

Final Assessment Report

Chemistry (BSc)

May 2018

Summary of the Program Review:

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the programs (BSc) delivered by the Department of Chemistry. A self-study (Volume I) was submitted to the Associate Vice-President, Academic on September 26, 2016. The self-study presented the program descriptions and learning outcomes, an analytical assessment of the program, and program data including information collected from a student survey along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). Appended were the course outlines for all courses in the program and the CVs (Volume II) for each full-time faculty member in the Department.

Two arm's-length external reviewers (Volume III) (Dr. Boyd, Professor Emeritus of Chemistry, Dalhousie University, and Dr. Natalie Cann, Professor of Chemistry, Queen's University) were ranked and selected by the Associate Vice-President, Academic ; in addition one internal reviewer was selected (Dr. Emmett Macfarlane, Associate Professor of Political Science).

They reviewed the self-study documentation and then conducted a site visit to the University on January 26-27, 2017. The visit included interviews with the Associate Vice-President, Academic; Dean of the Faculty; Faculty Associate Dean of Undergraduate Studies, Chair of the Department, Faculty members, lab instructors and meetings with a group of current undergraduate students. The external review team also had an opportunity to meet with the Liaison Librarian and Head Librarian.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report and the program response.

Program characteristics:

The Chemistry program began in 1957 with the co-op stream added in 1967, whereas the Biochemistry program (joint undergraduate program of the Department of Biology and Department of Chemistry) began in 1980. Chemistry also has joint programs with the Department of Earth and Environmental Sciences (Geochemistry), the Department of Physics and Astronomy (Chemical Physics, Materials and Nanosciences), and the Departments of Electrical and Computer Engineering and Chemical Engineering (Nanotechnology Engineering).

Summary of strengths, challenges and weaknesses based on self-study:

Strengths

- Faculty research funding
- Program ranked extremely highly (nationally and internationally)
- Program offers a larger enrolment co-op option than any other Canadian department.
- Co-operation between other departments to deliver programs (e.g., Biochemistry offered jointly with Biology and Chemical Physics offered jointly with Physics, etc.)

Challenges and weaknesses:

- Total number of required chemistry courses and total number of contact hours significantly exceed the Canadian Society for Chemistry (CSC) and national averages
- Limited number of elective courses
- Co-op employment of students (e.g., nature of job, instrumentation used, etc.) not well communicated to other students
- Limited number of meaningful employment opportunities, especially for early-year Co-op students

Summary of key findings from the external reviewers:

The University of Waterloo offers its students a range of accredited Chemistry programs that is unmatched by any Canadian university. Recent curriculum review and planning processes, coupled with the open and effective leadership within the Department of Chemistry, have strategically positioned the Department to face the future in an increasingly competitive environment.

The Department of Chemistry at Waterloo is one of the most research-active chemistry departments in Canada. Students benefit from learning in a research intensive environment in multiple ways: They gain hands-on research experience by completing fourth-year research projects; they can join a research group as part of a work term in the co-op program; they can work (NSERC USRA, ...) or volunteer in the research groups; and, finally, they have the opportunity to learn from the Department's faculty and to select courses (mostly in fourth year) that align with their interests.

Program response to external reviewer recommendations

External Reviewer Recommendations

1. Self-study reports should contain the detailed program requirements for all degree programs under review.

Response

Programs under review will be instructed to include detailed program requirements with their self-study. This will be communicated by the Quality Assurance Office through improvements to the self-study template.

2. The Dean of Science and the senior administration should ensure that the upgrades of Building C2, in particular the ventilation system upgrade, are to be completed as soon as possible.

Response

The anticipated renovation of the Chemistry-2 building ventilation system is currently undergoing a review and assessment and the Department hopes to be able to proceed with that over the next two years.

3. The Department should review the existing laboratory facilities and develop a plan for space management and upgrade, to align with ongoing equipment/infrastructure renewal.

Response

Space planning and renovations are part of the new annual budget planning process. The Department Executive Committee and Chair will be responsible for ensuring this recommendation is implemented.

4. The future plans of the Department of Chemistry should include a dedicated study space/resource center for Chemistry students.

Response

The review of laboratory space and student study space is an ongoing item that will be addressed as soon as possible – an immediate remedy for the student space is the provision of the departmental seminar room for student study when not in use. The Department also notes the large amount of study and student life space now available in the new STC building.

5. The Department of Chemistry should review its safety procedures at regular intervals.

Response

This is reviewed annually under Policy 34 by the Chair and Safety Committee.

6. The Department should review the coordination of multi-section courses. Course coordinators (if applicable) and instructors should place a high priority on following an agreed-upon timeline for delivering the course content, as students are distressed when sections are out of sync.

Response: Course coordinators are in place for multi-section courses in first year will be responsible for ensuring sequencing and timing of courses is consistent. Communication between instructors will alleviate any timing issues.

7. The Department should review the coordination and grading of CHEM 494 projects. Reminders with respect to the expectations for the time devoted to the project should be widely circulated, information about projects and the course should be circulated to students in a timely manner, and a greater emphasis on grading by reviewers should be considered.

