School of Natural Sciences and Mathematics

Department of Mathematical Sciences

Objectives

The Mathematical Sciences Department at The University of Texas at Dallas offers seven graduate programs, namely, Doctor of Philosophy and Master of Science in Mathematics; Doctor of Philosophy and Master of Science in Statistics; Master of Science in Actuarial Science; Master of Science in Bioinformatics and Computational Biology (jointly with the Department of Biological Sciences); and Graduate Certificate in Data Science. The Master of Science degrees in Mathematics and Statistics offer a number of specializations, including Applied Mathematics, Mathematics for Decision and Engineering Sciences, Applied Statistics, and Data Science. Altogether the wide spectrum of our programs prepares students for a variety of careers in mathematics, statistics, data science, actuarial science, bioinformatics, and other mathematically oriented disciplines.

A Master of Science degree may also be pursued by those who plan to teach Mathematics or Statistics above the remedial level at a community college or at a college or university. For such students, the Master of Science degree is a minimum as a doctoral degree is often 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.

Admission Requirements

The University's general admission requirements are discussed on the Graduate Admission page.

Specific additional admission requirements for students in degree programs in the Department of Mathematical Sciences follow. Students lacking undergraduate prerequisites for graduate courses in their area must complete these prerequisites or receive approval from the graduate advisor 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 (grade point average), etc., in determining the admission status of a potential graduate student. Accordingly, there is no rigid minimum cutoff score for admission to the program. Most applicants admitted to either the MS or PhD programs have GRE scores of at least 143 verbal, 155 quantitative, and 310 combined. However, exceptions are made in some cases when other credentials are especially strong. Higher standards prevail for applicants seeking Teaching Assistantships.

Master of Science in Mathematics

36 semester credit hours minimum
Department Faculty


Associate Professors: Maxim Arnold, Yan Cao, Liang Hong, Yifei Lou, Oleg Makarenkov, Tomoki Ohsawa, Anh Tran

Assistant Professors: Carlos Arreche, Sy Han (Steven) Chiou, Ronan Conlon, Qiwei Li, Stephen McKeown, Sunyoung Shin, Chuan-Fa Tang, Nathan Williams, Yunan Wu

Professors Emeriti: Larry P. Ammann, Patrick Odell, John W. Van Ness

Clinical Professor: Natalia Humphreys

Clinical Associate Professor: Mohammad Akbar

Clinical Assistant Professor: Wenyi (Roy) Lu

Professors of Instruction: Anatoly Eydelzon, Manjula Foley, Bentley T. Garrett, Yuly Koshevnik

Associate Professors of Instruction: Mohammad Ahsan, Kelly Aman, Malgorzata Dabkowska, Rabin Dahal, Changsong Li, Derege Mussa, My Linh Nguyen, Jigarkumar Patel, Tristan Whalen

Assistant Professors of Instruction: Anani Komla Adabrah, Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

Senior Lecturers: Irina Martynova, Brady McCary

UT Dallas Affiliated Faculty: Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

Degree Requirements

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](https://catalog.utdallas.edu/2021/graduate/programs/nsm/mathematics) page.

Students seeking a Master of Science in Mathematics must complete a total of 12 three-semester credit hour courses. 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 semester credit hours). The thesis is directed by a Supervising Professor and must be approved by the Head of the Mathematical Sciences Department. The thesis must be successfully defended before a thesis committee.

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

To satisfy the MS degree requirements, we currently offer a choice between four specializations - Mathematics, Applied Mathematics, Decision and Engineering Sciences, and Data Science.

**Mathematics Specialization (MS)**

- **MATH 6301** Real Analysis
MATH 6303 Theory of Complex Functions I
MATH 6311 Abstract Algebra I
MATH 6315 Ordinary Differential Equations

Choose four courses from the following:

MATH 6302 Functional Analysis I
MATH 6309 Differential Geometry
MATH 6310 Topology
MATH 6312 Combinatorics and Graph Theory
MATH 6325 Nonlinear Analysis I
MATH 7313 Partial Differential Equations I
MATH 7361 Algebraic Geometry and Non-linear Equations

Plus four guided electives with the approval of the Graduate Advisor for Mathematics.

