Statistics (STAT)

Statistics (STAT) Courses

STAT 5500 [0.5 credit] (MAT 5177)
Multivariate Normal Theory
Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.

STAT 5501 [0.5 credit] (MAT 5191)
Mathematical Statistics II
Confidence intervals and pivotals; Bayesian intervals; optimal tests and Neyman-Pearson theory; likelihood ratio and score tests; significance tests; goodness-of-fit-tests; large sample theory and applications to maximum likelihood and robust estimation.
Prerequisite(s): STAT 5600 or permission of the School.
Also offered at the undergraduate level, with different requirements, as STAT 4507, for which additional credit is precluded.

STAT 5502 [0.5 credit] (MAT 5192)
Sampling Theory and Methods
Unequal probability sampling with and without replacement; unified theory for standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; nonresponse; measurement errors; related topics.

STAT 5503 [0.5 credit] (MAT 5193)
Linear Models
Theory of non full rank linear models; estimable functions, best linear unbiased estimators, hypotheses testing, confidence regions; multi-way classifications; analysis of covariance; variance component models; maximum likelihood estimation, Minque, Anova methods; miscellaneous topics.
Prerequisite(s): STAT 5600 or permission of the School.

STAT 5504 [0.5 credit] (MAT 5194)
Stochastic Processes and Time Series Analysis
Stationary stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.

STAT 5505 [0.5 credit] (MAT 5195)
Design of Experiments
Overview of linear model theory; orthogonality; randomized block and split plot designs; latin square designs; randomization theory; incomplete block designs; factorial experiments: confounding and fractional replication; response surface methodology. Miscellaneous topics.
Prerequisite(s): STAT 5600 or permission of the School.

STAT 5506 [0.5 credit] (MAT 5175)
Robust Statistical Inference
Tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-methods, L-estimators. Influence function. Adaptive procedures.
Prerequisite(s): STAT 5600 or permission of the School.

STAT 5507 [0.5 credit] (MAT 5176)
Advanced Statistical Inference
Pure significance test; uniformly most powerful unbiased and invariant tests; asymptotic comparison of tests; confidence intervals; large-sample theory of likelihood ratio and chi-square tests; likelihood inference; Bayesian inference; fiducial and structural methods; resampling methods.
Prerequisite(s): STAT 5501 or permission of the School.

STAT 5508 [0.5 credit] (MAT 5172)
Topics in Stochastic Processes
Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures, and infinite particle systems, advanced topics in modeling, population models.

STAT 5509 [0.5 credit] (MAT 5196)
Multivariate Analysis
Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.
Prerequisite(s): STAT 5600 or permission of the School.

STAT 5516 [0.5 credit] (MAT 5197)
Nonparametric Statistics
Order statistics; projections; U-statistics; L-estimators; rank, sign, and permutation test statistics; nonparametric tests of goodness-of-fit, homogeneity, symmetry, and independence; nonparametric density estimation; nonparametric regression analysis: kernel estimators, orthogonal series estimators, smoothing splines; high-dimensional inference problems and false discovery.
Prerequisite(s): STAT 5600 or permission of the School.
Also offered at the undergraduate level, with different requirements, as STAT 4506, for which additional credit is precluded.
Lectures three hours a week.

STAT 5600 [0.5 credit] (MAT 5190)
Mathematical Statistics I
Statistical decision theory; likelihood functions; sufficiency; factorization theorem; exponential families; UMVU estimators; Fisher's information; Cramer-Rao lower bound; maximum likelihood, moment estimation; invariant and robust point estimation; asymptotic properties; Bayesian point estimation.
Also offered at the undergraduate level, with different requirements, as STAT 4500, for which additional credit is precluded.

STAT 5601 [0.5 credit] (MAT 5197)
Stochastic Optimization
Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, optimal stopping.

STAT 5602 [0.5 credit] (MAT 5317)
Analysis of Categorical Data
Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables, log-linear models; tests of symmetry, marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins, logistic models with binary response; measures of association and agreement.
Prerequisite(s): STAT 5600 and STAT 5501, or permission of the School.

STAT 5603 [0.5 credit] (MAT 5318)
Reliability and Survival Analysis
Types of censored data; nonparametric estimation of survival function; graphical procedures for model identification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associate statistical inference; rank tests with censored data applications.
Prerequisite(s): STAT 5600 and STAT 5501 or permission of the School.

