

mental to the study of the earth. Prerequisites: Geology 1000 and Geology 2000.

**4402 Field Methods (2 sem. hours).** A course designed to introduce field geology and familiarize students with basic field-mapping procedures. Prerequisites: Geology 1000 and Geology 2000.

**4506 Field Geology (6 sem. hours).** Practical training in the standard methods of geologic fieldwork and an introduction to regional geology. Prerequisites: to be determined by the college or university offering the course, but should include Geology 1000, Geology 2000, Geology 2300, Geology 4200, and Geology 4402.

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## Mathematics

**Professor:**

Robert A. Shive Jr., Ph.D.

**Associate Professors:**

Connie M. Campbell, Ph.D.

Mark J. Lynch, Ph.D.

**Assistant Professor:**

Gayla F. Dance, M.S., M.A., Chair

John Osoniach, Ph.D.

**Instructor:**

Tracy L. Sullivan, M.S.

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**Requirements for major:** Students may complete a major in mathematics with nine mathematics courses that include Analytic Geometry and Calculus II and III, Introduction to Advanced Mathematics, Senior Seminar, Abstract Algebra, Advanced Calculus, and at least 12 additional semester hours of mathematics at or above the 3000 level. A C- grade or higher is required for each of these courses. Majors must also complete Computer Science I and a physics course with a lab or an intermediate level course in French or German. All requirements for the major not taken at Millsaps must be approved in advance by the department chair.

**Requirements for minor:** Students may elect a minor in mathematics by completing five mathematics courses that include, Analytic Geometry and Calculus II, Analytic Geometry and Calculus III, Introduction to Advanced Mathematics, and at least eight additional semester hours of mathematics at or above the 3000 level. A C- grade or higher is required in each of these courses. In addition, Computer Science I is required.

## Courses

**1100 College Algebra (4 sem. hours).** Topics include solving polynomial equations and inequalities, functions and their graphs, systems of equations, properties of logarithmic and exponential functions, elementary analytic geometry, and applications of these topics. This course can be used as a single course preparation for Math 1210 or as the first in a two-semester preparation for Math 1220. (The second course in this sequence is Trigonometry.) Credit is not allowed for both Mathematics 1100 and Mathematics 1130.

**1110 College Trigonometry (4 sem. hours).** The basic analytic and geometric properties of

the trigonometric functions are studied. A preparatory course for the calculus sequence. Credit is not allowed for both Mathematics 1110 and Mathematics 1130. Prerequisite: Mathematics 1100 or departmental approval.

**1130 Precalculus (4 sem. hours).** This course covers topics included in College Algebra and Trigonometry. It is a one semester preparatory class for the calculus sequence. Credit is not allowed for both Mathematics 1100 and Mathematics 1130. Credit is not allowed for both Mathematics 1110 and Mathematics 1130.

**1150 Elementary Statistics (4 sem. hours).** Introduction to descriptive statistics and statistical inference. Topics include the Central Limit Theorem, confidence intervals, chi square test of independence and goodness of fit, analysis of variance, correlation, and regression analysis. Applications to business, education, and other disciplines are emphasized.

**1210 Survey of Calculus (4 sem. hours).** Topics include limits, the derivative, applications of the derivative with focus on applications in business and the social sciences, antiderivatives, and applications of the definite integral. Credit is not allowed for both Mathematics 1210 and Mathematics 1220. Prerequisite: Mathematics 1100 or 1130 or departmental approval.

**1220 Analytic Geometry and Calculus I (4 sem. hours).** Topics include limits, continuity of functions, the derivative, antiderivatives, integrals, the fundamental theorem, and applications. Course includes a computer-based laboratory. Credit is not allowed for both Mathematics 1210 and Mathematics 1220. Prerequisite: Mathematics 1100 and 1110, 1130, or departmental approval.

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**1750–1753 Selected Topics in Introductory Mathematics (1, 2, 3, or 4 sem. hours).** A narrowly defined, introductory study of an area of mathematics that is not covered through regular departmental offerings. While the course content will be decided upon by the instructor, topics could include mathematics in art and architecture, financial mathematics, and cryptology. Prerequisite: consent of the instructor.

**2230 Analytic Geometry and Calculus II (4 sem. hours).** Integration techniques; applications of the integral; the properties of exponential, logarithmic, trigonometric, and inverse trigonometric functions; indeterminate forms; improper integrals; and an introduction to infinite series. Prerequisite: Mathematics 1220 or departmental approval.

**2240 Analytic Geometry and Calculus III (4 sem. hours).** A continuation of Mathematics 2230. Infinite series, partial derivatives, and multiple integrals and their applications. Prerequisite: Mathematics 2230 or departmental approval.

**2310 Introduction to Advanced Mathematics (4 sem. hours).** Topics include logic and proofs, set theory, relations, functions, and cardinality. Prerequisite: Mathematics 1220.

**2750–2753 Selected Topics in Intermediate Level Mathematics (1, 2, 3 or 4 sem. hours).** A study of mathematical topics not covered in regular departmental offerings, or an extension of materials covered in regular departmental offerings. Prerequisite: Mathematics 1220.