Applied Mathematics Specialization (MS)

MATH 6313 Numerical Analysis
MATH 6315 Ordinary Differential Equations
MATH 6319 Principles and Techniques in Applied Mathematics I
MATH 6321 Optimization

MATH 5301 Elementary Analysis I and MATH 5302 Elementary Analysis II

or MATH 6301 Real Analysis

Choose three courses from the following:

MATH 6303 Theory of Complex Functions I
MATH 6308 Inverse Problems and Applications
MATH 6312 Combinatorics and Graph Theory
MATH 6318 Numerical Analysis of Differential Equations
MATH 6320 Principles and Techniques in Applied Mathematics II
MATH 6324 Applied Dynamical Systems I
MATH 6336 Nonlinear Control Systems
MATH 6340 Numerical Linear Algebra
MATH 6342 Scientific Computing
MATH 7313 Partial Differential Equations I

Plus four guided electives with the approval of the Graduate Advisor for Mathematics.
Mathematics for Decision and Engineering Sciences (MS)

**MATH 5301** Elementary Analysis I (or equivalent)

**MATH 5302** Elementary Analysis II (or equivalent)

**MATH 6305** Mathematics of Signal Processing

**MATH 6321** Optimization

**MATH 6331** Mathematics of Signals, Systems, and Controls

**MATH 7318** or **OPRE 7318** Stochastic Dynamic Programming

**STAT 5353** Probability and Statistics for Data Science and Bioinformatics

**STAT 6329** Applied Probability and Stochastic Processes

  or **MATH 6364** Stochastic Calculus in Finance

**STAT 6340** Statistical and Machine Learning

**FIN 6381** Introductory Mathematical Finance

  or **ACTS 6308** Actuarial Financial Mathematics

Plus two guided electives with the approval of the Graduate Advisor for Mathematics.

Data Science Specialization (MS)

**CS 5303** Computer Science I

**CS 5343** Algorithm Analysis and Data Structures

**CS 6307** Introduction to Big Data Management and Analytics for non CS-Majors

**CS 6375** Machine Learning

**MATH 6312** Combinatorics and Graph Theory

**MATH 6321** Optimization

**MATH 6340** Numerical Linear Algebra

  or **MATH 6319** Principles and Techniques in Applied Mathematics I

**MATH 6322** Mathematical Foundations of Data Science

**STAT 5353** Probability and Statistics for Data Science and Bioinformatics

**STAT 6340** Statistical and Machine Learning

Plus two guided electives with the approval of the Graduate Advisor for Mathematics.

Other Requirements

Electives must be approved by the Graduate Advisor for Mathematics. Typically, electives are 6000- and 7000-level Mathematics courses. Courses from other disciplines may also be used upon approval. Substitutions for required courses may be made if approved by the Graduate Advisor for Mathematics. Instructors may substitute stated prerequisites for students with relevant experience.
1. If a student takes both MATH 5301 (or equivalent) and MATH 5302 (or equivalent), then one of these classes can be counted towards the guided elective requirement. Therefore, such a student will need to take only three guided electives with the approval of the graduate advisor for mathematics.

2. Students who have not taken the CS 5333 Discrete Structures prerequisite for CS 5343 Algorithm Analysis and Data Structures should consult with their Graduate Advisor from the Mathematical Sciences Department to determine eligibility.

Master of Science in Statistics

36 semester credit hours minimum

Department Faculty

Professors: Zalman I. Balanov, Swati Biswas, Min Chen, Pankaj K. Choudhary, Baris Coskunuzer, Mieczyslaw K. Dabkowski, Vladimir Dragovic, Sam Efremovich, Yulia Gel, M. Ali Hooshyar, Wieslaw Krawcewicz, Susan E. Minkoff, L. Felipe Pereira, Dmitry Rachinskiy, Viswanath Ramakrishna, Janos Turi, John Zweck

Associate Professors: Maxim Arnold, Yan Cao, Liang Hong, Yifei Lou, Oleg Makarenkov, Tomoki Ohsawa, Anh Tran

Assistant Professors: Carlos Arreche, Sy Han (Steven) Chiou, Ronan Conlon, Qiwei Li, Stephen McKeown, Sunyoung Shin, Chuan-Fa Tang, Nathan Williams, Yunan Wu

Professors Emeriti: Larry P. Ammann, Patrick Odell, John W. Van Ness

Clinical Professor: Natalia Humphreys

Clinical Associate Professor: Mohammad Akbar

Clinical Assistant Professor: Wenyi (Roy) Lu

Professors of Instruction: Anatoly Eydelzon, Manjula Foley, Bentley T. Garrett, Yuly Koshevnik

Associate Professors of Instruction: Mohammad Ahsan, Kelly Aman, Malgorzata Dabkowska, Rabin Dahal, Changsong Li, Derege Mussa, My Linh Nguyen, Jigarkumar Patel, Tristan Whalen

Assistant Professors of Instruction: Anani Komla Adabrakh, Iris Alvarado, Hui Ding, Adannah Duruoha, Kemelli Estacio-Hiroms, Huizhen Guo, Neha Makhijani, Ajaya Paudel, Nasrin Sultana, Julie Sutton, Kristen Wetzler

Senior Lecturers: Irina Martynova, Brady McCary

UT Dallas Affiliated Faculty: Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

Program Objective

The curriculum for Master of Science in Statistics offers a balanced list of courses in theory, methodology, and application of statistics and data science. During their study, our Master of Science students acquire the necessary skills that make them competitive in the modern job market. Our
graduates generally find employment as statisticians, biostatisticians, data scientists, quantitative analysts, and so on, or they continue into doctoral degree programs.

