 Describe how your program conveys safe lab practices to students.

Laboratory's safety is a very important issue for our Department and for the Institution. At the Institutional level we have the office of "OSSOPA" that deal with all the security issues including the proper training of all personnel working with chemical, the handling and disposal of waste material, among others. At the Departmental level we have the Security Committee that has the responsibility to work with the Manual of Safety in the Chemistry lab and the Chemical Hygiene Plan. It is established in the Chemical Hygiene Plan that every laboratory must have in working condition eye wash station, showers, fume-hoods. In addition, the consumption of food or drinks is not allowed inside the laboratory. It is also a requirement that every student have to wear lab coat and goggles in the laboratories.

At the beginning of every semester, the students registered in laboratories courses have to take a workshop related with the Material Safety Data Sheet (MSDS). In addition, it is part of every chemistry laboratory course, that during the first period (3 hours) the professors discuss with their students the Manual of Safety in the Chemistry Lab and how to deal with possible emergencies.

The development of a safety culture in our student is achieved by a continuous enforcement about our responsibility with the environment and with our own security. In doing this, the role modeling by the faculty is essential for our students.

Section 7
Student Skills

7.4 Briefly describe the experiences that develop student skills essential for their effective performance as scientific professionals. Address each of these areas in your response: problem solving, teamwork, and ethics.

The student skills are developed in a coherent and integrated manner using a variety of activities throughout the curriculum. The Project-based Model for the Development of Chemical Information Skills, mini-research project in some courses, project-based laboratory experiences and undergraduate research are examples of these activities.

The Project-based Model for the Development of Chemical Information Skills includes activities in two chemistry courses and a seminar course dedicated to the developments of chemical information skills, as well as communication skills. The first activity consists of a min-research project in an assigned topic (biodiesel, bioethanol or optimization of the extraction of a natural product) in the Organic Chemistry Laboratory II course. Students has to review scientific literature, define a research problem, develop a testable hypotheses, execute the proposed experiments, analyze and discuss the data, draw an appropriate conclusion and present their findings in written report and oral presentation. The students work in a collaborative manner the entire project and are evaluated both individually and in group. Also each team member is evaluated by their peers in the group. In this project they begin to work as "scientific professionals", using the scientific method to solving experimental problems in order to find the optimal conditions for their experiments. Laboratory safety, the correct use and disposal of the substances used or produced in the experiments and ethical use of the information are important aspects emphasized.

In the Chemistry Seminar course the student has to select a relevant chemistry topic, define a problem to investigate, effectively review the chemistry literature and retrieve the relevant information, synthetize and integrate the information and present the results in a mini-review paper and oral presentation for their peers and chemistry professors. The course includes a series of activities such as seminars, discussions, demonstrations and assignments prepared to develop problem solving skills, team work skills, communication skills and ethics, among others.

In order to promote an ethical- conscious culture in students, the professional standards are presented in the seminar course. Two codes of conduct "Manual del Código de Ética del Colegio de Químicos de Puerto Rico" and The Chemical Professional's Code of Conduct are discussed. Research misconduct and copyright are also discussed. In a final activity the students present and analyze situations they confront in their chemistry courses that could represent an ethical dilemma. In the discussion, they emphasize the results of their actions, and present possible solutions to help the students to act in an ethical manner.

In the final research project, in the Instrumental Analysis Laboratory course, the student has to define a problem to investigate, effectively review the chemistry literature and retrieve the relevant information, analyze, synthetize and integrate the information and present a proposal, execute the experimental part, analyze and discuss the data and present the results in a written report and oral presentation. The students work in a collaborative manner the entire project and are evaluated both individually and in group. In this project the students must be able to show a high level of proficiency in all skills.

Química

UNIVERSIDAD DE PUERTO RICO EN CAYEY
Departamento de Química

HOJA DE TRÁMITE

FECHA: **30 de octubre de 2013**

A: Dr. José N. Caraballo
Rector Interino

DE: Dr. Wilfredo Resto
Director Interino

ASUNTO: **COMUNICACIÓN DE LA ASOCIACIÓN AMERICANA DE QUÍMICOS- RECONOCIMIENTO DEPARTAMENTO**

Se remite para:

____ Firma	_____ Su atención
____ Enviar al Decanato de Administración	_____ Archivo
_____ Devolver al Departamento de Química	**_X_ Su información**
_____ Su evaluación	_____ Acción que corresponda

Observaciones:

Saludos.

