Mathematics and Statistics

Mathematics (MATH)

Mathematics is among the oldest disciplines. Throughout history, mathematics has spanned the spectrum f rom pure to applied areas. The ancient Greek mathematicians were interested in problems that ranged from properties of numbers to applications of mathematics to music and astronomy. The Department of Mathematics and Statistics fulfills its mission by offering a broad and representative collection of courses to give students the ability to select, with their advisor, a program that fits their needs and goals. The Department of Mathematics and Statistics offers bachelor's (BA an d BS), master's (MS), and doctoral (PhD) degrees .

Note: For ease of description, certain courses in mathematics and statistics are categorized in the following groups (the courses in Group R are required of all majors):

G roup R: MATH 415, 511, 547, 551, 555

G roup A: MATH 513, 615, 621, 690, 720, 725

G roup B: STAT 460, 571, 572, 574, 576, 761, 762, 763, 771, 772, 775, 776

G roup C: MATH 530, 545, 553, 640, 655, 657, 714, 751, 753, 755,

M a j o r. * For the Bachelor of Arts (BA) degree with a major in mathematics, students must complete all courses in Group R plus MATH 531 and two additional courses from those listed in Groups A, B, and C.

For the Bachelor of Science (BS) degree in mathematics, students must complete all courses in Group R and one each from Groups A, B, and C. In addition, the BS candidate must complete two additional courses f rom those listed in Groups B and/or C.

For the Bachelor of Science (BS) degree in mathematics with emphasis in statistics, students must complete all courses in Group R, one course in Group A , and one course in Group C. In addition, the BS candidate must complete 12 additional hours of courses in G roup B which must include either STAT 571-572 or S TAT 771-772, plus one more course from Groups B or C. Students under this option may select statistics courses from other departments with the due approval of the Department of Mathematics and Statistics.

For the Bachelor of Science (BS) degree with emphasis in computing, students must complete all courses in G roup R. Students also must complete MATH 451 and an additional high-level programming language. In addition, the BS candidate must complete CS 300 and 320, plus five courses selected from Math, 331, 553, 657, 690, 751; STAT 774; CS 312, 410, 440, 510, 540, and 560.

At least three of the five additional courses must be in computer science (CS).

For students who are contemplating graduate work, it is highly recommended that they include MATH 513, 547, and 640 in their program, along with courses in one or more of French, German, or Russian. Students majoring in mathematics should consult closely with their mathematics advisor on any of these pro grams.

M i n o r. For a minor in mathematics, students must complete the calculus sequence (242, 243, 344) and take at least one additional upper-division course approved by both the Department of Mathematics and Statistics

and the student's major department.

*All bachelor's degrees in mathematics require a high-level algorithmic computer language. The MATLAB course, MATH 451, is strongly recommended .

Non-credit Courses

MATH 007. Arithmetic (3). Offered *C r / N C r* only. A review and study of the basic arithmetic operations for the mature student whose previous training in arithmetic is inadequate for completion of college mathematics courses.

MATH 011. Beginning Algebra (5). Offered *C r / N C r* only. Content consists of algebra topics usually covered in the first year of a standard high school algebra course. Not applicable to degree.

MATH 012. Intermediate Algebra (5). Offered *C r / N C r* only. Content consists of topics usually covered in the second year of a standard high school algebra course. Prerequisite: MATH 011 or one year of high school algebra, and qualifying score in recent department placement exam. Not applicable to degree.

MATH 013. College Algebra Supplement (2). Offered *C r / N C r* only. A supplement to MATH 111 to be taken concurrently with designated sections of MATH 111 to allow students 5 contact hours for mastering college algebra. Co-requisite: MATH 111 .

Lower-Division Courses

> MATH 111. College Algebra (3). *General education basic skills course*. A survey of functions, theory of equations and inequalities, complex numbers, and exponential and logarithmic functions. High school geometry is a highly recommended preparatory course. Prerequisites: MATH 012 or two years of high school algebra and qualifying score in recent department placement exam. Credit is allowed in only one of the two courses MATH 111 and 112.