**3410 College Geometry (4 sem. hours).** A study of advanced topics in Euclidean geometry

and an introduction to non-Euclidean geometries. Selected topics from finite and projective geometries. Prerequisite: Mathematics 2310. Offered on demand.

**3540 Differential Equations (4 sem. hours).** An introduction to ordinary differential equations, emphasizing equations of first and second order; linear differential equations of higher order and applications to physics, chemistry, and medicine. Prerequisite: Mathematics 2230.

**3560 Discrete Structures (4 sem. hours).** Topics covered include predicate logic, algorithms, modular arithmetic, counting techniques, recurrence relations, graph theory, and trees. Prerequisite: Mathematics 2230 and 2310. (This course is the same as Computer Science 3500.) Offered in alternate years.

**3570 Numerical Analysis (4 sem. hours).** Solutions of nonlinear equations and systems of linear equations, error analysis, numerical integration and differentiation, solution of differential equations, interpolation, and approximation. Prerequisite: Mathematics 3540, Math 3650, and Computer Science 1010 or the equivalent. Offered in alternate years.

**3620 Number Theory (4 sem. hours).** Prime numbers and their distribution, divisibility properties of the integers, Diophantine equations and their applications, theory of congruencies, Fermat's Theorem, quadratic reciprocity, and the historical background in which the subject evolved. Prerequisite: Mathematics 2310. Offered in alternate years.

**3650 Linear Algebra (4 sem. hours).** Systems of linear equations with emphasis on the Gauss-Jordan technique, determinants geometric vectors with applications to analytic geometry, physics, real finite dimensional vector spaces with applications through linear transformations, eigenvectors, eigenvalues, orthogonal diagonalization, and symmetric matrices. Prerequisite: Mathematics 2230.

**3700–3703 Undergraduate Research (1, 2, 3, or 4 sem. hours).** Research in special areas under the guidance of the instructor. Prerequisite: consent of the instructor.

**3750–3753 Selected Topics in Advanced Mathematics (1, 2, 3, or 4 sem. hours).** A study of an area of mathematics that is not covered in regular departmental offerings, or an extension of materials covered in regular departmental offerings. Prerequisite: consent of the instructor.

**4510 Mathematical Statistics (4 sem. hours).** Topics include sample spaces, discrete and continuous probability distributions, independence and conditional probability, properties of distributions of discrete and random variables, moment-generating functions, sampling distributions, and parameter estimation. Prerequisite: Mathematics 2240 and 2310. Offered in alternate years.

**4620 Abstract Algebra (4 sem. hours).** A rigorous treatment of groups, rings, ideals, isomorphisms, homomorphisms, integral domains, and fields. Prerequisite: Mathematics 2310.

**4630 Advanced Calculus (4 sem. hours).** A rigorous treatment of limits, continuity, differentiation, integration, and convergence in  $n$ -dimensional Euclidean spaces. Prerequisite: Mathematics 2310 and Mathematics 2240.

**4660 Topology (4 sem. hours).** Consideration of topological spaces, including metric spaces,

product spaces, and quotient spaces; separation axioms; connectedness; compactness; and continuous functions. Prerequisite: Mathematics 2310. Offered on demand.

**4750–4753 Selected Topics in Advanced Mathematics (1, 2, 3, or 4 sem. hours).** A study of an area of mathematics not covered in regular departmental offerings that require a high level of mathematical sophistication. Prerequisite: consent of the instructor.

**4800 Graph Theory (4 sem. hours).** A theoretical study of trees, connectivity, eulerian graphs, hamiltonian graphs, planarity, colorability, and extremal graph theory. Prerequisite: Mathematics 2310. Offered in alternate years.

**4810 Complex Analysis (4 sem. hours).** Topics include complex numbers, sets, and functions; limits and continuity; analytic functions; cauchy theorems and integrals; taylor and laurent series; residues; and contour integration. Prerequisite: Mathematics 2310 and Mathematics 2240 or consent of the department chair. Offered in alternate years.

**4902–4912 Senior Seminar (2 - 2 sem. hours).** Reading and research in advanced mathematics; group and individual presentations both oral and written; preparation for comprehensive examination; opportunities to expand understanding of topics of interest to the individual student. Prerequisite: senior standing or consent of the instructor.

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## Physics

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**Associate Dean of Sciences:**

George J. Bey III, Chair

**Associate Professor:**

Asif Khandker, Ph.D.

**Requirements for major:** Students may complete a major in physics with ten courses, including General Physics I and General Physics II, General Physics Laboratory I and II, Modern Physics, Classical Mechanics, Electromagnetism, Thermal Physics, Quantum Mechanics, Advanced Physics Laboratory, Electronics for Scientists, Similarities in Physics, and Senior Seminar. Students must receive a C or better in all of the required physics courses. Prospective majors should take General Physics I and II and General Physics Laboratory I and II no later than the sophomore year.

**Requirements for minor:** Students may elect a minor in physics with three courses beyond General Physics I and II, and General Physics Laboratory I and II. The courses must be approved by the department chair.

## Mathematics Requirements

Students interested in maintaining the option of study in physics or related fields (e.g., pre-engineering) are urged to begin their mathematics course work at Millsaps as early as possible and at the highest level possible. It is required that a minimum of Calculus I, II, III, and Differential Equations be taken by all physics or pre-engineering majors.