MATHEMATICS & STATISTICS

Degrees offered		HEGIS
Mathematics	BA*	1701
Mathematics Teaching	BA*	1701
Statistics	BA*	1702
Pure Mathematics	MA	1701
Statistics and Applied Mathematics	MA	1703
Mathematics Teaching	MA	1701
Mathematics or Statistics & Applied Mathematics	BA/MA	1701
Mathematics Teaching	BA/MA	1701

** See Hunter College Undergraduate Catalog 2004-2007, p. 141, for information concerning undergraduate programs in mathematics and statistics*

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Graduate Advisers:
For contact information, check online at http://math.hunter.cuny.edu

Education Adviser, Frank Gardella; 1101 West Building; (212) 772-4676; fgardell@hunter.cuny.edu

Website: http://math.hunter.cuny.edu

FACULTY

Alberto Baider, Professor; PhD, MIT; Differential Algebra, Dynamical Systems

Martin Bendersky, Professor; PhD, California (Berkeley); Algebraic Topology

Edward S. Binkowski, Associate Professor; PhD, Princeton; Data Analysis

Barry M. Cherkas, Professor; PhD, Georgetown; Partial Differential Equations, Collegiate Mathematics Education

Daniel S. Chess, Associate Professor; PhD, Princeton; Structure Theorems for Diffeomorphisms

Richard C. Churchill, Professor; PhD, Wisconsin; Differential Algebra, Dynamical Systems

Sandra P. Clarkson, Professor; EdD, Georgia; Mathematics and Statistics Education

Lucille Croom, Professor; PhD, Columbia; Mathematics Education

Dana Draghicescu, Assistant Professor; PhD, EPFL, Lausanne, Switzerland; Inference for Dependent Data, Space-time Covariance Models, Environmental Processes

Thomas F. Jambois, Associate Professor; PhD, California (Berkeley); Riemann Surfaces, Algebraic Geometry

John Loustau, Professor; PhD, California (Santa Barbara); Non-associative Algebras, Computer Graphics

Jane Matthews, Associate Professor; PhD, NYU; Combinatorial Group Theory, History of Mathematics

Ada Peluso, Professor; PhD, NYU; Combinatorial Group Theory

Joseph Roitberg, Professor; PhD, NYU; Algebraic Topology

Verna Segarra, Lecturer; MA, City College; Mathematics Education

Brian Shay, Associate Professor; PhD, CUNY; Algebraic Topology, Reasoning Under Uncertainty (AI), Mathematics of Financial Economics

Lev Shneerson, Professor; PhD, Ural State University; Combinatorial Semigroup Theory

Makram Talih, Assistant Professor; PhD, Yale; Spatial-temporal Modeling, Dynamic Graphical Models, MCMC

Robert D. Thompson, Professor; PhD, Washington; Algebraic Topology

William H. Williams, Professor; PhD, Iowa State; Sampling Theory, Time Series, Econometrics

The Department of Mathematics and Statistics offers a choice of master's programs. The masters in pure mathematics is intended primarily for students interested in studying mathematics on a broad scale. This program is used by students as preparation for industrial and academic employment, and as preparation for further graduate study. The program in statistics and applied mathematics is intended for students interested in applications to business, science, engineering, and industry, as well as teaching and research. In addition, the department offers, jointly with the School of Education, a master of arts in teaching, and a combined BA/MA in mathematics teaching. The MA in mathematics teaching is designed for individuals without provisional certification in mathematics. Individuals who already have provisional certification in mathematics should pursue either the MA in pure mathematics or the MA in statistics and applied mathematics.

MASTER OF ARTS – PURE MATHEMATICS PROGRAM

Admission Requirements

In addition to the general college requirements for admission, students must meet the following departmental requirements: at least 24 acceptable credits in mathematics with a B average in the courses involved. (In special cases, students who show evidence of unusual mathematical ability, but who do not meet both of the above requirements, will be considered.) See Undergraduate Catalog, p. 141, for major requirements and list of courses.

