Academic Program

THE DEPARTMENT OF STATISTICS
TEXAS A&M UNIVERSITY

Contents

This statement of regulations and requirements complements the University's regulations and requirements which are contained in the Graduate College Catalog. The degree requirements contained herein apply to all students entering as of September 1, 2007.

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Graduate Program in Statistics

The Department of Statistics offers a graduate program, leading to the degrees of Master of Science and Doctor of Philosophy. The Department also jointly sponsors graduate work with all subject matter area departments in setting up joint Ph.D. programs and flexible minor programs in statistics.

The Department of Statistics offers two options in its master's degree programs: (1) the Master of Science degree (thesis option) which requires the preparation of a thesis and (2) the Master of Science (non-thesis option) which requires more formal course work in lieu of the thesis. Within either option, students are allowed to choose either a broad-based or specialized program of study. All choices, however, provide a balanced training in statistical methods, computational statistics, and statistical theory, and are intended to prepare the student to adapt statistical methodologies to practical problems.

The aim of the Ph.D. program is to provide comprehensive and balanced training in statistical methods, computational statistics, and the theory of statistics. Particular emphasis is placed on training students to independently recognize the relevance of statistical methods to the solution of specific problems and to enable them to develop new methods when they are needed. The training aims to convey a sound knowledge of existing statistical theory, including the mathematical facility to develop new results in statistical methodology. At the same time, the program is kept sufficiently flexible to permit students to develop their specific interests.

Master of Science Program

Non-Thesis Option

A student seeking the Master of Science degree under the Non-Thesis Option must fulfill the following requirements:

A. Coursework. Note that STAT 601, 609, 619, 651, 652, 653 and 667 may not be used to fulfill any of the coursework requirements listed below.

1. STAT 604, 610, 611, 641, 642
2. One credit hour of STAT 681.
3. Two semester credit hours of statistical consulting experience (STAT 684) earned in a minimum of two semesters. Rules governing acceptable methods for completing this requirement are given below in Item B.
4. Three semester credit hours of STAT 685 for the preparation of a special problem (see item C below).
5. Fifteen semester credit hours based on one of the emphasis areas outlined below.
6. A total of 36 semester credit hours.

Broad-Based Plan

1. STAT 608
2. At least two additional approved statistics courses.
3. A least one course from a supporting field.

Biostatistics Emphasis

1. STAT 643 and 644
2. At least two additional approved statistics courses.
3. At least one course from a supporting field.

Computational Emphasis

1. Two courses in Mathematics (e.g., MATH 609, MATH 610 or MATH 660).
2. Two courses in Computer Science (e.g., CPSC 603, CPSC 654 or CPSC 659).
3. At least one approved statistics course.

Applied Emphasis

1. STAT 630, 607, 608, 636, 657, 659
2. At least one additional approved statistics courses.
3. At least one course from a supporting field.

Ph.D. Emphasis

1. STAT 612, 613, 614
2. At least two additional statistics courses from the list of traditional courses identified in the PhD Program.

(MATH 446 or MATH 663 are excellent preparatory courses.)

B. Consulting Experience. One semester credit hour of STAT 684 can be obtained through the completion of any of the experiences listed below.

1. One semester of service in the Statistical Consulting Center.
2. One semester of a departmentally approved internship.
3. Special experiences, with prior approval from either the Department Head or the Associate Department Head that involve the following:
   a. At least one semester of activity
   b. The application of statistical knowledge
   c. Working with non-statisticians
   d. Sufficient statistical supervision.

C. Form a master's advisory committee and complete a special project under the direction of the chairman of the advisory committee. Three semester credit hours of STAT 685 are earned by completion of this project. Upon completion, the student is required to compose a written report and make an oral presentation on the work. The purpose of this project is to familiarize the student with the type of problems that may be encountered in future work and to give the student a chance to develop the ability to present results both verbally and in writing. In many cases, work done during an internship may be used as the basis for the student's master's project. However, this project must be completed under the supervision of the chairperson of the student's advisory committee.

D. Pass at least one part of the qualifying exam (see below).

E. Pass a final oral examination. This examination is concerned with the student's coursework and special problem. It is administered by the student's advisory committee.

Thesis Option

A student seeking the Master of Science degree under the Thesis Option must fulfill the following requirements:

A. Coursework. Note that STAT 601, 609, 619, 651, 652, 653, 656 and 667 may not be used to fulfill any of the coursework requirements listed below.

1. STAT 604, 610, 611, 641, 642
2. One credit hour of STAT 681.
3. Six semester credit hours of STAT 691 for preparation of a thesis (see item B below).
4. Twelve semester credit hours based on one of the emphasis areas outlined below. STAT 691 semester credit hours may not be used to satisfy this requirement.
5. A total of 34 semester credit hours.

Broad-Based Plan

1. STAT 610 and 611
2. STAT 608
3. At least one additional approved statistics course.
4. At least one course from a supporting field.

Biostatistics Emphasis

1. STAT 610 and 611
2. STAT 643 and 644
3. At least two additional approved statistics courses.
4. At least one course from a supporting field.

Computational Emphasis

1. STAT 610 and 611
2. Two courses in Mathematics (e.g., MATH 609, MATH 610, or MATH 660)
3. Two courses in Computer Science (e.g., CPSC 603, CPSC 654 or CPSC 659).
4. At least one approved statistics course.

Applied Emphasis

1. STAT 630, 607, 608, 636, 657, 659
2. At least one additional approved statistics courses.
3. At least one course from a supporting field.

Ph.D. Emphasis

1. STAT 610, 611,612, 613, 614
2. At least two additional statistics courses from the list of traditional courses identified in the PhD Program.

