

## **University of Alberta Graduate Courses in Applied Statistics**

The courses listed in this document are offered through the departments of Educational Psychology, Human Ecology, Linguistics, Psychology, Sociology, Economics, Nursing, and Public Health. Course information and descriptions were compiled by the *Interdisciplinary Committee on Applied Graduate Statistics*, which promotes and advances graduate education in quantitative methods used in the social sciences by promoting interdisciplinary cooperation across departments.

Courses are divided into three levels. Level 1 courses provide a general introduction to basic statistics and quantitative methods. Level 2 courses provide a more advanced introduction to quantitative methods with either a focus on research methods and design or statistical analysis. Level 3 courses are more specialized. Most Level 3 courses require at least one Level 1 or Level 2 course as a prerequisite.

## Graduate Statistics Courses

Course Code	Course Title	Faculty / Department
<b>Level 1 - Introductory Courses</b>		
SOC 515	Quantitative Methods in Social Research	Arts / Sociology
EDPY 500	Introduction to Data Analysis in Educational Research	Education / Educational Psychology
SPH 519	Biostatistics I	School of Public Health / Public Health
NURS 512	Quantitative Design	Nursing / Nursing
LING 523	Introduction to Statistical Analysis of Linguistic Data Using R	Arts / Linguistics
<b>Level 2 - Methods Courses</b>		
PSYCO 522	Developmental Methods: Design and Data	Science / Psychology
EDPY 501	Introduction Methods to Educational Research	Education / Educational Psychology
EDPY 597	Survey Design and Implementation	Education / Educational Psychology
<b>Level 2 - Analysis Courses</b>		
PSYCO 531	Design and Analysis in Psychological Research I	Science / Psychology
SOC 509	Multivariable Analysis	Arts / Sociology
NURS 682	Statistics for Causal Analysis in Health Research	Nursing / Nursing
SPH 619	Biostatistics II	School of Public Health / Public Health
EDPY 505	Quantitative Methods I	Education / Educational Psychology
EDPY 507	Measurement Theory (Part I)	Education / Educational Psychology
ECON 598	Econometric Theory and Applications	Arts / Economics
<b>Level 3 - Advanced Courses</b>		
EDPY 605	Quantitative Methods II	Education / Educational Psychology
PSYCO 532	Design and Analysis in Psychological Research II	Science / Psychology
LING 603	Quantitative Methods	Arts / Linguistics
SPH 719	Biostatistics III	School of Public Health / Public Health
EDPY 607	Measurement Theory (Part II)	Education / Educational Psychology
PSYCO 631	Topics in Quantitative Methods: Scientific Interference	Science / Psychology
ECON 599	Applied Econometrics	Arts / Economics
ECON 509	Time Series Methods in Financial Econometrics	Arts / Economics
SOC 616	Structural Equation Modeling with LISREL	Arts / Sociology
HECOL 522	Introduction to Structural Equation Modeling	ALES / Human Ecology
PSYCO 523	Developmental Methods: Statistical Applications	Science / Psychology

## Course Offerings 2018-2019

Level	Course Code	FALL 2018			WIN 2019		
		Time	Class Size	Instructor	Time	Class Size	Instructor
Level 1	SOC 515	M 9:00-11:50 (LAB M 2:00-3:50)	15	Stevens			
	EDPY 500	M 1:00-3:50 (LAB W 1:00-3:50)	20	Cui	M 1:00-3:50 (LAB W 1:00-3:50)	20	Cui
	SPH 519	TR 9:30-10:50 (LAB R 11:00-11:50)	60	Dinu			
	NURS 512	F 9:00-11:50 (LAB W 1:00-1:50)	35	TBA	DIST EDUC	15	TBA
	LING 523	TR 3:30-4:50	12	TBA			
Level 2 - Methods	PSYCO 522				W 9:30-12:20	10	Hoglund
	EDPY 501	F 9:00-11:50 / T 5:00-9:00	20 / 20	King / McQuarrie	T 9:00-11:50 / R 6:00-8:00 (Online)	20 / 20	Leighton / Cor
	EDPY 597				M 9:00-11:50	20	TBA
Level 2 - Analysis	PSYCO 531	TR 3:30-4:50 (LAB R 12:30-1:50)	20	Wiebe			
	SOC 509						
	NURS 682				W (9:00-11:50) (LAB W 12:00-12:50)	15	MacDonald
	SPH 619				TR 9:30-10:50 (LAB R 11:00-11:50)	30	TBA
	EDPY 505	T 12:30-3:20 (LAB R 12:30-3:20)	20	Cui			
	EDPY 507	M 9:00-11:50 W 9:00-11:50	20 / 20	Gieri / Bulut			
	ECON 598	TR 12:30-1:50	40	Brencic			
Level 3	EDPY 605				T 12:30-3:20 (LAB R 12:30-3:20)	20	TBA
	PSYCO 532				TR 3:30-4:50 (LAB R 12:30-1:50)	20	Lind
	LING 603						TBA
	SPH 719	TR 9:30-11:50	20	TBA			
	EDPY 607				R 9:30-12:20	15	TBA
	PSYCO 631	M 9:00-11:50	10	Zheng	TR 1:00-2:20	6	Dixon
	ECON 599				TR 11:00-12:20	40	Liu
	ECON 509				TR 9:30-10:50	30	Fossati
	SOC 616						
	HECOL 522	W 1:00-3:50	15	Galovan			
PSYCO 523							

