

Courses of Instruction

All Courses of Instruction are located in one section at the back of this catalog.

Course and Subject Guide

The “Course and Subject Guide,” found in the Courses of Instruction section of this book, serves as a table of contents and provides quick access to subject areas and prefixes.

Department of Mathematics

Main Departmental Office
General Academic Building, Room 435
P.O. Box 311430
Denton, TX 76203-1430
940-565-2155
Fax: 940-565-4805
E-mail: mathchair@unt.edu
Web site: www.math.unt.edu

J. Matthew Douglass, Chair

Faculty

Professors Brand, Jackson, Johnson, Kallman, Kung, Lewis, Mauldin, Neuberger, Urbanski, Zamboni.
Associate Professors Allaart, Allen, Anghel, Bator, Betelu, Brozovic, Cherry, Clark, Conley, Douglass, Gao, Iaia, Liu, Monticino, Quintanilla, Richter, Shepler, Song. *Assistant Professors* Sari. *Lecturers* Grether, Teel.

Introduction

The department offers programs of study leading to the BA, MA, MS and PhD degrees with a major in mathematics, and the BSMTH. Its faculty is dedicated to excellence in scholarship and teaching. The faculty supports a strong program of instruction and research, having as its core a solid foundation of mathematical theory that furnishes the tools necessary to address and solve crucial problems in maintaining, improving and protecting the world. The program also promulgates mathematics as a discipline in its own right, a body of pure knowledge with exceptional power, enabling its practitioners and those who diligently study it to be adaptable and effective forces in the workplace.

Students who earn degrees in mathematics readily obtain jobs with high-technology companies

and in business, industry, government and teaching. Salaries and working conditions compare with those of engineers and scientists.

Students who plan to major in mathematics, physics, chemistry, biology or computer science should have had four years of mathematics in high school, including pre-calculus. Students who are required to take mathematics as part of their degree program in college should have had at least two years of algebra and one year of geometry in high school.

Required Placement and Testing

The Department of Mathematics enforces prerequisites for MATH 1100, 1190, 1350, 1400, 1650 and 1680. Students not meeting prerequisites for courses in which they enroll are required to drop the course or face academic penalty.

Students are blocked from enrolling in MATH courses above 1010 for their first mathematics course at UNT and must see the mathematics department for appropriate placement in mathematics courses.

For more information about placement procedures, please contact the mathematics advising office at 940-565-4045.

Prerequisites

- MATH 1100: MATH 1010 with grade of C or better, or UNT mathematics department approval. A passing THEA mathematics score does not substitute for the MATH 1010 prerequisite.
- MATH 1190, 1350, 1400, 1650, 1680: MATH 1100 or equivalent with grade of C or better, or UNT mathematics department approval. MATH 1350 or MATH 1351 does not satisfy the College of Arts and Sciences degree requirement.

Programs of Study

The department offers undergraduate and graduate programs in the following areas:

- Bachelor of Arts,
- Master of Arts,
- Master of Science, and
- Doctor of Philosophy, all with a major in mathematics; and
- Bachelor of Science in Mathematics.

Bachelor of Arts

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Arts degree as specified in the “General University Requirements”

in the Academics section of this catalog and the College of Arts and Sciences requirements.

2. **Major Requirements:** 34 hours of mathematics courses, which must include:
 - a. Mathematics Core (16 hours): MATH 1710, 1720, 2510, 2700 and 2730.
 - b. At least one of MATH 3510 or 3610 must be taken in satisfying other requirements.
 - c. Depth Requirement (6 hours): One of the following areas:
 - Analysis: two of the following: MATH 3350, 3410, 3420, 3610, 3740, 4100, 4200, 4520.
 - Algebra: two of the following: MATH 3400, 3510, 3520, 4430, 4450.
 - Probability/Statistics: two of the following: MATH 3680, 4610, 4650.
 - Geometry/Topology: MATH 4060 and 4500.
 - d. Breadth Requirement (9 hours): One course in each of the three areas not used to satisfy the depth requirement.
 - e. Mathematics elective (3 hours): One additional upper-level mathematics course numbered 3350 or higher.
 - f. All students seeking Secondary Teacher Certification must take MATH 4050.
3. **Other Course Requirements:** Three laboratory science courses are required, as follows:
 - a. One course from BIOL 1710/1730, GEOG 1710 and GEOL 1610
 - b. One course from PHYS 1710/1730 and CHEM 1410/1430
 - c. One additional course from BIOL 1710/1730, 1720/1740, GEOG 1710, GEOL 1610, PHYS 1710/1730, 2220/2240, CHEM 1410/1430 and 1420/1440.