B. Form an advisory committee and complete a thesis under the direction of the chairman of the advisory committee. The Department does not insist that this represent an original contribution to the field of statistics. It is intended to train the student in carrying out independently a piece of research; this may represent an application of existing statistical methods in a new area or a comparative evaluation of statistical methods.

C. Pass at least one part of the qualifying exam (see below). Students participating in an internship are given credit for passing the methods part of the qualifying exam at the master's level.

D. Pass a final oral examination. This examination is concerned with the student's coursework and thesis. It is administered by the student's advisory committee.

Master's Diagnostic and Qualifying Examination

The master's diagnostic and qualifying examination consists of two parts: (1) basic statistical methods and (2) basic statistical theory. Each part is evaluated with the performance judged to be “Pass at the Ph.D. level,” “Pass at the Master's level,” or “Fail.” To receive a Master's Degree, a student must take and pass at least one of the two parts of the exam at the Master's or Ph.D. level.

The qualifying exam is offered twice a year - prior to the beginning of the fall semester and prior to the beginning of the spring semester, and must be taken at the earliest possible time after the student has completed the required courses in item A.1 of the Master of Science requirements. This must be within 12 months of entry into the program. Any exception to this time limit must be obtained in writing from the head of the Department.

If a student plans to pursue a Ph.D., both parts of the qualifying examination must be taken according to the same time limit as in the previous paragraph. Both parts must be passed at the Ph.D. level before the student may take the Ph.D. preliminary examination.

The results of a student's examination are reported to the faculty of the Statistics Department. If the student's performance is judged to be deficient, the examination may be retaken the next time it is offered. Only one retake of the examination is allowed.

Doctor of Philosophy Program

The breadth of the field of statistics as well as the frontiers of knowledge in a particular research area are emphasized in the Ph.D. program. The student seeking a Ph.D. in statistics is required to fulfill the following requirements:

A. Coursework. Note that STAT 601, 609, 619, 651, 652, 653, 656 and 667 may not be used to fulfill any of the coursework requirements listed below.

1. STAT 604, 610, 611, 612, 613, 614, 620, 641 and 642.
2. At least four courses from the traditional course list provided below.
3. At least four courses from the advanced topics course list provided below.
4. Two semester credit hours of statistical consulting experience (STAT 684) earned in a minimum of two semesters. Rules governing acceptable methods for completing this requirement are given below in Item B.
5. Four semester credit hours of STAT 681.
6. A sufficient number of semester credit hours of research, STAT 691.
7. A total of at least 96 semester credit hours beyond a Bachelor's degree or 64 semester credit hours beyond a Master's degree.

Traditional Course List

605, 606, 607, 608, 615, 616, 617, 618, 623, 626, 627, 631, 632, 643, 644, 647, 659, 661, MATH 615, MATH 607, MATH 625, MATH 628

Advanced Topics Course List

621, 662, 665, 671, 672, 673, 674, 689 (may be taken repeatedly)

The role of courses in the Advanced Topics List is to allow students greater exposure to significant new advances in statistics. Many of these topics will be introduced through the course number STAT 689 (Special Topics). Examples of these topics include bootstrap and saddlepoint approximations, measurement error models, wavelets, and statistical genetics.

B. Consulting Experience. One semester credit hour of STAT 684 can be obtained through the completion of any of the experiences listed below.

1. One semester of service in the Statistical Consulting Center.
2. One semester of a departmentally approved internship.
3. Special experiences, with prior approval from either the Department Head or the Associate Department Head that involve the following:
   a. At least one semester of activity
   b. The application of statistical knowledge
   c. Working with non-statisticians
   d. Sufficient statistical supervision.

C. Pass both parts of the qualifying examination at the Ph.D. level. The student should note the time limits placed on when the qualifying exam must be taken (see information of page 5).

D. Form a Ph.D. advisory committee and pass the Preliminary Examination administered by the committee (see below).

E. Write a Ph.D. Dissertation and pass the final Defense of Dissertation Examination (see below). The student is also required to present the results of their research in a regularly scheduled departmental seminar.

Preliminary Examination

Once a student has decided upon an area of research, a faculty member of the Statistics Department should be found to direct the research. The student and the advisor should work together to form a Ph.D. advisory committee and to submit a degree plan to the University Office of Graduate Studies. This degree plan must be approved by the Office of Graduate Studies before the student is allowed to take the preliminary exam.

The preliminary examination consists of the following parts:

1. A written examination developed by the statistics members of the student's advisory committee. This examination is not to be taken until the student has passed both qualifying exams at the Ph.D. level. This exam may be waived at the discretion of the departmental committee members.
2. Written examinations administered by members of the student's advisory committee from outside the Statistics Department. These members may choose to waive these examinations.
3. An oral examination administered by the members of the student's advisory committee. This examination may not be taken until the student has successfully completed the first two parts of the preliminary examination, unless of course, both examinations are waived.

Note that the preliminary exam must conform to the time limits and scheduling requirements listed in the university graduate catalog. In particular, the exam is given no earlier than a date when the student is within approximately six credit hours of completion of the formal course work (i.e., all course work on the degree plan except 681, 684, and 691) or **no later than** the semester following the completion of the formal course work on the degree plan.

The Ph.D. Dissertation

After successfully completing the course work and the preliminary examination, a period of time is to be devoted to a research topic in either statistical methodology or statistical theory under the guidance of the student's advisor. The results of this research must be communicated in a written dissertation satisfying the guidelines established by the University. The research must constitute an original contribution to the science of

statistics and may derive new results in statistical theory or methodology or may be concerned with developing statistical methodology in new areas of application.

