Courses

STAT 2600 (4) Introduction to Data Science
Introduces students to importing, tidying, exploring, visualizing, summarizing, and modeling data and then communicating the results of these analyses to answer relevant questions and make decisions. Students will learn how to program in R using reproducible workflows. During weekly lab sessions students will collaborate with their teammates to pose and answer questions using real-world datasets.
Requisites: Requires prerequisite of APPM 1350 or MATH 1300 (both require minimum grade C-).
Grading Basis: Letter Grade

STAT 3100 (3) Applied Probability
Studies axioms, counting formulas, conditional probability, independence, random variables, continuous and discrete distribution, expectation, joint distributions, moment generating functions, law of large numbers and the central limit theorem.
Equivalent - Duplicate Degree Credit Not Granted: ECEN 3810 or MATH 4510 APPM 3570
Requisites: Requires a prerequisite or corequisite course of APPM 2350 or MATH 2400 (prereq minimum grade C-).

STAT 3400 (3) Applied Regression
Introduces methods, theory, and applications of linear statistical models, covering topics such as estimation, residual diagnostics, goodness of fit, transformations, and various strategies for variable selection and model comparison. Examples will be demonstrated using statistical programming language R.
Requisites: Requires prerequisite STAT 2600 and STAT 3100 or MATH 4510 (all minimum grade C-). Requires corequisite APPM 3310.
Grading Basis: Letter Grade

STAT 4000 (3) Statistical Methods and Application I
Introduces exploratory data analysis, probability theory, statistical inference, and data modeling. Topics include discrete and continuous probability distributions, expectation, laws of large numbers, central limit theorem, statistical parameter estimation, hypothesis testing, and regression analysis. Considerable emphasis on applications in the R programming language.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5000
Requisites: Requires prerequisite APPM 1360 or MATH 2300 (both minimum grade C-).
Grading Basis: Letter Grade

STAT 4010 (3) Statistical Methods and Applications II
Expands upon statistical techniques introduced in STAT 4000. Topics include modern regression analysis, analysis of variance (ANOVA), experimental design, nonparametric methods, and an introduction to Bayesian data analysis. Considerable emphasis on application in the R programming language.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5010
Requisites: Requires prerequisite STAT 4000 (minimum grade C-).
Grading Basis: Letter Grade

STAT 4100 (3) Markov Processes, Queues, and Monte Carlo Simulations
Brief review of conditional probability and expectation followed by a study of Markov chains, both discrete and continuous time, including Poisson point processes. Queuing theory, terminology and single queue systems are studied with some introduction to networks of queues. Uses Monte Carlo simulation of random variables throughout the semester to gain insight into the processes under study.
Equivalent - Duplicate Degree Credit Not Granted: APPM 4560 and APPM 5560
Requisites: Requires prerequisite courses of APPM 3570 or STAT 3100 or MATH 4510 (all minimum grade C-).

STAT 4230 (3) Stochastic Analysis for Finance
Studies mathematical theories and techniques for modeling financial markets. Specific topics include the binomial model, risk neutral pricing, stochastic calculus, connection to partial differential equations and stochastic control theory.
Equivalent - Duplicate Degree Credit Not Granted: APPM 4530, APPM 5530 and STAT 5230
Requisites: Requires prerequisite courses of APPM 3310 and APPM 3570, or STAT 3100, or MATH 4510 (all minimum grade C-).

STAT 4250 (3) Data Assimilation in High Dimensional Dynamical Systems
Develops and analyzes approximate methods of solving the Bayesian inverse problem for high-dimensional dynamical systems. After briefly reviewing mathematical foundations in probability and statistics, the course covers the Kalman filter, particle filters, variational methods and ensemble Kalman filters. The emphasis is on mathematical formulation and analysis of methods.
Equivalent - Duplicate Degree Credit Not Granted: APPM 5510, APPM 4510 and STAT 5250
Requisites: Requires prerequisite courses of APPM 3310 and APPM 3570 or STAT 3100 or MATH 4510 (all minimum grade C-).

STAT 4400 (3) Advanced Statistical Modeling
Introduces methods, theory and applications of modern statistical models, from hierarchical linear models, to generalized hierarchical linear models, including hierarchical logistic and hierarchical count regression models. Topics such as estimation, residual diagnostics, goodness of fit, transformations, and various strategies for variable selection and model comparison will be discussed in depth. Examples will be demonstrated using statistical programming language R.
Requisites: Requires prerequisite STAT 3400 and (STAT 4520 or STAT 5010) (all minimum grade C-).
Grading Basis: Letter Grade

