Four Year Report (2026)
Physics
Graduate and undergraduate Programs
(reviewed 2021-22)

A. Summary of Review

1. This review was conducted under the terms and conditions of the IQAP approved by Senate on May 25, 2016 and the Codicil to the Brock IQAP, approved by Senate December 15, 2021, which served until the revised IQAP was fully approved by the Quality Council and Senate in 2023.

2. The Review Committee consisted of two external reviewers: Mark Gallagher (Lakehead University), David Feder (University of Calgary) and one internal reviewer, Karen Campbell (Brock University).

3. The virtual site visit occurred on April 11, 13, 14, 2022.

4. The Final Assessment Report was approved by Senate on December 7, 2022.

5. The academic programs offered by the Department of Physics that were examined as part of the review are listed below, with the reviewers having assigned the following outcome categories:

Program (s)	Excellent Quality	Good Quality	Good Quality with Concerns	Non-Viable
PhD		X		
MSc		X		
MSc Materials Physics (ISP)		X		
BSc (Honours and Pass)		X		
BSc (with Major)		X		
BSc (Honours) Co-op			X	
Combined Major (Honours) with Computer Science, Mathematics and Statistics			X	
Combined Major (Honours and Pass) with Biological Sciences			X	

Additional information associated with the outcome categories:

- Concerns raised by the Review Committee leading to the Program Outcome Categories above, were "…consistently low enrolment in upper-year undergraduate and graduate courses presents its own challenges. Offering courses annually with as few as a single student may not be the best use of departmental resources. Furthermore, three programs have had little or zero uptake, and are assessed as "good quality with concerns". The review Committee asked that these three programs be critically assessed.

6. The next review of the Physics programs will be in 2029/30.

B: Recommendations

Recommendation #1

The department should consider opening the MSMP program to domestic students.

ARC Disposition of the Recommendation

ARC considers the recommendation to expand the MSMP program to allow for domestic students be accepted and in the process of implementation. The Committee expects that the Department will proceed through normal channels of advocacy for any associated space requirements.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Extend offers for MSMP to all qualified MSc applicants.	GPD	T	T	O
Action #2 Survey applicants and alumni on perceptions and outcomes of MSMP.	Chair	T	T	O
Action #3 Open MSMP for domestic students in Fall 2024, subject to departmental approval.	Chair/GPD	T	D	D

Explanation of Actions Taken, Status and Results:

The Department has carefully considered the recommendation and strongly feels that there would be negligible interest in a course-based MSc among domestic students. The program is designed for international students who are under-skilled or have only limited training adjacent to Materials Physics. It remains outside the department's resources to expand the program where we can meaningfully upskill domestic students. Nevertheless, the GPD now extends offers of acceptance to the MSMP program to all qualified applicants, of the thesis-based MSc program who were not matched with a research supervisor. We continue to track and update post-graduate employment data for all MSMP graduates.

Recommendation #2

The department should evaluate the viability of the combined majors programs.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee expects that the Department will consider the viability of the combined major programs as part of a larger curriculum review.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Identify issues and trends in combined majors and minors.	Chair	T	O	O
Action #2 Recruit among students taking year-1 Physics courses.	Chair	T	O	O

Explanation of Actions Taken, Status and Results:

The Department strongly feels that the modular nature and zero-cost of combined major programs are a strong incentive to keep the combined majors as a recruiting tool. Our streamlined proposal, restructuring the major into a core with concentrations (See Recommendation #7) highlights the modular nature of combined programs, giving students choice of specialization or breadth.

Coincidentally, the recently proposed modular degree structure (degree architecture modernization) for Brock shows a strong desire for creatively combined degrees. Should the proposal be adopted university-wide, there will not be a need for these specific combined majors, and we will discontinue them. Until then, the current combined majors remain the best way to combine STEM degrees.

Recommendation #3

We recommend that a thesis be required in the Honours program.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted for consideration. The Committee believes that the Department is best placed to determine the feasibility of a thesis being required.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Establish learning outcomes related to science writing and communication.	Chair/Senior Lab Supervisor	T	O	O
Action #2 Introduce scientific writing skills in PHYS 4F90.	Senior Lab Supervisor	T	O	O
Action #3 Extend thesis requirement to all Honours students.	Chair	D	C	

Explanation of Actions Taken, Status and Results:
The Department added PHYS 4F90 (Research Project I) as a required course in year 4 of the Honours program beginning in the 2024-2025 Calendar. Student research will be the capstone feature of an Honours degree going forward.

Students in this course have regular individual and peer reviews of their written work and presentations. This change was well received, and we have found good projects for all students, including projects in physics education research for our concurrent education students. We have also incorporated the opportunity to conduct research as a central message for our recruitment process.