Adjunto encontrará copia de la carta que nos hicieran llegar los miembros del Comité de la Asociación Americana de Químicos (ACS). Esto en relación a la decisión y las razones por las cuales, están reteniendo la aprobación del reconocimiento para el Departamento de Química.

c Dra. Glorivee Rosario, Decana Interina
Dra. María I. Rodríguez, Coordinadora

205 Ave. Antonio R. Barceló, Cayey, Puerto Rico 00736-9997
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Cathy A. Nelson, *Secretary* (202) 872-4589

24 October 2013

Dr. Wilfredo Resto, Acting Chair
Department of Chemistry
University of Puerto Rico at Cayey
205 Antonio R. Barceló Avenue
Cayey, PR 00736

Dear Dr. Resto:

The Committee appreciated the opportunity to talk with you concerning your application for ACS approval of the chemistry program at the University of Puerto Rico at Cayey. The discussion was very helpful to the members in gaining a better understanding of your department and its objectives. You and your colleagues are making excellent progress in the development of the chemistry program, and the Committee encourages you to continue your efforts.

The Committee commended the administration and faculty support for gaining ACS approval of the chemistry program. The large fraction of students who are interested in undergraduate research are well served by the university's policy to allow release time for faculty who have external research grants. The Committee praised the faculty dedication to keeping class sizes small and commended the unique industrial experience that you offer students through the Chemistry of Industry course (Chem 4017).

However, certain aspects of your program are not in compliance with the ACS Guidelines. After evaluating all of the information available on your program, the Committee decided to **withhold approval** because of the issues described below.

- **Frequency of course work.** The ACS Guidelines specify that approved programs must teach all foundation course work and a minimum of four in-depth courses, exclusive of research, on an annual basis. According to Table 5.2, the course used to meet the foundation requirement in biochemistry is CHEM 4065, which is taught on an alternate year basis. In 2011-12, only three in-depth courses were taught, and only one was taught in the 2012-13 academic year. In order to obtain ACS approval, your program must demonstrate the ability to teach the foundation course work and four in-depth courses each academic year.

- **Laboratory requirement.** The Committee was not able to understand how your students would meet the requirement for breadth of laboratory experience. Students must complete a minimum of 400 hours of lab that covers four of the five areas: analytical, biochemistry, inorganic, organic, and physical chemistry. Item 5.2 states that you would require lab course work in analytical, biochemistry, organic, and physical chemistry. According to your records of course offerings, you have not taught the biochemistry lab course (CHEM 4066) in the past five years. You must define the laboratory requirement using courses that are taught on a regular schedule so that students who wish to be certified are able to complete the necessary requirements.

- **Teaching contact hours.** According to Table 3.2 of the self-study questionnaire, Dr. Tirado has responsibility for 21 hours in the fall semester of 2011 and 20 hours in the spring semester of 2012. These totals included supervision of undergraduate research, which is not counted toward the maximum number of contact hours for the purposes of ACS approval. Since a breakdown of hours by course was not provided, the Committee could not determine whether your program is in compliance with this requirement.

In addition, the Committee made the following suggestions for the further improvement of the chemistry program.

Examinations. After reviewing the course materials that were submitted with your application, the Committee agreed that many of the examinations, particularly in the in-depth courses, do not meet the expectation for rigor that is required for ACS approval. Heavy reliance on fact-based and multiple-choice questions on examinations does not reflect a rigorous approach to assessing student learning. Students should be required to demonstrate their problem-solving skills and ability to discuss their knowledge of complex topics, especially in the in-depth courses. A copy of the supplement on the Committee's expectations for curricular rigor is enclosed.

