# STATISTICS

**STA 5325 Fundamentals of Probability 3 Credits**
**Grading Scheme:** Letter Grade
Topics in probability and statistics, particularly discrete and continuous random variables, sampling distributions, estimation, and hypothesis testing. Applications to engineering and natural science.
**Prerequisite:** grade of C or better in MAC 2313 and STA 3032 or equivalent.

**STA 5328 Fundamentals of Statistical Theory 3 Credits**
**Grading Scheme:** Letter Grade
Direct continuation of STA 4321/STA 5325. Basic material for distribution theory, sampling distributions, properties of estimators, hypothesis testing, linear regression analysis, and analysis of variance. A good knowledge of calculus is helpful.
**Prerequisite:** STA 4321 or equivalent.

**STA 5503 Categorical Data Methods 3 Credits**
**Grading Scheme:** Letter Grade
Description and inference using proportions and odds ratios, multi-way contingency tables, logistic regression and other generalized linear models, and loglinear models applications.
**Prerequisite:** STA 3024, 3032, 4210, 4322, STA 6127, or STA 6167. Intended for graduate students not majoring in statistics.

**STA 5507 Applied Nonparametric Methods 3 Credits**
**Grading Scheme:** Letter Grade
Introduction to nonparametric statistics. Includes one- and two-sample testing and estimation methods, one- and two-way layout models, and correlation and regression models.
**Prerequisite:** STA 2023, 3032, 4210, 4322, STA 6126, STA 6166. Intended for graduate students not majoring in statistics.

**STA 5701 Applied Multivariate Methods 3 Credits**
**Grading Scheme:** Letter Grade
Review of matrix theory, univariate normal, t, chi-squared and F distributions, and multivariate normal distributions. Inference about multivariate means, Hotelling's T2 multivariate analysis of variance, multivariate regression, and multivariate repeated measures. Inference about covariance structure, principal components, factor analysis, and canonical correlation. Multivariate classification techniques, discriminant and cluster analysis. Additional topics at the discretion of the instructor, time permitting.
**Prerequisite:** STA 3024, STA 6127, STA 6167, or 4211. Intended for graduate students not majoring in statistics.

**STA 5856 Applied Time Series Methods 3 Credits**
**Grading Scheme:** Letter Grade
Stationarity, autocorrelation, ARMA models, non-stationary processes, ARIMA models, regression with ARMA errors, model-based forecasting, forecasting algorithms.
**Corequisite:** STA 4322 or STA 5328.

**STA 6092 Applied Statistical Practice 3 Credits**
**Grading Scheme:** Letter Grade
Communication, management, and the organizational, computational, and statistical thinking skills needed for consulting in statistics. Integrating graphic and numeric computing tools, research design concepts, data summary, and statistical inference methods.
**Prerequisite:** STA 6208

**STA 6126 Statistical Methods in Social Research I 3 Credits**
**Grading Scheme:** Letter Grade
Descriptive statistics, estimation, significance tests, two-sample comparisons, methods for nominal and ordinal data, regression and correlation, introduction to multiple regression.

**STA 6166 Statistical Methods in Research I 3 Credits**
**Grading Scheme:** Letter Grade
Statistical methods based on t, F, and Chi2 tests. Analysis of variance for basic experimental designs. Factorial experiments. Regression analysis and analysis of covariance.
**Prerequisite:** STA 2023 or equivalent.

**STA 6167 Statistical Methods in Research II 3 Credits**
**Grading Scheme:** Letter Grade
Analysis of covariance and general linear model. Factorial, nested, split-plot, and incomplete block designs. Analysis of count data.
**Prerequisite:** STA 6166.

**STA 6177 Applied Survival Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Focusing on survival analysis, Kaplan-Meier estimates, proportional hazards model, related tests, phase I, II, and III clinical trials, designs and protocols.
**Prerequisite:** STA 6327

**STA 6207 Regression Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Focusing on simple linear regression; multiple regression; model selection residual analysis; influence diagnostics' multicollinearity; anova and regression; generalized linear models; nonlinear regression.
**Prerequisite:** STA 4322

**STA 6208 Basic Design and Analysis of Experiments 3 Credits**
**Grading Scheme:** Letter Grade
Focusing on the principles of experimental design, completely randomized design (analysis, contrasts, diagnostics), random effects models, factorial experiments (fixed, random, and mixed effect), block designs, Latin squares, split plots, and full and fractional factorial experiments.
**Prerequisite:** STA 6207

**STA 6246 Theory of Linear Models 3 Credits**
**Grading Scheme:** Letter Grade
Theory of Linear Models
**Prerequisite:** STA 6208, STA 6327, STA 6329.

