

Spanish—SPN

- 871 Seminar in Hispanic Literature and Society**
Fall. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Intensive study of Hispanic cultures and literatures. Topics vary.
- 872 Seminar in Literary Trends in the Hispanic World**
Fall of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Intensive study of the cultural approach of Hispanic literary trends. Topics vary.
- 873 Seminar in Major Hispanic Authors**
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Major Hispanic authors. Topics vary.
- 874 Seminar in Hispanic Literary Genres**
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Hispanic literary genres, including prose, poetry, theater, and essays. Topics vary.
- 875 Seminar in Popular Culture in the Hispanic World**
Fall of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: M.A. in Spanish or Hispanic cultural studies or the equivalent. Popular Hispanic cultures. Topics vary.
- 876 Seminar in Gender Studies in the Hispanic World**
Fall of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: M.A. in Spanish or Hispanic cultural studies or the equivalent. Gender studies including feminism and masculine identities.
- 877 Seminar in Visual Arts/Performance Studies in the Hispanic World**
Spring of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: M.A. in Spanish or Hispanic cultural studies or the equivalent. Visual arts and performance studies, including theater, television, cinema. Topics vary.
- 878 Seminar in Hispanic Cinema**
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: M.A. in Spanish or Hispanic cultural studies or the equivalent. Hispanic cinema. Topics vary.
- 879 Seminar in Literature and Culture of the Borderlands**
Fall of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Literatures and cultures of the Hispanic borderlands, including Latin America, Catalan, Basque. Topics vary.
- 880 Seminar in Colonial and Post-Colonial Studies**
Spring of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Colonial and post-colonial studies. Topics vary.

- 890 Independent Study**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department. Special projects, directed reading, and research arranged by an individual graduate student and a faculty member in areas supplementing regular course offerings.
- 891 Special Topics in Spanish**
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 15 credits in all enrollments for this course. R: Approval of department. Special topics supplementing regular course offerings proposed by faculty on a group study basis.
- 893 Interdisciplinary Seminar**
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with German; English; French. Administered by Department of Linguistics and Germanic, Slavic, Asian and African Languages. R: Approval of department. Examination of a theme, topic, or genre from several different national and disciplinary perspectives in the appropriate cultural and socio-historical context. Significant texts and important critical analysis selected from Great Britain, Spain, France, Germany, the Americas, and others.
- 999 Doctoral Dissertation Research**
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Approval of department. Doctoral dissertation research.

STATISTICS AND PROBABILITY

STT

Department of Statistics and Probability College of Natural Science

- 200 Statistical Methods**
Fall, Spring, Summer. 3(4-0) P: (MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or LBS 117 or LBS 118) or designated score on Mathematics placement test. Not open to students with credit in STT 201 or STT 315 or STT 421. Data analysis, probability models, random variables, estimation, tests of hypotheses, confidence intervals, and simple linear regression.
- 201 Statistical Methods**
Fall, Spring, Summer. 4(3-2) P: (MTH 103 or MTH 110 or MTH 116 or MTH 124 or MTH 132 or LBS 117 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, tests of hypotheses, confidence intervals, simple linear regression. Weekly lab using statistical software.

- 231 Statistics for Scientists**
Fall, Spring. 3(3-0) P: (MTH 124 or MTH 132 or MTH 152H or LBS 118) R: Open only to students in College of Natural Science. SA: STT 331. Calculus based course in probability and statistics. Probability models, random variables. Estimation, confidence intervals, tests of hypotheses, simple linear regression with applications in sciences.
- 290 Topics in Statistics and Probability**
Fall, Spring, Summer. 1 to 3 credits. RB: (MTH 103) R: Approval of department. Individualized study of selected topics.
- 315 Introduction to Probability and Statistics for Business**
Fall, Spring, Summer. 3(4-0) P: (MTH 124 or MTH 132 or MTH 152H or LBS 118) Not open to students with credit in STT 200 or STT 201 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.
- 317 Quantitative Business Research Methods**
Fall, Spring, Summer. 3(3-1) Interdepartmental with Marketing and Supply Chain Management. Administered by Department of Marketing and Supply Chain Management. P: (STT 315) R: Open only to juniors or seniors in The Eli Broad College of Business. Not open to students in The School of Hospitality Business. SA: ML 317, MTA 317. Application of statistical techniques, including forecasting, to business decision making. Includes applications of linear regression and correlation, analysis of variance, selected non-parametric tests, time series, and index numbers.
- 351 Probability and Statistics for Engineering**
Fall, Spring, Summer. 3(3-0) P: (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.
- 421 Statistics I**
Fall, Spring, Summer. 3(3-0) P: (MTH 103 or MTH 110 or MTH 116 or LBS 117) Not open to students with credit in STT 200 or STT 201 or STT 315. Basic probability, random variables, and common distributions. Estimation and tests for one-, two-, and paired sample problems. Introduction to simple linear regression and correlation, one-way ANOVA.
- 422 Statistics II**
Fall, Spring, Summer. 3(3-0) RB: (STT 421) Not open to students with credit in STT 464. Goodness of fit and other non-parametric methods. Linear models including multiple regression and ANOVA for simple experimental designs.
- 430 Introduction to Probability and Statistics**
Fall, Spring. 3(3-0) RB: (MTH 234 or concurrently) Not open to students with credit in STT 351. Calculus-based probability and statistics with applications. Discrete and continuous random variables and their expectations. Point and interval estimation, tests of hypotheses, simple linear regression.

