STATISTICS (STA)

STA 108 Elementary Introduction to Probability and Statistics 3
Survey of statistics intended for undergraduates in any discipline. Graphical displays, numerical measures, relationships between variables, elements of good data collection. Basic probability, introduction to inferential techniques including confidence intervals and significance testing. Emphasis on statistical literacy.
MAC: MAC Quantitative Reasoning
Prerequisites: None.
Notes: May not be taken for credit by students who have received credit for ECO 250 or ECO 350 or who are concurrently enrolled in ECO 250. Students may not earn credit for both RCO 114 and STA 108.

STA 271 Fundamental Concepts of Statistics 3
Survey of basic descriptive and inferential statistics. Graphs and descriptive measures, simple linear regression and correlation, data collection, basic probability and probability models, interval estimation and significance testing, analysis of variance, use of statistical software. An appropriate preparation for more advanced statistics courses in any discipline.
Prerequisites: Grade of C or higher in one of the following courses: MAT 115, MAT 118, MAT 120, MAT 150, MAT 151, MAT 183, MAT 190, MAT 191, MAT 196, or STA 108.

STA 290 Introduction to Probability and Statistical Inference 3
Introduction to probability models and statistical inference. Descriptive statistics, basic probability laws, discrete and continuous probability models, sampling distributions, central limit theorem, estimation, hypothesis testing, simple regression, and correlation.
Prerequisites: Grade of C or better in MAT 196 or Grade of C or better in MAT 292 or concurrent registration in MAT 292 or permission of instructor.

STA 300X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

STA 301 Statistical Methods 3
Two-group comparisons, simple and multiple regression, one and two factor ANOVA, categorical data analysis, nonparametric methods.
CIC: CIC College Writing
Prerequisites: Minimum grade of C (2.0) in either STA 271 or STA 290, or permission of instructor.

STA 352 Statistical Inference 3
Descriptive and inferential statistics. Emphasis on sampling distributions; theory of estimation and tests of hypotheses, linear hypothesis theory, regression, correlation and analysis of variance.
Prerequisites: Grade of at least C in STA 290 or permission of instructor.

STA 382 Introduction to Sampling Methods 3
Designing survey instruments; estimation of population mean, total, and proportion using simple random, stratified, systematic, and cluster sampling; other sampling techniques such as pps sampling and randomized response methods.
Prerequisites: Minimum grade of C (2.0) in STA 301, or permission of instructor.

STA 400X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

STA 422 Introduction to Complex Data Analysis 3
Methods for modeling and understanding complex data. Topics include linear regression models for sparse and high dimensional data sets, nonlinear models, tree-based methods, and clustering methods.
Prerequisites: Grade C or above in STA 301, or permission of instructor.

STA 431 Introduction to Probability 3
Events and probabilities (sample spaces), dependent and independent events, random variables and probability distribution, expectation, moment generating functions, multivariate normal distribution, sampling distributions.
Prerequisites: Grade of C or better in MAT 293 or MAT 296 and grade of C or better in STA 290 or permission of instructor.

STA 432 Introduction to Mathematical Statistics 3
Point estimation, hypothesis testing, confidence intervals, correlation and regression, small sample distributions.
Prerequisites: Grade of at least C in STA 431 or permission of instructor.

STA 435 Theory of Linear Regression 3
Linear regression, least squares, inference, hypothesis testing, matrix approach to multiple regression. Estimation, Gauss-Markov Theorem, confidence bounds, model testing, analysis of residuals, polynomial regression, indicator variables.
Prerequisites: Grade of at least C in STA 352 and MAT 310, or STA 662, or permission of instructor.

STA 440 SAS System for Statistical Analysis 1
Creating, importing, and working with SAS data sets. Using SAS procedures for elementary statistical analysis, graphical displays, and report generation.
Prerequisites: STA 271 or STA 290 or similar introductory statistics course.

