

DOCTOR OF PHILOSOPHY (Ph.D. STATISTICS) PROGRAM

Admission Requirements

Application for admissions must be filed with the *Director of Graduate Studies* at least one month before the start of the registration period of the proposed term of entrance.

1. Applicants with a bachelor's or master's degree or equivalent degree or title from any recognized institution of higher learning and who satisfy the University rules on admission to a graduate program may be admitted to the Ph.D. program subject to the following conditions:

An applicant with a bachelor's or master's degree other than in statistics may be required to take additional mathematics and statistics courses before admission to the Ph.D. program.

Additional requirements shall be determined by the Graduate Committee of the Center.

2. A student must obtain a grade of 2.0 or better in the qualifying examination based on the core courses of the MS(Statistics) program of the School before being allowed to continue in the doctoral program. Graduates of MS(Statistics) of the School are exempted from taking the qualifying examination.

Course Work

1. Doctoral courses:

		Units
Stat 301	Theory of Probability I	3
Stat 302	Theory of Probability II	3
Stat 303	Stochastic Processes	3
Stat 311	Theory of Statistical Inference I	3
Stat 312	Theory of Statistical Inference II	3
		15

2. At least 6 units of electives.

List of Possible Electives:

Stat 239	Distribution Theory
Stat 261	Sequential Analysis
Stat 262	Nonparametric Statistics
Stat 263	Bayesian Analysis
Stat 264	Elements of Decision Theory
Stat 265	Robust Statistics
Stat 313	Decision Theory
Stat 321	Asymptotic Methods of Statistics
Stat 380	Advanced Special Topics

3. At least 6 units of reading course (Stat 390)
4. At least 1 unit of seminar course (Stat 396).
5. Dissertation (Stat 400) – 12 units

Total Doctoral Units = 40

For bachelor's degree holders, all courses (38 units) in the M.S. (Statistics) program of the School will have to be taken in addition to the above course work.

Advancement to Candidacy

1. A student is qualified to take the candidacy examination based on the PhD core courses (Stat 301, Stat 302, Stat 303, Stat 311 and Stat 312), provided that his weighted average in these courses is 1.75 or better.
2. After passing the candidacy examination with a grade of 1.75 or better, a student is considered advanced to candidacy for the degree.
3. Failure at a second try shall bar the student permanently from the PhD program.

Graduation Requirement

Submission of an approved dissertation successfully defended in an oral examination.

SCHOLASTIC DELIQUENCY

The following are the grade requirements for students enrolled in the graduate programs:

No. of Units Taken	Average Grade Requirement
6	2.50
9	2.30
12	2.20
15	2.15
18	2.10
21	2.05
27 or more	2.00

Students who do not satisfy the above grade requirements will be dropped from the roll of the Statistical Center.

DESCRIPTION OF COURSES

STAT 100 CALCULUS AND MATRIX ALGEBRA FOR STATISTICS.

Differential and integral calculus; infinite series; matrix algebra

Credit: 3 u

STAT 195 INTRODUCTION TO MATHEMATICAL STATISTICS.

Probability distribution, sampling distribution, parametric and nonparametric inference.

Credit: 3 u

STAT 210 STATISTICAL SOFTWARE.

Database management and programming using statistical software.

Credit: 3 u

STAT 211 STATISTICAL COMPUTING.

Algorithms for statistical computing; numerical analysis for linear and nonlinear models; random number generation; Monte Carlo methods.

Credit: 3 u

STAT 221 INTRODUCTORY PROBABILITY.

Combinatorial analysis; sample space and random variables, probability distribution function; expectation; stochastic independence; common probability distributions.

Credit 3 u

STAT 222 INTRODUCTION TO STATISTICAL INFERENCE.

Sampling distributions, point and interval estimation; tests of hypothesis.

Pre-requisite: Stat 221

Credit: 3 u

STAT 223 APPLIED REGRESSION ANALYSIS.

Model building; diagnostic checking; remedial measures; applications

Co-requisite: Stat 222 or equivalent

Credit: 3 u

STAT 224 EXPERIMENTAL DESIGNS.

Completely randomized designs; randomized complete block design; Latin square design; factorial experiments; incomplete block design; higher-order designs.

Pre-requisite: Stat 223 or equivalent

Credit: 3 u

STAT 225 TIME SERIES ANALYSIS.