> MATH 112. Precalculus Mathematics (5). *General education basic skills course*. Functions, theory of equations and inequalities, complex numbers, the trigonometric functions, exponential and logarithmic functions, and other standard topics p re requisite to a beginning study of calculus. Course is not available for credit to students who have received a *C* or better in MATH 242 or its equivalent. Prerequisites: MATH 012 or two years of high school algebra, one unit of high school geometry, and qualifying score in recent departmental placement exam. Credit is allowed only in one of the two courses MATH 111 and 112.

MATH 121. Geometry for College Students (3). A study of lines, angle relationships, parallel lines, triangles, quad tri-laterals, similar triangles, circles, areas of polygons and circles, and some material on surface and solids, Prerequisite: MATH 111 or equivalent with a grade of C or better.

M ATH 123. College Trigonometry (3). Studies the trigonometric

functions and their applications. Credit in both MATH 123 and 112 is not allowed. Pre requisite: MATH 111 with *C* or better or equivalent high school preparation, and one unit of high school geometry.

> M ATH 131. Contemporary Mathematics (3). *General education basic skills course for students majoring in nontechnical areas.* A collection of applications of mathematics illustrating how contemporary mathematical thinking is used in the decision making process. Covers topics selected from such areas as the mathematics of social choice; management science; statistics; coding information; and the geometry of growth, shape, and symmetry. Prerequisite: MATH 012 or two years of high school algebra and a qualifying score on a recent departmental placement examination.

> M ATH 144. Business Calculus (3). *General education introductory course*. A brief but careful introduction to calculus for students of business and economics. Credit in both MATH 144 and 242 is not allowed. Pre requisite: MATH 111 or 112 with a *C* or better or equivalent high school preparation.

MATH 150. Workshop in Mathematics (1-3). Topics of interest to particular students and not elsewhere available in the curriculum. May be repeated for a total of 6 hours credit with departmental consent. Prerequisite: departmental consent.

MATH 211. Elementary Linear Algebra (3). Covers topics in linear algebra together with elementary applications. Prerequisite: one and one-half units of high school algebra or MATH 011.

> MATH 242. Calculus I (5) . *General education introductory course*. Analytic geometry and the calculus in an interrelated form. Credit in both MATH 242 and 144 is not allowed. Prerequisites: MATH 112 with a *C* or better or two units of high school algebra, and one unit of high school geometry and one-half unit of high school trigonometry, or MATH 123 and 111 with a *C* or better in each.

> M ATH 243. Calculus II (5). *General education further study course*. A continuation of MATH 242. Includes a study of integration and applications and an introduction to infinite series. Prerequisite: MATH 242 with a *C* or better.

Upper-Division Courses

MATH 300. The Evolution of Mathematics (3). A study of mathematics and mathematicians from antiquity to the present; to see how mathematics has developed from human beings' efforts to understand the world and the extent to which mathematics has molded our civilization and culture . Since mathematics is what mathematicians do, the lives of mathematicians from various ages and countries are studied. Not a mathematical skills course.

MATH 311. Introduction to Linear Algebra (1). A study of systems of linear equations, matrices, vectors, eigenvalues and eigenvectors. Credit not allowed in both MATH 211 and 3 11. Pre requisite: MATH 344 or concurrent enrollment.

MATH 331. Discrete Mathematics I (3). Astudy of some of the basic topics of discrete mathematics, including elementary logic, properties of sets, mathematical induction, counting problems using permutations and combinations, trees, elementary probability, and an introduction to graph theory. Prerequisite: Math 111 or 211 or equivalent college-level mathematics course.

MATH 344. Calculus III (3). A continuation of MATH 243. Includes a study of multiple integration and partial derivatives. Prerequisite: MATH 243 with a *C* or better.

MATH 415. An Introduction to Advanced Mathematics (3). Develops the concept of proof in a setting of mathematical tools needed in advanced courses. Covers topics in number theory, algebra, and analysis. Particular attention to equivalence relations, functions, induction, and mathematical systems. Prerequisite: MATH 344 with a *C* or better.

