

# STATISTICS (STAT)

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**STAT 252 Introductory Applied Probability Units: 3.00**

Basics of probability. Counting principle, binomial expansion. Conditional probability and Bayes' Theorem. Random variables, mean and variance. Bernoulli, binomial, geometric, hypergeometric and exponential distributions. Poisson approximation. Distribution, frequency and density functions. Normal distribution and central limit theorem.

NOTE STAT 252 is a new course for STAT Minors and Medials.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite MATH 120 or MATH 121 or MATH 126 or MATH 124. Exclusion STAT 268; STAT 351.

**Offering Faculty:** Faculty of Arts and Science

**STAT 263 Introduction to Statistics Units: 3.00**

A basic course in statistical methods with the necessary probability included. Topics include probability models, random variables, distributions, estimation, hypothesis testing, elementary nonparametric methods.

NOTE Also offered online, consult Arts and Science Online (Learning Hours may vary).

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite None. Exclusion BIOL 243; CHEE 209; COMM 162; ECON 250; GPHY 247; KNPE 251; NURS 323; PHED 251; POLS 385; PSYC 202; SOCY 211; STAM 200; STAT 267; STAT 367. One-Way Exclusion May not be taken with or after STAT 269. Recommended An Ontario 4U mathematics course or equivalent.

**Offering Faculty:** Faculty of Arts and Science

**STAT 268 Statistics and Probability I Units: 3.00**

Basic ideas of probability theory such as random experiments, probabilities, random variables, expected values, independent events, joint distributions, conditional expectations, moment generating functions. Main results of probability theory including Chebyshev's inequality, law of large numbers, central limit theorem. Introduction to statistical computing.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (MATH 120 or MATH 121 or MATH 122 or MATH 124). Corequisite (MATH 221 or MATH 280). Exclusion STAT 252; STAT 351.

**Offering Faculty:** Faculty of Arts and Science

**STAT 269 Statistics and Probability II Units: 3.00**

Basic techniques of statistical estimation such as best unbiased estimates, moment estimates, maximum likelihood. Bayesian methods. Hypotheses testing. Classical distributions such as the t-distribution, F-distribution, beta distribution. These methods will be illustrated by simple linear regression. Statistical computing.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (MATH 221 or MATH 280) and (STAT 252 or STAT 268 or STAT 351) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 351 Probability I Units: 3.00**

Probability theory; probability models; random variables; jointly distributed random variables; transformations and generating functions. Inequalities and limit laws. Distributions: binomial, Poisson, exponential, gamma, normal. Applications: elementary stochastic processes, time-to-failure models, binary communication channels with Gaussian noise.

LEARNING HOURS 120 (36L;12T;72P).

**Requirements:** Prerequisite None. Corequisite (MATH 221 or MATH 280). Exclusion STAT 252; STAT 268.

**Offering Faculty:** Faculty of Arts and Science

**STAT 353 Probability II Units: 3.00**

Intermediate probability theory as a basis for further study in mathematical statistics and stochastic processes; probability measures, expectations; modes of convergence of sequences of random variables; conditional expectations; independent systems of random variables; Gaussian systems; characteristic functions; Law of large numbers, Central limit theory; some notions of dependence.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (STAT 252 or STAT 268 or STAT 351) and (MATH 110 or MATH 111 or MATH 112) and MATH 281.

**Offering Faculty:** Faculty of Arts and Science

**STAT 356 Probability For Elec. Engrs. Units: 3.50**

**Requirements:** APSC171 OR MATH128

**Offering Term:** W

**Offering Faculty:** Fac of Engineering Appl Sci

**STAT 361 Applied Methods in Statistics I Units: 3.00**

A detailed study of simple and multiple linear regression, residuals and model adequacy. The least squares solution for the general linear regression model. Analysis of variance for regression and simple designed experiments; analysis of categorical data.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (MATH 110 or MATH 111 or MATH 112) and (STAT 252 or STAT 268 or STAT 351) and (STAT 263 or STAT 269) or permission of the Department. Exclusion ECON 351.

**Offering Faculty:** Faculty of Arts and Science

**STAT 362 R for Data Science Units: 3.00**

Introduction to R, data creation and manipulation, data import and export, scripts and functions, control flow, debugging and profiling, data visualization, statistical inference, Monte Carlo methods, decision trees, support vector machines, neural network, numerical methods.

LEARNING HOURS 118 (36L;12G;70P).

**Requirements:** Prerequisite (STAT 252 or STAT 263 or STAT 268 or STAT 351) and (MATH 110 or MATH 111 or MATH 120 or MATH 121 or MATH 124 or MATH 126 or [MATH 112 and MATH 212]) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 363 Fundamental Statistical Inference Units: 3.00**

**Requirements:** (STAT251 AND STAT261) OR (STAT251 AND STAT264) OR (STAT251 AND STAT265) OR STAT269

**Course Equivalencies:** STAT363; STAT463

**Offering Faculty:** Faculty of Arts and Science

**STAT 367 Engineering Data Analysis Units: 4.00**

Exploratory data analysis -- graphical and statistical analysis and presentation of experimental data. Random sampling.