Degree Requirements

Thirty credits (10 courses) from courses chosen as follows:

1. **MATH 721-722** Modern Algebra I and II, or **MATH 725** Linear Algebra and **STAT 722** Theory of Games
2. **MATH 746-747** Theory of Functions of a Real Variable I and II
3. **MATH 742** Theory of Functions of a Complex Variable
4. **MATH 751** General Topology
5. At least 6 credits chosen from courses at the **MATH 700** and/or **STAT 700** level.
6. Six credits at most from courses at the **MATH 600** and/or **STAT 600** level or from approved courses in another department.
7. Written comprehensive examination covering the courses listed in items 1 and 2 above, and in two additional areas.
8. Reading knowledge of French, German, Russian, or other language with a sufficiently rich mathematical literature.

MASTER OF ARTS – STATISTICS AND APPLIED MATHEMATICS PROGRAM

Admission Requirements

The general college admission requirements must be satisfied. The department's requirements are minimal in order to encourage all those who may have the mathematical maturity to handle the program to apply. Some students, however, may only be accepted into the program conditionally, contingent upon their successful completion of **MATH 250** (Calculus III) and **MATH 260** (Linear Algebra). Hence, irrespective of past specialization, the only requirement for entrance into the program is an adequate undergraduate record, Calculus III, and one semester of Linear Algebra.

Two program sequences are available for the MA in Statistics and Applied Mathematics, Track I: Statistics and Track II: Applied Mathematics.

Track I: Statistics Degree Requirements

Thirty credits (10 courses)* from courses chosen as follows:

Core Curriculum**(15 credits, 5 courses)

1. **STAT 701**, **702** Probability
2. **STAT 703** Mathematical Statistics
3. **STAT 706**, **707** General Linear Models I and II

Electives (15 credits, 5 courses)

4. Fifteen credits in statistics, computer science, mathematics, or relevant areas of application, selected to constitute a cohesive program. Typically, these courses are at the **MATH 700** and/or **STAT 700** level. Electives must be approved by the Graduate Statistics and Applied Math Adviser.

Project

5. **STAT 790** Case Seminar. The student, guided by a member of the faculty, prepares a project in statistics. This replaces the comprehensive examination requirement. Students may elect to fulfill this requirement by taking **MATH 777**, subject to the approval of the graduate adviser.

   The student must exhibit a working knowledge of two useful computer languages or data analysis packages. This replaces the foreign language requirement.

Track II: Applied Mathematics Degree Requirements

Thirty credits (10 courses)* from courses chosen as follows:

Core Curriculum**(15 credits, 5 courses)

1. **MATH 601** Mathematical Methods for the Physical Sciences
2. **MATH 746** Theory of Functions of a Real Variable I
3. **STAT 701**, **702** Probability
4. **STAT 706** General Linear Models I

Electives (15 credits, 5 courses)

5. Fifteen credits in statistics, computer science, mathematics, or relevant areas of application, selected to constitute a cohesive program. Typically, these courses are at the **MATH 700** and/or **STAT 700** level. Electives must be approved by the Graduate Statistics and Applied Math Adviser.

Suggested electives are:

MATH 642 Introduction to Theory of Functions of a Complex Variable

MATH 685 Numerical Methods

MATH 785 Advanced Numerical Methods

MATH 654 Dynamical Systems and Chaos

MATH 747 Theory of Functions of a Real Variable II

STAT 703 Mathematical Statistics

STAT 707 General Linear Models II

STAT 715 Time Series Analysis

STAT 722 Theory of Games

STAT 726 Theory and Methods of Sampling

STAT 786 Visualization for Statistics and Applied Mathematics

STAT 787 Statistical Models for Spatial Data Project

6. **STAT 790** Case Seminar. The student, guided by a member of the faculty, prepares a project in statistics. This replaces the comprehensive examination requirement. Students may elect to fulfill this requirement by taking **MATH 777**, subject to the approval of the graduate advisor.