Once the student's advisor feels that the student has completed the dissertation, a final oral examination is conducted by the advisory committee in which the student defends the dissertation.

Joint Ph.D. Program

The Department of Statistics is prepared to cooperate with other departments in joint programs for a Ph.D. degree. Such programs may range from predominantly mathematical to predominantly applied, and are intended to appeal to students with Master's degrees in other fields with an interest in statistics which goes beyond a minor status but for whom a complete switch in major would be difficult and time consuming.

Texas A&M University is not specifically authorized to grant joint degrees. Individual departments are given sufficient latitude in specifying their own requirements to enable the offering of degrees which are essentially joint majors.

Degrees reading "Ph.D. in Statistics"

To earn a joint degree that reads "Ph.D. in Statistics," the student must meet the following requirements:

A. Coursework. Note that STAT 601, 609, 619, 651, 652, 653, 656 and 667 may not be used to fulfill any of the coursework requirements listed below.

1. STAT 604, 610, 611, 612, 613, 614, 620, 641, 642.
2. At least two courses from the traditional course list provided in the PhD Program description.
3. At least two courses from the advanced topics course list provided in the PhD Program description.
4. Two semester credit hours of statistical consulting experience (STAT 684) earned in a minimum of two semesters. Rules governing acceptable methods for completing this requirement are given in the PhD Program description.
5. Four semester credit hours of STAT 681.
6. At least 21 additional semester credit hours in the joint field and supporting areas as required by the joint department. At least nine semester credit hours in the joint field must be normally considered post-master's courses.
7. A minimum of at least 24 semester credit hours of research, either STAT 691 or 691 credit in the joint department.
8. A total of at least 96 semester credit hours beyond a Bachelor's degree or 64 semester credit hours beyond a Master's degree.

B. Pass both parts of the qualifying examination at the Ph.D. level.

C. Form a Ph.D. advisory committee and pass the Preliminary Examination.

D. Write a Ph.D. Dissertation and pass the final Defense of Dissertation. The student is also required to present the results of their research in a regularly scheduled departmental seminar.

Degrees in Fields Other Than Statistics

For those joint programs for degrees whose name does not include statistics, the statistics courses to be included in the degree plan should be determined by the statistics faculty serving on the student's advisory committee. These courses should total approximately 30 semester credit hours and include the statistics courses required for a Master of Science degree in statistics. At least nine of the semester credit hours should be courses normally considered to be post-master's courses.

Internship Program

Students after one year of coursework are eligible to participate in an internship with a sponsoring company, hospital, or federal agency. The internships are generally a semester's stay at the sponsor's site. If a student participates in one of the internship programs approved by the department head, then:

1. The student is given credit for one hour of STAT 684.
2. In many cases work done during the internship may be used as the basis for a Master's project. However, this project must be completed under the supervision of the chairperson of the student's advisory committee.

Faculty, 2007-2008

- **S. J. Sheather**, *Professor and Head*; Ph.D. in Statistics: LaTrobe University, 1986; development of regression diagnostics and robust and flexible regression methods, statistical models of wine quality.
- **M. T. Longnecker**, *Professor and Associate Head*; Ph.D. in Statistics: Florida State University, 1976; statistical process control and applied statistics.
- **D. Akleman**, Lecturer; Ph.D. in Agricultural Economics: Texas A&M University, 1996; time series, risk analysis, econometrics.
- **M. Boggess,** Lecturer; Ph.D. in Mathematics: University of Newcastle, 1997; competings risks in parametric, semi-parametric and non-parametric survival models; neurotoxicology.
- **J. A. Calvin**, Professor and Executive Associate VP for Research; Ph.D. in Statistics: Colorado State University, 1985; multivariate variance components estimation, experimental design, biostatistics, applied statistics.
- **J. H. Carroll**, Senior Lecturer; MS in Statistics: Texas A&M University, 1990; Statistics education.
- **R. J. Carroll**, Distinguished Professor; Ph.D. in Statistics: Purdue University, 1974; data transformations, heteroscedastic regression, measurement error models and asymptotic theory.
- **W. Chen**, Associate Professor; Ph.D. in Statistics: New York University, 2001; econometric time series analysis.
- **D. B. H. Cline**, Professor; Ph.D. in Statistics: Colorado State University, 1983; stable laws, extreme values, distribution tails, time series, stationary processes, robust and nonparametric function estimation.
- **A. Dabney**, Assistant Professor; Ph.D. in Biostatistics: University of Washington, 2006; microarrays, bioinformatics, classification methods.
- **D. B. Dahl**, Assistant Professor; Ph.D. in Statistics: University of Wisconsin, Madison, 2004; Bayesian nonparameterics, statistical genomics, Bayesian computations, statistical computing.
- **P. F. Dahm**, Professor and Graduate Advisor; Ph.D. in Statistics: Iowa State University, 1979; measurement error models, biostatistics, econometrics.
- **R. Fan**, Associate Professor; Ph.D. in Biostatistics: University of Michigan, 1998; statistical genetics and applied probability.
- **R. J. Freund**, Professor Emeritus; Ph.D. in Experimental Statistics: North Carolina State University, 1955; statistical data analysis, applications of regression and linear models.
- **C. E. Gates**, Professor Emeritus; Ph.D. in Experimental Statistics: North Carolina State University, 1955; design and analysis of experimental data, estimation of wildlife abundance and modeling non-linear growth curves.
- **M. G. Genton**, Associate Professor; PhD. in Statistics: Swiss Federal Institute of Technology, Lausanne, 1996; robustness, spatial and spatio-temporal statistics, time series, multivariate analysis, and data mining.
- **J. D. Hart**, Professor; Ph.D. in Statistics: Southern Methodist University, 1981; nonparametric function estimation, time series, bootstrap methods.

