School of MATHEMATICAL AND STATISTICAL SCIENCES

GRADUATE STUDENT HANDBOOK

2019-2020

Table of Contents

Table of Contents
Welcome
Prospective Students
Master of Science
Ph. D.
Tuition/ Finacial Aid
Academic Opportunities
Academic Policies
Student Responsibilities
Facilities
Inclusion and Equity

1. Welcome

We are delighted that you have chosen to pursue our graduate studies (MS, PhD) in Mathematical Sciences at Clemson University. This handbook is designed to provide information to assist you in succeeding in all areas of your Clemson Mathematical Sciences experience and to answer some of the most common questions students typically have. While we have tried to cover all of the pertinent information, please feel free to contact us at any time for assistance. The first point of contact is Ms. Julie McKenzie (jdmcken@clemson.edu, (864) 656-5201); she can refer you to the best resource for your question.

The graduate Mathematical Science program is run by the graduate affairs committee. The committee members for the current and previous academic year are given below:

Committee for Graduate Affairs

(2018-2019)	(2019-2020)
Dr. Ellen Breazel	Dr. Taufiquar Khan*
Dr. Eleanor Jenkins	Dr. Chris McMahan
Dr. Taufiquar Khan*	Dr. Mishko Mitkovski
Dr. Peter Kiessler	Dr. Beth Novick
Dr. Chris McMahan	Dr. Yuyuan Ouyang
Dr. Svetlana Poznanovikj	Dr. Svetlana Poznanovikj
Dr. Brook Russell	Dr. Brook Russell
Dr. Martin Schmoll	Dr. Margaret Wiecek
Dr. Hui Xue	Dr. Fei Xue

*Associate Director for Graduate Studies

2. General Information

2.1. Clemson University

Clemson University was founded in 1889, a legacy of Thomas Green Clemson who willed his Fort Hill plantation to the state of South Carolina to establish a technical and scientific institution. Today, approximately 24,000 students (about 5,000 graduate students) are enrolled at Clemson. As a land-grant University, Clemson is engaged in extensive research, extension, and service activities to the people of South Carolina. You can access the University's website here.

2.2. College of Science

The College of Science at Clemson brings together the fields of mathematics, physical sciences and life sciences to give them additional attention and focus. Our faculty and students are driven by curiosity and the goal of improving the lives of everyone around us. Together, we will maintain a clear focus as we search for the discoveries of the future. You can access the College of Science website here.

2.3. Mathematical Sciences

2.3.1. Vision

The School of Mathematical and Statistical Sciences graduate program will be recognized nationally for its efforts to prepare mathematical scientists for academic and nonacademic employment, and for the high quality of the disciplinary and interdisciplinary research by its faculty and students.

2.3.2. Mission

The mathematical sciences Ph.D. program will prepare and train experts and leaders in the mathematical sciences. Our Ph.D. graduates will be experts in their research field, be familiar and competent in a broad array of mathematical sciences techniques, and will be effective communicators and teachers of basic mathematical sciences who can mentor and lead future mathematical scientists.

The mission of our Master of Science in Mathematical Sciences program is to prepare and train the next generation of mathematical scientists. M.S. students will familiarize themselves with a broad base of mathematical techniques from many areas of the mathematical sciences. They will be involved in a significant research project and will be taught to effectively disseminate their findings through written publication and oral presentation. Upon receiving the M.S. degree these students will be competent in a broad array of mathematical science techniques and will be effective communicators and teachers of basic mathematical sciences.

2.3.3. History

In 1975 the School put together a successful curricular reform to create an applied master's program in mathematical sciences. A grant from the NSF Program Alternatives in Higher Education supported efforts to create this novel program, where the emphasis was to prepare graduates for careers in business, industry, and government. A distinguished Board of Advisors provided valuable guidance during the planning phase of the applied master's program and included both academic members (from Brown, Princeton, Cornell, Rice) as well as members from industry (Milliken Corporation) and government (ICASE, Office of Naval Research, Oak Ridge National Labs). It was agreed that a level of training between the baccalaureate and the Ph.D., something more ambitious than the traditional master's degree, would be attractive to students and fill a significant national need. The applied master's program was formally created in December 1975.

Specifically, the applied M.S. program was based on the following premises (which not only turned out to be correct but which also anticipated several recent national trends):

- The major source of employment for mathematical scientists in the future will be nonacademic agencies.
- Most such employers will require more than a B.S. degree but less than a Ph.D. degree in the mathematical sciences.
- Employers will prefer personnel who possess not only a concentration in a particular area of the mathematical sciences, but also diversified training in most of the other areas.
- Graduates should possess more than superficial education in applying mathematical techniques to solve problems in areas other than the mathematical sciences. Inherent in this training is the ability to communicate, both orally and in writing, with persons from such areas.
- It is desirable to obtain such broad-based education in the mathematical sciences prior to specializing for the Ph.D. degree.

Table of Contents
Welcome
Prospective Students
Master of Science
Ph. D.
Tuition/ Finacial Aid
Academic Opportunities
Academic Policies
Student Responsibilities
Facilities
Inclusion and Equity

- Our applied master's program has subsequently been a model for other programs nationally, anticipating the breadth of training and computational skills needed for employment in business, industry, and government. The teaching component of the program, carried out as part of their assistantship duties, also affords our graduates valuable experience (and a competitive advantage) when applying for academic positions.

2.3.4. Faculty and Staff

An updated list of the Mathematical and Statistical Sciences Faculty can be found here, and an updated list of the Staff can be found here.

3. Prospective Students

Clemson's School of Mathematical and Statistical Sciences was one of the pioneers in producing graduate programs which incorporate a wide breadth of mathematical training along with deep content knowledge in an area of specialty into all levels of the graduate program. Students seeking either the M.S. or Ph.D. degree may choose to specialize in any one of the many areas of expertise of our faculty. Graduates from our programs are particularly desirable in industrial settings and in research focused jobs. They are also well equipped to teach a wide variety of courses at the undergraduate level upon graduation which increases their market value in the academic sector as well. In addition to our curriculum we also offer international exchange programs at the graduate level.

If you would like to visit our campus and meet some of our current faculty and students, please contact us and we will be glad to help you arrange an informative and pleasant visit. We can best accommodate visitors who allow us at least two weeks to plan the visit and will do our best to accommodate all visitors.

3.1. Prerequisite Requirements

In general, it is expected that students possess a bachelor's degree in mathematics, statistics, or computer science. In some cases, students from other departments who have an interest and background in mathematics can be admitted into our graduate programs. Any student who does not possess a Masters level degree in Mathematics or Mathematical Sciences and who desires to complete a PhD in our School will be required to complete the MS degree en route to the PhD.

All students entering the program are expected to have undergraduate prerequisite courses (linear algebra, differential equations, statistics, and a computer language) as well as undergraduate foundation courses (modern algebra, advanced calculus, probability, and discrete computing). Generally, an entering student is expected to have completed three of the four foundation courses prior to entry into the program in order to complete the master's program in two years plus two summer sessions.

Deficiencies will ordinarily be removed by taking the corresponding mathematical sciences course (MATH 6120, 6530, 6000, and 6600/8630, respectively).

Typical Requirements for admission include a bachelor's degree with at least a 3.4 grade point average. A minimum GRE score of 159 Quantitative, 156 Verbal, and 3.5 Analytical Writing is also expected.

For international students, a TOEFL score of at least100 (Internet Based) is required. On occasions, when other factors are considered (such as extremely strong letters of recommendation or extenuating circumstances in the undergraduate record), students may be admitted into the program; their progress in the first semester is then closely monitored by the Associate Director for Graduate Studies.

