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**SUBMITTED TO OUCQA FOR INFORMATION – July 14, 2015**

**APPROVED BY TRENT UNIVERSITY’S SENATE COMMITTEE – December 2, 2014**

**FINAL ASSESSMENT REPORT & IMPLEMENTATION PLAN**

**PREPARED BY PROGRAM QUALITY ASSURANCE COMMITTEE (PQAC)**

**MATHEMATICS**

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| **DEGREE PROGRAM BEING REVIEWED** | **BSc Mathematics**  **BSc Mathematical Computer Science**  **BSc Mathematical Economics**  **BSc Mathematical Physics** |
| **DEPARTMENT RESPONSIBLE** | **Mathematics** |
| **EXTERNAL REVIEWERS** | **Dr. Keith Taylor, Dalhousie University**  **Dr. Walter Whiteley, York University** |
| **INTERNAL REPRESENTATIVE** | **Dr. Mark Parnis, Trent University** |
| **DATE OF REVIEW VISIT** | **November 28-29, 2013** |

**SUMMARY**

*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 undergraduate 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(s) is responsible for completing a self-study which encompasses all degree programs under review. The self-study addresses all components of the evaluation criteria as outlined in Trent’s IQAP. Appendices will include the course outlines in each of the degree programs and CVs for full-time faculty members teaching in the degree programs. Qualified external reviewers are invited to conduct a review of the degree programs which involves a review of all relevant documentation (self-study, appendices, IQAP), and participating in a university site visit. During the site visit reviewers meet with the Provost and Vice President Academic, relevant Dean(s), the Chair and or Director of the degree program(s), full- and part-time faculty, support staff and students. Once the external reviewers’ report is received both the program and dean provide responses to the report.*

*The Program Quality Assurance Committee (PQAC) reviews and assesses the quality of the degree programs based on the four review documents and reports on significant program strengths, opportunities for improvement and enhancement, and the implementation of recommendations. The Final Assessment Report (FAR), prepared by PQAC will include an Implementation Plan which identifies those recommendations selected for implementation, and will specify: proposed follow-up, who is responsible for leading the follow-up, and the timeline for addressing the recommendation.*

During the academic year 2013-2014, the Department of Mathematics completed a review of the BSc in Mathematics, the BSc in Mathematical Computer Science, the BSc in Mathematical Economics, and the BSc in Mathematical Physics. Two arm’s-length external reviewers (Dr. Keith Taylor, Dalhousie University; Dr. Walter Whiteley, York University) and one internal member (Dr. Mark Parnis, Chemistry) were invited to review the self-study documentation and then conducted a site visit to the university on November 28-29, 2013.

Reviewers’ ‘found the Department of Mathematics to be well run with all members of the department energetically dedicated to giving their students a high quality educational experience. The collegial atmosphere in the department is exceptionally good. The members openly discuss issues in a professional and engaged manner.’ The review team commented that is was evident ‘that the students benefit from the pleasant learning environment in this relatively small department.’

The Dean agrees that ‘The Department of Mathematics enjoys a well-deserved reputation for its commitment to excellent in teaching. It functions as a cohesive unit, in which all members are dedicated to provide a solid mathematical foundation to all students and enable them to succeed in their respective degree choices.’

The reviewers’ comment that Mathematical Economics ‘has modest mathematics requirements (3.5 courses) and, as such, is best considered as a program of the Department of Economics. Nevertheless, the Department of Mathematics makes a substantial and critical contribution and the graduates of this program have the quantitative knowledge and skills that are essential for graduate students in Economics.’

Reviewers indicated Mathematical Physics is often ‘considered a discipline in its own right’ and that ‘math is a key component’ of this degree program. They did want to reinforce that any curriculum revisions to the mathematics degree should involve consultation with Physics to consider the ‘fit’ and ‘value add’ to the Mathematical Physics degree as well.

Mathematical Computer Science, as noted by the reviewers, is not often identified as a distinct area of study. Students have experienced difficulty completing this degree as fourth year courses are not offered on a regular basis, forcing students to complete reading courses in order to attain all degree requirements. Reviewers would recommend discontinuing this program and alternately students would have the option of a joint degree in computing and mathematics or a double degree.

