

***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 Mathematics & BSc in Mathematical Physics

# Completed by the Cyclical Program Review Committee (CPRC)

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| **Degree Programs Being Reviewed** | **Bachelor of Science in Mathematics**  **Bachelor of Science in Mathematical Physics** |
| **External Reviewers** | **Dr. Sue Ann Campbell, University of Waterloo**  **Dr. Cristina Stoica, Wilfrid Laurier University** |
| **Internal Representative** | **Dr. Marcel Dorken, Department of Biology, Trent University** |
| **Year of Review** | **2020-2021** |
| **Date of Site Visit** | **February 24, 25 & 26, 2021** |
| **Due Date for Implementation Report by the Program** | **January 15, 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** |

The mathematical science field is estimated to be one of the fastest growing occupation sectors in the coming decade due to its wide variety of application. Trent’s mathematics programs are inherently interdisciplinary and discuss a variety of topics including Biology, Physics, Economics, History, Ancient and Classics, Cryptography and Computation.

Students in the BSc Mathematics program will gain a thorough understanding of calculus, algebra, probability, and statistics and how to apply these concepts to real-world experiences. Students have the opportunity to concentrate their education with specializations in Mathematical Finance or Statistics.

The BSc Mathematical Physics program delivers an education in the most fundamental of the natural sciences, and describes mathematics as the language of physics. This program provides students with the theoretical frameworks of physics and mathematical methods that form the foundation and tools of physics.

**Executive Summary**

During the 2020-2021 academic year, the Bachelor of Science in Mathematics and Bachelor of Science in Mathematical Physics programs underwent a review. Two arm’s-length external reviewers, Dr. Sue Ann Campbell, University of Waterloo and Dr. Cristina Stoica, Wilfrid Laurier University and one internal representative, Dr. Marcel Dorken, Department of Biology were invited to review the self-study documentation. The virtual visit took place on February 24th, 25th and 26th, 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 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 participation in 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 14 recommendations focusing on three main areas: Faculty, Curriculum and Student Support. 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 12 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 January 15, 2023.

**Significant Program Strengths**

The External Reviewers found that the BSc Mathematics and BSc Mathematical Physics programs were of high quality. The Department of Mathematics continues to implement high impact practices to provide students with the best university experience which includes accessible professors, small classes in upper years, exposure to a liberal arts curriculum and opportunities to be part of Community-Based Research Projects. These practices provide students with an education that prepares them for the workplace and graduate studies. Faculty within the programs continue to create a learning community that enhances student experience and increases student engagement.

**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.

**Curriculum Review**

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

* students have access to regularly offered 3000 and 4000 level courses taught by faculty with expertise in the respective areas
* course that are not offered regularly are discontinued and removed from the calendar
* 4000 level courses are capstone level with appropriate prerequisites
* curriculum is streamlined to avoid content overlap between courses
* learning outcomes for the programs are achieved through a more diverse variety of assignments in courses

**Student Support**

The program should review current support services with Academic Skills to further provide assistance in the areas of mathematics and statistics, focusing on curriculum at the 1000- and 2000-levels. By providing this resource, students will have the necessary skills and prerequisites to be successful in the upper year courses.

**Complete List of Recommendations**

**FACULTY** – *Working with administration, provide a sustainable balance of permanent and part-time faculty*

**Recommendation 1**

That the program hire two tenure-track positions that best support the needs identified in the curriculum review

**Recommendation 2**

That the program revisit the hiring of a Master’s level position in Statistics as recommended in the previous review

**Recommendation 3**

That the program pursue a teaching stream faculty position whenever such a position becomes available

**Program Response**

These recommendations closely match current departmental goals; fulfilling these recommendations would solve a number of root issues that are identified problems that led to recommendations 2 and 3. The Department will develop a strategy for the next 3 years, incorporating staffing plan requests for expansion which will eventually correct for the permanency balance and allow for sustainable long-term delivery of high quality programs and education.

**Decanal Response**

In line with the Provost’s commitment to establish multi-year staffing plans (3), there is now the opportunity to engage in strategic succession planning, including new permanent hires (tenure track/teaching intensive faculty and/or additional support staff), to ensure viable future program delivery.

