

***SUBMITTED TO OUCQA FOR INFORMATION – January 26, 2022***

***APPROVED BY TRENT UNIVERSITY’S SENATE COMMITTEE – January 18, 2021***

# Final Assessment Report & Implementation Plan

# BSc in Physics and BSc in Chemical Physics

# Completed by the Cyclical Program Review Committee (CPRC)

|  |  |
| --- | --- |
| **Degree Programs Being Reviewed** | **Bachelor of Science in Physics****Bachelor of Science in Chemical Physics** |
| **External Reviewers** | **Dr. Thad Harroun, Brock University****Dr. James Fraser, Queen’s University** |
| **Internal Representative** | **Dr. Peter Lafleur, School of the Environment, Trent University** |
| **Year of Review** | **2020-2021** |
| **Date of Site Visit** | **March 8, 9, 11, 12, 2021** |
| **Due Date for Implementation Report by the Program** | **April 1, 2023** |
| **Date Prepared by CPRC** | **December 1, 2021** |
| **Date Approved by Provost & VP Academic** | **January 11, 2022** |
| **Signature of Provost & VP Academic** | **Provost & VP Academic Signature - Michael Khan** |

Physics is the central discipline to the natural sciences and is the foundation for modern astronomy, chemistry, biology, medicine, and engineering. Students have the opportunity to study electricity, magnetism, gravitation, electronics, the motion of projectiles, heat, light, sound, and the interactions between the smallest particles that make up matter: electrons, protons, neutrons, and quarks.

Students in the BSc Physics program benefit from hands-on experiential learning in a highly interactive learning environment, with access to advanced equipment and instrumentation. Students will learn to bring abstract and powerful concepts to life by learning complex systems such as quantum materials, lasers technologies, and celestial bodies.

The BSc Chemical Physics program is designed for students who are interested in the study of both physics and physical chemistry. Students will explore the interactions of matter with a telescopic view from the atomic, molecular, and solid state, and will master the techniques required to develop an understanding of the fundamental principles of our physical and chemical world. From the medicines we take to the materials we use, Chemical Physics concerns the why and how of matter in the world around us.

**Executive Summary**

During the 2020-2021 academic year, the Bachelor of Science in Physics and Bachelor of Science in Chemical Physics programs underwent a review. Two arm’s-length external reviewers, Dr. Thad Harroun, Brock University and Dr. James Fraser, Queen’s University, and one internal representative, Dr. Peter Lafleur, School of the Environment, Trent University were invited to review the self-study documentation. The virtual visit took place on March 8, 9, 11 and 12, 2021.

This Final Assessment Report (FAR), in accordance with Trent University’s Institutional Quality Assurance Policy (IQAP), provides a synthesis of the cyclical review of the graduate degree programs. The report considers four evaluation documents: the Program’s Self-Study, the External Reviewers’ Report, the Program Response, and the Decanal Response.

A summary of the review process is as follows: the academic unit completed a self-study that addressed all components of the evaluation criteria as outlined in Trent’s IQAP. Appendices included: Curriculum Vitae, Course Syllabi, Data Tables, Student and Alumni Surveys and a Library Statement of Support. Qualified external reviewers were invited to conduct a review of the program that involved a review of all relevant documentation, self-study, appendices, and IQAP and a virtual visit. During the virtual site visit, reviewers met with senior administration, faculty, students and staff.

Once the External Reviewers’ Report was received, both the Program and Dean provided responses to the Report. The Report identified six (6) recommendations focusing on curriculum. The Cyclical Program Review Committee (CPRC) reviewed and assessed the quality of the degree programs based on the four review documents and reported on significant program strengths, opportunities for improvement and enhancement, and the implementation of recommendations. CPRC identified four (4) recommendations for implementation to improve the quality of the program for students.

The Implementation Plan identifies those recommendations selected for implementation and specifies the proposed follow-up and the person(s) responsible for leading the follow-up. Academic units, in consultation with the respective Dean, will submit an Implementation Report in response to the recommendations identified for follow-up. The Report is due April 1, 2023.

**Significant Program Strengths**

The External Reviewers found that the BSc Physics and BSc Chemical Physics programs provide students with “a strong sense of satisfaction” from the learning experiences created by faculty and the strong community supported by the departments. Additionally, small classes with attentive instructors provide real one-on-one mentorship for students. This is complemented by physical spaces that allow students to work together and support each other. First year offerings use interactive teaching techniques that encourage engagement with the material and many upper year courses blend small group learning sessions with hands-on labs.

