Doctor of Philosophy Program

In

Statistics

International Program

B.E. 2547

1. Name of the Curriculum

Doctor of Philosophy Program in Statistics

2. Name of Degree

Doctor of Philosophy (Statistics)

Ph.D. (Statistics)

3. Responsible Units

Department of Mathematics and Statistics, Faculty of Science and Technology

Thammasat University

4. Objectives

1. To produce graduates at the doctoral level with academic excellence in statistics.
2. To produce graduates capable of developing new knowledge in both theoretical and applied statistics.
3. To perform research leading to the discovery of new knowledge in applied statistics which is useful in developing various academic areas.
4. To promote the collaboration in developing human resources in statistics with other institutes.

5. Expected Starting Date

Academic year 2547

6. Admission

6.1 Applicants must hold a Master's degree in Statistics or Mathematics with a cumulative grade-point average of at least 3.25. Applicants with a cumulative grade-point average of lower than 3.25 may be considered by Admission Committee.

6.2 Applicants must meet one of the following English proficiency requirements :

- TU-GET not less than 550 marks, or
- Paper-Based TOEFL not less than 550, or
- Computer-Based TOEFL not less than 213, or
- Internet-Based TOEFL not less than 79, or
- IELTS not less than 6.0.

The score must be earned within the last two years. Exception to the above requirements may be considered by Admission Committee.

6.3 Applicants must have qualifications in compliance with Thammasat University's Regulations on Graduate Studies.

7. Admission Procedure

7.1 Admission to the program for the applicants who reside in Thailand is determined by applications' previous academic records, a proposed dissertation topic, oral interview and/ or written examination.

7.2 For the applicants who reside abroad will not be required to take the entrance written examination and oral interview but must meet the requirements determined by the Admission Committee. Consideration will be made from applicants' previous academic records, and a proposed dissertation topic.

8. Academic System

8.1 The program operates in a 16-week semester basis. The first semester commences in June and ends in September. The second semester commences in November and ends in February. Summer session is optional with duration of at least 8 weeks and the total number of instruction hours must be equivalent to the regular semester.

8.2 English language is the medium of instruction and dissertation writing.

8.3 Study procedure comprise of lecture, discussion, analyze problems and dissertation.

8.4 Study plan in the curriculum is study plan 2 which emphasizes on dissertation to promote high quality knowledge in statistics in addition to coursework study.

8.5 Qualifying examination consists of both written and oral examination. Students are eligible to take the examination when the following criteria are satisfied.

8.5.1 Students complete all 16 credits of required courses and pass all courses.

8.5.2 Students must have a cumulative grade-point average of at least 3.00.

The qualifying examination is graded P for pass, and N for failure. Students need to get P before they are allowed to register for dissertation. If students fail the examination, a re-examination will be given. But students are allowed to take the examination only three times. If students fail 3 times, they will be dismissed from the program.

8.6 Thesis

8.6.1 Students could register for dissertation after receiving a grade of P for qualifying examination, having a cumulative grade-point average of at least 3.00. Students must receive a grade of P for foreign language examination prior to taking the dissertation defense.

8.6.2 The process of preparing the dissertation and dissertation examination, students must follow Thammasat University's Regulations concerning dissertation writing and the Regulations for Graduate Studies .

8.6.3 Students must receive a grade of S (Satisfactory) unanimously from the Dissertation Committee.

9. Duration of Study

Degree must be completed in a period of not more than 10 semesters from the students' initial registration in the Ph.D. program.

10. Registration

Students are allowed to register at least 6 credits but not more than 12 credits per semester. Other requirements must comply with Thammasat University's Regulations for Graduate Studies.

11. Grading System and Graduation

11.1 Grading System

Academic performance is evaluated as follows :

Grade	A	A-	B+	B	B-	C+	C	D	F
Grade Point	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.00	0.00

11.1.1 The number of credits that can be counted toward the degree must be based on the courses for which students receive a grade of S or at least B. Other requirements must comply with Thammasat University's Regulations for Graduate Studies.

11.1.2 The qualifying examination and the foreign language examination are graded P for pass and N for failure without grade point.

11.1.3 A dissertation is evaluated by the grades S (Satisfactory) or U (Unsatisfactory).

11.2 Graduation

For a student to graduate from the program, he/she must have

11.2.1 passed all required coursework with the total number of credits of not less than that specified in the curriculum.

11.2.2 a cumulative grade-point average of not less than 3.00.

11.2.3 received P for a qualifying examination and a foreign language examination.

11.2.4 Having the dissertation published or at least having the dissertation or part of the dissertation accepted for publication in an academic journal which has a peer review procedure.

11.2.5 received S for the dissertation.

11.2.6 fulfilled all requirements of the curriculum and of the Faculty of Science and Technology.