**STA 6275 Statistical Computing I: Optimization 3 Credits**
**Grading Scheme:** Letter Grade
First course in a two course sequence on statistical computing. Builds a foundation for numerical optimization at both algorithmic and theoretical levels. R is the primary computing platform.
**Prerequisite:** Permission of the instructor.

**STA 6276 Statistical Computing II: Monte Carlo Methods 3 Credits**
**Grading Scheme:** Letter Grade
Second of a two course sequence on statistical computing. Covers Monte Carlo (MC) methods, Monte Carlo methods based on Markov chains (MCMC), and variational inference. Describes implementations of these methods and classes of problems in Bayesian inference they can address. Also, discussion of convergence issues. R is the primary programming language.
**Prerequisite:** STA 6326;
**Corequisite:** STA 6327.

**STA 6326 Introduction to Theoretical Statistics I 3 Credits**
**Grading Scheme:** Letter Grade
Theory of probability. Probability spaces, continuous and discrete distributions, functions of random variables, multivariate distributions, expectation, conditional expectation, central limit theorem, useful convergence results, sampling distributions, distributions of order statistics, empirical distribution function.
**Prerequisite:** MAC 2313.

**STA 6327 Introduction to Theoretical Statistics II 3 Credits**
**Grading Scheme:** Letter Grade
Estimation and hypothesis testing. Sufficiency, information, estimation, maximum likelihood, confidence intervals, uniformly most powerful tests, likelihood ratio tests, sequential testing, univariate normal inference, decision theory, analysis of categorical data.
**Prerequisite:** STA 6326.

**STA 6329 Matrix Algebra and Statistical Computing 3 Credits**
**Grading Scheme:** Letter Grade
Basic theory of determinants, inverses and generalized inverses, eigenvalues and eigenvectors; applications of partitioned matrices; diagonalization and decomposition theorems; applications in least squares.
**Prerequisite:** MAC 3313.

**STA 6505 Analysis of Categorical Data 3 Credits**
**Grading Scheme:** Letter Grade
Varieties of categorical data, cross-classification tables, tests for independence. Measures of association. Loglinear models for multi-dimensional tables. Logit models and analogies with regression. Specialized methods for ordinal data.
**Prerequisite:** STA 6327 and STA 6208 or consent of instructor.

**STA 6707 Analysis of Multivariate Data 3 Credits**
**Grading Scheme:** Letter Grade
Techniques for analyzing multivariate data. Emphasis on MANOVA and tests on the structure of the dispersion matrix. Topics will include discriminant, factor, profile, and cluster analyses.
**Prerequisite:** STA 6208 and facility in a computer language.

**STA 6905 Individual Work 1-5 Credits, Max 10 Credits**
**Grading Scheme:** Letter Grade
Special topics designed to meet the needs and interests of individual students.
**Prerequisite:** departmental approval.

**STA 6910 Supervised Research 1-5 Credits, Max 5 Credits**
**Grading Scheme:** S/U
Supervised Research

**STA 6934 Special Topics in Statistics 1-4 Credits, Max 12 Credits**
**Grading Scheme:** Letter Grade
Special Topics in Statistics
**Prerequisite:** permission of graduate adviser.

**STA 6938 Seminar 1 Credit, Max 15 Credits**
**Grading Scheme:** S/U
Special topics of an advanced nature suitable for seminar treatment but not given in regular courses.
**Prerequisite:** departmental approval.

**STA 6940 Supervised Teaching 1-5 Credits, Max 5 Credits**
**Grading Scheme:** S/U
Supervised Teaching

**STA 6942 Internship 1-3 Credits, Max 8 Credits**
**Grading Scheme:** S/U
Supervised statistical consulting involving planning and/or analyzing research data. Whenever possible, student meets with researcher. Supervision by faculty member or delegated authority and post-internship report.
**Prerequisite:** STA 6208 or equivalent and consent of graduate coordinator.

