STATISTICS (STAT)

Any experimental courses offered by STAT can be found at:
registrar.iastate.edu/faculty-staff/courses/explistings/ (http://
www.registrar.iastate.edu/faculty-staff/courses/explistings/)

Courses primarily for undergraduates:

STAT 101: Principles of Statistics
(3-2) Cr. 4. F.S.SS.
Statistical concepts in modern society; descriptive statistics and
graphical displays of data; the normal distribution; data collection
(sampling and designing experiments); elementary probability; elements
of statistical inference; estimation and hypothesis testing; linear
regression and correlation; contingency tables. 1 1/2 years of high school
algebra required. Credit for only one of the following courses may be
applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or
STAT 226.

STAT 104: Introduction to Statistics
(2-2) Cr. 3. F.S.SS.
Statistical concepts and their use in science; collecting, organizing and
drawing conclusions from data; elementary probability; binomial and
normal distributions; regression; estimation and hypothesis testing. For
students in the agricultural and biological sciences. 1 1/2 years of high
school algebra required. Credit for only one of the following courses may
be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201,
or STAT 226.

STAT 110: Orientation in Statistics
(1-0) Cr. 1. F.
Opportunities, challenges, and the scope of the curriculum in statistics.
For students planning or considering a career in this area.

STAT 201: Introduction to Statistical Concepts and Methods
(3-2) Cr. 4. S.
Prereq: Credit or concurrent enrollment in MATH 165
Statistical thinking and applications of statistical concepts and methods
in modern society. Display and summary of categorical and numerical
data. Exploring relationships between variables, association, correlation,
and regression. Observational studies and experiments. Probability
customories, random variables, discrete and continuous distributions.
Elements of statistical inference; estimation and hypothesis testing.
Credit for only one of the following courses may be applied toward
graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 202: Career Development in Math and Statistics
(Cross-listed with MATH). Cr. 1. S.
Career development in the mathematics and statistics disciplines with an
emphasis on contemporary social issues. Presentations by professionals
in STEM fields about occupations, decision-making strategies, and career
goal implementation; development of job searching, resume writing,
negotiating, and interviewing techniques. Offered on a satisfactory-fail
basis only.

STAT 226: Introduction to Business Statistics I
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 150 or MATH 165
Obtaining, organizing, and presenting statistical data; measures of
location and dispersion; the Normal distribution; sampling and sampling
distribution of the sample mean; elements of statistical inference;
confidence intervals and hypothesis testing for the mean; describing
bivariate relationships and inference for simple linear regression analysis;
use of computers to visualize and analyze data. Credit for only one of the
following courses may be applied toward graduation: STAT 101, STAT
104, STAT 105, STAT 201, or STAT 226.

STAT 231: Probability and Statistical Inference for Engineers
(4-0) Cr. 4. F.S.
Prereq: Credit or concurrent enrollment in MATH 265 or MATH 265H
Emphasis on engineering applications. Basic probability; random
variables and probability distributions; joint and sampling distributions.
Descriptive statistics; confidence intervals; hypothesis testing; simple
linear regression; multiple linear regression; one way analysis of variance;
use of statistical software.

STAT 301: Intermediate Statistical Concepts and Methods
(3-2) Cr. 4. F.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226 or STAT
231 or STAT 305 or STAT 322 or STAT 330
Statistical concepts and methods used in the analysis of observational
data. Analysis of single sample, two sample and paired sample data.
Simple and multiple linear regression including polynomial regression
and use of indicator variables. Model building and analysis of residuals.
Introduction to one-way ANOVA, tests of independence for contingency
tables, and logistic regression. Credit for only one of the following
courses may be applied toward graduation: STAT 301, STAT 326, STAT
401, or STAT 587.
STAT 305: Engineering Statistics
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 165
Statistics for engineering problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multi-sample studies; regression analysis; use of statistical software. Credit for both STAT 105 and STAT 305 may not be applied toward graduation.

STAT 322: Probabilistic Methods for Electrical Engineers
(Cross-listed with E E). (3-0) Cr. 3. F.S.
Prereq: E E 224
Introduction to probability with applications to electrical engineering. Sets and events, probability space, conditional probability, total probability and Bayes’ rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating functions, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes.

STAT 326: Introduction to Business Statistics II
(2-2) Cr. 3. F.S.SS.
Prereq: STAT 226
Multiple regression analysis; regression diagnostics; model building; applications in analysis of variance and time series; random variables; distributions; conditional probability; use of computers to visualize and analyze data. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326, STAT 401, or STAT 587.

STAT 330: Probability and Statistics for Computer Science
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 166
Topics from probability and statistics applicable to computer science. Basic probability; Random variables and their distributions; Stochastic processes including Markov chains; Queuing models; Basic statistical inference; Introduction to regression.

STAT 332: Visual Communication of Quantitative Information
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250; (STAT 101 or STAT 104 or STAT 201 or STAT 231 or STAT 305 or STAT 322 or STAT 330)
Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

STAT 341: Introduction to the Theory of Probability and Statistics I
(Cross-listed with MATH). (3-2) Cr. 4. F.S.
Prereq: MATH 265 or MATH 265H
Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; transformations of random variables; simulation of random variables and use of the R statistical package. Credit for only one of the following courses may be applied toward graduation: STAT 341, STAT 347, STAT 447, or STAT 588.