3.2. Application Information

All application materials must be submitted through the online application system or sent directly to the Office of Graduate Admissions. Accompanying the applications, students must submit the following:

- Transcripts: any applicant will be required to submit the official transcripts from their undergraduate and graduate institutions. The Graduate School policy on transcripts can be accessed on the admissions page.
- Test Scores: the School requires GRE General Test scores. International students must also submit TOEFL scores. Be sure that your official test scores are sent directly from Educational Testing Services to Clemson. Clemson University's school code is **5111**.
- Letters of Recommendation: Three letters of recommendation are required. You will be asked to submit the names and email addresses of your recommenders on the online application. Your recommenders will receive instruction on submitting their recommendations from the application system.
- Statement (optional): A one page statement of your academic interests can improve your chances for admission. This statement should include your area of interest, career plans, and an indication of why you selected Clemson University.

Information about application fees can be found here. If you are applying for admission in the fall term (which begins in mid-August), it is recommended that you submit your application materials by January 15. If you are applying for the spring term (which begins in early January), submit application materials by October 1. However, completed applications received after these dates may still be considered for admission and financial aid. International applications should check with the International Services for additional deadlines.

The most important criterion for admission is whether a student's background and ability are sufficient to indicate successful completion of the degree program. Selection for financial aid is more competitive than just admission to the School. Additionally the goal of our assistantship program is the development of excellent teachers. International students will be required to pass the Clemson English Speaking Proficiency (CESP) test in order to maintain any assistantship offered.

3.3. Graduate Student Supervision

The School's Associate Director for Graduate Studies assigns all new graduate students to a temporary curriculum advisor, based on the student's transcript and stated interest areas. This curriculum advisor assists in planning for the first year's courses (fall, spring, and summer), and also serves as a mentor to the student relative to curriculum matters and career choices. In addition, the student's teaching activities are also monitored by the course coordinator. In this way, feedback concerning effective teaching strategies is provided as well as advice about handling potential classroom problems.

Each spring semester, new graduate students are required to attend a seminar in which faculty members from the School present their research interests and possible topics for master's projects. M.S. students select their advisor and their master's committee by the end of the second semester in the program, at which time the GS2 (committee selection and plan of study) is filed with the Graduate school. The student's M.S. committee is comprised of three faculty members (including their advisor), with at least two of the three members selected from the School of Mathematical and Statistical Sciences. The faculty advisor also serves as mentor for the student's teaching activities during the second year. Classroom visits are scheduled and an on-line teaching evaluation form is submitted by the advisor after each visit.

In addition, faculty serve on the advisory committees that approve each student's curriculum plan and administer the final oral examination on the student's project. Faculty members also serve as the advisors to the different student organizations, helping the student officers gain leadership experience. The School currently has student chapters of the American Mathematical Soceity (AMS), the Associaton for Women in Mathematics (AWM), and the Society for Industrial and Applied Mathematics (SIAM).

4. Master of Science Program

The mission of our Master of Science in the mathematical sciences program is to prepare and train the next generation of mathematical scientists. M.S. students will familiarize themselves with a broad base of mathematical techniques from many areas of the mathematical sciences. They will be involved in a significant research project and will be taught to effectively disseminate their findings through written publication and oral presentation. Upon receiving the M.S. degree these students will be competent in a broad array of mathematical science techniques and will be effective communicators and teachers of basic mathematical sciences.

The M.S. program is structured to introduce the student to many areas of the mathematical sciences and develop deep knowledge in the student's chosen area of specialization. Students are required to take courses satisfying a breadth requirement, concentration component and complete and present a project or thesis. Details about these requirements are outlined below.

4.1. Breadth Requirement

The M.S. breadth requirement consists of six graduate courses one from these five: algebra, analysis, computing, operations research, statistics, and one additional course in operations research or statistics. It is strongly suggested that students select from among the courses listed here. Any deviation from the choices of breadth courses listed here should be pre-approved by the Associate Director for Graduate Studies and the student's advisor.

Area	Suggested Courses
Algebra & Discrete Math	MATH 8530, 8510
Analysis	MATH 8210
Computational Math	MATH 8600
Operations Research (OR)	MATH 8100
Statistics	MATH 8000, 8050
OR or Stats	MATH 8000, 8040, 8030, 8140

Concentration Requirement

In addition to the satisfying the breadth requirements, students must select an identifiable concentration area and take six additional courses in that area. These include Algebra, Analysis, Computational Mathematics, Operations Research, Statistics and Probability, and Applied Statistics and Data Science. More detailed descriptions of each of these areas can be found in Section 7.

4.2. Research and Dissemination of Results

As a means of integrating the student's program of diverse study, a master's project must be completed by the end of the second year. The student makes an oral and written presentation of the master's degree project.

Alternatively, a student can opt to complete a M.S. thesis instead of the written M.S. project described above. If the student chooses this option then two of the concentration courses will be replaced with six hours of M.S. research.

To arrange the masters' project or thesis presentation, students will first need to reserve a room with April Haynes (ahayne@clemson.edu, (864) 656-5224). This must be done at least 2 weeks before the presentation date. Depending on the timeframe, students can choose to reserve a conference room or one of the classrooms. The availability of Martin O-10 or O-112 can be checked ahead of time on the room reservations page by clicking the specific room. Next, to officially schedule the presentation of a M.S. thesis, students must submit their presentation's date and time to the Grad School using their on-line form. This needs to be done no less than 2 weeks before the defense. Finally, students need to submit the School's Presentation Information form to Julie McKenzie (jdmcken@clemson.edu, (864) 656-5201) for final processing no later than 2 weeks before their defense. The Presentation Information form can also be found in Martin O-100. Julie will create an announcement and complete the GS7M form (students do not fill out the GS7 form themselves).

4.3. Research Hours Policy

M.S. students who are completing a master's project should register for one hour of MATH 8920 during their last semester in the program. M.S. students who are completing a master's thesis should register for a total of six hours of MATH 8910 during their last two semesters in the program. In very rare circumstances an M.S. student may be allowed to register for MATH 9700 (independent study) hours. This will be evaluated by the Associate Director for Graduate Studies on a case by case basis.

4.4. Program Timeline

A typical timeline for a M.S. program is as follows:

Semester 1

- Focus on finishing three breadth courses.
- If this is a spring semester, then attend the first year seminar.
- International students should enroll in our language improvement course and work toward passing the Clemson English Speaking Proficiency (CESP) test.

Semester 2

- Finish breadth requirements and attend first year seminar (spring semester only).
- Students who are supported as TAs should participate in the School's teacher training course (spring semester only).
- Choose a research adviser.
- Work with your adviser to identify a research committee (two more faculty members) and submit a committee selection form via iROAR.
- Ideally students will identify their research projects and get started with research at the end of the second semester.

Semester 3

- Work with your research adviser to complete a plan of study and submit the GS2 or GS2-14 form via iROAR early in the third semester.
- Students should make significant progress on their research projects by the end of the third semester.
- This is typically when those on TA support begin their teaching responsibilities.

Semester 4

- There are many things to complete this semester before you graduate. Be sure to check the graduate school deadlines for thesis defenses and graduation applications.
- Complete your research project.
- Write up your project or thesis.
- Defend the thesis or project. The defense will need to be scheduled through Julie McKenzie (jdmcken@clemson.edu, (864) 656-5201).
- Graduate!

More detailed sample curriculum for different concentration areas can be found below. For scheduling purposes,

M.S. Concentration Area	Sample Curriculum
Algebra & Discrete Math	Fall: 8000, 8210, 8510 Spring: 8030, 8050, 8600 Summer: 8530 Fall: 8100, 8550/8580, 8610 Spring: 8110, 8220, 9510/9520, 8920
Analysis	Fall: 8100, 8530, 8250/8260 Spring: 8050, 8210, 8600 Summer: 8030 Fall: 8410, 8610, 8250/8260 Spring: 8090, 8110, 8310, 8920
Computational Math	Fall: 8600, 8210, 8100 Spring: 8610, 8050, 8530 Summer: 8030 Fall: 8660, 8250, 8170 Spring: 9830, 9270, 8220
Operations Research (OR)	Fall: 8050, 8100, 8650 Spring: 8600, 8210, 8530 Summer: 8030 Fall: 8220, 8250, 8610 Spring: 9270, 9880, modeling course in another department, 8920
Stochastics	Fall: 8000, 8100, 8530 Spring: 8050, 8210, 8600 Summer: 8030 Fall: 8170, 9010, 9880/simulation Spring: 8110, 8090, 8180, 8920
Statistics and Probability	Fall: 8000, 8040, 8530 Spring: 8050, 8600, 8810 Summer: 8210 Fall: 8010, 8070/8090, 8100 Spring: 8020, 8030, 8060/8080/9810, 8920

be sure to consult the long range plan of course offerings.

