Department of Mathematical Sciences

http://www.utdallas.edu/nsm/math/

Faculty

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Affiliated Faculty: Thomas Butts and Titu Andreescu (Science and Mathematics Education)
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Objectives

The Mathematical Sciences Department at The University of Texas at Dallas offers graduate study in five majors: applied mathematics, engineering mathematics, mathematics, statistics, and an interdisciplinary degree in Bioinformatics and Computational biology. The degree programs offer students the opportunity to prepare for careers in these disciplines themselves or in any of the many other fields for which these disciplines are such indispensable tools. As other sciences develop, problems which require the use of these tools are numerous and pressing.

In addition to a wide range of courses in mathematics and statistics, the Mathematical Sciences Department offers a unique selection of courses that consider mathematical and computational aspects of engineering, biology and other scientific problems.

The Master of Science degree programs are designed for persons seeking specializations in applied mathematics, engineering mathematics, mathematics, statistics, bioinformatics and computational biology.

The Master of Science degree is available also for those who plan to teach mathematical sciences above the remedial level at a community college or at a college or university. The Master of Science degree is recommended as a minimum, since an earned doctorate is sometimes required.

For information concerning the Master of Arts in Teaching in Mathematics Education, designed for persons who are teaching in grades 6-12, see the Science and Mathematics Education section.

The Doctor of Philosophy degree programs cover two basic areas of concentration: statistics and applied mathematics. They are designed for those who plan to pursue academic, financial or industrial careers.

Facilities

The faculty, staff and students have access to a large network of Sun workstations and servers on campus. In addition, the Department has a classroom equipped with a cluster of 20 high-end Linux PCs that are used for instruction and special research purposes.

Admission Requirements

The University's general admission requirements are discussed here.

Specific additional admission requirements for students in Mathematical Sciences follow. Students lacking undergraduate prerequisites for graduate courses in their area must complete these prerequisites or receive approval from the graduate adviser and the course instructor before registering.

One of the components of a student's academic history which is evaluated when the student is seeking admission to the graduate program is his/her performance on certain standardized tests. Since these tests are designed to indicate only the student's potential for graduate study, they are used in conjunction with other measures of student proficiency (such as GPA, etc.) in determining the admission status of a potential graduate student. Accordingly, there is no rigid minimum cut-off score for admission to the program. However, a student with at least a Graduate Record Examination (GRE) combined score of 1050 with at least 550 on the math portion would have a reasonable probability of admission as a Master's student, assuming that the student's other credentials were in order. Similarly, a student with a GRE score of 1200 (with at least 650 in the quantitative portion) would have a reasonable probability of admission as a Ph.D. student, assuming that all other credentials were in order. Higher standards prevail for students seeking Teaching Assistantships.

Degree Requirements

Master of Science

The University's general degree requirements are discussed here.

Students seeking a Master of Science in Mathematical Sciences must complete a total of 12 three-credit hour courses. In some cases, credit for 3 hours is approved for good mathematics background. The student may choose a thesis plan or a non-thesis plan. In the thesis plan, the thesis replaces two elective courses with completion of an approved thesis (six thesis hours). The thesis is directed by a Supervising Professor and must be approved by the Head of the Mathematical Sciences Department.

Each student must earn a 3.0 minimum GPA in the courses listed for the student's program.

Applied Mathematics Major

MATH 5301-5302 Elementary Analysis I and II (or equivalent)
MATH 6303 Theory of Complex Functions
MATH 6313 Numerical Analysis
MATH 6315 Ordinary Differential Equations
MATH 6318 Numerical Analysis of Differential Equations
MATH 6319-6320 Principles and Techniques in Applied Mathematics I and II
MATH 6308 Inverse Problems and their Applications
MATH 6321 Optimization
Plus two guided electives.