MATH 451. Computational Mathematics using MATLAB (3). Introduces the use of MATLAB in computational algorithms. A bridge to upper-division courses in numerical methods and applied mathematics. Prerequisite: MATH 243 with a *C* or better.

MATH 480. Individual Projects (1-5). Repeatable up to 10 hours. Prerequisite: departmental consent.

Courses for Graduate/Undergraduate Credit

Credit in courses numbered below 600 is not applicable toward the MS in mathematics.

MATH 501. Elementary Mathematics (5). A study of topics necessary to an understanding of the elementary school curriculum, such as set theory, real numbers, and geometry. Not for major or minor credit. Prerequisites: elementary education major and MATH 111 or equivalent with *C* or better or departmental consent.

MATH 511. Linear Algebra (3). An elementary study of linear algebra, including an examination of linear transformations and matrices over finite dimensional spaces. Prerequisite: MATH 243 with *C* or better.

MATH 513. Fundamental Concepts of Algebra (3). Defines group, ring, and field and studies their properties. Prerequisites: MATH 415 and 511 with *C* or better or departmental consent.

MATH 530. Applied Combinatorics (3). Basic counting principles, occupancy problems, generating functions, recurrence relations, principles of inclusion and exclusion, the pigeonhole principle, Fibonacci sequences, and elements of graph theory. Prerequisite: MATH 344 with *C* or better.

> MATH 531. Introduction to the History of Mathematics (3). *General education issues and perspectives course* . Studies the development of mathematics from antiquity to modern times.

Solves problems using the methods of the historical period in which they arose. Requires mathematical skills. Prerequisites: MATH 511 and two additional courses at the 500 level or above, with *C* or better in each.

MATH 545. Integration Techniques and Applications (3). Studies the basic integration techniques used in applied mathematics. Includes the standard vector calculus treatment of line and surface integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Also includes the study of i m p roper integrals with application to special functions. Prerequisite: MATH 344 with *C* or better.

MATH 547. Advanced Calculus I (3). Covers the calculus of Euclidean space including the standard results concerning functions, sequences, and limits. Prerequisites: MATH 344 and 415 with *C* or better in each.

MATH 551. Numerical Methods (3). Approximating roots of equations, interpolation and approximation, numerical differentiation and integration, and the numerical solution of first order ordinary differential equations. Some computer use. Prerequisites: MATH 344 and 451 with *C* or better or departmental consent.

MATH 553. Mathematical Models (3) . Covers case studies from the fields of engineering technology and the natural and social sciences. Emphasizes the mathematics involved. Each student completes a term project which is the solution of a particular problem approved by the instructor. Prerequisite: Math 344 with *C* or better or departmental consent.

MATH 555. Differential Equations I (3). A study of first order equations including separation of variables and exact equations; second order equations including the general theory of initial value problems, constant coefficients, undetermined coefficients, variation of parameters, and special methods of solution using power series and the Laplace transform methods.
A standard course in differential equation for students in the sciences and engineering. Credit not allowed in both M ATH 550 and 555. Prerequisite: MATH 243 with *C* or better or departmental consent.

MATH 580. Selected Topics in Mathematics (3). Topic chosen from topics not otherwise represented in the curriculum. May be repeated up to a maximum of 6 hours credit with departmental consent. Prerequisite: departmental consent.

MATH 615. Elementary Number Theory (3). Studies properties of the integers by elementary means. Prerequisite: MATH 344 with *C* or better or departmental consent.

MATH 621. Elementary Geometry (3) . Studies Euclidean geometry from an advanced point of view. Prerequisite: MATH 344 with *C* or better or departmental consent.

MATH 640. Advanced Calculus II (3) . A continuation of MATH 547. Pre requisites: MATH 511 and 547 with *C* or better in each.

MATH 655. Differential Equations II (3). A continuation of MATH 555 (but with more emphasis on theoretical issues) that covers higher order differential equations, systems of first order equations (including the basics of linear algebra), some numerical methods, and stability and behavior of solutions for large times. Pre requisite: MATH 555 with *C* or better or departmental consent.