Classical procedures; stationarity; Box-Jenkins modeling procedure: autocorrelation function, partial autocorrelation function; identification, estimation, diagnostic checking, forecasting; transfer functions; applications.

Pre-requisite: Stat 223 or equivalent

Credit: 3 u

STAT 226 APPLIED MULTIVARIATE ANALYSIS.

Multivariate normal distribution; principal components analysis; biplots and h-plots; factor analysis; discriminant analysis; cluster analysis; multidimensional scaling; correspondence analysis; canonical correlation analysis; graphical and data oriented techniques; applications

Co-requisite Stat 223 or its equivalent

Credit: 3 u

STAT 230 SPECIAL TOPICS IN MATHEMATICS FOR STATISTICS.

Special topics in mathematics and their applications in statistics. To be arranged according to the needs of students.

Credit: 3 u

(may be repeated provided that the topics are different; topics to be indicated for record purposes)

STAT 231 PROBABILITY THEORY.

Probability spaces and random variables; probability distributions and distribution functions; mathematical expectation; convergence of sequences of random variables; laws of large numbers; characteristics functions.

Co-requisite: Stat 230

Credit: 3 u

STAT 232 PARAMETRIC INFERENCE.

Exponential family of densities; point estimation: sufficiency, completeness, unbiasedness, equivariance; hypothesis testing.

Pre-requisite: Stat 231

Credit: 3 u

STAT 233 LINEAR MODELS.

Subspaces and projections; multivariate normal distribution, non-central distributions, distribution of quadratic forms; the general linear model of full column rank, tests about the mean; tests about the variance; the general linear model not of full column rank; estimability and testability.

Pre-requisite: Stat 232

Credit 3 u

STAT 234 MULTIVARIATE ANALYSIS.

Distribution theory for multivariate analysis; the multivariate one-and-two sample models; the multivariate linear model.

Pre-requisite: Stat 233

Credit: 3 u

STAT 235 SURVEY OF STOCHASTIC PROCESSES.

Markov chains; Markov processes; Poisson processes; renewal processes; martingales.

Pre-requisite: Stat 221

Credit: 3 u

STAT 240 HIGH DIMENSIONAL DATA.

High dimensional data; high dimensional data visualization; high dimensional data analysis; dimension reduction; pattern search; clustering; applications

Pre-requisite: Stat 226/Equivalent, Stat 223/Equivalent

Credit: 3 u

STAT 241 NONLINEAR REGRESSION.

Classification of nonlinear models; iterative estimation and linear approximation; practical considerations: model specification, starting values, transformations; convergence; multiresponse model; models from differential equations; nonlinear inference regions; measures of nonlinearity; applications.

Pre-requisite: Stat 223 or equivalent

Credit: 3 u

STAT 242 ECONOMETRIC METHODS.

Distributed lag models; structural change; simultaneous equations; limited dependent variables; ARCH, GARCH, processes; cointegration; applications.

Pre-requisite: Econ 101, Stat 223 or equivalent

Credit: 3 u

STAT 243 CATEGORICAL DATA ANALYSIS.

Cross-classified tables, multidimensional tables; loglinear model; logit models, measures of association; inference for categorical data; applications

Pre-requisite: Stat 223 or equivalent

Credit: 3 u

STAT 244 DESIGN AND ANALYSIS OF CLINICAL EXPERIMENTS.

Reliability of measurements; parallel groups design; control of prognostic factors; blocking and stratification; analysis of covariance; repeated measurements and crossover studies; balanced incomplete block designs; factorial experiments; split-plot designs; applications.

Pre-requisite: Stat 223 or equivalent

Credit: 3 u

STAT 245 SURVIVAL ANALYSIS.

Functions of survival time; estimation of survival functions; survival distributions and their applications; distribution fitting and goodness-of-fit tests.

Pre-requisite: Stat 222 or equivalent

Credit: 3 u

STAT 246 RESPONSE SURFACE METHODS.

Product design and development; optimal designs; response surface models; response surface optimization; applications.

Pre-requisite: Stat 223/Equivalent

Credit: 3 u

STAT 247 DATA MINING AND BUSINESS INTELLIGENCE.

Principles of data mining; methods of data mining; themes of data mining; applications of data mining in business intelligence.

Pre-requisite: Stat 210/Equivalent, Stat 226/Equivalent,
Stat 223/Equivalent, and Stat 225/Equivalent

Credit: 3 u

STAT 249 NONPARAMETRIC MODELING.