STAT 342: Introduction to the Theory of Probability and Statistics II
(Cross-listed with MATH). (3-2) Cr. 4. F.S.
Prereq: (MATH 207 or MATH 317); (STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226 or STAT 231 or STAT 305 or STAT 322 or STAT 330); STAT 341
Sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; resampling methods; introduction to Bayesian inference; use of the R statistical package for simulation and data analysis.

STAT 347: Probability and Statistical Theory for Data Science
Cr. 4. F.
Prereq: (MATH 207 or MATH 317); MATH 265; (STAT 301 or STAT 326)
Introduction to probability; distribution functions and their properties; classical discrete and continuous distributions; sampling distributions; theory of estimation; theory of inference; use of R statistical package for simulation and data analysis. Credit for only one of the following courses may be applied toward graduation: STAT 341, STAT 347, STAT 447, or STAT 588.

STAT 361: Statistical Quality Assurance
(Cross-listed with I E). (2-2) Cr. 3. F.S.
Prereq: STAT 231, STAT 301, STAT 326, STAT 401, or STAT 587

STAT 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Department Chair Permission
Off-campus work periods for undergraduate students in a field of statistics.
STAT 471: Introduction to Experimental Design
(Dual-listed with STAT 571). (3-0) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
The role of statistics in research and the principles of experimental
design. Concepts of experimental and observational units, randomization,
replication, blocking, subdividing and repeatedly measuring experimental
units; factorial treatment designs and confounding; common designs
including randomized complete block design, Latin square design, split-
plot design, and analysis of data from such common designs; extensions
of the analysis of variance to cover variance components. Determining
sample size. Credit in only one of STAT 402, STAT 471, or STAT 571 may
be applied to graduation. May not be used for graduate credit in the
Statistics MS and PhD degree programs.

STAT 472: Introduction to Time Series
(Dual-listed with STAT 572). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 526 or STAT 587
Methods for analyzing data collected over time; review of multiple
regression analysis. Elementary forecasting methods: moving averages
and exponential smoothing. Autoregressive-moving average (Box-
Jenkins) models: identification, estimation, diagnostic checking, and
forecasting. Transfer function models and intervention analysis.
Introduction to multivariate time series methods. Credit for only one of
STAT 451, STAT 472, or STAT 572 may be applied to graduation. May
not be used for graduate credit in the Statistics MS and PhD degree
programs.

STAT 473: Introduction to Survey Sampling
(Dual-listed with STAT 573). (2-2) Cr. 3. S.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
Concepts of sample surveys and the survey process; methods of
designing sample surveys, including: simple random, stratified,
systematic, probability proportional to size, and multistage sampling
designs; methods of analyzing sample surveys including ratio, regression,
domain estimation and nonresponse.

STAT 474: Introduction to Bayesian Data Analysis
(Dual-listed with STAT 574). (2-2) Cr. 3. S.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
Probability models and prior distributions; updating priors through the
likelihood function. Computational and simulation-based methods for
deriving posterior distributions and for estimating parameters. Basic
statistical and hierarchical models. Model adequacy and posterior
predictive checks. Markov Chain Monte Carlo methods and introduction
to WinBUGS or similar software. Emphasis on applications and examples
from the social, biological and physical sciences. Credit for only one of
STAT 444, STAT 474, or STAT 574 may be applied to graduation. May
not be used for graduate credit in the Statistics MS and PhD degree
programs.

STAT 475: Introduction to Multivariate Data Analysis
(Dual-listed with STAT 575). (2-2) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Statistical and graphical methods for displaying and analyzing
multivariate data including plotting high-dimensional data using
interactive graphics; organizing and summarizing analyses of
multivariate data; comparing two group mean vectors; multivariate
analysis of variance; reducing variable dimension with principal
components; identifying factors with exploratory factor analysis;
grouping observations with multidimensional scaling and cluster
analysis; classification; R statistical software package and using Rstudio
to create reports (RMarkdown and GGplot). Knowledge of linear algebra
recommended. Credit for only one of STAT 407, STAT 475, or STAT 575
may be applied to graduation. May not be used for graduate credit in the
Statistics MS and PhD degree programs.

