Doctor of Philosophy Program in Business Analytics and Data Science
(International Program)
New Program 2017

Name of Institution National Institute of Development Administration

Responsible Agency Graduate School of Applied Statistics

Section 1. General Information

1. Program Title

Program Title in English: Doctor of Philosophy Program in Business Analytics and Data Science (International Program)

ชื่อหลักสูตร : หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการวิเคราะห์ธุรกิจและวิทยาการข้อมูล (หลักสูตรนานาชาติ)

2. Degree Title

Full Name: Doctor of Philosophy (Business Analytics and Data Science)

ชื่อเต็ม : ปรัชญาดุษฎีบัณฑิต (การวิเคราะห์ธุรกิจและวิทยาการข้อมูล)

Abbreviated Name: Ph.D. (Business Analytics and Data Science)

ชื่อย่อ : ปร.ด. (การวิเคราะห์ธุรกิจและวิทยาการข้อมูล)

3. Major Subject

None

4. Credit Requirements for Program Completion

Plan 1(1.1)[1] 48 credits: Dissertation 48 credits

Plan 2(2.1)[2] 72 credits: Coursework 36 credits, Dissertation 36 credits

5. Program Formats

5.1 Format: Doctorate degree according to the standard of higher education program

5.2 Medium of Instruction: English

5.3 Students Admissions: Open for Thai and international graduates

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[1] Focuses on research, no requirement for studying courses

[2] Research and studying courses requirements

5.4 Cooperation with Other Institutes: Direct teaching program only by the institute with collaboration agreements with other national and international academic institutes and universities

5.5 Award of the Degree: One degree will be provided for one major

6. Conditions of the Program and the Approval of the Program

6.1 New Program 2018

6.2 The program will be in use from the 1st semester of academic year 2018

6.3 Committee of the Academic Council authorized / approved the curriculum at its 4/2017 meeting on December 6, 2017.

6.4 The Council of the National Institute of Development Administration authorized / approved the curriculum at its 10/2017 meeting on December 20, 2017.

7. Provision Time Frame for Quality and Standard Controls of the Program

The program is prepared in accordance with published standards of the AUN-QA.

8. Graduate Employment Opportunities

1. Professors in various disciplines including business administration, business analytics and data science
2. Researchers / Scholars / Statistical Analysts
3. Business analysts, Business Planners, Strategists, Business consultants
4. Data Scientists/Data Modelers
5. Start ups and Enterpreneurs
6. Executives

9. Name, Surname, Personal Number and Educational Qualification of the Instructors Responsible for the Curriculum

No.	Personal Number Name-Surname Academic Position	Educational Institution
1.	x xxxx xxxxx xx x Dr.Arnond Sakworawich	- Ph.D. (Psychometrics and Quantitative Psychology), Fordham University, U.S.A. 2013. -M.BA. (International Business), NIDA, Thailand, 2001. - M.A. (Industrial and Organizational Psychology), Thammasart University, Thailand, 2004. - B.BA.(Organization and Human Resource Management), Chulalongkorn University, Thailand, 1998.
2.	x xxxx xxxxx xx x Assistant Prof Dr. Worapol Pongpech	- Ph.D. (Computer Science), University of Queensland, Australia, 2009. - M.Eng. (Computer Vision), Queensland University of Technology, Australia, 2003 - B.S. EE., Portland State University, U.S.A. 1997
3.	x xxxx xxxxx xx x Assistant Prof Dr. Tanasai Sucontphunt	- Ph.D. (Computer Science), University of Southern California, USA, 2012. - M.Sc. (Computer Science), University of Southern California, USA, 2003. - M.Sc. (Computer Science), Mahidol University, Thailand, 2001. - B.Eng. (Industrial Engineering), Chulalongkorn University, Thailand, 1997.

10. Program Facilities

All teaching courses will be held at the National Institute of Development Administration, 118 Seri Thai Rd, Khlong Chan, Bang Kapi, Bangkok 10240, Tel. +662 727 3000

11. External Factors on Program Planning

11.1 Situations or Economic Development

The advent and advancement of information technology bring the current world into big data era such that data are high in their variety, volume, and velocity. Such rapid changes intensify the need to pre-process, process, and analyze big data into information and intelligence and then ultimately convert information and intelligence into competitive advantage and actionable plans which eventually contribute social, economic, and national development in a long-run.

Especially, Thailand has confronted middle income trap that hinder our national development. Hence, we strongly need to transform data into information and intelligence as a part of value creation process to build up competitive advantage such that we can create knowledge-based economy and leave away from the labour-intensive or capital intensive economy.

This curriculum aims at developing Ph.D. graduate with 21st century skills with strong research and statistical methodology and skills, information technology skills, and inquiry skills so that they can apply, analyze, solve, and provide better solutions for business, finance, insurance, logistics, industry, society, economic, and national problems to achieve sustainable development.

11.2 Situation or Social and Cultural Development

Integration between multidiscliplinary and technology fusion in the current world leads to social and economic innovation. Such changes make it harder for graduates who acquire solely acquire knowledge in any single discipline to compete and succeed. This curriculum has been improved by harmonizing and integrating between several disciplines to align with frontier of knowledge and state-of-the art practices.

