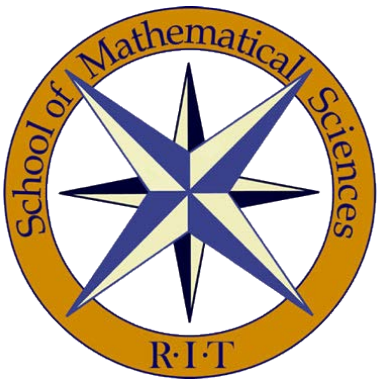
Graduate Student Handbook

MS Program in Applied and Computational Mathematics

School of Mathematical Sciences



R·I·T | *College of* SCIENCE

2018-2019

R·I·T

Rochester Institute of Technology

School of Mathematical Sciences
College of Science
85 Lomb Memorial Drive
Rochester, NY 14623-5603
(585) 475-2498 Fax 585-475-5766

August 2018

Dear Student:

The School of Mathematical Sciences is pleased to have you as a student, and we hope you will enjoy and professionally benefit from your studies with us. The objective of our graduate program in Applied and Computational Mathematics is to provide you with the capability to apply mathematical models and methods to study various problems that arise in industry, government, and business. Since our program is interdisciplinary, you will have the opportunity to choose from a variety of courses across campus.

This student handbook has been specially prepared to give you current information about the School of Mathematical Sciences Master's Degree Program in Applied and Computational Mathematics. We have included information about the nature of our program, admission requirements, application process, graduation requirements, facilities, financial aid, our faculty, and other related matters.

Please feel free to make any suggestions or comments you may have. We have always benefited from student input and we are pleased that there is a strong bond between our students and our faculty in the school. I invite you to drop by my office so we can become better acquainted. You have my best wishes for a successful study.

Sincerely,

Dr. Matthew Coppenbarger
Associate Professor and Head
School of Mathematical Sciences

R·I·T

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August 2018

Dear Student,

The School of Mathematical Sciences at Rochester Institute of Technology is proud to offer an M.S. degree program in Applied and Computational Mathematics. In the following pages, you will find details about the program, requirements, application process, and facilities available. RIT is known for its commitment to career education and life-long learning and this program reflects that philosophy.

As you read through this handbook, we are sure you will realize the innovative nature of this program and the opportunities its flexibility offers. If you have any questions or concerns, please feel free to contact me. You may also use our web site, http://www.rit.edu/science/sms, to obtain more information about our School and the program.

We hope that you will give serious consideration to this program as you plan to meet your higher education goals.

Sincerely,

Dr. Matthew Hoffman
Associate Professor and Director, MS Program in Applied and Computational Mathematics
mhjsma@rit.edu
(585) 475-4209

Table of Contents

Introduction and Objective

The School of Mathematical Sciences at the Rochester Institute of Technology offers an interdisciplinary Master of Science degree program in Applied and Computational Mathematics. The program addresses the need for the education and training of people in the areas of mathematics that can be used effectively to deal with problems encountered in business and industry.

The program is designed to introduce students to advanced applied mathematics methodology and to realize the potential for that methodology as a general tool in the study of a variety of problems in business and industry. In addition, the program emphasizes the computational tools available for solving various problems. Students will explore the use of computers as an aid in problem-solving. One of the ways this will be achieved is by the application of existing software packages in appropriate courses and in thesis work.

Because this is an interdisciplinary program, full-time or part-time students who would like to pursue the MS degree in Applied and Computational Mathematics will have the flexibility of choosing from a wide variety of courses across campus to concentrate in an area of applied mathematics. Students who come into the program with specific problems that require mathematical analysis and for which expertise is available in the School of Mathematical Sciences would select courses that contribute to the understanding and solution of the problem.

The Program

The master's degree program in Applied and Computational Mathematics consists of 36 semester credit hours (also referred to as units) of study divided into core courses, two courses constituting a concentration, electives, a year-long Graduate Seminar course sequence, and thesis research. The core courses provide the necessary background and foundational material and introduce students to some of the general tools of applied mathematics and computational mathematics. The concentration courses bring together in a mathematically unified manner the ideas in an area of interest to each student. In addition, students select electives in the program. The year-long Graduate Seminar course sequence exposes students to the different research areas in SMS and at RIT, and it teaches various research methods that will help students be successful in carrying out thesis research and in writing and defending the thesis. Finally, for the thesis requirement, each student presents original ideas and solutions to a specific mathematical problem. Applying or adapting existing methodologies to solve a problem and an extensive literature search of the methodology in a particular area is another alternative in writing a successful thesis. More details on the thesis requirements can be found in Sections 2.5 and 6.