## Level 1 Courses

Level 1 courses provide an overview of quantitative methods in the social sciences with an introduction to basic statistics. Courses include **EDPY 500** (Introduction to Data Analysis in Education Research), **SOC 515** (Quantitative Methods in Social Research), **SPH 519** (Biostatistics I), **NURS 512** (Quantitative Design), and **LING 523** (Introduction to Statistical Analysis of Linguistic Data).

Because they provide a basic introduction to quantitative methods, these courses are recommended for students with limited statistical knowledge, as well as those who are returning to statistics. The courses also include instruction on statistical software, either through SPSS in **EDPY 500**, **NURS 512**, and **SOC 515**, Stata in **SPH 519**, or R in **LING 523**.

For the 2017-18 academic year, **EDPY 500**, **SPH 519**, **NURS 512**, and **LING 523** will be offered during the FALL 2017 semester. **SOC 515** and **EDPY 500** will be offered during the WINTER 2018 semester.

### **Level 1 - Introductory Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Faculty / Department</b>
SOC 515	Quantitative Methods in Social Research	Arts / Sociology
EDPY 500	Introduction to Data Analysis in Educational Research	Education / Educational Psychology
SPH 519	Biostatistics I	School of Public Health / Public Health
NURS 512	Quantitative Design	Nursing / Nursing
LING 523	Introduction to Statistical Analysis of Linguistic Data Using R	Arts / Linguistics

### **SOC 515 - Quantitative Methods in Social Research (*Using SPSS*)**

SOC 515 combines research design and quantitative statistical methods. This course focuses on data collection, analysis, interpretation, and presentation. Sub-topics include sampling, data collection strategies, research ethics, measurement issues, questionnaire design, correlation and regression, path analysis, logistic analysis, and interaction. *Prerequisite: SOC 210 and 315 or instructor consent*

### **EDPY 500 - Introduction to Data Analysis in Educational Research (*Using SPSS*)**

This course provides an introduction to descriptive and inferential univariate statistics commonly used in social science research. Sub-topics include frequency distributions, central tendency, variability, z-scores, probability, distribution of sample means, hypothesis testing, t-tests, and simple regression. *Prerequisite: None listed*

**SPH 519** - Biostatistics I (*Using STATA*)

SPH 519 focuses on elementary biostatistical methods used to analyze epidemiologic data. Sub-topics include central limit theorem, confidence intervals, hypothesis testing, t-tests, ANOVA, simple linear regression, confounding, interaction, two-way ANOVA, Fisher's exact test, and contingency tables. It also introduces matched-pair design and analysis, time-to-event analysis, estimation of survival probabilities, competing risk models, and nonparametric inference. Students also learn about presenting statistical design, analysis, and results. *Prerequisite: None listed*

**NURS 512** - Quantitative Design (*Using SPSS*)

This course focuses on quantitative methods used in health research. Sub-topics include statistical review (variables, levels of measurement, central tendency, and distribution), data management, statistical tests, hypothesis testing, t-tests, chi-square, ANOVA, correlation, and regression. *Prerequisite: None listed*

**LING 523** - Introduction to Statistical Analysis of Linguistic Data (*Using R*)

This course provides an introduction on how to use basic statistical methods primarily using genuine data from linguistic research. Sub-topics include hypothesis testing, sampling, distributions, type I/II errors, power, family-wise error rate, measures of central tendency and dispersion, standard errors, confidence intervals, z-scores, t-tests, ANOVA, cross-tabulation, Chi-square, correlation, and simple linear regression. *Prerequisite: department consent*

**Level 2 Courses**

Level 2 courses provide a more advanced introduction to either research methods and study design or quantitative data analysis. It is recommended that incoming students have taken at least one Level 1 course (or equivalent) prior to enrolling in these courses.