   The student must exhibit a working knowledge of two useful computer languages or data analysis packages. This replaces the foreign language requirement.

**The 30 credits (10 courses) must be approved by an adviser and constitute a concentration.*

***Courses already taken as an undergraduate will satisfy specific course requirements but are not included in the 30 credit (10 course) total.*

PROGRAM FOR TEACHERS OF ADOLESCENT EDUCATION (GRADES 7-12) – MATHEMATICS MA

Two program sequences are available for the preparation of teachers of mathematics in grades 7-12, each of them designed for a different group of students. Track I is a 37-39 credit MA designed for individuals who have completed an undergraduate major in mathematics but have little or no background in teacher education. Track II is a 34.5-38 credit MA program designed for individuals who have certification in an area other than mathematics and are currently teaching mathematics in grades 7-12. A BA/MA program of at least 141 credits is also offered; this program is described in the undergraduate catalog p 143 and in this catalog (see below).

Track I: MA in Teaching – 37-39 credits

Admission Requirements

1. 24 or more credits in mathematics approved by the graduate mathematics adviser, including a course in elementary statistics, a year of calculus, and a course in matrix algebra or linear algebra.
2. An overall grade point average of 2.8 or better in undergraduate work.
3. An average of at least 2.7 in mathematics courses.
4. A general education core in the liberal arts and sciences to include the following in addition to math: 6 credits in English, 6 credits in a language other than English, 6 credits in social studies (to include at least one course in U.S. history or geography), 6 credits in the arts, and 6 credits in science.*

Applicants who have an overall GPA between 2.5 and 2.79 and meet all other requirements for matriculation may be considered for admission to nonmatriculant status. Only students who demonstrate strong verbal skills in addition to other indices of ability to do graduate work will be admitted as nonmatriculants. Applicants will be required to provide an on-site writing sample (essay) and participate in a face-to-face interview. Academically relevant data, such as scores on the General Aptitude Test of the Graduate Record Exam or on the Liberal Arts and Sciences Test of the NYS Teacher Certifica-tion examination, may also be submitted in support of admission.

See the School of Education section of this catalog for additional information on admission, progress standards, and exit criteria.

Degree Requirements

Education: 22-24 credits

See School of Education section of the catalog (p. 110) for specification of courses.

Mathematics: 15 credits

MATH 620 . . . . . 3 cr
Sequential Mathematics from an Advanced Standpoint I

MATH 630 . . . . . 3 cr
Sequential Mathematics from an Advanced Standpoint II

MATH 640** Topics in Calculus. . . . 3 cr

MATH 661*** . . . . . 3 cr
History of Mathematics

STAT 614*** . . . . . 3 cr
Data Analysis Using Statistical Software

**Students may be admitted lacking up to 12 credits of courses required for admission. Students must fulfill these conditions within their first three semesters of matriculation. Courses taken to fulfill conditions do not count toward the master's degree.*

***Required unless a student has had both multivariate calculus and experience with calculus using graphing calculators and computer packages such as MAPLE and MATHEMATICA. Students who do not need to take this course may substitute another 3-credit course or two seminars of 1.5 credits each with approval of the graduate adviser.*

****With approval of the graduate mathematics adviser, students who have had substantial coverage of a given area within an undergraduate curriculum may be allowed to replace a course or courses in this category with electives, preferably elective courses at a more advanced level in the same area.*

Comprehensive Examination
The comprehensive examination will have two parts: one part will deal with mathematics, the other part with pedagogy.

Track II: MA in Teaching – 34.5-38 credits

Admission Requirements

1. At least 18 credits in mathematics approved by the graduate mathematics adviser, including a course in elementary statistics, a year of calculus, and a course in matrix algebra or linear algebra.
2. An overall grade point average of 2.8 or better in undergraduate studies.
3. An average of at least 2.7 in mathematics courses.
4. NYS initial or provisional teacher certification in an area other than mathematics and assignment as a teacher of mathematics in grades 7-12.

