

Salve Regina University

Mathematics Major Handbook

Introduction

Mathematics has always been the language of technology and the natural sciences; however, during the past several decades the influence of mathematics has spread to the life, management, and social sciences as well. Furthermore, certain concepts inherent to mathematics—for example, respect for cause and effect, logic, honesty in presentation of material and critical thinking—are also at the heart of Western science and have been critical to the development of Western philosophy. Mathematics continues to be one of the greatest cultural and intellectual achievements of humankind. We wish to provide our students with the opportunity to develop an understanding and appreciation of this on-going achievement.

The mathematics programs at Salve Regina University, offered by the Department of Mathematical Sciences, support a liberal arts education by providing students a course of study to acquaint them with a broad range of concepts and tools of modern mathematics, develop an appreciation for the beauty of mathematics and its power in applications, strengthen their powers of abstract reasoning, and develop their analytic ability for examining and discovering structures and patterns. The department offers programs leading to a major or minor in mathematics. The department also offers courses to complete the core-curriculum requirement in mathematics and provides courses that constitute the mathematics component of other major programs at the University.

This document is intended to provide mathematics majors at Salve Regina University with detailed information on our major programs, course offerings of interest to majors, and other pertinent information to help mathematics majors succeed at Salve Regina and beyond.

Program Descriptions

Major in Mathematics (B.A.)

The Bachelor of Arts (B.A.) curriculum provides students with a solid foundation in mathematics while allowing them to combine the study of mathematics with an in-depth study of another field. For example, students can acquire excellent credentials for medical school by combining their B.A. in mathematics with at least two years of chemistry and at least one year each of biology and physics. Additionally, the B.A. in mathematics provides strong credentials for law school as well as for graduate school in mathematics.

Students seeking the B.A. in mathematics are required to take a minimum of thirteen (13) courses (41 credits):

MTH200: Discrete Mathematics 3

MTH203: Calculus III 3

MTH300: Linear Algebra 3

MTH301: Differential Equations 3

MTH411-412: Analysis I and II 3, 3

MTH415: Geometry 3

MTH421: Abstract Algebra 3

STA341-342: Statistical Theory I and II 3, 3

CMP201: Scientific Programming 3

PHY201-202: General Physics I and II 4, 4

While MTH201 and MTH202, Calculus I and II, are not included in the major, they or their equivalents are prerequisites for several required courses.

GPA requirement. To remain in the mathematics major program, a student must maintain an average of C in all required courses for the mathematics major, with no grade less than C- in any mathematics major core course. The *mathematics major core courses* are defined as the set consisting of MTH200, MTH203, MTH300, MTH301, and CMP201.

Double Major in Mathematics and Secondary Education (B.A.S.)

To earn a B.A.S. in mathematics in preparation for teaching at the secondary level, students are required to complete all the courses required for a B.A. in mathematics, and must also complete the requirements of the Secondary Education Department. To support the B.A.S. in mathematics and secondary education, the Mathematical Sciences Department has adopted for its curriculum the mathematics content standards described in Leitzel, James R.C. (Ed.). *A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics*. Washington, DC: Mathematical Association of America, 1991.

Minor in Mathematics

Students minoring in mathematics take six (6) courses (18 credits) in mathematical sciences at or above the 200 level, excluding STA201. The student determines the minor in consultation with the department chair.

Courses Credits

MTH200: Discrete Mathematics 3

Core Complement Course in Mathematics

This is a course in the foundations of mathematics and the ideas that underlie the science of computing. The topics that are explored are logical operations, relations and arguments, methods of proofs, set relations and operations, and difference equations. Topics in number theory are also explored.

MTH201: Calculus I 3

Core Complement Course in Mathematics

This course covers the following topics: limits and continuity, the derivative, finding and interpreting the derivative, graphing and optimization. The level and pace of this course are generally greater than those of the Applied Calculus I course (MTH191), and some proofs of important theorems are studied.

Prerequisite: MTH117 or equivalent.

MTH202: Calculus II 3

Core Complement Course in Mathematics

This course covers the following topics: integrals of functions of one variable, modeling with calculus, introduction to calculus of functions of several variables, techniques of integration, infinite series. Some proofs of important theorems are studied. *Prerequisite: MTH201 or equivalent.*

MTH203: Calculus III 3

Core Complement Course in Mathematics

This course covers the following topics: introduction to vectors, partial derivatives, and multiple integrals. Some proofs of important theorems are studied. *Prerequisite: MTH202 or equivalent.*

MTH300: Linear Algebra 3

This course covers the following topics: matrix algebra, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors and applications. Historical notes are included throughout the course. *Prerequisite: MTH202 or equivalent.*

MTH301: Differential Equations 3

This course covers the following topics: first-order ordinary differential equations, higher-order linear differential equations, stability and phase plane analysis, Laplace transformations, series solutions, numerical methods, and applications. Historical notes are included throughout the course. *Prerequisites:*

MTH202 or equivalent, and MTH300.