STAT 4430 (3) Spatial Statistics
Introduces the theory of spatial statistics with applications. Topics include basic theory for continuous stochastic processes, spatial prediction and kriging, simulation, geostatistical methods, likelihood and Bayesian approaches, spectral methods and an overview of modern topics such as nonstationary models, hierarchical modeling, multivariate processes, methods for large datasets and connections to spines.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5430
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences
STAT 4520 (3) Introduction to Mathematical Statistics
Examines point and confidence interval estimation. Principles of maximum likelihood, sufficiency, and completeness: tests of simple and composite hypotheses, linear models, and multiple regression analysis if time permits. Analyzes various distribution-free methods.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5520 and MATH 4520 and MATH 5520
Requisites: Requires prerequisites APPM 3570 or STAT 3100 or MATH 4510 (all minimum grade C-).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

STAT 4540 (3) Introduction to Time Series
Studies basic properties, trend-based models, seasonal models modeling and forecasting with ARIMA models, spectral analysis and frequency filtration.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5540 and MATH 4540 and MATH 5540
Requisites: Requires prerequisite course of APPM 4520 or STAT 4520 or MATH 4520 (minimum grade C).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

STAT 4610 (3) Statistical Learning
Consists of applications and methods of statistical learning. Reviews multiple linear regression and then covers classification, regularization, splines, tree-based methods, support vector machines, unsupervised learning and Gaussian process regression.
Requisites: Requires prerequisite course of STAT 3400 (minimum grade C).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

STAT 4630 (3) Computational Bayesian Statistics
Introduces Bayesian statistics, normal and non-normal approximation to likelihood and posteriors, the EM algorithm, data augmentation, and Markov Chain Monte Carlo (MCMC) methods. Additionally, introduces more advanced MCMC algorithms and requires significant statistical computing. Examples from a variety of areas, including biostatistics, environmental sciences, and engineering, will be given throughout the course.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5630
Requisites: Requires prerequisite course of APPM 4520 or STAT 4520 or MATH 4520 (minimum grade C). 
Recommended: Prerequisite prior programming and basic statistical modeling experience is required.

STAT 4680 (3) Statistical Collaboration
Educates and trains students to become effective interdisciplinary collaborators by developing the communication and collaboration skills necessary to apply technical statistics and data science skills to help domain experts answer research questions. Topics include structuring effective meetings and projects; communicating statistics to non-statisticians; using peer feedback, self-reflection and video analysis to improve collaboration skills; creating reproducible statistical workflows; working ethically.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5680
Requisites: Requires a prerequisite course of STAT 4520 or MATH 4520 (minimum grade C).
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

STAT 4690 (2) Advanced Statistical Collaboration
Educates and trains students to become advanced interdisciplinary collaborators by developing and refining the communication, collaboration and technical statistics and data science skills necessary to collaborate with domain experts to answer research questions. Students work on multiple projects. Discussions center on technical skills necessary to solve research problems and video analysis to improve communication and collaboration skills.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5690
Requisites: Requires prerequisite course of STAT 4680 or STAT 5680 (minimum grade C).
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

STAT 4700 (3) Philosophical and Ethical Issues in Statistics
Introduces students to philosophical issues that arise in statistical theory and practice. Topics include interpretations of probability, philosophical paradigms in statistics, inductive inference, causality, reproducible, and ethical issues arising in statistics and data analysis.
Equivalent - Duplicate Degree Credit Not Granted: STAT 5700
Requisites: Requires prerequisites STAT 4520 or STAT 3400 or STAT 4000 (all minimum grade C).
Grading Basis: Letter Grade

STAT 4700 (3) Statistical Learning
Introduces exploratory data analysis, probability theory, statistical inference, and data modeling. Topics include discrete and continuous probability distributions, expectation, laws of large numbers, central limit theorem, statistical parameter estimation, hypothesis testing, and regression analysis. Considerable emphasis on applications in the R programming language.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4000
Requisites: Restricted to graduate students only.
Grading Basis: Letter Grade

STAT 5010 (3) Statistical Methods and Applications II
Expands upon statistical techniques introduced in STAT 4000. Topics include modern regression analysis, analysis of variance (ANOVA), experimental design, nonparametric methods, and an introduction to Bayesian data analysis. Considerable emphasis on application in the R programming language.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4010
Requisites: Requires prerequisite STAT 5000 (minimum grade C)
Grading Basis: Letter Grade

STAT 5010 (3) Markov Processes, Queues, and Monte Carlo Simulations
Brief review of conditional probability and expectation followed by a study of Markov chains, both discrete and continuous time, including Poisson point processes. Queuing theory, terminology and single queue systems are studied with some introduction to networks of queues. Uses Monte Carlo simulation of random variables throughout the semester to gain insight into the processes under study.
Equivalent - Duplicate Degree Credit Not Granted: APPM 5560 and APPM 4560
Requisites: Restricted to graduate students only.