Core Courses

Each student chooses four (4) **Core courses**, for a total of 12 semester credit hours, from a total of six (6) core courses that are offered. These courses usually will be taken in the first year of study and will provide students with a focus on some of the ideas of applied and computational mathematics. Core courses are offered every year. The following are the six core courses along with the semesters they are offered:

Core Course	Semester Offered	Description
MATH 602 **Numerical Analysis I**	Fall	This course covers numerical techniques for the solution of nonlinear equations, interpolation, differentiation, integration, and matrix algebra.
MATH 645 **Graph Theory**	Fall	This course introduces the fundamental concepts of graph theory. Topics to be studied include graph isomorphism, trees, network flows, connectivity, matchings, graph colorings, and planar graphs.
MATH 622 **Mathematical Modeling I**	Fall	This course will introduce graduate students to the logical methodology of mathematical modeling. They will learn how to use an application field problem as a standard for defining equations that can be used to solve that problem and how to establish a nested hierarchy of models for an application field problem to clarify the problem's context and facilitate its solution.
MATH 601 **Methods of Applied Mathematics**	Spring	This course is an introduction to classical techniques used in applied mathematics. Models arising in physics and engineering are introduced. Topics include dimensional analysis, scaling techniques, regular and singular perturbation theory, and calculus of variations.
MATH 605 **Stochastic Processes**	Spring	This course is an introduction to stochastic processes, especially those that appear in various applications. It covers basic properties and applications of Poisson processes and Markov chains in discrete and continuous time.
MATH 722 **Mathematical Modeling II**	Spring	This course will continue to expose students to the logical methodology of mathematical modeling. It will also provide them with numerous examples of mathematical models from various fields.

Concentrations

In addition to the core courses, each student will complete an additional 15 semester credit hours (6 credits as **Concentration courses**, 9 credits as **Electives**) by taking a set of specialized courses from a wide variety of courses offered in the School of Mathematical Sciences and other departments.

The set of **Concentration courses** will be chosen to form a well-defined and meaningful focus area of study; for added flexibility, once students select a concentration, they will choose two of the three courses listed below for that concentration. The concentration and the corresponding course of study will be formulated by the student in consultation with the Faculty Adviser (please see Section 5). For students who come into the program with specific problems that require mathematical analysis, the concentration could be chosen to provide the necessary information to analyze models on which they are working. Courses are offered in the School of Mathematical Sciences unless indicated otherwise.

Concentration	Concentration Courses
Dynamical Systems	631 – Dynamical Systems (F) 731 – Advanced Dynamical Systems (S) 741 – Partial Differential Equations I (F)
Discrete Mathematics	646 – Combinatorics (S) 671 – Number Theory (F) 771 – Mathematics of Cryptography (F)
Scientific Computing	702 – Numerical Analysis II (S) 712 – Numerical Methods for Partial Differential Equations (F) High-performance computing course (examples: CSCI-654 Foundations of Parallel Computing, CSCI-652 Distributed Systems, CSCI-714 Scientific Visualization, CMPE-655 Multiple Processor Systems, CMPE-750 Advanced Computer Architecture, CMPE-755 High Performance Architectures)

Electives can be any concentration beyond the required two (2) concentration courses, any core course beyond the four (4) required, or any course from the list below. Courses outside of the MATH discipline must be approved by the MS Program Director.

633 – Measure Theory and Elements of Functional Analysis (F)
641 – Logic, Set Theory, and Computability
655 – Biostatistics (F)
735 – Mathematics of Finance I (F)
736 – Mathematics of Finance II (S)
742 – Partial Differential Equations II (S)
761 – Mathematical Biology (S)
789 – Special Topics
799 – Independent Study
821 – Applied Inverse Problems (F)
831 – Mathematical Fluid Dynamics (F)

Graduate Seminar

Students are required to take the two-course sequence of graduate seminar classes, MATH 606 and MATH 607 (Graduate Seminar I and II). These courses will expose students to the variety of research being carried out within SMS and more broadly at RIT, and they will provide various research skills that will be useful in carrying out thesis research and in writing and defending the thesis. MATH 606 and MATH 607 should be taken during the first year of graduate studies. For part-time graduate students or BS/MS students, MATH 606 and MATH 607 should be taken during the penultimate year (the academic year prior to the one in which thesis work is carried out).

First Year of Graduate Study

In a student's first year of study in the program, the following is a guideline of coursework to complete. Note that alternatives are possible depending on courses selected to satisfy the core, concentration, and elective course requirements.

Fall:	Core 1, Core 2, Concentration 1, MATH 606 (Graduate Seminar I)
Spring:	Core 3, Core 4, Concentration 2, MATH 607 (Graduate Seminar II)

Thesis requirement

The course of study culminates in the thesis work. The thesis requires that each student present original ideas and solutions to a mathematical problem. Applying or adapting existing methodologies to solve a problem and an extensive literature search of the methodology in a particular area is another option.

Thesis Adviser / advisory committee: Prior to enrolling in MATH 790 (Research and Thesis), the student chooses a Thesis Adviser who is normally a faculty member in the School of Mathematical Sciences. If the student wishes to choose a Thesis Adviser from outside of SMS, the choice of Thesis Adviser must be approved by the MS Program Director, and the MS Program Director may require the student to choose a co-adviser from within the SMS faculty. The student, after consulting with and receiving approval from the Thesis Adviser, invites at least two more faculty members to form the student's Advisory Committee. At least one of these additional faculty members must be from the School of Mathematical Sciences.