Degree Requirements

The University's general degree requirements are discussed on the Graduate Policies and Procedures page.

Students seeking a Master of Science in Statistics must complete a total of 12 three-semester credit hour courses. 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 semester credit hours). The thesis is directed by a Supervising Professor and must be approved by the Head of the Mathematical Sciences Department. The thesis must be successfully defended before a thesis committee.

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

To satisfy the MS degree requirements, we currently offer a choice between three specializations - Statistics, Applied Statistics, and Data Science.

Statistics Specialization (MS)

1. Five Core Courses:
   - STAT 6331 Statistical Inference I
   - STAT 6337 Advanced Statistical Methods I
   - STAT 6338 Advanced Statistical Methods II
   - STAT 6339 Linear Statistical Models
   - STAT 6341 Numerical Linear Algebra and Statistical Computing

2. Two or more courses from the following list:
   - STAT 6329 Applied Probability and Stochastic Processes
     or STAT 7345 Advanced Probability and Stochastic Processes
   - STAT 6348 Applied Multivariate Analysis
     or STAT 7331 Multivariate Analysis
   - STAT 6347 Applied Time Series Analysis
     or STAT 7338 Time Series Modeling and Filtering
   - STAT 7330 Bayesian Data Analysis
   - STAT 7334 Nonparametric and Robust Statistical Methods

3. The remaining courses are electives and must be approved by the Graduate Advisor for Statistics. Up to two of the following 5000-level courses may be counted as electives:
   - MATH 5301 Elementary Analysis I
   - MATH 5302 Elementary Analysis II
**Applied Statistics Specialization (MS)**

1. Five core courses:
   - **STAT 5351** Probability and Statistics I
   - **STAT 5352** Probability and Statistics II
   - **STAT 6337** Advanced Statistical Methods I
   - **STAT 6338** Advanced Statistical Methods II
   - **STAT 6341** Numerical Linear Algebra and Statistical Computing

2. Two or more courses from the following list:
   - **STAT 6329** Applied Probability and Stochastic Processes
   - **STAT 6347** Applied Time Series Analysis
   - **STAT 6348** Applied Multivariate Analysis
   - **STAT 7330** Bayesian Data Analysis

3. The remaining courses are electives and must be approved by the Graduate Advisor for Statistics. Many students select the electives to build expertise in another subject to enhance their employment opportunities.

**Data Science Specialization (MS)**

- **CS 5303** Computer Science I
- **CS 5343** Algorithm Analysis and Data Structures
- **CS 6307** Introduction to Big Data Management and Analytics for non CS-Majors
- **CS 6375** Machine Learning
- **MATH 6312** Combinatorics and Graph Theory
- **STAT 5351** Probability and Statistics I
- **STAT 5352** Probability and Statistics II
- **STAT 6337** Advanced Statistical Methods I
- **STAT 6338** Advanced Statistical Methods II
- **STAT 6348** Applied Multivariate Analysis
- **STAT 6340** Statistical and Machine Learning

Plus one guided elective with the approval of the Graduate Advisor for Statistics.

**Other Requirements**

Electives must be approved by the Graduate Advisor for Statistics. Typically, the electives are
graduate courses in statistics and mathematics. Courses from other disciplines may also be used upon approval. Substitutions for required courses may be made if approved by the Graduate Advisor for Statistics. Instructors may substitute stated prerequisites for students with relevant experience.

3. Students who have not taken the CS 5333 Discrete Structures prerequisite for CS 5343 Algorithm Analysis and Data Structures should consult with their Graduate Advisor from the Mathematical Sciences Department to determine eligibility.