Degree Requirements

Education: 9-11 credits
See School of Education section of the catalog (p. 111) for specification of courses.

Mathematics: 25.5-27 credits

Core: 6 credits

MATH 620 . . . . . 3 cr
Sequential Mathematics from an Advanced Standpoint I

MATH 630 . . . . . 3 cr
Sequential Mathematics from an Advanced Standpoint II

Additional Core: 3 credits

MATH 640* Topics in Calculus . . . . 3 cr

Other Required Areas**

MATH 621 . . . . . 3 cr
Introduction to Abstract Algebra

MATH 623 Theory of Numbers . . . . 3 cr
MATH 661 History of Mathematics . 3 cr

STAT 614 . . . . . 3 cr
Data Analysis Using Statistical Software

Electives: 4.5-6 credits
Courses in mathematics and statistics (1.5 or 3 credits) or in such areas as computer science, with the approval of the graduate mathematics adviser.

Comprehensive Examination
The comprehensive examination will have two parts: one part will deal with mathematics, the other part with pedagogy.

**Required unless a student has had both multivariate calculus and experience with calculus using graphing calculators and computer packages such as MAPLE and MATHEMATICA. Students who do not need to take this course may substitute another 3-credit course or two seminars of 1.5 credits each with approval of the graduate adviser.*

***With approval of the graduate mathematics adviser, students who have had substantial coverage of a given area within an undergraduate curriculum may be allowed to replace a course or courses in this category with electives, preferably elective courses at a more advanced level in the same area.*

MATHEMATICS OR STATISTICS AND APPLIED MATHEMATICS BA/MA

The BA/MA program offers promising students the opportunity to complete both the bachelor's and master's degree requirements with a minimum of 120 credits. Requirements are the same as those for a major in the department, plus 30 credits at the graduate level. Interested students should contact the departmental graduate adviser for further information regarding eligibility and curriculum requirements.

Option 1: Accelerated BA/MA Program in MATHEMATICS

Students complete the BA in pure mathematics with 30 additional credits at the graduate level in pure mathematics approved by the departmental graduate adviser.

Option 2: Accelerated BA/MA Program in STATISTICS AND APPLIED MATHEMATICS

Students complete the BA in statistics or mathematics with 30 additional credits at the graduate level in applied mathematics, statistics and computer science approved by the departmental graduate adviser.

PREPARATION FOR ADOLESCENT EDUCATION (GRADES 7 – 12) BA/MA

Students interested in teaching grades 7-12 may pursue a combined BA/MA program in teaching. This program requires a minimum of 141 credits.

Admission Requirements

1. Completion of at least 45 credits with a GPA of 2.8
2. Completion of at least 10 credits in mathematics, including a year of calculus (**MATH 150** and **155** or equivalent), with an average of 2.7 in these major courses.

Degree Requirements

The BA/MA program includes 46 credits in mathematics and 22-24 credits in teacher education courses, some of them taken at the undergraduate level and some at the graduate level. The required mathematics courses of the BA/MA in the teaching of mathematics are:

1. **MATH 150** and **155** (or the equivalent), **250**, **260** and **311** (or the equivalent), **620**, **623** or **634**, **630**, **661**, **STAT 213** and **STAT 614** (or the equivalent),
2. 9 additional credits at the 250 level or above, selected with the approval of the departmental mathematics education adviser.

COURSE LISTINGS

Each course 45 hours, 3 cr. unless otherwise noted

MATHEMATICS

MATH 601 Mathematical Methods for the Physical Sciences
Topics include: Fourier Series, Sturm-Liouville theory, Green functions, and eigenfunction expansions. These will be applied to the heat, wave, Laplace, and one-dimensional Schroedinger equations.
prereq: a course in ordinary differential equations

MATH 620 Sequential Mathematics from an Advanced Standpoint I
Study, from an advanced standpoint, of the mathematics involved in the new sequential mathematics high school curriculum, with special focus on algebra, geometry, and statistics. Open only to Teacher Education Program students.
prereq: Calculus II and a course in linear or matrix algebra