Undergraduate research. From the application package and conference, the Committee understands that the students are very interested in undergraduate research projects and encourages your faculty to continue to develop this component of the curriculum. Some of the projects described in the student reports do not reflect original research, and some students are working with non-tenure-track faculty who may not have been able to establish a robust research program. I have enclosed a copy of the supplement that describes CPT's expectations for undergraduate research at ACS-approved programs.

The Committee believes that your chemistry program is moving in a very positive direction and encourages you to implement solutions that correct the deficiencies identified in this letter. When you have made the necessary changes to your program, you should begin the approval process by submitting a new pre-application.

Please do not hesitate to contact me if you have any questions about the Committee's decision or the requirements for ACS approval.

Sincerely,

Cathy A. Nelson

Cathy A. Nelson
Secretary
Committee on Professional Training

CAN/hdk

Enclosure: Supplement on Rigorous Undergraduate Chemistry Programs
Supplement on Undergraduate Research

ACS Chemistry for Life

Committee on Professional Training

Rigorous Undergraduate Chemistry Programs

The ACS approval program is intended to promote the development of excellent undergraduate programs that, according to the ACS Guidelines, "offer their students a broad-based and rigorous chemistry education that provides them with the intellectual, experimental, and communication skills to participate effectively as scientific professionals." One hallmark of an excellent program is that it is rigorous; however, articulating a clear description of what constitutes a "rigorous" program is surprisingly challenging.

In academic settings, the term "rigorous" is usually defined in a context-specific way. Thus, the goal of this supplement is to elaborate the qualities that CPT seeks as evidence for rigor in periodic reviews. In the CPT vision, a rigorous undergraduate program is comprised of an integrated series of experiences that demonstrate the systematic application of fundamental principles to understanding chemical systems. Hence, in evaluating undergraduate programs, CPT seeks as evidence for rigor certain attributes to be manifest in the curriculum, in faculty instructional approaches, in student competencies, and in the assessment of student learning as described below.

Characteristics of the Curriculum in Rigorous Undergraduate Programs

A rigorous undergraduate curriculum is one that provides both foundation and in-depth course work that

- is appropriately balanced in breadth of content coverage and depth of treatment, and
- introduces students to an appropriately modern, quantitative, and mechanistic molecular perspective of the natural world.

Programs exemplify a rigorous breadth of coverage through offering a significant diversity of courses, particularly at the in-depth level. Supplements that further articulate CPT expectations for coverage in different areas of chemistry are available on the CPT website (www.acs.org/cpt.). Although it is impossible for CPT to consider the detailed content and course materials of every course in a given program in periodic reviews, CPT will evaluate program attributes that are believed to serve as critical indicators of undergraduate curriculum rigor. For foundation and in-depth courses, the depth and sophistication of the textbook used can serve as one proxy for course rigor. In addition, for in-depth courses, syllabi and exams will be thoroughly evaluated for evidence of course rigor. CPT will use in-depth course rigor as a proxy for rigor of the overall undergraduate program. The sophistication and depth of undergraduate research reports will be used as an additional indicator of program rigor.

Characteristics of Faculty Instructional Approaches in Rigorous Undergraduate Programs

The ability to offer a rigorous program depends on a competent faculty with modern disciplinary expertise in both chemistry content and in best practices in undergraduate chemistry instruction. Faculty should engage regularly in activities that sustain their vitality as professional chemists such as attendance at seminars, colloquia and professional meetings and workshops, and should consult on a continual basis the primary chemical literature.

Undergraduate research often provides a capstone experience in a rigorous program. A rigorous undergraduate research experience is one in which students demonstrate

- mastery of independent thought,
- self-direction of activities, and
- application of an integrated, quantitative, and molecularly mechanistic view of chemistry.

Characteristics of Assessments in Rigorous Undergraduate Programs

In evaluating program rigor, CPT will evaluate carefully summative assessments of student learning such as exams. Rigorous assessments are those that require students to demonstrate higher-order problem-solving and conceptual understanding skills. Appropriately rigorous exam formats include

- free response items,
- items requiring multi-step quantitative reasoning,
- items requiring demonstration of molecular mechanistic understanding of reaction pathways and chemical processes, and
- items that stretch students intellectually by requiring application of chemical concepts to new situations.