Thesis research: All students must enroll in a total of 7 credits of MATH 790 (Research and Thesis). These credits may be spread across multiple semesters. While enrolled in these credits, students work closely with their Thesis Adviser on the mathematical problems of their choice. Students should be mindful of the problem they select to address in their thesis when choosing core, concentration, and elective courses so that the courses naturally lead to and provide much of the information necessary for studying the problem. (For students who are also professionals, the topic chosen may be related to a problem that would arise from the student's workplace.) During each semester that a student wishes to enroll in any number of Research and Thesis credits, the student must complete and submit the form in Appendix E, or provide the same information by email with the Thesis Adviser included, prior to the end of the Add/Drop period. Research and Thesis credits are given grades of "R" (registered) or "U" (unsatisfactory). Grades of "U" will be given if the Thesis Adviser indicates that satisfactory progress has not been made; in these cases, Research and Thesis credits carrying "U" grades must be repeated. Regularly scheduled meetings can be used by the Advisory Committee to monitor and encourage student progress.

Thesis submission / defense: During or after the semester in which the final Research and Thesis credit is taken, each student will submit a written thesis and defend it in an oral examination conducted by the Advisory Committee. At least four weeks before the defense, the student must present a copy of the successfully finished thesis to the Thesis Adviser, all members of the Advisory Committee, and the MS Program Director. The thesis must conform to the formatting requirements detailed on the Wallace Memorial Library website (http://infoguides.rit.edu/thesis-services). In addition, an announcement for the thesis defense also must be circulated via email (through the SMS Senior Staff Specialist) at least four weeks before the defense. The defense will include a public portion and a portion in which only the Advisory Committee is present, during which time the student should be prepared to address questions from the Committee members related to the thesis itself as well as the general area represented by the thesis. Outcomes of the thesis defense include Pass (No Corrections), Pass (Minor Corrections), and Fail. In cases of Pass (Minor Corrections), a final version of the thesis that incorporates corrections required by the Advisory Committee must be submitted within three months of the defense date, or else the outcome will revert to "Fail."

Final thesis submission: Once the thesis defense is passed and all corrections incorporated, each student must follow the Wallace Memorial Library instructions (http://infoguides.rit.edu/thesis-services) to make an appointment to submit hard copies of the thesis to the library for binding. Each student must submit at least two hard copies: one copy will be held by the Wallace Memorial Library, and the other will be held by the School of Mathematical Sciences. WML and SMS will pay for these two copies; each student may choose to submit additional hard copies for binding (for example, for personal copies and/or copies to give to their Thesis Adviser). Each student also must submit an electronic copy of the thesis to ProQuest (instructions are on the Wallace Memorial Library website listed above). In order to be certified for graduation, the student must submit to the MS Program Director by email (i) a scan or photograph of the receipt from Wallace Memorial Library indicating the hard copies have been submitted, and (ii) the confirmation received from ProQuest after electronic submission.

Continuation of Thesis: When a student completes all coursework as well as the minimum required Research and Thesis credits but has not yet successfully completed the thesis defense and submitted the thesis to the Wallace Library and to ProQuest, the student must enroll in a zero-credit Continuation of Thesis (MATH-791) for subsequent terms (not including summer terms or Tiger terms). Continuation of Thesis allows the student to maintain access to campus resources such as the Wallace Center. Continuation of Thesis carries a tuition fee equivalent to one credit, but this fee is waived by SMS for the first term of Continuation of Thesis enrollment. In subsequent terms, the Continuation of Thesis fee must be paid by the student. A student who fails to enroll for Continuation of Thesis when required will be automatically withdrawn from the program. For complete details of the Continuation of Thesis policy, see Part VIII of Section D12.0 of the Institute Policies and Procedures Manual at https://www.rit.edu/academicaffairs/policiesmanual/d120.

Degree Requirement Summary

In summary, the MS Program in Applied and Computational Mathematics is structured in the following way.

Core Courses	Concentration Courses	Graduate Electives	Graduate Seminar	Thesis
4 courses 12 credits	2 courses 6 credits	3 courses 9 credits	2 courses 2 credits	7 credits

Each student will normally take all four (4) core courses, the two (2) graduate seminar courses, the two (2) concentration courses, and the thesis credits in the School of Mathematical Sciences. However, up to 9 semester credits of coursework may consist of transfer credit or may be taken in other RIT departments, subject to approval by the MS Program Director. At a minimum, students will take at least 27 out of the required 36 credits in the School of Mathematical Sciences; *any credits taken outside of SMS must be approved in advance by the MS Program Director*.