STA 442 Statistical Computing 3
Statistical methods requiring significant computing or specialized software. Simulation, randomization, bootstrap, Monte Carlo techniques; numerical optimization. Extensive computer programming involved. This course does not cover the use of statistical software packages.
Prerequisites: Minimum grade of C (2.0) in STA 301, knowledge of a scientific programming language.

STA 445 Nonparametric Statistics 3
Introduction to nonparametric statistical methods for the analysis of qualitative and rank data. Binomial test, sign test, tests based on ranks, nonparametric analysis of variance, nonparametric correlation and measures of association.
Prerequisites: Grade of at least C in STA 352 or STA 662, or permission of instructor.

STA 465 Analysis of Survival Data 3
Methods for comparing time-to-event data, including parametric and nonparametric procedures for censored or truncated data, regression model diagnostics, group comparisons, and the use of relevant statistical computing packages.
Prerequisites: STA 301 or STA 352, or permission of instructor.

STA 470 Introduction to Categorical Data Analysis 3
Methods for analyzing dichotomous, multinomial and ordinal responses. Measures of association; inference for proportions and contingency tables; generalized linear models including logistic regression.
Prerequisites: Grade of at least C in STA 301, or permission of instructor.
STA 481 Introduction to Design of Experiments 3
Planning and analysis of experimental and observational studies. Completely randomized, blocked, split-plot, and repeated measures designs. Factorial arrangements and interaction. Power and sample size calculation.
Prerequisites: Minimum grade of C (2.0) in STA 301. or permission of instructor.

STA 482 Introduction to Time Series Models 3
Estimation/removal of trend and seasonality, introduction to stationary stochastic processes, fitting ARMA/ARIMA models, forecasting techniques, miscellaneous topics, and introduction to a time series modeling software package.
Prerequisites: STA 352 or permission of instructor.

STA 491 Actuarial Exam Preparation Seminar 1
Topics vary according to interest and demand. Intended to help prepare for the P/1, FM/2, or MLC exam.
Prerequisites: STA 431 or STA 687 or permission of instructor.
Notes: One credit maximum. May be repeated; Grade: Pass/Not Pass (P/NP).

STA 493 Directed Study in Statistics 1-3

STA 494 Directed Study in Statistics 1-3

STA 497 Research Experience in Statistics 1-3
Supervised research activity on contemporary research questions in the fields of statistics and its applications.
Notes: May be repeated once for credit as topic varies. Grade: Pass/Not Pass (P/NP).

STA 571 Statistical Methods for Research I 3
Introduction to statistical concepts. Basic probability, random variables, the binomial, normal and student’s t distributions, hypothesis tests, confidence intervals, chi-square tests, introduction to regression, and analysis of variance.
Notes: Hours do not count toward degree requirements for a mathematics major.

STA 572 Statistical Methods for Research II 3
Statistical methodology in research and use of statistical software. Regression, confidence intervals, hypothesis testing, design and analysis of experiments, one- and two-factor analysis of variance, multiple comparisons, hypothesis tests.
Prerequisites: STA 571 or permission of instructor.

STA 593 Directed Study in Statistics 1-3

STA 600X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

STA 602 Statistical Methods for Data Analytics 3
Introduction to fundamental statistical techniques for data analytics such as hypothesis testing, data transformation, estimation, confidence intervals, regressions models, ANOVA, multivariate analysis, non-parametric methods, and design of experiments.
Notes: Same as IAF 602. Prerequisite: Student in the M.S. in Informatics and Analytics or the M.S. in Applied Statistics program or permission of instructor.

STA 606 Solving Problems with Data Analytics 3
How data analytics is used to solve applied problems in varied contexts. Students will learn how to choose appropriate methodologies, manage data, conduct analyses and report results.
Prerequisites: Student in the M.S. in Informatics and Analytics or the M.S. in Applied Statistics program with a grade of C or better in IAF 601 and IAF 602 or permission of instructor.
Notes: Same as IAF 606.

STA 622 Complex Data Analysis 3
Methods for modeling and understanding complex data. Topics include linear regression models for sparse and high dimensional data sets, nonlinear models, tree-based methods, and clustering methods.
Prerequisites: Permission of instructor.
Notes: Same as IAA 622.