**Master of Science in Actuarial Science**

*36 semester credit hours minimum*

**Department Faculty**

**Professors:** Zalman I. Balanov, Swati Biswas, Min Chen, Pankaj K. Choudhary, Baris Coskunuzer, Mieczyslaw K. Dabkowski, Vladimir Dragovic, Sam Efmozovich, Yulia Gel, M. Ali Hooshyar, Wieslaw Krawcewicz, Susan E. Minkoff, L. Felipe Pereira, Dmitry Rachinskiy, Viswanath Ramakrishna, Janos Turi, John Zweck

**Associate Professors:** Maxim Arnold, Yan Cao, Liang Hong, Yifei Lou, Oleg Makarenkov, Tomoki Ohsawa, Anh Tran

**Assistant Professors:** Carlos Arreche, Sy Han (Steven) Chiou, Ronan Conlon, Qiwei Li, Stephen McKeown, Sunyoung Shin, Chuan-Fa Tang, Nathan Williams, Yunan Wu

**Professors Emeriti:** Larry P. Ammann, Patrick Odell, John W. Van Ness

**Clinical Professor:** Natalia Humphreys

**Clinical Associate Professor:** Mohammad Akbar

**Clinical Assistant Professor:** Wenyi (Roy) Lu

**Professors of Instruction:** Anatoly Eydelzon, Manjula Foley, Bentley T. Garrett, Yuly Koshevnik

**Associate Professors of Instruction:** Mohammad Ahsan, Kelly Aman, Malgorzata Dabkowska, Rabin Dahal, Changsong Li, Derege Mussa, My Linh Nguyen, Jigarkumar Patel, Tristan Whalen

**Assistant Professors of Instruction:** Anani Komla Adabrah, Iris Alvarado, Hui Ding, Adannah Duruoha, Kemelli Estacio-Hiroms, Huizhen Guo, Neha Makihjani, Ajaya Paudel, Nasrin Sultana, Julie Sutton, Kristen Wetzler

**Senior Lecturers:** Irina Martynova, Brady McCary

**UT Dallas Affiliated Faculty:** Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

**Program Objective**

The objective of the program is to educate future leaders of the actuarial industry with training in actuarial theory and methods in a wide spectrum of actuarial applications involving probabilistic and statistical models. All students will be prepared to take five actuarial preliminary exams and will take
two advanced actuarial classes to prepare for professional accreditation. Furthermore, students who
did not take classes required for VEE (Validation of Educational Experience) credits in statistics,
finance, and economics will have such opportunity. With this combined knowledge of mathematics
particularly of probability, statistics, and decision theory together with knowledge of financial
mathematics and insurance, the expected passing of five actuarial exams, and the three required VEE
credits, graduates of the program will be able to work as senior actuaries in insurance, consulting,
finance, government, and emerging markets.

Course Requirements

The University's general degree requirements are discussed on the Graduate Policies and Procedures
page.

The minimal total required number of classes for graduation is 36 semester credit hours. Among them,
27 semester credit hours of required courses and 9 semester credit hours of electives.

Required Courses: 27 semester credit hours

**STAT 5351** Probability and Statistics I

**STAT 5352** Probability and Statistics II

**ACTS 6301** Principles of Actuarial Models: Long Term Actuarial Mathematics

**ACTS 6302** Investment and Financial Markets

**ACTS 6303** Principles of Actuarial Models: Long Term Actuarial Mathematics II

**ACTS 6304** Principles of Actuarial Models: Short Term Actuarial Mathematics

**ACTS 6305** Principles of Actuarial Models: Short Term Actuarial Mathematics II

**ACTS 6306** Advanced Actuarial Applications

**ACTS 6308** Actuarial Financial Mathematics

Prescribed Elective Courses: 9 semester credit hours

For the prescribed elective courses select three courses from the following:

**STAT 6337** Advanced Statistical Methods

**STAT 6329** Applied Probability and Stochastic Processes

**STAT 6338** Advanced Statistical Methods II

**STAT 7330** Bayesian Data Analysis

**STAT 6347** Applied Time Series Analysis

**STAT 7338** Time Series Modeling and Filtering

**STAT 6348** Applied Multivariate Analysis
**Preparation for Actuarial Exams**

These classes prepare for the three preliminary actuarial examinations jointly administered by the Society of Actuaries (SOA), Casualty Actuarial Society (CAS) and the Canadian Institute of Actuaries (CIA):

- **Exam 1/P:** [STAT 5351](#) and [STAT 5352](#)
- **Exam 2/FM:** [ACTS 6308](#)
- **Exam 3L/MLC:** [ACTS 6301](#)
- **Exam 3F/MFE:** [ACTS 6302](#)
- **Exam 4/C:** [ACTS 6304](#)
- **Exam 5/FAP:** [ACTS 6306](#)

**Validation by Educational Experience (VEE) Credits**

- Applied Statistical Methods: [STAT 6337](#) and [STAT 6347](#)
- Corporate Finance: [FIN 6301](#)
- Economics: [MECO 6303](#)
Master of Science in Bioinformatics and Computational Biology