M.S. IN APPLIED AND COMPUTATIONAL MATHEMATICS
PROGRAM OF STUDY FORM

School of Mathematical Sciences	Checklist for MS Graduation Requirements	
Student:	UID:	
Faculty Adviser:	Date:	**Major:** ACMTH-MS
Thesis Adviser:	Thesis Committee:	

Min sch: 36 Last Checked:

Area	Cr	Grade	Notes
CORE COURSES			12 sch
1:	3		
2:	3		
3:	3		
4:	3		
CONCENTRATION			6 sch
1:	3		
2:	3		
ELECTIVES			9 sch
1:	3		
2:	3		
3:	3		
THESIS			9 sch
MATH 606 Graduate Seminar I	1		
MATH 607 Graduate Seminar II	1		
MATH 790 Research and Thesis	7		

Additional Notes

Cooperative Education Option

The optional cooperative education (co-op) program may be used to gain valuable industrial or business experience as well as financial support while the student is enrolled in the graduate program. Co-op enables a student to alternate periods in school with full-time, paid professional employment. Students may sign up for the co-op program after their first year, and they may co-op until they have earned the minimum number of course and research/thesis credits required for graduation. Although a co-op position cannot be guaranteed, RIT and the School of Mathematical Sciences have a successful track record of finding co-op placements through the Office of Cooperative Education and Career Services, http://www.rit.edu/oce.

Please contact Morgan Leonard, Career Services Coordinator (475-5469, mcloce@rit.edu) for more information about co-op.

Admission Requirements

Applicants should have a baccalaureate degree with a cumulative grade point average of 3.0 or above out of 4.0 (or its equivalent) from an accredited institution. The degree can be in mathematics or any related field.

Although GRE scores are not required, submitting them would enhance the chances of acceptance into the program.

Core courses in the MS Program rely on prerequisite knowledge in five key areas: differential equations, linear algebra, probability, discrete mathematics, and computer programming. Most of these courses are required for undergraduate programs in such areas as science, engineering, and computer science. Applicants should have earned at least B's in undergraduate coursework in these areas.

Any student who has not had the prerequisite courses or equivalent industrial experience or has earned lower than B's in any of the prerequisite courses may be given conditional admission and be required to complete "bridge" courses selected from among the existing undergraduate courses as prescribed by the MS Program Director (see Section 5). Until the time these requirements are completed, the student would be considered a non-matriculated student. In those cases where a students took the prerequisite courses many years earlier with no subsequent work related to mathematics, provisional admission may be given with the expectation that the student earn a B average in the first three graduate courses the student takes in the program. The MS Program Director evaluates students to determine eligibility for conditional and provisional admission.

The Bridge Program

Students who require additional mathematics, statistics, or computer science background for graduate coursework in the MS program in Applied and Computational Mathematics may take advantage of the Bridge Program. Courses at RIT and other colleges can be used in the Bridge Program. ***Note:*** Matriculated graduate students will be charged graduate tuition for any courses they take at RIT. This includes undergraduate courses.

Calculus: A three-semester sequence in differential and integral calculus, including partial derivatives and multiple integrals. RIT courses: MATH 181, 182, and 221 (Project-based Calculus I and II and Multivariable Calculus).

Differential Equations: An introduction to ordinary differential equations, including the solutions to common first-order equations and linear second-order equations. RIT course: MATH 231 (Differential Equations).

Discrete Mathematics: An introduction to discrete mathematics with applications in computer science and mathematics with an emphasis on proof techniques. RIT course: MATH 200 (Discrete Mathematics with Introduction to Proofs).

Probability and Statistics: A calculus-based course (or courses) covering probability theory, random variables, sampling theory, hypothesis testing and confidence interval. RIT course: MATH 251 (Probability and Statistics I).

Linear Algebra: A course (or courses) covering the basic concepts of linear algebra, including matrix arithmetic, determinants, vector spaces, eigenvalues, orthogonality and numerical techniques. RIT course: MATH 241 (Linear Algebra).

Computer Science: Students should be proficient in a modern programming language such as C++, C, Java, or Python, and should be familiar with programming concepts, algorithms and data structures. RIT courses: CSCI-141 and 142 (Computer Science I and II).

Information for Non-matriculated Students

A student with a bachelor's degree from an approved undergraduate school and having the background necessary for specific courses may take graduate courses as a non-matriculated student with the permission of the MS Program Director and the instructor. Courses taken for credit usually may be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at Rochester Institute of Technology as a non-matriculated student will be limited to a maximum of 9 semester credits.

Transfer Credits

A student may be eligible to transfer a maximum of 9 semester credits for graduate-level courses taken elsewhere. The MS Program Director will evaluate the transcripts to determine whether transfer credit should be given.

Part-time Students

The MS program is ideal for practicing professionals who are interested in applying mathematical methods in their work and in enhancing their career options. The graduate program normally may be completed in three years (six semesters) of part-time study.

International Students

Each Graduate department at RIT has identified minimal TOEFL scores for accepting students. For the MS Program in Applied and Computational Mathematics, international students must achieve a minimum TOEFL iBT score of 90, have the language requirement waived by Admissions for appropriate reasons, or receive a favorable recommendation from RIT's English Language Center. Students who do not satisfy any of these requirements may be admitted on a conditional basis, with the requirement of successfully completing a prescribed plan of coursework at the English Language Center prior to enrolling in any MS program courses.

Course Administration

Policies regarding course registration, withdrawal, and repetition; grades needed for program credit; transfer credit; and full-time equivalency are given below.