Equivalent honors courses can also be used to satisfy this requirement.

Proficiency in a foreign language equivalent to 2050 is required. Students wishing to pursue careers in elementary or secondary education are encouraged to choose Spanish for the foreign language requirement. Students intending to pursue a graduate degree in mathematics are encouraged to study French, German or Russian.

4. **GPA:** Students must achieve at least a 2.0 GPA in all mathematics courses above 3350.
5. **Computer Competency:** Students taking mathematics courses at the 2000-level or above are expected to be competent in computer programming, using languages such as BASIC, C, C++, Fortran, PASCAL or Java. This competency can be obtained through completion of CSCE 1020 or 1030 or consent of the department.

6. **Minor Requirements:** One of the following is required:
 - a. A minor of at least 18 hours (6 advanced). A minor in statistics does not fulfill this requirement.
 - b. Completion of the certificate in actuarial science. Students must take MATH 3680, 4610 and 4650 for fulfilling degree requirements; students are also encouraged to take MATH 3350 and 3740. Also, no mathematics courses may be chosen for fulfilling the elective requirements of the certificate.

BA with a Major in Mathematics

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
MATH 1710, Calculus I**	4
PSCI 1040, American Government*	3
Humanities*	3
Total	16

SPRING

SPRING	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or GEOG 1710, Earth Science, or GEOL 1610, Introduction to Physical Geology (may be used to satisfy a portion of the Natural Sciences requirement)**	3-4
ENGL Composition II requirement (ENGL 2700, Technical Writing recommended)*	3
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
MATH 1720, Calculus II	3
Computer Competency or Elective (see major requirements)	4
Total	16-17

SOPHOMORE YEAR

FALL	HOURS
HIST 2610, United States History to 1865*	3
MATH 2700, Linear Algebra and Vector Geometry	3
MATH 2730, Multivariable Calculus	3
PHYS 1710/1730, Mechanics and Laboratory, or CHEM 1410/1430, General Chemistry I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)*	4
Visual and Performing Arts (advanced)*	<u>3</u>
Total	16

SPRING	HOURS
HIST 2620, United States History Since 1865*	3
MATH 2510, Real Analysis I	3
MATH Breadth or Depth requirement (advanced, see major requirements)	3
Additional Laboratory Science (see major requirements)**	3–4
Minor	<u>3</u>
Total	15–16

JUNIOR YEAR

FALL	HOURS
MATH 3510, Introduction to Abstract Algebra I, or MATH 3610, Real Analysis II (see major requirements)	3
MATH Breadth or Depth requirement (advanced, see major requirements)	3
PSCI 1050, American Government*	3
Minor	3
Minor	<u>3</u>
Total	15

SPRING	HOURS
MATH Breadth or Depth requirement (advanced, see major requirements)	3
Elective	3
Minor	3
Minor (advanced)	3
Social and Behavioral Sciences*	<u>3</u>
Total	15

SENIOR YEAR

FALL	HOURS
MATH Breadth or Depth requirement (advanced, see major requirements)	3
Minor (advanced)	3
Elective (advanced)	3
Elective (advanced)	3
Elective	<u>3</u>
Total	15

SPRING	HOURS
MATH Elective (3350 or higher)	3
Elective (advanced)	3
Elective (advanced)	3
Elective (advanced)	<u>3</u>
Total	12

**See the University Core Curriculum section of this catalog for approved list of course options.*

***See Arts and Sciences degree requirements section of this catalog for approved list of course options.*

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed.

Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science in Mathematics Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Science degree as specified in the “General University Requirements” in the Academics section of this catalog and the College of Arts and Sciences requirements.

2. **Major Requirements:** 40 hours of mathematics courses, which must include:

- Mathematics Core (16 hours): MATH 1710, 1720, 2510, 2700 and 2730.
- At least one of MATH 3510 or 3610 must be taken in satisfying other requirements.
- Depth Requirement (9 hours): One of the following areas:
 - Analysis: MATH 3610 and two of the following: MATH 3350, 3410, 3420, 3740, 4100, 4200, 4520.
 - Algebra: MATH 3510 and two of the following: MATH 3400, 3520, 4430, 4450.
 - Probability/Statistics: MATH 3680, 4610 and 4650.
 - Geometry/Topology: MATH 3740, 4060 and 4500.
- Breadth Requirement (9 hours): One course in each of the three areas not used to satisfy the depth requirement.
- Mathematics elective (6 hours): Two additional upper-level mathematics courses numbered 3350 or above.
- All students seeking Secondary Teacher Certification must take MATH 4050.

3. **Other Course Requirements:** Three laboratory science courses are required. This requirement may be satisfied by one of the following two options:

- Emphasis on Life Science
 - Two of these must be either BIOL 1710/1730 and 1720/1740 or GEOG 1710 and GEOL 1610.
 - The third course must be either PHYS 1710/1730 or CHEM 1410/1430.

- b. Emphasis on Physics or Chemistry
 - Two of these must be either PHYS 1710/1730 and 2220/2240 or CHEM 1410/1430 and 1420/1440.
 - The third course must be BIOL 1710/1730, GEOG 1710 or GEOL 1610.

Equivalent honors courses can also be used to satisfy this requirement.

Students may complete either of two options to satisfy the College of Arts and Sciences foreign language requirement:

Option I: Proficiency in a foreign language equivalent to 1020 is required. Students wishing to pursue careers in elementary or secondary education are encouraged to choose Spanish for the foreign language requirement. Students intending to pursue a graduate degree in mathematics are encouraged to study French, German or Russian.

Option II: Complete 6 hours of technical writing courses from the following: ENGL 2700, 4180, 4190 and 4250.

4. **GPA:** Students must achieve a grade point average of at least 2.0 in all mathematics courses above 3350.

5. **Computer Competency:** Students taking mathematics courses at the 2000 level or above are expected to be competent in computer programming, using languages such as BASIC, C, C++, Fortran, PASCAL or Java. This competency can be obtained through completion of CSCE 1020 or 1030 or consent of the department.

6. **Minor Requirements:** One of the following is required:

- a. A minor of at least 18 hours (6 advanced). A minor in statistics does not fulfill this requirement.
- b. Completion of the certificate program in actuarial science. Students must take MATH 3680, 4610 and 4650 for fulfilling degree requirements; students are also encouraged to take MATH 3350 and 3740. Also, no mathematics courses may be chosen for fulfilling the elective requirements of the certificate program.

BS in Mathematics Language Option II

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing II*	3
MATH 1710, Calculus I	4
PSCI 1040, American Government*	3
Humanities*	3
Understanding the Human Community*	3
Total	16

SPRING	HOURS
ENGL Composition II requirement (ENGL 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PSCI 1050, American Government*	3
Computer Competency or Elective (see major requirements)	4
Understanding the Human Community*	3
Total	16

SOPHOMORE YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or GEOG 1710, Earth Science, or GEOL 1610, Introductory Physical Geology (may be used to satisfy a portion of the Natural Sciences requirement)*	3-4
HIST 2610, United States History to 1865*	3
MATH 2700, Linear Algebra and Vector Geometry	3
MATH 2730, Multivariable Calculus	3
Minor	3
Total	15-16