STAT 476: Introduction to Spatial Data Analysis
(Dual-listed with STAT 576). (3-0) Cr. 3. Alt. S., offered even-numbered
years.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
The analysis of spatial data; geostatistical methods, mapping and spatial
prediction; methods for areal data; models and methods for spatial
point processes. Emphasis on application and practical use of spatial
statistical analysis. Use of R and R packages for spatial data analysis.
Credit for only one of STAT 406, STAT 476, or STAT 576 may be applied to
graduation. May not be used for graduate credit in the Statistics MS and
PhD degree programs.
STAT 477: Introduction to Categorical Data Analysis
(Dual-listed with STAT 577). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models. Credit for only one of STAT 457, STAT 477, or STAT 577 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 478: Introduction to Stochastic Process Models
(Dual-listed with STAT 578). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 231 or STAT 341 or STAT 347 or STAT 447 or STAT 588
Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queuing processes; applications to bioinformatics and other quantitative problems. Credit for only one of STAT 432, STAT 478, or STAT 578 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 482: Regression for Social and Behavioral Research
(Dual-listed with STAT 582). (2-2) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; logistic, multinomial and Poisson regression. Credit for only one of STAT 404, STAT 482, or STAT 582 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 483: Empirical Methods for the Computational Sciences
(Dual-listed with STAT 583). (3-0) Cr. 3. F.
Prereq: MATH 166; STAT 330
Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R. Knowledge of linear algebra recommended. Credit for only one of STAT 430, STAT 483, or STAT 583 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 484: Computer Processing of Scientific Data
(Dual-listed with STAT 584). (3-0) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Structure, content and programming aspects of modern statistical software packages. Advanced techniques for data management, graphics, exploratory data analysis, and generalized linear models. Credit for only one of STAT 479, STAT 484, or STAT 584 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 486: Introduction to Statistical Computing
(Dual-listed with STAT 586). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Modern statistical computing. Topics may include: basic and advanced R programming; data management; spread sheets; verifying data accuracy; transferring data between software packages; data and graphical analysis with statistical software packages; algorithmic programming concepts and applications; simulation studies and resampling methods; software reliability; statistical modeling and machine learning. Credit for only one of STAT 480, STAT 486, or STAT 586 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in STAT; Permission of Instructor
No more than 9 credits in Stat 490 may be counted toward graduation.

STAT 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in STAT; Permission of Instructor
No more than 9 credits in Stat 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

STAT 500: Statistical Methods I
(3-2) Cr. 4. F.
Prereq: STAT 447 or STAT 588 or current enrollment in STAT 542; knowledge of matrix algebra.
Analysis of data from designed experiments and observational studies. Randomization-based and model-based inference on group means; pairing/blocking and other uses of restricted randomization. Model assessment and diagnostics; remedial measures; alternative approaches based on ranks. Simple linear regression, multiple linear regression, and model selection criteria. Use of linear models to analyze data; least squares estimation; estimability; sampling distributions of estimators; general linear tests; inference for parameters and contrasts.
STAT 501: Multivariate Statistical Methods
(3-0) Cr. 3. S.
Prereq: STAT 500; STAT 542; STAT 579 or equivalent; knowledge of matrix algebra.
Statistical methods for analyzing and displaying multivariate data; the multivariate normal distribution; inference in multivariate populations, simultaneous analysis of multiple responses, multivariate analysis of variance; summarizing high dimensional data with principal components, factor analysis, canonical correlations, classification methods, clustering, multidimensional scaling; introduction to basic nonparametric multivariate methods. Statistical software: SAS or R.

STAT 502: Applied Modern Multivariate Statistical Learning
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 500, STAT 542, STAT 579.
A Statistics-MS-level introduction to Modern Multivariate Statistical Learning. Theory-based methods for modern data mining and machine learning, inference and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics. Substantial use of R packages implementing these methods.

STAT 503: Exploratory Methods and Data Mining
(2-2) Cr. 3. Alt. S., offered irregularly.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587; STAT 341 or STAT 347 or STAT 447 or STAT 542 or STAT 588; STAT 480 or STAT 486 or STAT 579 or STAT 586
Approaches to finding the unexpected in data; exploratory data analysis; pattern recognition; dimension reduction; supervised and unsupervised classification; interactive and dynamic graphical methods; computer-intensive statistical techniques for large or high dimensional data and visual inference. Emphasis is on problem solving, topical problems, and learning how so-called black-box methods actually work.

STAT 505: Environmental Statistics
(3-0) Cr. 3.
Prereq: STAT 447 or STAT 542 or STAT 588; STAT 401 or STAT 500 or STAT 587
Statistical methods and models for environmental applications. Emphasis on environmental toxicology. Analysis of data with below detection-limit values. Dose-response curve modeling, including overdispersion and estimation of safe doses. Trend analysis; analysis of autocorrelated data. Equivalence testing.

STAT 506: Statistical Methods for Spatial Data
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 447 or STAT 542 or STAT 588
The analysis of spatial data; geostatistical methods and spatial prediction; discrete index random fields and Markov random field models; models for spatial point processes.

STAT 510: Statistical Methods II
(3-0) Cr. 3. S.
Prereq: STAT 500; STAT 447 or STAT 542 or STAT 588 or credit/enrollment in STAT 543
Linear models and analysis of variance for multifactor experiments with balanced and unbalanced data. Likelihood analysis for general linear models and models with non-normal random components; linear model results in the context of likelihood; linear mixed models and their application; estimation, inference, and prediction. Introduction to generalized linear models and generalized linear mixed models. Case studies of applications including problem formulation, exploratory analysis, model development, estimation and inference, and model assessment.

STAT 512: Design of Experiments
(3-0) Cr. 3. F.
Prereq: STAT 510
Basic techniques of experimental design developed in the context of the general linear model; completely randomized, randomized complete block, and Latin Square designs; factorial experiments, confounding, fractional replication; split-plot and incomplete block designs.