12. Impact from 11 on the Program Development in Relation to the Institution's Obligation

12.1 Program Development

From the impact of external situations above, the objectives of program development is to produce researchers, scholars, professors, specialists and consultants with capability to synthesize theories for building new knowledge, to transfer knowledge, to analyze complicated problems. These products must have potential in self-development in

their job both in the aspects of academic and professional with morality and ethics. These characteristics are reflected in various courses of the program.

Moreover, the integration and convergence among discipline are the key factors in the current world of work as well as the advent of big data and data sciences. Hence, the curriculum and major have been revised tremendously to reflect those trends and situations.

Business analytics and data science major has been opened to reflect the integration between business and data analysis as well as to align with current practice in the field of business analytics and intelligence and data sciences.

12.2 The Connection with the Institution's Obligations

The National Institute of Development Administration has approved the Long-Term Development Plan of NIDA (2008 - 2022). The Strategy 6 (of 8 Strategies) is maintaining the excellence in academic program, academic research and management which reflecting the needs of society. Especially, the Strategy 6.3 Major and Curriculum Development is to meet the needs of society under the changes of all time and pressure from environmental factors. To be complete in all majors in the development administration program, Business Analytics and Data Science Program is opened for strengthening the science in data and business analytics and related fields as well as being an identity of the institute.

13. Relationship with Other Programs Offered in Other Schools / Departments of the Institution

13.1 Courses / Subjects in the Curriculum being offered by other Schools / Departments

LC 6000 Advanced Reading and Writing in English for Graduate Studies 3 Credits

LC 4003 Advanced Integrated English Language Skill Development 3 Credits

13.2 Courses / Subjects in this Curriculum that are available for Other Curriculums

None

13.3 Administration

Curriculums and program management is interdisciplinary. The goals and objectives are in accordance with course description. An enrollment of students in each semester must be approved by their advisor. In case students are from different major, an enrollment in that course must be approved by responsible instructor under supervision of Ph.D. Program Committee of Graduate School of Applied Statistics in accordance with Regulations on Education of National Institute of Development Administration.

Section 2. Specific Information of the Program

1. Philosophy of the Program

1.1 Philosophy

The program's philosophy is to be a national leading program producing excellent Doctorate scholars in academics, synthetic theory, related phenomenon analysis, social communication skill and being a person with ethics

1.2 Objectives

To produce graduates with characteristics as follows,

1.2.1 Having high ethics in professionals and living

1.2.2 Having leadership in giving opinion in academics and professionals.

1.2.3 Having high potential in theoretical synthesis and analysis of related phenomenon.

1.2.4 Having insight in knowledge and ability to do high-quality research for creating new knowledge.

1.2.5 Having social communication skill.

1.2.6 Having analytical and synthetic skill in integration of knowledge for new solution correctly and creatively.

2. Development Plans

Development/Adjustment Plans	Strategies	Evidences/Indicators
- Improving the curriculum to meet the standards specified by AUN-QA	- Teaching staffs evaluation done by students - Annual seminar for teaching improvement - Evaluation and revision of the curriculum on every 3 – 5 years	- The result of teaching staffs evaluation done by students - Report of seminar's result - Report of the result on curriculum evaluation
- Teaching staffs and academic support staffs development	- Promotion of teaching staffs to do academic services for other organizations - Promotion of teaching staffs to research on the teaching courses in the program	- Quantity of academic services per teaching staffs in the curriculum - Quantity of research publication

Section 3. Educational System, Operation and Program Structure

1. Educational System

1.1 System

Binary educational system composed of 2 semesters which are the 1st semester and 2nd semester, and optionally 3rd semester for summer. The study period is 15 weeks for normal semester and 8 weeks for summer semester with equivalent teaching hours to normal semester.

1.2 Summer Semester

Summer semester is subject to the consideration of the lecturer responsible for the curriculum

1.3 Comparable Credits in the Bi-semester System

None

2. Program Operation

2.1 Teaching Hours

Semester 1	August–December
Semester 2	January–May
Summer Session	June-July

2.2 Qualifications of Applicants

2.2.1 Holder of a Master's Degree or equivalent in any related field from an institution accredited by Commission of Higher Education (CHE) or accredited by NIDA's Council approval. For applicant's work experience is in accordance with the announcement of NIDA.

2.2.2 Passing the selection procedure both paper exam and interview.

2.2. 3 Have good command of English, both written and verbal with the English score that meet the minimum requirement of the announcement of NIDA.

2.2.4 Qualifications of applicants may change or add in accordance with the announcement of National Institute of Development Administration and the announcement of Graduate School of Applied Statistics.

2.3 Problems Faced by First Year Students

As the curriculum is English program, Thai students and foreign students who don't use English as the first language may have problems in English both written and

verbal skill. Foreign students may also have problem in self adaption to the circumstance of Thai society and culture.

2.4 Strategies to Solve Problems or Situations' Limitation in 2.3.

2.4.1 Remedial courses in English is provided for students.

2.4.2 Lecturer are appointed to be an advisor for each student

2.4.3 Provide a pick-up car on the arrival date of international students as well as an orientation regarding educational system, places in the institute, health care and living in Thailand.

2.4.4 Students are subjected to meet their advisor at least once a month.

2.5 Five Year Plan for Student Admission

Year	2018	2019	2020	2021	2022
Number of Admission	5	5	5	5	5
Accumulated Number	-	10	15	17	17
Number of Graduates	-	-	-	3	5

2.6 Budget

The budget will be provided by the government and revenue of the National Institute of Development Administration.

