Cyclical Program Review Final Assessment Report and Implementation Plan for the Academic Programs Offered by the Department of Physics, Engineering Physics and Astronomy

Programs Reviewed:

- Physics: Bachelor of Arts, Bachelor of Science, Bachelor of Science (Hons), Bachelor of Science (Hons) (Specialization).
- Astrophysics: Bachelor of Science (Hons) (Specialization).
- Mathematical Physics: Bachelor of Science (Hons) (Specialization).
- Engineering Physics: Bachelor of Applied Science, Bachelor of Applied Science (Internship).
- Physics, Engineering Physics, and Physics and Astronomy: Master of Applied Science, Master of Science, Doctor of Philosophy.

In accordance with Queen's University Quality Assurance Processes (QUQAP), this final assessment report provides a synthesis of the external evaluation, internal responses, and assessment of the above programs. This report identifies the significant strengths of the programs, and opportunities for program improvement.

An implementation plan is attached that identifies:

- who will be responsible for acting on and monitoring progress on the recommendations,
- any resource or governance implications resulting from the recommendations, and
- timelines for implementation of the recommendations.

Final Assessment Report: Executive Summary

Summary of Review

1) The Department of Physics, Engineering Physics and Astronomy produced a self-study document that was reviewed by the Deans, Faculties of Arts and Science and Engineering and Applied Science, the Vice-Provost and Dean, School of Graduate Studies and Postdoctoral Affairs, and the Vice-Provost (Teaching and Learning). The self-study was approved on February 27, 2023.
2) The review team visit took place on March 26-29, 2023. The review team members were:
    i. Dr. Wendy Taylor, Professor, Department of Physics and Astronomy, York University.
    ii. Dr. Martin Williams, Associate Professor, Department of Physics, University of Guelph.

iii. Dr. Peter Taylor, Professor, Department of Mathematics and Statistics, Queen's University

3) The visit included meetings with
   i. Undergraduate and graduate students
   ii. Faculty members
   iii. Administrative and technical staff
   iv. Department Head, Undergraduate and Graduate Chairs
   v. Directors, McDonald Institute
   vi. Heads of cognate departments
   vii. Dean and Associate Dean, Teaching and Learning, Faculty of Arts and Science
   viii. Associate Dean, Academic, Faculty of Engineering and Applied Science
   ix. Interim Head Engineering and Science Librarian
   x. Vice-Provost and Dean and Associate Dean, School of Graduate Studies and Postdoctoral Affairs
   xi. Vice-Provost (Teaching and Learning)
4) The review team reported on May 10, 2023. The Department Head, both Faculty Deans and the Vice-Provost and Dean (School of Graduate Studies and Postdoctoral Affairs) provided responses to the review team report.
5) The Senate Cyclical Program Review Committee considered all the documentation, and a draft Final Assessment Report and Implementation Plan, at its meeting on November 27, 2023. The Report and Plan was approved on January 22, 2024.

The following strengths were noted:

- The programs attract high-performing students.
- Students receive instruction and supervision from faculty who maintain active research programs and regularly publish in top journals.
- Innovative Teaching (Undergraduate programs). The Department is a leader in teaching and learning across the institutional landscape and should be applauded for its continued efforts to innovate and implement evidence-based teaching and learning practices. These efforts are recognized and validated by its many award-winning professors.
- Faculty members include several research award winners, including a Nobel Prize and Breakthrough Prize recipient.
- The Department hosts a Tier 1 Research Institute, the Arthur B. McDonald Canadian Astroparticle Physics Research Institute, which partners with 13 universities and research institutes across Canada.
- The graduate students unanimously reported satisfaction with their graduate research learning experience.
- Dual-Faculty Program Delivery Mode (Engineering Physics undergraduate program). This mode of delivery is uncommon, beneficial to students, and an important strength. Continued efforts to resolve budgetary challenges are essential to the continued success and long-term viability of the Engineering Physics undergraduate program.

