**STATISTICS (3470)**

**3470:550 Probability (3 Credits)**
Prerequisite: Appropriate background is one semester of calculus or equivalent. Introduction to probability, random variables and probability distributions, expected value, sums of random variables, Markov processes. May not be used to meet graduate major requirements in statistics.

**3470:551 Theoretical Statistics I (3 Credits)**
Prerequisite: Three semesters of calculus or equivalent. Sequential (part 1 of 2). Elementary combinatorial probability theory, probability distributions (discrete and continuous), expectation and variance, moments and moment generating functions, bivariate and multivariate probability distributions, conditional distributions and independence, distributions of functions of random variables (univariate and bivariate), order statistics and their distributions.

**3470:552 Theoretical Statistics II (3 Credits)**
Prerequisite: Three semesters of calculus or equivalent. Sequential (2nd of 2 parts). Sampling distributions, point estimation and properties of point estimators, sufficiency, Rao-Blackwell method and MVUE, methods of obtaining point estimators, interval estimation, hypothesis testing, power and sample size calculation, Neyman-Pearson theory of optimal tests.

**3470:553 Theoretical Statistics I Supplement (1 Credit)**
Prerequisite: Appropriate background is at least one semester of calculus-based probability theory and mathematical statistics at the 3470:451 level. The course goes more in-depth on some of the material covered in 3470:451 but not emphasized. For ready reference, the topics covered in Stat-451 are elementary combinatorial probability theory, probability distributions (discrete and continuous), expectation and variance, bivariate and multivariate distributions and distributions of functions of random variables. Some study material and problems from outside the book will be included.

**3470:554 Theoretical Statistics II Supplement (1 Credit)**
Prerequisite: 3470:553 or permission. Topics in theoretical statistics that are a sequel to the coverage of 3470:451 and 3470:551 but are still not covered in 3470:452 (including a proof of the central limit theorem, large-sample properties of maximum likelihood estimators, convergence in probability and convergence in distribution, completeness and ancillarity). Some study material and problems from outside the book will be included.

**3470:561 Applied Statistics (4 Credits)**
Prerequisite: Appropriate background is two semesters of calculus or equivalent. Applications of statistical theory to natural and physical sciences and engineering, including probability distributions, interval estimation, hypotheses testing (parametric and nonparametric), and simple linear regression and correlation. May not be used to meet graduate major requirements in statistics.

**3470:562 Applied Regression and ANOVA (4 Credits)**
Prerequisite: Appropriate background is one semester of applied statistics or equivalent. Applications of the techniques of regression and multifactor analysis of variance. May not be used to meet graduate major requirements in statistics.

**3470:565 Design of Sample Surveys (3 Credits)**
(Appropriate background is one semester of applied statistics or equivalent.) Design and analysis of frequently used sample survey techniques.

**3470:569 Reliability Models (3 Credits)**
(Appropriate background is one semester of applied statistics or equivalent.) Selected topics in reliability modeling including parametric and nonparametric models, competing modes of failure, censored data and accelerated life models.

**3470:570 Biostatistics and Epidemiology (3 Credits)**
Prerequisite: Appropriate background is one semester of applied statistics or equivalent. Biostatistics and Epidemiological methods for biological and medical studies, including ANOVA, analysis of repeated measures, disease-related measures, log-linear models, and clinical trials.

**3470:571 Introduction to Actuarial Science (3 Credits)**
(Prerequisite: 550 or equivalent) Introduction to actuarial science and financial mathematics used in actuarial science. Topics include time value of money, annuities, loans, bonds, cash flows and immunizations, interest rate swaps.

**3470:572 Actuarial Models (3 Credits)**
(Prerequisite: 3470:461 or 3470:561) Study of theory, frequency and aggregate models used in actuarial applications. Calibration and evaluation, credibility procedures, fundamental principles of pricing in short-term insurance coverage.

**3470:573 Survival Analysis (3 Credits)**
Prerequisite: Applied Statistics (3470:461 or 3470:561) or equivalent. Basic concepts in survival analysis, censoring and data truncation, estimation of survival models, nonparametric hazard and survival function estimation, comparing survival times between groups.