2.7 Educational System

☑ Classroom

☐ Distant study via publications

☐ Distant study via the broadcast media

☐ Distant study via E-learning

☐ Distant study via the internet

☐ Others (specify)

2.8 Credit Transfer, Courses and Cross Institution Enrolment (if any)

Guidelines for Education Equivalence Credits Transfer are based on the regulations of the National Institute of Development Administration concerning education and/or the notification of the Graduate School of Applied Statistics**.**

3. Program Structure and Teaching Staff

3.1 Program Structure

3.1.1 Credit

Plan 1.1 at least 48 credits

Plan 2.1 at least 72 credits

3.1.2 Program Structure

Program structure is in accordance with the announcement of the institute on the subject of Graduate Program Criteria 2015, Doctorate Program as follows,

	Plan 1 (1.1) Focuses on research, no requirement for studying courses	**Plan 2 (2.1)** Research and studying courses requirements
Remedial courses	Non credit	Non credit
Core courses	Additional courses can be taken as non credit	12 credits
Major courses		12 credits
Elective courses		At least 12 credits
Dissertation	48 credits	36 credits
Total not less than	**48 credits**	**72 credits**

Remark Plan 1(1.1) and 2(2.1) is only for applicants with Master Degree

Plan 1(1.1) Students are subjected to present a research proposal to their advisor for consideration on setting education plan. If the proposal is initially approved by advisor, it will be passed to the Ph.D. Program Committee for consideration. For the better in working on research, the students may take some additional studying courses in the same major of Master Program as non credit depending on their advisor's consideration.

Plan 1(1.1) and 2(2.1) Students with master degree who have no background in business analytics and data science, must take some basic courses in MS Program in Business Analytics and Intelligence or in the related major on appropriation and consideration of Ph.D. Program in Busniess Analytics and Data Science Committee.

In case of necessity and appropriation, the dean or advisor / responsible lecturer may have the Ph.D. Program students to take courses for credits exceeding the limitation of credits in the curriculum structure.

3.1.3 Course List

(1) Remedial Courses

Students in Plan 1(1.1) and 2(2.1) are subjected to take remedial course in English as non credit in following courses,

LC 4003 Advanced Integrated English Language Skills Development 3 Credits *

LC 6000 Advanced Reading and Writing in English for Graduate Studies 3 Credits*

Remark 1. The condition on exemption in remedial courses is in accordance with the announcement of the school / the institute except the condition on exemption in remedial courses in English which is in accordance with the condition of the curriculum of English course for graduate students.

2. In case of any change / improvement of the curriculum of English courses for graduate students, the conditions of remedial courses in English must change accordingly.

* Non credit

(2) Core Course

Students in Plan 2(2.1) of each major must enroll in the core course for 12 credits as follows,

(1)	BADS 6050 Epistemiology and Research Methodology	3 Credits
(2)	BADS 6051 Theories and Research in Big Data Engineering	3 Credits
(3)	BADS 6052 Theories and Research in Machine Learning	3 Credits
(4)	BADS 6053 Advanced Statistical Analysis	3 Credits

(3) Major Courses

Students of Plan 2(2.1) in each major must enroll in major courses for 12 credits as follows,

(1)	BADS 7150 Advanced Marketing Models	3 Credits
(2)	BADS 7151 Predictive Modeling in Finance	3 Credits
(3)	BADS 7250 Advanced Image Analytics	3 Credits
(4)	BADS 7152 Business Information Visualization and Descriptive Analytics	3 Credits

(4) Elective Courses

Students of Plan 2(2.1) in each major must enroll in elective course for at least 12 credits as follows,

Elective Courses

(1)	BADS 7160 Advanced Big Data Management	3 Credits
(2)	BADS 7161 Modeling Techniques in Marketing Decision	3 Credits
(3)	BADS 7163 Advanced Customer Relationship Management Analytics	3 Credits
(4)	BADS 7164 Prescriptive Analytics in Business Analytics and Data Sciences	3 Credits
(5)	BADS 7165 Theories and Practices in Social Network and Media Analysis	3 Credits
(6)	BADS 7166 Theories and Practices in Spatial Data Analysis	3 Credits
(7)	BADS 7167 Thoeries and Models for Project/Program Evaluation	3 Credits
(8)	BADS 7168 Advanced Poll and Public Opinion Survey Methodology	3 Credits
(9)	BADS 7251 Advanced Text Analytics and Natural Language Processing	3 Credits
(10)	BADS 7153 Advanced Human Resource Analytics	3 Credits
(11)	BADS 7252 Advanced Distributed, Paralell, and Cloud Computing	3 Credits
(12)	BADS 7253 Advance Real Time Analytics and Automation	3 Credits
(13)	BADS 7261 Advanced Speech Recognition	3 Credits
(14)	BADS 7262 Advanced Cognitive Analytics	3 Credits
(15)	BADS 7263 Advanced Machine Learning	3 Credits
(16)	BADS 7264 Advanced Artificial Intelligence	3 Credits
(17)	BADS 7265 Advanced Bioinformatics	3 Credits
(18)	BADS 7266 Advanced Medical Image Analytics	3 Credits

Selected Topics in Business Analytics and Data Science

(1)	BADS 8001-8010 Readings in Business Analytics and Data Sceince	3 Credits
(2)	BADS 8011-8020 Practicum in Business Analytics and Data Sceince	3 Credits
(3)	BADS 8021 Seminar in Business Analytics and Data Sceince	3 Credits
(4)	BADS 8801-8820 Selected Topics in Business Analytics and Data Sceince	3 Credits

Remark

(1) The Elective courses also include other graduate courses offered by the school or others in NIDA (To register for these courses, students must receive approvals from his/her advisor)

(2) Courses opened in each semester will be selected by the school and the institute.

