STATISTICS (STA)

Statistics (STA) Courses

STA 5093. Introduction to Statistical Inference. (3-0) 3 Credit Hours.
Prerequisite: Admission to the Master's program or consent of instructor. This course covers introduction to sampling methods, random variables, and descriptive analysis methods, basic probability theory, common probability distributions, joint distributions, moment generating function, statistical estimation, interval estimation, hypothesis testing for a single parameter and comparing two parameters, and goodness-of-fit tests. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 5103. Applied Statistics. (3-0) 3 Credit Hours.
Prerequisite: STA 5093 or equivalent, or consent of instructor. This course covers relations between categorical variables, one-way factor models, factorial experiments, multiple comparisons, simple linear regression, and multiple linear regression. Statistical software will be used for data analysis. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 5313. Theory of Sample Surveys with Applications. (3-0) 3 Credit Hours.
Prerequisite: STA 5093 or STA 6003 or consent of instructor. Basic sampling techniques and their comparisons for finite populations. Topics include simple random sampling, stratified sampling, ratio and regression estimates, systematic sampling, cluster sampling, multistage and double sampling, and bootstrap and other sampling plans. This course has Differential Tuition.

STA 5503. Mathematical Statistics I. (3-0) 3 Credit Hours.
Prerequisite: Admission to the Statistics graduate program or consent of instructor. Axioms of probability, counting rules, univariate random variables, multivariate random variables, joint, marginal, and conditional probability distributions, mathematical expectation, variable transformation, moment generating function, commonly used probability distributions, sampling distributions, laws of large numbers and the central limit theorem. This course has Differential Tuition.

STA 5513. Mathematical Statistics II. (3-0) 3 Credit Hours.
Prerequisite: STA 5503 or consent of instructor. Data reduction, sufficient and complete statistics, unbiased estimation, maximum likelihood estimation, method of moments, best unbiased estimator, Fisher information, Cramer-Rao lower bound, hypothesis testing, likelihood ratio test, Neyman-Pearson lemma and uniformly most powerful test, and interval estimation. This course has Differential Tuition.

STA 5893. AI Practicum. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing or consent of instructor. This AI practicum course includes weekly AI seminar which provides insights on the current state of the AI and ML technologies and covers a wide variety of AI topics, such as computer vision, natural language processing (NLP), theoretical ML, AI fairness and ethics, cognitive science, AI hardware, etc. The seminars will include speakers from industry and academia, who discuss the state of the practice with real use cases and methodologies to make AI projects a tangible success. The practicum also offers an experiential training opportunity to apply AI to problems in the real world. Standard AI programming tool suites and design flow concepts will be learned through the mini-project. Students will also be introduced to how AI is impacting society, the ethics of AI solutions, concerns surrounding AI, and deploying AI in complex scenarios. Python programming experience is needed. This course has Differential Tuition.

STA 5973. Directed Research. (0-0) 3 Credit Hours.
Prerequisite: Graduate standing and permission in writing (form available) from the instructor and the student's Graduate Advisor of Record. The directed research course may involve either a laboratory or a theoretical problem. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master's degree. This course has Differential Tuition.

STA 6003. Statistical Methods in Research and Practice I. (3-0) 3 Credit Hours.
Prerequisite: One semester of calculus and one statistics course, or consent of instructor. The course includes concepts and knowledge in basic probability, common distributions, point and interval statistical estimations, test of hypothesis, goodness-of-fit tests, simple linear regression, and analysis of variance for regression. Course emphasis will be placed on understanding the underlying assumptions and limitations of the different techniques. Statistical software will be used for data analysis. Cannot be applied to MS in Statistics and Data Science. This course has Differential Tuition.

STA 6013. Regression Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 6003 or equivalent, or consent of instructor. Multiple regression analysis, including model adequacy checks, transformations, weighted regression, diagnostics, outlier detection, polynomial regression, indicator variables, multicollinearity, remedial measures, variable selection, model validation, autocorrelation, and specialized regressions including robust regression, nonlinear regression, logistic regression, generalized linear models, and penalized regressions. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6033. SAS Programming and Data Management. (3-0) 3 Credit Hours.
This course introduces essential SAS programming concepts with a focus on data management and the preparation of data for statistical analysis. Topics include accessing data, exploring and validating data, manipulating data with functions, processing repetitive code, combining and restructuring data, analyzing and reporting data, exporting results, and SQL. This course employs efficient and innovative methods, including the use of PROCs and Macros, to accomplish the above. This course also prepares students for the SAS Certified Associate: Programming Fundamentals Using SAS certificate exam and the SAS Specialist: Base Programming Using SAS certificate exam. This course has Differential Tuition.