**3470:575 Foundations of Statistical Quality Control (3 Credits)**
(Prerequisite: 550 or equivalent) Course provides a solid foundation in the theory and applications of statistical techniques widely used in industry.

**3470:576 Bayesian Statistics (3 Credits)**
(Prerequisite: 3470:461 or 3470:561) Basic concepts in Bayesian theory, sampling methods, MCMC, hierarchical modeling. Computer applications of Bayesian statistics to natural and physical sciences and engineering.

**3470:577 Time Series Analysis (3 Credits)**
Prerequisite: Appropriate background is one semester of probability, or one semester of theoretical statistics, or one semester of applied statistics or equivalent. Stationarity. ARIMA modeling with seasonality. Parameter estimation, model diagnostics and forecasting. Regression with autocorrelated errors. Cointegration and multivariate ARMA models. Heteroscedasticity and long-memory models.

**3470:580 Statistical Data Management (3 Credits)**
(Prerequisite: 461 or equivalent) Students learn data organization and structures, design of statistical databases, statistical software analysis, importing and exporting of data between software, and missing data analysis.

**3470:582 Statistical Data Management Supplement (1 Credit)**
Prerequisite: Appropriate background is one semester of familiarity with statistical software packages such as MINITAB, SPSS, SAS and R or permission. This course is solely intended to teach Master's students coming from the department's undergraduate curriculum how to manage (edit, search and manipulate with) data on the computer with a number of statistical software packages widely used in the academic and industry (above and beyond what they have learned at the undergraduate level). Homework assignments and data analysis projects are given.
3470:583 Advanced Statistical Computing (3 Credits)
Prerequisite: Appropriate background is one semester of applied statistics or equivalent. Topics include data management, random number generation, resampling methods, numerical optimization, Markov Chain Monte Carlo, smoothing methods, data mining: clustering and classification.

3470:584 Introduction to Machine Learning (3 Credits)

3470:585 Applied Analytics-Decision Trees (3 Credits)
Prerequisite: 3470:561. Selected topics in predictive modeling using CHAID, Classification and Regression Trees, Logistic Regression and Neural Networks.

3470:586 Spatial-temporal Statistics (3 Credits)
(Appropriate background is one semester of applied statistics or equivalent). Basic concepts of geostatistic, point pattern, area unit. Spatial-temporal modeling in high dimensional data. Computer applications to natural and physical sciences and engineering.

3470:589 Topics in Statistics (1-3 Credits)
(May be repeated for a total of six credits) Prerequisite: permission. Selected topics in advanced statistics, including quality control, reliability, sampling techniques, decision theory, advanced inference, stochastic processes and others.

3470:591 Workshop in Statistics (1-3 Credits)
(May be repeated with change of topic) Group studies of special topics in statistics. May not be used to meet undergraduate or graduate major requirements in mathematics and statistics. May be used for elective credit only.

3470:595 Statistical Consulting (1-3 Credits)
Prerequisite: 3470:580 or permission. Students will be assigned to work with an instructor on current projects in the Center for Statistical Consulting. May be repeated for a total of 4 credits; however, only 2 credits will count toward major requirements. Does not count for elective credit for math science department majors.

3470:650 Advanced Probability & Stochastic Processes (3 Credits)
Prerequisite: 3470:651. Random walk, distributions, unlimited sequence of trials, laws of large numbers, convolutions, branching processes, renewal theory, Markov chains, time-dependent stochastic processes.

3470:651 Probability & Statistics (4 Credits)
(Appropriate background is three semesters of Calculus or equivalent.) Probability, random variables, moments and generating functions, random vectors, special distributions, limit theorems, sampling, point estimation, hypothesis testing, confidence estimation.

3470:652 Advanced Mathematical Statistics (3 Credits)
Prerequisite: 3470:651. Convergence of random variables, the Central Limit Theorem; theory of estimation; theory of hypothesis testing; the multivariate normal density; introduction to linear models; Bayesian statistics.