STAT 513: Response Surface Methodology
(3-0) Cr. 3.
Prereq: STAT 402 or STAT 471 or STAT 512 or STAT 571; knowledge of elementary matrix theory and matrix formulation of regression
Analysis techniques for locating optimum and near-optimum operating conditions: standard experimental designs for first- and second-order response surface models; design performance criteria; use of data transformations; mixture experiments; optimization for multiple-response problems. Requires use of statistical software with matrix functions.

STAT 515: Theory and Applications of Nonlinear Models
(3-0) Cr. 3.
Prereq: STAT 447 or STAT 543 or STAT 588; STAT 510
Construction of nonlinear statistical models; random and systematic model components, additive error nonlinear regression with constant and non-constant error variances, generalized linear models, transform both sides models. Iterative algorithms for estimation and asymptotic inference. Basic random parameter models, beta-binomial and gamma-Poisson mixtures. Requires use of instructor-supplied and student-written R functions.
STAT 516: Statistical Design and Analysis of Gene Expression Experiments
(3-0) Cr. 3.
Prereq: STAT 500; STAT 447 or STAT 542 or STAT 588
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, and empirical Bayes analysis; procedures for controlling false discovery rate for multiple testing; clustering problems for gene expression data; testing gene categories; emphasis on current research topics for statistical analysis of high dimensional gene expression data.

STAT 520: Statistical Methods III
(3-0) Cr. 3. F.
Prereq: STAT 510; STAT 447 or STAT 543 or STAT 588
Nonlinear regression; generalized least squares; asymptotic inference. Generalized linear models; exponential dispersion families; maximum likelihood and inference. Designing Monte Carlo studies; bootstrap; cross-validation. Fundamentals of Bayesian analysis; data models, priors and posteriors; posterior prediction; credible intervals; Bayes Factors; types of priors; simulation of posteriors; introduction to hierarchical models and Markov Chain Monte Carlo methods.

STAT 521: Theory and Applications of Sample Surveys
(3-0) Cr. 3. S.
Prereq: STAT 401 or STAT 500 or STAT 587; STAT 447 or STAT 542 or STAT 588

STAT 522: Advanced Applied Survey Sampling
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: STAT 421 or STAT 473 or STAT 521 or STAT 573
Advanced topics in survey sampling and methodology: clustering and stratification in practice, adjustments and imputation for missing data, variance estimation in complex surveys, methods of panel and/or longitudinal surveys, procedures to increase response rates, and computing. Examples are taken from large, well-known surveys in various subject areas.

STAT 525: Statistical Methods for Mathematics Teachers
(6-0) Cr. 6.
Prereq: STAT 341 or equivalent
Descriptive statistics; data collection through experimentation and sampling; univariate statistical inference; contingency tables; design of experiments and ANOVA; simple linear regression; logistic regression; multiple linear regression; statistics pedagogy. (Offered on a 3-year cycle; offered SS 2020.) May not be used for graduate credit in the Statistics program. Credit in STAT 410 or STAT 525, but not both, may be applied toward graduation.

STAT 526: Applied Statistical Modeling
Cr. 3. F.
Prereq: Admission to Master of Business Analytics program
Probability concepts and distributions used in statistical decision-making for business applications. Least-squares and maximum likelihood estimation, sampling distributions of estimators, formal statistical inference, analysis of variance, multiple regression models and strategies for model selection, logistic regression, and Poisson regression. Applications implemented with the R statistical package. Simulations used to investigate properties of inferential procedures and to assist in data analysis. May not be used for graduate credit in the Statistics program.

STAT 528: Visual Business Analytics
Cr. 3. F.
Prereq: Admission to the Master of Business Analytics Program
Types of data displays; numerical and visual summaries of data; data structures for data displays; data vs info graphics; good practices of displaying data; human perception and cognition in data displays; graphics as tools of data exploration; graphical diagnostics of statistical models and machine learning procedures; strategies and techniques for data visualizations; basics of reproducibility and repeatability; web-based interactive applets for visual presentation of data and results; programming in R. May not be used for graduate credit in the Statistics program.

STAT 531: Quality Control and Engineering Statistics
(Cross-listed with IE). (3-0) Cr. 3.
Prereq: STAT 401 or STAT 587; STAT 342 or STAT 447 or STAT 588
Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.
STAT 533: Reliability
(Cross-listed with I E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 342 or STAT 432 or STAT 447 or STAT 478 or STAT 578 or STAT 588
Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrent events and degradation data; planning studies to obtain reliability data.

STAT 534: Ecological Statistics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 447 or STAT 542 or STAT 588
Statistical methods for non-standard problems, illustrated using questions and data from ecological field studies. Estimation of abundance and survival from mark-recapture studies, deterministic and stochastic matrix models of population trends, integral projection models, and hierarchical modeling, especially of population dynamics. Additional topics vary based on student interest.