Smoothing methods; kernel smoothing; spline smoothing; regression trees; projection pursuit; nonparametric regression; cross-validation; scoring; high dimensional predictors; additive models; backfitting.

Pre-requisite: Stat 222/232 and Stat 223/Equivalent

Credit: 3 u

STAT 250 SAMPLING DESIGNS.

Concepts in designing sample surveys; non-sampling errors; simple random sampling; systematic sampling; sampling with varying probabilities; stratification, use of auxiliary information; cluster sampling; multi-stage sampling;

Co-requisite: Stat 222/Stat 232

Credit: 3 u

STAT 251 SURVEY OPERATIONS.

Planning a survey; sample design and sample size, frame construction; tabulation plans; preparation of questionnaires and manual of instruction; field operations; processing of data, preparation of report.

Pre-requisite: Stat 222

Co-requisite: Stat 223

Credit: 3 u

STAT 252 BOOTSTRAP METHODS.

Empirical distribution functions; resampling and nonparametric statistical inference; optimality of the bootstrap; bootstrap in hypothesis testing; bootstrap in confidence intervals; bootstrap in regression models; bootstrap for dependent data.

Pre-requisite: Stat 222/232 and Stat 223/Equivalent

Credit: 3 u

STAT 260 QUANTITATIVE RISK MANAGEMENT.

Market risk; financial time series; copulas; extreme value theory; credit risk models; operational risks.

Pre-requisite: Stat 223 and Stat 225

Credit: 3 u

STAT 261 STOCHASTIC CALCULUS FOR FINANCE.

Continuous-time model; Brownian motion; random walk; quadratic variation; Ito formula; Black-Scholes equation; risk-neutral measure; martingale representation theorem; fundamental theorems of asset pricing

Pre-requisite: Stat 221/231/Equivalent

Credit: 3 u

STAT 262 NONPARAMETRIC STATISTICS.

Distribution-free statistics; U-statistics; power functions; asymptotic relative efficiency of tests; confidence intervals and bounds; point estimation; linear rank statistics; other methods for constructing distribution-free procedures.

Pre-requisite: Stat 232

Credit: 3 u

STAT 263 BAYESIAN ANALYSIS.

Bayesian inference; empirical and hierarchical analysis; robustness; numerical procedures.

Pre-requisite: Stat 232

Credit: 3 u

STAT 264 ELEMENTS OF DECISION THEORY.

Basic concepts, risk function, Bayes and minimax solutions of decision problems, statistical decision functions, formulation of general decision problems.

Pre-requisite Stat 231

Credit: 3 u

STAT 265 ROBUST STATISTICS.

Breakdown point and robust estimators; M-, R-, and L- estimates; robust tests; robust regression and outlier detection.

Pre-requisite: Stat 232

Credit: 3 u

STAT 266 APPLIED NONPARAMETRIC METHODS.

Methods for single, two and k samples; trends and association; nonparametric bootstrap.

Pre-requisite: Stat 222 and Stat 223

Credit: 3 u

STAT 267 ADVANCED APPLIED MULTIVARIATE ANALYSIS.

Confirmatory factor analysis; multidimensional scaling; correspondence analysis; classification trees; CHAID; procrustes analysis; neural networks; structural equation modeling.

Pre-requisite: Stat 226 or equivalent/COI

Credit: 3 u

STAT 268 ADVANCED TIME SERIES ANALYSIS.

Nonstationarity; cointegration; interventions models; state space models; transfer functions; frequency domain; panel data; nonparametric methods for time series; nonparametric prediction; AR-Sieve; block bootstrap

Pre-requisite: Stat 223/Equivalent and 225/Equivalent

Credit: 3 u

STAT 270 EXPLORATORY DATA ANALYSIS.

Graphical methods; single batch analysis and analysis of several batches; order statistics; resistant estimators; robust tests; robust regression; median polish; applications.

Pre-requisite: Stat 222 or equivalent

Credit: 3 u

STAT 271 STATISTICAL QUALITY CONTROL.

Overview of the statistical methods useful in quality assurance; statistical process control; control charts for variables and attributes, cusum chart, multivariate chart; process capability analysis; acceptance sampling; MIL STD tables and JIS tables; off-line quality control; introduction to response surface analysis; Taguchi method; applications.

Pre-requisite: Stat 222

Credit: 3 u

STAT 272 RELIABILITY THEORY.