MATH 657. Optimization Theory (3). Introduces selected topics in linear and nonlinear optimization. Develops the revised simplex method along with a careful treatment of duality. Then extends the theory to solve parametric, integer, and mixed integer linear programs. Prerequisite: MATH 511 with *C* or better.

MATH 690. Introduction to Mathematical Logic (3). An axiomatic development of elementary mathematical logic through first-order logic culminating in theorems on completeness and consistency. Investigates connections with Boolean algebra, formal languages, and computer logic. Prerequisite: MATH 415 or 511 with *C* or better or departmental consent.

MATH 713. Abstract Algebra I (3). Treats the standard basic topics of abstract algebra. Pre requisite: MATH 513 with *C* or better or departmental consent.

MATH 714. Applied Mathematics (3). Cross-listed as PHYS 714. A study of mathematical techniques applicable to physics and other sciences. Instructor selects topics, such as power series, infinite products, asymptotic expansions, WKB method, contour integration and residue methods, integral transforms, Hilbert spaces, special functions, and integral equations. Pre requisite: MATH 555 or instru c t o r's consent.

MATH 720. Modern Geometry (3). Examines the fundamental concepts of geometry. Pre requisite: MATH 513 with *C* o r better or departmental consent.

MATH 725. Topology I (3). Studies the results of point set and algebraic topology. Pre requisite: MATH 547 with *C* or better or departmental consent.

MATH 743. Real Analysis I (3). Includes a study of the foundations of analysis and the fundamental results of the subject. Prerequisite: MATH 640 with *C* or better or departmental consent.

MATH 745. Complex Analysis I (3). Studies the theory of analytic functions. Pre requisite: MATH 640 with *C* or better or departmental consent.

MATH 750. Workshop (1-3). Topics appropriate for mathematics workshops that are not in current mathematics courses. May be repeated to a total of 6 hours credit with departmental consent. Prerequisite: departmental consent.

MATH 751. Numerical Linear Algebra (3). Includes analysis of direct and iterative methods for the solution of linear systems, linear least squares problems, eigenvalue

problems, error analysis, and reduction by orthogonal transformations. Prerequisites: MATH 511, 547, and 551 with *C* or better in each, or departmental consent.

MATH 753. Ordinary Differential Equations (3) . Covers existence, uniqueness, stability, and other qualitative theories of ordinary differential equations. Prerequisite: MATH 545 or 547 with *C* or better or departmental consent.

MATH 755. Partial Differential Equations I (3). Studies the existence and uniqueness theory for boundary value problems of partial differential equations of all types. Prerequisite : M ATH 547 with *C* or better or departmental consent.

MATH 757. Partial Differential Equations for Engineers (3). Includes Fourier series, the Fourier integral, boundary value problems for the partial diff e rential equations of mathematical physics, Bessel and Legendre functions, and linear systems of ordinary diff e rential equations. Pre requisite: MATH 555 with *C* or better.

MATH 758. Complex and Vector Analysis for Engineers (3). A survey of some of the mathematical techniques needed in engineering including an introduction to vector analysis, line and surface integrals and complex analysis, contour integrals, and the method of residues. Not applicable toward a graduate degree in mathematics. Pre requisite: MATH 555 with *C* o r better.

Courses for Graduate Students Only

MATH 813. Abstract Algebra II (3). Acontinuation of MATH 713. Prerequisite: MATH 713 or equivalent.

MATH 818. Selected Topics in Number Theory (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

MATH 825. Topology II (3) . A continuation of MATH 725. Prerequisite: MATH 725 or equivalent.

MATH 828. Selected Topics in Topology (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

MATH 829. Selected Topics in Geometry (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

MATH 839. Selected Topics in Foundations of Mathematics (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

MATH 843. Real Analysis II (3). A continuation of MATH 743. Prerequisite: MATH 743 or equivalent.

MATH 845. Complex Analysis II (3) . A continuation of MATH 745. Prerequisite: MATH 745 or equivalent.

MATH 848. Calculus of Variations (3). Includes Euler-Lagrange equations, variational methods, and applications to extremal problems in continuum mechanics. Prerequisite: MATH 547 or 757.