- 441 Probability and Statistics I: Probability**
Fall, Spring, Summer. 3(3-0) RB: (MTH 234 or MTH 254H or LBS 220)
Probability models and basic statistics at an intermediate mathematical level. Discrete, continuous, univariate, and multivariate distributions. Random variables. Normal approximation. Sampling distributions, parameter estimation, and elementary tests of hypotheses.
- 442 Probability and Statistics II: Statistics**
Spring. 3(3-0) RB: (STT 441 and MTH 314)
Estimation, tests of hypotheses, confidence intervals. Goodness of fit, non-parametric methods. Linear models, multiple regression, ANOVA.
- 455 Actuarial Models**
Spring. 3(3-0) Interdepartmental with Mathematics. RB: (STT 441)
Stochastic models used in insurance. Survival distributions, life insurance, life annuities, benefit premiums, benefit reserves, analysis of benefit reserves.
- 461 Computations in Probability and Statistics**
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.
- 464 Statistical Methods for Biologists I**
Fall. 3(3-0) Interdepartmental with Animal Science; Crop and Soil Sciences. RB: (STT 421)
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression (prediction). Analyses of counted and measured data to compare several biological groups (contingency tables and analysis of variance).
- 465 Statistical Methods for Biologists II**
Spring. 3(3-0) Interdepartmental with Animal Science; Crop and Soil Sciences. RB: (STT 464)
Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.
- 471 Statistics for Quality and Productivity**
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: factorials and fractional factorials, confounding and aliasing. Engineering parameter design through experimentation.
- 481 Issues in Statistical Practice**
Spring. 1(1-0) P: Completion of Tier I writing requirement. R: 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.
- 490 Directed Study of Statistical Problems**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: 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.
- 801 Design of Experiments**
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.
- 818 Introduction to Econometrics**
Spring. 3(3-0) Interdepartmental with Economics; Agricultural Economics. Administered by Department of Economics. P:M: (EC 801 and STT 430) R: Not open to Economics Ph.D. students. SA: EC 820
The single equation regression model. Properties of least-squares estimators under various specifications. Multicollinearity, heteroskedasticity, serial correlation, generalized least squares.
- 820A Econometrics IA**
Fall. 3(3-0) Interdepartmental with Economics. RB: Multivariate Calculus R: Open only to Ph.D. students in Economics, in the Department of Agricultural Economics, and 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.
- 821 Econometrics II**
Fall. 3(3-0) Interdepartmental with Economics; Agricultural Economics. Administered by Department of Economics. P:M: (EC 820A and EC 820B)
Analysis of cross-sectional economic data. Qualitative and limited dependent variables. Probit, logit, tobit, and sample selectivity. Duration models. Count data. Analysis of panel data.
- 822 Econometrics III**
Spring. 3(3-0) Interdepartmental with Economics; Agricultural Economics. Administered by Department of 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)
Multivariate normal distribution, tests of hypotheses on means, multivariate analysis of variance. Discriminant analysis. Principal components. Factor analysis. Analysis of frequency data.
- 844 Time Series Analysis**
Spring of odd years. 3(3-0) RB: (STT 442 or STT 862)
Stationary time series. Autocorrelation and spectra. ARMA and ARIMA processes: estimation and forecasting. Seasonal ARIMA models. Identification and diagnostic techniques. Multivariate time series. Time series software.
- 847 Analysis of Survival Data**
Spring of even years. 3(3-0) Interdepartmental with Epidemiology. RB: (STT 422 or STT 442 or STT 862)
Analysis of lifetime data. Estimation of survival functions for parametric and nonparametric models. Censored data. The Cox proportional hazards model. Accelerated failure time models. Frailty models. Use of statistical software packages.
- 850 Applied Multivariate Statistical Methods**
Fall. 4(3-2) Interdepartmental with Fisheries and Wildlife. Administered by Department of 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)
Discrete and continuous random variables and vectors. Important probability models. Inequalities and limit laws. Sampling distributions and functions of random vectors. Statistical inference.
- 862 Theory of Probability and Statistics II**
Spring. 3(3-0) RB: (MTH 314 and MTH 421 or concurrently and STT 861)
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 314) 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)
Modern statistical methods. Applicability and computer implementation. Resampling methods, including the bootstrap. Markov chain Monte Carlo methods. Survival analysis. Nonparametric curve estimation.
- 866 Spatial Data Analysis**
Spring. 4(3-2) Interdepartmental with Geography. Administered by Department of 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.