**Level 2 - Methods Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Faculty / Department</b>
PSYCO 522	Developmental Methods: Design and Data	Science / Psychology
EDPY 501	Introduction Methods to Educational Research	Education / Educational Psychology
EDPY 597	Survey Design and Implementation	Education / Educational Psychology

Methods courses include **PSYCHO 522** (Developmental Methods: Design and Data), **EDPY 501** (Introduction Methods to Educational Research), and **EDPY 597** (Survey Design and Implementation). These courses focus primarily on research design and cover a wide array of different research methods.

**EDPY 501** will be offered during the FALL 2017 semester, and **EDPY 597** will be offered in WINTER 2018.

### **PSYCHO 522 - Developmental Methods: Design and Data**

This course provides an introduction to developmental research methods. Topics include lifespan change (conceptual and methodological issues), lifespan research (nature, objective, logistics, and ethics), study of change (measurement and design issues), study of change (descriptive and explanatory designs, intra-individual change, differences, and variability, large-scale and epidemiological lifespan research, idiographic, nomothetic, and qualitative methods), and significance (linking theoretical, methodological, and practical issues). *Prerequisite: None listed*

### **EDPY 501 - Introduction Methods to Educational Research**

This course covers ethics, research processes and problems, literature reviews, research question development, qualitative and quantitative methods, questionnaire design, reporting results, and evaluating findings. It also reviews different methods that include experimental studies, correlation/survey, grounded theory, ethnography/narrative, and mixed methods. *Prerequisite: None listed*

### **EDPY 597 - Survey Design and Implementation**

The main objective of this course is to help students develop an understanding of basic survey research methods, particularly those that apply to educational settings with research applications in education, psychology, and the social sciences. The course is taught from the theoretical basis of Social Exchange Theory and focuses on the design of survey instruments, as well as the collection, analysis, and interpretation of responses. Topics include item development, survey construction, ethical concerns, complex surveys and nonresponse issues, sampling theory and strategies, and survey data analysis and reporting. *Prerequisite: None listed*

### **Level 2 - Analysis Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Faculty / Department</b>
PSYCO 531	Design and Analysis in Psychological Research I	Science / Psychology
SOC 509	Multivariable Analysis	Arts / Sociology
SPH 619	Biostatistics II	Public Health / Public Health
NURS 682	Statistics for Causal Analysis in Health Research	Nursing / Nursing
EDPY 505	Quantitative Methods I	Education / Educational Psychology
EDPY 507	Measurement Theory (Part I)	Education / Educational Psychology
ECON 598	Econometric Theory and Applications	Arts / Economics

Statistical analysis courses include **EDPY 505** (Quantitative Methods I), **NURS 682** (Statistics for Causal Analysis in Health Research), **SPH 619** (Biostatistics II), **PSYCHO 531** (Design and Analysis in Psychological Research I), **SOC 509** (Multivariable Analysis), **EDPY 507** (Measurement Theory (Part I)), and **ECON 598** (Economic Theory and Applications). Students should leave these courses with a general knowledge of quantitative methods that they can build on with the Level 3 courses.

**PSYCO 531, SDPY 505, EDPY 507, and ECON 598** will be offered during the FALL 2017 semester. **NURS 682** and **SPH 619** will be offered during the WINTER 2018 semester.

Most of these courses cover the following material: (1.) descriptive statistics, including frequency distributions, measures of central tendency, and measures of dispersion; (2.) probability, inference, and estimation, which include confidence intervals, z-scores, type I/II errors, power, and sampling procedures; (3.) hypothesis testing, including t-tests (for two independent samples and for two related samples), F-tests, and ANOVA; and (4.) measures of association with cross-tabulations, chi-squared tests, correlation, and regression.

**PSYCO 531, SOC 509, NURS 682, ECON 598, and SPH 619** cover a variety of methods. **EDPY 505** focuses specifically on ANOVA and **EDPY 507** specifically covers the development and evaluation of measurement instruments.