MATH 849. Selected Topics in Analysis (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

MATH 851. Numerical Analysis of Ordinary Differential Equations (3). Includes single-step and multi-step methods of ordinary differential equations, stability, consistency and convergence, error estimation, step size selection, stiff systems, and boundary value problems. Prerequisites: MATH 555 and 751.

MATH 852. Numerical Analysis of Partial Differential Equations (3). Includes analysis of algorithms for the solution of initial value problems and boundary value problems for systems of PDEs with applications to fluid flow, structural mechanics, electromagnetic theory, and control theory. Prerequisite: MATH 751.

MATH 854. Tensor Analysis with Applications (3). After introducing tensor analysis, considers applications to continuum mechanics, structural analysis, and numerical grid generation. Prerequisite: MATH 545 or 757.

MATH 856. Partial Differential Equations II (3). A continuation of MATH 755. Prerequisite: MATH 755.

MATH 857-858. Selected Topics in Engineering Mathematics I and II (3-3). Advanced topics in mathematics of interest to engineering students, including tensor analysis, calculus of variations and partial differential equations. Not applicable toward the MS in mathematics.

MATH 859. Selected Topics in Applied Mathematics (2-3). Repeatable with departmental consent.

MATH 880. Proseminar (1). Oral presentation of research in areas of interest to the students. Prerequisite: major standing.

MATH 881. Individual Reading (1-5). Repeatable up to a maximum of 6 hours with departmental consent. Prerequisite: departmental consent.

MATH 885. Thesis (1-4). May be repeated to a maximum of 6 hours credit. Prerequisite: departmental consent.

MATH 941-942. Applied Functional Analysis I and II (3-3). Introduces functional analysis and its applications. Prerequisites: MATH 843 and 755 (MATH 755 may be a co-requisite).

MATH 947-948. Mathematical Theory of Fluid Dynamics I and II (3-3). Mechanics of fluid flow, momentum and energy principles, Navier-Stokes and Euler equations, potential flows, vortex dynamics, stability analysis, and numerical methods applied to fluid dynamics. Prerequisite: MATH 745.

M ATH 952. Advanced Topics in Numerical Analysis (3) . Advanced topics of current research interest in numerical analysis. Topics chosen at instructor's discretion. Possible areas of concentration are

numerical methods in ordinary differential equations, partial differential equations, and linear algebra. Prerequisites: MATH 751, 851, and instructor's consent.

MATH 958 & MATH 959. Selected Advanced Topics in Applied Mathematics (3&3). To pics of current research interest in applied mathematics. Repeatable for credit with departmental consent. Prerequisite: instructor's consent.

MATH 981. Advanced Independent Study in Applied Mathematics (1-3). Arranged individual directed study in an area of applied mathematics. Repeatable to a maximum of 6 hours. Prerequisites: must have passed the PhD qualifying exam and instructor's consent.

MATH 985. PhD Dissertation (1-9). Repeatable to a maximum of 24 hours. Pre requisite: must have passed the PhD preliminary exam.

Statistics (STAT)

No major or minor in statistics is available, but a BS degree with emphasis in statistics is offered as described under the mathematics section. Statistics courses satisfy general education requirements. As part of the 124 semester hours required for graduation, students may take up to 15 semester hours of statistics courses in addition to the 45 or 50 semester hours of course work allowed in mathematics.

Lower-Division Course

STAT 170. Statistics Appreciation (3). A nontechnical course stressing and explaining how statistics and probability help solve important problems in a variety of fields (e.g., biology, economics, education, government, health sciences, social sciences, etc.). The material is developed by examples rather than by traditional statistical methods and does not require any special knowledge of mathematics.

Upper-Division Courses

STAT 360. Elementary Probability (3). Includes probability functions, random variables and expectation of finite sample spaces. Prerequisite: MATH 111 with a *C* or better or equivalent.

> STAT 370. Elementary Statistics (3). *General education introductory course*. Surveys elementary descriptive statistics, binomial and normal distributions, elementary problems of statistical inference, linear correlation and regression. Not open to mathematics majors. Pre requisite: MATH 111 with a *C* or better or equivalent.