STAT 5230 (3) Stochastic Analysis for Finance
Studies mathematical theories and techniques for modeling financial markets. Specific topics include the binomial model, risk neutral pricing, stochastic calculus, connection to partial differential equations and stochastic control theory.
Equivalent - Duplicate Degree Credit Not Granted: APPM 4530, APPM 5530 and STAT 4230
Requisites: Restricted to graduate students only.
STAT 5250 (3) Data Assimilation in High Dimensional Dynamical Systems
Develops and analyzes approximate methods of solving the Bayesian inverse problem for high-dimensional dynamical systems. After briefly reviewing mathematical foundations in probability and statistics, the course covers the Kalman filter, particle filters, variational methods and ensemble Kalman filters. The emphasis is on mathematical formulation and analysis of methods.
Equivalent - Duplicate Degree Credit Not Granted: APPM 4510, STAT 4250 and APPM 5510
Requisites: Restricted to Graduate, Graduate Nondegree and non sponsored students only.

STAT 5430 (3) Spatial Statistics
Introduces the theory of spatial statistics with applications. Topics include basic theory for continuous stochastic processes, spatial prediction and kriging, simulation, geostatistical methods, likelihood and Bayesian approaches, spectral methods and an overview of modern topics such as nonstationary models, hierarchical modeling, multivariate processes, methods for large datasets and connections to spines.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4430
Requisites: Restricted to graduate students only.

STAT 5520 (3) Introduction to Mathematical Statistics
Examines point and confidence interval estimation. Principles of maximum likelihood, sufficiency, and completeness: tests of simple and composite hypotheses, linear models, and multiple regression analysis if time permits. Analyzes various distribution-free methods. Department enforced prerequisite: one semester calculus-based probability course, such as MATH 4510 or APPM 3570.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4520 and MATH 5520
Requisites: Restricted to graduate students only.

STAT 5530 (3) Mathematical Statistics
Covers the theory of estimation, confidence intervals, hypothesis testing, and decision theory. In particular, it covers the material of APPM 5520 in greater depth, especially the topics of optimality and asymptotic approximation. Additional topics include M-estimation, minimax tests, the EM algorithm, and an introduction to Bayesian estimation and empirical likelihood techniques. Recommended Prerequisite is a one-semester calculus-based probability course such as MATH 4510 or APPM 3570.
Credit not granted for APPM 5530 and STAT 5520 or MATH 5520.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4520 and MATH 5520
Requisites: Restricted to graduate students only.

STAT 5540 (3) Introduction to Time Series
Studies basic properties, trend-based models, seasonal models modeling and forecasting with ARIMA models, spectral analysis and frequency filtration. Department enforced prerequisite: APPM 5520 or MATH 5520.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4540 and MATH 4540 and MATH 5540
Requisites: Restricted to graduate students only.

STAT 5560 (3) Computational Bayesian Statistics
Introduces Bayesian statistics, normal and non-normal approximation to likelihood and posteriors, the EM algorithm, data augmentation, and Markov Chain Monte Carlo (MCMC) methods. Additionally, introduces more advanced MCMC algorithms and requires significant statistical computing. Examples from a variety of areas, including biostatistics, environmental sciences, and engineering, will be given throughout the course.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4630
Requisites: Requires prerequisite course of APPM 4520 or STAT 4520 or MATH 4520 (minimum grade C-).
Recommended: Prerequisite prior programming and basic statistical modeling experience is required.

STAT 5580 (3) Statistical Collaboration
Educates and trains students to become effective interdisciplinary collaborators by developing the communication and collaboration skills necessary to apply technical statistics and data science skills to help domain experts answer research questions. Topics include structuring effective meetings and projects; communicating statistics to non-statisticians; using peer feedback, self-reflection and video analysis to improve collaboration skills; creating reproducible statistical workflows; working ethically.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4680
Requisites: Requires a prerequisite course of STAT 5520 or MATH 5520 (minimum grade C). Restricted to graduate students only.
Grading Basis: Letter Grade

STAT 5620 (3) Applied Statistical Collaboration
Educates and trains students to become effective interdisciplinary collaborators by developing and refining the communication, collaboration and technical statistics and data science skills necessary to collaborate with domain experts to answer research questions. Students work on multiple projects. Discussions center on technical skills necessary to solve research problems and video analysis to improve communication and collaboration skills.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4690
Requisites: Requires prerequisite course of STAT 4680 or STAT 5680 (minimum grade C-). Restricted to graduate students only.
Grading Basis: Letter Grade

STAT 5690 (2) Advanced Statistical Collaboration
Educates and trains students to become advanced interdisciplinary collaborators by developing and refining the communication, collaboration and technical statistics and data science skills necessary to collaborate with domain experts to answer research questions. Students work on multiple projects. Discussions center on technical skills necessary to solve research problems and video analysis to improve communication and collaboration skills.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4690
Requisites: Requires prerequisite course of STAT 4680 or STAT 5680 (minimum grade C). Restricted to graduate students only.
Grading Basis: Letter Grade

STAT 5700 (3) Philosophical and Ethical Issues in Statistics
Introduces students to philosophical issues that arise in statistical theory and practice. Topics include interpretations of probability, philosophical paradigms in statistics, inductive inference, causality, reproducible, and ethical issues arising in statistics and data analysis.
Equivalent - Duplicate Degree Credit Not Granted: STAT 4700
Grading Basis: Letter Grade