Recommendation #4

The department should consider offering both an algebra-based and a calculus-based stream to students in first year.

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted and in the process of implementation. The Committee encourages the Department to continue working with the Yousef Haj-Ahmad Department of Engineering as they undertake these curriculum changes.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Departmental Action Team (DAT) on first-year courses formed.	Year 1 DAT	T	C	
Action #2 Adjusted lab schedule to accommodate enrollment increase.	Lab Supervisor	T	O	O

Explanation of Actions Taken, Status and Results:
Calculus-based PHYS 1P95 (Physics for Scientists and Engineers I) and PHYS 1P96 (Physics for Scientists and Engineers II) were introduced in the 2024-2025 Calendar. Enrollment in the first two iterations went from 35 to 50.

Several Physics majors have taken part alongside Engineering and other motivated students. The Department curricular committee monitors all the first-year courses and is looking forward to continued growth in those courses.

Recommendation #5

That the Major and Honours programs require COSC 1P02 [Introduction to Computer Science] and the [Introduction to] Scientific Computing course ([PHYS] 4P10).

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted for consideration. The Committee expects that the Department will consider requiring COSC 1P02-Introduction to Computer Science and PHYS 4P10-Introduction to Scientific Computing as part of a larger curriculum review.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Departmental Action Team (DAT) on Computation formed.	Computational DAT	T	C	

Explanation of Actions Taken, Status and Results:
PHYS 1P97 (Essential Skills for the Modern Scientist), which weaves together introduction to programming, scientific thinking and problem solving, was introduced in 2024, and will continue to be a required component of the Honours program. Currently there is no room in the program's year 1 or 2 for a dedicated course in computer programming, thus PHYS 1P97 will serve that role.

PHYS 4P10 (Introduction to Scientific Computing) is now a core requirement in two Concentrations of the Honours degree.

Recommendation #6

We recommend the use of key software: Matlab, LaTeX, MS, Python, and Mathematica / Maple.

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted for consideration. The Committee expects that the Department will consider the use of key software as part of a larger curriculum review.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Departmental Action Team (DAT) on Computation formed.	Computational DAT	T	C	

Explanation of Actions Taken, Status and Results:
Both PHYS 1P97 (Essential Skills for the Modern Scientist) and PHYS 4P10 (Introduction to Scientific Computing) now fully incorporate Python and Matlab. The department has purchased Overleaf subscriptions (an online LaTeX system) for thesis-based students (4F90 and graduate). We provide training for students to use the free version for lab reports in several other courses.

Recommendation #7

That the department evaluate course offerings with an eye on streamlining courses.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee encourages the Department to continue working with the Department of Mathematics and Statistics and others as they evaluate their course offerings.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Math curricula review completed, and significant program changes recommended.	Math DAT	T	O	O
Action #2 The Department will monitor course enrollments considering the changes to the Math curricula.	Chair	T	O	O

Explanation of Actions Taken, Status and Results:

Since the review, we have dramatically streamlined required MATH courses (see Recommendation #12), which have allowed us to more effectively schedule PHYS courses with an eye to the students' interests. We submitted Calendar changes in 2025 to modularize the program with four Concentrations, differentiating the Brock program from most Ontario programs, adding valuable credentials to student's transcripts, and showing students different pathways to STEM careers.

By coincidence, if the proposed overhaul and modularization of the Brock degree program is adopted, our streamlining review will make it easier to adopt.

Recommendation #8

Remove courses not offered in the past six years from the calendar.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee again encourages the Department to continue working with the Department of Mathematics and Statistics and others as they evaluate their course offerings.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Removed from the Calendar several courses no longer offered.	Chair/GPD	T	C	

Explanation of Actions Taken, Status and Results:
In 2022, the Department removed 7 older courses that have not run in several years, nor had the prospect of being scheduled in the near future. The department has implemented a two- or three-year, on-off cycle for all the courses currently listed in the calendar.

Recommendation #9

The review team strongly recommends that the department should avail themselves of the resources of the Brock Library to integrate library or information literacy skills into the curriculum.

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted and in the process of implementation. The Committee expects that the Department will work with the Library to utilize the resources of this unit to integrate information literacy skills into the curriculum.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Continue to communicate with the Faculty Library Team on Digital Scholarship, acquisitions, and OER.	Chair	T	O	O

Action #2 Incorporate explicit Information Literacy Instruction into courses.	Department	T	O	O

Explanation of Actions Taken, Status and Results:
The department now holds annual Library Updates for both graduate and undergraduate students in key courses (e.g. PHYS 1P97, 4F90, 5N01, 5N02).