36 semester credit hours minimum

Mathematics Faculty

**Professors:** Zalman I. Balanov, Swati Biswas, Min Chen, Pankaj K. Choudhary, Baris Coskunuzer, Mieczyslaw K. Dabkowski, Vladimir Dragovic, Sam Efremovich, Yulia Gel, M. Ali Hooshyar, Wieslaw Krawcewicz, Susan E. Minkoff, L. Felipe Pereira, Dmitry Rachinskiy, Viswanath Ramakrishna, Janos Turi, John Zweck

**Associate Professors:** Maxim Arnold, Yan Cao, Liang Hong, Yifei Lou, Oleg Makarenkov, Tomoki Ohsawa, Anh Tran

**Assistant Professors:** Carlos Arreche, Sy Han (Steven) Chiou, Ronan Conlon, Qiwei Li, Stephen McKeown, Sunyoung Shin, Chuan-Fa Tang, Nathan Williams, Yunan Wu

**Professors Emeriti:** Larry P. Ammann, Patrick Odell, John W. Van Ness

**Clinical Professor:** Natalia Humphreys

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**Clinical Assistant Professor:** Wenyi (Roy) Lu

**Professors of Instruction:** Anatoly Eydelzon, Manjula Foley, Bentley T. Garrett, Yuly Koshevnik

**Associate Professors of Instruction:** Mohammad Ahsan, Kelly Aman, Malgorzata Dabkowska, Rabin Dahal, Changsong Li, Derege Mussa, My Linh Nguyen, Jigarkumar Patel, Tristan Whalen

**Assistant Professors of Instruction:** Anani Komla Adabrah, Iris Alvarado, Hui Ding, Adannah Duruoha, Kemeli Estacio-Hiroms, Huizhen Guo, Neha Makhijani, Ajaya Paudel, Nasrin Sultana, Julie Sutton, Kristen Wetzler
Senior Lecturers: Irina Martynova, Brady McCary

UT Dallas Affiliated Faculty: Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

Mathematics Faculty With Research Interests in Bioinformatics and Computational Biology: Swati Biswas, Yan Cao, and Min Chen

Biology Faculty

Professors: Rockford K. Draper, Juan E. González, Lawrence J. Reitzer, Stephen Spiro, Li Zhang, Michael Qiwei Zhang

Associate Professors: John G. Burr, Zachary Campbell, Jeff L. DeJong, Heng Du, Tae Hoon Kim, Faruck Morcos, Kelli Palmer, Duane D. Winkler, Zhenyu Xuan

Assistant Professors: Nicole De Nisco, Nikki Delk, Jyoti Misra

Professors Emeriti: Hans Bremer, Lee A. Bulla, Donald M. Gray

Associate Professors Emeriti: Gail A. M. Breen, Dennis L. Miller

Clinical Professor: David Murchison

Research Assistant Professors: Lan Guo, Li Liu

Professors of Instruction: Scott A. Rippel, Uma Srikanth

Associate Professors of Instruction: Mehmet Candas, Wen-Ju Lin, Elizabeth Pickett, Ilya Sapozhnikov, Michelle Wilson

Assistant Professors of Instruction: Ida Klang, Meenakshi Maitra, Caitlin Maynard, Iti Mehta, Jing Pan, Ruben D. Ramirez, Eva Sadat, Subha Sarcar, Zhuoru Wu

Senior Lecturer: Wen-Ho Yu

UT Dallas Affiliated Faculty: Leonidas Bleris, Sheena D’Arcy, Stephen D. Levene, Jonathan E. Ploski, Lucien (Tres) Thompson

Biological Sciences Faculty With Research Interests in Bioinformatics and Computational Biology: Faruck Morcos, Zhenyu Xuan, Hyuntae Yoo, and Michael Q. Zhang

Program Objective

The Master of Science program in Bioinformatics and Computational Biology is an interdisciplinary program offered jointly by the Departments of Mathematical Sciences and Biological Sciences, with the former serving as the administrative unit. By combining coursework from the disciplines of Biology, Computer Science, Mathematics, and Statistics, it caters to the growing demand of a new breed of scientists who have expertise in all these disciplines. In addition to coursework, the program also provides opportunities to gain practical experience by getting involved in research with faculty members.

A successful applicant to the program is expected to have a Bachelor's degree in Biology, Mathematics, Statistics, or in another science/engineering discipline, and must have completed at least one
semester of Calculus. Additional coursework in one or more of the disciplines of Biology, Computer Science, Mathematics, and Statistics is desirable but is not required.

