in today's world, and this program provides a vibrant, supportive environment to learn. Vital to a wide variety of disciplines, graduates of this program have found employment in pharmaceutical research and development; government public policy; economic forecasting and analysis; market research; public health; and many other areas. The mission of the program in applied statistics is to train students to possess the applied skills necessary for immediate employment and/or provide a course of study that would make further (doctoral) study in statistics, biostatistics, data science, or other related fields feasible. The program provides strong training in statistical analysis, statistical programming, and design of scientific studies, emphasizing hands-on work with data and communication of statistical concepts. The program features an active internships program. Students can choose to pursue the degree with a concentration in biostatistics and bioinformatics; business and marketing analytics; or data science.

Programs

Master's Programs in Mathematics

- M.A. in Mathematics (http://catalog.wcupa.edu/graduate/sciences-mathematics/mathematics-ma/)
- M.A. in Mathematics - Mathematics Education Concentration (http://catalog.wcupa.edu/graduate/sciences-mathematics/mathematics/mathematics-ma-mathematics-education-concentration/)
- M.S. in Applied and Computational Mathematics (http://catalog.wcupa.edu/graduate/sciences-mathematics/mathematics/applied-computational-mathematics-ms/)
- M.S. in Applied Statistics (http://catalog.wcupa.edu/graduate/sciences-mathematics/applied-statistics/ms/)
- M.S. in Applied Statistics - Biostatistics and Bioinformatics Concentration (http://catalog.wcupa.edu/graduate/sciences-mathematics/applied-statistics/ms-biostatistics-bioinformatics-concentration/)
- M.S. in Applied Statistics - Business and Marketing Analytics Concentration (http://catalog.wcupa.edu/graduate/sciences-mathematics/applied-statistics/ms-business-marketing-analytics-concentration/)
- M.S. in Applied Statistics - Data Science Concentration (http://catalog.wcupa.edu/graduate/sciences-mathematics/applied-statistics/ms-data-science-concentration/)

Certificates in Mathematics

- Applied Statistics (http://catalog.wcupa.edu/graduate/sciences-mathematics/applied-statistics-certificate/)
- Post-Master's Certificate of Advanced Study in Applied Statistics (http://catalog.wcupa.edu/graduate/sciences-mathematics/mathematics/post-masters-certificate-advanced-study-applied-statistics/)

Accelerated Bachelor's to Master's

- B.A. to M.A. in Mathematics (http://catalog.wcupa.edu/undergraduate/sciences-mathematics/mathematics-bs-mathematics-ma/)
- B.S. in Mathematics - Mathematics Concentration to M.A. in Mathematics (http://catalog.wcupa.edu/undergraduate/sciences-mathematics/mathematics-bs-mathematics-concentration/)
Admissions
All applicants to one of West Chester University’s graduate programs will be held to the graduate admissions requirements (http://catalog.wcupa.edu/general-information/admissions-enrollment/graduate-admissions/). When applicable, additional requirements for admission into specific department program(s) may be listed below.

Admission Policy for the Master’s in Mathematics Programs

M.A. in Mathematics

In addition to meeting the basic admission requirements of the University, applicants must have a bachelor’s degree in mathematics or a related field. Applicants must schedule an interview with the graduate coordinator prior to enrollment. A full treatment of calculus along with an advanced undergraduate course in modern algebra, linear algebra, differential equations, and geometry is recommended. Deficiencies in these areas may be removed by successfully completing appropriate courses. Applicants must submit scores for the general section of the GRE.

M.A. in Mathematics - Mathematics Education Concentration

In addition to meeting the basic admission requirement of the University, applicants must have a bachelor’s degree with a mathematics major or related field. Applicants must schedule an interview with the graduate coordinator prior to enrollment. Deficiencies, as determined by the graduate coordinator, may be removed by successfully completing appropriate course(s). Applicants must submit scores for the general section of the Graduate Record Examination (GRE).

Admission Policy for the M.S. in Applied and Computational Mathematics

In addition to meeting the general requirements for admission to a graduate program at West Chester University, applicants must have successfully completed the undergraduate calculus sequence, as well as courses in differential equations and linear algebra. Applicants must submit two letters of reference addressing their academic ability, and complete an in-person interview with the Graduate Coordinator.