STA 6103. Statistical Methods in Research and Practice II. (3-0) 3 Credit Hours.
Prerequisite: STA 6003 or equivalent, or consent of instructor. The course is specifically designed for non-statistics major graduate students and is a continuation of STA 6003. The course includes topics in multiple linear regression, experimental design introductions, analysis of variance, analysis of covariance, generalized linear models, and optional topics such as introduction to causal inference and multi-stage least squares procedure. Statistical software will be used for data analysis. Cannot be applied to MS in Statistics and Data Science. This course has Differential Tuition.

STA 6113. Applied Bayesian Statistics. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or consent of instructor. Probability and uncertainty, conditional probability and Bayes' Rule, single parameter and multiple parameter Bayesian analysis, posterior analysis for commonly used distributions, prior distribution elicitation, comparison of Bayesian and frequentist methods, Bayesian methods in linear models, Bayesian computation methods including rejection sampling, and stochastic simulation (Markov chain Monte Carlo), Bayesian shrinkage and regularization, hierarchical Bayesian methods, and applications. This course has Differential Tuition.

STA 6133. Simulation and Statistical Computing. (3-0) 3 Credit Hours.
Prerequisite: STA 5513 or consent of instructor. Elements of computer number representation, deterministic methods for function optimization, the Newton-Raphson method and variants, numerical quadrature, Gaussian quadrature, Laplace approximation, simulation of probability distributions, the inverse transform, common transformation methods, accept-reject methods, examples in Statistics, simulation from multivariate distributions, Monte Carlo integration, importance sampling, methods for variance reduction, Bootstrap, and Jackknife applications. This course has Differential Tuition.

STA 6233. R Programming for Data Science. (3-0) 3 Credit Hours.
This course is designed to introduce students to the statistical program language R for data manipulation and analysis. Topics include importing and writing various types of data, exploring and summarizing data, reshaping and cleaning data, generating graphical representations of data, and conducting basic statistical analyses using R. Other topics include writing R functions for own research problems, simplifying code for readability and performance, and object-oriented programming. Techniques for efficient programming will be stressed. This course has Differential Tuition.

STA 6243. Exploratory Data Analysis with Python. (3-0) 3 Credit Hours.
This course delves into the exploration of Exploratory Data Analysis (EDA) principles and methodologies, emphasizing data cleaning, preparation, exploration, and visualization. Students will engage with real-world datasets, learning to source, manage, transform, and explore a variety of data types using Python as the primary software tool. The course emphasizes critical thinking in the interpretation of data analytics and the development of compelling data narratives. Students are expected to complete comprehensive projects that showcase their ability to innovate in data management, analysis, and visualization. It aims to equip students with the skills needed for data science roles alongside facilitating effective communication to convey insights. This course has Differential Tuition.

STA 6253. Time Series Analysis and Applications. (3-0) 3 Credit Hours.
Prerequisite: STA 5513 or consent of instructor. This course provides examples and goals of time series analysis, stochastic processes, mean and autocovariance and cross-covariance functions, stationarity, estimation of mean and autocovariance functions, linear filters, smoothing time series, autoregressive and moving average (ARMA) processes, estimation by method of moments, least squares and maximum likelihood, model diagnostics, order and model selection, forecasting/prediction of time series, best linear prediction, and autoregressive integrated moving average (ARIMA) models. This course has Differential Tuition.

STA 6413. Nonparametric Statistics. (3-0) 3 Credit Hours.
Prerequisite: STA 5093 or consent of instructor. This course is designed to cover two big topics: (i) statistical inference under a nonparametric setting and (ii) nonparametric regression modeling based on smoothing techniques. The statistical inference methods include one-sample location problems, two-sample location problems, two-sample dispersion problems, and regression problems. The nonparametric modeling methods include local regression and penalized regression with the optimal choice of the smoothing parameter, density estimation, wavelets, and other adaptive nonparametric regression methods. This course has Differential Tuition.

STA 6443. Statistical Modeling. (3-0) 3 Credit Hours.
Prerequisite: Basic statistics or equivalent. Introduction of basic statistical methods, with specific emphasis on inferential statistics and predictive modeling algorithms . Topics include (i) exploratory data analysis; data visualization, graphical methods, extracting important variables and detecting outliers, (ii) linear models; analysis of variance (ANOVA), linear regression models, and logistic regression models. Students will be provided the opportunity to gain an understanding of when to apply and how to select various predictive modeling algorithms for various types of problems, as well as data assumptions and requirements for algorithm use, proper parameter setting, and interpreting results. Cannot be applied to MS in Statistics and Data Science. This course has Differential Tuition.