Probability and probability models for discrete and continuous random variables. Process capability. Normal probability graphs. Sampling distribution of means and proportions. Statistical Quality Control and Statistical Process Control. Estimation using confidence intervals. Testing of hypothesis procedures for means, variances and proportions -- one and two samples cases. Linear regression, residuals and correlation. ANOVA. Use of statistical software. (44/0/0/4/0)

**Requirements:** (MATH128 AND MATH129) OR COMM161 OR (APSC171 AND APSC172) OR MATH12##

**Offering Faculty:** Faculty of Arts and Science

**STAT 454 Statistical Spectrum Estimation Units: 3.00**

Many systems evolve with an inherent amount of randomness in time and/or space. The focus of this course is on developing and analyzing methods for analyzing time series. Because most of the common time-domain methods are unreliable, the emphasis is on frequency-domain methods, i.e. methods that work and expose the bias that plagues most time-domain techniques. Slepian sequences (discrete prolate spheroidal sequences) and multi-taper methods of spectrum estimation are covered in detail. (12/0/0/12/12)~ COURSE NOT OFFERED IN 2010-2011 ~

**Requirements:** (STAT353 AND MATH312) OR (MATH338 AND STAT251) OR (STAT261 AND MATH321)

**Offering Faculty:** Faculty of Arts and Science

**STAT 455 Stochastic Processes and Applications Units: 3.00**

Markov chains, birth and death processes, random walk problems, elementary renewal theory, Markov processes, Brownian motion and Poisson processes, queuing theory, branching processes. Given jointly with STAT 855.

LEARNING HOURS 120 (36L;12T;72P).

**Requirements:** Prerequisite STAT 353.

**Offering Faculty:** Faculty of Arts and Science

**STAT 456 Bayesian Analysis Units: 3.00**

An introduction to Bayesian analysis and decision theory; elements of decision theory; Bayesian point estimation, set estimation, and hypothesis testing; special priors; computations for Bayesian analysis. Given Jointly with STAT 856.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite STAT 463 or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 457 Statistical Learning II Units: 3.00**

Introduction to the theory and application of statistical algorithms. Topics include classification, smoothing, model selection, optimization, sampling, supervised and unsupervised learning. Given jointly with STAT 857.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite STAT 361 or ECON 351 or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 462 Statistical Learning I Units: 3.00**

A working knowledge of the statistical software R is assumed. Classification; spline and smoothing spline; regularization, ridge regression, and Lasso; model selection; treed-based methods; resampling methods; importance sampling; Markov chain Monte Carlo; Metropolis-Hasting algorithm; Gibbs sampling; optimization. Given jointly with STAT 862.  
LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite ([STAT 361 or ECON 351] and STAT 362) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 463 Fundamentals of Statistical Inference Units: 3.00**

Decision theory and Bayesian inference; principles of optimal statistical procedures; maximum likelihood principle; large sample theory for maximum likelihood estimates; principles of hypotheses testing and the Neyman-Pearson theory; generalized likelihood ratio tests; the chi-square, t, F and other distributions.

LEARNING HOURS 132 (36L;96P).

**Requirements:** Prerequisite STAT 269. Equivalency STAT 363. Recommended STAT 353.

**Course Equivalencies:** STAT363; STAT463

**Offering Faculty:** Faculty of Arts and Science

**STAT 464 Discrete Time Series Analysis Units: 3.00**

Autocorrelation and autocovariance, stationarity; ARIMA models; model identification and forecasting; spectral analysis. Applications to biological, physical and economic data.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite STAT 361 or ECON 351 or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 465 Quality Management Units: 3.00**

An overview of the statistical and lean manufacturing tools and techniques used in the measurement and improvement of quality in business, government and industry today. Topics include management and planning tools, Six Sigma approach, statistical process charting, process capability analysis, measurement system analysis and factorial and fractional factorial design of experiments.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (STAT 263 or STAT 269) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 466 Statistical Programming with SAS and Applications Units: 3.00**

Introduction to the basic knowledge in programming, data management, and exploratory data analysis using SAS software: data manipulation and management; output delivery system; advanced text file generation, statistical procedures and data analysis, macro language, structure query language, and SAS applications in clinical trial, administrative financial data.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite (STAT 263 or STAT 269) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 471 Sampling and Experimental Design Units: 3.00**

Simple random sampling; Unequal probability sampling; Stratified sampling; Cluster sampling; Multi-stage sampling; Analysis of variance and covariance; Block designs; Fractional factorial designs; Split-plot designs; Response surface methodology; Robust parameter designs for products and process improvement. Offered jointly with STAT 871.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite ([STAT 361 or ECON 351] and STAT 463) or permission of the Department. Equivalency STAT 362.

**Offering Faculty:** Faculty of Arts and Science

**STAT 473 Generalized Linear Models Units: 3.00**

An introduction to advanced regression methods for binary, categorical, and count data. Major topics include maximum-likelihood method, binomial and Poisson regression, contingency tables, log linear models, and random effect models. The generalized linear models will be discussed both in theory and in applications to real data from a variety of sources. Given jointly with STAT 873.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite ([STAT 361 or ECON 351] and STAT 463) or permission of the Department.

**Offering Faculty:** Faculty of Arts and Science

**STAT 486 Survival Analysis Units: 3.00**

Introduces the theory and application of survival analysis: survival distributions and their applications, parametric and nonparametric methods, proportional hazards models, counting process and proportional hazards regression, planning and designing clinical trials. Given jointly with STAT 886.

LEARNING HOURS 120 (36L;84P).

**Requirements:** Prerequisite ([STAT 361 or ECON 351] and STAT 463) or permission of the Department. Recommended STAT 462.

**Offering Faculty:** Faculty of Arts and Science



**STAT 499 Topics in Statistics Units: 3.00**

An important topic in statistics not covered in any other courses.

**Requirements:** Prerequisite Permission of the Department.  
Exclusion STAT 505.

**Offering Faculty:** Faculty of Arts and Science

**STAT 506 Topics in Statistics II Units: 3.00**

An important topic in probability or statistics not covered in any other course.

LEARNING HOURS 132 (24I;108P).

**Requirements:** Prerequisite Permission of the Department.

**Offering Faculty:** Faculty of Arts and Science