**Opportunities for Program Improvement and Enhancement**

As a function of continuous improvement, it is critical to explore opportunities to enhance student-centred education and the learning experience of our students. This section identifies ways in which the program can stay current with the discipline and contribute to student success.

**Post Graduation Options for Students**

Students indicated that they were uncertain of what a physics degree would offer after graduation and the external reviewers believed this might be a factor in students switching to other programs with more obvious career paths. The department should consider creating a specific first year module to inform students of potential careers. Additionally, the department could collaborate with Careerspace and Recruitment to ensure students are aware of post graduate options including: post graduate education, career planning and career development.

**Curriculum Review**

The program in Chemical Physics is encouraged to review curriculum offerings on an annual basis to ensure that:

* the prescribed path to completion in the academic calendar reflect the paths students are currently taking. This may involve:
	+ removing photochemistry and thermodynamics courses from the list of required courses
	+ the addition of upper-year Chemistry courses to the program requirements
	+ new course development to support the program learning outcomes
* consideration is given to other areas of Chemical Physics/Physical Chemistry such as soft-, bio, agri-, or food-materials

**Laboratory Components Review**

Laboratory components should be reviewed on a continuous basis to ensure student success within the program. Specifically, the following should be monitored and/or considered:

* audit laboratory components to ensure that students are meeting the identified learning outcomes
* adjust laboratory offerings to fill knowledge gaps; this may require removing labs that are offering canonical lab experiences (e.g., Millikan oil drop)
* labs should develop student skills that are highly transferable to other non-physics sciences
* student workloads are reasonable in all years of study
* creation of authentic experiential learning opportunities in first year courses eg. PHYS 1001H and PHYS 1002H

**Complete List of Recommendations**

**Recommendation 1**

That a second permanent laboratory learning specialist be hired with contract hours apportioned through the calendar year according to the needs of the department.

*We recognize that recommendations for additional department members are common in reviews, and we are respectful of the University’s autonomy in setting priorities. However, this single hire has the potential to make a disproportionately large difference in the continued pedagogical development, recruitment, and retention.*

**Program Response**

The need for a second permanent laboratory support staff member has been a top priority for the department for the past 5 years. The securing of this position was in the final stages during the program review and the Department is thrilled to have been able to hire this person prior to the Fall 2021 term. With this second Laboratory Demonstrator/Technician the program is in much better position to tackle the other recommendations (specifically Recommendations 3 and 4).

**Decanal Response**

A second permanent demonstrator/technician has already been added to support laboratory learning.

**Recommendation 2**

That the Physics and Chemistry departments take a critical review of the Chemical Physics program pathway and course offerings as they stand.

*In the medium term, the prescribed path to completion in the calendar of courses should be changed to reflect actual paths students are taking. This may involve removing photochemistry and one thermodynamics from the required list of courses and encouraging new pathways that allow for additional options among other upper-year Chemistry courses. Ensuring that [students] are able (and encouraged) to enroll in the 4th year project course should be a second priority.*

**Program Response**

The Departmental curriculum will be taking a close look at the viability of the Chemical Physics program from a course-offering standpoint. Staffing issues outside of the department have constrained the offering of Photochemistry (CHEM 4050) in recent years. The departments are working together to explore both staffing and curriculum. The curriculum committee will furthermore explore modifying Chemical Physics course requirements (especially thermodynamics), including the creation of new courses to serve both degree programs.

**Decanal Response**

The Department is encouraged to review the Chemical Physics curriculum and related course offerings in conjunction with the department of Chemistry.

**Recommendation 3**

That the Physics and Chemistry departments begin long-term planning for either a replacement or wholesale overhaul of the Chemical Physics program.

*We recommend consideration of other areas of Chemical Physics/Physical Chemistry attuned to other growth areas at Trent, such as soft-, bio-, agri-, or food-materials as an innovative direction that might draw more students.*

**Program Response**

The Chair and departmental curriculum committee are currently exploring various ways to strengthen the Chemical Physics degree program and make it attractive to more students. These approaches include the development of new courses, longer-term staffing plans for key courses, and review of program course pathways. We are also exploring opportunities for replacing the Chemical Physics program with new programs that modernise the intersection of chemistry and physics.

**Decanal Response**

Initial discussions have been started to explore a variety of options to strengthen, and possibly expand the Chemical Physics offering, especially in the context of Chemical Physics being the nucleus of a new degree program in the area of Science of Materials or Nanoscience.

**Recommendation 4**

That the department give curricula-wide consideration of labs to create a cohesive structure that covers all focus areas and learning expectations outlined by APS/AAPT, starting with 1001/1002 and ending with 4050.