- **K. Hatfield**, Lecturer; MBA in Operations Research **:** North Texas State University, 1980; Statistics education and consulting.
- **R. R. Hocking**, Professor Emeritus; Ph.D. in Statistics: Iowa State University, 1962; regression, mixed models and multivariate analysis.
- **J. Huang**, Associate Professor; Ph.D. in Statistics: University of California, Berkeley, 1997; nonparametric and semiparametric methods, statistical function estimation using polynomial splines, survival analysis, event history analysis, analysis of longitudinal data, functional data analysis, nonlinear time series.
- **O. C. Jenkins**, Associate Professor Emeritus; Ph.D. in Statistics: Texas A&M University, 1972; statistical sampling and experimental design.
- **M. Jun**, Assistant Professor, Ph.D. in Statistics: University of Chicago, 2005; statistical methodologies, environmental problems, space-time covariance modeling, numerical model evaluation in air quality problems, combining numerical model output with observed data.
- **S. Lahiri**, Professor; Ph.D. in Statistics: Michigan State University, 1989; asymptopic expansions, environmental statistics, resampling methods, spatial statistics, small area estimation, time series, wavelets.
- **E. Li**, Assistant Professor, Ph.D. in Statistics: North Carolina State University, 2004; longitudinal data analysis, mixed models, semiparametric methods, multiple endpoints, biostatistics.
- **F. Liang**, Associate Professor, Ph.D. in Statistics: University of Hong Kong, 1998; Bayesian computation and bioinformatics.
- **Y. Ma**, Assistant Professor, Ph.D. in Statistics: Massachusetts Institute of Technology, 1999; semiparametric methods, mixed effect models with non-normally distributed random effect, skew-elliptical distributions, HIV modeling and analysis, inverse problem using Markov Chain Monte Carlo approach.
- **B. Mallick**, Professor; Ph.D. in Statistics: University of Connecticut, 1994; Bayesian nonparametric and semiparametric modeling, survival analysis, generalized linear models, neural networks, spatial statistics.
- **J. H. Matis**, Professor; Ph.D. in Statistics: Texas A&M University, 1970; biomathematics, compartmental analysis, statistical ecology and applied stochastic processes.
- **Y. Mu**, Assistant Professor, Ph.D. in Statistics: University of Illinois, Urbana-Champaign, 2005; linear and nonlinear quantile regression models, semi-parametric statistical methods, applied and computational statistics, biostatistics.
- **U. Müller-Harknett**, Assistant Professor; Ph.D. in Mathematics: University of Bremen, 1997; non- and semi-parametrics, efficient estimation.
- **H. J. Newton**, Professor and Dean; Ph.D. in Statistics: State University of New York at Buffalo, 1975; time series analysis, computational statistics.
- **E. Parzen**, Distinguished Professor; Ph.D. in Mathematics: University of California (Berkeley), 1953; statistical science-developing statistical methods for time series analysis, data analysis, and change analysis.
- **L. J. Ringer**, Professor Emeritus; Ph.D. in Statistics: Texas A&M University, 1966; applied statistics, survey sampling and reliability.

- **H. Schmiediche,** Senior Lecturer; Ph.D. in Statistics: Texas A&M University, 1993; computational statistics.
- **M. Sherman**, Professor; Ph.D. in Statistics: University of North Carolina at Chapel Hill, 1992; biostatistics, spatial statistics.
- **S. Sinha**, Assistant Professor, Ph.D. in Statistics: University of Florida, 2004; methodological research: missing data technique, measurement error, splines, Bayesian methods: parametric and nonparametric methods, application: epidemiology, genetic epidemiology.
- **W. B. Smith**, Professor Emeritus; Ph.D. in Statistics: Texas A&M University, 1967; multivariate analysis, missing data methods, correspondence analysis.
- **F. M. Speed**, Professor and Associate Dean for Technology Mediated Instruction; Ph.D. in Statistics: Texas A&M University, 1969; computational statistics, biostatistics, linear models, applied statistics, multivariate methods, environmental and industrial statistics, teaching statistics real time.
- **C. H. Spiegelman**, Professor; Ph.D. in Statistics & Applied Mathematics: Northwestern University, 1976; calibration curves, measurement error models, applied statistics, especially to chemistry.
- **S. Subba Rao**, Assistant Professor; Ph.D. in Statistics: University of Bristol, UK, 2001; time series, nonstationary processes, nonlinear processes, recursive online algorithms, spatio-temporal models.
- **E. Toby**, Lecturer; Ph.D. in Mathematics: University of California, San Diego, 1988; biostatistics, diffusions processes.
- **M. Vannucci**, Professor; Ph.D. in Statistics, University of Florence, Italy, 1996; wavelets, nonparametric estimation, smoothing of time series, Bayesian methods, variable selection, statistical computing.
- **N. Wang**, Professor; Ph.D. in Statistics: Cornell University, 1992; semiparametric methods, regression, missing data.
- **S. Wang**, Professor; Ph.D. in Statistics: University of Texas at Austin, 1988; saddlepoint approximations, bootstrap methods, measurement error models, survey sampling, biostatistics.
- **T. E. Wehrly**, Professor; Ph.D. in Statistics: University of Wisconsin, 1976; stochastic models, directional data, mathematical statistics, nonparametric function estimation.
- **W. West**, Associate Professor; Ph.D. in Statistics: Rice University, 1994; computational and graphical statistics, toxicological risk assessment, Nonparametric statistics, stochastic modeling.
- **J. Wickersham**, Assistant Lecturer; MS in Statistics: Texas A&M University, 2006; Statistical education, biostatistics, linear models, stochastic processes.
- **L. Zhu**, Assistant Professor; Ph.D. in Biostatistics: University of Minnesota, 2000; spatial statistics and Bayesian modeling.
- **J. Zinn**, Professor of Mathematics and Statistics; Ph.D. in Mathematics: University of Wisconsin, 1972; empirical processes, bootstrapping.