M.S. in Applied Statistics

In addition to meeting the basic admission requirements of the University, applicants must have at least one undergraduate level (or higher) course in statistics. Deficiencies, as determined by the program director, may be removed by successfully completing an appropriate course.

Admission Policy for the Certificate in Applied Statistics

In addition to meeting the basic admission requirements of the University, applicants must have at least one undergraduate level (or higher) course in statistics. Deficiencies, as determined by the program director, may be removed by successfully completing an appropriate course.

Admission Policy for the Post-Master’s Certificate for Advanced Study in Applied Statistics

Admission into the post-master’s certificate program requires completion of a master’s degree in statistics or closely related field, with coursework in mathematical statistics, linear models, and at least one course in statistical programming.

Coursework that counted toward a master’s degree will not be considered toward completion of the certificate.

Policies
All graduate students are held to the academic policies and procedures (http://catalog.wcupa.edu/graduate/academic-policies-procedures/) outlined in the graduate catalog. Students are encouraged to review departmental handbooks for program tips, suggested course sequences, and explanations of procedures. When applicable, additional policies for specific department programs may be listed below.

Requirements for the M.A. in Mathematics

In addition to completing the course requirements, candidates must either pass a comprehensive examination or submit a thesis.

Requirements for the M.S. in Applied and Computational Mathematics

The electronic portfolio is developed cumulatively as the student progresses through curriculum of the program and must be submitted prior to graduation for approval by a faculty committee.

Requirements for the M.S. in Applied Statistics

Students must achieve a grade of B- or better in the following foundational courses: STA 504 or STA 505, STA 511, and STA 512. Per University policy, students may only repeat at most two total courses and must maintain an overall GPA of 3.0 or higher to remain in good academic standing ("STA 504 is a 4 credit alternative and will increase the curriculum to 33 credits.").

Faculty

Professors

Michael J. Fisher (mfisher@wcupa.edu) (2008)
B.S., Millersville University; M.S., Ph.D., Lehigh University

Gail M. Gallitano (ggallitano@wcupa.edu) (1992)
Graduate Coordinator, Mathematics
B.S., Monmouth College; M.S., Farleigh Dickinson University; M.A., M.Ed., Ed.D., Columbia University

Robert J. Gallop (rgallop@wcupa.edu) (2001)
B.S., Pennsylvania State University; M.S., Ph.D., Drexel University

Peter L. Glidden (pglidden@wcupa.edu) (1995)
Chairperson, Mathematics
B.A., College of Wooster; M.A., Columbia University

Clifford A. Johnston (cjohnston@wcupa.edu) (1992)
B.S.E., Mansfield University; M.A., Ph.D., Temple University

Lisa E. Marano (lmarano@wcupa.edu) (2002)
B.A., Rider University; M.S., Ph.D., Lehigh University

Scott McClintock (smcclintoc@wcupa.edu) (2007)
B.S., San Jose State University; M.S., Ph.D., University of Kentucky

Mark A. McKibben (mmckibben@wcupa.edu) (2013)
B.S., M.S., Ph.D., Ohio University

James McLaughlin (jmlaughlin2@wcupa.edu) (2005)
B.S., University of Ulster; M.S., Queen’s University Belfast; Ph.D., University of Illinois

Viorel Nitica (vnitica@wcupa.edu) (2001)
B.S., M.S., University of Bucharest; Ph.D., Pennsylvania State University
Typically offered in Spring.

MAT 546. Real Analysis II. 3 Credits.
A rigorous study of real-valued functions of real variables. Typically offered in Fall, Spring & Summer.

MAT 550. Fundamentals of Applied Mathematics. 3 Credits.
This course is designed to provide an intense review of the core concepts essential to the study of applied mathematics. Topics include the main theorems of differential and integral calculus; techniques and theorems of vector analysis; sequences and power series; complex arithmetic and elementary complex-valued functions; first-order, second-order, and systems of linear differential equations; matrix algebra and vector spaces. The computer algebra systems Matlab and Mathematica will be introduced as computational tools for these topics. Typically offered in Fall, Spring & Summer.

MAT 553. Geometry I. 3 Credits.
A study of geometry using calculus as our main tool. The course covers the basics of differential geometry: parametrizations, tangent spaces, curvature, geodesics; leading to Stokes theorem and the Gauss-Bonnet theorem. Several examples will be studied in depth, including the sphere and the projective plane (which were introduced in the first course).