SPRING	HOURS
HIST 2620, United States History Since 1865*	3
MATH 2510, Real Analysis I	3
PHYS 1710/1730, Mechanics and Laboratory, or CHEM 1410/1430, General Chemistry I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4

MATH Breadth or Depth (advanced, see major requirements)	3
Minor	<u>3</u>
Total	16

JUNIOR YEAR

FALL	HOURS
MATH 3510, Introduction to Abstract Algebra I, or MATH 3610, Real Analysis II (see major requirements)	3
MATH Breadth or Depth requirement (advanced, see major requirements)	3
Minor	3
Minor	3
Additional Laboratory Science (see major requirements)**	<u>3-4</u>
Total	15-16

SPRING	HOURS
MATH Breadth or Depth requirement (advanced, see major requirements)	3
MATH Breadth or Depth requirement (advanced, see major requirements)	3
Minor (advanced)	3
Minor (advanced)	3
Social and Behavioral Sciences	<u>3</u>
Total	15

SENIOR YEAR

FALL	HOURS
MATH Breadth or Depth requirement (advanced, see major requirements)	3
MATH Elective (3350 or higher)	3
Elective (advanced)	3
Elective	3
Visual and Performing Arts (advanced)*	<u>3</u>
Total	15

SPRING	HOURS
MATH Elective (3350 or higher)	3
Elective (advanced)	3
Elective (advanced)	3
Technical Writing Elective (advanced, see major requirements)	<u>3</u>
Total	12

*See the *University Core Curriculum* section of this catalog for approved list of course options.

** See *Arts and Sciences degree requirements* section of this catalog for approved list of course options.

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed.

Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Preparing for Graduate School

It is to be emphasized that the above are minimal requirements for an undergraduate degree in mathematics. For students who plan to go to graduate school in mathematics, the department strongly recommends the following courses: MATH 3410, 3510, 3610 and 4500. Other advanced courses should be selected in consultation with the faculty and the undergraduate advisor in the Department of Mathematics.

Minor in Mathematics

Students planning to minor in mathematics should consult the undergraduate advisor of the Department of Mathematics. A minor consists of at least 18 hours and usually includes MATH 1710, 1720, 1780 or 2700, and 2730 or 2770, plus 6 advanced hours. Neither MATH 1350 nor 1351 may be included in the minor, except for elementary education majors.

Minor in Statistics

A minor in statistics requires MATH 1710, 1720, 2730, 3680, 4610 and 4650. In addition, one additional course concerning the application of statistical methods to another discipline must be taken. This course must be chosen in consultation with the undergraduate advisor in the Department of Mathematics. These courses include, but are not limited to, the following: CHEM 3451, DSCI 3870, ECON 4870 and 4875, GEOG 3190, PHYS 4110 and 4310, PSCI 3300, and PSYC 3630.

Teacher Certification

The College of Arts and Sciences encourages students to explore teaching at the secondary level as a career option. The student's academic advisor in the Dean's Office for Undergraduates and Student Advising in GAB, Room 220, can assist students with specific requirements for teacher certification in Mathematics. Upon completion of this program, students will be prepared to sit for the certification examinations in Mathematics. Students should consult with the mathematics faculty advisor for additional certification options.

Requirements utilizing a BA degree:

MATH 1710, 1720, 2510, 2700, 2730; MATH 3510 or 3610; MATH 4050; and 12 advanced hours from approved list (see major requirements). See major for additional course work and GPA requirements.

Requirements utilizing a BS degree:

MATH 1710, 1720, 2510, 2700, 2730; MATH 3510 or 3610; MATH 4050; and 18 advanced hours from approved list (see major requirements). See major for additional course work and GPA requirements.