Statistics and Probability—STT

- 871 Theory of Statistics I**
Fall. 3(3-0) RB: (MTH 828 or concurrently and STT 881 or concurrently)
Empirical distributions, quantiles, Glivenko-Cantelli Theorem. Important distributions and families. Convergences, Slutsky Theorem, asymptotics of differentiable functions. Basic concepts of decision theory. Confidence sets. Some basic statistical methods.
- 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)
Measures and their extensions, integration, and convergence theorems. Product measures, Lebesgue decomposition, transition probabilities, Kolmogorov consistency theorem. Independence. Classical limit theorems for partial sums.
- 882 Theory of Probability II**
Spring. 3(3-0) RB: (STT 881)
Conditional expectation, martingales, stationary processes. Brownian motion, convergence in distribution, and the invariance principle.
- 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 Department of Management. RB: (STT 430 or STT 441) or equivalent R: Open only to doctoral students in Business Administration.
Seminar on design and analysis of regression-based statistical models. Modeling issues arising in business research.

- 915 Advanced Survival Analysis**
Spring of odd years. 3(3-0) Interdepartmental with Epidemiology. Administered by Department of Epidemiology. RB: (EPI 810 and EPI 826 and EPI 852)
Methods of analysis of time to event data parametric and nonparametric models, frailty models.
- 920 Advanced Methods in Epidemiology and Applied Statistics**
Spring of even years. 3(3-0) Interdepartmental with 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)
Convergence of measures on metric spaces. Prohorov's theorem. Function spaces with the uniform and Skorokhod metric. Empirical processes. Weak convergence of Martingales. Applications.
- 964 Stochastic Analysis**
Spring of even years. 3(3-0) RB: (STT 882)
Stochastic integrals and semi-martingales, Ito formula, stochastic differential equations. Applications.
- 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.

STUDIO ART

STA

Department of Art and Art History College of Arts and Letters

- 110 Drawing I**
Fall, Spring. 3(0-6)
Fundamental concepts of drawing. Emphasis on observational, descriptive and analytical drawing. Practice of drawing skills using common drawing media.
- 111 Drawing II**
Fall, Spring. 3(0-6) P: (STA 110)
Development of imagery and expression; abstraction and the use of the human figure as subject matter.
- 113 Color and Design**
Fall, Spring. 3(0-6)
Basic elements of two-dimensional design. Principles of organization and the theory and practice of color as a basis for creative solutions for the problems of the artist and designer.
- 114 Three-Dimensional Form**
Fall, Spring. 3(0-6)
Formal elements of three-dimensional form. Application of the principles of organization as a means for producing creative solutions for the artist and designer. Related practical experience with a variety of materials and processes.
- 300 Intermediate Drawing**
Fall, Spring. 3(0-6) P: (STA 111 and STA 113 and STA 114)
Observational and imaginative drawing including the human figure. Non-representational drawing. Contemporary drawing systems, concepts, and processes.
- 320 Painting I**
Fall, Spring. 3(0-6) P: (STA 111 and STA 113 and STA 114)
Representational painting of landscape, figure, and still life imagery. Painting concepts, materials, and techniques.
- 325 Painting II**
Fall, Spring. 3(0-6) P: (STA 320)
Continuation of representational painting, and introduction to non-representational painting and concepts.
- 340 Ceramics I**
Fall, Spring. 3(0-6) P: (STA 111 and STA 113 and STA 114)
Ceramic processes including handbuilding, glaze formulation, and kiln firing as a means of cultural expression.
- 345 Ceramics II**
Fall, Spring. 3(0-6) P: (STA 340)
Continued development of ceramic forming and kiln firing techniques including handbuilding, glaze formulation, mold making, casting, and wheel throwing for cultural and artistic expression.
- 350 Figure Modeling**
Fall, Spring. 3(0-6) P: (STA 111 and STA 113 and STA 114)
Modeling human and natural forms. The figure as a means of artistic and cultural expression.