MAT 554. Geometry II. 3 Credits.
This course is an introduction to the fundamental techniques of algebraic topology. Topics covered include fundamental groups and covering spaces, connectedness, compactness, separation axioms, metrization theorems, and function spaces.

MAT 555. Topology. 3 Credits.
This course is a rigorous introduction to point-set topology. Topics covered include topological spaces and continuous functions, connectedness, compactness, separation axioms, metrization theorems, and function spaces. Typically offered in Summer.

MAT 556. Algebraic Topology. 3 Credits.
This course is an introduction to the fundamental techniques of algebraic topology. Topics covered include fundamental groups and covering spaces, basic homological algebra, simplicial homology, singular homology, and cohomology. Typically offered in Summer.


MAT 558. Theory Of Numbers. 3 Credits.
Contact department for more information about this course.

MAT 559. Linear Algebra. 3 Credits.

MAT 560. History Of Mathematics. 3 Credits.
Contact department for more information about this course.

MAT 561. Discrete Mathematics & Graph Theory. 3 Credits.
Repeatable for Credit.

MAT 562. Topics In Algebra. 3 Credits.
Contact department for more information about this course.
MAT 548. Industrial Mathematics - Continuous Models. 3 Credits.
This course is designed to provide a survey of mathematical concepts, techniques, and numerical algorithms used to study real-world continuous mathematical models. Application areas include population dynamics, climatology, feedback and control systems, traffic flow, diffusion, fluids and transport, and epidemiology. Computer software packages such as Matlab, Mathematica, and Maple will be used in the analysis of the problems.
Pre / Co requisites: MAT 548 requires prerequisite of MAT 500.
Typically offered in Fall.

MAT 549. Industrial Mathematics - Discrete Models. 3 Credits.
This course is designed to provide a survey of mathematical concepts, techniques, and numerical algorithms used to study real-world discrete mathematical models. Application areas include forestation, particle dynamics, image processing, genetics, queues, efficient call and traffic routing, and optimal scheduling. Computer software packages such as Matlab, Mathematica, and Maple will be used in the analysis of the problems.
Pre / Co requisites: MAT 549 requires prerequisite MAT 500.
Typically offered in Spring.

MAT 552. Operations Research. 3 Credits.
This course provides an overview of deterministic operations research methodology including linear, integer, nonlinear, and dynamic programming, and classical optimization problems. The computer algebra system MATLAB and other software will be used as an investigative tool in analyzing the problems that arise.
Pre / Co requisites: MAT 552 requires prerequisite of MAT 500.
Typically offered in Fall.

MAT 553. Stochastic Modeling. 3 Credits.
This course introduces topics in stochastic optimization and control (including Markov chains, queueing theory, reliability theory, inventory theory, and forecasting), discrete-event and Monte Carlo simulation, and stochastic differential equations. Applications are drawn from manufacturing, finance, logistics, and service systems. The computer algebra system MATLAB and other software will be used as an investigative tool in analyzing these models.
Pre / Co requisites: MAT 553 requires prerequisite of MAT 500.
Typically offered in Spring.

MAT 554. Scientific Computing. 3 Credits.
This case-study driven course will illustrate the use of computational tools in multiple science and engineering domains. The focus is on using MATLAB and appropriate numerical methods (including solutions of linear and nonlinear algebraic equations, solutions of ordinary and partial differential equations, finite elements, linear programming, optimization algorithms, and fast-Fourier transforms) to assist in investigating mathematical models of phenomena in the physical, ecological, and financial realms.
Pre / Co requisites: MAT 554 requires prerequisite of MAT 500.
Typically offered in Spring.

MAT 555. Industrial Practicum - Continuous Models. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using continuous mathematical techniques and that emanate from industry. Ideally, the problems would be obtained from partnerships with local industry and they will ordinarily focus on topics arising in optimization, financial mathematics, and other stochastic models.
Pre / Co requisites: MAT 555 requires prerequisites of MAT 548, MAT 549, and one of MAT 552, MAT 553 or MAT 554.
Typically offered in Fall.

