### STATISTICS AND PROBABILITY

#### Department of Statistics and Probability

**College of Natural Science**

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<tr>
<th>Course Code</th>
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<tr>
<td>442</td>
<td>Statistics I</td>
<td>Fall, Spring, Summer. 3(3-0) P:M: MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LBS 110 or LBS 118 or designated score on Mathematics Placement test. Not open to students with credit in STT 200 or STT 315 or STT 421. Probability and statistics with business applications. Analysis of variance, selected non-parametric tests, applications of linear regression and correlation. Includes statistical software.</td>
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<tr>
<td>428</td>
<td>Statistics II</td>
<td>Fall, Spring, Summer. 3(3-0) P:M: MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LBS 110 or LBS 118 or designated score on Mathematics Placement test. Not open to students with credit in STT 200 or STT 315 or STT 421. Probability and statistics with computer applications. Data analysis, probability models, random variables, estimation, confidence intervals, simple linear regression. Weekly lab using statistical software.</td>
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<tr>
<td>350</td>
<td>Probability and Statistics for Engineering</td>
<td>Fall, Spring, Summer. 3(3-0) P:M: MTH 234 or MTH 254H or LBS 220 R: Open only to juniors or seniors. Not open to students with credit in STT 430. Probability and statistics for engineering majors. Probability models and random variables. Estimation, confidence intervals, tests of hypotheses, simple linear regression. Applications to engineering.</td>
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<td>464</td>
<td>Statistics for Biologists</td>
<td>Fall. 3(3-0) Interdepartmental with Animal Science and Crop and Soil Sciences. Administered by Statistics and Probability. RB: STT 421 Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression. Analyses of counted and measured data to compare several biological groups including contingency tables and analysis of variance.</td>
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<tr>
<td>430</td>
<td>Introduction to Probability and Statistics</td>
<td>Fall, Spring. 3(3-0) P:M: MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LBS 110 or LBS 118 or designated score on Mathematics Placement test. Not open to students with credit in STT 200 or STT 315 or STT 421. A first course in probability and statistics primarily for business majors. Data analysis, probability models, random variables, confidence intervals, and tests of hypotheses with business applications.</td>
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<tr>
<td>320</td>
<td>Topics in Probability and Statistics</td>
<td>Fall, Spring, Summer. 3(3-0) P:M: MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LBS 110 or LBS 118 or designated score on Mathematics Placement test. Not open to students with credit in STT 200 or STT 315 or STT 421. Probability and statistics with computer applications. Data analysis, probability models, random variables, estimation, confidence intervals, simple linear regression. Weekly lab using statistical software.</td>
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### Actuarial Models

**Course Code** 455

**Course Name** Actuarial Models

**Description** Spring. 3(3-0) Interdepartmental with Mathematics. Administered by Statistics and Probability. RB: STT 441 and MTH 360 Stochastic models used in insurance. Survival distribution, life insurance, life annuities, benefit premiums, benefit reserves, and analysis of benefit reserves.

### Computations in Probability and Statistics

**Course Code** 461

**Course Name** Computations in Probability and Statistics

**Description** Spring. 3(3-0) RB: (CSE 131 or CSE 230) and (MTH 314 and STT 441) Computer algorithms for evaluation, simulation and visualization. Sampling and prescribed distributions. Robustness and error analysis of procedures used by statistical packages. Graphics for data display, computation of probabilities and percentiles.

### Statistics for Biologists

**Course Code** 464

**Course Name** Statistics for Biologists

**Description** Fall of even years. 3(3-0) RB: STT 351 or STT 422 or STT 442 Scientific context of quality: Box, Deming, Taguchi. Graphical techniques, control charts. Design of experiments: factorial and fractional factorials, confounding and aliasing. Engineering parameter design through experimentation.

### Issues in Statistical Practice

**Course Code** 481

**Course Name** Issues in Statistical Practice

**Description** Spring. 1(1-0) P:M: Completion of Tier I writing requirement. RB: Open only to seniors in the Department of Statistics. Selected readings and projects illustrating special problems encountered by professional statisticians in their roles as consultants, educators, and analysts.