Engineering Mathematics Major

MATH 5301-5302 Elementary Analysis I and II (or equivalent)
MATH 6303 Theory of Complex Functions
MATH 6313 Numerical Analysis
MATH 6315 Ordinary Differential Equations
MATH 6318 Numerical Analysis of Differential Equations
MATH 6319-6320 Principles and Techniques in Applied Mathematics I and II
MATH 6331 Systems, Signals and Control
MATH 6305 Mathematics of Signal Processing
plus two guided electives.

Mathematics Major

MATH 5301-5302 Elementary Analysis I and II (or equivalent)
MATH 6303 Theory of Complex Functions
MATH 6313 Numerical Analysis
MATH 6315 Ordinary Differential Equations
MATH 6318 Numerical Analysis of Differential Equations
MATH 6301 Real Analysis
MATH 6302 Real and Functional Analysis
MATH 6306 Topology and Geometry
MATH 6311 Abstract Algebra I
plus two guided electives.

Statistics Major

Students seeking a Master of Science in Mathematical Sciences with a major in Statistics must complete the following core courses:
STAT 6331 Statistical Inference I
STAT 6337-38 Statistical Methods I, II
STAT 6339 Linear Statistical Models
STAT 6341 Numerical Linear Algebra and Statistical Computing

One course from each of any two of the following sets of courses:
{STAT 6329, STAT 6343, STAT 7334} Stochastic Processes or Experimental Design or Nonparametric and Robust Statistical Methods
{STAT 6348, STAT 7331} Multivariate Analysis
{STAT 6347, STAT 7338} Time Series Analysis

Students must choose remaining courses from among the following electives:
MATH 6301, MATH 6302, MATH 6313, MATH 6331 or any 6300- or 7300-level statistics courses. Also, a maximum of two of the following prerequisite 5000-level courses may be counted as electives: MATH 5301, 5302, Elementary Analysis I, II and STAT 5351, 5352 Probability and Statistics I, II.

Other Requirements

Electives must be approved by the graduate adviser. Typically, electives are 6000- and 7000-level mathematical sciences courses. Courses from other disciplines may also be used upon approval.

Substitutions for required courses may be made if approved by the graduate adviser. Instructors may substitute stated prerequisites for students with equivalent experience.

Master of Science in Bioinformatics and Computational Biology

Master of Science in Bioinformatics and Computational Biology (BCBM) is offered jointly by the Departments of Mathematical Sciences and Molecular and Cell Biology. This program combines coursework from the disciplines of biology, computer science, and mathematical Sciences. The BCBM program seeks to answer the demand for a new breed of scientist that has fundamental understanding in the fields of biology, mathematics, statistics, and computer science. With this interdisciplinary training, these scientists will be well prepared to meet the demand and challenges that have arisen and will continue to develop in the biotechnology arena.

Faculty from both Mathematical Sciences (MMS) and Molecular and Cell Biology (MCB) participate in the Bioinformatics and Computational Biology program, with the Mathematical Sciences Department serving as the administrative unit. Both departments participate in advising students.

For the Master's degree in Bioinformatics and Computational Biology, beginning students are expected to have completed multivariate calculus, linear algebra, two semesters of general Chemistry, two semester of organic Chemistry, two semesters of general physics, programming in C/C++, and two semesters of biology.

Requirements for completing a degree in BCBM are:

Core courses:

BIO 5410 Biochemistry
BIO 5420 Molecular Biology
BIO 5381 Genomics
STAT 5351 Probability and Statistics I
STAT 5352 Probability and Statistics II
MATH 6341 Bioinformatics

Additional core courses for the Computational Biology track:
MATH 6313 Numerical Analysis
MATH 6343 Computational Biology
MATH 6345 Mathematical Methods in Medicine & Biology

Additional core courses for the Bioinformatics track:

CS 5333 Discrete Structures
CS 5343 Algorithms Analysis and Data Structures
CS 6360 Database Design

Elective: A minimum of 7 semester credit hours of elective, approved by the student's adviser. Typically, electives are 6000- and 7000- level courses in mathematical sciences, biology or computer science.
Courses from other disciplines may also be used upon approval.

