STATISTICS (STA)

STA 4374 Statistical Process Control (3)
Pre-requisite(s): STA 3381 or equivalent
Development of statistical concepts and theory underlying procedures used in statistical process control applications and reliability.

STA 4382 Intermediate Statistical Methods (3)
Pre-requisite(s): A minimum grade of C in either STA 2381 or STA 3381; or consent of instructor
Development and application of two-sample inferences, analysis of variance, multiple comparison procedures, and nonparametric methods.

STA 4385 Mathematical Statistics I (3)
Pre-requisite(s): MTH 2321 with minimum grade of C
Introductions to the fundamentals of probability theory, random variables and their distributions, expectations, transformations of random variables, moment generating functions, special discrete and continuous distributions, multivariate distributions, order statistics, and sampling distributions.

STA 4386 Mathematical Statistics II (3)
Pre-requisite(s): STA 4385 with minimum grade of C
Theory of statistical estimation and hypothesis testing. Topics include point and interval estimation, properties of estimators, properties of test of hypotheses including most powerful and likelihood ratios tests, and decision theory including Bayes and minimax criteria.

STA 5300 Statistical Methods (3)
Introduction to descriptive and inferential statistics. Topics may be selected from the following: descriptive statistics and graphs, probability, regression, correlation, tests of hypotheses, interval estimation, measurement, reliability, experimental design, analysis of variance, nonparametric methods, and multivariate methods.

STA 5301 Introduction to Experimental Design (3)
Pre-requisite(s): Graduate standing
Simple and complex analysis of variance and analysis of covariance designs. The general linear model approach, including full-rank and less than full-rank models, will be emphasized.

STA 5303 Applied Regression Analysis (3)
Pre-requisite(s): STA 5300 or equivalent Regression modeling, estimation, and diagnostics with emphasis on applications
Topics include simple linear regression, multiple regression, logistic regression, and Poisson regression. The statistical programming language R is used.

STA 5304 SAS and SAS Programming for Statistical Analysis (3)
Pre-requisite(s): STA 2381 or STA 5300 or equivalent; STA 3381 or equivalent
Concepts in SAS programming, including methods to establish and transform SAS data sets, perform statistical analyses, and create general customized reports. Methods from both BASE SAS and SAS SQL are considered. Successful completion of the course prepares students to take the SAS certification exam.

STA 5305 Advanced Experimental Design (3)
Pre-requisite(s): STA 5353 and 5381
The course examines a variety of complex experimental designs that are available to researchers including split-plot factorial designs, confounded factorial designs, fractional factorial designs, incomplete block designs, and analysis of covariance. The designs are examined within the framework of the general linear model. Extensive use is made of computer software.

STA 5320 Predictive Analytics (3)
Pre-requisite(s): STA 5303 Concepts, methods, and tools used for predictive modeling and data analytics with applications are considered The focus of this course is on advanced tools using various multivariate regression techniques, statistical modeling, machine learning, and simulation for forecasting. Practical applications are emphasized.

STA 5330 SAS Programming for Data Analytics (3)
SAS Programming for Data Analytics

STA 5350 Statistical Machine Learning (3)
Pre-requisite(s): STA 5303
Fundamental topics of machine learning including supervised/ unsupervised learning, cost function optimization, feature selection and engineering, and bias/variance trade-off. Learning algorithms including classification methods, support vector machines, decision trees, neural networks, and deep learning are covered.

STA 5351 Introduction to Theory of Statistics (3)
Pre-requisite(s): MTH 2321 or equivalent or consent of instructor
Introduction to mathematics of statistics. Fundamentals of probability theory, convergence concepts, sampling distributions, and matrix algebra.

STA 5352 Theory of Statistics I (3)
Co-requisite(s): STA 5380, STA 6375
Pre-requisite(s): MTH 2321 or STA 5351 or consent of instructor
Theory of random variables, distribution and density functions, statistical estimation, and hypothesis testing. Topics include probability, probability distributions, expectation, point and interval estimation, and sufficiency.

STA 5353 Theory of Statistics II (3)
Co-requisite(s): STA 5381
Pre-requisite(s): STA 5352
Topics include sampling distributions, likelihood and sufficiency principles, point and interval estimation, loss functions, Bayesian analysis, asymptotic convergence, and test of hypothesis.

STA 5360 Introduction to Bayesian Data Analysis (3)
Pre-requisite(s): STA 3381 or equivalent or consent of instructor
Overview of analytic and computational methods in Bayesian inference beginning with two-sample t-inference procedures, and extending through regression, focusing on state-of-the-art software for Bayesian computation.

STA 5361 Methods in Time Series Analysis (3)
Co-requisite(s):
Pre-requisite(s): STA 3386 or STA 5303 or equivalent or concurrent enrollment or consent of instructor
Statistical methods of analyzing time series including autocorrelation, model identification, estimation, forecasting, and spectral analysis. Applications in a variety of areas including economics and environmental science will be considered. Credit cannot be earned for both this course and STA 5362.