**STA 6971 Research for Master's Thesis 1-15 Credits**
**Grading Scheme:** S/U
Research for Master's Thesis

**STA 7179 Survival Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Theoretical introduction to statistical inferential procedures useful for analyzing randomly right censored failure time data.
**Prerequisite:** STA 6177.

**STA 7233 Advanced Regression 3 Credits**
**Grading Scheme:** Letter Grade
Introduces a variety of advanced methods used in modern regression analyses, including semiparametric regression, regularization and shrinkage estimators, and advanced statistical machine learning methods.
**Prerequisite:** STA 7249.

**STA 7249 Generalized Linear Models 3 Credits**
**Grading Scheme:** Letter Grade
Fitting of generalized linear models, diagnostics, asymptotic theory, overdispersion, estimating equations, mixed models, generalized additive models, smoothing.
**Prerequisite:** STA 6208, 6208, STA 6327, STA 6246.

**STA 7334 Limit Theory 3 Credits**
**Grading Scheme:** Letter Grade
Review of different models of convergence. Cramer-Wold device. Multivariate CLT. Asymptotic theory of empirical distribution and sample quantiles. Bahadur's representation. Asymptotic theory of sample moments. Delta method and its multiparameter generalization. Variance stabilizing transformation. U-statistics: asymptotic theory and its statistical applications. Hoeffding's decomposition. Asymptotic theory of maximum likelihood estimation. Wald's consistency theorem for MLE. Asymptotic normality and efficiency. Asymptotic theory of GLRTs. Statistical applications: asymptotic theory of categorical data, linear models, and generalized linear models.
**Prerequisite:** STA 6467.

**STA 7346 Statistical Inference 3 Credits**
**Grading Scheme:** Letter Grade
Decision rules and risk functions. Sufficiency, Minimax, and Bayes rules for estimating location and scale parameters.
**Prerequisite:** STA 6327.

**STA 7347 Advanced Inference 3 Credits**
**Grading Scheme:** Letter Grade
Bayesian statistical inference. Inference using large samples. Relative efficiencies of tests and estimates with special reference to Pitman and Bahadur efficiencies.
**Prerequisite:** STA 7346.

**STA 7348 Bayesian Theory 3 Credits**
**Grading Scheme:** Letter Grade
Theory underlying the Bayesian paradigm. Issues related to selection of priors; Bayesian interference, both exact and asymptotic; Bayesian model selection; high-dimensional problems; and Bayesian robustness.
**Prerequisite:** STA 7346

**STA 7466 Probability Theory I 3 Credits**
**Grading Scheme:** Letter Grade
Measure and probability spaces. Random variables. Distribution functions. Abstract Lebesgue and Stieltjes integration. Monotone. Dominated, Cauchy, and mean convergence. Fubini and Radon-Nikodym theorems. Zero-one laws.
**Prerequisite:** MAA 5228, MAA 6236, or equivalent.

**STA 7467 Probability Theory II 3 Credits**
**Grading Scheme:** Letter Grade
Summability of independent random variables. Laws of large numbers. Convergence in distribution. Characteristic functions. Uniqueness and continuity theorems. The Lindeberg-Feller central limit theorem. Degenerate convergence criterion.
**Prerequisite:** STA 7466.

**STA 7828 Topics in Stochastic Processes 3 Credits**
**Grading Scheme:** Letter Grade
Branching processes, Brownian motion, continuous state space Markov chains, diffusion processes, Markov chain Monte Carlo, martingales, point processes, renewal processes, stationary processes, stochastic calculus, stochastic differential equations.
**Prerequisite:** STA 6466 and STA 6467.

**STA 7934 Special Topics in Statistics 1-9 Credits, Max 15 Credits**
**Grading Scheme:** Letter Grade
Possible Topics: Smoothing Methods, Analysis of Longitudinal Data, Data Mining and Statistical Learning, Mixed Models, Theory and Methods, Resampling Methods, Functional Data Analysis.
**Prerequisite:** Permission of Graduate Coordinator.

**STA 7979 Advanced Research 1-12 Credits**
**Grading Scheme:** S/U
Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

**STA 7980 Research for Doctoral Dissertation 1-15 Credits**
**Grading Scheme:** S/U
Research for Doctoral Dissertation