Independent Study

(1)	BADS 9000 Independent study	3 Credits

Dissertation

(1)	BADS 9900 Dissertation	36/48 Credits

3.1.4 Study Plan

Plan 1(1.1)

Year	1st Semester	2nd Semester
1	LC 6000 Advanced Reading and Writing in English for Graduate Studies 3 Credits - Take a Qualifying Examination	LC 4003 Advanced Integrated English Language Skill Development 3 Credits BADS 9900 Dissertation 6-9 Credits
2	BADS 9900 Dissertation 3-15 Credits	BADS 9900 Dissertation 3-15 Credits
3	BADS 9900 Dissertation 3-15 Credits	BADS 9900 Dissertation 3-15 Credits

Remark: Students must pass Qualifying Examination within 4 semesters otherwise their student status will be terminated

Plan 2(2.1)

Year	1st Semester	2nd Semester
1	LC 6000 Advanced Reading and Writing in English for Graduate Studies 3 Credits BADS 6050 Epistemiology and Research Methodology 3 Credits BADS 6051 Theories and Research in Big Data Engineering 3 Credits BADS 6052 Theories and Research in Machine Learning 3 Credits BADS 6053 Advanced Statistical Analysis 3 Credits	LC 4003 Advanced Integrated English Language Skill Development 3 Credits BADS 7150 Advanced Marketing Models 3 Credits BADS 7151 Predictive Modeling in Finance 3 Credits BADS 7250 Advanced Image Analytics 3 Credits BADS 7152 Business Information Visualization and Descriptive Analytics 3 Credits - Take a Qualifying Examination
2	Elective courses 3-9 Credits BADS 9900 Dissertation 3-15 Credits	Elective courses 3-9 Credits BADS 9900 Dissertation 3-15 Credits
3	BADS 9900 Dissertation 3-15 Credits	BADS 9900 Dissertation 3-15 Credits

Remark: Students must pass Qualifying Examination within 6 semesters otherwise their student status will be terminated

3.1.5 Course Description

Remedial Courses

LC 4003 Advanced Integrated English Language Skills Development 3 Credits (Non credit) (3-0-6)

Course contents and teaching activities focus on the integrated skills of listening, speaking, reading and writing with a particular emphasis on academic writing. Students will also work in small groups, practicing paper presentation techniques, precise writing, and research writing

LC 6000 Advanced Reading and Writing in English for Graduate Studies 3 Credits (Non credit) (3-0-6)

Review of essential reading and writing strategies required to read and write academic English. Course contents include work on sentence structures, vocabulary and recognition of major thought relationships in paragraphs, as well as practice in reading and writing academic English

Core Courses

BADS 6050 Epistemiology and Research Methodology 3 Credits (3-0-6)

Philosophy of sciences, epistemology, inquiry skills, literature review, theory building and testing, research problem formulation, development of research hypothesis, research design, qualitative research methods, mixed methods, quantitative research methods, sampling, questionnaire design and scale construction, data collection, correlational research, experimental research, quasi-experimental research, data analysis, research report writing and presentation, publication and publishing procedures.

BADS 6051 Theories and Research in Big Data Engineering 3 Credits (3-0-6)

Optimization algorithms for big data including convergent parallel algorithms, limited memory bundle algorithm, diagonal bundle method, convergent parallel algorithms, network analytics,Big Data Governance and metadata management : data integration/mashup among heterogeneous datasets from diversified domain repositories to make data discoverable, accessible, and usable through a machine readable and actionable standard data infrastructure, Big data integration and representation

BADS 6052 Theories and Research in Machine Learning 3 Credits (3-0-6)

Classification Theory, Decision Trees, Bayesian and Naïve Bayes Classifiers, Linear Discriminant, Neural Networks, Support Vector Machine, Hidden Markov Models, Evolutionary Learning, Dimension Reduction, Emphasis on business analytics and data science applications.

BADS 6053 Advanced Statistical Analysis **3 Credits (3-0-6)**

Multivariate analysis overview, Multivariate normal distribution, Hotelling T2, MANOVA, MANCOVA, Multivariate regression analysis, Canonical correlational analysis, Discriminant analysis and classification models, General linear model and generalized linear models, Principle component analysis, Exploratory factor analysis, Emphasis on business analytics and data science applications.

Major Courses

BADS 7150 Advanced Marketing Models **3 Credits (3-0-6)**

Theory and models in marketing analytics, consumer behavior, organizational buying models, price, product, advertising, promotion, sales force, distribution, new product planning, strategy, and decision support systems.

BADS 7151 Predictive Modeling in Finance **3 Credits (3-0-6)**

Predictive modeling in finance, Time Series Analysis, ARIMA, ARCH models, GARCH models, CHARMA model, Stochastic process, Artificial Neural Networks in finance, bankrupcy models, credit scoring models, and risk modeling.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7250 Advanced Image Analytics **3 Credits (3-0-6)**

Analyzing and extracting information from 2D and 3D digital images and video, data structures for 2D and 3D digital images, digital image processing, visual feature extraction, dimension reduction, object recognition, machine learning, video tracking, and recent trend and research in image and video analytics.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7152 Business Information Visualization and Descriptive Analytics **3 Credits (3-0-6)**

Business information visualization, graphics for exploratory data analysis, regression graphics, categorical data visualization, multivariate data visualization, time-series data visualization, spatial data visualization, social network visualization, 3D animation for business information, graphic visualization, and information visualization.