Course Registration

Students are responsible for registering for courses. Online registration via the **Student Information System (SIS)** (http://sis.rit.edu) is available toward the end of each preceding semester; first-year students should register for courses by late June or early July whenever possible. The Program Assistant can help first-year students with any issues associated with registering for approved courses. Students should register only for courses included in their approved plans of study. Any desired changes must be discussed and approved by the Application Domain Advisory Committee prior to registration.

Course Withdrawal

Students should discuss any course withdrawal with the Program Director before withdrawing. If a student withdraws from a course during the Add/Drop period specified in RIT's Academic Calendar, the course will not be listed on the student's semester grade report or permanent record. After the Add/Drop period is over, courses dropped will appear on the semester grade report and will remain on the student's permanent record. If the course is dropped no later than the last day to drop from classes with a grade of "W" as specified in RIT's Academic Calendar (typically Friday of the 11th week of classes), the course will appear with a grade of "W". After this date it is not possible to withdraw from a course except in extraordinary circumstances that should be discussed with the Program Director.

Minimum Course Grade to Satisfy a Program Requirement

Per RIT policy, students must attain a grade of C or higher for the course to count as satisfying a program requirement. Thus, courses where a grade of C- or lower is earned cannot be used to satisfy a requirement of the program. However, the course grade is included in calculating grade point average (GPA). If the course is mandatory, it must be repeated, as described below. For more information on RIT's grade policies, see https://www.rit.edu/academicaffairs/policiesmanual/d050.

Repeating a Course

Per RIT policy, for graduate students, approval from the dean or dean's designee of the student's home academic unit is required for any graduate courses a student wishes to take a second time.

If permission to take a course a second time is granted, the grades of all courses attempted count in calculating the graduate cumulative GPA. In addition, a graduate program GPA manually calculated by the academic unit is used for degree certification and must be at least 3.0 ("B" average) as a graduation requirement. All academic program course attempts are included in this calculation. See https://www.rit.edu/academicaffairs/policiesmanual/d050.

Graduate Probation and Suspension

Any matriculated graduate student whose program cumulative GPA falls below a 3.0 ("B" average) at any time after completing at least 9 semester credit hours (excluding MATH-606 and MATH-607) is placed on probation and counseled by the Program Director. These students are required to raise their program cumulative GPA to the 3.0 level within the next 9 semester credit hours (excluding MATH-606 and MATH-607); otherwise, they are suspended from the graduate program.

Any suspended student may apply to the Program Director for readmission and may be readmitted upon demonstration of sufficient and valid reason for readmission. The decision to readmit a student on probation or suspension is made by the Head of the School of Mathematical Sciences.

Applying Previous Graduate Course Credits

At the discretion of the Program Director, graduate-level coursework completed at another institution or taken in another RIT graduate program may be transferred and applied toward the Ph.D. degree. Approved transferred coursework is included in the student's plan of study, which indicates the specific requirements transferred courses are deemed to satisfy. Such classes must be listed on the plan of study as they appear on the other school's transcript, using that school's numbering (if any), course name, credit hours (in semesters), and grade awarded. Pass/fail courses may not be used to satisfy course requirements.

Transfer credit for any coursework earned before matriculating in the Mathematical Modeling Ph.D. program should be requested through application to the Program Director during the first year. Graduate courses taken at RIT before enrolling in the Ph.D. program can be transferred in the same manner. Courses taken at other institutions after beginning the Ph.D. program can be transferred only if included in the student's plan of study approved by the Application Domain Advisory Committee prior to taking any such courses.

Transfer credit is subject to RIT policies limiting the total number of credit hours that can be transferred.

Full-time Equivalency

RIT considers graduate-level students to be full-time in every academic term in which they are enrolled for at least 9 credit hours. With approval of the Program Director, a full-time equivalency can be granted for such activities as dissertation research, research or teaching assistantships, and internships.

Application Process

Applications for admission are accepted and processed on a rolling basis throughout the year. However, for full consideration of merit scholarships and assistantships, all application documents must be submitted to the Office of Graduate Enrollment Services by February 15.

Applying through Graduate Enrollment Services

The student should request official transcripts from previous institutions that the student attended. They should be sent directly to the Office of Graduate Enrollment Services. The student also should arrange for two letters of recommendation to be sent with the application.

Requests for an application packet and the completed application should be sent to:

Rochester Institute of Technology
Bausch & Lomb Center, Bldg. 77, Room A-130
58 Lomb Memorial Drive
Rochester, New York 14623-5604
Attention: Office of Graduate Enrollment Services

For general information and an on-line application form, see the RIT Graduate Enrollment Services page at http://www.rit.edu/emcs/ptgrad/grad_admission.php.

Once an applicant's file is complete, it will be forwarded to the School of Mathematical Sciences. The acceptance of the student will be determined by the MS Program Director, based on the recommendation of faculty who review the student's file.

Application Process for BS/MS Option

Undergraduate students in the School of Mathematical Sciences programs can enter an accelerated BS/MS option. Students with third- or fourth-year-level status may apply with a Change of Program/Plan form submitted to the Associate Head and must complete all of the admission requirements outlined above as well as meet with the MS Program Director prior to applying.

