

Department of Mathematics and Statistics

UMKC 2007-08 Graduate and Professional Catalog (1.0)

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Department of Mathematics and Statistics

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Department Description

The Department of Mathematics and Statistics offers the master of science degree, with concentration in either mathematics or statistics. The department also participates in the UMKC School of Graduate Studies Interdisciplinary Ph.D. program. Qualified students can select mathematics as their coordinating discipline or as co-discipline when applying for admission or preparing their plans of study. See the School of Graduate Studies section of this catalog for more information about the Ph.D. program.

These programs are designed to develop the student's knowledge of mathematics and statistics and to provide the tools and understanding necessary for the study of other scientific and quantitative fields.

The Department of Mathematics and Statistics has an institutional membership in the American Mathematical Society.

Advising System

Advising is on an individual basis with senior mathematics faculty members. Appointments for advising may be made by contacting the department or the principal graduate adviser.

Library Resources

In addition to the Miller Nichols Library, the department has full access to the holdings and services of the Linda Hall Library of Science and Technology, a privately endowed institution of international prominence. The Linda Hall Library subscribes to more than 700 mathematics journals and maintains a large and growing collection of mathematics books.

Graduate Programs

Graduate Admissions

To be admitted to the graduate program a student must meet the admission requirements found in the General Graduate Academic Regulations and Information section of this catalog, and must have a baccalaureate degree with a major in mathematics or present evidence of strong performance in at least three mathematics courses beyond calculus.

Assistantships and Scholarships

Each year, the department has several graduate teaching assistantships available. Awards in the form of research assistantships, fellowships and scholarships are ordinarily available, and each applicant will be considered for these awards.

For further information and application forms for graduate teaching assistantships, write to the address at the beginning of this section.

Student Learning Outcomes

Master of Arts or Master of Science in Mathematics, with emphasis in Mathematics or Statistics

- Students graduating with an M.A. or M.S. degree will, at a higher level than required for the baccalaureate degree:
 - Have a broad understanding of several branches of mathematics and how they are related.
 - Be able to read and/or listen to documents and discussions having mathematical content, with an appropriate level of understanding, exhibit a high level of mathematical literacy.
 - Be able to read, write, and understand mathematical proofs, and construct mathematical proofs as appropriate.
 - Be able to reason with and apply mathematical concepts, principles and methods; analyze and evaluate problems (both theoretical and practical) and plan strategies for their solution.
 - Be able to clearly articulate mathematical information accurately and effectively, using a form, structure and style that suit the purpose (including written and face-to-face presentation).
 - Be able to work collaboratively with others on projects requiring mathematical knowledge and input, to function effectively in a professional workplace related to mathematics, or in a graduate program.
 - Be able to independently acquire further mathematical knowledge without guidance.
- Students graduating with an M.A. or M.S. will be prepared for entry into professional schools, graduate programs, or the job market.

Master of Science: Mathematics

The master's program gives the student broad training in basic higher-level mathematics. A **concentration is available in either mathematics or statistics.**

Degree Requirements

No fewer than 30 credit hours of approved coursework are required, and at least 18 credit hours must be at the 5500 level in the department. Courses numbered below 400 do not carry graduate credit for mathematics graduate students.

All master's degree candidates must take six core courses (all at the 5500 level) in the selected emphasis area. For details about the M.S. degree requirements, please refer to the departmental Web site (<http://cas.umkc.edu/math>).

Doctor of Philosophy

UMKC offers an Interdisciplinary Ph.D. program. Students desiring to study at the doctoral level in mathematics must apply to the School of Graduate Studies. Detailed information on the general and discipline-specific requirements appears in the School of Graduate Studies section of this catalog. For more details visit the department Web site (<http://cas.umkc.edu/math>).

Mathematics Courses

5509 General Algebra I (3). Groups, rings, modules, homology, fields and Galois theory, valuations, matrices, and multilinear algebra. Prerequisite: Math 410 or equivalent. Note: Continued in Math 5519.

5510 Complex Variables I (3). The group of linear fractional transformations, complex integration, Cauchy's theorem, the maximum modulus theorem, analytic continuation, Riemann surfaces. Note: Continued in Math 5520. Prerequisite: Math 402 and Math 407, or consent of instructor.

5513 Real Variables I (3). Theory of measure with applications to analysis. Riemann and Lebesgue integration. Note: Continued in Math 5523. Prerequisite: Math 402.

5514 Mathematics For Secondary Teachers: Algebra And Analysis (3). Designed for secondary-school teachers. Examine high school mathematics from a higher point of view. Real and complex numbers, functions, algebraic structures of equations, integers and polynomials, number system structures; analyses of alternate approaches, extensions and applications of mathematical ideas, discussion of historical contexts and connections between ideas that may have been studied separately in different courses, relationships of ideas studied in secondary-school to those students may encounter in later study. When taken for graduate credit as Math 5514, an extra project is required. Prerequisites: Math 220, Math 301, and one of Math 402 or Math 410 Offered: Every Winter

5517 Matrix Theory I (3). Unitary matrices, normal matrices, Jordan canonical form, nonnegative matrices and their applications, the symmetric eigenvalue problem. Prerequisites: Math 402 and 420, or consent of the instructor

5519 General Algebra II (3). Continuation of Math 5509.

5520 Complex Variables II (3). Continuation of Math 5510.

5521 Differential Equations (0-3). This course offers an introduction to the qualitative theory and applications of ordinary differential equation (ODE). The presentation of the course will be a blend of fundamental theory and examples. The basic results will be proved rigorously and more advanced results will be only illustrated by examples that demonstrate when and how they may be applied. Prerequisites: Math 345, Math 412 and Math 420, or consent of the instructor.