STA 631 Introduction to Probability 3
Events and probabilities (sample spaces), dependent and independent events, random variables and probability distribution, expectation, moment generating functions, multivariate normal distribution, sampling distributions.

STA 632 Introduction to Mathematical Statistics 3
Point estimation, hypothesis testing, confidence intervals, correlation and regression, small sample distributions.
Prerequisites: Grade of at least C in STA 631 or permission of instructor.

STA 635 Theory of Linear Regression 3
Linear regression, least squares, inference, hypothesis testing, matrix approach to multiple regression. Estimation, Gauss-Markov Theorem, confidence bounds, model testing, analysis of residuals, polynomial regression, indicator variables.
Prerequisites: Grade of at least C in STA 662 or permission of instructor.

STA 640 SAS System for Statistical Analysis 1
Creating, importing, and working with SAS data sets. Using SAS procedures for elementary statistical analysis, graphical displays, and report generation.

STA 642 Statistical Computing 3
Statistical methods requiring significant computing or specialized software. Simulation, randomization, bootstrap, Monte Carlo techniques; numerical optimization. Extensive computer programming involved. This course does not cover the use of statistical software packages.

STA 645 Nonparametric Statistics 3
Introduction to nonparametric statistical methods for the analysis of qualitative and rank data. Binomial test, sign test, tests based on ranks, nonparametric analysis of variance, nonparametric correlation and measures of association.

STA 648 Topological Data Analysis 3
This course covers persistent homology and topological data analysis. Topics include persistence modules, bar codes, stability, and the use of statistics and machine learning in topological data analysis.

STA 651 Mathematical Statistics 3
Prerequisites: STA 352 and either MAT 394 or MAT 395 or MAT 595.
STA 652 Mathematical Statistics 3
**Prerequisites:** STA 352 and either MAT 394 or MAT 395 or MAT 595.

STA 654 Mathematical Data Science II: Machine Learning 3
Based on the specialty of the instructor, selected well-known machine learning algorithms will be studied in great mathematical detail. General topics may include Regression, Dimension Reduction, Density Estimations, and Classification. Advanced topics may include Google PageRank algorithm, Manifold Learning, and the Mapper algorithm. 
**Prerequisites:** MAT 653.

STA 655 Applied Probability Models 3
An introduction to Markov chains, Poisson processes, renewal processes, Brownian motion, and survival models. Examples drawn from applied field such as engineering, management, finance, and sciences. 
**Prerequisites:** STA 631 or permission of instructor.

STA 661 Advanced Statistics in the Behavioral and Biological Sciences I 3
Statistical techniques and design considerations for controlled experiments and observational studies. Exploratory data analysis, elementary probability theory, principles of statistical inference, contingency tables, one-way ANOVA, bivariate regression and correlation. 
**Prerequisites:** STA 271 or an equivalent introductory statistics course.

STA 662 Advanced Statistics in the Behavioral and Biological Sciences II 3
Continuation of STA 661. Multiple regression and correlation, analysis of covariance, factorial ANOVAs, randomized block designs, multiple comparisons, split-plot designs, repeated measures. 
**Prerequisites:** STA 661 or permission of instructor.

STA 665 Analysis of Survival Data 3
Methods for comparing time-to-event data, including parametric and nonparametric procedures for censored or truncated data, regression model diagnostics, group comparisons, and the use of relevant statistical computing packages. 
**Prerequisites:** STA 662 or permission of instructor.

STA 667 Theory of Time Series 3
Examples of time series, objectives in time series modeling, theory and applications of linear and non-linear time series models, ARMA/ARIMA/ARCH/GARCH models, and time series modeling using computer packages. 
**Prerequisites:** STA 631 or STA 651 or permission of instructor.

STA 668 Consulting Experience 1
Development of consulting skills through reading and discussion of literature on statistical consulting and participation in statistical consulting sessions. 
**Prerequisites:** STA 662 or permission of instructor. 
**Notes:** Grade: Satisfactory/Unsatisfactory (S/U).