MAT 556. Industrial Practicum - Discrete Models. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using discrete mathematical techniques and that emanate from industry. Ideally, the problems would be obtained from partnerships with local industries and they will ordinarily focus on topics arising in the biological, natural, and physical sciences.
Pre / Co requisites: MAT 556 requires prerequisites of MAT 548, MAT 549, and at least one of the following: MAT 552, MAT 553, or MAT 554.
Typically offered in Spring.

MAT 557. Complex Analysis I. 3 Credits.
Contact department for more information about this course.

MAT 595. Topics in Mathematics. 1-3 Credits.
Topics announced at time of offering.
Consent: Permission of the Department required to add. Repeatable for Credit.

MAT 599. Independent Study. 1-3 Credits.
Contact department for more information about this course.

MAT 609. Thesis I. 3 Credits.
Contact department for more information about this course.

MTE

MTE 507. Foundations of Secondary Mathematics Education. 3 Credits.
Research methods in mathematics education; forces which have shaped mathematics education; classroom implications of 20th-century learning theorists; assessment in the classroom; methods of organizing for instruction; cultural and gender considerations.
Typically offered in Summer.

MTE 508. Jr. High School Math - Curriculum, Instruction, and Assessment. 3 Credits.
This course will focus on the curricula, methods of instruction, and assessment techniques used to teach mathematics in a junior high school setting. Course topics will include elementary school mathematics from the perspective of a secondary school teacher, junior high school mathematics, algebra I, and general/consumer mathematics. Teachers also will explore strategies that can be used to integrate the calculator, computer, and new CD-ROM technologies into the mathematics classroom.
Pre / Co requisites: MTE 508 requires prerequisite of MTE 507.
Typically offered in Spring.

MTE 512. Sr. High School Math - Curriculum, Instruction, and Assessment. 3 Credits.
This course will focus on the curricula, methods of instruction, and assessment techniques used to teach mathematics in a senior high school setting. Course topics will include geometries, algebra II, trigonometry, precalculus, and discrete mathematics. Teachers also will explore strategies that can be used to integrate the scientific and graphing calculator, computer, and the new CD-ROM technologies into the mathematics classroom.
Pre / Co requisites: MTE 512 requires prerequisite of MTE 507.
Typically offered in Spring.

MTE 552. Teaching Children Mathematics II. 3 Credits.
A continuation of the pedagogical strategies and methods for teaching the topics covered in MAT 351/MTE 553 extended to topics such as real numbers, geometry, percent, proportional reasoning, measurement, and algebra.
Pre / Co requisites: MTE 552 requires a prerequisite of MTE 553 and field clearances.
Typically offered in Fall.

MTE 553. Teaching Children Mathematics I. 3 Credits.
In-depth treatment of strategies, methods, and materials for teaching the following concepts in an elementary classroom: place value; addition, subtraction, multiplication, and division of whole numbers; measurement; elementary number theory; geometry; fractions; and integers.
Pre / Co requisites: MTE 553 requires prerequisites of two mathematics courses.
Typically offered in Fall.

MTE 595. Topics in Mathematics Education. 1-3 Credits.
Topics announced at time of offering.
Consent: Permission of the Department required to add.

MTE 599. Independent Study. 1-3 Credits.
Contact department for more information about this course.

MTE 604. Research Seminar. 3 Credits.
This course will focus on the study of research in mathematics education. Contemporary topics of research will be discussed and pursued. Students will be expected to report on a topic of research of their choosing. In addition, empirical study and design will be discussed along with data analysis and the reporting of results.

MTE 610. Thesis. 3-6 Credits.
Contact department for more information about this course.

STA

STA 501. Methodologies in Applied Statistics. 3 Credits.
This course will teach the commonly used statistical techniques that are most likely to be encountered in graduate research. Topics will include t-tests, multiple linear regression, ANOVA, chi-squared tests and power/sample size calculations.
STA 503. Introduction to R. 1 Credit.
This is an introductory course in R programming. The major topics include setting up Rstudio, R data objects, data input/output, built-in and user-defined R functions, control statement and looping, basic R plot functions, commonly used R libraries, and R markdown.
Distance education offering may be available.
Typically offered in Fall.

STA 504. Mathematical Statistics I with Calculus Review. 4 Credits.
A rigorous treatment of probability spaces and an introduction to the estimation of parameters. This course will also review relevant calculus topics.
Typically offered in Fall.