Exam items that require students to devise experiments to answer questions and that require articulation of chemical reasoning are excellent examples of rigorous assessment. Although one component of a rigorous exam might be multiple-choice items if special attention is paid to the construction of items that elucidate more than simple declarative knowledge, in general, CPT expects that rigorous assessments, especially those used for in-depth courses, will not rely heavily on a multiple-choice format. In addition to faculty-formulated exams, programs may also wish to consider using standardized ACS exams for assessment. Although such exams are necessarily multiple-choice in format, these exams provide a useful vehicle for national, normative-based assessment of student learning.

Strategies for Improvement of Program Rigor

Since appropriate rigor is a critical metric for ACS approval of an undergraduate chemistry program, programs should routinely assess the rigor of their undergraduate chemistry offerings. Should programs wish to further improve the rigor of their offerings, several strategies might be employed. Programs are encouraged to

- consult with colleagues at institutions of comparable size and mission, particularly those with excellent reputations for the production of well-trained undergraduates,
- consult the literature in chemical education for insight into rigorous and modern presentations of chemistry at the undergraduate level, and
- invite well-respected and knowledgeable chemists to consult on issues of undergraduate program rigor.

Attaining appropriate rigor in an undergraduate program is possible over time through careful attention to the programmatic details articulated above and by maintaining a watchful eye on modern developments in chemistry and chemical education.

Undergraduate Research

Research can be the most rewarding and educationally valuable aspect of an undergraduate chemistry degree. Students grow both professionally and personally in ways that are not possible through traditional classroom and laboratory classes. In addition, faculty members and chemistry programs are strengthened and kept vibrant through the pursuit of research and through the mentoring relationships developed via student-faculty collaborative work. The Committee on Professional Training strongly supports departments' efforts to establish active and vibrant undergraduate research programs, recognizing the role that research can play in developing a wide range of student skills. The 2008 ACS Guidelines allow for the use of undergraduate research both as in-depth course work, as well as a means of meeting 180 of the 400 laboratory hours required for certification provided that a well-written, comprehensive, and well-documented research report is prepared at the end of a project. (Samples of such research reports must be submitted with the periodic reports.)

Characteristics of Undergraduate Research

Research is the development of new knowledge or understanding in order to advance science. While the specific areas of research vary immensely in the chemical sciences and in chemical education, there are some traits that are common to undergraduate research in general.

Undergraduate research is conducted with a faculty advisor or mentor. The student's research project is typically based on the faculty mentor's research interests, which allows the student to draw upon the mentor's expertise and resources and also allows the faculty mentor to develop a productive research program. The mentor meets regularly with the student to make research plans, assess risks associated with the proposed research, and review results. The student is encouraged to take primary responsibility for the project and to make substantial input into its direction. The student-mentor relationship also builds student confidence, offers encouragement when necessary, and provides guidance and assistance for the student's future education and career development.

While the nature of each project depends on the specifics of the project, an ideal undergraduate research project:

- represents original scientific work that is intended for publication in a peer-reviewed scientific journal
- has a clearly communicated purpose and potential outcomes

culminate in a thorough written report that includes a thorough description of background work on which the project is based (complete with appropriate references, full experimental details...). The faculty supervisor should constructively criticize drafts of the report. Oral and poster presentations are an extremely useful step in this process. However, a research project must not culminate solely in an oral or poster presentation, as it would not become part of the archived body of knowledge. A written report adds to the permanent scientific knowledge base and can be used by future researchers pursuing related projects.
A separate supplement (available on the CPT website) provides guidelines for preparing a research report. Student co-authorship on a paper, while highly encouraged, is not a substitute for a comprehensive report written by the student. Examples of student research reports must be included with an institution's periodic report if research is used as an in-depth course for student certification. Research done off-campus and/or during the summer, even though it might not be for academic credit, may count toward certification. In such cases, the student must prepare a comprehensive report that is evaluated and approved by a faculty member of the home institution.