> S TAT 460. Elementary Probability and Mathematical Statistics (3). *General education further study course* . Covers elementary probability concepts, some useful discrete and continuous distributions and mathematical aspects of statistical inference including maximum likelihood estimation, confidence intervals, hypothesis testing and regression. Prerequisite: MATH 243 with a *C* or better.

> S TAT 471. Probabilistic Models and Statistical Methods (3). *General education further study course*. Covers axioms of probability, Bayes' Theorem, random variables and their distribution, joint distributions of random variables, transformations of random variables, moment generating function, characteristic functions, central limit theorem and other topics with applications to engineering. Prerequisite: MATH 344 with a C or better.

Courses for Graduate/Undergraduate Credit

Credit in courses numbered below 600 is not applicable toward the MS in mathematics.

STAT 570. Special Topics in Statistics (3). Covers topics of interest not otherwise available. Prerequisite: departmental consent.

> S TAT 571->572. Statistical Methods I and II (3-3). *General education further study courses*. Includes probability models, points and interval estimates, statistical tests of hypotheses, correlation and regression analysis, introduction to non-parametric statistical techniques, least squares, analysis of variance, and topics in design of experiments. Prerequisite: MATH 243 with *C* or better or departmental consent.

> S TAT 574. Elementary Survey Sampling (3). *General education further study course*. Reviews basic statistical concepts. Covers simple, random, stratified, cluster, and systematic sampling, along with selection of sample size, ratio, estimation, and costs. Applications studied include problems from the social and natural sciences, business, and other disciplines. Prerequisite: any elementary course in statistics, such as STAT 370, SOC 501, or PSY401 with a *C* or better.

> S TAT 576. Applied Non-parametric Statistical Methods (3). *General education further study course.* Studies assumptions and needs for non-parametric tests, rank tests, and other nonparametric inferential techniques. Applications involve problems from the social and natural sciences, business, and other disciplines. Prerequisite: any elementary statistics course such as STAT 370, SOC 501, or PSY401 with *C* or better.

STAT 761. Probability (3). A study of axioms of probability, discrete and continuous random variables, expectation, examples of distribution functions, moment generating functions, and sequences of random variables. Prerequisite: MATH 344 with *C* or better.

STAT 762. Applied Stochastic Processes (3). Studies random variables, expectation, limit theorems, Markov chains, and stochastic processes. Prerequisite: STAT 761 or 771 with *C* or better or departmental consent.

STAT 763. Applied Regression Analysis (3). Studies linear, polynomial, and multiple regression. Includes applications to business and economics, behavioral and biological sciences, and engineering. Uses computer packages for doing problems.

Prerequisites: STAT 571 and MATH 344 and 511 with *C* or better in each or departmental consent.

STAT 764. Analysis of Variance (3). An introduction to experimental design and analysis of data under linear statistical models. Studies single-factor designs, factorial experiments with more than one factor, analysis of covariance, randomized block designs, nested designs, and Latin square designs. Uses computer packages for doing problems. Prerequisites: STAT 571 and MATH 344 and 511 with *C* or better in each or departmental consent.

STAT 771-772. Theory of Statistics I and II (3-3). An examination of stochastic dependence distributions of functions of random variables limiting distributions, order statistics, theory of statistical inference, non-parametric tests, and analysis of variance and covariance. Prerequisite: MATH 545 or 547 with *C* or better or departmental consent.

STAT 774. Statistical Computing I (3). Trains students to use modern statistical software for statistical modeling and writing of technical reports. Examines many of the advanced features of most commercial statistical packages. Students perform complete statistical analyses of real data sets. Prerequisites: STAT 763 and 764 or departmental consent.

STAT 775. Applied Statistical Methods I (3). Covers selected topics from time series analysis including basic characteristics of time series, autocorrelation, stationarity, spectral analysis, linear filtering, ARIMA models, Box-Jenkins forecasting and model identification, classification, and pattern recognition. Prerequisite: STAT 763 with *C* or better or departmental consent.