Doctor of Philosophy

The University's general degree requirements are discussed here.

Each Doctor of Philosophy degree program is tailored to the student. The student must arrange a course program with the guidance and approval of the graduate adviser. Adjustments can be made as the student's interests develop and a specific dissertation topic is chosen. A minimum of 90 semester hours beyond the bachelor's degree is required.

Applied Mathematics Major

MATH 6301 Real Analysis
MATH 6302 Real and Functional Analysis
MATH 6303 Theory of Complex Functions I
MATH 6306 Topology and Geometry
MATH 6311 Abstract Algebra I
MATH 6313 Numerical Analysis
MATH 6315 Ordinary Differential Equations
MATH 6316 Differential Equations
MATH 6318 Numerical Analysis of Differential Equations
MATH 6319-6320 Principles and Techniques in Applied Mathematics I and II
MATH 7313 Partial Differential and Integral Equations I
MATH 7319 Functional Analysis

Statistics Major

MATH 6301 Real Analysis
MATH 6302 Real and Functional Analysis
STAT 6331- 6332 Statistical Inference I, II
STAT 6337- 6338 Statistical Methods I, II
STAT 6339 Linear Statistical Models
STAT 6344 Probability Theory I
STAT 7330 Decision Theory
STAT 7331 Multivariate Analysis
STAT 7334 Nonparametric Statistics
STAT 7338 Time Series Modeling and Filtering
STAT 7345 Stochastic Processes
MATH 6303 Theory of Complex Functions I, or MATH 6313 Numerical Analysis, or
MATH 6315 Ordinary Differential Equations I, or MATH 7319 Functional Analysis

Electives and Dissertation

An additional 18-24 credit hours for Applied Math and 18-24 credit hours for Statistics designed for the student's area of specialization are taken as electives in a degree plan designed by the student and the graduate adviser. This plan is subject to approval by the Department Head. After completion of the first 3 or 4 academic semesters of the course program, the student must pass a Ph.D. Qualifying Examination in order to continue on to the research and dissertation phase of the Ph.D. program.
Finally, a dissertation is required and must be approved by the graduate program. Areas of specialization include:

- **Applied Mathematics**: applied analysis, biomathematics, differential equations, relativity, scattering theory, systems theory, signal processing.

- **Statistics**: statistical inference, applied statistics, statistical computing, probability, stochastic processes, linear models, time series, statistical classification, multivariate analysis, nonparametric and robust statistics, asymptotic theory.

Other specializations are possible, including interdisciplinary topics. There must be available a dissertation research adviser or group of dissertation advisers willing to supervise and guide the student. A dissertation Supervising Committee should be formed with at least four members from the Mathematical Sciences faculty. The dissertation may be in Mathematical Sciences exclusively or it may involve considerable work in an area of application.

Research

Within the Mathematical Sciences programs opportunities exist for work and/or research in applied mathematics, engineering mathematics, mathematics and statistics. The opportunity to take course work in several of the other university programs also allows the student to prepare for interdisciplinary work. Special topics within research areas include functional analysis, operator theory, differential and integral equations, optimization, numerical analysis, system theory and control with application in material and molecular sciences, inverse problems with applications in geosciences and medical sciences, relativistic cosmology, differential geometry, applications of topology to biology, mathematical and computational biology with applications in cardiovascular physiology, neurobiology and cell biology; probability theory, applied probability, stochastic processes, mathematical statistics, statistical inference, asymptotic theory, statistical time series, Bayesian analysis, robust multivariate statistical methods, robust linear models, robust and nonparametric methods, sequential analysis, statistical computing, signal processing, remote sensing, change-point problems, forecasting and applications in their respective areas such as energy finance, semiconductor manufacturing, psychology, actuarial sciences, physical and medical sciences.

For a complete list of faculty and their areas of research, visit the website www.utdallas.edu/nsm/math/faculty.