MTH399: Special Topics **1-3**

The purpose of this course is to provide an opportunity for students to investigate topics not covered in ordinary course work. The subject matter varies to suit the students and the interests of the professor.

MTH411-412: Analysis I, II **3, 3**

Topics are chosen from metric and normed spaces, functions of one and several variables, differentiation, Riemann integration, vector calculus and complex variables. Historical notes are included throughout the course. *Prerequisites: MTH200 and MTH203.*

MTH415: Geometry **3**

Students study concepts of geometry. In particular, students study Euclidean and non-Euclidean geometries. Historical notes are included throughout the course. *Prerequisite: MTH202 or consent of instructor.*

MTH421: Abstract Algebra **3**

In this course students study groups, rings, and fields. Topics in number theory are also explored and historical notes are included throughout the course. *Prerequisites: MTH200 and MTH300.*

MTH491: Internship **3**

MTH499: Independent Study **3**

Statistics Courses Credits

STA341: Statistical Theory I **3**

This course provides a calculus-based treatment of probability, which forms the foundation of statistics. Students study probability theory, combinatorics, random variables, discrete and continuous distribution theory, expected values, moment-generating functions, multivariate distributions, functions of random variables, and conditional and marginal probability distributions, and the Central Limit Theorem. *Prerequisite or Corequisite: MTH203.*

STA342: Statistical Theory II **3**

This course builds on the calculus-based treatment of probability provided in STA341 to introduce concepts in statistics. Topics in this course include least-squares regression, estimation including maximum likelihood and minimum variance estimators, confidence intervals, tests of hypotheses, significance testing with p-values, and goodness-of-fit tests. *Prerequisite: STA341.*

Computational Science Courses Credits

CMP200: Introduction to UNIX **1**

This course provides an introduction to UNIX and a desktop. Students learn how to log in and log out, bash shell commands, navigate the directory tree, manipulate files, create and delete files and directories, backup and restore user files and directories, set permissions on files and directories, customize the user environment, use basic network commands and programs, search directories and files, list and selectively terminate user processes, and write and execute shell scripts.

CMP201: Scientific Programming **3**

In this course students learn computer programming in a high-level programming language, while using computer programming to explore mathematical concepts. Along with problem analysis, algorithm development, and the integration of numerical and graphical computation in the solution of problems, students use computer programming to explore a variety of mathematical concepts such as recursion and mathematical induction, Euclidean algorithm, limits, convergence of sequences and series, Monte Carlo simulation and estimation of probability using pseudorandom number generators. *Prerequisite or*

Corequisite: MTH202.

CMP301: Scientific Computation

3

This course provides an introduction to numerical analysis and scientific computation. Topics include nonlinear equations, linear systems, interpolation and curve fitting, numerical differentiation and integration, numerical solution of differential equations, approximation of functions, and models of computation on serial and parallel computers. *Prerequisites: CMP201, MTH202, and MTH300.*

Technology Utilization

Support of the curriculum

The department makes use of several forms of technology in a wide variety of courses. For example, MATLAB is used in MTH202-203, MTH300-301, STA341-342, and CMP201. Additionally, Microsoft EXCEL has been used in MTH301, and WebCT has been used in MTH200.

Support of students

All department faculty members can be contacted via email, in addition to in-person meetings during office hours. Some department faculty members, additionally, provide help with course material via Instant Messenger.

Showcase your best work

For each of the mathematical sciences courses required for the major, each student is required to add one or two significant mathematical course assignments to his or her mathematics major electronic portfolio (or *ePortfolio*). An essay that explicitly ties the assignment to at least one standard, selected from the MAA's A Call for Change document, must accompany each such assignment.

Sample 4-year schedules for B.A. in Mathematics

Starting in the fall semester of an Odd Year (e.g., Fall 2007) with (MTH 201) Calculus I

Year	Fall	Spring
1	MTH201 (if needed) MTH200 should be taken if MTH201 is not taken here.	MTH202, MTH200 (if not taken in the Fall semester) MTH200 may switch places with CMP201.
2	MTH203, MTH300, PHY201 (may be taken in the 1 st or 3 rd year)	MTH301, CMP201 (may switch places with MTH200), PHY202 (may be taken in the 1 st or 3 rd year)
3	MTH421, STA341	STA342
4	MTH411, MTH415	MTH412

Starting in the fall semester of an Odd Year (e.g., Fall 2007) with (MTH 203) Calculus III

Year	Fall	Spring
1	MTH203	MTH200, CMP201
2	MTH300, PHY201 (may be taken in the 1 st or 3 rd year)	MTH301, PHY202 (may be taken in the 1 st or 3 rd year)