*With a second laboratory learning specialist as mentioned in the first recommendation, the department can really build a culture of lab-based experiential learning. Inclusion in first year may increase program attractiveness and improve retention and recruitment.*

**Program Response**

The Department agrees that a curriculum-wide review of laboratory activities will further strengthen the experiential learning aspects of the programs. With the second permanent laboratory staff member hired, the department has already begun what we anticipate will be a two-year review process.

**Decanal Response**

With the support staff situation being solidified, the department is now in a good position to review the structure of experiential learning activities and laboratory components in all of their courses from 1st to 4th year.

**Recommendation 5**

That a new learning objective be added to 1001/1002 that helps students understand how the tools of physics are used in a wide range of careers.

**Program Response**

The curriculum committee will consult with course instructors in PHYS 1001H and PHYS 1002H on ways to add advocacy for students to consider majoring in any of the physics program, and for supporting an explicit career-path-related learning objective in both courses, as recommended.

**Decanal Response**

This is an interesting suggestion. An early exposure towards possible careers with a degree in any of the physics programs would assist students to put their discipline oriented learning into the broader perspective of societal needs and career opportunities.

**Recommendation 6**

That the Faculty preserve the Astronomy mission of the Department.

**Program Response**

The Department agrees that with only one astronomer on the faculty the astronomy mission of the Department of Physics & Astronomy is precarious. Furthermore, engagement with the recruitment office and with visitors to open house events confirms that students are clamouring for a larger astronomy footprint at Trent.

**Decanal Response**

The hiring of additional faculty members into the department will be reviewed in the context of Trent’s multi-year academic planning process. If additional faculty appointments are viable, the department would have the opportunity to advocate for a position in the area of astronomy.

**Recommendation 7 (CPRC)**

That the department explore opportunities for students to use primary sources and provide additional writing opportunities other than lab reports.

**Additional Information**

This recommendation has been proposed by the Cyclical Program Review Committee. The External Reviewers’ Report indicated that the Degree Level Expectation - Application of Knowledge, specifically ‘the ability to make critical use of scholarly reviews and primary sources’, was being under served. To improve the overall quality of the Chemical Physics degree program, it is recommended that during the curriculum review the department explore opportunities for students to use primary sources and writing opportunities other than lab reports.

**Implementation Plan**

The Implementation Plan provides a summary of the recommendations that require action. The Academic Unit in consultation with their Dean will be responsible for moving forward with the recommendations to ensure that each is completed within the recommended timeframe. The Academic Unit will submit an Implementation Report to their Dean reporting on the completion and/or status of each recommendation. The Dean will review the Implementation Report prior to submitting the report to the Office of the Provost.

**DUE DATE FOR IMPLEMENTATION REPORT: April 1, 2023**

|  |  |  |  |
| --- | --- | --- | --- |
| **Recommendation** | **Proposed Follow-Up**If no follow-up is recommended, indicate ‘No follow-up report is required’ and provide rationale | **Specific Timeline**Indicate specific timeline for addressing or completing recommendation | **Position Responsible for Leading Follow-up** |
| **Recommendation 1**That a second permanent laboratory learning specialist be hired with contract hours apportioned through the calendar year according to the needs of the department. | No follow-up is required. Dean has indicated that this position has already been hired.  |  |  |
| **Recommendation 2**That the Physics and Chemistry departments take a critical review of the Chemical Physics program pathway and course offerings as they stand.**Recommendation 3**That the Physics and Chemistry departments begin long-term planning for either a replacement or wholesale overhaul of the Chemical Physics program.**Recommendation 7 (CPRC)** That the department explore opportunities for students to use primary sources and provide additional writing opportunities other than lab reports. | Department, in consultation with the department of Chemistry, to start a curriculum review of the BSc Chemical Physics degree. The review should include exploring possibilities of expanding or revitalizing the program. | April 2023 | Chairs of Physics & Astronomy and Chemistry in consultation with Dean of Science |
| **Recommendation 4**That the department give curricula-wide consideration of labs to create a cohesive structure that covers all focus areas and learning expectations outlined by APS/AAPT, starting with 1001/1002 and ending with 4050.  | Department to start review of laboratory components with the goal to develop a cohesive succession of experiential learning opportunities. | Dec 2022 | Chair  |
| **Recommendation 5**That a new learning objective be added to 1001/1002 that helps students understand how the tools of physics are used in a wide range of careers.  | Department to consider specific first year module to make students more aware of potential careers with a physics degree | Dec 2022 | Chair |
| **Recommendation 6**That the Faculty preserve the Astronomy mission of the Department.  | Additional faculty positions, including Astronomy, will be addressed in the context of (multi-year) staffing plans |  |  |