STA 670 Categorical Data Analysis 3
Methods for analyzing dichotomous, multinomial and ordinal responses. Measures of association; inference for proportions and contingency tables; generalized linear models including logistic regression and loglinear models. 
**Prerequisites:** STA 602 or permission of instructor.

STA 671 Multivariate Analysis 3
Multivariate normal distribution. Cluster analysis, discriminant analysis, canonical correlation, principal component analysis, factor analysis, multivariate analysis of variance. Use and interpretation of relevant statistical software. 
**Prerequisites:** ERM 680 and ERM 681, or STA 573, or STA 662, or permission of instructor.

STA 673 Statistical Linear Models I 3
Abstract vector spaces, inner product spaces, projections, the Spectral Theorem, least squares, multiple regression, ANOVA, multiple comparisons, data analysis. 
**Prerequisites:** STA 352 and MAT 310 or permission of instructor.

STA 674 Statistical Linear Models II 3
Abstract vector spaces, inner product spaces, projections, the Spectral Theorem, least squares, multiple regression, ANOVA, multiple comparisons, data analysis. 
**Prerequisites:** STA 352 and MAT 310 or permission of instructor.

STA 675 Advanced Experimental Design 3
Topics include factorials and fractional factorials, incomplete block designs, split-plot and repeated measures, random and mixed effects models, crossover designs, response surface designs, power analysis. 
**Prerequisites:** STA 662 or permission of instructor.

STA 676 Sample Survey Methods 3
Survey methods for students from any discipline. Random, stratified, cluster, multi-stage and other sampling schemes. Estimation of population means, variances, and proportions. Questionnaire design and analysis. 
**Prerequisites:** STA 602 or permission of instructor.

STA 677 Advanced Topics in Data Analysis and Quantitative Methods 3
Topics vary according to interest and demand. Quantitative methods not normally covered in detail in other statistics courses. Topics may be selected from psychometrics, econometrics, biometrics, sociometrics, quantitative epidemiology. 
**Prerequisites:** STA 662.

STA 682 Theory of Time Series 3
Examples of time series, objectives in time series modeling, theory and applications of linear and non-linear time series models, ARMA/ARIMA/ARCH/GARCH models, and time series modeling using computer packages. 
**Prerequisites:** STA 631 or STA 651 or permission of instructor.

STA 690 Graduate Seminar 1
Development of presentation skills through reading, discussions, and presentation of current research topics in applied statistics. 
**Prerequisites:** STA 662 or permission of instructor. 
**Notes:** Grade: Satisfactory/Unsatisfactory (S/U).

STA 691 Actuarial Exam Preparation Seminar 1
Topics vary according to interest and demand. Intended to help prepare for the P/1, FM/2, or MLC exam. 
**Prerequisites:** STA 631 or STA 687 or permission of instructor. 
**Notes:** May be repeated when topic varies, grading method is Pass/Not Pass (P/NP).

STA 698 Project in Statistics 3
Directed research project in statistics. 
**Prerequisites:** Permission of instructor. 
**Notes:** Grade: Satisfactory/Unsatisfactory (S/U).

STA 699 Thesis 1-6
Individual guidance in the development of a specific research problem.
STA 701 Seminar in Computational Statistics 3
Readings from the literature in Computational Statistics.
Prerequisites: Either STA 651, and STA 652. or STA 676; or permission of instructor;
Notes: May be repeated up to 9 hours as topics vary.

STA 703 Topics in High Dimensional Data Analysis 3
Advanced study in special topics in statistical data analysis with large scale data sets. The course may be repeated up to 9 hours as topics vary.
Prerequisites: STA 642, STA 673, or permission of instructor.
Corequisites: STA 674.

STA 709 Topics in Computational Statistics 3
Advanced study in special topics in Computational Statistics.
Prerequisites: STA 632 or STA 652 or permission of instructor.
Notes: May be repeated for credit.

STA 750X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

STA 801 Thesis Extension 1-3
Thesis Extension.

STA 803 Research Extension 1-3