Degree Requirements

The University's general degree requirements are discussed on the Graduate Policies and Procedures page.

The MS program in Bioinformatics and Computational Biology requires completion of at least 36 semester credit hours. The program offers a choice between two tracks. Track 1 is designed for students with a general background in science/engineering, whereas Track 2 is designed for students with a strong background in biology. To build further expertise, both tracks offer a choice of three elective groups, namely, Computer Science oriented, Statistics oriented, and Biology oriented elective groups. Both also offer opportunities for research. Students are expected to choose a track and an elective group based on their backgrounds and interests in consultation with the Graduate Advisor for the program.

Track 1 (MS)

I. Core: 15 semester credit hours

- **BMEN 6374** Genes, Proteins and Cell Biology for Engineers
- **BIOL 6V00** Topics in Biological Sciences (Computational Molecular Evolution)
- **CS 5303** Computer Science I
- **MATH 5303** Advanced Calculus and Linear Algebra
- **STAT 5351** Probability and Statistics I (for Elective Group 2)
  - or **STAT 5353** Probability and Statistics for Data Science and Bioinformatics (for Elective Groups 1 and 3)

II. Elective Groups (Choose one elective group)

**Elective Group 1 (Computer Science Oriented): 15 semester credit hours**

- **CS 5343** Algorithm Analysis and Data Structures
- **MATH 6312** Combinatorics and Graph Theory
- **MATH 6341** Bioinformatics
  - or **BIOL 5376** Applied Bioinformatics
- **MATH 6346** Medical Image Analysis

AND one of the following:

- **CS 6307** Introduction to Big Data Management and Analytics for non CS-Majors
- **CS 6314** Web Programming Languages
Elective Group 2 (Statistics Oriented): 18 semester credit hours

- STAT 5352 Probability and Statistics II
- STAT 6337 Advanced Statistical Methods I
- STAT 6338 Advanced Statistical Methods II
- STAT 6340 Statistical and Machine Learning
- MATH 6341 Bioinformatics
  - or BIOL 5376 Applied Bioinformatics
- MATH 6346 Medical Image Analysis

Elective Group 3 (Biology oriented): 15 semester credit hours

- MATH 6341 Bioinformatics
  - or BIOL 5376 Applied Bioinformatics
- MATH 6345 Mathematical Methods in Medicine and Biology
- MATH 6346 Medical Image Analysis

AND two of the following:

- BIOL 5375 Genes to Genomes
- BIOL 5381 Genomics
- BIOL 6315 Epigenetics
- BIOL 6373 Proteomics
- BIOL 6385 Computational Biology
  - or BMEN 6389 Computational Biology
  - or MATH 6343 Computational Biology

III. Research or Elective[s] or a Combination Thereof

- Elective Group 1: 6 semester credit hours
- Elective Group 2: 3 semester credit hours
- Elective Group 3: 6 semester credit hours

Track 2 (MS)
I. Core: 14 semester credit hours

**BIOL 5410** Biochemistry

**BIOL 5420** Molecular Biology

**STAT 5351** Probability and Statistics I (for Elective Group 2)

or **STAT 5353** Probability and Statistics for Data Science and Bioinformatics (for Elective Groups 1 and 3)

**MATH 5303** Advanced Calculus and Linear Algebra

II. Elective Groups [Choose one elective group]

Elective Group 1 (Computer Science oriented): 18 semester credit hours

**CS 5303** Computer Science I

**CS 5343** Algorithm Analysis and Data Structures

**MATH 6312** Combinatorics and Graph Theory

**MATH 6341** Bioinformatics

or **BIOL 5376** Applied Bioinformatics

**MATH 6346** Medical Image Analysis

AND one of the following:

**CS 6307** Introduction to Big Data Management and Analytics for non CS-Majors

**CS 6314** Web Programming Languages

**CS 6360** Database Design

**CS 6375** Machine Learning

Elective Group 2 (Statistics oriented): 18 semester credit hours

**STAT 5352** Probability and Statistics II

**STAT 6337** Advanced Statistical Methods I

**STAT 6338** Advanced Statistical Methods II

**STAT 6340** Statistical and Machine Learning

**MATH 6341** Bioinformatics

or **BIOL 5376** Applied Bioinformatics

**MATH 6346** Medical Image Analysis

Elective Group 3 (Biology oriented): At least 18 semester credit hours

**MATH 6341** Bioinformatics
or **BIOL 5376** Applied Bioinformatics

**MATH 6346** Medical Image Analysis

**MATH 6345** Mathematical Methods in Medicine and Biology

AND two of the following:

**BIOL 5375** Genes to Genomes

**BIOL 5381** Genomics

**BIOL 6315** Epigenetics

**BIOL 6373** Proteomics

**BIOL 6385** Computational Biology

or **BMEN 6389** Computational Biology

or **MATH 6343** Computational Biology

**BIOL 6V00** Topics in Biological Sciences (Computational Molecular Evolution)

**BIOL 6V00** Topics in Biological Sciences (Introduction to Programming for Biological Sciences)

### III. Research or Elective[s] or a Combination Thereof

All Elective Groups: 4 semester credit hours

#### Other Requirements

- For a PhD bound student in the Department of Biological Sciences, **BIOL 5440** Cell Biology and **BIOL 5460** Quantitative Biology (or an equivalent) are required. This requirement can be fulfilled by taking these courses as 'electives' in the Bioinformatics and Computational Biology program.

- Electives must be approved by the Graduate Advisor of the program.

- Substitutions for required courses may be made if approved by the Graduate Advisor of the program and the Head of the Mathematical Sciences Department.

- A student may choose to write an MS thesis under the supervision of a faculty member. The thesis project can count for 3 to 6 semester credit hours of electives towards the required 36 hours, in accordance with University policies. The thesis must be approved by the Head of the Mathematical Sciences Department. Once the thesis project is completed, the student must successfully defend it before his/her thesis committee.

1. Students who have not taken the CS 5333 Discrete Structures prerequisite for CS 5343 Algorithm Analysis and Data Structures should consult with their Graduate Advisor from the Mathematical Sciences Department to determine eligibility.

#### Doctor of Philosophy in Mathematics

*75 semester credit hours minimum beyond the baccalaureate degree*
Department Faculty

**Professors:** Zalman I. Balanov, Swati Biswas, Min Chen, Pankaj K. Choudhary, Baris Coskunuzer, Mieczyslaw K. Dabkowski, Vladimir Dragovic, Sam Efremovich, Yulia Gel, M. Ali Hooshyar, Wieslaw Krawcewicz, Susan E. Minkoff, L. Felipe Pereira, Dmitry Rachinskiy, Viswanath Ramakrishna, Janos Turi, John Zweck

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**Professors Emeriti:** Larry P. Ammann, Patrick Odell, John W. Van Ness

**Clinical Professor:** Natalia Humphreys

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**Senior Lecturers:** Irina Martynova, Brady McCary

**UT Dallas Affiliated Faculty:** Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

Degree Requirements

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](https://catalog.utdallas.edu/2021/graduate/programs/nsm/mathematics) page.

The student must arrange a course program with the guidance and approval of the Graduate Advisor for Mathematics. A minimum of 75 semester credit hours beyond the bachelor's degree is required.

The following five courses have to be taken by each student:

- **MATH 6301** Real Analysis
- **MATH 6302** Functional Analysis I
- **MATH 6303** Theory of Complex Functions I
- **MATH 6311** Abstract Algebra I
- **MATH 6315** Ordinary Differential Equations

Each student should take at least six courses from the following list:
MATH 6309 Differential Geometry
MATH 6310 Topology
MATH 6312 Combinatorics and Graph Theory
MATH 6313 Numerical Analysis
MATH 6316 Differential Equations
MATH 6318 Numerical Analysis of Differential Equations
MATH 6319 Principles and Techniques in Applied Mathematics I
MATH 6320 Principles and Techniques in Applied Mathematics II
MATH 6321 Optimization
MATH 6325 Nonlinear Analysis I
MATH 6340 Numerical Linear Algebra
MATH 6342 Scientific Computing
MATH 7313 Partial Differential Equations I
MATH 7319 Functional Analysis II
MATH 7361 Algebraic Geometry and Non-linear Equations

Electives and Dissertation

At least an additional four courses designed for the student's area of specialization are taken as electives in a degree plan designed by the student and the Graduate Advisor for Mathematics (or the student's PhD advisor). This plan is subject to approval by the Department Head. The student must pass a PhD Qualifying Examination and the oral examination in accordance with departmental policies in order to continue in the PhD program. Finally, a dissertation is required and must be approved by the graduate program.

There must be available a dissertation research advisor or group of dissertation advisors willing to supervise and guide the student. A dissertation Supervising Committee should be formed in accordance with the UT Dallas policy memorandum (UTDPP1052).