STA 505. Mathematical Statistics I. 3 Credits.
A rigorous treatment of probability spaces and an introduction to the estimation of parameters.
Typically offered in Fall.

STA 506. Mathematical Statistics II. 3 Credits.
Continuation of STA 505. Correlation, sampling, tests of significance, analysis of variance, and other topics.
Pre / Co requisites: STA 506 requires a prerequisite of STA 505 or STA 504.
Typically offered in Fall.

STA 507. Introduction to Categorical Data Analysis. 3 Credits.
Data-driven introduction to statistical techniques for analysis of data arising from medical and public health studies. Contingency tables, logistic regression survival models, non parametric methods and other topics.
Pre / Co requisites: STA 507 requires prerequisites of STA 511 and STA 512 or permission of instructor.

STA 511. Intro Stat Computing & Data Management. 3 Credits.
This course will give students the ability to effectively manage and manipulate data, conduct statistical analysis and generate reports and graphics, primarily using the SAS Statistical Software package.
Distance education offering may be available.
Typically offered in Fall.

STA 512. Principles of Experimental Analysis. 4 Credits.
Course provides technology-driven introduction to regression and other common statistical multivariable modeling techniques. Emphasis on interdisciplinary actions.
Pre / Co requisites: STA 512 requires prerequisite: STA 511 or permission of instructor.
Typically offered in Spring.

STA 513. Intermediate Linear Models. 4 Credits.
Rigorous mathematical and computational treatment of linear models.
Pre / Co requisites: STA 513 requires prerequisites of STA 505 or STA 504, STA 506, STA 511, and STA 512 or permission of instructor.

STA 514. Modern Experimental Design. 3 Credits.
Focusing on recent journal articles, this course will investigate issues associated with design of various studies and experiments. Pharmaceutical clinical trials, case-controlled studies, cohort studies, survey design, bias, causality and other topics.
Pre / Co requisites: STA 514 requires prerequisites of STA 511 and STA 512 or consent of instructor.

STA 531. Topics In Applied Statistics. 3 Credits.
Contact department for more information about this course.
Repeatable for Credit.

STA 532. Survival Analysis. 3 Credits.
This course will provide students with the knowledge and tools to conduct a complete statistical analysis of time to event data. Students will get experience using common methods for survival analysis, including Kaplan-Meier Methods, Life Table Analysis, parametric regression methods, and Cox proportional Hazard Regression. Additional topics include discrete time data, competing risks, and sensitivity analysis.

STA 533. Longitudinal Data Analysis. 3 Credits.
Introduction to the application and theory of models for clustered and longitudinal data. Course will address the analysis for both continuous and categorical response data. Course will be held in the statistics lab and use the statistical software package SAS. Other software such as R, HLM, SPSS, MIXORMIXREG may be introduced.
Pre / Co requisites: STA 533 requires prerequisites: STA 511, STA 512, STA 507 and STA 513 or permission of Director of M.S. Applied Statistics.

STA 534. Time Series. 3 Credits.
Time series analysis deals with the statistical study of random events ordered through time. This class will focus on the characteristics inherent in such processes such as repetitive cycles and deteriorating dependence. Course topics will include seasonal decomposition, exponential smoothing, and ARIMA models. Emphasis will be placed on real life data analysis and statistical communication. Data analysis will be done with a variety of programs such as SAS, R, and Excel.
Pre / Co requisites: STA 534 requires prerequisite of STA 511 and STA 512.

STA 535. Multivariate Data Analysis. 3 Credits.
Multivariate data typically consist of many records, each with readings on two or more variables, with or without an “outcome” variable of interest. Procedures covered in this course include multivariate analysis of variance (MANOVA), principal component analysis, factor analysis and classification techniques.
Pre / Co requisites: STA 535 requires prerequisite: STA 505, STA 506, STA 511, STA 512.

STA 536. Data Mining. 3 Credits.
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The purpose of this course is to give you an introduction to many of the modern techniques that are used to analyze a wide array of data sets. We will be applying these methods using the statistical programming language R.
Pre / Co requisites: STA 536 requires a prerequisite of a grade of C or higher in STA 512.
Typically offered in Spring & Summer.