The last program review proposed a master’s level position in a very different context that is no longer applicable.

**CURRICULUM** *– Review and reform curriculum and course offerings*

**Recommendation 4**

That the program, in conjunction with faculty renewal, decide which non-specialized areas (e.g. Applied Math, Geometry, Algebra, Discrete Math) are feasible for the department to support

**Recommendation 5**

That the program ensure that adequate 4000-level courses are offered to support non-specialized areas so that students have an accessible path to graduation

**Recommendation 6**

That the program ensure 4000-level courses are capstone with prerequisites at the 3000-level so that interested students are prepared for graduate school

**Recommendation 7**

That the Program ensure 3000- and 4000-level courses are taught by permanent faculty where possible

**Recommendation 8**

That overlapping content between courses be removed

**Recommendation 9**

That courses not offered in many years be removed

**Recommendation 10**

That the program determine an appropriate cap on the number of reading courses a student can take

**Program Response**

**The Department will further explore these recommendations and conduct an overall curriculum review, consulting with relevant departments and the Dean of Science as required.**

Areas to Support: The reviewers list a number of areas that are not specializations, and suggest that the program decide which areas are feasible for the department to support. The program agrees that this is a necessity. At the 3000 level, every course listed has been offered at least once in the last two years and is set up to allow for alternation by synergistic offerings. At the 4000-level, courses offered only once or not at all in the last 5 years can be removed.

Adequate 4000-level Courses: Practically speaking, the department does not have staffing to allow for more 4000-level courses to be offered without a reduction in other areas.

4000-level Courses as Capstones: The Programs agree that ensuring that 4000-level courses are capstones would increase the quality of the program, specifically for students destined for graduate school, but to do so requires setting up a prerequisite system flowing from 2000 to 3000 and then 4000-level courses that will result in significantly lower enrolments. As with the point above, this would require additional staffing.

Overlapping Content: The Department agrees that allowing overlapping content between courses is not optimal.

Streamline Courses based on Historic Offerings: The Department agrees that it is reasonable to remove courses which have been infrequently offered for many years such as MATH 4215H, 4251H, 4310H and 4710H.

Cap Size: The Department will review a cap on reading courses.

**Decanal Response**

The department should carefully review the curriculum and identify core areas of instruction (areas of strength), eliminate potential overlap in content and remove outdated or no longer required upper year courses. This will require careful balancing of required service courses for other units, while still being able to satisfy the need of offering a certain breadth of upper year courses for MATH majors.

While there is no formal limit on the number of reading courses a student can take, most departments informally agree on a reasonable maximum number of reading course credits students can take towards the degree.

**STUDENT SUPPORT** – *In conjunction with the administration, explore options and increase resources to provide a more sustainable model to support large service courses in first and second year.*

**Recommendation 11**

That a Lab Demonstrator be hired on a full-time, permanent basis. The Lab Demonstrator could run several of the seminars/labs of the larger first and second year courses, supervise the TAs, and manage WeBWork assigned practice problems.

**Recommendation 12**

That longer-term (2 semester) full-time CUPE positions be created to run tutorials and labs.

**Recommendation 13**

That non-mathematics majors be hired for marking large first year courses. For example, a student in a Physics program who achieved a grade of A or higher in Calculus 1 can be hired to mark in the same course.

**Recommendation 14**

That the program work with Student Support Services to develop a Mathematics and Statistics Learning Centre for first year and second year large courses, in particular for service courses. The students would be serviced in developing strategies and problems solving skills, review and deepen their prerequisite skills. Such a centre should be supported by resources allocated by the University specific to this scope.

**Program Response**

The Department agrees in general that support for courses, especially the large first-year courses, is a critical need. The quality of instruction and the retention of students depends directly on the support provided to the incoming class each fall. This directly speaks to a quality issue, without sufficient support and proper scaffolding for incoming learners, attrition will be an inevitable result. The Programs pride themselves on being a contributor to the Trent experience, and to a high-quality personal education, but the rapid growth of the university and to first-year courses is beginning to take its strain. The implementation of this recommendation largely corrects this strain.