STA 6543. Predictive Modeling. (3-0) 3 Credit Hours.
This course presents students with basic understanding of predictive modeling techniques and predictive analytics tools, with specific emphasis on problem-solving with real data using R programming. Topics include data preprocessing, over-fitting and model tuning, supervised learning methods, including linear regression and classification, nonlinear regression and classification models, resampling methods, model regularization, tree and rule-based methods, and support vector machines. Unsupervised learning methods include principal component analysis, clustering methods, and outlier detection. Students will learn how to select various predictive modeling algorithms for a wide variety of applications and how to code the programs in R, as well as assumptions and requirements of predictive modelling, optimal tuning parameter setting, and how to interpret and report the results. Cannot be applied to MS in Statistics and Data Science. This course has Differential Tuition.

STA 6713. Linear Models. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. The main objective of this course is to understand the underlying theories of linear models for regression, analysis-of-variance (ANOVA), and linear mixed models. By starting with the review of topics in matrix algebra, including rank, inverse, determinants, and spectral decomposition, students learn multivariate Normal distribution and properties of their linear and quadratic transformations. Then, relevant theories are connected to linear regression problems to derive the statistical properties of parameter estimates and implement hypothesis testing. Students will also have the opportunity to learn the statistical properties of ANOVA models and their hypothesis-testing problems under linear model contexts. The formulation of linear mixed model and generalized linear model under matrix algebra theory is also covered. This course has Differential Tuition.

STA 6813. Multivariate Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. This course includes an introduction to multivariate data, matrix algebra, random vectors, multivariate normal distribution, inference about mean vectors, comparison of several multivariate means, principal component analysis, factor analysis, and discrimination and classification. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6833. Design and Analysis of Experiments. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. Introduction to experimental design and applied data analysis as used in business, technological, and scientific settings. Topics include one-factor and two-factor experiments, randomized block designs, two-level and three-level factorial and fractional factorial designs, nested and split-plot designs, and optimal designs. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6843. Computer Aided Optimal Design. (3-0) 3 Credit Hours.
Prerequisite: STA 6833 or equivalent, or consent of instructor. Introduction to obtaining experimental designs and statistical methods for fitting response surfaces, and how to computer-generate the designs and use them in applied settings. Topics discussed include generating designs for obtaining process improvements with steepest ascents and for fitting response surfaces of different shapes, and use of the resultant model diagnostics to find optimum operating conditions. Use is made of JMP and SAS for design generation. This course has Differential Tuition.

STA 6853. Categorical Data Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. This course will cover an introduction to categorical data, analysis and asymptotic inferences on contingency tables, generalized linear model, logistic regression, logit models for binary data and multicategories, log-linear model, models for matched pairs, modeling correlated responses, and generalized linear mixed models. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6863. Spatial Statistics. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. This course will cover types of spatial data, problems dealt by geostatistical methods, basic theory of random fields, Gaussian random fields, covariograms and variograms, exploratory spatial data analysis, description of some geostatistical software, covariogram/variogram estimation: method-of-moments, least squares, maximum likelihood and restricted maximum likelihood, model selection, spatial prediction (kriging): simple kriging, ordinary kriging, universal kriging, lognormal kriging, trans-Gaussian kriging, indicator kriging, Poisson kriging, block kriging, statistical properties of kriging predictors, cross-validation, and simulation of random fields. This course has Differential Tuition.

STA 6903. Survival Analysis. (3-0) 3 Credit Hours.
Prerequisite: STA 5093 or equivalent, or consent of instructor. This course introduces both parametric and nonparametric methods for analyzing time to event data. Topics include survivor and hazard functions, censoring, Kaplan-Meier estimation, log-rank and related tests, inference based on standard lifetime distributions, regression approach to survival analysis including the Cox proportional hazards model, and time dependent covariates. Emphasis will be given on application, interpretation and data analysis using statistical software. This course has Differential Tuition.

STA 6923. Introduction to Statistical Learning. (3-0) 3 Credit Hours.
Prerequisite: STA 5103 or equivalent, or consent of instructor. This course provides an introduction to statistical learning and data mining tools in analyzing the vast amounts of data found in business, informatics, cyber security and other industries. The course mostly covers supervised learning. The topics include concepts in statistical and machine learning, data preprocessing, variance-bias tradeoff, linear regressions with model assessment and regularization, model averaging, resampling tools, tree-based models with bagging, boosting, and random forests, discriminant analysis, and nearest-neighbor classification. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6933. Advanced Topics in Statistical Learning. (3-0) 3 Credit Hours.
Prerequisite: STA 6923 or equivalent, or consent of instructor. This course provides a deeper understanding of selected statistical learning concepts and tools with mathematical justifications. The topics include principal component analysis, cluster analysis, linear and nonlinear methods in regression and classification with regularization, generalized additive models, support vector machines, neural networks, and an introduction to deep learning. Statistical software will be used for data analysis. This course has Differential Tuition.