5. Doctor of Philosophy (Ph.D.) Program

The mathematical sciences Ph.D. program will prepare and train experts and leaders in the mathematical sciences. Our Ph.D. graduates will be experts in their research field, be familiar and competent in a broad array of mathematical sciences techniques, and will be effective communicators and teachers of basic mathematical sciences who can mentor and lead future mathematical scientists.

There are 5 requirements in the Ph.D. program: the preliminary exams, breadth requirement, depth coursework, comprehensive exam, and dissertation. The details of these requirements are outlined below.

5.1. Preliminary Exams

The first priority of a beginning Ph.D. student is to pass three preliminary exams. In order to remain in good standing, the preliminary exams must be completed within two years of entering the Ph.D. program (after obtaining master's if "master's en route"). Listed below are the examination areas and the preparatory coursework for each exam. Student can also view past exams and syllabi here.

Preliminary Exams are graded either Strong Pass/Pass/Fail. Within 2 years of entering the Ph.D. program, graduate students are required to receive at least 2 Strong Passes and an additional Pass or Strong Pass without accumulating 4 Fails. MS students are allowed to take prelims and all passes and fails will count toward their progress. Any prelims taken by a graduate student become part of their permanent prelim record.

A no-show will count as a Fail if a student signed up and did not withdraw by the specific withdrawal deadline (which are set by the Associate Director for Graduate Studies) unless there are unusual circumstances such as a medical excuse, a family emergency etc. An exception to the no-show fail policy can only be made if a written request is submitted by the student to the Associate Director for Graduate Studies and Grad Student Services Coordinator and approved by the Associate Director for Graduate Studies.

Algebra & Discrete Math	MATH 8510, 8530
Analysis	MATH 8210, 8220
Computational Math	MATH 8600, 8610
Operations Research (OR)	MATH 8100, 8130
Statistics	MATH 8040, 8010*
Stochastic	MATH 8030, 8170*

*(8000 is a helpful prerequisite for these courses)

The exams are offered in August and January of each year; here is how to sign up.

5.2. Breadth Requirements

Ph.D. students are required to complete two breadth courses in each of the following areas: algebra and discrete math, analysis, computational math, operations research and stochastics, and statistics. Transfer courses and coursed completed as a Masters student en route to the Ph.D. may be counted toward this requirement (see the courses listed below in Section 7).

5.3. Ph.D. Coursework

The coursework of a Ph.D. student must include at least 27 hours of non-research, non-professional development graduate courses at the 8000 level or above. Courses taken in order to fulfill another degree may not be counted. The Ph.D. coursework should also include at least 18 hours of Math 9910 (dissertation research).

5.4. Comprehensive Oral Examinations

Within one year of completing the preliminary examinations, a Ph.D. student must complete a comprehensive oral examination (fourth exam) given by his or her dissertation committee. This oral examination is designed to demonstrate the student's readiness to begin his or her Ph.D. research.

To arrange the comprehensive oral examination, students will first need to reserve a room with April Haynes (ahayne@clemson.edu or (864) 656-5224). This must be done at least 2 weeks before the examination date. Students may choose to reserve a conference room or one of the classrooms. The availability of Martin O-10 or O-112 can be checked ahead of time on the room reservations page by clicking the specific room. Next, to officially schedule the presentation, students must submit their presentation's date and time to the Grad School using their on-line form. This needs to be done 2 weeks before the examination. Finally, students need to submit the School's Presentation Information form to Julie McKenzie (jdmcken@clemson.edu or (864) 656-5201) for final processing 2 weeks before their examination. This form can also be found in Martin O-100. Julie will create an announcement and complete the GS5D form (students do not fill out the GS5D form themselves).

5.5. Research and Dissemination of Results

The final requirement of the Ph.D. degree is the Ph.D. dissertation. Ph.D. students are required to write a Ph.D. dissertation detailing their original and significant contributions to the body of research in their area of concentration and defend it. The Graduate School has compiled a guidebook for theses and dissertations.

The process of arranging the Ph.D. dissertation defense is nearly identical to that of arranging the comprehensive oral examination. All steps should be done at least 2 weeks before the day of the defense. Students must first reserve a room with April Haynes. Next, students must officially schedule their defense with the Grad School using their on-line form. Typically students should allow at least 2 weeks between giving their defense and the GS7D form deadline (see Section 8.4). Finally, students need to submit the School's Presentation Information form to Julie McKenzie for final processing no later than 2 weeks before their defense. Julie will create an announcement and complete the GS7D form (students do not fill out the GS7D form themselves).

Note that students will also need to submit their completed thesis or dissertation electronically for format approval. Visit Graduate School's website for the deadlines.

5.6. Research Hours Policy

Ph.D. students begin the program with an allowance of zero research hours per semester. As students demonstrate maturity by passing certain milestones in the Ph.D. program this allowance is increased as follows:

- When a student completes the three required prelims, their research hours allowance is increased by three hours per semester.
- When a student completes the Ph.D. breadth requirement, their research hours allowance is increased by three hours per semester.
- When a student completes their comprehensive oral exam, their research hour allowance is increased by three hours per semester.

5.7. Program Timeline

A typical timeline for a Ph.D. student is as follows:

Year 1

- Focus on completing coursework related to prelim exams
- Attempt a prelim (or two) at the end of this year.
- Attend a graduate student seminar and research seminar each week.

Year 2

- Complete all prelims during this year
- Choose a research advisor during this year as well.
- Complete a GS2 committee selection form via iRoar.
- Attend a graduate student seminar and research seminar each week.

Year 3

- Begin working on research projects and develop a prospectus for your dissertation in consultation with your research adviser.
- Submit a GS2 Ph.D. coursework via iRoar.
- Complete your comprehensive oral exam during this year.
- Complete the Ph.D. breadth requirement.
- Attend a graduate student seminar and research seminar each week.

Year 4

- Focus on your research and topics coursework in your area of specialty.
- Attend a graduate student seminar and research seminar each week.

Year 5 (and possibly 6)

- Attend a graduate student seminar and research seminar each week.
- Make sure to double check the Graduate School deadlines for graduation.
- Complete and defend your dissertation.
- Graduate!

6. Tuition and Financial Aid

6.1. Tuition and Fees

For additional information on tuition, fees, assistantships and other forms of support available to graduate students, please note that our program fees are classified as Tier 2 fees and see the Financial/Tuition on the Student Financial Servies website.

6.2. Assistantships and Fellowships

All incoming students will be considered for School assistantship support which includes tuition remission (fees are still charged) and a stipend. Assistantships involve instructing or assisting in the instruction of a maximum of 10 semester credit hours per year. These assistantships consist of $17,000 stipends per academic year for MS students and up to $18,000 per year for Ph.D. students. Stipends are distributed over nine months with an additional $3,000 for summer assistantships. Teaching assistants also receive a substantial tuition reduction. For eligibility, enrollment and other information on Clemson's graduate assistantship policies, visit here.

In addition, graduate students are also supported through faculty research grants or contracts that can come with tuition reductions. The Graduate School awards several one-year $5,000 to $10,000 scholarships to highly qualified applicants. SC Graduate Incentive Fellowships are available to graduate students who are members of minority groups; these renewable awards provide $10,000 per year for doctoral students. More information for Clemson Fellowships and Awards can be found at here.