Lab Demonstrator: In both 2020-21 and 2021-22, the Department was unable to staff tutorials with Teaching Assistant coverage due to a combination of a reduction in total graduate students supervised, and continued increase in first-year enrollment (plus COVID-19 and the online year in 2020-21). The result was a patchwork hiring of various lab demonstrators on a course-by-course basis, which did cover the needs largely, although finding qualified applicants was a real issue. The Department agrees with this recommendation, and has already had discussions with the Dean on the need for a full-time OPSEU position to run several seminars in large first-year courses and take a leadership role in managing student support, such as managing TAs and our Drop-In Centre support. Such a position might be seen as equivalent to a Lab Demonstrator found in many other science departments.

Long-term CUPEs:The Department supports the recommendations that the staffing of tutorials and labs in large first and second year service courses needs to be more sustainable and will discuss with the Dean what alternate staffing options and resources are available to fill these positions.

Non-MATH Majors for Marking:The Department already actively recruits and hires talented non-mathematics majors to mark courses in which they have demonstrated that they are qualified to mark. For example, most of the markers and AAs and support for MATH 1051H and 1052H comes from undergraduate students in Forensic Science, Biology and Environmental and Life Sciences.

Learning Centre:The Department of Mathematics already offers tutoring support for first and second-year courses through a Mathematics and Statistics Drop-In Centre, and in addition mathematics study-skills support is offered through the Academic Skills Centre. However, the Department will discuss with the Dean the feasibility and resource implications of expanding support offerings to develop a more full-fledged Mathematics and Statistics Learning Centre. Such an offering would increase the quality of the program, and help prevent attrition, especially among first-year students struggling to catch up in mathematics’ requirements for Science programs.

**Decanal Response**

To provide long term stability for large first year courses, the possibility of hiring dedicated (permanent) support staff should be explored.

In conjunction with Academic skills, additional possibilities for providing enhanced math and stats support should be explored.

**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: January 15, 2023**

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| **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** |
| **FACULTY** | | | |
| **Recommendation 1**  That the program hire two tenure-track positions that best support the needs identified in the curriculum review  **Recommendation 3**  That the program pursue a teaching stream faculty position whenever such a position becomes available | New hires are related to resources and are part of annual staffing plan discussions under the purview of the Dean. |  | Chair in discussions with Dean |
| **Recommendation 2**  That the program revisit the hiring of a Master’s level position in Statistics as recommended in the previous review | Dean has indicated this is no longer applicable and there is no need to revisit this option. |  |  |
| **CURRICULUM** | | | |
| **Recommendation 4**  That the program, in conjunction with faculty renewal, decide which non-specialized areas (e.g. Applied Math, Geometry, Algebra, Discrete Math) are feasible for the department to support  **Recommendation 5**  That the program ensure that adequate 4000-level courses are offered  **Recommendation 6**  That the program ensure 4000-level courses are capstone with perquisites at the 3000-level  **Recommendation 7**  That the Program ensure 3000- and 4000-level courses are taught by permanent faculty where possible  **Recommendation 8**  That overlapping content between courses be removed  **Recommendation 9**  That courses not offered in many years be removed | Department to undergo detailed curriculum review | Complete review by December 2022 | Chair, Department of Mathematics |
| **Recommendation 10**  That the program determine an appropriate cap on the number of reading courses a student can take | Department to review and decide on an appropriate cap on reading courses. | May 2022 | Chair, Department of Mathematics |
| **STUDENT SUPPORT** | | | |
| **Recommendation 11**  That a Lab Demonstrator be hired on a full-time, permanent basis | Department to explore possibilities of hiring additional support staff in conjunction with multi-year planning | May 2022 | Department Chair in consultation with Dean of Science |
| **Recommendation 12**  That longer-term (2 semester) full-time CUPE positions be created to run tutorials and labs | Enrolments for winter semesters are not always available in August during the initial hiring of CUPE. |  |  |
| **Recommendation 13**  That non-mathematics majors be hired for marking large first year courses. | Department to consider and determine if this is possible. | May 2022 | Chair, Department of Mathematics |
| **Recommendation 14**  That the program work with Student Support Services to develop a Mathematics and Statistics Learning Centre for first year and second year large courses, in particular for service courses. | Review current support services with Academic Skills | December 2022 | Chair, Department of Mathematics |