19/sep/2014

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Decanato de Asuntos Académicos

INFORME GENERAL: TRABAJOS DE ACREDITACIÓN 2014-2015

Programa:	Química
Agencia de Acreditación:	ACS: American Chemical Society
Coordinador(a) Vicepresidencia de Asuntos Académicos	Dra. Ingrid Montes
Coordinador(a) Decanato de Asuntos Académicos	Dra. María I. Rodríguez
Coordinador(a) Programa o Departamento:	Dra. Elba Reyes

Situación actual con relación a su acreditación profesional	Apoyo que necesita del Decanato de Asuntos Académicos Nivel Central	Apoyo a nivel de la UPR-Cayey y/o actividades	Recomendaciones ACS	Comentarios Adicionales ACS o DAA
El Programa de Química sometió su informe "Self-Study Questionnaire: Application for ACS Approval of the Bachelor's Degree Chemistry Program" en **diciembre 2012**. **Octubre 24, 2013** el Programa de Química recibe contestación del Comité ACS: **Withhold approval status.**	Apoyo y orientación de Vicepresidencia con la Dra. Ingrid Montes.	Aproyar la Programación de reuniones ACS con la facultad de química Apoyo presupuestario para plazas Dar seguimiento al informe **Septiembre 18, 2014**: Reunión con Dr. Wilfredo Resto y Dra. Elba Reyeys, Representante ACS: Tema: Plan de Acción para solucionar los señalamientos.	Vésase attachment: Rigorous Undergraduate Chemistry Programs: Este documento dicta las pautas a seguir de acuerdo a los estándares ACS	Ante la decisión de ACS octubre 2013, DAA recomienda no someter carta de intención hasta que veamos un progreso real en atender asuntos de carácter administrativo. Mientras tanto se debe elaborar un plan de acción con el aval de la facultad de química. Este plan debe incluir el trabajo que se hará en dos áreas importantes para ACS: los aspectos curriculares y rigor del programa. Esto incluye la revisión de exámenes, investigación sub-graduada, personal,

				projección de cursos para los próximo 5 años, colectar data, evidencias de projectos, avalúo, evaluación summativa, distribución de los créditos, carga académica, aprobación departamental de rotación de cursos, y definir el curso capstone, etc. El trabajo para acreditarse es continuo y sistemático. El director tiene la responsabilidad de supervisar que todos los aspectos dirigidos a la acreditación se cumplan. Se le recomendó al Director que planifiquen cursos necesarios para cumplir con estándares ACS. Los cursos de servicio se deben planificar de acuerdo al personal que tiene para atender las secciones sin violentar las certificación que estipula dos preparaciones por profesor, 3 siempre que sea necesario. Es importante el aspecto del laboratorio, y los créditos asignados para cumplir con las horas requeridas por ACS.
Señalamientos: **1.** Frequency of course work: El progrma no sigue las guias de ACS en su oferta de cursos clasificados como "foundation courses".			ACS recomienda programar un mímino de 4 cursos por año de tematica profunda "in-depth courses" clasificados como	DAA recomienda preparar una tabla de rotación de cursos para los próximo 5 años. Debe ser discutirdo y aprobado por la facultad. Este instrumento les ayuda con la planificación de acuerdo a los

2. **Laboratory requirement**: El comité evaluador no entiende como los estudiantes pueden cumplir con su experiencia de laboratorio con solo cuatro de las cinco áreas determinadas por ACS: analítica, bioquímica, inorganica, organica, y química física. 3. El informe reflejó que no se dictó el curso de bioquímica en los pasados 5 años. Por lo tanto, no se logran las 400 horas mínimas requeridas y definidas como la experiencia de laboratorio. 4. **Teaching contact hours**: Se informa que un profesor tuvo 21 horas de			"foundation courses ACS recomienda que definan el requisito de laboratoio utilizando los cursos que se ofrecen de manera regular para que los estudiantes que desean certificarse puedan cumplir con los requisitos necesarios.	estándares ACS. Además, les ayuda a visualizar la cantidad de secciones de cursos de servicio pueden atender por semestre. Además le permite al estudiante ver con anticipación en que momento se dará el curso X. DAA obervo que en el informe no esta claro si deben cubrir las 5 áreas o si con 4 podrían cumplir con la experiencia de laboratorio. Si la meta del departamento es acreditarse con ACS, el DAA recomienda que se planifique de acuerdo a las guías de ACS . Tienen que asegurarse que todos los cursos necesarios para cumplir con la acreditación esten debidamente establecidos en la oferta académica.