Doctor of Philosophy in Statistics

75 semester credit hours minimum beyond the baccalaureate degree

Department Faculty

**Associate Professors:** Maxim Arnold, Yan Cao, Liang Hong, Yifei Lou, Oleg Makarenkov, Tomoki Ohsawa, Anh Tran

**Assistant Professors:** Carlos Arreche, Sy Han (Steven) Chiou, Ronan Conlon, Qiwei Li, Stephen McKeown, Sunyoung Shin, Chuan-Fa Tang, Nathan Williams, Yunan Wu

**Professors Emeriti:** Larry P. Ammann, Patrick Odell, John W. Van Ness

**Clinical Professor:** Natalia Humphreys

**Clinical Associate Professor:** Mohammad Akbar

**Clinical Assistant Professor:** Wenyi (Roy) Lu

**Professors of Instruction:** Anatoly Eydelzon, Manjula Foley, Bentley T. Garrett, Yuly Koshevnik

**Associate Professors of Instruction:** Mohammad Ahsan, Kelly Aman, Malgorzata Dabkowska, Rabin Dahal, Changsong Li, Derege Mussa, My Linh Nguyen, Jigarkumar Patel, Tristan Whalen

**Assistant Professors of Instruction:** Anani Komla Adabrah, Iris Alvarado, Hui Ding, Adannah Duruoha, Kemelli Estacio-Hiroms, Huizhen Guo, Neha Makhijani, Ajaya Paudel, Nasrin Sultana, Julie Sutton, Kristen Wetzler

**Senior Lecturers:** Irina Martynova, Brady McCary

**UT Dallas Affiliated Faculty:** Hervé Abdi, Titu Andreescu, Alain Bensoussan, Stefano Leonardi, Faruck Morcos, Zhenyu Xuan, Michael Qiwei Zhang

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**Degree Requirements**

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](https://catalog.utdallas.edu/2021/graduate/programs/nsm/mathematics) page.

The student must arrange a course program with the guidance and approval of the Graduate Advisor for Statistics. A minimum of 75 semester credit hours beyond the bachelor's degree is required.

The following six courses have to be taken by each student:

- **STAT 6331** Statistical Inference I
- **STAT 6332** Statistical Inference II
- **STAT 6337** Advanced Statistical Methods I
- **STAT 6338** Advanced Statistical Methods II
- **STAT 6339** Linear Statistical Models
- **STAT 6344** Probability Theory I

Each student should take at least three courses approved by the Graduate Advisor for Statistics from the following list:

- **STAT 7330** Bayesian Data Analysis
- **STAT 7331** Multivariate Analysis
**STAT 7334** Nonparametric and Robust Statistical Methods  
**STAT 7336** Nonparametric Curve Estimation  
**STAT 7338** Time Series Modeling and Filtering  
**STAT 7339** Advanced Regression Modeling  
**STAT 7340** Functional Data Analysis  
**STAT 7345** Advanced Probability and Stochastic Processes

## Electives and Dissertation

An additional 18-24 semester credit hours designed for the student's area of specialization are taken as electives in a degree plan designed by the student and the Graduate Advisor for Statistics (or the student's PhD advisor). This plan is subject to approval by the Department Head. The student must pass a PhD Qualifying Examination and the oral examination in accordance with departmental policies in order to continue in the PhD program. Finally, a dissertation is required and must be approved by the graduate program.

There must be available a dissertation research advisor or group of dissertation advisors willing to supervise and guide the student. A dissertation Supervising Committee should be formed in accordance with the UT Dallas policy memorandum ([UTDPP1052](#)).

## Research

Within the Mathematical Sciences Department opportunities exist for research in a wide range of areas within the mathematical sciences. Some specific examples are given below. The opportunity to take coursework in several of the other University programs also allows the student to prepare for interdisciplinary research. Such coursework must be approved by the assigned Graduate Advisor.


Some of the broad research areas represented in Statistics are as follows: probability theory, stochastic processes, statistical inference, asymptotic theory, statistical methodology, time series analysis, Bayesian analysis, robust multivariate statistical methods, nonparametric methods, nonparametric curve estimation, sequential analysis, biostatistics, survival analysis, statistical genetics and genomics, and bioinformatics.

For a complete list of faculty and their areas of research, visit [math.utdallas.edu/people/faculty](http://math.utdallas.edu/people/faculty).

## Graduate Certificate in Data Science

12 semester credit hours

The Department of Mathematical Sciences, in cooperation with the Department of Computer Science,
offers a graduate certificate in Data Science.

Admission Requirements
Students must gain admission to a graduate program at UT Dallas and have the pre-requisites needed to take the certificate courses.

Certificate Requirements
Students must complete the following four courses with a GPA of 3.0 or better.

- **CS 6307** Introduction to Big Data Management and Analytics for non CS-Majors
- **CS 6375** Machine Learning
- **MATH 6312** Combinatorics and Graph Theory
- **STAT 6340** Statistical and Machine Learning

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