Response

Both the First-Year Coordinator and the Chem 494 Coordinator will report to the Undergraduate Affairs Committee this summer on plans to improve the student experience and orientation in these key courses.

8. The Department should review the coordination of joint programs.

Response

The advisors of the joint programs, particularly Biochemistry (joint with Biology) and MNS (joint with Physics and Astronomy) have met frequently over the last several months since the site visit to implement and communicate curriculum changes, a process which is largely now complete for Biochemistry, and close to final approval for MNS. The comments of the site visit team served as a useful catalyst to complete this work.

9. The Department should review the list of required courses for the Materials and Nanoscience program to ensure that required core courses meet the students' needs and that pre-requisites adequately prepare students for upcoming courses.

Response

Course changes are ongoing at the present moment. The Materials and Nanoscience Coordinating Committee has set the course sequence.

10. The Department should continue to support initiatives that strengthen the library-department relationship.

Response

The Chemistry Liaison Librarian will be invited annually to department meetings to provide updates and receive feedback. Instructors will be reminded of the availability of the library to enhance the program and courses delivered.

11. The Department should review placement information to ensure that co-op students receive a breadth of experiences throughout their co-op program.

Response

The Co-op Coordinator and Chair will annually hold an information session for students in CHEM 100 and 200. As part of Faculty-wide changes, new venues for informing students have been identified, including second year (2A) instructors who can mentor coop students on preparing for their first work term, and peer mentoring by having senior coop students present their final work term reports as posters to junior coop students who can benefit from the range of placements highlighted as well as the experiences of the senior students.

12. We recommend that the Department develop a long-term plan for the sustainability of the 2+2 and 2+1+1 initiatives and that the issue of resources and support be discussed with the Faculty of Science and the University.

Response

The Department will develop a plan with the Dean's Office in summer of 2017 to execute this recommendation. The Dean together with the Associate Dean International has identified a number of steps that may be taken over the next year to deal with these concerns, including the provision of additional teaching resources to support these programs and the international teaching they involve. The Department hopes to fully

address this recommendation over the next year, and will continually monitor the growth of these programs to ensure they are properly supported.

13. The Department should consider discontinuing programs with chronic low enrolments, such as geochemistry and chemical physics.

Response

This is currently under review by the Undergraduate Affairs Committee. Geochemistry has had low enrolments for a number of years and may be discontinued; this will be determined by the Earth and Environment Science department which has taken over administrative leadership of this program. The Chemical Physics program has low enrolment, but requires no special courses and attracts high-achieving students, so will be monitored but maintained for the near future. One option being explored is moving this program from a second-year entry to a first-year entry, making it more visible to students. The Materials specialization of the Chemistry program has been deactivated.

14. We recommend that the Department continue to assess its programs, ensuring that all accredited programs provide outstanding training in chemistry while, at the same time, balancing workload and accommodating diverse student interests.

Response

The Department through the Undergraduate Affairs Committee will continue to review its programs. Since the curriculum has undergone significant changes over the last two years, student success and outcomes will be monitored over the next five years to identify any ongoing or new weaknesses. Continued investment in the lab components will remain a high priority.

15. The Department should consider the implementation of annual Department-level review of the suite of experiments for the labs, with the goal of identifying issues with current experiments and selecting potential new experiments. The external reviewers recommended that the Department explore means, such as assistance from students, to support the lab instructors in updating and developing experiments.

Response

The Chair, along with the Dean and Undergraduate Affairs Committee will plan to adjust workloads so instructors have time for lab updates and development.

16. The Department should review its website to ensure that potential students can easily identify the many programs offered.

Response

The Undergraduate Affairs Committee along with the Associate Chair of Undergraduate program and Dean's Office will work to ensure the website is updated and contains information pertinent to potential students.

17. The Department should review its mechanisms for communicating with successful graduates.

Response

The Undergraduate and Graduate Affairs Committees along the Science Alumni Office will review how it communicates with graduates. The Department will continue to run its exit survey of graduating students and will work with the Science Alumni Office to facilitate ongoing communication with them.

18. The Department should explore opportunities for including student members on committees.

Response

The Chair and Executive Committee are reviewing this recommendation. Student representatives are invited to particular meetings regarding curriculum when appropriate, but attendance by students at every meeting is difficult due to scheduling constraints. Students have been invited to interviews and asked to provide feedback with our latest faculty hire and this practice will continue.

19. The Department should explore opportunities to include more discussion and group work into the curriculum.

Response

This is currently discussed by the Undergraduate Affairs Committee and the Teaching Fellow. Compilation of the various efforts involving group work is ongoing and will be shared throughout the Department for information.