STAT 536: Statistical Genetics
(Cross-listed with GDCB). (3-0) Cr. 3.
Prereq: STAT 401 or STAT 587; STAT 447 or STAT 588; GEN 320 or BIOL 313
Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

STAT 542: Theory of Probability and Statistics I
(4-0) Cr. 4. F.
Prereq: MATH 414.

STAT 543: Theory of Probability and Statistics II
(3-0) Cr. 3. S.
Prereq: STAT 542.

STAT 544: Bayesian Statistics
(3-0) Cr. 3. S.
Prereq: Credit or concurrent enrollment in STAT 543
Specification of probability models; subjective, conjugate, and noninformative prior distributions; hierarchical models; analytical and computational techniques for obtaining posterior models; model checking, model selection, diagnostics; comparison of Bayesian and traditional methods.

STAT 546: Nonparametric Methods in Statistics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 510, STAT 542
Overview of parametric versus nonparametric methods of inference; introduction to rank-based tests and/or nonparametric smoothing methods for estimating density and regression functions; smoothing parameter selection.

STAT 547: Functional Data Analysis
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 543, STAT 510
Theory and methods for analyzing functional data, which are data that take the forms of trajectories and images, possibly highly discretized and contaminated with noise. Topics include basic operations on functional data, necessary theoretical foundations, functional principal component analysis, kernel and spline smoothing, covariance modeling and estimation, dynamics modeling, concurrent regression models, functional linear models, inference for functional data, classification, and other optional topics.
STAT 551: Time Series Analysis
(3-0) Cr. 3. F.
Prereq: STAT 447 or STAT 542 or STAT 588
Concepts of trend and dependence in time series data; stationarity and
basic model structures for temporal dependence; moving average and
autoregressive error structures; analysis in time domain and in frequency
domain; parameter estimation, prediction and forecasting; identification
of appropriate model structure and model assessment techniques.
Possible extended topics including non-linear models, dynamic models,
state-space models.

STAT 554: Stochastic Process Models
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: STAT 542
Markov chains on discrete spaces in discrete and continuous time
(random walks, Poisson processes, birth and death processes) and their
long-term behavior. Optional topics may include branching processes,
renewal theory, introduction to Brownian motion.

STAT 557: Statistical Methods for Counts and Proportions
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 401 or STAT 500 or STAT 587; STAT 447 or STAT 543 or STAT
588
Statistical methods for analyzing simple random samples when
outcomes are counts or proportions; measures of association and
relative risk, chi-squared tests, loglinear models, logistic regression and
other generalized linear models, tree-based methods. Maximum likelihood
estimation and large sample theory. Extensions to longitudinal studies
and complex survey designs, models with fixed and random effects. Use
of statistical software: SAS or R.

STAT 559: Item Response Theory
Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401 or STAT 500 or STAT 587
Statistical methods for analysis of binary and polytomous data using
latent trait models. Application and theory of model selection and fit,
dimensionality, differential item functioning and test development. Use of
appropriate statistical software.

STAT 565: Methods in Biostatistics and Epidemiology
(Cross-listed with TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401 or STAT 500 or STAT 587; STAT 447 or STAT 543 or STAT
588
Statistical methods commonly used in epidemiology and human and
animal health studies. Overview of cohort studies, case-control studies
and randomized clinical trials. Topics include inference procedures
for disease risk factors, analysis of time-to-event and survival data,
analysis of longitudinal studies of disease progression and health
status, diagnostic test evaluation, and meta-analysis. Examples will
come from recent studies of physical and mental health, nutrition and
disease progression in human and animal populations. Use of statistical
software: SAS or R.

STAT 568: Statistical Bioinformatics
(Cross-listed with BCB, COM S, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and one of STAT 430 or STAT 483 or STAT 583),
credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome
annotation, motif discovery, variant discovery, molecular phylogeny, gene
expression analysis, and metagenomics. Statistical topics include model
building, inference, hypothesis testing, and simple experimental design,
including for big data/complex models.

STAT 570: Systems Biology
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430 or STAT 483 or
STAT 583
Algorithmic and statistical approaches in computational functional
genomics and systems biology. Analysis of high throughput biological
data obtained using system-wide measurements. Topological analysis,
module discovery, and comparative analysis of gene and protein
networks. Modeling, analysis, and inference of transcriptional regulatory
Dynamic systems and whole-cell models. Ontology-driven, network based,
and probabilistic approaches to information integration.
STAT 571: Introduction to Experimental Design
(Dual-listed with STAT 471). (3-0) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
The role of statistics in research and the principles of experimental
design. Concepts of experimental and observational units, randomization,
replication, blocking, subdividing and repeatedly measuring experimental
units; factorial treatment designs and confounding; common designs
including randomized complete block design, Latin square design, split-
plot design, and analysis of data from such common designs; extensions
of the analysis of variance to cover variance components. Determining
sample size. Credit in only one of STAT 402, STAT 471, or STAT 571 may
be applied to graduation. May not be used for graduate credit in the
Statistics MS and PhD degree programs.