Undergraduate Course Offerings

201. Elementary Statistical Inference. (3-0). Credit 3. Data collection, tabulation, and presentation. Elementary description of the tools of statistical inference; probability, sampling, and hypothesis testing. Applications of statistical techniques to practical problems. May not be taken for credit after any other course in statistics or INFO 303 has been taken.

211. Principles of Statistics I. (3-0). Credit 3. Introduction to probability and probability distributions. Sampling and descriptive measures. Inference and hypothesis testing. Linear regression, analysis of variance. Prerequisite: MATH 152 or 172.

212. Principles of Statistics II. (3-0). Credit 3. Continuation of STAT 211. Design of experiments, model building, multiple regression, nonparametric techniques, contingency tables, and short introductions to response surfaces, decision theory and time series data.

301. Introduction to Biometry. (3-0). Credit 3. Intended for students in animal sciences. Introduces fundamental concepts of biometry including measures of location and variation, probability, tests of significance, regression, correlation, and analysis of variance which are used in advanced courses and are being widely applied to animal-oriented industry. Credit will not be allowed for more than one of STAT 301, 302 or 303. Prerequisite: MATH 141 or 166 or equivalent.

302. Statistical Methods. (3-0). Credit 3. Intended for undergraduate students in the biological sciences and agriculture (except agricultural economics). Introduction to concepts of random sampling and statistical inference; estimation and testing hypotheses of means and variances; analysis of variance; regression analysis; contingency tables. Credit will not be allowed for more than one of STAT 301, 302 or 303. Prerequisite: MATH 141 or 166 or equivalent.

303. Statistical Methods. (3-0). Credit 3. Intended for undergraduate students in the social sciences. Introduction to concepts of random sampling and statistical inference, estimation and testing hypotheses of means and variances, analysis of variance, regression analysis, contingency tables. Credit will not be allowed for more than one of STAT 301, 302 or 303. Prerequisite: MATH 141 or 166 or equivalent.

307. Sample Survey Techniques. (3-0). Credit 3. Concepts of population and sample; the organization of a sample survey; questionnaire design. Basic survey designs and computation of estimates and variances. Prerequisites: STAT 301, 302, 303, or INFO 303.

407. Principles of Sample Surveys. (3-0). Credit 3. Principles of sample surveys and survey design; techniques for variance reduction; simple, stratified and multi-stage sampling; ratio and regression estimates; post-stratification; equal and unequal probability sample. Prerequisite: STAT 212.

408. Introduction to Linear Models. (3-0). Credit 3. Intro to the formulation of linear models and the estimation of the parameters of such models, with primary emphasis on least squares. Application to multiple regression and curve fitting. Prerequisites: MATH 304; STAT 212.

410. Algorithms and Applications of Optimization. (3-0). Credit 3. Unconstrained optimization, equality and inequality constraints, linear programming, network flows, and integer programming. Computer algorithms for practical problems in business, statistics, and operations research. Prerequisite: INFO 303. Cross-listed with INFO 410.

414. Mathematical Statistics. (3-0). Credit 3. Introduction to the mathematical theory of statistics, including random variables and their distributions, expectation and variance, point estimation, confidence intervals and hypothesis testing. Prerequisite: MATH 221, 251 or 253.

415. Mathematical Statistics II. (3-0). Credit 3. Continuation of the mathematical theory of statistics, including sampling and limiting distributions, principles for statistical inference and inference for bivariate and categorical data. Prerequisite: STAT 414.

485. Problems. Credit 1 to 6. Special problems in statistics not covered by another course in the curriculum. Work may be in theory or methodology. Prerequisite: Approval of instructor.

489. Special Topics in Statistics. Credit 1 to 4. Selected topics in an identified area of statistics. Topics may be of interest to applied mathematics majors as well as majors in other disciplines. May be repeated for credit. Prerequisite: Approval of instructor.

Graduate Course Offerings

601. Statistical Analysis. (3-2). Credit 4. For students in engineering, physical, and mathematical sciences. Introduction to probability, probability distributions, and statistical inference; hypotheses testing using t and F tests; introduction to methods of analysis such as tests of independence, regression, analysis of variance with some consideration of planned experimentation. Prerequisite: MATH 152 or 172.

604. Special Problems in Statistical Computations and Analysis. (3-0). Credit 3. Computer algorithms for programming; statistical analysis, efficient uses of existing statistical computer programs, generation of random numbers and statistical variables, programming of simulation studies, selected topics in statistical analysis not covered in STAT 601 or 652. Prerequisites: CPSC 201; STAT 601 or concurrent enrollment in STAT 610 and 641.

605. Advanced Topics in Computational Statistics. (3-0). Credit 3. Algorithms in constrained and unconstrained optimization; time series analysis; multivariate analysis; use and development of modern graphical exploratory data analysis; methods for interfacing programs with existing computer environments. Prerequisites: STAT 604.