STA 5362 Time Series Analysis (3)
Pre-requisite(s): STA 5352
Statistical methods for analyzing time series. Topics include autocorrelation function and spectrum, stationary and non-stationary time series, linear filtering, trend elimination, forecasting, general models, and autoregressive integrated moving average models with applications in economics and engineering. Students cannot receive credit for this course and for STA 5361.

STA 5363 Advanced Data-Driven Methods (3)
Pre-requisite(s): STA 5381, 5383, and 6376
Advanced topics and theoretical underpinnings of modern data-driven methods are presented, including supervised and unsupervised methods from both statistical and machine learning perspectives; uncertainty analysis, model selection and development; and both nonlinear and linear methods.

STA 5364 Survival and Reliability Theory (3)
Pre-requisite(s): STA 5352
Basic concepts of lifetime distributions. Topics include types of censoring, inference procedures for exponential, Weibull, extreme value distributions, parametric and nonparametric estimation of survival function and accelerated life testing.

STA 5365 Design of Experiments and Clinical Trials (3)
Pre-requisite(s): STA 5381
Traditional designs of experiments are presented within the framework of the general linear model. Also included are the latest designs and analyses for clinical trials and longitudinal studies. Credit cannot be received for this course and STA 5375.

STA 5367 Managerial Epidemiology (3)
Cross-listed as HPA 5367
See HPA 5367 for course information.

STA 5371 Methods in Data Mining and Management (3)
Pre-requisite(s): STA 3386 or STA 5303 or equivalent course or consent of instructor
An introduction to the methods and practices of data mining and management. Concepts, principles, methods, implementation techniques, and applications of data mining, with a focus on modeling, pattern discovery, and cluster analysis.

STA 5372 Statistical Process Control (3)
Pre-requisite(s): STA 3381 or equivalent; STA 2381 or equivalent
Development of statistical concepts and theory underlying procedures used in statistical process control applications. Topics include sampling inspection procedures, continuous sampling procedures, theory of process control procedures, and experimental design and response surface analysis to design and analyze process experiments.

STA 5373 Computational Statistical Methods (3)
Pre-requisite(s): STA 2381 or STA 5300 or an equivalent course in statistical methods
Methods, programming, and algorithms used in computational statistics; topics include, but are not limited to, Monte Carlo simulation, bootstrap, cross-validation, and MCMC. Programming in R and to write R functions.

STA 5374 Applied Sampling Techniques (3)
Pre-requisite(s): A grade of C or better in any one of STA 2381 or STA 5300 or an equivalent course in statistical methods
Planning, execution, and analysis of sampling from finite populations. Simple random, stratified random, ratio, systematic, cluster, subsampling, regression estimates, and multi-frame techniques are covered. Use of computer software for analyzing data collected from designs covered in class.

STA 5376 Methods in Biostatistics (3)
Pre-requisite(s): STA 2381 or STA 5300, or an equivalent course in statistical methods
A survey of methods of data analysis for biostatisticians in the biomedical and pharmaceutical fields. Regression analysis, experimental design, categorical data analysis, clinical trials, longitudinal data, and survival analysis.

STA 5377 Spatial Statistics (3)
Pre-requisite(s): STA 5353; or consent of instructor
Exploratory spatial data analysis using both graphical and quantitative descriptions of spatial data including the empirical variogram. Topics include several theoretical isotropic and anisotropic variogram models and various methods for fitting variogram models such as maximum likelihood, restricted maximum likelihood, and weighted least squares. Techniques for prediction of spatial processes will include simple, ordinary, universal and Bayesian kriging. Spatial sampling procedures, lattice data, and spatial point processes will also be considered. Existing software and case studies involving data from the environment, geological and social sciences will be discussed.

STA 5380 Methods in Statistics I (3)
Co-requisite(s): STA 5352, STA 6375
Pre-requisite(s): MTH 2311 and MTH 2321, or consent of instructor
Descriptive parametric and nonparametric inferential methods for qualitative and quantitative data from a single population. Parametric and nonparametric inferential methods for qualitative and quantitative data from two populations. Linear regression using matrix notation, including topics in multiple regression, modeling diagnostic procedures, and model selection.

STA 5381 Methods in Statistics II (3)
Co-requisite(s): STA 5353
Pre-requisite(s): STA 5380 or consent of instructor
A continuation of STA 5380 with robust regression, quantile regression, and regression trees. K population descriptive and inferential methods. A matrix approach to one-way analysis of variance and least squares in balanced designs with fixed and random effects. Multiple comparison procedures, power, and sample size. A brief introduction to generalized linear models.

STA 5383 Introduction to Multivariate Analysis (3)
Pre-requisite(s): STA 5353 and STA 5381 or equivalent
Statistical models and procedures for describing and analyzing random vector response data. Supporting theoretical topics include matrix algebra, vector geometry, the multivariate normal distribution and inference on multivariate parameters. Various procedures are used to analyze multivariate data sets.

STA 5384 Multivariate Statistical Methods (3)
Discriminant analysis, canonical correlation analysis, and multivariate analysis of variance.

