**Mathematics**

**Doctor of Philosophy (Ph.D.) Degree**

**DEGREE INFORMATION**

**Priority Program Admission Deadlines:**

**Fall:** February 1

**Spring**: October 1

International applicant deadlines:

<http://www.grad.usf.edu/majors>

**Minimum Total Hours:** 90 post-baccalaureate

 60 post-masters

**Level:** Doctoral

**CIP Code:** 27.0101

**Dept. Code:** MTH

**(Major/College Codes:** MTH AS

**Approved:** 1971

**Concentrations:**

Pure and Applied (PAA)

Statistics (STT)

**CONTACT INFORMATION**

**College:** Arts and Sciences

**Department:** Mathematics and Statistics

**Contact Information:** [www.grad.usf.edu](http://www.grad.usf.edu)

 **MAJOR INFORMATION**

The Department of Mathematics and Statistics offers a Ph.D. in mathematics with concentrations in Pure and Applied mathematics and in Statistics. The major provides the experience and knowledge to understand and appreciate prior accomplishments in the discipline and develops the skills necessary for a meaningful contribution to the intellectual advancement and applications of the discipline. It prepares its graduates to pursue long-term careers in their field by providing solid and cutting-edge knowledge. Graduates receive training that enables them to conduct independent research and write research papers publishable in peer-reviewed journals of their discipline, as well as a technical education enabling them to take on leading positions in a modern economy.

**Major Research Areas:** Approximation Theory, Complex & Harmonic Analysis, Functional Analysis, Mathematical Physics, Partial Differential Equations, Dynamical Systems, Mathematical Biology, Probability, Statistics, Stochastic Modeling and Analysis, Combinatorial Algebra, Knot Theory, Cybersecurity & Cryptography, Theoretical Computer Science, Biomolecular Computation, and Extremal Combinatorics

**ADMISSION INFORMATION**

Must meet University requirements (see Graduate Admissions), as well as requirements for admission to the major, listed below.

* A degree from a regionally accredited institution relevant to the prospective concentration. Either
* a Master's degree or equivalent in mathematical sciences/statistics or a related area; or
* a Bachelor’s degree or equivalent in mathematical sciences/statistics or related area with a strong record of undergraduate/graduate courses related to prospective concentration.
* At least a 55th percentile Quantitative score on the GRE; Verbal and Analytic Writing scores on the GRE are also considered.
* At least a 3.50 GPA in graduate and/or upper undergraduate mathematics/statistics courses.
* Three letters of recommendation (two of which should be from college level mathematics/statistics professors)
* A completed departmental application form, including a statement of goals.
* A completed departmental graduate teaching assistantship application form (if such a position is desired).

Applicants to the Ph.D. program may be offered admission to the MA program and move to the Ph.D. program after establishing a record of success in graduate courses. Graduate Teaching and Research Assistantships are available on a competitive basis. Contact the Department for recommended prerequisites for each concentration.

**CURRICULUM REQUIREMENTS**

Total Minimum Hours: 90 hours post-baccalaureate

 60 hours post-masters

Post-master’s hours:

Core courses – 9 hours

Concentration – 9-18 hours minimum

Sequence Courses – 24 hours minimum

Electives – 2 hours minimum

Dissertation – 16 hours minimum

**Core Courses 9 hours**

All students in the Mathematics Ph.D. program must take the following core courses:

MAA 5307 3 Real Analysis I

MAS 5145 3 Advanced Linear Algebra

MAE 5177 3 Teaching College Mathematics (Proposed course)

**Concentrations**

Students select from one of the concentrations below. Each concentration requires a number of courses to ensure breadth of disciplinary knowledge. Substitutions may be allowed with prior approval of both the Concentration Director and Concentration Graduate Committee.

**Pure and Applied Concentration – 9 hours**

The student must complete at least one course from each of the following groups:

Group 1 – Algebra: MAS 5311 Algebra I

 MAS 6312 Algebra II

Group 2 – Complex Analysis: MAA 6406 Complex Analysis I

 MAA 6407 Complex Analysis II

Group 3 – Topology: MTG 5316 Topology I

 MTG 6317 Topology II

**Statistics Concentration – 18 hours**

The student must complete the following courses:

STA 5446 Probability Theory I

STA 6447 Probability Theory II

STA 5526 Nonparametric Statistics

STA 6746 Multivariate Analysis

STA 6876 Time Series Analysis

MAT 5932 Special Topics (Survival Analysis)

 Choose three of the following seven courses: 12 hours

STA 6206 Stochastic Processes

MAT 6932 Special Topics (Stochastic Dynamic Modeling)

MAT 5932 Special Topics (Time Series Analysis II)

MAT 5932 Special Topics (Nonlinear Time Series Analysis)

MAT 5932 Special Topics (Multivariate Iterative Processes with Applications)

MAT 6908 Independent Study (preapproval required)

MAT 5932 Special Topics Courses (preapproval required)

**Sequences of Courses 24 hours minimum**

Each concentration offers coherent pairs/triples of courses, referred to as sequences, to ensure a certain depth of disciplinary knowledge. The student must complete two Fundamental sequences and a total of four sequences from among the Fundamental and Elective Sequences with at least a 3.00 average in each sequence. Fundamental Sequences prepare students for Fundamental Qualifying Examinations, of which students must pass two. A student who passes a Fundamental Qualifying Examination at Ph.D. level will be considered to have completed the corresponding Fundamental Sequence. Prior to offering, the Mathematics Graduate Committee may approve a pair of courses to be an elective sequence. Each course may count towards only one sequence.