#### **PSYCO 531** - Design and Analysis in Psychological Research I (*Using R*)

This course focuses on treatment of statistical and data analysis methods. Sub-topics include probability review, random variables and probability distributions, exploratory methods and robust statistics, sampling distributions and hypothesis tests, bivariate correlations and regression, the analysis of variance, and factorial and measures designs. *Prerequisite: PSYCO 413 or equivalent*

#### **SOC 509** - Multivariable Analysis (*Using SPSS or SAS*)

SOC 509 focuses on data and variables (coding variables, describing variables, and the logic and use of sample weights), multiple regression, assumptions of the regression model, regression diagnostics, model specification (mediating variables, moderating variables), the generalized linear model, logistic regression, and Poisson regression. *Prerequisite: None listed, SOC 515 or equivalent recommended*

#### **SPH 619** - Biostatistics II (*Using STATA*)

SPH 619 provides an extension of regression and ANOVA models with a focus on diagnostics and model building, along with an introduction to some more advanced methods. Topics include multiple linear and logistic regression, ANOVA, confounding and interaction, assessment of collinearity/model building, regression diagnostics, analysis of covariance (ANCOVA), and proportional hazards regression. Subtopics under proportional hazards regression include hazard ratios, hypothesis testing, adjusted survival curves, testing proportional hazards assumption, non-proportional hazards model, and time-dependent variables. *Prerequisite: SPH 519 or consent of instructor*

**NURS 682** - Statistics for Causal Analysis in Health Research (*Using SPSS*)

This course develops foundational statistical skills for the analysis of social, behavioral, and health data. Content includes descriptive and inferential statistics, including correlation, t-tests, ANOVA, and multivariable linear and logistic regression. The focus is on parametric statistics, although non-parametric equivalents are discussed. A key focus is on determining the appropriate statistical test for the study design and level of measurement. The course integrates theory and application (using SPSS). *Prerequisite: Any undergraduate statistics course.*

**EDPY 505** - Quantitative Methods I (*Using SPSS*)

This course focuses on data analysis using ANOVA and ANCOVA. Sub-topics include one-way between subjects design, multiple comparison procedures, two-way between subject design, one-way within subjects design, simple mixed design, and analysis of covariance. *Prerequisite: EDPY 500 or equivalent*

**EDPY 507** - Measurement Theory (Part I) (*Using Excel*)

This course focuses specifically on the development and evaluation of measurement instruments. This course covers classical test theory (CTT), item response theory (IRT), items analysis, item development (selected and constructed response), test fairness (differential item functioning), establishing score meaning (standard setting), modern test administration (computer adaptive testing), and validity. *Prerequisite: None listed*

**ECON 598** - Econometric Theory and Applications

This course provides advanced treatment of estimation, inference and econometric problems and techniques, including the use of matrix operations and statistical distribution theory, with an emphasis on applied econometric analysis. *Prerequisite: ECON 481 and 482 or equivalent, and an advanced undergraduate level course in econometrics. Note: Not open to students with credit in ECON 506.*



### Level 3 Courses

Level 3 courses are more advanced and cover a wide range of topics. These courses also provide a more thorough understanding of topics in quantitative methods and statistics. Topics include matrix algebra, multiple linear and logistic regression, ANCOVA and MANOVA, discriminant analysis, cluster analysis, principal component and factor analysis, and structural equation modeling. Most of these courses require at least one Level 1 or 2 course as a prerequisite.

#### **Level 3 - Advanced Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Faculty / Department</b>
EDPY 605	Quantitative Methods II	Education / Educational Psychology
PSYCO 532	Design and Analysis in Psychological Research II	Science / Psychology
LING 603	Quantitative Methods	Arts / Linguistics
SPH 719	Biostatistics III	School of Public Health / Public Health
EDPY 607	Measurement Theory (Part II)	Education / Educational Psychology
PSYCO 631	Topics in Quantitative Methods: Scientific Interference	Science / Psychology
ECON 599	Applied Econometrics	Arts / Economics
ECON 509	Time Series Methods in Financial Econometrics	Arts / Economics
SOC 616	Structural Equation Modeling with LISREL	Arts / Sociology
HECOL 522	Introduction to Structural Equation Modeling	ALES / Human Ecology
PSYCO 523	Developmental Methods: Statistical Applications	Science / Psychology

**EDPY 605**, **LING 603**, **PSYCO 532**, and **SPH 719** cover a series of advanced quantitative methods. **PSYCO 631** specifically covers hypothesis testing. **EDPY 607** expands on **EDPY 507** to focus on practice in educational measurement. **ECON 509** stresses time series analysis. Three courses (**SOC 616**, **HECOL 522**, and **PSYCHO 523**) also focus specifically on structural equation modeling (SEM). Taking **HECOL 522** and **PSYCHO 523** in sequence is recommended for students interested in these topics.