5523 Real Variables II (3). Continuation of Math 5513.

5524 Mathematics For Secondary Teachers: Geometry (3). Designed for secondary-school teachers. Examine high school mathematics from a higher point of view. Congruence, distance and similarity, trigonometry, area and volume, axiomatics and Euclidean geometry; analyses of alternate approaches, extensions, and applications of mathematical ideas, discussion of historical contexts and connections between ideas that may have been studied separately in different courses, relationships of ideas studied in secondary-school to those students may encounter in later study. When taken for graduate credit as Math 5524, an extra project is required. Prerequisites: Math 220, Math 301, and one of Math 402 or Math 410 Offered: Every Fall on Demand

5530 Axiomatic Set Theory (3). Zermelo-Fraenkel set theory, transfinite induction equivalents of the axiom of choice, cardinal and ordinal arithmetic, the generalized continuum hypothesis, inaccessible cardinals.

5532 Advanced Numerical Analysis I (3). Error Analysis, Solving Systems of Linear Equations, Solutions of Nonlinear Equations, the Least-Squares Problems, and Approximating functions. Prerequisite: Math 402 and 420 or consent of instructor. Note: Continued in Math 5542.

5542 Advanced Numerical Analysis II (3). Eigenvalues and Eigenvectors, Linear Programming, Optimization, Numerical Differentiation and Integration, Numerical Solution of Ordinary and Partial Differential Equations. Prerequisite: Math 532 or consent of instructor. Note: Continuation of Math 5532.

5552 General Topology (3). Topological spaces, continuity, metric spaces, topological products, connectedness, compactness, separation axioms, convergence, metrization theorems, Tychynoff's Theorem. Other topics may include: homotopy, fundamental group, function spaces. Prerequisites: Math 402, or consent of instructor

5557 Functional Analysis (3). Hilbert spaces, linear operators, compact operators, Banach spaces, the Hahn-Banach theorem, the open mapping and closed graph theorems, the principle of uniform boundedness, locally convex spaces. Prerequisites: Math 402 and 420

5590 Special Topics (1-3). Selected topics in various fields of mathematics. May be repeated for credit when the topic varies. Prerequisite: Consent of instructor.

5699 Research And Thesis (1-16). Doctoral dissertation.

5899 Required Graduate Enrollment (1).

Statistics Courses

5501 Statistical Design Of Experiments (0-3). This course is designed to present a variety of experimental design techniques to students with moderate mathematical and statistical background. The course includes three major components: efficient factorial designs, linear and quadratic process optimization of the location parameter, and variability reduction. Students will be trained to use SPSS statistical software package. Prerequisite: Stat 436 or consent of instructor

5537 Mathematical Statistics I (3). Probability theory, distribution functions, sampling, statistical inference, topics in advanced applied statistics. Prerequisite: Math 402 or consent of the instructor. Note: Continued in Stat 5547.

5547 Mathematical Statistics II (3). Continuation of Stat 5537.

5551 Applied Statistical Analysis (3). Methods for analyzing data from experiments and observational studies; design-based and model-based inferences; model assessment; ANOVA; power analysis; SAS procedures. Prerequisites: Stat 436 or consent of instructor Offered: Every other Winter

5561 Time Series Analysis (0-3). This course is intended to present the basis knowledge (including models, methods and concepts) of time series analysis to students with a good background in intermediate mathematical statistics. Some elementary knowledge of basic linear regression analysis would be helpful but not necessary. The presentation will be balanced between theory and data analysis, with sufficient theory to understand the basis of methods and a broad variety of models and many real data examples. Case studies will be drawn from business and economics, network traffic and meteorology, and data will be analyzed by students using existing computer programs (SAS, Minitab and R). Students are also expected to understand proper use and limits of time series models. Prerequisites: Stat 441 or consent of instructor note: This course will be offered every other winter.

5565 Regression Analysis (3). Simple linear regression; multiple linear regression; correlation analysis; model selections; checking assumptions; regression diagnostics; combating multi-collinearity; nonlinear regression. Prerequisites: Stat 436 or consent of instructor Offered: On Demand

5572 Multivariate Analysis (3). Random vectors; multivariate normal distributions; Hotelling's T-square distribution; Wishart distribution; inferences on one mean vector; MANOVA; inferences on covariance matrices; profile analysis. Prerequisites: Math 420 or consent of instructor Offered: Every other Fall

5576 Probability (3). Existence and extension of measure, random variable, expectation and its properties, types of convergence, law of large numbers, weak convergence, central limit theorem, and martingale. Prerequisites: Stat 436 and Math 412 Offered: Every Fall