**Fundamental Sequences for the Pure and Applied Mathematics concentration**

Algebra: MAS 5311 Algebra I

 MAS 6312 Algebra II

Real Analysis: MAA 5306 Introduction to Real Analysis

 MAA 5307 Real Analysis I (taken as a core requirement)

 MAA 6616 Real Analysis II

Topology: MTG 5316 Topology I

 MTG 6317 Topology II

**Elective Sequences for the Pure and Applied Mathematics concentration**

Applied Mathematics one of MAP 5407 Methods of Applied Mathematics

 MAP 5345 Applied Partial Differential Equations

 one of MAA 5405 Applied Complex Variables

 MAT 5932 Special Topics (Numerical Analysis)

 and one of MAP 6205 Control Theory and Optimization

 MAT 6932 Special Topics (Dynamical Systems II)

Combinatorics MAD 6206 Combinatorics I

 MAD 6207 Combinatorics II

Complex Analysis MAA 6406 Complex Analysis I

 MAA 6407 Complex Analysis II

Differential Geometry MTG 6256 Differential Geometry I

 MTG 6257 Differential Geometry II (Proposed course)

Dynamical Systems MAT 5932 Special Topics (Dynamical Systems I)

 MAT 6932 Special Topics (Dynamical Systems II)

Functional Analysis MAA 6506 Functional Analysis I

 MAA 6507 Functional Analysis II

Harmonic Analysis MAT 6932 Special Topics (Harmonic Analysis)

 MAP 6356 Partial Differential Equations

Nonlinear Analysis MAP 5316 Ordinary Differential Equations I

 MAP 5317 Ordinary Differential Equations II

Partial Differential Equations MAP 5345 Applied Partial Differential Equations

 MAP 6356 Partial Differential Equations

Theory of Computing MAD 6616 Theory of Computing

 MAD 6510 Analysis of Algorithms

All sequences for the Statistics Concentration are Elective Sequences for the Pure and Applied Concentration.

**Fundamental Sequences for the Statistics Concentration**

Statistical Methods: STA 5166 Statistical Methods I

STA 6167 Statistical Methods II

STA 6208 Linear Statistical Models

Mathematical Statistics: STA 5326 Mathematical Statistics I

STA 6326 Mathematical Statistics II

**Elective Sequences for the Statistics Concentration**

Linear Models and Multivariate Analysis: STA 6208 Linear Models

STA 6746 Multivariate Analysis

Probability: STA 5446 Probability I

STA 6447 Probability II

Stochastic Processes and Time Series Analysis: STA 6876 Time Series Analysis

STA 6206 Stochastic Processes

**Electives – 2 hours minimum**

Students select graduate course electives in consultation with their advisor.

**Independent Study, Graduate Seminar, and Directed Research**

Prior to passing two Fundamental Qualifying Examinations at Ph.D. level, students may not earn credit toward the MA or Ph.D. degrees for MAT 6908 Independent Study, MAT 6939 Graduate Seminar, and MAT 6911 / 7912 Directed Research, although they may take these courses with the approval of the Concentration Graduate Director. Students must obtain the approval of the Seminar Organizer to take credit hours of MAT 6939 Graduate Seminar.

**External Coursework**

Graduate coursework taken from other departments may be accepted toward the minimum number of credits with prior approval from the Concentration Graduate Director.

**Qualifying Examinations**

A Qualifying Examination based on a Fundamental Sequence is called a Fundamental Qualifying Examination. The student is required to pass two Fundamental Qualifying Examinations at the Ph.D. Level. The student is expected to pass both within 17 months after entering the Ph.D. unless an extension is granted by the Concentration Graduate Committee. Students may repeat an examination only once unless additional attempts are granted by the Concentration Graduate Committee. The syllabus for each examination is available from the Department. Fundamental Qualifying Examinations are offered in January, May and August.

After passing two Fundamental Qualifying Examinations, the student will select a Dissertation Advisor, who will convene a Specialty Examination Committee. The Specialty Examination Committee will prepare a syllabus for the student’s Specialty Examination on background material for the student’s intended research. The syllabus for the Specialty Examination and the names of two examiners from the Faculty, must be approved by the Concentration Graduate. The student is expected to complete the Specialty Examination within 25 months after entering the Ph.D. unless an extension is granted by the Concentration Graduate Committee.

Passing two Fundamental Qualifying Examinations and the Specialty Examination at the Ph.D. level is considered passing the Doctoral Qualifying Examination. After passing the Doctoral Qualifying Examination, the student should form their Doctoral Dissertation Committee and apply for Doctoral Candidacy. Once admitted to Doctoral Candidacy, the student may enroll in Doctoral Dissertation hours.

Each Spring semester after admission to doctoral candidacy, the candidate shall give an oral presentation to the Doctoral Committee of the problem(s) under investigation. The presentation may also include a discussion of partial results. The Dissertation Advisor shall submit to the Department Chairperson a written report of the presentation.

**Dissertation - 16 credit hours minimum**

MAT 7980 16 Doctoral Dissertation

Students admitted to doctoral candidacy are required to take at least 16 hours in MAT 7980 Doctoral Dissertation, with a minimum of 6 credits of dissertation hours accumulated during each previous 12-month period (previous 3 terms, e.g. Fall, Spring, Summer) until the degree is granted.

The candidate will conduct original and significant research which is worthy of publication. The research will be described in the doctoral dissertation. Research towards the dissertation typically forms the major part of the work required for the Ph.D. in Mathematics. The Doctoral Dissertation Defense shall consist of an oral presentation of the research in the dissertation to the supervisory committee.

**Handbook**

The student is responsible for familiarizing themselves with the additional program requirements and expectations listed in the program handbook, particularly those concerning timely progress.

**COURSES**

 See <http://www.ugs.usf.edu/course-inventory/>