Advising

Upon admission into the program, the student will be assigned a Faculty Adviser. By default, each student's Faculty Adviser will be the MS Program Director. If the student identifies another SMS faculty member whom they would like as their Faculty Adviser, they can be assigned a new Faculty Adviser at the discretion of the MS Program Director. The role of a Faculty Adviser is to help answer any questions and address any concerns the student may have about the program, coursework, research and thesis, etc. The Faculty Adviser should be a different faculty member than the Thesis Adviser (described in Section 2.4), and the Faculty Adviser may or may not serve on the Advisory Committee.

The Faculty Adviser, potentially in conjunction with other faculty members, will assist the student in formulating a concentration and in selecting appropriate courses and will oversee the academic aspects of the student's program. During the first year, the student, in consultation with the Faculty

Adviser, should fill out the Program of Study Form included in this handbook. This will help each student chart a clear plan for his or her program.

Graduation Requirements

The general requirements for the MS degree in Applied and Computational Mathematics are the same as in the Graduate Bulletin. These requirements, in summary, are the following.

> (i) Successful completion of all required courses of the Institute and the College. As mentioned in Section 6.1, these requirements should be met within seven years of the date of the oldest course counted toward the MS program.
>
> (ii) A program cumulative grade point average of 3.0 (B) or higher. (For BS/MS students, this program GPA is computed solely based on the courses counted for the MS degree.)
>
> (iii) Completion of a thesis at the discretion of the degree-granting program.
>
> (iv) Satisfactory adjustment of all financial obligations to the Institute.

The Dean of the College of Science and the faculty of the School of Mathematical Sciences may be petitioned, in extraordinary circumstances, to review and judge the cases of individual students who believe the spirit of the above requirements have been met yet fall short of the particular requirement. If the petition is accepted and approved by the faculty, Dean, and Provost and Vice President for Academic Affairs, a signed copy will be sent to the registrar for inclusion in the student's permanent record.

Seven-year Rule: The required credits for the master's degree must be completed within seven years after the student's initial registration in graduate courses at the Institute as a regular or non-matriculated student. Extension of this rule may be granted through petition to the Graduate Council. Note that students who are required to, but do not enroll in Continuation of Thesis, will be automatically withdrawn from the program even if the seven-year limit has not been reached.

Facilities

Wallace Center

The Wallace Memorial Library (http://library.rit.edu) is a high-technology, multimedia resource center containing more than 700,000 items. Services include interlibrary loans, computerized literature, searching of databases, and class instruction. Each RIT college has a Reference Librarian to serve as liaison. The College of Science liaison is Dr. Adwoa Boateng (http://infoguides.rit.edu/prf.php?account_id=43305); she can be contacted for consultation and assistance related to research needs.

Computing Services

The RIT computing environment includes support provided by Information and Technology Services. Every enrolled RIT student receives a username and password that may be used to access computer laboratories, library services, and assistance to connect student computers to RIT's network for

Internet access and communicate with others electronically. Students can contact the Information & Technology Services at (585) 475-HELP (4357) or visit http://start.rit.edu for assistance and service support.

Students also have access to programming and simulation languages, graphics software, and design tools on a variety of platforms.

Financial Aid

A limited number of Graduate Merit Scholarships are available from the Office of Financial Aid and a number of Teaching Assistantships are available from the School of Mathematical Sciences. The graduate program application packet also contains the application form for scholarships and assistantships. The amount of the scholarships varies and is applied towards tuition.

Faculty and Staff Profiles

A list of the names of the members of the Faculty in the School of Mathematical Sciences, indicating their areas of specialization, is given in Appendix A. As may be seen from this list, members of the Faculty have interests in a wide array of applications of mathematics.

A list of staff members is provided in Appendix B. The list includes the roles in which each staff member supports SMS graduate students.

Miscellaneous Information

Course Meeting Times

Graduate course meeting times can be found on the Student Information System, located at http://sis.rit.edu.

Communication

The MS Program Director is **Dr. Matthew Hoffman**. His office is in Gosnell Hall, room GOS-2302. His phone number is **585-475-4209**, and his email address is **mjhsma@rit.edu.**

Email is the primary mode of communication used to contact students. Every enrolled student has an email account and is strongly advised to check for email messages regularly.

Automatic Withdrawal

A student will be withdrawn from the program if

(i) the student fails to register for any courses for three successive semesters;

(ii) the student has not registered for thesis work within one year after completing the coursework; or

(iii) the student has completed the minimum credit requirements for the program, has not yet successfully defended and submitted the thesis, and is not registered for Continuation of Thesis.

Students in danger of being withdrawn are advised to see their Faculty Adviser as well as the MS Program Director.

Enrollment

Enroll for courses via the **Student Information System (SIS)** located at http://sis.rit.edu.

Enroll for research and thesis credits by submitting a completed version of the form in Appendix E (or email equivalent) to the **Student Support Services Specialist, Ms. Corinne Teravainen**.