MATH 621 Introduction to Abstract Algebra
Introduction to the theory of groups and rings.
prereq: a course in linear algebra

MATH 622 Further Topics in Advanced Abstract Algebra
Elements of Galois theory, construction with ruler and compass, advanced topics in ring theory and linear algebra.
prereq: a course in introductory abstract algebra

MATH 623 Theory of Numbers
Congruences, quadratic residues, elementary diophantine analysis, continued fractions, sums of squares.
prereq: a course in linear algebra

MATH 628 Number Systems
Postulational construction of the positive integers. Development of the rational integers, the rational numbers, the real numbers, the complex numbers, together with binary operations and order relations. Topics from hypercomplex number systems or the theory of transfinite numbers.

MATH 630 Sequential Mathematics from an Advanced Standpoint II
Study, from an advanced standpoint, of the mathematics involved in the new sequential mathematics high school curriculum, with specific focus on geometry, and both algebraic and transcendental functions.
open only to Teacher Education Program students

MATH 634 Geometries I
Topics in affine and projective geometry and/or topics in differential geometry.
prereq: a course in linear algebra

MATH 640 Topics in Calculus
Topics in single and multi-variable calculus examined from an advanced standpoint and incorporating use of graphing calculators and such computer packages as MAPLE and MATHEMATICA.
prereq: **MATH 630**
open only to Teacher Education Program students

MATH 641 Mathematical Analysis I
Mature consideration of theory and processes of calculus, including the Heine-Borel and Bolzano-Weierstrass Theorems.
prereq: **MATH 260** *and either* **MATH 254** *or* **255**

MATH 642 Introduction to Theory of Functions of a Complex Variable
Complex numbers, analytic functions, elementary functions, contour integrals, Cauchy integral theory, series.
prereq: a course in advanced calculus

MATH 645 Mathematical Analysis II
Continuation of **MATH 641** with an emphasis on functions of several variables.
prereq: **MATH 641**

MATH 653 Calculus on Manifolds
Functions on Euclidean space, implicit function theorem, Fubini's Theorem, integration on chains and manifolds.
prereq: a course in advanced calculus

MATH 654 Dynamical Systems and Chaos
Topics include: flows in one and two dimensions; phase portraits; limit cycles; bifurcations; iterated maps on the interval; introduction to chaos and fractals; the Mandelbrot set and its significance.
prereq: a course in multivariate calculus and a course in linear algebra
Familiarity with MAPLE or MATHEMATICA encouraged

MATH 661 History of Mathematics
Survey of the history of mathematics and statistics to the present including roots in non-Western culture and contributions of women and minorities.

MATH 671 Fundamental Concepts of Modern Mathematics
An axiomatic approach to theory of sets; axiom of choice, Zorn's Lemma, transfinite arithmetic.
prereq: any 2 courses chosen from linear algebra, modern algebra, or advanced calculus I and II

MATH 672 Mathematical Logic
A survey of the central results and techniques of metalogic, principally mathematical induction, the soundness and completeness of theorems for first-order logic, the Skolem Theorem; and Church's Theorem on undecidability.
prereq: a course in linear algebra or permission of instructor

MATH 685 Numerical Methods
Accuracy and precision, convergence, iterative and direct methods. Topics selected from: solution of polynomial equations and linear systems of equations; curve fitting and function approximation; interpolation; differentiation and integration; differential equations.
prereq: a course in ordinary differential equations

MATH 690 Advanced Topics in Mathematics for Teachers
Topics to be studied in any given term will be announced prior to registration. May be repeated as topics vary, but not more than twice.
prereq: **MATH 620** *or* **630***; additional prereqs vary with specific topics and will be announced at time of course offering*

MATH 721 Modern Algebra I
Semi-groups, groups with operators, rings, modules, field extensions, vector spaces.
prereq: an undergraduate course in linear algebra and an undergraduate course in abstract algebra