Implementation Plan:

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Self-study reports should contain the detailed program requirements for all degree programs under review	Include in future templates and instructions	Quality Assurance Office	Self-study template will be updated in Fall 2017
2.	The Dean of Science and the senior administration should ensure that the upgrades of Building C2, in particular the ventilation system upgrade, are completed as soon as possible	Evaluation underway	Dean's Office	Two year project planned to commence in March 2018
3.	The Department should review the existing laboratory facilities and develop a plan for space management and upgrade, to align with ongoing equipment/infrastructure renewal	Space planning and renovations are part of new annual budget planning process	Department Executive Committee and Chair	Annually
4	The future plans of the Department of Chemistry should include a dedicated study space/resource center for Chemistry students	Short-term: make seminar room available for students Long-term: review with students	Chair	Short term space allocated in C2; longer term space will follow renovation (point 2) that will be completed in 2020.

5.	The Department of Chemistry should review its safety procedures at regular intervals	Annually reviewed under Policy 34	Chair and Safety Committee	Annually
6.	The Department should review the coordination of multi-section courses. Course coordinators (if applicable) and instructors should place a high priority on following an agreed-upon timeline for delivering the course content, as students are distressed when sections are out of sync	Review with course coordinators in CHEM 120 & 123	First-year Coordinator, UG Affairs Committee and Associate Chair, UG programs	Completed Fall 2017 – will also be an item of focus in all upcoming offerings.
7.	The Department should review the coordination and grading of CHEM 494 projects. Reminders with respect to the expectations for the time devoted to the project should be widely circulated, information about projects and the course should be circulated to students in a timely manner, and a greater emphasis on grading by reviewers should be considered	Additional Orientation with 494 students; Highlight website; New LEARN site as student resource	CHEM 494 coordinator (Chair)	Completed Fall 2017
8.	The Department should review the coordination of joint programs	Coordinating Committees	Chair and Chairs of Biology and Physics and Astronomy	Biochem/Biol Coordinate completed Winter 2017. MNS/Physics coordination completed Fall 2017
9.	The Department should review the list of required courses for the Materials and Nanoscience	Course changes ongoing now; course sequence is set	MNS Coordinating Committee	Completed Fall 2017

	program to ensure that required core courses meet the students' needs and that pre-requisites adequately prepare students for upcoming courses			
10.	The Department should continue to support initiatives that strengthen the library-department relationship	CHEM 100, CHEM 200 and CHEM 494	UG Affairs Committee	Librarian involved in course and department meetings Fall 2017.
11.	The Department should review placement information to ensure that co-op students receive a breadth of experiences throughout their co-op program	Information sessions for students, CHEM 100, CHEM 200, mentoring by second year instructors, peer mentoring by senior coop students	Co-op Coordinator, Chair, instructors.	Annually
12.	The Department should develop a long-term plan for the sustainability of the 2+2 and 2+1+1 initiatives and that the issue of resources and support be discussed with the Faculty of Science and the University	Develop a plan with the Dean's Office. Consult with Department. New dedicated faculty lecturer position undergoing search	Chair, Associate Chair (UG programs) and Dean; Chemistry Executive Committee, Department of Physics & Astronomy	Lecturer to be in place for May 2018. Coordination between departments and Dean's office through ongoing meetings in 2018.
13.	The Department should consider discontinuing programs with chronic low enrolments, including geochemistry, chemical physics and materials specialization in Chemistry.	Geochemistry – referred to EES department; Chemical Physics – new entry point being explored;	UG Affairs Committee	Winter 2018

		Materials Specialization in Chemistry inactivated.		
14.	We recommend that the Department continue to assess its programs, ensuring that all accredited programs provide outstanding training in chemistry while, at the same time, balancing workload and accommodating diverse student interests	Additional plan flexibility introduced beginning September 2019.	UG Affairs Committee	Once new plan is underway, annual assessments of student outcomes will be made.
15.	The Department should consider the implementation of annual Department-level review of the suite of experiments for the labs, with the goal of identifying issues with current experiments and selecting potential new experiments. We recommend that the Department explore means, such as assistance from students, to support the lab instructors in updating and developing experiments	Plan to adjust workloads so instructors have some time for lab updates and development	Chair with Dean on resources; UG Affairs Committee on priorities and implementation.	2018
16.	The Department should review its website to ensure that potential students can easily identify the many programs offered	Website has been revised	UG Affairs Committee, Associate Chair (UG programs), and Dean's Office	Completed Summer 2017
17.	The Department should review its mechanisms for communicating with successful graduates	Under review	UG Affairs and Grad Affairs Committees and Science Alumni Office	Ongoing

18.	The Department should explore opportunities for including student members on committees	Under review	Chair and Executive Committee	Summer 2017 for hiring committees and ongoing with curriculum changes.
19.	The Department should explore opportunities to include more discussion and group work into the curriculum	Second (254), third (360) and fourth year (430) courses have added group activities to their curriculum.	UG Affairs Committee, Teaching Fellow	Winter and Fall 2017.

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.



Date of next program review: _____ 2024
Date

Signatures of Approval:

Chair/Director Date
May 30, 2018

AFIW Administrative Dean/Head (For AFIW programs only) Date
Faculty Dean Date
31.5.18

Associate Vice-President, Academic (For undergraduate and augmented programs) Date

Associate Vice-President, Graduate Studies and Postdoctoral Affairs (For graduate and augmented programs) Date