606. Design of Experiments. (3-0). Credit 3. Fundamental concepts in the design of experiments, justification of linear models, randomization, principles of blocking, and the use of concomitant observations; construction and analysis of basic designs including confounding, fractional replication, composite designs, and incomplete block designs. Prerequisite: STAT 619 or STAT 642 or approval of instructor.

607. Sampling. (3-0). Credit 3. Planning, execution, and analysis of sampling from finite populations; simple, stratified, multistage, and systematic sampling; ratio estimates. Prerequisite: STAT 601 or 652 or concurrent enrollment in STAT 641.

608. Regression Analysis. (3-0). Credit 3. Multiple, curvilinear, nonlinear, robust, logistic and principal components regression analysis. Regression diagnostics, transformations, analysis of covariance. Prerequisite: STAT 601 or 641.

609. Order Statistics and Non-Parametric Methods. (3-0). Credit 3. Application of distribution-free and rank procedures for estimation, confidence interval construction and hypothesis testing; both exact and approximate methods considered. Prerequisite: STAT 601 or 641 or 652.

610. Theory of Statistics-Distribution Theory. (3-0). Credit 3. Brief introduction to probability theory; distributions and expectations of random variables, transformations of random variables, and order statistics; generating functions and basic limit concepts. Prerequisite: MATH 409 or concurrent enrollment in MATH 409.

611. Theory of Statistics-Inference. (3-0). Credit 3. Theory of estimation and hypothesis testing; point estimation, interval estimation, sufficient statistics, decision theory, most powerful tests, likelihood ratio tests, chi-square tests. Prerequisite: STAT 610 or equivalent.

612. Theory of Linear Models. (3-0). Credit 3. Theory of least squares, theory of general linear hypotheses and associated small sample distribution theory, analysis of multiple classifications. Prerequisites: MATH 423; STAT 611 or equivalent.

613. Advanced Theory of Statistical Inference. (3-0). Credit 3. General theory of estimation and sufficiency including maximum likelihood and minimum variance estimation; Neyman-Pearson theory of testing hypotheses; elements of decision theory. Prerequisites: MATH 409; STAT 611.

614. Statistical Applications in Probability. (3-0). Credit 3. Basic probability concepts; convergence and limiting distributions; sample statistics and transformations; Gaussian and other stochastic processes; stationarity and ergodicity; weak convergence. Prerequisite: STAT 610.

615. Introduction to Stochastic Processes. (3-0). Credit 3. Survey of the theory of Poisson processes, discrete and continuous time Markov chains, renewal processes, birth and death processes, diffusion processes, and covariance stationary processes. Prerequisites: MATH 409; STAT 611.

616. Multivariate Analysis. (3-0). Credit 3. Multivariate normal distributions and multivariate generalizations of classical test criteria, Hotelling's T^2, discriminant analysis and elements of factor and canonical analysis. Prerequisites: STAT 611, 612.

617. Theory of Sampling. (3-0). Credit 3. General randomization theory of multistage sampling of finite populations, sampling with and without replacement and with equal and unequal probabilities, ratio and regression estimates, analytic studies and multiframe problems. Prerequisites: STAT 607 and 611; approval of instructor.

618. Advanced Experimental Design. (3-0). Credit 3. Randomization theory of experimental design. General analysis of experimental design models; role of Galois fields and their related finite geometries in the general p^n factorial representation, confounding and fractional replication; construction and analysis of balanced and partially balanced incomplete block designs. Designs for special situations. Prerequisites: STAT 606, 611, 612.

619. Analysis of Variance. (3-0). Credit 3. Extensive treatment of the analysis of variance for the analysis of designed experiments: randomized blocks, Latin squares, split plot, and factorials; evaluation of treatment response: multiple comparisons, orthogonal contrasts, and regression. Analysis using concomitant information; some consideration of the analysis of non-orthogonal data. Prerequisite: STAT 601 or 652.

620. Statistical Large Sample Theory. (3-0). Credit 3. Transformations of statistics; statistical functionals including influence curves and M, L, and R estimators; asymptotic properties of estimators; asymptotic properties of tests; U-statistics; Edgeworth expansions and the bootstrap. Prerequisites: STAT 613 and 614 or approval of instructor.

621. Advanced Stochastic Processes. (3-0). Credit 3. A second course in stochastic processes, at the non-measure theoretic level. Topics include various types of continuous time processes such as discrete Markov process, Brownian motion and diffusions. Prerequisite: STAT 615 or equivalent.

623. Statistical Methods for Chemistry. (3-0). Credit 3. Chemometrics topics of process optimization, precision and accuracy; curve fitting; chi-squared tests; multivariate calibration; errors in calibration standards; statistics of instrumentation. Prerequisites: STAT 601 or STAT 652 or STAT 641 or approval of instructor.

625. Statistical Methods in Reliability. (3-0). Credit 3. Statistical theories pertinent to solution of engineering problems in reliability introduced, established, and applied; distribution and failure theory including exponential, log normal, gamma, and Weibull; parameters studied include mean time to failure, failure rate, variances, and standard deviations, confidence limits, and tests of hypotheses. Prerequisites: INEN 614; STAT 601 or 642; or approval of instructor.

626. Methods in Time Series Analysis. (3-0). Credit 3. Introduction to statistical time series analysis; autocorrelation and spectral characteristics of univariate, autoregressive, moving average models; identification, estimation and forecasting. Prerequisite: STAT 601 or 642 or approval of instructor.

627. Nonparametric Function Estimation. (3-0). Credit 3. Nonparametric function estimation; kernel, Fourier series and spline methods; automated smoothing methods including cross-validation; large sample distributional properties of estimators; recent advances in function estimation. Prerequisites: STAT 611.