#### **EDPY 605 - Quantitative Methods II**

This course focuses on multivariate statistical analysis. Sub-topics include matrix algebra, multiple regression, profile analysis, MANOVA, discriminate analysis, logistic regression, cluster analysis, canonical correlation, factorial design, principal component analysis, factor analysis, SEM, and confirmatory factor analysis. *Prerequisite: None listed, EDPY 505 or equivalent recommended*

**PSYCHO 532** - Design and Analysis in Psychological Research II (*Using R*)

This course focuses on the treatment of experimental design and analysis methods. Sub-topics include matrix algebra, multiple regression and linear models, logistic regression, component analysis, mixed model analysis of variance, within factorial designs, split plots: within-between designs, Latin square and cross-over designs, the analysis of covariance, and the multivariate analysis of variance. *Prerequisite: PSYCO 531 or equivalent*

**LING 603** - Quantitative Methods (*Using R*)

LING 603 focuses more on regression. Topics include multiple linear regression, logistic regression, multinomial logistic regression, and hierarchical agglomerative clustering (behavioral profiles). Students in this course also replicate the results from genuine linguistic data, as presented in published articles. *Prerequisite: LING 523 or consent of department*

**SPH 719** - Biostatistics III (*Using STATA*)

SPH 719 further expands on the material with a focus on multinomial logistic, ordinal logistic, Poisson, and negative binomial regression, along with clustered data, survival analysis with competing risks, factor analysis, propensity score analysis, and Bayesian statistics. The course includes a large section on longitudinal data analysis, covering linear mixed models and generalized estimating equations for continuous data and non-linear mixed models and generalized estimating equations for binary outcomes. *Prerequisite: SPH 619 or consent of instructor*

**EDPY 607** - Measurement Theory (Part II)

EDPY 607 provides a follow-up to EDPY 507. This course focuses on practice in educational measurement. Sub-topics include polytomous IRT models (graded response, partial credit, generalized partial credit, and rating scale models), multidimensional IRT (compensatory vs. non-compensatory models, simple vs. complex structure, item parameter estimation, and ability estimation in MIRT), explanatory IRT models (models with item, person, and person-by-item predictors), basic concepts of CAT (IRT concepts underlying CAT, creating and evaluating item banks, beginning a CAT, terminating a CAT, ability estimation, and item selection methods), generalizability theory, and an introduction to test equating and linking methods. *Prerequisite: EDPY 507 or consent of instructor*

**PSYCHO 631** - Topics in Quantitative Methods: Scientific Interference

This course focuses on the logic and history of hypothesis testing and discusses a range of common critiques. As an alternative, this course highlights model comparison as a general framework for describing evidence and building strategies. This course aims to provide a deeper understanding of the inference tools that can be used for evaluating evidence. *Prerequisite: PSYCO 531/532 or equivalent*

**ECON 599** - Applied Econometrics

This course addresses the role of economic theory in the process of specification and estimation of models. Interpretation and critical evaluation of applied work by means of selected topics in economics and econometrics. *Prerequisite: ECON 598 or equivalent*

**ECON 509** - Time Series Methods in Financial Econometrics (*Using R*)

This course focuses on time series econometrics for macroeconomics, international finance, and finance. Sub-topics include stationary univariate models, estimation and model selection, state-space models, forecasting and asymptotic theory, univariate nonstationary time series, asymptotic for nonstationary data and unit root tests, stationary VAR models, structural VAR models, spurious regression, and cointegration. *Prerequisite: None listed*

**SOC 616** - Structural Equation Modeling with LISREL (*Using LISREL*)

SOC 616 provides a general introduction to SEM. It covers the specification, identification, and analysis of path models, CFA models, and structural regression models, as well as topics of model estimation and local fit testing, global fit testing, multiple group analysis, and measurement invariance. SOC 616 teaches LISREL as the primary software. *Prerequisite: None listed*

**HECOL 522** - Introduction to Structural Equation Modeling (*Using Mplus*)

HECOL 522 provides a general introduction to SEM. It covers the specification, identification, and analysis of path models, CFA models, and structural regression models, as well as topics of model estimation and local fit testing, global fit testing, multiple group analysis, and measurement invariance. HECOL 522 teaches Mplus as the primary software. *Prerequisite: Statistics coursework covering regression analysis*

**PSYCHO 523** - Developmental Methods: Statistical Applications (*Using Mplus*)

This course focuses on applying SEM to longitudinal data analysis. Topics include traditional approaches to longitudinal data analysis, mediation and path analysis, moderation and multiple-group models, introduction to latent variables, structural regression, modeling change over time, predictors of change, mediation and moderation in SEM, and practical issues in longitudinal data analysis. *Prerequisite: PSYCO 522 or equivalent*