STAT 572: Introduction to Time Series
(Dual-listed with STAT 472). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 526 or STAT 587
Methods for analyzing data collected over time; review of multiple
regression analysis. Elementary forecasting methods: moving averages
and exponential smoothing. Autoregressive-moving average (Box-
Jenkins) models: identification, estimation, diagnostic checking, and
forecasting. Transfer function models and intervention analysis.
Introduction to multivariate time series methods. Credit for only one of
STAT 451, STAT 472, or STAT 572 may be applied to graduation. May
not be used for graduate credit in the Statistics MS and PhD degree
programs.

STAT 573: Introduction to Survey Sampling
(Dual-listed with STAT 473). (2-2) Cr. 3. S.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
Concepts of sample surveys and the survey process; methods of
designing sample surveys, including: simple random, stratified,
systematic, probability proportional to size, and multistage sampling
designs; methods of analyzing sample surveys including ratio, regression,
domain estimation and nonresponse.

STAT 574: Introduction to Bayesian Data Analysis
(Dual-listed with STAT 474). (2-2) Cr. 3. S.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
Probability models and prior distributions; updating priors through the
likelihood function. Computational and simulation-based methods for
deriving posterior distributions and for estimating parameters. Basic
statistical and hierarchical models. Model adequacy and posterior
predictive checks. Markov Chain Monte Carlo methods and introduction
to WinBUGS or similar software. Emphasis on applications and examples
from the social, biological and physical sciences. Credit for only one of
STAT 444, STAT 474, or STAT 574 may be applied to graduation. May
not be used for graduate credit in the Statistics MS and PhD degree
programs.

STAT 575: Introduction to Multivariate Data Analysis
(Dual-listed with STAT 475). (2-2) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Statistical and graphical methods for displaying and analyzing
multivariate data including plotting high-dimensional data using
interactive graphics; organizing and summarizing analyses of
multivariate data; comparing two group mean vectors; multivariate
analysis of variance; reducing variable dimension with principal
components; identifying factors with exploratory factor analysis;
grouping observations with multidimensional scaling and cluster
analysis; classification; R statistical software package and using Rstudio
to create reports (RMardown and GGplot). Knowledge of linear algebra
recommended. Credit for only one of STAT 407, STAT 475, or STAT 575
may be applied to graduation. May not be used for graduate credit in the
Statistics MS and PhD degree programs.

STAT 576: Introduction to Spatial Data Analysis
(Dual-listed with STAT 476). (3-0) Cr. 3. Alt. S., offered even-numbered
years.
Prereq: (STAT 301 or STAT 326 or STAT 401 or STAT 587); (STAT 341 or STAT
347 or STAT 447 or STAT 588)
The analysis of spatial data; geostatistical methods, mapping and spatial
prediction; methods for areal data; models and methods for spatial
point processes. Emphasis on application and practical use of spatial
statistical analysis. Use of R and R packages for spatial data analysis.
Credit for only one of STAT 406, STAT 476, or STAT 576 may be applied to
graduation. May not be used for graduate credit in the Statistics MS and
PhD degree programs.
STAT 577: Introduction to Categorical Data Analysis
(Dual-listed with STAT 477). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models. Credit for only one of STAT 457, STAT 477, or STAT 577 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 578: Introduction to Stochastic Process Models
(Dual-listed with STAT 478). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 231 or STAT 341 or STAT 347 or STAT 447 or STAT 588
Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queuing processes; applications to bioinformatics and other quantitative problems. Credit for only one of STAT 432, STAT 478, or STAT 578 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 579: An Introduction to R
(0-2) Cr. 1. F.
Prereq: Enrollment in STAT 500
An introduction to the logic of programming, numerical algorithms, and graphics. The R statistical programming environment will be used to demonstrate how data can be stored, manipulated, plotted, and analyzed using both built-in functions and user extensions. Concepts of modularization, looping, vectorization, conditional execution, and function construction will be emphasized.

STAT 580: Statistical Computing
(3-0) Cr. 3. S.
Prereq: STAT 579; STAT 447 or STAT 588 or STAT 542
Introduction to scientific computing for statistics using C: Introduction to C for computing and memory efficiency; design of statistical algorithms; use of algorithms in modern libraries, parallel computing. Interfacing R with C. Building statistical libraries. Statistical computing: solving nonlinear equations; optimization, integration; simulation methods, inversion of probability integral transformations, rejection sampling, importance sampling.

STAT 581: Analysis of Gene Expression Data for the Biological Sciences
(3-0) Cr. 3. S.
Prereq: STAT 401 or STAT 587
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on practical use of methods. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 582: Regression for Social and Behavioral Research
(Dual-listed with STAT 482). (2-2) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; logistic, multinomial and Poisson regression. Credit for only one of STAT 404, STAT 482, or STAT 582 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 583: Empirical Methods for the Computational Sciences
(Dual-listed with STAT 483). (3-0) Cr. 3. F.
Prereq: MATH 166; STAT 330
Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R. Knowledge of linear algebra recommended. Credit for only one of STAT 430, STAT 483, or STAT 583 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.
STAT 584: Computer Processing of Scientific Data
(Dual-listed with STAT 484). (3-0) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Structure, content and programming aspects of modern statistical software packages. Advanced techniques for data management, graphics, exploratory data analysis, and generalized linear models. Credit for only one of STAT 479, STAT 484, or STAT 584 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 585: Data Technologies for Statistical Analysis.
Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 579.
Introduction to computational methods for data analysis. Accessing and managing data formats: flat files, databases, web technologies based on mark-up languages (SML, KML, HTML), netCDF. Elements of text processing: regular expressions for cleaning data. Working with massive data, handling missing data, scaled computing. Efficient programming, reproducible code.