630. Overview of Mathematical Statistics. (3-0). Credit 3. Basic probability theory including distributions of random variables and their expectations. Intro to theory of statistical inference from likelihood point of view including maximum likelihood estimation, confidence intervals, and likelihood ratio tests. Intro to Bayesian methods. Prerequisite: MATH 221, 251, 253. Textbook: *Mathematical Statistics and Data Analysis*. Author: Rice.

631. Statistical Methods for Finance. (3-0). Credit 3. Regression and the capital asset pricing model, statistics for portfolio analysis, resampling, time series models, volatility models, option pricing and Monte Carlo methods, copulas, extreme value theory, value at risk, spline smoothing of term structure. Prerequisite: STAT 610, 611, 608.

632. Statistical Decision Theory. (3-0). Credit 3. Fundamentals of Bayesian inference, single and multi-parameter models, Bayesian regression and linear models, posterior simulation, MCMC, hierarchical models. Prerequisite: STAT 611 or approval of instructor.

634. Response Surface Design and Analysis. (3-0). Credit 3. Definition of response surface and relation to multiple regression; ridge analysis; first, second and third order designs for response surface estimation; optimization of response surface designs for various criteria; the Box-Draper theory, and EVOP. Prerequisites: STAT 606, 608 or 642.

635. Application of Stochastic Processes to the Natural Sciences. (3-0). Credit 3. Basic concepts, random walks, Markov chains, branching processes, Markov processes in continuous time, homogeneous and nonhomogeneous processes, multi-dimensional processes, queuing processes, epidemic processes, competition and predation, diffusion and non-Markovian processes. Prerequisites: STAT 611 or approval of instructor.

636. Methods in Multivariate Analysis. (3-0). Credit 3. Multivariate extensions of the chi-square and t-tests, discrimination and classification procedures. Applications to diagnostic problems in biological, medical, anthropological, and social research; multivariate analysis of variance, principal component and factor analysis, canonical correlations. Prerequisites: MATH 423, STAT 642 or 652.

637. Statistical Methods in Ecology. (3-0). Credit 3. Derivation and application of statistical distributions for sampling models, birth-death processes, time intervals, size models, heterogeneous and clustered models in ecology; stochastic models for population growth, competition and predation and multi-dimensional processes. Prerequisites: STAT 601 or 642 or 652 with approval of instructor.

641. Statistical Methods I. (3-0). Credit 3. An application of the various disciplines in statistics to data analysis, introduction to statistical software; demonstration of interplay between probability models and statistical inference. Prerequisites: Concurrent enrollment in STAT 610.

642. Statistical Methods II. (3-0). Credit 3. Design and analysis of experiments; scientific method; graphical displays; analysis of nonconventional designs and experiments involving categorical data. Prerequisites: STAT 610, 641.

643. Biostatistics I. (3-0). Credit 3. Bio-assay for quantitative and quantal responses; statistical analysis of contingency, including effect estimates, matched samples and misclassification. Prerequisites: STAT 608 and 642.

644. Biostatistics II. (3-0). Credit 3. Generalized linear models; survival analysis with emphasis on semiparametric models and methods. Prerequisites: STAT 643.

647. Spatial Statistics. (3-0). Credit 3. Spatial correlation and its effects; spatial prediction (kriging); spatial regression; analysis of point patterns (tests for randomness, modeling patterns); sub-sampling methods for spatial data. Prerequisite: STAT 601 or STAT 611 or equivalent.

651. Statistics in Research I. (3-0). Credit 3. For graduate students in other disciplines. A non-calculus exposition of the concepts, methods, and usage of statistical data analysis. T-tests, analysis of variance, and linear regression. Prerequisite: MATH 102 or equivalent.

652. Statistics in Research II. (3-0). Credit 3. Continuation of STAT 651. Concepts of experimental design, individual treatment comparisons, randomized blocks and factorial analysis, multiple regression, chi-square tests and a brief introduction to covariance, non-parametric methods, and sample surveys. Prerequisite: STAT 651.

653. Statistics in Research III. (3-0). Credit 3. Currently listed as STAT 689. The analysis of messy and complex data sets using analysis of variance, analysis of covariance and regression analysis. Transformations; regression diagnostics; nonlinear, robust, logistic and principal components regression; structural equations. Prerequisite: STAT 652.

655. Forecasting Methods and Applications. (3-0). Credit 3. Development of statistical methods for describing business trends and economic fluctuations, generation of forecasts and error limits, evaluation of forecasts; applications to economic data arising in business. Prerequisite: STAT 651 or approval of instructor. Cross-listed with INFO 655.

657. SAS Programming. (3-0). Credit 3. Programming with SAS/IML, programming in SAS Data step, advanced use of various SAS procedures. Prerequisite: STAT 642.

659. Applied Categorical Data Analysis. (3-0). Credit 3. Introduction to analysis and interpretation of categorical data using ANOVA/regression analogs; includes contingency tables, loglinear models, logistic regression; use of computer software such as SAS, GLIM, SPSSX. Prerequisite: STAT 601 or 641 or 652 or equivalent.

661. Statistical Genetics. (3-0), Credit 3. Basic concepts in human genetics, sampling designs, gene frequency estimation, Hardy-Weinberg equilibrium, linkage disequilibrium, association and transmission disequilibrium test studies, linkage and pedigree analysis, segregation analysis, polygenic models, DNA sequence analysis. Prerequisites: STAT 610 and 611.