Elective Courses

BADS 7160 Advanced Big Data Management 3 Credits (3-0-6)

Sources of data, measurement and scaling, development of data collection instrument, managing structured and unstructured data, how to upload, store, retrieve and process big data, data quality audit, missing value and imputation, data transformation, data storage and retrieval.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7161 Modeling Techniques in Marketing Decision 3 Credits (3-0-6)

Features of marketing data, modeling continuous dependent variable, binomial dependent variable, unordered multinomial dependent variable, ordered multinomial dependent variable, limited dependent variable, and duration dependent variable.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7162 Advanced Analytics and Data Mining Applications 3 Credits (3-0-6)

Applications in customer analytics, financial analytics, risk analytics, fraud detection, text mining, web analytics etc. The course is designed to be "hands-on" in that students will develop understanding mainly through conducting application projects and presenting results.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7163 Advanced Customer Relationship Management Analytics 3 Credits(3-0-6)

Theories and practices of customer relationship management and customer relationship management analytics, market segmentation using K-means clustering and self-organizing map, up-sell, cross-sell, customer retention, and direct marketing using artificial neural network, market basket analysis, response analysis, recency, frequency, and monetary value analysis, churn model, and decision tress.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7164 Prescriptive Analytics in Business Analytics and Data Sciences 3 Credits (3-0-6)

Linear, integer and nonlinear programming models, duality and sensitivity analysis, network flow models, meta-heuristics, decision models. Monte Carlos simulation and stochastic models, Markov chains, queueing models, discrete even simulation.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7165 Theories and Practices in Social Network and Media Analysis 3 Credits

Theories and practices in social network and media analysis, sociometry and social network, data collection on social network, social network detection and visualization, social network dynamic and growth, computing social network centrality, community and cluster on social network, communication and diffusion of innovation on social network, network models, and information models.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7166 Theories and Practices in Spatial Data Analysis 3 Credits (3-0-6)

Theories and practices in spatial data analysis, geographical information system and business analytics, sampling spatial data, point pattern analysis, spatially continuous data analysis, spatial regression, spatial regression models for count and categorical dependent variables, map and spatial data visualization.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7167 Thoeries and Models for Project/Program Evaluation 3 Credits (3-0-6)

Theories for project/program evaluation, project/program evaluation process, project/program evaluation models, need assessment, quantitative and qualitative project/program evaluation, project/program evaluation design, indicator selection for project/program evaluation, cost-effectiveness evaluation, project/program assessment, effectiveness and efficiency assessment, impact assessment, monitoring program implementation, ethics for evaluators.

Prerequisite: BADS 6050 or Instructor's consent

BADS 7168 Advanced Poll and Public Opinion Survey Methodology 3 Credits (3-0-6)

Overview of polls and public opinion survey, Sample survey, poll and public opinion survey, population and sampling, Type of survey errors, methods of data collection, non-respondants in survey, questions and answer in survey, interview for survey, quality check and data preparation, pre-processing survey data, data analysis for survey, applying poll and public opinion survey for policy planning and development.

Prerequisite: BADS 6050 or Instructor's consent

BADS 7251 Advanced Text Analytics and Natural Language Processing 3 Credits (3-0-6)

Theories and research in text analytics and natural language processing, especially recent research in Thai natural language processing, Text data streaming,

extraction, loading, and transforming, advanced statistical and Natural Language Processing techniques, schema analysis, classical content analysis, content dictionaries, word-based analysis, and semantic network analysis.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7153 Advanced Human Resource Analytics 3 Credits (3-0-6)

Confirmatory factor analysis for measurement model and measurement invariant used for human resource assessment, Path analysis and Structural Equation Modeling for human resource research, Growth curve and latent growth curve modeling for human resource development, Integer programming for human resource optimization including work scheduling and job rotation.

Prerequisite: BADS 6053 or Instructor's consent

BADS 7252 Advanced Distributed, Paralell, and Cloud Computing 3 Credits (3-0-6)

Survey of distributed, parallel, and cloud computer architectures, models of parallel computation, and interconnection networks, parallel algorithm development and analysis, programming paradigms and languages for parallel computation, different approaches to writing parallels software for shared–memory and message–passing paradigms, example applications, performance measurement and evaluation, design and implementation of efficient and effective thread packages, communication mechanisms, process management, virtual memory, and file systems for scalable parallel processing, state-of-the-art cloud computing technologies.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7253 Advance Real Time Analytics and Automation 3 Credits (3-0-6)

A survey of recent researches and trends in real time analytics and automation, advanced methods and technologies for real-time data analytics, internet of things and censor, recent applications and innovations related to real time analytics and automation.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7261 Advanced Speech Recognition 3 Credits (3-0-6)

State-of-the-art theories, researches and technologies on speech recognition, innovations, products and services related to specch recognition including voice search, Internet phones, and voice biometrics. Algorithms and practices in speech signal processing and recognition with the focus on Thai language.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7262 Advanced Cognitive Analytics **3 Credits (3-0-6)**

Theories and recent researches and trends in cognitive analytics, contextual, interactive and adaptive response through natural language processing, signal processing, machine learning, dialog, speech recognition, computer vision, deep learning, and artificial intelligence.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7263 Advanced Machine Learning **3 Credits (3-0-6)**

Advanced topics in machine learning, a survey of recent trends and researches in machine learning, and state of the art technologies and innovation from machine learning.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7264 Advanced Artificial Intelligence **3 Credits (3-0-6)**

Advanced topics in artificial intelligence, such as, planning, natural language processing, fuzzy logic, Markov decision models, Bayesian networks, genetic algorithms, machine Learning

Prerequisite: BADS 6052 or Instructor's consent

BADS 7265 Advanced Bioinformatics **3 Credits (3-0-6)**

A survey of recent researches and trends in bioinformatics, and advanced methods and tools used in Bioinformatics.