3470:655 Linear Models (3 Credits)
(Appropriate background is Linear Algebra or 3470:651 or equivalent.) General linear model in matrix notation, general linear hypothesis, regression models, experimental design models, analysis of variance and covariance, variance components.

3470:661 Statistics for the Life Sciences (3 Credits)
Prerequisite: college level algebra or equivalent. Data description and presentation, probability applications in the life sciences (including sensitivity, specificity, relative risk), principles and application of statistical inference, ANOVA, correlation and regression. May not be used to meet graduate major requirements in statistics.

3470:663 Experimental Design (3 Credits)
(Appropriate background is one semester of applied statistics or equivalent.) Selected topics in experimental design including random and fixed effects, nested designs, split plot designs, confounding, fractional factorials, Latin squares, and analysis of covariance.

3470:665 Regression (3 Credits)
(Appropriate background is one semester of applied statistics or equivalent.) Correlation, simple and multiple linear regression: least squares, matrix notation, model building and checking estimation, hypothesis testing, outliers, influence, multicollinearity, transformations, categorical regressors; logistic regression.

3470:666 Nonparametric Statistics - Methods (3 Credits)
(Appropriate background is one semester of applied statistics or equivalent.) Theory and practice using techniques requiring less restrictive assumptions. Nonparametric analogues to t- and F-tests, ANOVA, regression and correlation. Computer applications.

3470:667 Factor Analysis (3 Credits)
(Appropriate background is one semester of applied statistics or equivalent.) Theory and techniques for identifying variables through use of principal components and factor analysis. Identification of groups using cluster analysis. Computer applications.

3470:668 Multivariate Statistical Methods (3 Credits)
(Appropriate background is two semesters of applied statistics or equivalent.) Multivariate techniques including distance concept, Hotelling T2, multivariate ANOVA, regression and correlation, linear contrasts, factorial experiments, nested and repeat measure designs, Bonferroni X2 tests, linear discrimination analysis, canonical correlations, application.

3470:669 Regression Encore (1 Credit)
Prerequisite: 3470:462 or 3470:562. Some advanced topics in regression analysis (beyond those covered in 3470:462 and 3470:562) that are usually included in the graduate-level regression analysis course 3470:665.

3470:670 Advanced Biostatistics (3 Credits)
Prerequisite: 3470:570. Statistical issues and methods for biological, medical and health sciences including: clinical trials, sample size, power, log-linear models, survival analysis, and bioassay. Computer applications.

3470:675 Response Surface Methodology (3 Credits)
(Appropriate background is two semesters of applied statistics or equivalent.) First and second order response designs, efficient experimental plans, methods for the analysis, and optimization of response functions.

3470:689 Advanced Topics in Statistics (1-3 Credits)
(May be repeated for a total of six credits) Prerequisite: 3470:651. Selected topics in statistics including concepts in order, statistics, advanced inference, sequential analysis, stochastic processes, reliability theory, Bayesian statistics and regression.

3470:692 Statistics Masters Paper (2-3 Credits)
Prerequisite: permission of advisor. Supervised writing of paper based on a terminal project and its presentation in front of an audience. For Masters of Science in Statistics (Non-thesis Option). A minimum of 2 credit-hours and a maximum of 3 credit-hours.
Practicum in Statistics & Mathematics (1-3 Credits)
Prerequisite: graduate teaching assistant or permission. Training and experience in college teaching of statistics. May not be used to meet degree requirements. Credit/non-credit.

Individual Reading: Statistics (1-3 Credits)
Prerequisites: graduate standing and permission of the graduate academic adviser and the department chair. Directed studies in statistics under the guidance of a selected faculty member. (May be repeated for a total of four credits)

Master's Research (1-6 Credits)
(May be repeated) Prerequisite: permission of advisor. Research in suitable topics in statistics culminating in a research paper. No more than 2 credits applicable to major requirements.

Master's Thesis (2 Credits)
Prerequisite: Permission. (May be repeated for a total of 4 credits) Properly qualified candidates for master's degree may obtain 2-4 credits for research experience which culminates in the presentation of faculty-supervised thesis.