MATH 722 Modern Algebra II
Continuation of **MATH 721**.
prereq: **MATH 721**

MATH 725 Linear Algebra
Selected topics in advanced linear algebra.
prereq: a course in linear algebra and a course in modern algebra

MATH 742 Theory of Functions of a Complex Variable
Conformal mappings, Riemann surfaces, analytic continuations, residue calculus, special functions.
prereq: a course in complex variables and either a course in topology or permission of department

MATH 746 Theory of Functions of a Real Variable I
Real numbers, Lebesque measure, metric and Lp spaces, general measure and integration theory.
prereq: 1 year of advanced calculus

MATH 747 Theory of Functions of a Real Variable II
prereq: **MATH 746**

MATH 751 General Topology
Topology of plane sets, continuous functions, separation axioms, compact and metric spaces.
prereq: advanced calculus or permission of department

MATH 772 Seminar
Introduction to methods and literature of mathematical research at master's level.
prereq: permission of the department

MATH 773, 774 Independent Study
prereq: permission of the department
1 cr. each, 45 hrs

MATH 775, 776 Independent Study
prereq: permission of the department
2 cr. each, 45 hrs

MATH 777, 778 Independent Study
prereq: permission of the department
3 cr. each, 45 hrs

MATH 785 Advanced Numerical Methods
Advanced topics in numerical methods used to provide numerical solutions to partial differential equations including the finite element method, finite difference method. Including stability, convergence and correctness. Programming in MATHEMATICA.
prereq: **MATH 685** *(***PHYS 685***) or permission of the instructor*

MATH 795 Advanced Topics in Mathematics
Topics to be studied in any given term will be announced prior to registration. May be repeated as topics vary, but not more than twice.
prereq: prereqs vary with specific topics and will be announced at the time of course offering

STATISTICS

STAT 614 Data Analysis Using Statistical Software
A second course in statistics using statistical software to analyze real data and teach new methodology. Methods covered include exploratory data analysis, analysis of variance, simple and multiple regression, nonparametric statistics, and model building.
prereq: **STAT 213** *or both* **MATH 125** *and* **STAT 113** *with C or better in each course familiarity with a Windows computing environment encouraged*

STAT 701 Advanced Probability Theory I
Non-measure theoretic probability. Combinatorics, random variables, distributions. Moment generation functions. Limit laws.
*prereq: a course in multivariate calculus (***MATH 250** *or equivalent) or permission of department*

STAT 702 Advanced Probability Theory II
Continuation of **STAT 701**. Recurrent events, Markov chains, diffusion. Introduction to stochastic processes.
prereq: **STAT 701** *or permission of the department*

STAT 703 Mathematical Statistics
Bernoulli, binomial, Poisson and other discrete density functions. Continuous distributions: the normal, t, chi square and F distributions. Order Statistics. Point and interval estimation, maximum likelihood and Bayes' estimation. Testing hypotheses, the Neyman-Pearson lemma, likelihood ratio tests. An introduction to linear models and the design of laboratory experiments. The analysis of variance.
prereq: permission of the department

STAT 706 General Linear Models I
The multivariate linear model. Model building. Indicator variables. Variable screening. Residual analysis. Weighted regression. Correlated errors. Multi-collinearity. Polynomial regression. The principles of experimental design. The analysis of variance. Computer lab sessions.
prereq: **STAT 701** *and* **703** *or equivalent or permission of department*

STAT 707 General Linear Models II
A review of multivariate linear model and maximum likelihood estimation. Nonlinear regression models. Logistic and Poisson regression models. Family of generalized linear models. Multidimensional tables. Odds ratio. Model selection and evaluation. Computer-based exploratory data analysis. Examples from the life sciences.
prereq: **STAT 701** *and* **703** *or equivalent or permission of department*

STAT 714 Topics in Statistical Inference
Topics vary but may be selected from multivariate analysis, regression, experimental design, time series, biostatistics.

