Mathematical Sciences

Majoring in Mathematical Sciences is the first step toward many satisfying and challenging careers. There are two concentrations possible within the major: mathematics or statistics. With a wide variety of courses in mathematics, statistics, and math education available, you will find many ways to construct an individualized curriculum toward your B.S. degree.

For students majoring in Chemistry, Physics, Computer Science, or Engineering, there is a 2nd major option in Mathematical Sciences designed specifically for you.

What opportunities can you enjoy as a member of the University of Memphis Department of Mathematical Sciences?

- Working with top-flight research faculty, some who currently enjoy major NIH and NSF grants, and others who are part of one of the best research groups in the world in the area of Graph Theory and Combinatorics. We also have highly-regarded research groups in Partial Differential Equations, Ergodic Theory and Dynamics, Analysis, and Bio-Statistics
- Getting close guidance from faculty advisors to help you develop a program that meets your needs and goals, and to help you navigate your schedule and requirements properly
- Meeting mathematicians from around the world who visit our campus for our annual Erdős Lecture Series or for conferences
- Becoming a member of a successful alumni group, including graduates who went on for advanced degrees at Carnegie-Mellon, Johns Hopkins, the Wharton School of Business at the University of Pennsylvania, and the University of Memphis Law School
- Scholarship opportunities: the Department of Mathematical Sciences offers two scholarships for full-time undergraduates majoring in Math or Statistics.

Career Opportunities in Mathematics

Accounting and Finance
Software Development & Programming
Statistics
Cost Estimation and Analysis
Actuarial Services
Academic or Applied Research Engineering

For more information on careers in the Mathematical Sciences:
http://www.memphis.edu/msci/ugrad/index.php
UM Career Services: http://www.memphis.edu/careerservices
# MATHEMATICAL SCIENCES
## SAMPLE FOUR-YEAR PLAN
### Mathematics Concentration

#### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ENGL 1010</td>
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<td>ENGL 1020</td>
<td>3</td>
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<tr>
<td>GE MATH- MATH 1910</td>
<td>4</td>
<td>MATH 1920</td>
<td>4</td>
</tr>
<tr>
<td>GE Social/Behavioral Science</td>
<td>3</td>
<td>GE Nat. Science w/lab*</td>
<td>4</td>
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<tr>
<td>Elective</td>
<td>3</td>
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**Semester Totals**  
16 hrs.  
14 hrs.

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>GE History</td>
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<td>GE History</td>
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<tr>
<td>ENGL 2201 or 2202</td>
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<td>MATH 2702</td>
<td>3</td>
</tr>
<tr>
<td>MATH 2110</td>
<td>4</td>
<td>COMM 2381</td>
<td>3</td>
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<tr>
<td>GE Nat. Science w/lab*</td>
<td>4</td>
<td>GE Humanities/Fine Arts</td>
<td>3</td>
</tr>
<tr>
<td>GE Social/Behavioral Science</td>
<td>3</td>
<td>MATH 2120</td>
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</tbody>
</table>

**Semester Totals**  
17 hrs.  
15 hrs.

#### Junior Year

<table>
<thead>
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<th>Course</th>
<th>Hours</th>
<th>Course</th>
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<tr>
<td>MATH 3242</td>
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<tr>
<td>UD MATH</td>
<td>3</td>
<td>UD MATH</td>
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<tr>
<td>COMP 4001</td>
<td>3</td>
<td>GE Humanities/Fine Arts</td>
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<tr>
<td>UD Elective</td>
<td>3</td>
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</tbody>
</table>

**Semester Totals**  
15 hrs.  
15 hrs.

#### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
<th>Course</th>
<th>Hours</th>
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<td>UD Elective</td>
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<td>Elective</td>
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</table>

**Semester Totals**  
15 hrs.  
13 hrs.

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*Choose one Natural Science sequence: CHEM 1110/1111 and 1120/1121 OR PHYS 2110/2111 and 2120/2121.

GE = General Education Requirements  
BS = Bachelor of Science college requirements  
UD = Upper division  
Foreign Language Requirement – See the [Undergraduate Catalog](http://catalog.memphis.edu)

Degree hours = 120  
42 Upper Division hours required for graduation  
No more than 2 hours of physical education courses may be counted toward a degree.  
Residence – 30 of the last 60 hours must be taken at University of Memphis; at least 60 hours must be at a four-year institution; transfer students must earn at least 6 hours of a major at UM and at least 3 hours of a minor at UM.
MATHEMATICAL SCIENCES PROGRAM REQUIREMENTS

A. University General Education Program (41 hours)
See the Undergraduate Catalog for the University General Education Program requirements. Note these requirements specified for the Mathematical Sciences major: Mathematics: MATH 1910; Natural Science: CHEM 1110/1111, 1120/1121, or PHYS 2110/2111, 2120/2121.

B. The Major (41-42 hours in addition to University General Education Program)

1. Major Core (17 hours);
   Completion of MATH 1920, 2110, 2120, 2702, and 3242 (majors are encouraged to consider the departmental honors program described below) plus one of the following courses: COMP 1900 or COMP 4001.