7. Academic Opportunities

7.1. Faculty Research Areas

7.1.1. Algebra, Discrete Mathematics and Number Theory

The field of algebra, discrete mathematics, and number theory encompasses one of the primary branches of pure mathematics. Problems in this field often arise (or follow naturally from) a problem that is easily stated involving counting, divisibility, or some other basic arithmetic operation. While many of the problems are easily stated, the techniques used to attack these problems are some of the most difficult and advanced in mathematics. Algebra, discrete mathematics, and number theory have seen somewhat of a renaissance in the past couple of decades with Andrew Wiles' proof of Fermat's Last Theorem, the increasing need for more advanced techniques in cryptography and coding theory arising from the internet, as well as surprising applications in areas such as particle physics and mathematical biology. Algebra, discrete mathematics, and number theory have been featured in the motion picture "Good Will Hunting", the play "Fermat's Last Tango," as well as numerous episodes of the CBS hit drama "Numb3rs."

There are five different concentration areas with in this field: Applicable Algebra, Combinatorics and Discrete Mathematics, Commutative Algebra, Mathematical Biology and Number Theory.

The core courses of an algebra, discrete mathematics, and number theory concentration are matrix analysis (MATH 8530) and abstract algebra I and II (MATH 8510, MATH 8520). Matrix analysis is a basic course in linear algebra dealing with topics such as similarity of matrices, eigenvalues, and canonical forms just to name a few. Abstract algebra I and II abstract the familiar structures of the integers, rational numbers, matrices, etc. into the concepts of groups, rings, fields, and modules. One also studies one of the crowning achievements of the subject, Galois Theory. In addition to the School's broad course requirements, it is expected a student in algebra, discrete mathematics, and number theory will gain a deeper level of understanding of each of the concentrations listed below as well as taking significant advanced courses in that student's particular concentration.

MATH 8500: Computational Algebraic Geometry	Covers algebraic geometry and commutative algebra via Grobner bases. Includes ideals and varieties (affine and projective), Grobner bases, elimination theory, dimensions, solving polynomial systems via eigenvalues and eigenvectors. Selected applications may include coding theory, computer vision, geometric theorem proving, integer programming, or statistics. Prerequisite: MATH 3110, 4120.
MATH 8510: Abstract Algebra I	Basic algebraic structures: groups, rings and fields; permutation groups, Sylow theorems, finite abelian groups, polynomial domains, factorization theory and elementary field theory.

MATH 8520: Abstract Algebra II	A continuation of MATH 8510 including selected topics from ring theory and field theory.
MATH 8530: Matrix Analysis	Topics in matrix analysis that support an applied curriculum: similarity and eigenvalues; Hermitian and normal matrices; canonical forms; norms; eigenvalue localizations; singular value decompositions; definite matrices. Prerequisite: MATH 3110, 4530 or 4630.
MATH 8540: Theory of Graphs	Connectedness; path problems; trees; matching theorems; directed graphs; fundamental numbers of the theory of graphs; groups and graphs. Prerequisite: permission of instructor.
MATH 8550: Combinatorial Analysis	Combinations; permutations; permutations with restricted position; Polya's theorem; principle of inclusion and exclusion; partitions; recurrence relations; generating functions; Mobius inversion; enumeration techniques; Ramsey numbers; finite projective and affine geometries; Latin rectangles; orthogonal arrays; block designs; error detecting and error correcting codes. Prerequisite: MATH 3110.
MATH 8560: Applicable Algebra	Applied algebraic ideas in lattice theory and Boolean Algebra; finite-state sequential machines; group theory as applied to network complexity and combinatorial enumeration; algebraic coding theory. Topics vary with background and interests of students. Prerequisites: MATH 8510 and 8530 or permission of instructor.
MATH 8570: Cryptography	Classical and modern cryptography and their uses in modern communication systems are covered. Topics include entropy, Shannon's perfect secrecy theorem, Advanced Encryption Standard (AES), integer factorization, RSA cryptosystem, discrete logarithm problem, Diffie-Hellman key exchange, digital signatures, elliptic curve cryptosystems, hash functions, and identification schemes. Prerequisite: MATH 3110, 4000 or 6000, 4120 or 8510.
MATH 8580: Number Theory	Covers topics and techniques from modern number theory including unique factorization, elementary estimates on the distribution of prime numbers, congruences, Chinese remainder theorem, primitive roots, n-th powers modulo an integer, quadratic residues, quadratic reciprocity, quadratic characters, Gauss sums and finite fields. Students must have completed a graduate-level matrix analysis course before enrolling in this course.
MATH 9550: Commutative Algebra	This course covers the fundamentals of commutative algebra and its algebraic geometric aspect, providing background for further study in algebraic geometry and algebraic number theory. Students must have completed at least one semester of graduate abstract algebra to enroll in this course.
MATH 9510: Algebraic Number Theory	Covers arithmetic of number fields and number rings. Covers prime decomposition, ideal class groups, unit groups of number fields and distribution of prime ideals in number fields. Provides an overview of completions absolute values and valuation theory. Prerequisite: MATH 8510.
MATH 9520: Analytic Number Theory	The theory of Fourier analysis and complex analysis are essential to modern number theory. Course focuses on applications of this theory to number theory, such as the proof of the prime number theorem and the connection of complex L-series to the distribution of primes and to arithmetic geometry. Students are expected to have completed a graduate-level course in linear analysis before enrolling in this course.

MATH 9540 Advanced Graph Theory	Continuation of MATH 8540 including the four-color theorem, domination numbers, Ramsey theory, graph isomorphism, embeddings, algebraic graph theory and tournaments. Research papers are also examined. Students are expected to have completed a graduate-level course in graph theory before enrolling in this course. Prerequisite: MATH 8540 or permission of instructor.
MATH 9850: Selected Topics in Algebra and Combinatorics	Advanced topics in algebra and combinatorics from current problems of interest. May be repeated for credit, but only if different topics are covered. Sample offerings include: - Introduction to Cryptography - Coding Theory - Finite Fields - Algebraic Curves - Introduction to Computational Algebra I - Introduction to Computational Algebra II
MATH 9860: Selected Topics in Geometry	Advanced topics in Geometry from current problems of interest. May be repeated for credit, but only if different topics are covered.

7.1.2. Pure and Applied Analysis

The study of analysis provides a basic understanding of qualitative and quantitative problem-solving techniques, the ability to analyze new areas of interest, and the ability to interact with colleagues from other disciplines in a problem-solving situation. Modern applications of analysis include biomedical modeling, image analysis, robotic control, ecology, environmental modeling, and financial engineering. A plan of study for students concentrating in analysis will include courses in theoretical analysis applied analysis, numerical analysis, and physical system modeling.