Prerequisite: BADS 6052 or Instructor's consent

BADS 7266 Advanced Medical Image Analytics **3 Credits (3-0-6)**

A survey of recent researches and trends in medical image analysis and visualization, advances in image processing techniques and algorithms.

Prerequisite: BADS 6052 or Instructor's consent

Selected Topics in Business Analytics and Data Science Courses

BADS 8001-8010 Readings in Business Analytics and Data Sceince **3 Credits (0-0-12)**

This course intends to allow a student who is preparing a dissertation proposal or is interested in a particular research topic to read academic papers under instructors' supervision. The student must present an analytical report on the topic to the supervisor.

BADS 8011-8020 Practicum in Business Analytics and Data Sceince **3 Credits (0-0-12)**

Practicum in areas and issues related and/or beyond those covered in other courses. Students must practice or work in host organization under supervision. Students must write up their practicum report which can be research report, software, case study, project and so on. Topics will be announced by GSAS and host organization prior to being offered.

BADS 8021 Seminar in Business Analytics and Data Sceince 3 Credits (2-2-5)

Discussions on the new and current issues related to Business Analytics and Data Science. Leaders of the discussion will be lecturers, academicians, researchers, or practitioners. Each individual student has to participate in the discussion actively by presenting his/her own works.

BADS 8801-8820 Selected Topics in Business Analytics and Data Sceince 3 Credits (3-0-6)

Lecture in the areas and issues beyond those covered in other courses. Topics will be announced prior to being offered.

Independent Study

BADS 9000 Independent study 3 Credits (0-0-12)

Students choose their own interesting topics to study by themselves, the topics must be approved by a faculty member who is responsible for the course, and they are required to write the reports.

Dissertation

BADS 9900 Dissertation 36/48 Credits

A student-initiated research report on a particular topic under consultation of an advisor, together with an oral examination, the study must be extensive and of acceptable research standards.

3.2 Name, Surname, Personal ID Number, Position, Education of Program Faculty

3.2.1 Program's Responsible Staffs

Title / Name - Surname	ID No.	Degree	Major	Institute
Dr. Arnond Sakworawich	xxxxxxxxxxxxx	Ph.D.	Psychometrics and Quantitative Psychology	Fordham University, U.S.A.
		M.A.	Industrial and Organizational Psychology),	Thammasart University, Thailand, 2004.
		M.BA.	International Business	NIDA, Thailand, 2001.
		B.BA.	Organization and Human Resource Management	Chulalongkorn University, Thailand, 1998.
Asst.Prof Dr. Worapol Pongpech	xxxxxxxxxxxxx	Ph.D.	Computer Science	University of Queensland, Australia,2009.
		M.Eng.	Computer Vision	Queensland University of Technology, Australia, 2003.
		B.S.	EE.	Portland State University, U.S.A.,1997.
Asst.Prof Dr.Tanasai Sucontphunt	xxxxxxxxxxxxx	Ph.D.	Computer Science	University of Southern California, U.S.A.
		M.Sc.	Computer Science	University of Southern California, U.S.A., 2003.
		M.Sc.	Computer Science	Mahidol University, Thailand, 2001.
		B.Eng.	Industrial Engineering	Chulalongkorn University, Thailand, 1997.

3.2.2 Fulltime Faculty Members

Title / Name - Surname	ID No.	Degree	Major	Institute
Asst. Prof Dr. Preecha Vichitthamaros	xxxxxxxxxxxxx	Ph.D.	Management of Technology	Asian Institute of Technology, Thailand, 2002
		MBA.	Management Of Technology	Asian Institute of Technology, Thailand, 1995.
		M.S.	Statistics	Chulalongkorn University, 1991.
		B.Sc.2nd Class Hons.		Chulalongkorn University, 1989.
Assoc.Prof Dr.Duanpen Teerawanviwat	xxxxxxxxxxxxx	Ph.D.	Sociology	University of Hawaii, U.S.A., 1989.
		M.A.	Sociology	University of Florida, U.S.A., 1981.
		M.Ed.	Educational Research	Chulalongkorn University, 1976.
		B.Ed.2nd Class Hons	Educational	Chulalongkorn University, 1974.
Assoc.Prof Dr.Pachitjanut Siripanich	xxxxxxxxxxxxx	Ph.D.	Statistics	Oregon State University, U.S.A., 1987.
		M.S.	Mathematics	The Senate of Carleton University, Canada. 1976.
		B.S.	Mathematics	Chulalongkorn University, 1974.
Associate Prof Dr.Kannapha Amaruchkul	xxxxxxxxxxxxx	Ph.D.	Industrial Engineering	University of Minnesota, U.S.A.,2007.
		M.S.	Industrial Engineering and Operations Research	University of California, Berkeley, U.S.A., 2003.
		B.A.	Mathematics	Princeton University, U.S.A., 2001.