12. Graduate Faculty

See appendix

13. Number of Students

The number of students to be admitted and the number of graduates expected over the next five years are as follows:

Students	Academic Year				
	2547	2548	2549	2550	2551
First year	5	5	5	5	5
Second year	-	5	5	5	5
Third year	-	-	5	5	5
Total	5	10	15	15	15
Graduates	-	-	5	5	5

14. Place of Study

The Program is conducted at the Faculty of Science and Technology, Thammasat University.

15. Library

Thammasat University Central Library and the reading room Department of Mathematics and Statistics have various books and academic journals in Statistics in both Thai and English. An approximated number of books and journals is as follows.

Books

Thai	1,211	books
English	2,788	books

Journals

Thai	13	journals
English	21	journals

On-line Data Base

Students can access to the Statistics journals for up to 85 journals

Students can also use other libraries: such as Central Library of any university, Thammasat University Computer Center, Government and Private Document Center, Asian Institute of Technology Library, etc.

16. Budget

Tuition and fees are approximately 80,000 baht per year.

17. Curriculum

17.1 Total requirements at least 72 credits

17.2 Course Structure

Required courses		16	credits
Elective courses	at least	20	credits
Dissertation		36	credits

17.3 Courses

17.3.1 Course Numbers

The first two letters represent the Doctoral Degree Program in Statistics. The course listings consist of three numbers :

The last number represents a required or an elective courses :

0-4 represents required courses

5-9 represents elective courses

The middle number represents course content :

1-2 represents theoretical courses

3-7 represents application courses

8 represents computer courses

0,9 represents seminar or independent study courses

The first number represents the level of difficulty

6 represents foundation courses

7 represents basic courses

8 represents advanced courses

9 represents dissertation

17.3.2 Required Courses. Students are required to take 5 courses 16 credits of the following required courses.

		Credits
ST.811	Probability and Measure Theory	3 (3-0-9)
ST.812	Advanced Probability Theory	3 (3-0-9)
ST.821	Advanced Statistical Inference I	3 (3-0-9)
ST.822	Advanced Statistical Inference II	3 (3-0-9)
ST.823	Theory of Linear Models	4 (4-0-12)

17.3.3 Elective Courses. Students are required to take at least 7 courses 20 credits of the following elective courses.

		Credits
ST.815	Advanced Sampling Techniques	3 (3-0-9)
ST.816	Stochastic Processes	3 (3-0-9)
ST.817	Decision Theory	3 (3-0-9)
ST.825	Advanced Theory of Nonparametric Statistics	3 (3-0-9)
ST.826	Advanced Design and Analysis of Experiments	3 (3-0-9)
ST.827	Theory of Multivariate Statistics	3 (3-0-9)
ST.828	Time Series Analysis	3 (3-0-9)
ST.835	Applied Spatial Statistics	3 (3-0-9)
ST.836	Survival Analysis	3 (3-0-9)
ST.837	Nonlinear Statistical Methods	3 (3-0-9)
ST.845	Risk Theory	3 (3-0-9)
ST.855	Genetic Data Analysis	3 (3-0-9)
ST.866	Categorical Data Analysis	3 (3-0-9)
ST.875	Bayesian Statistics	3 (3-0-9)
ST.876	Statistical Methods for Quality Control	3 (3-0-9)
ST.877	Reliability Analysis	3 (3-0-9)
ST.878	Special Topics in Statistics	3 (3-0-9)
ST.879	Monte Carlo Statistical Methods	3 (3-0-9)

ST.885	Large Scale Data Analysis	3 (3-0-9)
ST.899	Statistical Consulting	2 (0-4-2)

17.3.4 Dissertation

		Credits
ST.900	Dissertation	36

17.4 Study Plan

First Year-First Semester

		Credits
ST.811	Probability and Measure Theory	3
ST.821	Advanced Statistical Inference I	3
	Elective Courses	6

First Year-Second Semester

		Credits
ST.812	Advanced Probability Theory	3
ST.822	Advanced Statistical Inference II	3
	Elective Courses	6

Second Year-First Semester

		Credits
ST.823	Theory of Linear Models	4
	Elective Courses	8

Second Year-Second Semester

		Credits
ST.900	Dissertation	12

Third Year-First Semester

ST.900	Dissertation	12

Third Year-Second Semester

ST.900	Dissertation	12

17.5 Course Description

17.5.1 Required Courses

ST.811 Probability and Measure Theory 3 Credits

Measure and integration theory. Product measure, Fubini theorems. L^p spaces. Probability measures, random variables. Distribution and characteristic functions. Independence, zero-one-laws, laws of large numbers. Central limit theorems. Radon-Nikodym theorem.

ST.812 Advanced Probability Theory 3 Credits

Prerequisite : ST.811

Convergence of distributions and related topics. Conditional distributions and expectations. Martingales. Stochastic processes.