STAT 715 Time Series Analysis
Introduction to univariate Box-Jenkins (difference equation) time-series modeling. Topics include ARIMA models; stationarity; forecasting; diagnostics; and seasonal modeling. Extensive use of process control and economic time series. Transfer function models.
prereq: C or better in **STAT 614***, or an equivalent introductory statistics course familiarity with a Windows computing environment encouraged*

STAT 716 Data Analysis
Probability-free alternatives to classical statistics, concentrating on graphical and robust methods. Topics selected from: data summaries; transformations; the jackknife and resampling schemes; robust estimation; and robust regression methods.
prereq: C or better in **STAT 614***, or an equivalent introductory statistics course*

STAT 717 Multivariate Analysis
An introduction to multivariate methods. Topics selected from: factor analysis; discriminant analysis; clustering; multidimensional scaling; MANOVA; canonical correlation; and projection-pursuit.
prereq: C or better in **STAT 614***, or an equivalent introductory statistics course familiarity with a Windows computing environment encouraged*

STAT 718 Analysis of Variance
Intermediate topics in analysis of variance (ANOVA), with an emphasis on exploratory aspects. Topics include: one-, two- and many-way layouts; decomposition and partitioning of variance; fixed-, random-, and mixed-effects models; repeated measures; contrasts; multiple comparisons; and robust analogs.
prereq: C or better in **STAT 614***, or an equivalent introductory statistics course familiarity with a Windows computing environment encouraged*

STAT 722 Theory of Games
Utility, zero-sum two-person games, minimax theorem or rectangular games. Relation to linear programming; applications to problems in economics and other fields.
prereq: a course in linear algebra and a course in probability

STAT 724 Topics in Applied Mathematics I
Selected topics. Topics vary but may be selected from multivariate analysis, regression, experimental design, time series, biostatistics.
prereq: permission of the department

STAT 725 Topics in Applied Mathematics II
Selected topics. Topics vary but may be selected from multivariate analysis, regression, experimental design, time series, biostatistics.
prereq: permission of the department

STAT 726 The Theory and Methods of Sampling
The techniques of modern sampling with applications to human population studies. Structured sampling designs. Unequal probability sampling. Efficient sampling. Accuracy, precision and the sources of bias. Longitudinal panel study design. The study of available Federal data bases relating to the health and welfare of US residents.
prereq: **STAT 701** *or equivalent, or permission of the department*

STAT 751 Advanced Biometrics
A second course in statistics covering quantitative methods applicable in the life sciences. Topics include experimental design, life table analysis, ethical issues, survival analysis, logistic regression, and Cox regression.
prereq: mathematics at the level of **MATH 125/126** *and* **STAT 113***,* **STAT 213***, or equivalent introductory statistics course linear algebra recommended, but not required*

STAT 786 Visualization for Statistics and Applied Mathematics
The structure and purpose of visualization systems, including fully developed examples from statistics and applied mathematics. Final project using advanced analysis techniques required.
prereq: **STAT 614** *or* **MATH 685** *(***PHYS 685***) or permission of the instructor*

STAT 787 Statistical Models for Spatial Data
Spatial data and spatial models, intrinsic stationarity, large and small sample variation, the variogram, estimation of the variogram, prediction and kriging, spatial models on lattices, spatial point patterns.
prereq: **STAT 701** *and* **STAT 703** *(theory);* **STAT 716** *or* **STAT 786** *(data analysis, programming); or permission of the instructor*

STAT 790 Case Seminar
Students register for this course in the semester of their project presentation, but may attend throughout their tenure as graduate students. Designed to develop the student's ability to apply methods from statistics, probability or operations research to complex real problems.
prereq: permission of department

STAT 791, 792, 793 Independent Study
Independent study in which a student selects a topic of interest to him or herself. The study is carried out under the direction of a faculty member.
1 cr, 2 cr, or 3 cr

Courses offered only if student demand is sufficient:

MATH 741 Functional Analysis

STAT 638 Special Topics in Applied Statistics