MATH 8210: Linear Analysis	Metric spaces, completeness of a metric space and the completion of a metric space, infinite dimensional vectors spaces, Zorn's Lemma, normed spaces and compactness, Schauder Basis, linear operators (bounded and unbounded), linear functionals, minimization results for normed spaces, inner product spaces, projection theorems and minimization, Hilbert spaces, Riesz-Fischer Theorem and self-adjoint operators, orthogonal systems. Prerequisites: MATH 4540/6540 or 4530 and 8530
MATH 8220: Measure and Integration	Riemann and Riemann-Stieljes integration, inner and outer measures, Cantor sets, measurability and additivity, abstract integration and Lebesgue integration, types of convergence and convergence interchange results, Lebesgue spaces; integration and differentiation, product measure, Fubini type results. Prerequisite: MATH 4540/6540, MATH 8210
MATH 8230: Complex Analysis	Topological concepts; complex integration; local and global properties of analytic functions; power series; analytic continuation; representation theorems; calculus of residues. Designed for nonengineering majors. Prerequisite: MATH 4640/6640
MATH 8250: Introduction to Dynamical Systems Theory	Techniques of analysis of dynamical systems; sensitivity analysis, linear systems, stability and control; theory of differential and difference equations. Prerequisite: MATH 4540/6540 and 3110 or 4530 and 8530

MATH 8260: Partial Differential Equations	First-order equations: elliptic, hyperbolic and parabolic; second-order equations: existence and uniqueness results, maximum principles, finite difference and Hilbert Space methods. Prerequisite: MATH 8210 or permission of instructor
MATH 8270: Dynamical System Neural Networks	Scalar and planar maps with applications from biology; existence and uniqueness, bifurcations, periodic equations, stability of equilibria, conservative systems. Prerequisites: MATH 4530, 4540, 8250 and 8210
MATH 8310: Fourier Series	Fourier series with applications to solution of boundary value problems in partial differential equations of physics and engineering; introduction to Bessel functions and Legendre polynomials. Prerequisite: MATH 4640/6640
MATH 8370: Calculus of Variations and Optimal Control	Fundamental theory of the calculus of variations; variable end points; the parametric problem; the isoperimetric problem; constraint inequalities; introduction to the theory of optimal control; connections with the calculus of variations; geometric concepts. Prerequisite: MATH 4530/6530 or 4630/6630
MATH 8410: Applied Mathematics	Derivation of equations from conservation laws, dimensional analysis, scaling and simplification; methods such as steepest descent, stationary phase, perturbation series, boundary layer theory, WKB theory, multiple-scale analysis and ray theory applied to problems in diffusion processes, wave propagation, fluid dynamics and mechanics. Prerequisites: MATH 2080 and 4530/6530 or 4630/6630
MATH 9270: Functional Analysis	Topological Vector Spaces, Hahn-Banach Theorems, Closed and Open Mapping Theorems, Linear operators on specific spaces and spectral theory, distributions and Sobolev spaces. Prerequisite: MATH 8210, MATH 8220
MATH 9740: Mathematical Models in Investment Science	The course deals with a collection of concepts, constructs, and mathematical models that have been created to help deal with (in a rational manner) a portion of the myriad of problems that arise in the financial arena. There are two major themes in the course: How to decide the best course of action in an investment situation, e.g. how to devise the best portfolio, how to devise the optimal investment strategy for managing an investment, how to select a group of investment projects. How to determine the correct arbitrage-free, fair, or equilibrium value of an asset, e.g. the value of a firm, the value of a bond, the value of a derivative such as a put or call option.
MATH 9820: Selected Topics in Analysis	Advanced analysis topics from current problems of interest. May be repeated for credit if different topics are covered. Topics include: - Stochastic Calculus for Finance - Computational Finance

7.1.3. Computational Mathematics

Advanced work in all areas of science and technology relies critically on computation. Computational mathematics involves the design and analysis of mathematical models for various problems and the construction of algorithms which efficiently and accurately compute solutions. A concentration area in computational mathematics includes courses in digital modeling, continuous and discrete simulation, and numerical analysis. The goal of the program is to offer depth in the area of concentration and breadth in the other mathematical sciences, with special emphasis on courses that will provide tools for innovative approaches to computer applications in industry. The first course in digital models is an introductory, but fundamental, course concerned with the construction of models for various problem types and the study of the structure of problem solving. The course in scientific computing, also a basic course, includes the study of some of the most frequently used mathematical algorithms in scientific problems. Students can specialize in computational problems which primarily lend themselves to discrete or to continuous mathematical models. Advanced courses in discrete and continuous simulation are available.

The curriculum includes Data Structures, Graph Algorithms, Computational Problems in Discrete Structures, Numerical Linear Algebra, Numerical Approximation Theory, Numerical Solution of Ordinary and Partial Differential Equations, Digital Models, Introduction to Scientific Computing. Some of the courses in computer science at the graduate level offered by the Department of Computer Science which may be chosen as electives are: Theory of Computation, Introduction to Artificial Intelligence, Design and Analysis of Algorithms, and Software Development Methodology. Students often take a graduate course in engineering or science which supports their graduate research.

MATH 8600: An Introduction to Scientific Computing	Floating point models, conditioning and numerical stability, numerical linear algebra, integration, systems of ordinary differential equations and zero finding; emphasis is on the use of existing scientific software. Prerequisites: MATH 2080, 3110 and CPSC 1100.
MATH 8610: Advanced Numerical Analysis I	Consideration of topics in numerical linear algebra: eigenvalue problems, the singular value decomposition, iterative algorithms for solving linear systems, sensitivity of linear systems, and optimization algorithms. Students must have completed undergrad-level courses in linear algebra and numerical analysis; or a grad-level course in scientific computing before enrolling in this course. Prerequisites: MATH 4530 and 4600.
MATH 8630: Digital Models I	Experimental mathematics; pseudostochastic processes; analytical and algebraic formulations of time-independent simulation; continuous-time simulation and discrete-time simulation; digital optimization; Fibonacci search; ravine search; gradient methods; current research in digital analysis. Students are expected to have digital computer experience and to have completed undergraduate-level courses in linear algebra, advanced calculus, and computer programming language before enrolling in this course.
MATH 8650: Data Structures	Representation and transformation of information; formal description of processes and data structures; tree and list structures; pushdown stacks; string and formula manipulation; hashing techniques; interrelation between data structure and program structure; storage allocation methods. Prerequisites: Computational maturity and permission of instructor.
MATH 8660: Finite Element Method	Discusses the basic theory of the finite element method (FEM) for the numerical approximation of partial differential equations. Topics include Sobolev spaces, error estimation, and implementation of FEM in one and higher dimensions. Prerequisite: MATH 8600 or consent of instructor.

MATH 9830: Selected Topics in Computational Mathematics	Advanced topics in computational mathematics and numerical analysis from current problems of interest. May be repeated for credit if different topics are covered. Sample Offerings: ⅄ Scientific Simulations in Java ⅄ Fiber and Film Systems: Modeling and Simulation ⅄ Analysis of Finite Element Methods

7.1.4. Mathematical Biology

Mathematical Biology is a very diverse group, both in the biological systems studied and in mathematics used to study these systems. Biological applications include population dynamics, epidemiology of infectious diseases, biochemical networks, and systems biology. Continuous- and discrete-time models, and even models on time scales, are used to study these problems, along with techniques from computational algebra, graph theory, dynamical systems, optimization, stochastic processes, numerical analysis, and statistics.

7.1.5. Operations Research and Stochastics

Operations Research (OR) is distinguished by its use of quantitative methods (mathematics, statistics, and computing) to aid in rational decision making. Operations Research has been successfully applied to a wide range of problems arising in business and government, such as locating industrial plants, allocating emergency facilities, planning capital investments, designing communication systems, and scheduling production in factories. A common element of these decision problems is the need to allocate scarce resources (such as money, time, or space) while attempting to meet conflicting objectives (such as minimizing cost or maximizing production).

Operations Research often approaches a particular problem from several modeling perspectives and uses various analytical techniques. Because of the diversity and broad scope of decision problems, the successful OR practitioner requires training in a number of mathematical concepts and techniques. Areas in the mathematical sciences that relate directly to OR are optimization (linear, nonlinear, integer, network programming, calculus of variations, control theory); applied probability (stochastic processes, queueing, reliability); and applied statistics (simulation, econometrics, time series). Computational mathematics also plays an important role in the effective application of OR because of the need to structure and analyze vast amounts of data and to solve large-scale problems efficiently. Other areas of the mathematical sciences related to OR are combinatorics, graph theory, financial mathematics, and dynamical systems.