STAT 5604 [0.5 credit] (MAT 5173)
Stochastic Analysis
Brownian motion, continuous martingales, and stochastic integration.
Prerequisite(s): STAT 5708 or permission of the School.

STAT 5610 [0.5 credit] (MAT 5375)
Introduction to Mathematical Statistics
Limit theorems. Sampling distributions. Parametric estimation. Concepts of sufficiency and efficiency. Neyman-Pearson paradigm, likelihood ratio tests. Parametric and non-parametric methods for two- sample comparisons. Notions of experimental design, categorical data analysis, the general linear model, decision theory and Bayesian inference.
Precludes additional credit for STAT 5600.
Also offered at the undergraduate level, with different requirements, as STAT 4500, for which additional credit is precluded.

STAT 5701 [0.5 credit] (MAT 5198)
Stochastic Models
Markov systems, stochastic networks, queuing networks, spatial processes, approximation methods in stochastic processes and queuing theory. Applications to the modeling and analysis of computer-communications systems and other distributed networks.
Also offered at the undergraduate level, with different requirements, as STAT 4508, for which additional credit is precluded.

STAT 5702 [0.5 credit] (MAT 5182)
Modern Applied and Computational Statistics
Resampling and computer intensive methods: bootstrap, jackknife with applications to bias estimation, variance estimation, confidence intervals, and regression analysis. Smoothing methods in curve estimation; statistical classification and pattern recognition: error counting methods, optimal classifiers, bootstrap estimates of the bias of the misclassification error.

STAT 5703 [0.5 credit] (MAT 5181)
Data Mining
Visualization and knowledge discovery in massive datasets; unsupervised learning: clustering algorithms; dimension reduction; supervised learning: pattern recognition, smoothing techniques, classification. Computer software will be used.
Includes: Experiential Learning Activity

STAT 5704 [0.5 credit] (MAT 5174)
Network Performance
Advanced techniques in performance evaluation of large complex networks. Topics may include classical queueing theory and simulation analysis; models of packet networks; loss and delay systems; blocking probabilities.

STAT 5705 [0.5 credit] (MAT 5373)
Statistical Machine Learning
Discriminant analysis, principal component analysis, support vector machines; reproducing kernel Hilbert spaces and kernel methods; neural networks; VC Theory, PAC learning. Additional topics may include: Bayesian modelling, manifold learning, boosting.
Includes: Experiential Learning Activity

STAT 5708 [0.5 credit] (MAT 5170)
Probability Theory I
Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables.

STAT 5709 [0.5 credit] (MAT 5171)
Probability Theory II
Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectations, basic properties and convergence theorems for martingales, introduction to Brownian motion.
Prerequisite(s): STAT 5708 (MAT 5170) or permission of the School.

STAT 5713 [0.5 credit]
Advanced Data Mining
Topics from recent literature on mining complex data structures and data such as: tree/graph, sequence, web/test, stream, spatiotemporal, high-dimensional, multivariate time series, mixed-mode; clustering (EM, topic modeling, fuzzy), SVM; multi-label learning; deep learning; combining learners, network analysis/link prediction/ graphical models (Bayesian, Markov networks); anomaly detection.

STAT 5901 [0.5 credit] (MAT 6991)
Directed Studies

STAT 5902 [0.5 credit] (MAT 5992)
Seminar in Biostatistics
Students work in teams on the analysis of experimental data or experimental plans. The participation of experimenters in these teams is encouraged. Student teams present their results in the seminar, and prepare a brief written report on their work.

STAT 5904 [0.5 credit] (MAT 5993)
Statistical Internship
This project-oriented course allows students to undertake statistical research and data analysis projects as a cooperative project with governmental or industrial sponsors. Practical data analysis and consulting skills will be emphasized. The grade will be based upon oral and written presentation of results.
Includes: Experiential Learning Activity
Prerequisite(s): permission of the graduate director.

STAT 5909 [2.0 credits]
M.Sc. Thesis in Statistics

STAT 5910 [1.0 credit]
M.Sc. Project in Statistics
Project in statistics supervised by a professor approved by the graduate director resulting in a major report (approximately 30-40 pages), together with a short presentation on the report. Graded by the supervisor and another professor appointed by the graduate director.
Includes: Experiential Learning Activity

STAT 6508 [0.5 credit] (MAT 5314)
Topics in Probability and Statistics