Note: Students who are matriculated in a degree or certificate program, or who are making application to one, should check with their Faculty Adviser before enrolling to make sure that the course(s) for which they plan to register fulfill the degree or certificate requirements of their program. In addition, certain courses may have prerequisites or restrictions placed on them.

RIT considers graduate-level students to be "full time" in every academic term in which they are enrolled for at least 9 credit hours. With approval of the MS Program Director, a full-time equivalency can be granted for such activities as thesis work, teaching assistantships and internships.

Graduate Probation and Suspension

Any matriculated graduate student whose program cumulative grade point average falls below a 3.0 (B average) after 9 semester credit hours or more will be placed on probation and counseled by his or her Faculty Adviser. These students will be required to raise their program cumulative grade point average to the 3.0 level within the next 9 semester credit hours. Otherwise, they will be suspended from the graduate program.

Any suspended student may apply to the MS Program Director for readmission and may be readmitted upon demonstration of sufficient and valid reason for readmission. The decision to readmit a student on probation or suspension will be made by the School of Mathematical Sciences Head. Any contracts negotiated and signed as a condition of readmission are binding.

Appendix A: Faculty Profiles

Faculty Name	College of Terminal Degree	Title	Specialty
Anurag Agarwal	SUNY Buffalo	Associate Prof.	Cryptography, Combinatorics, Complex Ana.
Ephraim Agyingi	University of Manchester (UK)	Associate Prof.	Numerical Analysis
Peter Bajorski	Technical University of Wroclaw, Poland	Professor	Imaging Science, Network Communication, Biomedical Applications, High-dimensional Data
Mihail Barbosu	Paris VI University (France)	Professor	Dynamical Systems, Applied Math., Celestial Mechanics and Space Dynamics
Nate Barlow	Clarkson University, Potsdam	Assistant Prof.	Stability Analysis, Asymptotic & Approximation Methods, Math for Engineers, Fluid Mechanics, Numerical Methods, Parallel Programming, Waves
David Barth- Hart	University of Rochester	Associate Prof.	Algebra, Number Theory
Maurino Bautista	Purdue University	Professor	Numerical Analysis, Applied Math.
Bernard Brooks	University of Guelph	Professor	Mathematical Biology
Nathan Cahill	University of Oxford (UK)	Associate Prof.	Biomedical Image Computing
Manuela Campanelli	University of Bern	Professor	Astrophysics
Linlin Chen	University of Rochester	Associate Prof.	Data Analysis, Computational Biology
Elizabeth Cherry	Duke University	Associate Prof.	Mathematical Physiology, Scientific Computing, Dynamical Systems
Matthew Coppenbarger	University of Rochester	Head of School; Associate Prof.	Math. Physics Disc. Math., Functional Analyst.
Michael Cromer	University of Delaware, Newark	Assistant Prof.	Analysis and Simulation of Nonlinear Systems of Partial Differential Equations; Complex Fluids, Modeling, Asymptotics, Perturbations, Numerical Methods
Joshua Faber	Massachusetts Institute of Technology	Associate Prof.	Numerical Relativity
Raluca Felea	University of Rochester	Professor	Microlocal Analysis
Ernest Fokoué	University of Glasgow	Associate Prof.	Statistical Machine Learning, Bayesian Statistics, Computational Statistics, Statistical Data Mining
John Hamilton, Jr.	Indiana University	Visiting Research Faculty	Mathematical Modeling
Anthony Harkin	Boston University	Associate Prof.	Dynamical Systems, PDEs, Comp. Math.
Matthew Hoffman	University of Maryland	Associate Prof.	Data Assimilation, Applied Mathematics, Scientific Computation
Jay Alan Jackson	Florida State University	Associate Prof.	Math & Music, Interactive Computer Graphics and Visualization
Jobby Jacob	Clemson University	Associate Prof.	Graph Theory
Baasansuren Jadamba	University of Erlangen-Nuremberg	Associate Prof.	Numerical Analysis of Partial Differential Equations, Finite Element Methods
Akhtar Khan	Michigan Technological University	Professor	Applied Math, Optimization, Medical Imaging
Seshavadhani Kumar	University of Delaware	Professor	Operations Research, Simulation
Steven LaLonde	Syracuse University	Associate Prof.	Multivariate Modeling, Survey Questionnaire Design, Psychometrics, Survey Sampling, Market Research
Manuel Lopez	Wesleyan University	Associate Prof.	Abstract Algebra
Carlos Lousto	Universiade Nacional de La Plata	Associate Prof.	Astronomy
Carl V. Lutzer	University of Kentucky	Professor	Mathematical Physics
Sophia Maggelakis	Old Dominion University	Professor	Mathematical Biology
Kara Maki	University of Delaware	Associate Prof.	Transport and Interfacial Phenomena, Complex Fluids, Rare Events
Nishant Malik	Potsdam Institute for Climate Impact Research	Assistant Prof.	