- Intra-Faculty Collaboration (Graduate programs). The review team applauded the Department for its efforts in fostering and growing the interdepartmental graduate program partnership and research collaboration with the Department of Chemistry. Ways to further strengthen and enhance the quality of graduate programming through this relationship should be explored, supported, and encouraged as the skills acquired and benefits to graduate student learning and success are numerous and obvious.
- The Department has engaged with the community beyond the University through public science outreach events, a science summer camp for middle-school girls, and even the development of inexpensive mechanical ventilators during the COVID-19 pandemic.

The following opportunities for enhancement were noted:

- The current undergraduate and graduate programming offered by the Department is strong and in demand. Curriculum is dynamic and it is imperative that the Department continues to be forward-thinking by exploring opportunities to strengthen, enhance and expand its current curriculum and offerings. The review team found the department well-positioned to do this, encouraged by the enthusiasm and vision of recent faculty hires and the work and vision of the curriculum committees.

<u>Curriculum Enhancements</u>

a) Equity, Diversity, Inclusivity, and Indigenization (EDII)
The institutional efforts at incorporating EDII into the fabric of its institutional learning outcomes are visionary. It is hoped that these outcomes are assimilated and manifest themselves shortly in the Department's program and course learning outcomes.
The department's current efforts and successes in improving representation amongst its student body are to be lauded. Its first gender-parity graduating class is an important accomplishment but continued urgent efforts are necessary to ensure that this accomplishment does not become a statistical anomaly. The continued unwavering commitment of the Department to prioritizing the enrolment, recruitment and support of students who self-identify as belonging to underrepresented people groups is crucially important.

b) Science Communication and Technical Writing
An area of the curriculum that should be reviewed and strengthened is science communication and technical writing. These skills should be explicitly embedded, and the associated learning outcomes assessed at the various levels of the curriculum.

<u>Teaching and Learning, Mental Health and Wellbeing</u>
The review team supported the Department's self-assessment that there is need for improved access to mental health supports for students. These are essential elements for ensuring holistic student education and learning and program success. The University's "Academic Consideration" resource, whereby a student can request through a central website a

no-questions-asked 3-day extension, was also highlighted for praise by students and faculty as a significant contributor in dealing with program-related stresses and mental health issues.

Sustainability of Programming Quality

The review team found that the faculty complement is fully optimized to ensure and sustain the quality of programming currently being delivered. If the current trajectory of increasing student numbers continues, the review team strongly recommends that the Department's current complement of faculty and staff be appropriately increased to ensure program delivery quality.

Summary of Review Team Recommendations

The review team made 8 recommendations in the following areas:

- Revising program level learning outcomes to integrate recent changes to Queen's Degree Level Expectations on equity, diversity, inclusion and Indigenization.
- Development of elements of the undergraduate programs including:
    - computational skills
    - learning and assessment structures common to Arts and Science and Engineering and Applied Science students.
- At the graduate level, recommendations include enhanced tracking of students' progress, consideration of appropriate core course requirements, and evaluation of graduate student funding levels.
- Health and safety, building maintenance and repairs.
- University processes that support program quality and the student experience, including timely student payments, enhancements in dealing with academic integrity issues, and consultation with academic units on changes initiated at the University level.

Status

The academic programs in the Department of Physics, Engineering Physics and Astronomy have been approved to continue.

Dates monitoring reports due:	September 2025, January 2028
Date of next review:	2029 – 2030 academic year
Prepared by Vice-Provost (Teaching and Learning)	November 20, 2023
Approved by the Senate Cyclical Program Review Committee	January 22, 2024

Implementation Plan

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
1. That, within the next 18 months, the Faculty of Arts and Science work with the academic unit to address the deficiencies of the learning spaces (undergraduate laboratories and graduate offices) in Stirling Hall by, e.g., regular custodial maintenance, necessary repairs throughout, upgrading of lighting throughout, replacement of graduate student office furniture, etc., to ensure that these spaces are conducive to learning.	Work closely with central services to ensure: - critical repairs are pushed forward - accessibility improvements continue - sustained focus on custodial maintenance standards.	Department Head and Department Manager	Very large resource implications for repairs (significant deferred maintenance costs).	December 2025
2. That, within the next 18 months, the academic unit introduce equity, diversity, inclusion and Indigenization objectives into their Program Learning Outcomes to ensure that the revised Queen's	Curriculum review involving the three departmental curriculum committees and EDIIF committee.	Department Head, Undergraduate and Graduate Chairs, working with Centre for	Several departmental committees will be involved. Approval at Faculty level.	Consultation complete, changes made by April 2024. Implementation September 2025.