STA 537. Advanced Statistical Programming Using SAS. 3 Credits.
This course will focus on skills and techniques considered essential to advanced SAS programming. The primary topics covered will be SAS SQL and SAS Macro Programming. Other advanced topics such as indices, efficient programming techniques, memory usage, graphics, and using best programming practices will also be covered.
Pre / Co requisites: STA 537 requires a prerequisite of STA 511.

STA 538. Statistical Programming Using R. 3 Credits.
The statistical programming language R is one of the most popular tools for data analysis. It is freely available to most common operating systems and also an extremely powerful and customizable programming language. This course will focus on performing many rigorous statistical analyses and simulating data in R. Some of the topics include: verifying concepts of statistical inference using simulations, fitting linear models, performing various statistical tests, along with advanced graphics and visualization.
Typically offered in Fall, Spring & Summer.

STA 539. Applied Bayesian Methods. 3 Credits.
Review of conditional probability and Bayes’ Theorem, conditional distributions and conditional expectations, and likelihood functions; prior and posterior distributions; conjugate priors; credible intervals; Bayes’ factors; Bayesian estimation in linear models; predictive analysis; Markov Chain Monte Carlo methods. Use of appropriate technology.
Pre / Co requisites: STA 539 requires prerequisites of STA 506 and STA 511.
Typically offered in Fall, Spring & Summer.

STA 540. Statistical Consulting. 3 Credits.
This course will discuss the skills needed to be successful in different consulting environments. It will provide detailed instruction on use of communication skills and consulting strategies. Several interactive case studies will be presented. Then, students will be required to work as part of a team on a real consulting project. Students will be involved in a consulting session with clients, research and carry out the data analysis, and present the final results in another consulting meeting. Statistical methods from previous courses may be applied to the data for the projects. In addition, new statistical techniques may be taught as part of the class if these projects require statistical methodologies not introduced in previous classes.
Pre / Co requisites: STA 540 requires prerequisites of STA 511 and STA 512. Typically offered in Fall, Spring & Summer.
STA 541. Categorical Data Analysis II. 3 Credits.
This course will extend the information presented in the STA 507 course. We will cover statistical methods for producing Receiver Operating Characteristic Curves and the Optimal operating point from logistic regression. Goodness-of-link and complex modeling issues for count data such as overdispersion and underdispersion will be presented. Students will be exposed to discussion of techniques for both cross-sectional and longitudinal count data. Techniques to assess goodness of fit for count data will be introduced. Students will be exposed to various programming techniques to fit such data within the SAS software using procedures such as PROC GENMOD, PROC COUNTREG, PROC FMM, PROC GLIMMIX, and PROC NLMIXED. Upon completion of this second part of Categorical Data Analysis, students will be comfortable with the analytical techniques for a variety of count outcomes in the real world setting. Proper communication and interpretation of these models is an essential component of the course.
Pre / Co requisites: STA 541 requires a prerequisite of STA 507. Typically offered in Fall, Spring & Summer.

STA 542. Statistical Methods for Observational Studies. 3 Credits.
In the assessment of the association between a predictor and a response confounding by another factor might yield wrong answers. One standard technique to protect against confounding is randomization, which is the standard for conducting randomized clinical trials (RCT). In the setting where randomization cannot be applied, such as cohort or case-control studies, the potential for confounding exists; therefore, analytical techniques must be developed to address this potential confounding. These studies where the respective predictor is observed (i.e. gender, case versus control, etc...) rather than randomized (i.e. drug versus placebo, Treatment 1 versus Treatment 2, etc...) are referred to as observational studies. This course will cover statistical methods for the design and analysis of observational studies. Students will be exposed to discussion of differences between experimental, observational, and quasi-experimental studies. Techniques to assess statistical effects while addressing confounding (both measured and unmeasured) and selection bias will be introduced. Various techniques introduced are: propensity scores, inverse probability weighting, instrumental variables, Marginal Structural Models, Structural Nested Mean Models. Students additionally will be introduced to the Rubin Causal Model framework in the assessment of Causal effects.
Pre / Co requisites: STA 542 requires prerequisites of STA 511 and STA 512. Typically offered in Fall, Spring & Summer.