STA 6943. Statistics Internship. (0-0) 3 Credit Hours.
Prerequisite: Graduate standing, 15 semester credit hours of graduate work, and consent of instructor. Internship must be approved in advance by the Internship Coordinator and the student's Graduate Advisor of Record. Supervised full- or part-time off-campus work experience and training in statistics. Individual conferences and written reports required. This course has Differential Tuition.

STA 6953. Independent Study. (0-0) 3 Credit Hours.
Prerequisite: Graduate standing and permission in writing (form available) from the instructor and the student's Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the degree. This course has Differential Tuition.

STA 6961. Comprehensive Examination. (0-0) 1 Credit Hour.
Prerequisite: Approval of the appropriate Graduate Program Committee to take the Comprehensive Examination. Independent study course for the purpose of taking the Comprehensive Examination. May be repeated as many times as approved by the Graduate Program Committee. Enrollment is required each term in which the Comprehensive Examination is taken if no other courses are being taken that term. The grade report for the course is either "CR" (satisfactory performance on the Comprehensive Examination) or "NC" (unsatisfactory performance on the Comprehensive Examination). This course has Differential Tuition.

STA 6973. Special Problems. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Problems courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to the degree. This course has Differential Tuition.

STA 6983. Master's Thesis. (0-0) 3 Credit Hours.
Prerequisite: Permission from the Graduate Advisor of Record and thesis director. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. This course has Differential Tuition.

STA 7023. Applied Linear Statistical Models. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An in-depth study of regression and analysis of variance models. Topics include multiple regression and model building, multiple and partial correlation, analysis of residuals, analysis of variance, multivariate analysis of variance, analysis of variance as regression analysis, generalized linear model, and applications of statistical models to problems in business. Computer software packages such as SAS or SPSS will be used for data analysis. This course is designed for doctoral students in Business and cannot be applied to a Master of Science degree in Applied Statistics without consent of the instructor and prior approval from the Graduate Advisor of Record. This course has Differential Tuition.

STA 7211. Doctoral Research. (0-0) 1 Credit Hour.
May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7212. Doctoral Research. (0-0) 2 Credit Hours.
May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7213. Doctoral Research. (0-0) 3 Credit Hours.
May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7214. Doctoral Research. (0-0) 4 Credit Hours.
May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7216. Doctoral Research. (0-0) 6 Credit Hours.
May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7311. Doctoral Dissertation. (0-0) 1 Credit Hour.
Prerequisite: Admission to candidacy for Doctoral degree in Applied Statistics. May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7313. Doctoral Dissertation. (0-0) 3 Credit Hours.
Prerequisite: Admission to candidacy for Doctoral degree in Applied Statistics. May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7314. Doctoral Dissertation. (0-0) 4 Credit Hours.
Prerequisite: Admission to candidacy for Doctoral degree in Applied Statistics. May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7316. Doctoral Dissertation. (0-0) 6 Credit Hours.
Prerequisite: Admission to candidacy for Doctoral degree in Applied Statistics. May be repeated for credit, but not more than 15 hours may be applied toward the Doctoral degree. This course has Differential Tuition.

STA 7503. Advanced Inference I. (3-0) 3 Credit Hours.
Prerequisite: STA 5513 or equivalent and Doctoral standing. This course is a brief discussion of measure theory and Lebesgue integration, statistical models, location and scale families of distributions, exponential families of distributions, sufficiency, factorization theorem, completeness, ancillarity, Basu's theorem, Fisher information, Kullback-Leibler divergence, elements of statistical decision theory, basic concepts for point estimation, best-unbiased estimation, Rao-Blackwell theorem, Lehmann–Scheffé theorem, Cramér–Rao (information) inequality, maximum likelihood estimation (MLE), and profiled/concentrated likelihood. This course has Differential Tuition.

STA 7513. Advanced Inference II. (3-0) 3 Credit Hours.
Prerequisite: STA 7503. Elements of asymptotics, different forms of stochastic convergence, laws of large numbers, central limit theorems, univariate and multivariate delta methods, asymptotic properties of maximum likelihood estimators, limit distribution of estimators, asymptotic relative efficiency, asymptotic confidence regions, tests of hypotheses, Neyman-Pearson theory, uniformly most powerful tests, unbiased tests, applications to exponential families, monotone likelihood ratio families, likelihood ratio tests, Wald tests, Rao/Score tests, asymptotic properties of tests, and duality between confidence regions and tests of hypotheses. This course has Differential Tuition.