The reviewers suggest that the department focus on areas of strength rather than trying to maintain a diverse set of course offerings. They noted that the number of courses offered was more extensive that might be expected for a department of this size. The reviewers further comment that upper year courses which are not frequently offered be considered and that courses which do not play a key role in the revised program structure be eliminated. They also cite a curriculum principle that “A student does not need to be introduced to all areas of mathematics beyond the core”.

**SIGNIFICANT PROGRAM STRENGTHS**

* Reviewers’ commented, ‘As to overall research activity, the Department does very well when compared to departments in Canadian universities of a similar size and mission.’
* Reviewers also indicated that Trent is similar to other programs in that ‘every mathematics department in the world teaches a large number of students in service courses’ at the first and second year levels. Science students are typically required to complete a mandatory mathematics credit. Smaller class sizes are typical in the upper years and are considered ‘healthy distribution for a mathematics department’.
* The offering of MATH 1005H was thought, by the reviewers, to be an excellent transitional course for students without the background in calculus and vectors. The course fills a gap and helps to ensure the success and retention of students in both mathematics and science.

**OPPORTUNITIES FOR PROGRAM IMPROVEMENT AND ENHANCEMENT**

* The program should build on its strengths in modelling and dynamics and differentiate itself from ‘programs at comparable universities’. Reviewers’ comment, ‘It is worth noting that all the main areas of mathematics cannot be represented in a small department.’… ‘Moreover, there is value in a small department having one or more areas of depth. This department has clusters of depth in the analytic foundations of dynamics and mathematical modelling.’ (p. 6 reviewers’ report).
* A curriculum review is noted as being a priority for the department. The complexity of program requirements and course offerings have become unmanageable due to increased course offerings and faculty retirements. Students could meet degree requirements ‘without gaining a depth one would expect of an honours graduate in any of the modes of mathematical thinking.’
* Development of a capstone course to provide to provide opportunities to students to develop both ‘writing communication’ and ‘oral presentation’ skills. The program will need to address this in order to meet the UUDLEs requirements. The reviewers also note that this course will help to ‘introduce a research experience into the curriculum’ which may offset some of the changes to the new evaluation system at NSERC.

**COMPLETE LIST OF RECOMMENDATIONS**

Recommendation 1

The Department work with the Department of Computer Science to investigate the potential impact of closing the program in Mathematical Computer Science, and if deemed appropriate, move to close the program.

Recommendation 2

The Department name, as an assigned duty, a faculty member to serve as a liaison with the Trent Faculty of Education with the goal to preserve and enhance the flow of majors and honours students in mathematics interested in a teaching career.

Recommendation 3

In the curriculum renewal process, the Department design components that will enhance the written and oral communication skills of both majors and honours students. A capstone course for Honours students with oral presentations, research and a written report as the main elements is strongly recommended.

Recommendation 4

In the curriculum renewal process, the Department consider the appropriateness of a computer programming requirement.

Recommendation 5

In the curriculum renewal process, the Department consider reducing the core requirements for the three year General BSc Major in Mathematics while including computing and statistics.

Recommendation 6

That the Dean of Science work with the Department and the Vice-President Research and International to develop a funding mechanism to deal with the statistics deficit at Trent. In the ideal, the solution will include one or more tenure-track appointments and the establishment of a structured statistical consulting service.

Recommendation 7

The Department should be cautious with their proposal to develop an honours program in Actuarial Science in the near future. Instead, the Department consider alternative methods to enhance the assistance currently provided to students interested in a career as an actuary.

Recommendation 8

Our primary recommendation is that the Department move forward with the curriculum renewal process keeping in mind the discussions we had with them during our visit and the points made in Section 4 of this report.

**IMPLEMENTATION PLAN**

**\*** *The applicable Dean, in consultation with the Department Chair shall be responsible for monitoring the Implementation Plan. The Dean shall provide a follow-up Implementation Report in accordance with the date(s) stipulated in the above plan.*