662. Advanced Statistical Genetics. (3-0). Credit 3. Newton's method and scoring in genetics, counting methods and the EM algorithm, genetic identity coefficients, descent graph methods, molecular phylogeny, models of recombination, sequence analysis, diffusion processes, linkage disequilibrium mapping of quantitative trait loci. Prerequisite: STAT 661.

665. Applications of Wavelets. (3-0). Credit 3. Wavelet theory, wavelet-based statistical methods, smoothing of noisy signals, estimation of function data and representation of stochastic processes. Some emphasis on Bayesian procedures. Prerequisite: STAT 611.

667. Statistics for Advanced Placement Instruction. (1-0). Credit 1. Introduction to the topics expected to be covered in an approved course in AP Statistics.

671. Methods of Statistical Data Modeling I. (3-0). Credit 3. Introduction to new methods of statistical analysis, especially statistical data modeling, exploratory data analysis, adaptive and robust estimation. Prerequisite: STAT 611 or equivalent.

672. Methods of Statistical Data Modeling II. (3-0). Credit 3. Continuation of STAT 671. Exploratory data analysis, multiparameters, nonparametric regression, censored sample analysis, and confirmatory statistical inference. Prerequisite: STAT 611, 671.

673. Time Series Analysis I. (3-0). Credit 3. An introduction to diverse modes of analysis now available to solve for univariate time series; basic problems of parameter estimation, spectral analysis, forecasting and model identification. Prerequisite: STAT 611 or equivalent.

674. Time Series Analysis II. (3-0). Credit 3. Continuation of STAT 673. Multiple time series, ARMA models, test of hypotheses, estimation of spectral density matrix, transfer function and forecasting. Prerequisites: STAT 673.

681. Seminar. Credit 1. Oral presentations of special topics and current research in statistics. Prerequisite: Graduate classification in statistics.

684. Professional Internship. Credit 1 to 3. Practicum in statistical consulting for students in Ph.D. program. Students will be assigned consulting problems brought to the Department of Statistics by researchers in other disciplines. Prerequisite: STAT 641 and 642.

685. Problems. Credit 1 to 6. Individual instruction in selected fields in statistics; investigation of special topics not within scope of thesis research and not covered by other formal courses. Prerequisites: Graduate classification; approval of instructor.

689. Special Topics in Statistics. Credit 1 to 4. Selected topics in an identified area of statistics. Open to non-majors. May be repeated for credit. Prerequisite: Approval of instructor.

691. Research. Credit 1 or more. Research for thesis or dissertation. Prerequisite: Graduate classification.

Courses By Area:

Methods	Mathematical Statistics	Linear Models	Time Series	Biostatistics/ Bioinformatics	Service
STAT 604 - Special Problems in Stat Comp. & Analysis	STAT 610 - Theory of Stat Dist. Theory	STAT 606 - Design of Experiments	STAT 626 - Methods in Time Series Analysis	STAT 643 - Biostatistics I	STAT 601 - Statistical Analysis
STAT 605 - Advanced Topics in Computational Statistics	STAT 611 - Theory of Stat Inference	STAT 608 - Least Squares and Regression Analysis	STAT 673 - Time Series Analysis I	STAT 644 - Biostatistics II	STAT 635 - Application of Stochastic Processes to Natural Sci.
STAT 607 - Sampling	STAT 613 – Advanced Theory of Statistics	STAT 612 - Theory of Linear Models	STAT 674 - Time Series Analysis II	STAT 661 - Statistical Genetics	STAT 637 - Statistical Methods in Ecology
STAT 623 - Statistical Methods for Chemistry	STAT 614 – Stat Applic. in Probability	STAT 616 - Multivariate Analysis			STAT 651 - Statistics in Research I
STAT 641 - Statistical Methods I	STAT 615 - Stochastic Processes	STAT 618 - Advanced Experimental Design			STAT 652 - Statistics in Research II
STAT 642 - Statistical Methods II	STAT 620 - Statistical Large Sample Theory	STAT 636 - Methods in Multivariate Analysis			STAT 653 - Statistics in Research III
STAT 647 - Spatial Statistics	STAT 621 - Adv. Stoch. Processes				
STAT 657 - SAS Program.	STAT 627 - Nonparametric Function Estimation				
STAT 659 - Applied Categorical Data Analysis	STAT 630 - Overview of MATH STAT				
	STAT 632 - Statistical Decision Theory				

Scheduling Coursework

The following list indicates the Department's usual schedule of course offerings. Those courses marked even or odd are offered only in even numbered and odd numbered years, respectively. Because several courses are offered only every other year, it is important to plan a program of study and schedule of courses as early as possible.

Course	Semester(s) Offered	Course	Semester(s) Offered
201	1, 2	625	4
211	1, 2, 3	626	3
212	1, 2	627	2 (odd)
301	1, 2	630	1
302	1, 2, 3	631	2
303	1, 2, 3	632	1
307	1, 2	634	4
407	1	635	4
408	2	636	1
410	crosslisted, see INFO 410	637	4
414	1	641	1
415	2	642	2
601	1, 2, 3	643	1
604	1	644	2
605	4	647	1
606	4	651	1, 2, 3
607	1	652	1, 2, 3
608	2	653	1
609	4	655	crosslisted, see INFO 655
610	1	657	2
611	2	659	2
612	1	661	2
613	1	662	1 (odd)
614	2	665	2 (odd)
615	1	667	3
616	2	671	1 (odd)
617	4	672	4
618	4	673	1 (even)
619	4	674	4
620	1	681	1, 2
621	2 (odd)	684	1, 2, 3
623	2	689	1, 2

1: Fall, 2: Spring, 3: Summer, 4: As resources allow.