2. Mathematics (21-22 hours): 18 semester hours of upper division courses with departmental approval. The following are examples of approved course selections.
   (1) Applied Mathematics: MATH 4120, 4391, 4635, 4721, and six upper division hours from the following: MATH 3221, 4242, 4261, 4350, 4351, 4361, 4392, 4396, 4640.
   (2) General Mathematics: MATH 4242, 4261, 4350, 4635, and 6 upper division hours chosen from: MATH 3221, 4084, 4120, 4351, 4361, 4391, 4411, 4636, 4721.
   (3) Graduate Study in Mathematics: MATH 4242, 4261, 4350, 4351, 4361, and one additional course from: MATH 3221, 4084, 4120, 4391, 4411, 4635.
   (4) Secondary Mathematics Education: MATH 3221, 3581, 4151, 4261, 4635, and either MATH 4636, or 4637.

Students are encouraged to work with their advisors to plan their programs.

Additional Course (3 hours): Each major must take one additional upper division MATH course.

2. Statistics (21 hours): MATH 4635, 4636, 4637, and one of MATH 4607 or 4608, and 9 additional upper division hours chosen from: MATH 4242, 4261, 4350, 4351, 4361, 4391, 4607, 4608, 4640, 4643, 4685, 4686, 4721.

Additional Course (3 hours): Each major must take one additional upper division MATH course.

D. Electives
   Electives may be chosen to bring the total number of hours to 120.

E. Honors Program
   The Department of Mathematical Sciences offers an honors program in Mathematics and Statistics for the talented student. To be admitted into the program, an entering freshman must score at least 29 on the Math ACT, and have a high-school GPA of 3.50, although exceptions may be made by the freshman's advisor, based upon an interview at the time of initial registration.

   Currently enrolled students may be admitted into the Honors Program upon an interview with the Departmental Honors Director. The basic requirements will be a 3.5 GPA on all MATH courses, an overall GPA of 3.25, and timely progress toward a degree. Such students may be admitted into MATH 1421, 2421, or 2422. Upon completion of the entry course with a grade of at least B, such students will retroactively receive credit for any previous course(s) in the Honors Sequence. A student may not enroll in MATH 3402 without having previously completed MATH 2422.

   The successful candidate will complete the Major Core as listed above under item C, and complete one of the Areas of Concentration listed above, with the following exceptions and additions:
   - In place of MATH 1910, 1920, 2110, and 3242, the Honors student must complete the four-course sequence of Honors Mathematics courses (MATH 1421, 2421, 2422, and 3402), and two semesters of the Mathematics Honors Seminar, MATH 3410 and 3411.
   - Upon successful completion of the courses listed above, the student shall be considered to have completed MATH 3242, and MATH 2120 for prerequisite and graduation purposes.
   - The Honors student must take MATH 4402 - Senior Honors Seminar.
   - Each of MATH 1421, 2421, 2422, 3402, 3410, 3411, 4402 must be completed with at least a grade of B.
   - A GPA of 3.50 in all MATH courses must be maintained.

   Upon completion of the program, the successful candidates will be recognized at the commencement ceremony by having their degrees conferred "With Honors in Mathematical Sciences," and their diplomas and records at the University of Memphis will reflect this distinction.

Second Major in Mathematical Sciences for majors in Chemistry, Computer Science, Engineering, and Physics (29-30 hours) - The student must satisfy each of (a), (b), (c), and (d).
(a) Complete MATH 1910, 1920, 3242. (b) Complete one of COMP 2700, MATH 2110, or MATH 2702. (c) Complete 9 hours from upper division MATH courses approved by the Chair or Chair's designee of the Department of Mathematical Sciences. Of these 3 courses, at least one must be chosen from MATH 4022, 4083, 4084*, 4085*, 4086, 4120, 4242, 4261**, 4350**, 4361, 4391, 4411**, 4635***, 4721, and (d) 6 additional hours of courses which may be chosen from either MATH and/or the student’s major approved by the Chair or Chair's designee of the Department of Mathematical Sciences.

Mathematical Sciences Minor
A minimum of 20 semester hours, including MATH 1910 (4), 1920 (4), and 9 additional upper division semester hours in MATH plus one of COMP 2700, MATH 2110, 2702, or an additional upper division MATH course approved by the department.

ABM – Accelerated Bachelor’s/Master’s Degree

See the Undergraduate Catalog for details: catalog.memphis.edu

The University of Memphis: www.memphis.edu  College of Arts & Sciences: www.memphis.edu/cas
## MATHEMATICS COURSE DESCRIPTIONS

**MATH 1420. Foundations of Math.** Basic logic; propositions and truth values; recognizing fallacies, sets, and Venn diagrams.

**MATH 1421. Honors Calculus I.** Concepts of differential calculus with emphasis on theory; limits, continuous functions.

**MATH 1480. Mathematics for Elementary School Teachers.** Examination of mathematics taught at the elementary school level.