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
Degree Level Expectations are being met in the programs in time for the next cyclical program review.	Consult relevant stakeholders on proposed changes to program-level learning outcomes (PLLOs). Make changes to the PLLOs.	Teaching and Learning and Human Rights and Equity Office.		
3. That, within the next 2 years, the University work through the relevant channels to streamline the academic integrity investigating and reporting procedure to minimize instructor workload, and to implement a centralized pan-university Academic Integrity Departures database for recording student academic integrity infractions to ensure that information about academic integrity departure cases is available across Departments and Faculties.	Responsibility for academic integrity procedures lies with the Provost's Office. The chair of the Senate Cyclical Program Review Committee (SCPRC) will inform the Provost of this recommendation by April 2024.			
4. That, within the next 6 months, the Faculty of Arts and Science work with the academic unit to reduce delays of financial payments and reimbursements to both undergraduate and graduate students; an acceptable payment	Faculty of Arts and Science to provide additional interim support to help with backlog and ensure that sustainable support is in place.	Faculty Office, Arts and Science, and Department Manager.	Resource implication of additional interim support.	

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
processing time is approximately 2 weeks. This includes hiring temporary staff in a timely manner to replace financial administrative staff who are on long-term leaves, e.g., maternity. In addition, the academic unit should restore cash advances or develop an acceptable alternative.	Department to develop a plan to communicate effectively with students around timesheet deadlines and importance of maintaining valid student visas. SCPRC to request that the Vice-Provost and Dean (SGPSA) discuss with the Vice-Principal (Finance and Administration) the negative impact on graduate students caused by lack of travel advances.	Department Manager Vice-Provost and Dean, SGSPA		September 2024. December 2024.
5. That, within the next 6 months, the academic unit prioritize adherence to health and safety regulations throughout the building, e.g., the installation of the chemical shower on the 5th floor that was requested by the Program Associate, and replacement of damaged floor tiles in the labs and offices.	Departmental safety committee to meet regularly with mandate to ensure that the building is equipped and operated safely. Joint Health and Safety Committee inspection of building.	Departmental safety committee.	There may be financial resource implications for repairs necessary to ensure safety.	Regular safety committee meetings to take place on an ongoing basis. JHSC inspection Fall 2023.

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
6a. That the academic unit consider explicitly including computational skills in the undergraduate Physics program learning outcomes and that it work with the School of Computing to offer a 3.0 credit specialized computing course for Physics students.	Determine whether existing 100-level Computing courses meet Physics students' requirements. Address whether students with demonstrable computing proficiency can be exempted from a first-year course requirement. Develop robust, organized physics computing curriculum as part of planned revisions to the BScH Physics Major program.	Physics and Astronomy Curriculum Committee	None apparent at this time.	Exploratory work by end summer 2024. Proposals put forward to department Fall Term 2024. Wider revisions implemented by Fall 2027.
6b. That the academic unit be proactive about fostering positive and caring interactions within the diverse undergraduate student community. This would include interactions between students and teaching assistants.	Enact proposals of Student Support Committee in this area (e.g. additional training in EDII, gatherings between community members). Implement departmental policy re: faculty members' responses to students requiring additional support. Review this issue annually at student feedback sessions.	Department Head, Graduate & Undergraduate Chairs and Departmental Student Council Chair.	Additional UG support to conduct first-year information sessions. Support from Departmental Student Council.	Beginning 2023-2024: annual review thereafter.