Recommendation #10

The department should work with the Centre for Pedagogical Innovation and Co-op / Experiential Education group to bolster communication and professional skills.

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted and in the process of implementation. The Committee again expects that the Department will work with CPI, CCEE, and the Library, to utilize the resources of these units to bolster communication and professional skills within the curriculum.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Careers skills development with CCEE and CPI.	Chair	D	T	O

Explanation of Actions Taken, Status and Results:
The Department has worked with CPI in the last couple of years on ed-tech issues, such as improved use of Brightspace LMS. All graduate students and 4th year students considering Teaching Assistant positions are regularly recommended to attend all CPI leadership and instructional skills workshops as they arise.

The Department has met in the last year with teams from Co-op, Career, and Experiential Education (CCEE) and they have provided useful and detailed reports on our Co-op students and their placements. Already we have used information from these reports in recruiting efforts. With this deeper connection with CCEE, the Department Curriculum Committee is developing action items for 2026 and forward to monitor, assist, and motivate co-op students.

Recommendation #11

The department should work to develop a Strategic Plan which includes an analysis of faculty workload.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted. The Committee believes that the Department is best positioned to determine appropriate strategies to move forward with developing a Strategic Plan.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Department Action Team (DAT) formation in 2023.	Chair	T	C	
Action #2 Identify and monitor workload issues.	Chair	T	O	O

Explanation of Actions Taken, Status and Results:

The Department has been intensely planning workload issues with an eye to retirements in 2026 and 2027 and shifting workload patterns as the number of year-1 students continues to grow. The Chair and GPD have also rectified collective agreement workload issues from past practice and updated them in the Departmental policies and procedures.

The resulting four-year plan (2025-2029), reviewed with the Dean, lays out how we can successfully deliver the program, accounting for sabbaticals, retirements, and teaching releases for research.

Recommendation #12

The department should conduct a thorough inventory of Mathematics courses required for degree completion and the topics therein.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee expects that the Department will conduct a thorough inventory of Mathematics courses required for degree completion as part of a larger discussion about curriculum.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Departmental Action Team review of math curricula.	Math DAT	C		
Action #2 Proposed changed submitted to UPC for 2023-2024.	Chair	T	C	

Explanation of Actions Taken, Status and Results:

After a thorough review of the MATH requirements, we removed MATH 3P09, replaced MATH 3P06 with a new Physics-oriented course, MATH 2P96 (Mathematical Methods in Physics), and adjusted the schedule of when MATH courses are taken. The Department curriculum committee continues to monitor the changes to the Math requirements for potential impacts. This change has been well received by students and faculty.

Recommendation #13

The review team recommends that graduate students be trained explicitly in ethical norms.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted. The Committee believes that the Department is best positioned to determine appropriate strategies, consistent with Brock's DLEs, to train graduate students explicitly in ethical norms.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Implementation for MSMP underway.	GPD	T	T	O
Action #2 Implementation for MSc, PhD under review by Department.	Chair/GPD	D	T	O

Explanation of Actions Taken, Status and Results:
PHYS 5N02 (Graduate Science Preparation Seminar) was developed partly in response to this recommendation and has become a key course in teaching the norms surrounding the practice of scholarship. This seminar has come a long way in three years, and its emphasis on the norms of the practice of science has lifted the culture of the whole graduate program.

Recommendation #14

Add [PHYS] 5N01 [Scientific Writing] as a required course in the thesis-based MSc program.

ARC Disposition of the Recommendation
ARC considers the recommendation to be accepted for consideration. The Committee encourages the Department to work with the Faculty of Graduate Studies to explore adding PHYS 5N01-Scientific Writing as a required course within the context of the broader PhD and Masters' program requirements.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	Responsibility	Year One	Year Two	Year Three
Action #1 Under review by the Department.	Chair/GPD	T	T	O

Explanation of Actions Taken, Status and Results:
As part of the PHYS 5N01 (Scientific Writing) requirement in PhD, a renewed emphasis on supervisors providing greater and more detailed feedback on thesis and paper writing has resulted in more timely thesis preparation and submission.

Recommendation #15

The department should seek avenues to boost program enrolments.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee expects that the Department will work with the Faculty of Graduate Studies and the Office of Student Recruitment to determine appropriate strategies to boost program enrolments.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics & Science to report by the end of academic year 2022/23.