**MATH 1481. Math/Elem School Teachers II.** Further examination of mathematics taught at the elementary school level.

**MATH 1530. Prob/Statistics/Non Calculus.** Introduction to statistical literacy.

**MATH 1710. College Algebra.** Analysis of functions using graphing calculators; partial fractions; conic sections.

**MATH 1720. Trigonometry.** Circular functions; inverse circular functions, graphs of circular and inverse functions, identities, equations.

**MATH 1730. Pre-Calculus.** Exponents, radicals, quadratic functions, inequalities; relations and functions.

**MATH 1830. Elementary Calculus.** Introduction to concepts and methods of elementary calculus of one real variable.

**MATH 1900. Experiences with Calculus.** In-depth study of concepts introduced in MATH 1830.

**MATH 1910. Calculus I.** Introduction to calculus of one real variable.

**MATH 1920. Calculus II.** Integration and applications of the definite integral. Also: MATH 2421. Honors Calculus II.

**MATH 2120. Differential Equations.** Introduction to ordinary differential equations.

**MATH 2422. Honors Calculus III.** Multivariable calculus. Also: MATH 2110. Calculus III.

**MATH 2702. Introduction to Proofs and Fundamentals of Mathematics.** Logic, algebra of sets; forms of proof.

**MATH 3221. Elementary Number Theory.** Divisibility properties of integers; prime numbers; congruences.

**MATH 3242. Introduction to Linear Algebra.** Systems of linear equations, matrices, elementary row and column operations, determinants.

**MATH 3402. Honors Mathematics IV.** Algebra and differential equations.

**MATH 3410. Honors Seminar in Math I.** Exploration of origin and evolution of important mathematical ideas.

**MATH 3411. Honors Seminar in Math II.** Investigation of major topics in field of mathematics.

**MATH 3581. College Geometry.** Postulates and propositions from Euclidean geometry.


**MATH 4080. Math for Secondary Teachers 1.**

**MATH 4081. Math for Secondary Teachers 2.**

**MATH 4082. Mathematics for Middle School Teachers.** Capstone course consisting of more thorough study of fundamental concepts.

**MATH 4083. Dynamical Systems and Chaos.** Dynamical systems, one and two-dimensional maps, chaos, fractals, differential equations.

**MATH 4084. Introduction to Graph Theory.** Graph theory.

**MATH 4085. Combinatorics.** Convexity and fundamental theorems, geometric incidences and graphs, among other topics.

**MATH 4086. Analytic Number Theory.** Various topics in analytic number theory.

**MATH 4120. Ordinary Differential Equations.** Existence and uniqueness of solutions, phase plane analysis.

**MATH 4151. History of Mathematics.** Development of mathematics from earliest times to present.

**MATH 4242. Linear Algebra.** Linear transformations, polynomials, determinants, direct-sum decompositions, diagonalizable operators.

**MATH 4261. Abstract Algebra.** Groups; homomorphisms; rings; integral domains; polynomials; fields.

**MATH 4350. Introduction to Real Analysis I.** Real number system, functions and sequences, limits, continuity, differentiation.

**MATH 4351. Introduction to Real Analysis II.** Integration theory; Riemann and Lebesgue integrals; partial differentiation.

**MATH 4361. Complex Variables.** Complex numbers; analytic functions; Cauchy-Riemann conditions; Taylor and Laurent series.

**MATH 4391. Partial Differential Equations I.** Laplace transforms; Fourier series; introduction to partial differential equations.

**MATH 4392. Partial Differential Equations II.** Methods of characteristics; Green’s functions; regularity of solutions of boundary value.

**MATH 4396. Perturbation Methods.** Asymptotic approximations, boundary layers, matched asymptotic expansions, multiple scales.

**MATH 4402. Senior Honors Seminar.** In-depth study of one or more topics in mathematical sciences.

**MATH 4410. Topology.** Introductory set theory; metric spaces; topological spaces; continuous functions; separation axioms.

**MATH 4635. Introduction to Probability Theory.** Probability functions; random variables; moment generating functions.

**MATH 4636. Introduction to Statistical Theory.** Functions of two random variables; gamma, beta, bivariate normal distributions.

**MATH 4637. Statistical Learning I.** Tools used in modeling and understanding of big data.

**MATH 4638. Statistical Learning II.** Cross validation, Bayesian inference and computation, and non-parametric methods.

**MATH 4640. Introduction to Probability Models.** Introduction to Markov chains; branching processes; Poisson processes.

**MATH 4643. Introduction to Regression/Time Series Analysis.** Hypothesis testing and confidence intervals for linear regression models.

**MATH 4645. Convexity and Fundamental Theorems, Geometric Incidences and Graphs, Among Other Topics.**

**MATH 4646. Explorations in Data Science.** Capstone course to fuse core concepts/skills of computer science and mathematical sciences.

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For more information, please contact:
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Undergraduate Advisor Contact:
David Dwiggins; 901-678-4174; ddwiggns@memphis.edu

The Department of Mathematical Sciences
Dunn 373; http://www.memphis.edu/msci/

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