MATH 8000: Probability	Basic probability theory with emphasis on results and techniques useful in operations research and statistics; axiomatic probability, advanced combinatorial probability, conditional informative expectation, functions of random variables, moment generating functions, distribution theory and limit theorems. Prerequisite: MATH 2060
MATH 8030: Stochastic Processes	Theory and analysis of time series; recurrent events; Markov chains; random walks; renewal theory; application to communication theory; operations research. Prerequisite: MATH 4000/6000 or MATH 8000
MATH 8100: Mathematical Programming	Formulation and solution of linear programming models; mathematical development of the simplex method; revised simplex method; duality; sensitivity analysis; parametric programming, implementation, software packages. Prerequisite: MATH 3110

MATH 8110: Nonlinear Programming	Theoretical development of nonlinear optimization with applications; classical optimization; convex and concave functions; separable programming; quadratic programming; gradient methods. Prerequisites: MATH 4400 and 4540
MATH 8120: Discrete Optimization	Principal methods used in integer programming and discrete optimization; branch and bound, implicit enumeration, cutting planes, group knapsack, Lagrangian relaxation, surrogate constraints, heuristics (performance analysis), separation/branching strategies and polynomial time algorithms for specific problems on special structures. Prerequisite: MATH 8100 or equivalent
MATH 8130: Advanced Linear Programming	Development of linear programming theory using inequality systems, convex cones, polyhedra and duality; solution algorithms and computational considerations for large scale and special structured problems using techniques of upper bounded variables, decomposition, partitioning and column generation; game theory; nonlinear representations and other methods such as ellipsoid and Karmarkar. Prerequisite: MATH 4400/6400, 8100 or equivalent
MATH 8140: Network Flow Programming	Max-flow/min-cut theorem; combinatorial applications; minimum cost flow problems (transportation, shortest path, transshipment); solution algorithms (including the out-of-kilter method); implementation and computational considerations. Prerequisite: MATH 4400/6400, 8100 or equivalent
MATH 8160: Network Algorithms and Data Structures	Design, analysis and implementation of algorithms and data structures associated with the solution of problems formulated as networks and graphs; applications to graph theory, combinatorial optimization and network programming. Corequisite: MATH 6400, 8100, 8540, 8630 or permission of instructor
MATH 8170: Stochastic Models in Operations Research I	Stochastic control; structure of sequential decision processes; stochastic inventory models; recursive computation of optimal policies; discrete parameter finite Markov decision processes; various optimality criteria; computation by policy improvement and other methods; existence of optimal stationary policies; stopping-rule problems; examples from financial management, maintenance and reliability, search, queuing and shortest path. Prerequisite: MATH 8030
MATH 8180: Stochastic Models in Operations Research II	Introduction to queuing theory: Markovian queues, repairman problems, queues with an embedded Markov structure, the queue GI/G/1, queues with a large number of servers, decision making in queues; introduction to reliability theory; failure distributions; stochastic models for complex systems; maintenance and replacement policies; reliability properties of multicomponent structures. Prerequisite: MATH 8170
MATH 8190: Multicriteria Optimization	Theory and methodology of optimization problems with vector-valued objective functions; preference orders and domination structures; generating efficient solutions; solving mulitcriteria decision-making problems, noninteractive and interactive methods with applications. Prerequisite: MATH 8100 or equivalent

MATH (ME) 8740: Integration Through Optimization	Theory, methodology and applications of decomposition, integration and coordination for large-scale or complex optimization problems encountered in engineering design. Topics include conventional and non-conventional engineering optimization algorithms, analysis models and methods, multidisciplinary optimization, analytic target cascading, multiscenario optimization, and multicriteria optimization. Case studies are included. Students are expected to have completed a graduate-level course in mathematical programming or scientific computing or engineering optimization before enrolling in this course. May also be offered as ME 8470.
MATH 9880: Selected Topics in Operations Research	Advanced topics in operations research from current problems of interest. May be repeated for credit, but only if different topic covered.

7.1.6. Statistics and Probability

Graduate study in statistics and probability has taken on a new look and increased importance in the last two decades due to dramatically increased computational power and the aggressive and highly successful application of statistical methods by our competitors in the world marketplace. In particular, the Japanese have extensively employed design of experiments, data analysis, and statistical process control to improve the quality of their processes and the quality of their manufactured products. Recently a number of major U.S. corporations began emulating the Japanese approach by getting management to support the introduction of “statistical thinking” throughout the company, and requiring that the people running their processes have sufficient formal training in statistics to properly implement and monitor statistical process control programs.

Whether one is interested in applying statistical methods to problems in government or industry, or would like to engage in teaching and research at a university, a program can be tailored to meet these objectives within the constructs of the graduate program at Clemson. In addition to comprehensive training in statistical theory and methodology, students are exposed to areas such as combinatorics, mathematical programming, and scientific computing. While these areas are not part of a traditional statistics program, knowledge of them is becoming essential to the application and development of statistical methods. Thus, the School of Mathematical and Statistical Sciences at Clemson is an ideal place to pursue the study of statistics. Students who choose to pursue the PhD degree may do research within the School of Mathematical and Statistical Sciences or they may enroll in the Management Science PhD program which is jointly administered by Mathematical Sciences and the Department of Management. That program stresses the use of analytic models and quantitative methods for decision making.

MATH 8000: Probability	Basic probability theory with emphasis on results and techniques useful in operations research and statistics; axiomatic probability, advanced combinatorial probability, conditional informative expectation, functions of random variables, moment generating functions, distribution theory and limit theorems. Prerequisite: MATH 2060
MATH 8010: General Linear Hypothesis I	Least-square estimates; Gauss-Markov theorem; confidence ellipsoids and confidence intervals for estimable functions; tests of hypotheses; one-, two- and higher-way layouts; analysis of variance for other models. Prerequisites: MATH 4030/6030 and 3110
MATH 8020: General Linear Hypothesis II	Continuation of MATH 8010. Prerequisite: MATH 8010

MATH 8040: Statistical Inference	Sampling distributions; maximum likelihood estimation and likelihood ratio tests; asymptotic confidence intervals for Binomial, Poisson and Exponential parameters; two sample methods; nonparametric tests; ANOVA; regression and model building. Prerequisite: MATH 4000/6000 or equivalent or permission of instructor.
MATH 8050: Data Analysis	Methodology in analysis of statistical data emphasizing applications to real problems using computer-oriented techniques: computer plots, transformations, criteria for selecting variables, error analysis, multiple and stepwise regression, analysis of residuals, model building in time series and ANOVA problems, jackknife and random subsampling, multidimensional scaling, clustering. Prerequisites: MATH 3010 and 4000/6000, or MATH 4010/6010 and 8000.
MATH 8060: Nonparametric Statistics	Order statistics; tolerance limits; rank-order statistics; Kolmogorov-Smirnov one-sample statistics; Chi-square goodness-of-fit test; two-sample problem; linear rank statistics; asymptotic relative efficiency. Prerequisite: MATH 6000 or 8000.
MATH 8070: Applied Multivariate Analysis	Applied multivariate analysis: computer plots of multivariate observations; multidimensional scaling; multivariate tests of means, covariances and equality of distributions; univariate and multivariate regressions and their comparisons; MANOVA; principle components analysis; factor analysis; analytic rotations; canonical correlations. Prerequisites: MATH 4030/6030 and 8050 or permission of instructor.
MATH 8080: Reliability and Life Testing	Probability models and statistical methods relevant to parametric and nonparametric analysis of reliability and life testing data. Prerequisites: MATH 4000/6000 and 4010/6010 or equivalent.
MATH 8090: Time Series Analysis, Forecasting and Control	Modeling and forecasting random processes; autocorrelation functions and spectral densities; model identification, estimation and diagnostic checking; transfer function models; feedforward and feedback control schemes. Prerequisites: MATH 6000 and 6050, or MATH 8000 and 6050 or equivalent.
MATH 8810: Mathematical Statistics	Fundamental concepts of sufficiency, hypothesis testing and estimation; robust estimation; resampling (jackknife, bootstrap, etc.) methods; asymptotic theory; two-stage and sequential sampling problems; ranking and selection procedures. Prerequisite: MATH 4030/6030 or equivalent.
MATH 8820: Introduction to Bayesian Statistics	Selective course focused on Bayes theorem, conjugate priors, posterior distributions, credible intervals, Monte Carlo approximations, Markov chain Monte Carlo (MCMC) methods, Gibbs sampling, Metropolis-Hastings algorithm, Bayesian hypothesis testing, hierarchical modeling, linear regression, and logistic regression. Students are expected to have completed a course in introductory probability and a course in introductory statistics, and have some experience with the software R before enrolling in this course.
MATH 8840: Statistics for Experimenters	Statistical methods for students who are conducting experiments; introduction to descriptive statistics, estimation, and hypothesis testing as they relate to design of experiments; higher-order layouts, factorial and fracitonal factorial designs, and response surface models. Fall semester only. Prerequisite: MATH 2060 or equivalent.