ST.821 Advanced Statistical Inference I 3 Credits

Sufficiency, completeness. Parameter estimation. Minimum variance unbiased estimator. Asymptotic theory of maximum likelihood estimation. Decision rules, Bayes' estimation. Robust estimator (M-estimator, R-estimator, and L-estimator). Comparison of inference methods based on jackknife, bootstrap.

ST.822 Advanced Statistical Inference II 3 Credits

Prerequisite : ST.821

Neyman-Pearson theory of hypothesis testing. Uniformly most powerful tests, unbiased tests, likelihood ratio tests. Asymptotic theory of likelihood ratio test. Chi-square test. Sequential test. Theory of linear rank test. Logit, probit, and log-linear analysis. Nonparametric test.

ST.823 Theory of Linear Models 4 Credits

Prerequisite : ST.822

Theory of estimation and testing in full and non-full rank linear models. Normal theory distribution properties. Least squares principle and the Gauss-Markov theorem. Estimability and properties of best linear unbiased estimators. General linear hypothesis. Large sample theory for

non-normal linear models. Analysis of variance and covariance. Extension of theory to mixed and random models. Inference for variance components. Effects of departures from the underlying assumptions. Robust alternatives to least squares.

17.5.2 Elective Courses

ST.815 Advanced Sampling Techniques 3 Credits

Prerequisite : with consent of the instructor

Advanced topics of current interest in design and analysis of survey data. Bayesian and classical approaches to sampling and related applications including small area estimation. Subsampling for independent and identically distributed data: Jackknife, typical-values, bootstrap. Subsampling for dependent or nonidentically distributed data.

ST.816 Stochastic Processes 3 Credits

Prerequisite : with consent of the instructor

Makov chains and Markov processes. Branching processes. Poisson processes. Birth and death processes. Queuing theory. Renewal theory. Stationary processes. Brownian motion. Martingales. Gaussian processes and further topics.

ST.817 Decision Theory 3 Credits

Prerequisite : with consent of the instructor

Decision theory, decision functions. Game theory, normal forms, extensive forms, zero sum games, the minimax theorem, sequential games. Axiomatic treatment of utility. Estimation and hypothesis testing as decision problems, risk, admissibility. Bayes decision functions and their properties. Stein and empirical Bayes estimation. Decision analysis and influence diagrams. Bayes sequential decision procedures. Markov decision processes and partially observable Markov decision processes.

ST.825 Advanced Theory of Non parametric Statistics 3 Credits

Prerequisite : with consent of the instructor

Nonparametric estimation and hypothesis testing, power and relative efficiency, exchangable random variables, ranking and distribution free statistics, generalized U-statistics, generalized linear rank statistics, limiting distribution and density estimation of practical nonparametric test.

ST.826 Advanced Design and Analysis of Experiments 3 Credits

Prerequisite : with consent of the instructor

Construction and analysis of multifactor designs, factorials, fractional factorials, incomplete block designs, Latin squares, minimum aberration designs, orthogonal arrays of strength and response surface designs. Optimal designs for linear and nonlinear models. Emphasis will be placed on new concepts/tools and recent advances.

ST.827 Theory of Multivariate Statistics 3 Credits

Prerequisite : with consent of the instructor

Multivariate random vectors, exact and asymptotic distributions. Multivariate normal distribution. Hotelling T^2. Wishart's distribution. Inference for population mean vector, covariance matrix, correlation matrix. Multivariate multiple regression, MANOVA. Discriminant analysis. Distribution of characteristic roots and vectors. Principal component analysis. Factor analysis. canonical correlation analysis. Structural equation modeling.

ST.828 Time Series Analysis 3 Credits

Prerequisite : with consent of the instructor Linear processes. Autoregressive-moving average models. Fourier periodogram/spectral analysis. Regression with autocorrelated errors. Linear filters and bivariate spectral analysis. Transfer function models. State space models. Long memory processes. Bayesian forcasing techniques.

ST.835 Applied Spatial Statistics 3 Credits

Graphical and quantitative description of spatial data. Models for spatial data, and mthods for model fitting. Statistical inference, and spatial prediction. Spatial sampling procedures. Use of existing software with emphasis on analysis of real data from environmental, geological, and agricultural sciences.

ST.836 Survival Analysis 3 Credits

Statistical methods for analysis of time-to-event data. Parametric and non-parametric estimates from complete and censored data. Survival distribution and hazard rate. Kaplan-Meier estimator for survival distribution and Greenwood's formula. Log-rank statistics. Regression models, including accelerated life models and proportional hazards models. Partial likelihood and diagnostics. Sequential analysis in clinical trials.

ST.837 Nonlinear Statistical Methods 3 Credits

Prerequisite: with consent of the instructor

Theory and methods associated with Gaussian and Exponential Family nonlinear models. Point and interval estimation, hypothesis testing, prediction, and curvature. Computing algorithms and statistical. Mixed model and multivariate extensions.