STAT 776. Applied Statistical Methods II (3). Covers selected topics from multivariate analysis including statistical theory associated with the multivariate normal, Wishart and other related distributions, partial and multiple correlation, principal component analysis, factor analysis, classification and discriminant analysis, cluster analysis, James-Stein estimates, multivariate probability inequalities, majorization and Schur functions. Prerequisite: STAT 764 with *C* or better or departmental consent.

Courses for Graduate Students Only

STAT 861-862. Theory of Probability I and II (3-3) . The axiomatic foundations of probability theory emphasize the coverage of probability measures, distribution functions, characteristic functions, random variables, modes of convergence, the law of large numbers and central limit theorem, and conditioning and the Markov property. Prerequisites: MATH 743 and STAT 761 or 771.

STAT 870-871. Theory of Statistical Inference I and II (3-3). Covers asymptotic theory of maximum likelihood estimation, sufficiency and completeness, unbiased estimation, elements of decision theory and the Neyman-Pearson theory of testing hypotheses. Pre requisites: MATH 743 and STAT 761 or 771.

STAT 872-873. Theory of Linear Models I and II (3-3). An introduction to the theory of linear models and analysis of variance. Includes multivariate normal distribution, distributions of quadratic forms, general linear models, general linear hypothesis, confidence regions, prediction and tolerance intervals, design models (1-factor and 2-factor), analysis of covariance, and components-of-variance models. Prerequisites: MATH 511 and STAT 772.

STAT 875. Design of Experiments (3). Astudy of basic concepts of experimental design which include completely randomized design, randomized block design, randomization theory, estimation and tests, latin square design, factorial experiments, confounding, split-plot designs, incomplete block designs, and intra- and inter-block information. Prerequisite: STAT 572 or 772.

STAT 876. Non-parametric Methods (3). An introduction to the theory of non-parametric statistics. Includes order statistics; tests based on runs; tests of goodness of fit; rank-order statistics; one-, two-, and k-sample problems; linear rank statistics; measure of association for bivariate samples; and asymptotic efficiency. Prerequisite: STAT 772.

STAT 877. Multivariate Statistical Methods (3). Elementary theory and techniques of analyzing multidimensional data; covers Hotelling's T2, multivariance analysis of variance, principal components analysis, linear discrimination analysis, canonical correlation analysis, and analysis of categorical data. Prerequisites: MATH 511 and STAT 772.

STAT 878. Special Topics (2-3). Repeatable with departmental consent. Prerequisite: departmental consent.

STAT 879. Individual Reading (1-5). Prerequisite: departmental consent.

STAT 884. Statistical Computing II (3). Teaches special graphics and numerical methods needed in the analysis of statistical data. Includes advanced simulation techniques, numerical methods for linear and nonlinear problems, analysis of missing data, smoothing and density estimation, projection-pursuit methods, and graphic techniques. Prerequisites: MATH 751 and STAT 772 with *C* or better or departmental consent.

STAT 971 & STAT 972. Selected Advanced Topics in Probability and Statistics (3&3). Topics of current research interest in probability and statistics. Repeatable for credit with departmental consent. Prerequisite: instructor's consent.

STAT 978. Advanced Independent Study in Probability and Statistics (1-3). Arranged individual directed study in an are a of probability or statistics. Repeatable to a maximum of 6 hours. Prerequisites: must have passed the PhD qualifying exam and instructor's consent.

STAT 986. PhD Dissertation (1-9). Repeatable to a maximum of 24 hours. Prerequisite: must have passed the PhD preliminary exam. Puebla, Mexico, and Strasbourg and Orléans, France .

Retroactive Credit Policy

Qualified students may earn Fairmount College credit for previous language experience by successfully completing a language course, or courses, at the appropriate level.

Based on their previous experience, students enroll at their predicted level. Normally, predicted entry level is calculated by assuming that one year of high school language is the equivalent to one semester of college language.

Students must apply for retroactive credit during the semester in which they are enrolled in the retroactive credit eligible course(s). Deadline for application will be announced in all language classes.

If a student successfully completes the course, or courses (with a grade of *C* or better), the student receives the graded credit hours for that course, or courses, and the appropriate number of ungraded retroactive credit hours.