Requirements utilizing a BA degree with Certification in Mathematics/Physics: MATH 1710, 1720, 2510, 2700, 2730; MATH 3510 or 3610; MATH 4050; 12 advanced hours of mathematics from approved list (see major requirements); PHYS 1710/1730, 2220/2240, 3210, 3220. *See major for additional course work and GPA requirements.*

Requirements utilizing a BS degree with Certification in Mathematics/Physics: MATH 1710, 1720, 2510, 2700, 2730; MATH 3510 or 3610; MATH 4050; 18 advanced hours of mathematics from approved list (see major requirements); PHYS 1710/1730, 2220/2240, 3210, 3220. *See major for additional course work and GPA requirements.*

Students must also complete the required 21 hours in upper-level education courses (EDSE 3800, 3830, 4060, 4070, 4108, 4118, 4840) and meet all GPA requirements to apply for state certification. In order to enroll for the first required education course, the student must make application to the certification program in the College of Education in Matthews Hall, Room 105.

All state certification requirements and information on required examinations is available on the web site of the State Board for Educator Certification (SBEC), www.sbec.state.tx.us.

Certificate in Actuarial Science

Students interested in this interdisciplinary certificate program should contact the undergraduate advisor of the mathematics department. To be admitted into this program, students must complete the following courses: MATH 2700, 2730; either MATH 3680 or ECON 4630 or DSCI 3710; ECON 1100, 1110; CSCE 1020 or 1030 (CSCE 1040 is encouraged but not required); RMIN 2500; and FINA 3770.

This certificate requires 18 hours of courses: ECON 4870, ECON 4875, and four advanced elective classes selected from prefixes MATH, ECON, FINA and RMIN. Electives should be selected both for broad knowledge of the actuarial field and for preparation for the rigorous examination process prescribed by the Society of Actuaries and the Casualty Actuary Society. These four courses must be selected from the following:

- For students not majoring in mathematics, MATH 3350, 3740, 4610 and 4650. Recommended courses are MATH 4610 and 4650. Students considering graduate work in computational finance should also take MATH 3410 and 3420. For math majors, these classes should be taken for fulfilling major requirements, but these classes may not be used for fulfilling certificate requirements.
- FINA 4200, 4210, 4300, 4310 and 4400. Recommended courses are FINA 4200, 4210 and 4310.

- Any 4000-level RMIN course. Recommended courses are RMIN 4200 and 4310. Students are also encouraged to seek internships that may be pursued in conjunction with RMIN 4800.

- ECON 4180.

- Any other course must receive approval from the undergraduate advisor of the Department of Mathematics.

This program should prepare students for the preliminary actuarial exams, as follows:

- Actuarial Exam 1/P: MATH 4610. Students are encouraged to take MATH 4610 and attempt Exam 1/P before the end of the junior year.
- Actuarial Exam 2/FM: FINA 3770 and 4210.
- VEE (Validation by Educational Experience)-Economics: ECON 1100 and 1110.
- VEE-Applied Statistical Methods: ECON 4030 and 4870.
- VEE- Corporate Finance: FINA 3770 and 4200.

More information about the actuarial exams, the VEE requirements, careers in actuarial science and internship opportunities may be found at www.beanactuary.org, www.soa.org and www.casact.org.

Certificate in Statistics

A certificate in statistics consists of MATH 3680, 4610, 4650, and one additional course concerning the application of statistical methods to another discipline, chosen in consultation with the undergraduate advisor in the Department of Mathematics. Acceptable courses include, but are not limited to, the following: CHEM 3451, DSCI 3870, ECON 4870 and 4875, GEOG 3190 and 4410, PHYS 4110 and 4310, PSCI 3300, and PSYC 3630.

Graduate Degrees

The department offers degree programs leading to the Master of Arts, Master of Science and Doctor of Philosophy. For information, consult the *Graduate Catalog*.

Scholarships and Financial Assistance

The department administers five scholarship funds: the E. H. Hanson Scholarship, the Roger L. Perry Memorial Scholarship, the Mildred Masters McCarty Scholarship, the John Ed Allen Scholarship and the John W. Neuberger Scholarship. Jobs as tutors and graders also are available for mathematics majors. Contact the mathematics department office for information and application forms.