MATH 8850: Advanced Data Analysis	Continuation of MATH 8050, covering alternatives to ordinary least squares, influence and diagnostic considerations, robustness, special statistical computation methods. Prerequisites: MATH 6030, 8000 and 8050.
MATH 9010: Probability Theory I	Axiomatic theory of probability; distribution functions; expectation; Cartesian product of infinitely many probability spaces, and the Kolmogorov consistency theorem; models of convergence; weak and strong laws of large numbers. Prerequisite: MATH 4000 and 8220, or MATH 8000 and 8220 or consent of instructor.
MATH 9020: Probability Theory II	Continuation of MATH 9010; characteristic functions, infinitely divisible distributions, central limit theorems, laws of large numbers, conditioning, and limit properties of sums of dependent random variables, conditioning, matingales. Prerequisite: MATH 9010.
MATH 9810: Selected Topics in Mathematical Statistics and Probability	Advanced topics in mathematical statistics and probability of current interest. May be repeated for credit, but only if different topics are covered.

7.1.7. Applied Statistics and Data Science

Applied statisticians and data scientists collaborate with scientists in academia, industry, and government on the design, implementation, and analysis of research studies. This collaboration combines traditional statistical methodology and development, and well as aspects of mathematical sciences such as model development and computation.

The courses in applied statistics and data science focus on design and analysis of experiments, statistical analysis, and statistical computing. They allow students to rigorously apply proper statistical methodology to solve real world problems in agriculture, education, engineering, forestry, life sciences, and beyond. Students interested in applied statistics and data science can combine course offerings in statistics and other areas of mathematical sciences to develop a deep and broad based understanding of this research area.

7.2. Colloquia, Seminars, and Clubs

The School holds regular seminars and special colloquia each semester. These seminars are given by both students and professors and are a great way for students to interact with faculty and learn more about other research areas. Visit here for a current list of seminars and colloquia offered by the School.

The School also has active American Mathematical Society (AMS), Associate for Women in Mathematics (AWM), and Society for Industrial and Applied Mathematics (SIAM) chapters as well as a Graduate Student Seminar.

7.3. International Graduate Exchange Programs

7.3.1. University of Kaiserslautern

The University of Kaiserslautern is located in the state of Rheinland-Pfalz, 70 miles from Frankfurt, a city with the biggest airport in Europe. It is a leading technical university in Germany with a student body of over 9,000 students. The Department of Mathematics at this university has been the first mathematics department in Germany to receive a German federal government grant for the program Mathematics International. Participants of the program are German and foreign students in approximately equal numbers. Together with the Department of Mathematics in Kaiserslautern, Germany, the department offers a graduate exchange program in mathematical sciences. This program was established in 1996 and enables exchange students to receive the M.S. degree from their home university and the host university. This is an innovative exchange program enabling Clemson students to obtain two graduate degrees and a cross-cultural, educational experience from Germany. Participating students must meet all applicable academic requirements of each university in order to earn that university's degree.
This is a two-and-a-half-year program. Individual schedules will be determined depending on the credentials of each student. Students from Clemson University participating in the exchange program will be offered graduate assistantships at the University of Kaiserslautern equivalent to those that are offered to master's level graduate students in the University of Kaiserslautern, Department of Mathematics. All lectures are held in English, which makes Kaiserslautern a unique place in Germany, and most likely in Europe, with this kind of program.

While completing the curriculum, students can choose to specialize in one of the following five areas: Algebraic Geometry and Computer Algebra, Financial Mathematics, Applicable Analysis and Probability, Industrial Mathematics: Modeling and Scientific Computing, or Optimization and Statistics. A single master's project will suffice for both degrees.

For further information, contact Dr. Margaret M. Wiecek (wmalgor@clemson.edu, (864) 656-5245). Additional information can be found here.

7.3.2. University of Bremen

The School of Mathematical and Statistical Sciences at Clemson University and the Center of Industrial Mathematics at the University of Bremen agreed to a cooperative program for Graduate Students in 2009. The program is partially funded through the School of Mathematical and Statistical Sciences at Clemson, the University of Bremen, Alexander von Humboldt Foundation, and the National Science Foundation. The primary purpose of the program is to give students an international experience in graduate school. Additional purposes are to promote joint research and educational experiences between the universities, to enhance faculty and other exchanges between the universities, and to strengthen international cooperation. The program is directed at the preparation of highly qualified and internationally aware graduate students.

Clemson University graduate students who have completed their first year of study will participate in a summer program at Bremen for a period of two and a half months. At Bremen, participating Clemson students will take one mathematics course for four weeks, work on a research project for another four weeks as a part of their pre-determined research project, and spend another two weeks for writing up the project. The Center of Industrial Mathematics will offer the summer course in English as well as supervise research projects in English. A maximum of four Clemson students may participate in this program every year.

In order to participate in this cooperative program, students must have completed two semesters of graduate studies at Clemson University. Additional academic standards will be required by the University of Bremen. Admission decisions for the summer program will be based on academic records at Clemson and on recommendations by the faculty members at Clemson. Clemson students participating in the summer program will be exempted from any language requirement for admission to summer programs at the University of Bremen. In particular, Clemson students en route to their Ph.D. or students interested in a Master's Thesis option are most encouraged to apply for this program.

Clemson University students will receive a certificate of participation in the summer program from the University of Bremen. The intent of the summer program is to supplement the Clemson graduate program with international experience for Clemson students as well as foster research collaboration between Clemson and the University of Bremen.

Students from Clemson participating in the program will be offered a summer graduate research assistantship from the School of Mathematical and Statistical Sciences at Clemson. The Center of Industrial Mathematics will supplement the summer support for graduate students by covering local expenses in Germany—to include student accommodation and some expense money for the summer. Airfare and other expenses related to travel in Europe are the responsibility of the participating Clemson student.

For further information please contact Dr. Taufiquar Khan (khan@clemson.edu, (864) 656-3257).

7.3.3. Russian Academy of Sciences

The School of Mathematical and Statistical Sciences at Clemson University and the Institute of Machine Sciences at Russian Academy of Sciences in Moscow, Russia (IMASH) have agreed to implement a Graduate Student Exchange Agreement. The purpose of this agreement is to enhance the educational experience and the cross-cultural understanding of student and faculty from both institutions. The program is directed at the preparation of highly qualified and internationally aware graduate students.

Clemson University graduate students who have completed two semesters of study are eligible to participate in the program at IMASH for either a full semester or for a shorter, summer program. The purpose of each student exchange will be to enable students to take classes and/or engage in research activities at, but not to pursue a degree from IMASH. Academic work passed at IMASH will normally be accepted for credit towards the M.S. or Ph.D. degree at Clemson.