### Directed Study of Statistical Problems

**Course Code** 490

**Course Name** Directed Study of Statistical Problems

**Description** Fall, Spring. 1(1-0) A maximum of 9 credits in all enrollments for this course. RB: Open only to juniors or seniors in the Department of Mathematics or Department of Statistics and Probability. Approval of department. Individualized study of selected topics.

### Design of Experiments

**Course Code** 801

**Course Name** Design of Experiments

**Description** Fall of odd years. 3(3-0) RB: STT 422 or STT 442 or STT 465 or STT 471. Blocking and randomization. Split-plot, Latin square and factorial designs. Fractional factorial designs, aliasing and confounding of effects. Mixture and central composite designs and response surface exploration. Clinical trials.

### Advanced Statistics for Biologists

**Course Code** 814

**Course Name** Advanced Statistics for Biologists

Statistics and Probability—STT

818 Introduction to Econometrics
Spring. 3(3-0) Interdepartmental with Agricultural Economics and Economics. Administered by Economics. P:M: STT 430 R: Not open to doctoral students in the Economics major; SA: EC 820
The single equation regression model. Properties of least-squares estimators under various specifications. Multicollinearity, heteroskedasticity, serial correlation, and generalized least squares.

820A Econometrics IA
Fall. 3(3-0) Interdepartmental with Economics. Administered by Economics. R: Open only to doctoral students in the Economics major or the Department of Agricultural Economics or the Business Administration major or approval of department. Statistical tools for econometrics. Applications of statistical tools, including probability distributions, estimation, hypothesis testing, and maximum likelihood to econometric problems.

820B Econometrics IB
Fall. 3(3-0) Interdepartmental with Agricultural Economics and Economics. Administered by Economics. P:M: EC 820A and EC 820B

821 Econometrics II
Fall. 3(3-0) Interdepartmental with Agricultural Economics and Economics. Administered by Economics. P:M: EC 820A and EC 820B
Dynamic models and time series data. ARMA models. ARCH models. Unit roots, cointegration and error correction. Rational expectations models.

825 Sample Surveys
Fall. 3(3-0) RB: STT 422 or STT 442 or STT 862
Application of statistical sampling theory to survey designs. Simple random, stratified, and systematic samples. Sub-sampling, double sampling, Ratio and regression estimators.

842 Categorical Data Analysis
Spring of odd years. 3(3-0) RB: STT 442 or STT 862
Analysis of categorical and ordinal data: contingency tables; chi square tests; exact tests; log-linear models; measures of association; logistic regression; generalized linear models.

843 Multivariate Analysis
Spring of even years. 3(3-0) RB: STT 442 or STT 862 Not open to students with credit in STT 850.

844 Time Series Analysis
Spring of odd years. 3(3-0) RB: STT 442 or STT 862

847 Analysis of Survival Data
Spring of even years. 3(3-0) Interdepartmental with Epidemiology. Administered by Statistics and Probability. RB: STT 422 or STT 442 or STT 862

850 Applied Multivariate Statistical Methods
Spring. 4(3-2) Interdepartmental with Fisheries and Wildlife. Administered by Fisheries and Wildlife. RB: (STT 422 or concurrently) and MTH 314 SA: FOR 976
Application of multivariate methods to research problems. Hotelling’s T-test, profile analysis, discriminant analysis, canonical correlation, principal components, principal coordinates, correspondence analysis, and cluster analysis.

861 Theory of Probability and Statistics I
Fall. 3(3-0) RB: MTH 320 or concurrently

862 Theory of Probability and Statistics II
Spring. 3(3-0) RB: STT 861 and (MTH 415 or concurrently)
Statistical inference: sufficiency, likelihood, estimation, and tests of hypotheses in parametric and nonparametric cases. Linear models, goodness of fit, and other topics.

863 Applied Statistics Methods I
Fall. 3(3-0) RB: (STT 442 or STT 862) and (MTH 415 or concurrently) SA: STT 841
Application of regression models including simple and multiple regression, model diagnostics, model selection, one- and two-way analysis of variance, mixed effects models, randomized block designs, and logistic regression.