Actions	**Responsibility**	**Year One**	**Year Two**	**Year Three**
Action #1 Development of Brock Physics swag for recruitment at OUF, Open House, etc.	Chair	T	O	O
Action #2 Engaging with Faculty of Education.	Chair	T	O	O

Explanation of Actions Taken, Status and Results:

Physics has expanded its recruitment, adding many events to the calendar. The 2024 eclipse took us to several DSBN and NCDSB STEM activities and other public outreach events. We have hosted 'lab-day' for grade-10 Physics classes from DSBN schools. Physics is co-organizing and presenting at the FIRST Tech Challenge Ontario Provincial Championship and Canada Cup hosted at Brock in 2025, 2026, 2027.

We hosted the 2025 Ontario Association of Physics Teachers annual meeting. We have participated in all three annual District School Board of Niagara STEM Expos and are participating in outreach STEM Day for the NCDSB in 2026 and are coordinating a Physical Sciences Day organized for 2027. Our alumni have made new testimonial videos for 2024 and 2025, and we send personal messages and calls to all applicants.

Finally, we now routinely identify struggling students at several time points in the Fall term, reaching out with counseling and advising alongside the Academic Advisors in FMS.

Recommendation #16

The Faculty of Mathematics and Science should provide financial resources to the department to hire technical support for the MSMP program.

ARC Disposition of the Recommendation
ARC considers the recommendation to be not accepted as it lies outside of the Committee's jurisdiction. The Committee expects that the Department will proceed through normal channels of advocacy for increased resources.

Implementation Plan (1st Priority) Recommendation not accepted as it lies outside of the Committee's jurisdiction.

Explanation of Actions Taken, Status and Results:
Recommendation not accepted

C. Unit Summative Analysis and Evaluation

1. **To what extent has the Department achieved the improvements suggested by the reviewers?**
   Of the fifteen ARC-accepted recommendations, the Department has completed eight with good success (nos. 3,4,5,6,7,8,13,14), have implemented new continual improvement processes for five (nos. 9,10,11,12,15) and have considered and debated at length two (nos. 1 and 2).

2. **What overall impact has it had on the programs?**
   It's hard to express the momentum that has been building in the four years since the Cyclical Review. Significant initiatives now underway are not captured in the comments to the above recommendations but exist as a direct result of working through the issues of this report. Some of these are mentioned in Question 4 below.
   The sentiment of the Department now is one of cautious optimism. Overall, the implementations discussed above have been very well received by students and faculty. We hope that translates into increased student numbers and improved retention in the long run.

3. **How is the Department adopting a process of continuous quality improvement?**
   Since 2023, five to seven faculty and teaching staff meet weekly for informal discussion of curricula, pedagogy, recruitment and other concerns. We meet to engage in intentional reflection and action to effectively serve Brock students and implement continual change.

4. **How well do the programs now align with the priorities in Brock's 2023-2028 Academic Plan?**
   [1) High-Quality and meaningful, 2) Accessible, Flexible & Customizable, 3) Supportive & Student-Centered, 4) Equitable, Diverse, and Inclusive and 5) Future-Oriented].

   (1) **High-Quality and meaningful**
   A significant and encouraging outcome of our momentum to improve has been two REB-approved experiments in pedagogical innovation in 2025. The Department has never before

undertaken such deliberate, measurable actions to improve student learning and support student success.

(2) **Accessible, Flexible & Customizable**
Following the streamlining of our courses, we proposed to modularize the program with Core and Concentrations as a way of differentiating the program and providing student choice and flexibility. Our idea predates the new direction of the University degree structure by only a few months.

(3) **Supportive & Student-Centered**
As mentioned above, the Department is now much more engaged in student success, working alongside FMS Academic Advising, Co-op, and Concurrent Education. We have also had an active Physics Student Club for two years now.

(4) **Equitable, Diverse, and Inclusive**
In the new culture of the Department, we have implemented peer-tutoring and peer-support programs and provided stipends for students to attend conferences such as the Canadian Conference for Undergraduate Women & Gender Minorities in Physics (CCUW*iP).

(5) **Future-Oriented**
Program modularization with Core and Concentrations will help students envision how Physics can provide pathways to a STEM career. Standards-based alternative grading is already lifting grades and boosting student learning in year-1 courses, and creating new, better study behaviors in the era of AI.

5. How does this review and its results position the Department as it moves into the next review cycle?
Speaking as Chair, I envision the next cyclical review will contain much less content on the historical record of the department and lean much more into reporting the innovations of curricula and pedagogy, new directions of research, improvements in the student experience and engagement, and hopefully, report on the attraction of more students.

D. ARC Final Summary

In final summary of the 2021/22 cyclical academic review of the graduate and undergraduate programs offered by the Department of Physics, ARC has determined the following:

1. That the Reviewers' Recommendations have been addressed satisfactorily.

2. That the Department has established a direction for next steps as it prepares for the next review cycle.

3. That the Department has achieved a broad-based, reflective, and forward-looking self-assessment.