Title / Name - Surname	ID No.	Degree	Major	Institute
Dr.Sarawut Jansuwan	xxxxxxxxxxxxx	Ph.D.	Transportation Engineering	Utah State University, U.S.A.,2013.
		M.S.	Civil Engineering	Chulalongkorn University, 2012.
		B.Eg.	Civil Engineering	Chaing Mai University, 2009.
Assoc.Prof Dr. Surapong Auwatanamongkol	xxxxxxxxxxxxx	Ph.D.	Computer Science	Southern Methodist University, U.S.A.,1991.
		M.S.	Information and Computer Science	Georgia Institute of Technology, USA.,1982.
		B.S.	Electrical Engineering	Chulalongkorn University, 1978.
Asst.Prof. Dr.Thitirat Siriborvornratanakul	xxxxxxxxxxxxx	Ph.D.	Computer Engineering	University of Tokyo, Japan.2011.
		M.E.	Electronic Engineering	The University of Tokyo, Japan.2008.
		B.S.	Computer Engineering	Chulalongkorn University, 2005.
Assoc.Prof Dr.Ohm Sornil	xxxxxxxxxxxxx	Ph.D.	Computer Science	Virginia Tech, U.S.A., 2001.
		M.S.	Computer Science	Syracuse University, U.S.A. 1997.
		B.S.	Electronic Engineering	Chulalongkorn University, 1993.
Asst.Prof Dr.Sukanya Suranauwarat	xxxxxxxxxxxxx	Ph.D.	Computer Science and Communication Engineering	Kyushu University, Japan., 2002.
		M.E.	Computer Science and Communication Engineering	Kyushu University, Japan.,2000.
		B.E.	Computer Science and Communication Engineering	Kyushu University, Japan.,1998.

Title / Name - Surname	ID No.	Degree	Major	Institute
Asst.Prof. Dr.Pramote Luenam	xxxxxxxxxxxxx	Ph.D.	Information Systems	University of Maryland, Baltimore County, U.S.A., 2008.
		M.S.	Information Systems	University of Maryland at Baltimore County, U.S.A., 2002.
		M.B.A.	Management	Kasetsart University, 1998.
		M.S.	Computer Science	Chulalongkorn University, 1993.
		B.S.	ชลประทาน	มหาวิทยาลัยเกษตรศาสตร์(1887.)
Asst.Prof. Dr. Rattakorn Poonsuph	xxxxxxxxxxxxx	Sc.D.	Computer Science	University of Massachusetts Lowell, U.S.A., 2003.
		M.B.A.	Computer Information System	New Hampshire College, U.S.A. 1996.
		พบ.ม.	สถิติประยุกต์	สถาบันบัณฑิตพัฒนบริหารศาสตร์ (1991.)
		วท.ม.	คอมพิวเตอร์	มหาวิทยาลัยรามคำแหง, 1989.
Asst.Prof Dr.Pramote Kuacharoen	xxxxxxxxxxxxx	Ph.D.	Electrical and Computer Engineering	Geogia Institute of Technology,U.S.A., 2004.
		M.S.	Electrical and Computer Engineering	Georgia Institute of Technology , U.S.A. 2001.
		B.S.	Computer and Systems Engineering	Rensselaer Polytechnic Institute , U.S.A., 1995.

3.2.3 Invited Lecturers / Special Lecturer

There will be invited lecturers/special lecturers occasionally both from public and private sector nationally and internationally.

4. Fiels Works (Apprenticeship or Cooperative Education, if any)

Practicum in Business Analytics and Data Science are offered.

5. Regulations on Research Projects (if any)

5.1 Brief Description

The dissertation must be an initiative work in theory and shown the expertise in the subject with good quality for publication in academic journal. The process of working on dissertation of students must be under supervision of their dissertation committee appointed by the dean and approval of Ph.D. Program Committee, Graduate School of Applied Statistics. The dissertation committees include 4 – 5 members. The Chairman must be a lecturer of the school and the co-chairman (if any) can be the lecturer of the school or an expert from within or outside the institute. The dissertation defense must consist of at least 1 expert from outside the institute, and a chairman of dissertation defense committee (can't be dissertation advisor and co-advisor).

5.2 Learning standards

The standard of research is in accordance with the regulations of the National Institute of Development Administration and the consideration on the purpose of educational Plan.

5.3 Timetable of Taking Dissertation Course

After the pass of Qualifying Examination

5.4 Credits

Plan 1 (1.1) 48 credits

Plan 2 (2.1) 36 credits

5.5 Preparation for Students Working on Dissertation

Appointment for dissertation consultancy is made and recorded. Proposal presentation and progress are also made for an improved work on dissertation as well as the giving information on the website.

5.6 Evaluation Process

Evaluation on dissertation progress will be made continually till the end of the process of dissertation presentation according to the standards of the institute.