STA 543. Statistical Methods in Business and Finance. 3 Credits.
This course will cover the application of statistics to modeling, estimation, inference and forecasting in the business and financial world through real world problems with an emphasis on critical evaluation. It will cover selected topics from econometrics, decision theory, and financial modeling, as well as business optimization and simulation.
Pre / Co requisites: STA 543 requires prerequisites of STA 505 or STA 504; STA 511; STA 512. Typically offered in Fall, Spring & Summer.

STA 544. Applied Marketing Analytics. 3 Credits.
In this course we will learn how to provide in-depth insights about core big data assets commonly used in business analytics, as well as research in pharmaceutical, package goods, and financial industries. Additional topics will include national and customer level data assets, projection methodologies, business analytics techniques, and specific applications of statistical and analytic techniques to the marketing industry.
Typically offered in Fall, Spring & Summer.

STA 545. Statistical Design and Analysis of Clinical Trials. 3 Credits.
This course in the statistical design and analysis of clinical trials will focus on the scientific questions each phase of clinical trials (Phase I, Phase II, and Phase III) addresses. For oncology trials, various Phase I designs will be explored, noting the strengths and weaknesses of each design. Group Sequential procedures that specify how interim analyses will be performed in Phase III trials will be explored, together with graphical methods associated with each procedure.
Pre / Co requisites: STA 545 requires a prerequisite of a grade of C or higher in STA 511 and STA 512. Typically offered in Fall & Summer.

STA 546. Foundations of Bioinformatics. 3 Credits.
Bioinformatics is an interdisciplinary field involving molecular biology, computer science, mathematics, and statistics. Most data sets are very large and so require computationally intensive algorithms. This course intends to introduce students to many areas of biological data, along with algorithms and software to help model biological processes.
Pre / Co requisites: STA 546 requires a prerequisite of a C or higher in STA 512. Typically offered in Fall, Spring & Summer.

STA 551. Foundations of Data Science. 3 Credits.
This is a data science survey course. The first part of this course will be dedicated to data science foundations. Topics include statistical models, machine learning algorithms, model performance metrics, and major resampling algorithms. The second part will focus on data science processes. Topics include data science project life cycle, model selection, validation, performance evaluation, and data science ethics. The last part of the course will discuss data science infrastructure and pipelines.
Pre / Co requisites: STA 551 requires a prerequisite of a C or higher in STA 503 and STA 506. Typically offered in Fall, Spring & Summer.

STA 552. Applied Statistical Machine Learning. 3 Credits.
This course introduces commonly used models and algorithms in data science fields. Both supervised and unsupervised machine learning algorithms will be discussed. Specific topics will be selected from supervised learning (probabilistic and linear classification, neural networks, tree-based models), unsupervised learning (clustering and feature extraction), and semi-supervised learning algorithms. This course will introduce both theories and applications.
Pre / Co requisites: STA 552 requires a prerequisite of a C or higher in STA 503 and STA 506. Typically offered in Fall, Spring & Summer.

STA 553. Data Visualization. 3 Credits.
This course focuses on the principles of data visualization and addresses questions about what, why, and how to visualize. Topics include visualization design elements such as colors, shapes, and movements, etc.; data exploratory visualization; statistical graphics and model visualization; process visualization; dashboard design; and the ethics of data visualization. The course will also introduce some commonly used visualization tools.
Pre / Co requisites: STA 553 requires a prerequisite of a C or higher in STA 503. Typically offered in Fall, Spring & Summer.

STA 599. Independent Study. 1-3 Credits.
Individual exploration of a topic in statistics. Typically offered in Fall, Spring & Summer. Repeatable for Credit.

STA 601. Internship In Applied Statistics. 1-6 Credits.
In cooperation with a regional industrial company student will perform an internship in applied statistics.
Typically offered in Fall, Spring & Summer. Repeatable for Credit.

STA 609. Thesis I. 3-6 Credits.
Preliminary research under the guidance of a mathematics faculty member. Students must present oral preliminary findings before proceeding to STA 610.
Typically offered in Fall, Spring & Summer. Repeatable for Credit.

STA 610. Thesis II. 3-6 Credits.
Research project under the guidance of the mathematics faculty. 
Pre / Co requisites: STA 610 requires prerequisite of STA 609. Typically offered in Fall, Spring & Summer. Repeatable for Credit.