STAT 586: Introduction to Statistical Computing
(Dual-listed with STAT 486). (3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401 or STAT 587
Modern statistical computing. Topics may include: basic and advanced R programming; data management; spread sheets; verifying data accuracy; transferring data between software packages; data and graphical analysis with statistical software packages; algorithmic programming concepts and applications; simulation studies and resampling methods; software reliability; statistical modeling and machine learning. Credit for only one of STAT 480, STAT 486, or STAT 586 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 587: Statistical Methods for Research Workers
(3-2) Cr. 4. F. S. S.
Prereq: An applied statistics course at the undergraduate level, such as STAT 101, 104, 105, 201, or 226. Students without an equivalent course should contact the department.
A first course in statistics for graduate students from the applied sciences. Principles of data analysis and scientific inference, including estimation, hypothesis testing, and the construction of interval estimates. Statistical concepts and models, including group comparison, blocking, and linear regression. Different sections are designed for students in various disciplines, and additional methods covered may depend on the target audience. Topics covered may include basic experimental designs and analysis of variance for those designs, analysis of categorical data, logistic and log-linear regression, likelihood-based inference, and the use of simulation. Equivalent to STAT 401 in previous catalogs. May not be used for graduate credit in the Statistics MS and PhD degree programs. Credit in STAT 401 or STAT 587, but not both, may be applied toward graduation.

STAT 588: Statistical Theory for Research Workers
(4-0) Cr. 4. F. S. S.
Prereq: MATH 151 and permission of instructor, or MATH 265
Provides an introduction to the theoretical basis of fundamental statistical methods for graduate students in the applied sciences. Probability and probability distributions, moments and moment generating functions, conditional expectation, and transformation of random variables. Estimation based on loss functions, maximum likelihood, and properties of estimators. Sampling distributions, exact and asymptotic results, and the development of intervals. Principles of Bayesian analysis, inference from posterior distributions, and optimal prediction. Uses simulation to verify and extend theoretical results. Equivalent to STAT 447 in previous catalogs. May not be used for graduate credit in the Statistics MS and PhD degree programs. Credit in STAT 447 or STAT 588, but not both, may be applied toward graduation.

STAT 590: Special Topics
Cr. arr. Repeatable.

STAT 590A: Special Topics: Theory
Cr. arr. Repeatable.

STAT 590B: Special Topics: Methods
Cr. arr. Repeatable.

STAT 590C: Special Topics: Design of Experiments
Cr. arr. Repeatable.

STAT 590D: Special Topics: Sample Surveys
Cr. arr. Repeatable.

STAT 590E: Special Topics: Statistics Education
Cr. arr. Repeatable.
STAT 590F: Special Topics: Statistical Computing and Graphics
Cr. arr. Repeatable. F.

STAT 598: Cooperative Education
Cr. R. F.S.S.
Prereq: Permission of the department chair
Off-campus work periods for graduate students in a field of statistics.

STAT 599: Creative Component
Cr. arr.

Courses for graduate students:

STAT 601: Advanced Statistical Methods
(3-0) Cr. 3. S.
Prereq: STAT 520, STAT 543 and MATH 414 or enrollment in STAT 641
Methods of constructing complex models including adding parameters to existing structures, incorporating stochastic processes and latent variables. Use of modified likelihood functions; quasi-likelihoods; profiles; composite likelihoods. Asymptotic normality as a basis of inference; Godambe information. Sample reuse; block bootstrap; resampling with dependence. Simulation for model assessment. Issues in Bayesian analysis.

STAT 602: Modern Multivariate Statistical Learning
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 520, STAT 543, STAT 579
Statistical theory and methods for modern data mining and machine learning, inference, and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, and reproducing kernel Hilbert spaces; kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics.

STAT 606: Advanced Spatial Statistics
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: STAT 506, STAT 543
Consideration of advanced topics in spatial statistics, including areas of recent development in modern spatial statistics. Topics may include spatial sampling design; spatial Markov random fields; non-Gaussian spatial models, including spatial generalized linear mixed effects model; spatial Bayesian hierarchical models, simulation of random fields; spatial-temporal process models; non-stationary process models; multivariate spatial process models; spectral methods for spatial data; computational methods for large spatial data, spatial models for stream networks. Use of R to analyze various real spatial data.

STAT 611: Theory and Applications of Linear Models
(3-0) Cr. 3. F.
Prereq: STAT 510; STAT 542 or STAT 447 or STAT 588; a course in matrix algebra
Matrix preliminaries, estimability, theory of least squares and of best linear unbiased estimation, analysis of variance and covariance, distribution of quadratic forms, extension of theory to mixed and random effects models, restricted maximum likelihood estimation and inference for variance components.