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
	Ensure TAs are completing mandated training in equity, teaching and supervision. Identify/provide training for TAs on building inclusive community.			
6c. That the academic unit be proactive about clarifying the ways in which learning structures and assessment structures are formed to handle students belonging to two different programs (Physics and Engineering Physics) in a single course, e.g., the Physics students see on the onQ system the grade distribution for Physics students only (likewise for the Engineering Physics students), which can lead to tensions between the two student cohorts.	Continue discussion begun at strategic retreat on managing differences in attitudes and expectations from students in the two cohorts.	Department Head, Undergraduate Chair.		Ongoing, informing changes such as the revisions to BScH Physics Major by Fall 2027.
6d. That the Faculty of Arts and Science work with the Faculty of Engineering and Applied Science to ensure that a proportion of the higher tuition of the Engineering	Continue targeted fundraising for laboratory equipment. Convene discussions with the Faculties of Engineering &	Department Head	Resource implications are at the heart of this recommendation.	New equipment in place by end Fall term 2023.

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
Physics students go directly to modernizing the upper year laboratory equipment.	Applied Science and Arts and Science on funding model for Engineering Science programs, including Engineering Physics.			Fall term 2023.
6e. That the academic unit regularly encourage instructors to be mindful of balancing the amount of material covered in a course and the efficacy of the learning process. Students reported concerns about such an imbalance in some upper-year courses.	Review upper-year courses alongside the full review of the BScH Physics Major and Minor, and BASc Engineering Physics Major. Consider discontinuing specialization plans to direct more faculty resources to upper-year course offerings.	Undergraduate curriculum committees	None apparent at this time.	Exploratory work by end summer 2024. Proposals put forward to department Fall Term 2024. Wider revisions implemented by Fall 2027.
7a. That the academic unit ensure that both Masters' and PhD supervisory committees are formed within the first year of the student's degree. 7b. That the academic unit enforce annual mandatory meetings with the supervisory committee to assess the student's progress in all graduate programs.	Explore possibilities for implementing this recommendation, including reducing the size of supervisory committees and creation of a graduate student database.	Graduate Chair, Graduate Steering Committee, Graduate Physics Society.	Resource limitations may influence the department's ability to implement the recommendation in full.	Exploration by end of 2024-2025 academic year. Implementation to begin Fall term 2025.

Recommendations	Proposed Follow-up	Responsibility for Leading Follow-up	Resource or Governance Implications	Timeline for Addressing Recommendation
7c. That the academic unit consider degree and program learning outcomes as they contemplate alternative definitions of the core course requirements in order to better serve the diversity of research disciplines.	Update the core course requirements. Revise program-level learning outcomes to reflect the recently updated Degree Level Expectations.	Graduate Chair, Graduate Steering Committee, consulting with Centre for Teaching and Learning.	Support from Centre for Teaching and Learning.	By end Fall term 2024.
7d. That the academic unit offer the core courses regularly, e.g., at least once every two years.	Coordinate a plan to offer core courses at least every two years. Conduct longer-term planning to anticipate the needs of research groups.	Department Head, Graduate Chair.	Faculty resources are a limiting factor.	By end of 2024-2025 academic year.
7e. That the academic unit re-evaluate the graduate funding levels, in light of the recent dramatic increase in cost of living in Kingston	Minimum guaranteed funding level to be increased.	Department	Resource implications.	April 2023 (action complete).

The Deans of Arts and Science and Engineering and Applied Science are responsible for monitoring the implementation plan. The details of progress made will be presented in monitoring reports to the Vice-Provost (Teaching and Learning), submitted to the Senate Cyclical Program Review Committee (SCPRC) for approval and to Senate for information. All monitoring reports will be posted on the university web site.

Final Assessment Report & Implementation Plan	**Date approved by SCPRC** January 22, 2024
Vice-Provost (Teaching and Learning)	_____ **Signature**
Vice-Provost and Dean, School of Graduate Studies	_____ **Signature**
Dean, Faculty of Arts and Science	_____ **Signature**
Dean, Faculty of Engineering and Applied Science	_____ **Signature**
Final status of academic programs in the Department of Physics, Engineering Physics and Astronomy	**Approved to Continue**
Date of next program review	**2029-2030 Academic Year**

Next Steps for Department

Monitoring reports to be submitted 18 months and 4 years after receipt of the signed Final Assessment Report: September 2025 and January 2028**.** The provost's office will remind the department of the deadlines nearer the time and provide a template for these reports.