864 Applied Statistical Methods II
Spring of odd years. 3(3-0) RB: STT 863
Generalized linear models, loglinear models, hierarchical models, repeated measures, discriminant analysis and classification, clustering, regression, classification trees, selected nonparametric methods.

865 Modern Statistical Methods
Spring of even years. 3(3-0) RB: STT 863

866 Spatial Data Analysis
Spring. 4(3-2) Interdepartmental with Geography. Administered by Geography. RB: (GEO 463 or STT 421 or STT 430) or equivalent quantitative methods courses SA: GEO 466
Theory and techniques for statistical analysis of point patterns, spatially continuous data, and data in spatial zones.

871 Theory of Statistics I
Fall. 3(3-0) RB: (MTH 828 or concurrently) and (STT 881 or concurrently)

872 Theory of Statistics II
Spring. 3(3-0) RB: STT 871 and (STT 882 or concurrently)
Theory of Neyman Pearson tests and extensions. Convex loss estimation, best unbiased estimates, sufficient statistics, information lower bounds. Extensive application to linear models. LAN families and applications to estimation and tests.

881 Theory of Probability I
Fall. 3(3-0) RB: MTH 828 or concurrently

882 Theory of Probability II
Spring. 3(3-0) RB: STT 881

886 Stochastic Processes and Applications
Fall. 3(3-0) RB: STT 441 or STT 861
Markov chains and their applications in both discrete and continuous time, including classification of states, recurrence, limiting probabilities, Queuing theory, Poisson process and renewal theory.

888 Stochastic Models in Finance
Spring. 3(3-0) RB: STT 441 or STT 861 SA: STT 887
Stochastic models used in pricing financial derivatives. Discrete-time models, Brownian motion, stochastic integrals and Ito's formula, the basic Black-Scholes model, risk neutral distribution, European and American options, exotic options, the interest rate market, futures and interest rate options.

890 Statistical Problems
Fall, Spring. Summer. 1 to 3 credits. A student may earn a maximum of 24 credits in all enrollments for this course. R: Approval of department.
Individualized study on selected problems.

899 Master's Thesis Research
Fall, Spring. Summer. 1 to 6 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Approval of department.
Master's thesis research.

914 Applied Regression Models in Business Research
Spring. 3(3-0) Interdepartmental with Management. Administered by Management. RB: (STT 430 or STT 441) or equivalent SA: STT 888
Seminar on design and analysis of regression-based statistical models. Modeling issues arising in business research.
920 Advanced Methods in Epidemiology and Applied Statistics
Spring of even years. 3(3-0) Interdepartmental with Epidemiology. Administered by Epidemiology. P:M: EPI 826
Pattern recognition and cluster analysis, longitudinal data analysis, path analysis, repeated measures and time-series analysis.

953 Asymptotic Theory
Fall of odd years. 3(3-0) RB: STT 872
Asymptotics of M- and R- estimators. Asymptotically efficient and adaptive procedures.

954 Semi-Nonparametric Inference
Fall of odd years. 3(3-0) RB: STT 872
Robust procedures in regression and time series settings, nonparametric curve estimation, survival analysis in non- and semi-parametric models.

961 Convergence of Measures and Stochastic Processes
Fall of even years. 3(3-0) RB: STT 882

964 Stochastic Analysis
Spring of even years. 3(3-0) RB: STT 882

990 Problems in Statistics and Probability
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. RB: STT 872 R: Approval of department.
Individual study on an advanced topic in statistics or probability.

996 Advanced Topics in Probability
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 15 credits in all enrollments for this course. RB: STT 882 R: Approval of department.
Current topics in probability.

997 Advanced Topics in Statistics
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 15 credits in all enrollments for this course. RB: STT 872 R: Approval of department.
Topics selected from non- and semi parametric statistics, multivariate analysis, time series analysis, Bayesian statistics, regression and kernel estimation, and other topics in advanced statistics.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 120 credits in all enrollments for this course. R: Approval of department.
Doctoral dissertation research.