STAT 612: Advanced Design of Experiments
(3-0) Cr. 3. Alt. S., offered irregularly.
Prereq: STAT 512
General theory of factorial experiments. Design optimality criteria, approximate design and general equivalence theory, computational approaches to constructing optimal designs for linear models, and extensions to nonlinear models. Advanced topics of current interest in the design of experiments, including one or more of: distance based design criteria and construction of spatial process models, screening design strategies for high-dimensional problems, and design problems associated with computational experiments.

STAT 615: Advanced Bayesian Methods
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 544 and STAT 601

STAT 621: Advanced Theory of Survey Statistics
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: STAT 521
Advanced topics of current interest in the design of surveys and analysis of survey data, including: asymptotic theory for design and model-based estimators, use of auxiliary information in estimation, variance estimation techniques, small area estimation, non-response modeling and imputation.
STAT 641: Foundations of Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501 or equivalent course.
Sequences and set theory; Lebesgue measure, measurable functions.
Absolute continuity of functions, integrability and the fundamental
theorem of Lebesgue integration. General measure spaces, probability
measure, extension theorem and construction of Lebesgue-Stieltjes
measures on Euclidean spaces. Measurable transformations and random
variables, induced measures and probability distributions. General
integration and expectation, Lp-spaces and integral inequalities. Uniform
integrability and absolute continuity of measures. Probability densities
and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli
theorems.

STAT 642: Advanced Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: STAT 641, or STAT 543 and MATH 515
Probability spaces and random variables. Kolmogorov’s consistency
theorem. Independence, Borel-Cantelli lemmas and Kolmogorov’s 0 - 1
Law. Types and characterizations of convergence for random variables.
Sums of independent random variables, empirical distributions, weak
and strong laws of large numbers. Convergence in distribution and its
formulations, tightness, characteristic functions, central limit theorems
and Lindeberg-Feller conditions. Conditional probability and expectation,
discrete parameter martingales.

STAT 643: Advanced Theory of Statistical Inference
(3-0) Cr. 3. F.
Prereq: STAT 543, STAT 642
Foundational concepts for likelihood, including sufficiency, completeness,
exponential families, statistical information. Elements of decision theory,
risk management strategies, theoretical properties of decision rules.
Large-sample properties of maximum likelihood and Bayesian estimation,
consistency, asymptotic normality, efficiency, likelihood ratios. Potential
additional topics including M-estimation, U-statistics, nonparametric
inference.

STAT 644: Advanced Bayesian Theory
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 544 and STAT 642
Exchangeability, parametric models, consistency and asymptotic
normality of posterior distributions, posterior robustness, selection of
priors using formal rules, improper priors and posterior propriety. Bayes
factors, model selection, MCMC theory, irreducibility, Harris recurrence,
regeneration, minorization and drift conditions, ergodicity, central limit
theorems, Gibbs samplers, Metropolis Hastings samplers, techniques for
speeding up convergence of certain MCMC algorithms.

STAT 645: Advanced Stochastic Processes
(Cross-listed with MATH). (3-0) Cr. 3. S.
Stochastic integration and Itô’s formula. Stochastic differential
equations and applications.

STAT 647: Advanced Multivariate Analysis
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 543, knowledge of matrix algebra
Classical and high dimensional multivariate methods and their theories;
multivariate random vectors and their distributions (multivariate normal,
elliptical contour distributions); dependence measures and copulas;
Wishart distribution and distributions for quadratic form statistics;
Hotelling’s T square test and its derivation; high-dimensional inference for
mean and covariance, concentration inequalities, random matrix theory,
signal detection and identification.

STAT 648: Seminar on Theory of Statistics and Probability
Cr. arr. Alt. F., offered irregularly.
Prereq: STAT 543.
Seminar topics change with each offering.

STAT 651: Advanced Time Series
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 551, STAT 642
Estimation and distributional theory for time series, generalized
estimating functions, M-estimation, frequency domain estimation. Limit
theorems under time dependence, mixing, long-memory. Approximations
of sampling distributions and standard errors for time series statistics,
bootstrap, subsampling.

STAT 680: Advanced Statistical Computing
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 543 and STAT 580
Normal approximations to likelihoods. The delta-method and propagation
of errors. Topics in the use of the E-M algorithm including; its use in
the exponential family, computation of standard errors, acceleration.
Resampling methods: brief theory and application of the jackknife and
the bootstrap. Randomization tests. Stochastic simulation: Markov
Chain, Monte Carlo, Gibbs' sampling, Hastings-Metropolis algorithms,
critical slowing-down and remedies, auxiliary variables, simulated
tempering, reversible-jump MCMC and multi-grid methods.

STAT 690: Advanced Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690A: Advanced Special Topics: Theory
Cr. arr. Repeatable.
Prereq: Permission of instructor
STAT 690B: Advanced Special Topics: Methods
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690C: Advanced Special Topics: Design of Experiments
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690D: Advanced Special Topics: Sample Surveys
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690E: Advanced Special Topics: Statistical Computing
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690F: Advanced Special Topics: Graphics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 699: Research
Cr. arr. Repeatable.