Appendix A: Faculty Profiles, Continued

Faculty Name	College of Terminal Degree	Title	Specialty
Carol E. Marchetti	University of Rochester	Associate Prof.	Statistics
James Marengo	Colorado State University	Professor	Statistics, Probability
Douglas Meadows	Stanford University	Professor	Topology, Computer Science
Laura Munoz	University of California, Berkeley	Assistant Prof.	Mathematical Physiology
Darren A. Narayan	Lehigh University	Professor	Graph Theory, Discrete Math
Richard O'Shaughnessy	California Institute of Technology	Assistant Prof.	Graviational Wave Astronomy, Numerical Relativity Merger Waveforms and Strong Field Tests of General Relativity
Niels Otani	University of California, Berkeley	Associate Prof.	Cardiac Electrophysiology Dynamics
Robert Parody	University of South Carolina	Associate Prof.	Experimental Design, Response Surface Methods, Mixture Experiments, Simulation, Quality Control and Improvement
Michael Radin	University of Rhode Island	Associate Prof.	Differential Equations
David Ross	Courant Institute of Mathematical Science	Professor	Applied Mathematics
Hossein Shahmohamad	University of Pittsburgh	Professor	Graph Theory
Wanda Szpunar-Lojasiewicz	University of Cracow, Poland	Associate Prof.	Analysis
Joseph Voelkel	University of Wisconsin-Madison	Professor	Statistical Methodology, Experimental Design, Statistical Process Control
Paul Wenger	University of Illinois at Urbana-Champaign	Associate Prof.	Graph theory
John Whelan	UC Santa Barbara	Associate Prof.	Gravitational Physics
Tamas Wiandt	University of Minnesota	Professor	Dynamical Systems
Elmer Young	Ohio State University	Associate Prof.	Topology
Yosef Zlochower	University of Pittsburgh	Associate Prof.	Numerical Relativity

Appendix B: Staff Profiles

Faculty Name	Title	Support Role for Graduate Students
Kate Koch	Staff Assistant	
Ginny Gross	Student Services Senior Staff Specialist	Helps students with enrollment
Corinne Teravainen	Student Support Services Specialist	Organizes teaching assistants
Tina Williams	Senior Staff Specialist, Administrative Office	Handles payroll matters for student employees

Appendix C: MATH Graduate Course Offerings

601 – Methods of Applied Mathematics
602 – Numerical Analysis I
605 – Stochastic Processes
606 – Graduate Seminar I
607 – Graduate Seminar II
622 – Mathematical Modeling I
631 – Dynamical Systems
641 – Logic, Set Theory and Computability
645 – Graph Theory
646 – Combinatorics
655 – Biostatistics
671 – Number Theory
702 – Numerical Analysis II
712 – Numerical Methods for Partial Differential Equations
722 – Mathematical Modeling II
731 – Advanced Dynamical Systems
735 – Mathematics of Finance I
736 – Mathematics of Finance II
741 – Partial Differential Equations I
742 – Partial Differential Equations II
761 – Mathematical Biology
771 – Mathematics of Cryptography
789 – Special Topics
790 – Research & Thesis
799 – Independent Study

Some of the above courses may be offered only upon sufficient demand or as topics courses.

COURSE OFFERINGS APPROVED FOR THE 2016-17 ACADEMIC YEAR

NOTE: (*) INDICATES THAT THE COURSE WILL BE OFFERED IN THE INDICATED SEMESTER ONLY UPON SUFFICIENT DEMAND.

		F	S
601	Methods of Applied Mathematics		X
602	Numerical Analysis I	X	
605	Stochastic Processes		X
606	Graduate Seminar I	X	
607	Graduate Seminar II		X
622	Mathematical Modeling I		X
631	Dynamical Systems	X	
641	Logic, Set Theory and Computability**		
645	Graph Theory	X	
646	Combinatorics		X
655	Biostatistics	X	
671	Number Theory	X	
702	Numerical Analysis II		X
712	Numerical Methods for PDEs	X	
731	Advanced Dynamical Systems		X
735	Mathematics of Finance I	X	
736	Mathematics of Finance II		X
741	PDE I	X	
742	PDE II*		X
761	Mathematical Biology*		X
771	Mathematics of Cryptography	X	
789	Special Topics	X	X
790	Research and Thesis	X	X
799	Independent Study	X	X
	* - Electives offered regularly		
	** - Electives offered upon sufficient enrollment		

Appendix D: Graduation checklist

Rochester Institute of Technology
School of Mathematical Sciences
Applied and Computational Mathematics Program

Name: _____ **UID:** _____

Concentration: _____

Faculty Adviser: _____

Thesis Adviser: _____

Thesis Topic: _____

	Semester	Course	Title	Credits	Grade
Year 1					
Year 2					

Appendix E: Request for Research and Thesis Credit Enrollment

Rochester Institute of Technology
School of Mathematical Sciences
Applied and Computational Mathematics Program

Name: _____ **UID:** _____

Term: _____ **Number of Research/Thesis Credits Desired:** _____

Thesis Topic: _____

Thesis Adviser: _____

Adviser Signature: _____ **Date:** _____

To enroll in research and thesis credits, submit this form with the Thesis Adviser's signature, or provide the same information by email with the Thesis Adviser included, by the end of the Add/Drop period to Ms. Corinne Teravainen, Student Support Services Specialist, in Gosnell 2306.