3	MTH421, STA341	STA342
4	MTH411, MTH415	MTH412

**Starting in the fall semester of an Even Year (e.g., Fall 2008) with (MTH 201)
Calculus I**

Year	Fall	Spring
1	MTH201 (if needed)	MTH202 (if needed), MTH200 (may switch places with CMP201)
2	MTH203, MTH300, PHY201 (may be take in the 1 st or 3 rd year)	MTH301, CMP201 (may switch places with MTH200), PHY202 (may be take in the 1 st or 3 rd year)
3	MTH411, MTH415	MTH412
4	MTH421, STA341	STA342

**Starting in the fall semester of an Even Year (e.g., Fall 2008) with (MTH 203)
Calculus III**

Year	Fall	Spring
1	MTH203	MTH200, CMP201
2	MTH300, PHY201 (may be taken in the 1 st or 3 rd year)	MTH301, PHY202 (may be taken in the 1 st or 3 rd year)
3	MTH411, MTH415	MTH412
4	MTH421, STA341	STA342

Note that MTH411-412, and MTH415 are offered every other academic year, when the fall semester occurs in an even year, while STA341-342, and MTH421 are offered every other academic year, when the fall semester occurs in an odd year. MTH415 and MTH421 are only offered during the fall semesters.

Declaring your major

Although you must officially declare a major by the end of your sophomore year (or after earning 60 credits), you may declare a major as early as the fall semester of your freshman year. In any case, if you're interested in majoring or minoring in mathematics, you should speak with the chair of the Mathematical Sciences Department as soon as possible during your freshman year. This is important to ensure that you register for the right courses at the right time so that you'll be able to complete your degree within four years.

To declare your major, you must

1. Obtain a copy of your transcript from the Registrar's Office. (Copies of transcripts are free, but you'll need to bring a photo ID.)
2. Schedule an appointment with the department chair.

During your meeting with the department chair, you will complete a declaration of major form along with the advising guide (which becomes the second page of your declaration of major form). The department chair will have current copies both of the declaration of major form and the advising guide.

If your major is only mathematics, then the department chair will make a copy of the completed form both for you and for the Mathematical Sciences Department records, and will deliver the form to the Academic Advising Office. You will also be assigned an advisor in the Mathematical Sciences Department. If, on the other hand, you want to declare as a mathematics/secondary education double major, you will additionally need to make an appointment with the chair of the Education Department to complete the declaration of major form. In this case, both department chairs must sign the form and you will be assigned two advisors, one in the Mathematical Sciences Department and the other in the Education Department.

What you can do with your B.A. in Mathematics from Salve Regina University

While many recent graduates of our major in mathematics have become secondary level mathematics teachers (e.g., Tiverton High School, and Portsmouth Abby), others have completed graduate programs in mathematical sciences (e.g., Mathematical Finance at Columbia University) and built successful careers in industry (e.g., Mizuho Bank in Japan and BlueCross BlueShield of Vermont).

Tips on how to be successful in your mathematics major

1. Meet with the department chair during your first year, as early as possible. Even the first semester of your freshman year is not too early to start planning for your mathematics major.
2. Take advantage of your professors' office hours.
3. Do not allow yourself to fall behind. Study at least some mathematics nearly every day, and ask questions when you have them.
4. Before each class, read the material in your textbook that will be covered in class. Write down your questions and make sure you get them answered, either in class or during office hours.
5. Take some time during breaks between semesters to review the content of courses that are prerequisites for the courses you will take in the upcoming semester.
6. Courses you take outside of the Mathematical Sciences Department provide important contributions to your education as a mathematician. Among other things, they can help you improve your communication skills, and can help you connect mathematics to the world around you.
7. It can be helpful to study with other students, but make sure you study mathematics by yourself, too. It is important to be able to communicate mathematical ideas to your peers, but you also need to be an independent learner.

Mathematical Sciences Department Faculty

All full-time Mathematical Sciences Department faculty members hold Ph.D. degrees either in mathematics or applied mathematics, and, in addition to being committed to teaching, have been actively engaged in scholarship. In particular, department faculty members have given talks at conferences, published papers in peer-reviewed journals, published books, obtained grants, and consulted to various organizations and companies.