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| **Recommendation** | **Proposed Follow-Up**  If no follow-up is recommended please clearly indicate ‘***No follow up report is required***’ and provide rationale. | **Responsibility for Leading Follow-Up \*** | **Timeline for Addressing Recommendation** |
| **Recommendation 1**  **The Department consider discontinuing the degree programs in both Mathematical Computer Science and Computing Physics in consultation with Dean of Science and respective Departments.**  *\*note Computing Physics should read Mathematical Physics (error found after submission to Quality Council)* | Decisions to close either of these degree program should be made based on consultation with the COIS, PHYS, and the Dean, and any affected parties.  The Department had noted that students interested in both Mathematics and Computer Science could complete a joint- or double-major.  The Dean had recommended that the Computing Physics degree be discontinued in favor of focusing resources on improving the degree in Mathematics. | Science Dean  MATH Chair  COIS Chair  PHYS Chair | Implementation Date  Decisions to discontinue the programs should be implemented for September 2015.  Reporting Date  PQAC requests a progress report be submitted by October 2015. |
| **Recommendation 2**  **The Department name, as an assigned duty, a faculty member to serve as a liaison with the Trent Faculty of Education with the goal to preserve and enhance the flow of majors and honours students in mathematics interested in a teaching career.** | No follow up report is required.  PQAC notes that this course is important to the Teacher Education Stream and is a valuable recruitment tool but overall has no effect on the quality of the math program. |  |  |
| **Recommendation 4**  **In the curriculum renewal process, the Department consider the appropriateness of a computer programming requirement.** | No follow up report is required.  The Department supports a ½ course computer programming requirement and notes that MATH majors are exposed to computing throughout the program (i.e., Maple programming, algorithmic and logical thought, and COIS 1020H Programming for Computing Systems is recommended). |  |  |
| **Recommendation 6**  **That the Dean of Science work with the Department and the Vice-President Research and International to develop a funding mechanism to deal with the statistics deficit at Trent. In the ideal, the solution will include one or more tenure-track appointments and the establishment of a structured statistical consulting service.** | Tenure-Track Appointments  PQAC noted that statistics is program specific and a number of departments currently have faculty with an expertise in statistics.  *PQAC acknowledges that there are discipline-specific needs in the areas of faculty appointments that should be recognized in related future discussions. When budgets allow, additional tenure-track positions should be approved to enhance the faculty complement.*  Statistical Consulting Service  No follow up report is required for the establishment of a statistical consulting service.  PQAC noted that the establishment of a Statistical Consulting Service has no bearing on the quality of the Mathematics program and therefore falls outside the purview of PQAC. | Science Dean  Provost | Report Date  PQAC requests a progress report be submitted by October 2015. |
| **Recommendation 7**  **The Department should be cautious with their proposal to develop an honours program in Actuarial Science in the near future. Instead, the Department consider alternative methods to enhance the assistance currently provided to students interested in a career as an actuary.** | No follow up report is required.  PQAC recommends that the department not pursue the development of a degree in Actuarial Science but instead focus on current strengths (dynamics and mathematical modelling). |  |  |
| **Recommendations 3, 5 & 8: Curriculum Renewal**  **Recommendation 3**  **In the curriculum renewal process, the Department design components that will enhance the written and oral communication skills of both majors and honours students. A capstone course for Honours students with oral presentations, research and a written report as the main elements is strongly recommended.**  **Recommendation 5**  **In the curriculum renewal process, the Department consider reducing the core requirements for the three year General BSc Major in Mathematics while including computing and statistics.**  **Recommendation 8**  **Our primary recommendation is that the Department move forward with the curriculum renewal process keeping in mind the discussions we had with them during our visit and the points made in Section 4 of this report.** | PQAC recommends the department move forward with the external reviewers’ suggested curriculum review process, to include:   * developing a consolidated structure of core courses: trim core offerings, expand core courses to include select upper year courses, consider removing streams * develop capstone course with both oral and written communications (Rec #3) * reduce core requirements for the 3-year General BSc in Mathematics while including computing and statistics (Rec #5) * curriculum should meet the UUDLEs requirements * curriculum should build on strengths of faculty research (modelling and dynamics) * students should be encouraged to take a course sequence that deepens and matures their mathematical thinking   *Specifically PQAC would ask that the program comment on:*   * *the viability of streams* * *the written component of the capstone course; the department only mentions the oral component* * *whether or not the program would consider building additional oral communication opportunities into the 1000-, 2000- or 3000-levels or whether these opportunities exist in the current curriculum.* | Science Dean  MATH Chair | Implementation Date  Curriculum renewal should be completed for September 2016.  Rec #3  Capstone Course: Sept 2016  Rec #5  Revisions to BSC Gen MATH:  Sept 2015  Reporting Date  PQAC requests a progress report be submitted by October 2015. |