ST.845 Risk Theory 3 Credits

Probabilistic models for insurance systems. Frequency and severity distribution. Individual and collective risk models. Distribution for insurance claims. Ruin model for the claims process. Random sums and compound distributions. Compound Poisson process theory. Reinsurance.

ST.855 Genetic Data Analysis 3 Credits

Analysis of discrete genetic data. Maximum likelihood estimation, including iterative procedures. Statistical techniques for characterizing genetic disequilibrium and diversity. Measures of population structure and genetic distance. Methods for segregation and linkage analysis. Construction of phylogenetic trees. DNA sequence analysis. Resampling techniques and computer simulations in genetic.

ST.866 Categorical Data Analysis 3 Credits

Statistical models and methods for categorical data, cross-classification tables, tests for independence. Loglinear models for multi-contingency tables. Logistic regression and other generalized linear models. Discussion of software implementation of methods and usage in assignments.

ST.875 Bayesian Statistics 3 Credits

Introduction to Bayesian statistics. Subjective probability. Bayes' rule, Prior distribution, congugate priors, posterior distributions, predictive distribution. Limit theory for posterior distributions. Markov Chain Monte Carlo (MCMC) methods. Hierarchical models, mixture models, model checking, and methods for Bayesian model selection. Sequential experiments. Exchangeability. Bayesian nonparametrics.

ST.876 Statistical Methods for Quality Control 3 Credits

Prerequisite : with consent of the instructor

Statistical issues in industrial measurement, Shewhart, CUSUM, EWMA, and other control charts. Process capability studies. Estimation of product and process characteristics. Acceptance sampling. Continuous sampling and sequential sampling. Off-line quality control. Economic and decision theoretic arguments in quality control.

ST.877 Reliability Analysis 3 Credits

Prerequisite : with consent of the instructor

Statistical methods for analyzing life-testing data and accessing system reliability. Bayesian aspects; product limit estimator, probability plotting, maximum likelihood estimation for censored data, accelerated failure time and proportional hazards regression models with applications to accelerated life testing. Repairable system data. Experimental designs and sampling plans for accelerated testing and burn-in procedures. Taguchi's reliability improvement philosophy. Field performance and software reliability analysis.

ST.878 Special Topics in Statistics 3 Credits

Prerequisite : with consent of the instructor

Topics of current interest in statistics.

ST.879 Monte Carlo Statistical Methods 3 Credits

Prerequisite: with consent of the instructor

Numerical optimization and integration methods, random variate generation, rejection sampling, importance sampling, Monte Carlo EM algorithm, simulated annealing, Markov Chain Monte Carlo methods, Metropolis-Hastings algorithm, Gibbs sampler, and Slice sampler. Emphasis will be placed on recent advances and new software tools.

ST.885 Large Scale Data Analysis 3 Credits

Prerequisite : with consent of the instructor

Data structure, data base and warehouse, data mining, on-line analytical processing (OLAP), outlier analysis, data reduction techniques, cluster analysis

ST.899 Statistical Consulting 2 Credits

Prerequisite : with consent of the instructor

Participants will work on problems arising in the service and will discuss various ways of handling such problems. There will be working sessions with researchers in substantive fields and occasional lectures on consulting. Consultant's report involving a designed experiment or sample in which the student participates with members of the department. Presentation and discussion consulting experiences with course instructor and other student consultants.

17.5.3 Dissertation

ST.900 Dissertation 36 Credits

FACULTY RESPONSIBLE FOR THE PROGRAM

Chinnaphong Bumrungsup	**Ph.D. (Statistics)**
Kamon Budsaba	**Ph.D. (Statistics)**
Saengla Chaimongkol	**Ph.D. (Statistics)**

FACULTY

Kamon Budsaba Associate Professor Dr.

B.Sc. (Statistics), (1st Class Honours), Silpakorn University.

M.Sc. (Statistics), Chulalongkorn University.

M.A. (Acturial Science) Ball State University, U.S.A.

Ph.D.(Statistics), North Carolina State University, U.S.A.

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M.S. (Mathematics), University of Illinois, Chicago Circle, U.S.A.

Ph.D. (Statistics), University of Florida, U.S.A.

Phantipar Sakarindr Associate Professor

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M.S. (Statistics), Iowa State University, U.S.A.

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M.Sc. (Mathematics), Srinakharinwirot University.

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Ph.D. (Operations Research),

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M. Phil. (Pure Mathematics), University of Manchester Institute of Science and Technology, UK.

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B.S (Agriculture) (2nd Class Honours), Kasetsart University.

M.S. (Applied Statistics) (2nd Class), National Institute of Development Administration.

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M.Sc. (Mathematics), Carleton University, Canada.

Ph.D. (Statistics), University of Iowa, U.S.A.