STA 5385 High-Dimensional Data Analysis (3)
Pre-requisite(s): STA 5383
Methods for analyzing high-dimensional multivariate data. Topics include matrix computation of summary statistics, graphical techniques using linear dimension reduction, statistical inference of high-dimensional multivariate parameters, high-dimensional principal components analysis and singular value decompositions, and supervised classification methods for high-dimensional sparse data.

STA 5387 Stochastic Processes (3)
Pre-requisite(s): STA 5353
The study of probability theory as motivated by applications from a variety of subject matters. Topics include: Markov chains, branching processes, Poisson processes, continuous time Markov chains with applications to queuing systems, and renewal theory.

STA 5388 Seminar in Statistics (3)
Pre-requisite(s): Consent of instructor
Selected topics in Statistics. May be repeated once with change of topic.

STA 5V85 Practice in Statistics (1-3)
Consulting, research, and teaching in statistics.

STA 5V95 Topics in Statistics (1-3)
Pre-requisite(s): Consent of instructor
Selected topics in statistics. May involve texts, current literature, or an applied data model analysis. This course may be repeated up to four times with change of topic.

STA 5V99 Thesis (1-3)
Supervised research for the master's thesis. A maximum of three semester hours to count for the degree.

STA 6351 Large Sample Theory (3)
Pre-requisite(s): STA 5353
Large sample theory, including convergence concepts, laws of large numbers, central limit theorems, and asymptotic concepts in inference.

STA 6352 Bayesian Theory and Methods I (3)
Pre-requisite(s): STA 5353 or equivalent
This course introduces the principles of Bayesian statistical inference, covering foundational concepts, decision theory, prior construction, and posterior computation. Students will explore Bayesian methods for point and interval estimation, contrasting them with frequentist approaches, along with other key inferential techniques. Practical aspects of Bayesian computation, including modern computational techniques and their implementation, are also introduced.

STA 6353 Semiparametric Regression Models (3)
Pre-requisite(s): STA 5353
Semiparametric inference, with an emphasis on regression models applicable to a wider class of problems than can be addressed with parametric regression models. Topics include scatterplot smoothing, mixed models, additive models, interaction models, and generalized regression. Models are implemented using various statistical computing packages.

STA 6360 Bayesian Theory and Methods II (3)
Pre-requisite(s): STA 6352 or equivalent
This course focuses on Bayesian model building, with an emphasis on Bayesian hierarchical models and their practical implementation. Topics include prior construction, computational challenges, and sample size determination. The course also covers assessing model performance through simulation techniques.

STA 6363 Functional Data Analysis (3)
Pre-requisite(s): MATH 2311, STA 5300, STA 5383, or consent of instructor
Introduction to the analysis of data that may be considered to be realizations from smooth functions. Visualization and data exploration, nonparametric smoothing, functional linear models, functional principle components analysis, analysis involving derivatives, registration, and nonlinear smoothing.

STA 6366 Statistical Bioinformatics (3)
Pre-requisite(s): STA 5353 and 5383; or consent of instructor
Critical evaluation of current statistical methodology used for the analysis of genomic and proteomic data.

STA 6375 Computational Statistics I (3)
Co-requisite(s): STA 5352, STA 5380
Pre-requisite(s): MTH 2311 and 2321
A comprehensive introduction to computing for statisticians. Topics range from information technology and fundamentals of scientific computing to computing environments and workflows, statistical document preparation for reproducible research, and programming languages. Students cannot receive credit for this and for STA 5373.

STA 6376 Computational Statistics II (3)
Pre-requisite(s): STA 6375
A continuation of STA 6374 with an emphasis on computational and applied mathematics, pseudo-random variate generation, and Monte Carlo methods. Credit cannot be received for this course and for STA 5373.

STA 6380 Modern Trends in Data Science Computing (3)
Pre-requisite(s): STA 6375 and 6376
A hands-on survey of practical data science technologies and tools used in industry. Topics vary and may include version control systems and collaborative software development; distributed computing; data storage and access; cloud computing; web technologies, applications, and dashboards; and workflow and pipelining tools.

STA 6382 Theory of Linear Models (3)
Pre-requisite(s): STA 5353 and 5381; and knowledge of matrix theory
Theory of general linear models including regression models, experimental design models, and variance component models. Least squares estimation. Gauss-Markov theorem and less than full rank hypotheses.

STA 6383 Advanced Multivariate Analysis (3)
Pre-requisite(s): STA 5383
Multivariate normal and related distributions. Topics include generalizations of classical test statistics including Wilk's Lambda and Hotelling's T2, discriminant analysis, canonical variate analysis, and principal component analysis.

STA 6384 Analysis of Categorical Responses (3)
Pre-requisite(s): STA 5353 and STA 5381 or equivalent
Theory of generalized linear models including logistic, probit, and log linear models with special application to categorical and ordinal categorical data analysis.

STA 6V00 Graduate Research (1-10)
Pre-requisite(s): Graduate standing
For research credit prior to admission to candidacy for an advanced degree. Credit will be given for the amount of work done. May be repeated for credit through 45 hours.

STA 6V99 Dissertation (1-6)
Supervised research for the doctoral dissertation. maximum of nine semester hours will count for the degree. A student may register for one to six semester hours in one semester.