Coherent systems; paths and cuts, life distribution; dependent components; maintenance policies and replacement models; domains of attraction.

Pre-requisite: Stat 231

Credit: 3 u

STAT 273 SIX SIGMA STATISTICS.

DMAIC(define-measure-analyze-improve-control) methodology; statistical process control; process capability; failure mode and effects analysis (FMEA); measurement system analysis; optimization by experimentation; taguchi method.

Pre-requisite: COI

Credit: 3 u

STAT 274 MARKET RESEARCH.

The marketing research; data and data generation in marketing research; analytical methods; consumer behavior modeling.

Pre-requisite: Stat 223/Equivalent and Stat 226/Equivalent

Credit: 3 u

STAT 275 ECONOMIC STATISTICS.

The Philippine Statistical System; surveys being regularly conducted by the system: questionnaire designs, sampling designs, estimators, issues; official statistics being generated: national accounts, consumer price index, input-output table, poverty statistics, leading economic indicators, seasonally adjusted series; statistical methods useful in generating official statistics.

Pre-requisite: Stat 222/232 and Stat 250

Credit: 3 u

STAT 276 STATISTICS FOR GEOGRAPHIC INFORMATION SYSTEMS.

Components of a geographical information system, data structures and elements of spatial modeling; exploratory spatial data analysis; quadrat analysis, tessellations and spatial autocorrelation; spatial modeling and prediction; some sampling theory; applications.

Pre-requisite: Consent of Instructor

Credit: 3 u

STAT 277 STATISTICS FOR IMAGE ANALYSIS.

Radiometric enhancement techniques; geometric enhancement using image domain techniques; multispectral transformation of data; supervised classification techniques; clustering and unsupervised classification; applications.

Pre-requisite: Consent of Instructor

Credit: 3 u

STAT 280 SPECIAL FIELDS OF STATISTICS.

Courses in special fields, new areas or latest developments in statistics.

Pre-requisite: Consent of Instructor

Credit: 3 u

(may be repeated provided that the topics are different; topics to be indicated for record purposes)

STAT 290 STATISTICAL CONSULTING.

Application of statistical concepts and methodologies to data of researchers seeking statistical consultancy services.

Pre-requisite: Consent of Instructor

Credit: 1 unit

STAT 298 SPECIAL PROBLEM.

The problem is on a subject involving the use of statistical methods and analysis.

Credit: 5 u

STAT 300 THESIS.

The thesis may be on a subject involving original investigation, which in some respect modifies or enlarges what has been previously known and is recommended for approval by the major professor or adviser.

Credit: 6 u

STAT 301 THEORY OF PROBABILITY I

Measure theory; probability spaces; random variables; integration, expectation and moments; convergence.

Credit: 3 units

STAT 302 THEORY OF PROBABILITY II

Conditional expectations; dependence; martingales.

Credit: 3 units

Pre-requisite: Stat 301

STAT 303 STOCHASTIC PROCESSES

The theory of stochastic processes; some stochastic processes.

Credit: 3 units

Pre-requisite: Stat 302

STAT 311 THEORY OF STATISTICAL INFERENCE I

Sufficiency, completeness, exponential families, unbiasedness; equivariance, Bayes estimation, minimax estimation; admissibility.

Credit: 3 units

Pre-requisite: Stat 301

STAT 312 THEORY OF STATISTICAL INFERENCE II

Uniformly most powerful tests; unbiased tests; invariance; linear hypothesis; minimax principle.

Credit: 3 units

Pre-requisite Stat 311

STAT 313 DECISION THEORY

Recent developments and applications in decision theory.

Credit: 3 units

Pre-requisite: Stat 311

STAT 321 ASYMPTOTIC METHODS FOR STATISTICS

Limit theorems; U-statistics; M-, R-, and L- estimators; differentiable functionals; asymptotic tests.

Credit: 3 units

Pre-requisite: Stat 311

STAT 380 ADVANCED SPECIAL TOPICS

Advanced topics in statistics to be presented in lecture series as unique opportunities arise.

Credit: 3 units

(may be repeated provided that the topics are different; topics to be indicated for record purposes)

STAT 390 READING COURSE
Credit: 2 units

STAT 396 SEMINAR
Faculty and graduate student discussions of current researches in statistics.
Credit: 1 unit

STAT 400 DISSERTATION
Credit: 12 units