contacto en agosto 2011 y 20 horas en enero 2012, estos totales incluyeron las horas de supervisión sub-graduada. Las horas de supervisión sub-graduada no se cuentan como “horas contacto”de acuerdo las guías ACS para su aprobación.			ACS recomienda que se demuestre unicamente las horas de contacto por profesor. Esta tabla del “breakdown” no fue incluida y el comité evaluador no pudo determinar si el programa cumplió con este requisito.	
Sugerencias ACS: **Exámenes:** **1.** ACS señala que los exámenes de los cursos de temática profunda “in-depth courses” no cumplen con el **requisito de rigor**, aspecto importante para la aprobación de ACS. Los exámenes son se selección múltiple y/o basados en hechos (fact-based) (memory level).			ACS recomienda que en los exámenes deben requirir que el estudiante demuestre destrezas de solución de problemas y la habilidad para discutir temas complejos, expecialmente en los “in-depth courses. Según ACS, el progrma debe tener evaluación sumativa del aprendizaje del estudiante tales como exámenes. Los exámenes deben requerir del estudiante que demuestre	**Rigourous Undergraduate Chemistry Programs:** • CPT busca evidencia de rigor de la siguiente manera: • Rigor como una serie de experiencias integradas al programa que demuestren la aplicación sistemática de principios fundamentales del entendimiento de sistemas químicos. • Rigor como attributos que se manifiestan a través del curriculo, en los métodos instruccionales de la facultad, en las competencias del estudiantes, en el avalúo del aprendizaje del estudiante.

			destrezas para la solución de problemas y la comprensión de conceptos. Tales como : • Items con respuestas abiertas • Items que requieren multiples pasos de rasonamiento cuantitativo. • Items que requieren la demostración de entendimiento de los procesos químicos y comprensión de reacciones mecánicas de origen molecular • Items que obligan al estudiante a expandir su conocimiento intelectual mediante la aplicación de conceptos químicos a nuevas situaciones. Exámenes deben requerir que los estudiantes experimenten para contestar preguntas y que articulen un rasonamiento químico para cumplir con el aspecto de	DAA recomienda que se revisen los exámenes y se identifiquen items que se puedan reestructurarse para mejorar el exámen. Además deben tomar en consideración los tipos de items que pueden incluirse de manera que el exámen pondere más en los aspectos de analisis y demostración de su conocimiento.

2. Investigación sub-graduada: Basado en la información subministrada y conferencias, el comité ACS entiende que a pesar del interés de los estudiantes en participar en projectos de investigación sub-graduada algunos de los projectos de los estudiantes descritos en el 'report' de los estudiantes no reflejan investigación de carácter original, y otros estan trabajando con profesores que no son 'tenure-track'. ACS entiende que estos profesores tal vez no han desarrollado sus propias investigaciones			rigor. De usarse exámenes en los cursos "in-depth" deben ser aquellos exámenes estandarizados por ACS. Estos son recomendados por estar normalizados a nivel nacional.	**Carácteristicas de los métodos de enseñanza de la facultad en un Programa Sub-graduado Riguroso según ACS** Un programa riguroso depende de una facultad competente, dotada en su disciplina en áreas de contenido y las mejores prácticas de enseñanza de química. La facultad asiste regularmente a seminarios, coloquios, reuniones profesionales, talleres, y consulta continuamente la literatura en el área de química. Una projecto de investigación sub-grada tiene que ser representativo de inversión sustancial de tiempo, particulamente si es para cumplir como requisitos de hora de laboratorio como descrito en las guías ACS 2008.

acapacidad.				La investigación puede satisfacer un máximo de 4 semestres horas créditos o 6 cuartas horas de un curso de contenido profundo requisito para certificación.