Dr. Carol Gibbons, *Assistant Professor*

O'Hare 200, (401) 341-3114, gibbons@salve.edu

Ph.D., Mathematics, University of Rhode Island

M.S., Mathematics, University of Rhode Island

B.A., Mathematics, Merrimack College

Interests: Difference equations, assessment of student learning, and group and individual math projects



Sr. Madeleine Gregoire, D.H.S., *Associate Professor*

O'Hare 200, (401) 341-3141, gregoir@salve.edu

Ph.D., Mathematics, The Catholic University of America

M.A., Mathematics, The Catholic University of America

B.A., Elementary Education, Diocesan Sisters' College

Interests: Foundations of mathematics, and abstract algebra



Dr. Ernest E. Rothman, *Professor and Chair*

O'Hare 240B, (401) 341-3237, rothman@salve.edu

AIM, Yahoo!, MSN: erothmanSRU; Jabber: erothmanSRU@jabber.org;

Skype: erothmansru

<http://homepage.mac.com/samchops>

Ph.D., Applied Mathematics, Brown University, May 1988

Sc.M., Applied Mathematics, Brown University, May 1984

B.S., Mathematics, *summa cum laude* with Honors in Mathematics, Brooklyn College, CUNY, June 1981

Interests: Numerical analysis and scientific computation; development on UNIX-based operating systems, especially Mac OS X; and applied mathematics and computational science education.



Dr. William R. Stout, *Professor*

O'Hare 240A, (401) 341-3110, stout@salve.edu

Ph.D., Applied Mathematics, University of Virginia

M.B.A., George Washington University

M.S., Mathematics, Colorado State University

B.A., Mathematics, College of the Holy Cross



Interests: Analysis, differential equations, and mathematics education.

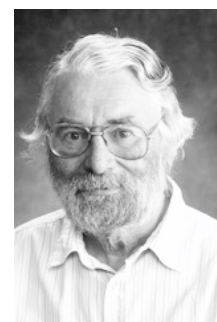
Dr. Jörn Zeuge, *Associate Professor*

O'Hare 201, (401) 341-3155, zeugej@salve.edu

Dr. rer. nat., Mathematics, University of Hamburg

Dipl.-Math., Mathematics, University of Hamburg

cand. rer. nat., Mathematics, University of Hamburg



Interests: Geometry, history of mathematics, and astronomy

Resources on the Internet

Salve Regina University Mathematical Sciences Department

<http://www.salve.edu/departments/mth/index.cfm>

Mathematics

- Mathematical Association of America (<http://www.maa.org/>)
- American Mathematical Society (<http://www.ams.org/>)
- Society for Industrial and Applied Mathematics (<http://www.siam.org/>)
- Mathworld (<http://mathworld.wolfram.com/>)
- The Geometry Center (<http://www.geom.umn.edu/>)
- National Council of Teachers of Mathematics (<http://www.nctm.org/>)

Statistics

- American Statistical Association (<http://www.amstat.org/>)
- NIST/SEMATECH e-Handbook of Statistical Methods

(<http://www.itl.nist.gov/div898/handbook/index.htm>)

Computer Science

- IEEE Computer Society (<http://www.computer.org/portal/site/ieeecs/index.jsp>)
- Association for Computing Machinery (<http://www.acm.org/>)

Computational Resources

- The MathWorks (<http://www.mathworks.com/>)
- Microsoft, Inc. (<http://www.microsoft.com>)
- Apple Computer, Inc. (<http://www.apple.com>)
- The R Project for Statistical Computing (<http://www.r-project.org/>)
- Octave (<http://www.gnu.org/software/octave>)
- OpenOffice (<http://www.openoffice.org/>)

Interdisciplinary Resources

- DIMACS (<http://dimacs.rutgers.edu/>)
- Society for Mathematical Biology (<http://www.smb.org/>)
- The Society for Modeling and Simulation International (<http://www.scs.org/>)
- Computational Economics (<http://wueconc.wustl.edu/~sce/>)
- International Association for Statistical Computing (<http://www.stat.unipg.it/iasc/>)

Career Information

- Salve Regina University Career Development Center (<http://www.salve.edu/offices/careerdev>)
- Casualty Actuarial Society (<http://www.casact.org/>)
- Society of Actuaries (<http://www.soa.org/ccm/content/>)
- Be An Actuary (<http://www.beanactuary.org/>)
- The Actuarial Foundation (<http://www.actuarialfoundation.org/>)
- American Academy of Actuaries (<http://www.actuary.org/>)
- Careers in Mathematics Video (<http://www.msri.org/ext/CareersInMathematics.html>)
- US Department of Labor Bureau of Labor Statistics Occupational Outlook for
 - Mathematicians (<http://stats.bls.gov/oco/ocos043.htm>)
 - Actuaries (<http://stats.bls.gov/oco/ocos041.htm>)
 - Statisticians (<http://stats.bls.gov/oco/ocos045.htm>)
 - Computer Programmers (<http://stats.bls.gov/oco/ocos110.htm>)
- American Mathematical Society's Mathematical Sciences Career Information (<http://www.ams.org/careers/home.html>)
- Society for Industrial and Applied Mathematics Career Information for Applied Mathematicians (<http://www.siam.org/careers/>)

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