Students will be screened for eligibility for admission to the student exchange with respect to the standard rules, regulations and availability of positions at IMASH. Prospective Semester Track students should follow the admission procedures as described on their website. Semester Track admission decisions will be based on academic records and faculty recommendations. Students whose first language is not Russian, must meet language proficiency requirements. At most two Clemson students may participate in the Semester Track. Admissions decisions for the Summer Program at IMASH will be based solely on academic records and recommendations by the faculty members at Clemson. At most four Clemson students can participate in the summer program and will be exempted from any language requirement for admission at the IMASH, however enrollment in a Russian language class while at IMASH is encouraged.

Students from Clemson participating in the Semester Track will be offered graduate assistantships at the IMASH equivalent to those that are offered to graduate students at IMASH. Clemson students participating in the Summer Program at IMASH will be offered regular summer graduate assistantships by the School of Mathematical and Statistical Sciences. Airfare and other expenses related to travel in Europe are the responsibility of the participating Clemson student.

For further information please contact Dr. Irina Viktorova (iviktor@clemson.edu, (864) 656-6906).

7.4. Conferences

Graduate students are encouraged to travel to research conferences in their area of specialty as often as possible. The School provides some limited financial support for such travel which can be requested by completing a Graduate Travel Request form.

8. Academic Policies

Please consult the Graduate School Policy Handbook and the Graduate Catalog for an up to date account of University Policies. All policies in this handbook should be viewed as additional policies of the School of Mathematical and Statistical Sciences. In the event that any policy in this handbook conflicts with the policies of Clemson University or of the Graduate School of Clemson University, the policies of the Graduate School and of the University will be given deference.

8.1. Class Schedule

The School has a Long Range Course Plan to help students plan ahead.

8.2. Master's Forms and Advising

All M.S. students must form an advisory committee who will supervise progress, approve degree curriculum, and initiate recommendation for degree. M.S. students must form their committee no later than the middle of their second semester.

8.2.1. GS2 Form

The GS2 form is a map of your course of study and advising. Masters students must select an advisor and submit a GS2 Plan of Study form by the middle of their second semester. The form is submitted via iROAR. More information regarding the form can be found in the graduate student handbook and here. Students must submit the GS2 form before the deadline listed below in Section 8.4.

8.2.2. GS2-14 Form (MS En Route to PhD)

Students who are enrolled in the Ph.D. program and who plan to complete or have completed the requirements for a Master's degree in the Mathematics department need to fill out the GS2-14 form. This form is the "Master's en route to Ph.D. Degree Curriculum" and can be found here. Contact Julie McKenzie (jdmcken@clemson.edu or (864) 656-5201) with any questions about this form.

8.2.3. GS7M Form

Graduating M.S. students must fill out a GS7M form for final exam and thesis approval. The form can be found here. Note that students do not fill out the GS7M form themselves. Rather, students need to submit the School's Presentation Information form to Julie McKenzie for final processing no later than 2 weeks before their defense. The Presentation Information form can also be found in Martin O-100. Julie will then complete the GS7M form.

8.3. Ph.D. Forms and Advising

All Ph.D. students must form an advisory committee who will supervise progress, approve degree curriculum, administer the final oral examination and initiate recommendation for degree. Students must form this committee by the beginning of their fourth semester after entering the Ph.D. program.

8.3.1. GS2 Form

The GS2 form is a map of your course of study and advising. Ph.D. students have until the beginning of their fourth semester to fill out this form. The form is submitted via iROAR. More information regarding the form can be found in the graduate student handbook and here. Students must submit the GS2 form before the deadline listed below in Section 8.4.

8.3.2. GS5D Form

Results of the comprehensive exam required by the graduate school will be reported to the Office of Enrolled Student Services via the GS5D form found here. This form also serves as the application for admission to candidacy for a doctoral degree. Note that students do not fill out the GS5D form themselves. Rather, students need to submit the School's Presentation Information form to Julie McKenzie (jdmcken@clemson.edu or (864) 656-5201) for final processing no later than 2 weeks before their defense. The Presentation Information form can also be found in Martin O-100. Julie will then complete the GS5D form.

8.3.3. GS7D Form

Graduating Ph.D. students must fill out a GS7D form for Dissertation defense and approval. The form can be found here. Note that students do not fill out the GS7D form themselves. Rather, students need to submit the School's Presentation Information form to Julie McKenzie for final processing no later than 2 weeks before their defense. The Presentation Information form can also be found in Martin O-100. Julie will then complete the GS7D form.

8.4. Deadlines

Deadlines for the GS2 and GS7 forms can be found here and are outlined below:

Graduating Date:	Dec 2018	May 2019	Aug 2019	Dec 2019
GS2 Form Deadline:	Jun 20, 2018	Nov 14, 2018	Feb 13, 2019	Jun 19, 2019
GS7M/GS7D Form Deadline:	Nov 29, 2018	Apr 11, 2019	Jul 18, 2019	Nov 28, 2019

9. Student Responsibilities

9.1. Assistantship Information

Students supported by an instructional/teaching assistantship must be present at Clemson and be enrolled as a full-time student during the appropriate session(s). Duties are assigned by the Coordinator of Instruction (Dr. Patrick Gerard) prior to the beginning of each semester. Duties start the Monday before classes begin and end the day after grades are due at the end of the semester. You are expected to be present and available for any duties before then.

If a student is not assigned any duties by the first few weeks of the session, it is the student's responsibility to contact the Coordinator of Instruction and let them know.

All supported students must complete the TA training course offered in the Spring within one year. All international students must complete the Clemson English Speaking Proficiency (CESP) test within one year as well.

9.2. Yearly Evaluation

All graduate students will be evaluated by the School at the end of Summer to assess their development as a student, in their assistantship responsibilities, and as a researcher.

9.3. Inform School of Status

Students are expected to keep the School updated concerning their status concerning enrollment or employment status. Travel and resulting absences are to be reported through the Missed Class Notification form.

10. Facilities

The School maintains a computer laboratory for the exclusive use of its graduate students in Martin E-007. Access is provided to the campus-wide PC-based network as well as to the college network of Linux workstations. Specialized mathematical and statistical software packages for coursework and research are maintained on all of these platforms for student use.

Many of the courses offered by the School of Mathematical and Statistical Sciences are taught in 'smart' classrooms, with two or more projectors displaying information entered by the instructor on an electronic podium that has functions similar to those of a tablet computer. The Department has multiple specialized classrooms. Martin M-303, M-304, and M-305, each containing 21 desktop computers, are used for undergraduate and graduate mathematical computing courses and courses requiring a computing lab. Martin M-1 is a 126-seat SCALE-UP classroom. SCALE-UP stands for Student-Centered Activities for Large Enrollment Undergraduate Programs. The room is equipped with 14 tables that each seat nine students. Every table is also equipped with three interactive monitors. This SCALE-UP classroom provides an innovative and interactive experience for the students.

10.1. Room Reservations

Martin Hall features two conference rooms, O-10 and O-112. To reserve either of these rooms, first check the availability on the appropriate calendar (O-10, O-112), then contact April Haynes (ahayne@clemson.edu, (864) 656-5224) or Lynn Callahan (lcalla@clemson.edu, (864) 656-5240).

If you have a seminar or a weekly meeting that needs to be placed on the School calendar, contact April or Lynn. The calendar is updated on a regular basis should be utilized when scheduling visitors. This should help avoid Colloquia and seminars being scheduled at the same time.

For classroom reservations, contact April Haynes or Connie McClain (vmcclai@clemson.edu, (864) 656-5230).

11. Inclusion and Equity

The School of Mathematical and Statistical Sciences aspires to create a diverse community that welcomes people of different races, cultures, ages, genders, sexual orientation, religions, socioeconomic levels, political perspectives, abilities, opinions, values, and experiences. For more information on the relevant policies, visit the Office of Access and Equity. Our diversity advocate in the College of Science is Dr. Julia Frugoli, Associate Dean for Inclusive Excellence and Graduate Education (jfrugol@clemson.edu, (864) 656-1859). Dr. Frugoli may also be found in her office 118-K Long Hall.