Section 4. Learning Outcomes, Teaching Strategies and Evaluation

1. Development of Students' Special Characteristics

Special Characteristics	Strategies or Students' Activities
Moral and Ethics ELO 1: Work and make a decision complied with professional ethics and code of conduct.	- Implant the students with discipline and timeliness in class attendance and date of assignment submission. - Remind the students of loyalty, fraudulent acts in the examinations as well as not claiming falsely on other's work.
Knowledge ELO 2: Understand concepts, theories, and knowledges in business analytics and data science necessary for self and life long learning.	- Offer a special lecture by guest speakers from government and public organizations as a forum for students to exchange and share knowledge as well as give opinion in the related field of study to improve skill in positive thinking systematically.
Intellectual Skills ELO 3: Apply business analytics and data science theories and knowledges into practical problems. ELO 4: Solve problems in business analytics and data science with analytical and creative thinking. ELO 5: Create new knowledge in business analytics and data science.	- Offer students with a case study in some courses for intellectual skill development and broadening knowledge besides from the class room. Students must conduct research/dissertation to create new knowledge and publich in an international journal as a part of fulfilment for their doctoral degree completion.
Interpersonal Skills and Responsibilities ELO 6: Present and communicate knowledges and concepts in business analytics and data science to target audience effectively.	- Working in group and individuals is assigned in the learning in each course for creating student's responsibility toward group and oneself. Students also practice giving and accepting other's opinion.
Skill in Numerical Analysis, Communication and Use of Information Technology ELO 7: Use information technology effectively to solve real practical problem in business analytics and data science	- Students are appointed to learn practical skills from the computer laboratory. They will also analyze data using real data from various enterprises. They may get information from the present online networks to the practice in the laboratory.

2. Learning Outcomes Development

2.1 Morality and Ethics

2.1.1 Moral and Ethical Outcomes

Enhance students with ethics in living with others and being useful in the society. The instructor in each course must also have mentioned qualifications to integrate ethics in the course to equip students with technical and professional ethics, realization in ethics and social responsibility, discipline and timeliness, and respect of other's opinion.

2.1.2 Teaching Strategies in Development of Moral and Ethical Learning

Implant the students with discipline and timeliness in class attendance and date of assignment submission. Remind the students of loyalty, fraudulent acts in the examinations as well as not claiming falsely on other's work.

2.1.3 Strategies in Evaluating Moral and Ethical Learning Outcomes

Assessment can be performed on timeliness of the students in class attendance, submitting the assignment within the given date, involvement in activities, amount of fraudulent acts in the examinations, and responsibilities to duties as assigned

2.2 Knowledge

2.2.1 Learning Outcomes

Students acquire knowledge and understanding of the principles and theories of the field from learning of each course. They are able to analyze problems, apply knowledge and skills, and use the right tools to solve the problems. In addition, they are also able to create advanced academic research in broadened knowledge application to professional development as well as analyze research and evaluate learning outcomes by using knowledge in business analytics and data science correctly.

2.2.2 Teaching Strategies for Learning and Knowledge Development

Offer a special lecture by guest speakers from government and public organizations as a forum for students to exchange and share knowledge as well as give opinion in the related field of study to improve skill in positive thinking systematically.

2.2.3 Strategiies in Learning and Knowledge Evaluation

Evaluation of student's knowledge will be done by subtest or oral test for discussion and sharing knowledge in the class. Additionally, the evaluation can also be done by the test in each course, report, presentation done by students in the period of being a student of the curriculum.

2.3 Intellectual Skills

2.3.1 Intellectual Skill Outcomes

Students are able to develop intellectual skill and systematic thinking, apply theoretical knowledge and technical analysis leading to the discovery of new approaches and methods, and distinguish the facts about data, analysis, synthesis, and correct interpretation. They also realize the roles and importance of information technology and its application to statistical knowledge and analysis for professional development. Students must also conduct research/dissertation to create new knowledge and publich in an international journal as a fulfilment for their doctoral degree completion.

2.3.2 Teaching Strategies for Intellectual Skill Development

Offer students with a case study in some courses for intellectual skill development and broadening knowledge besides from the class room.

2.3.3 Strategies in Learning and Intellectual Skill Assessment

Evaluation will be done by analysis and case study, discussion and knowledge sharing in class, as well as examination.

2.4 Interpersonal Skills and Responsibilities

2.4.1 The Outcomes of Interpersonal Skills and Responsibilities Development

Students must have responsibility upon their assignment, group works, personal works, and professionals continually as well as the ability in cooperation with others in planning and continual self-learning development. They are also encouraged to have leadership and self-adaption toward cooperation with others.

2.4.2 Teaching Strategies to Develop Interpersonal Skills and Responsibilities

Working in group and individuals is assigned in the learning in each course for creating student's responsibility toward group and oneself. Students also practice giving and accepting other's opinion.

Students are also encouraged to work as a group to do research and inquire new knowledge along all courseworks and dissertation completion so that they will be able to learn continually by themselves.

2.4.3 Strategies in Interpersonal Skills Responsibility Development

Evaluation will be done by assignment shared by responsibility and the result of activity in group and individuals.

2.5 Skill in Numerical Analysis, Communication and Use of Information Technology

2.5.1 Outcomes of Skills Development in Numerical Analysis, Communication and Information Technology

Students are able to analyze, interpret and communicate with others understandably and successfully, understand academic vocabularies in the field of study and use them correctly, and choose statistical technique, technology in analysis and data processing appropriately and existing databases. They also have skill and ability in academic writing sufficiently in graduate study.

2.5.2 Teaching Strategies that Enhance Skills in Numerical Analysis, Communication and Information Technology

Students are appointed to learn practical skills from the computer laboratory. They will also analyze data using real data from various enterprises. They may get information from the present online networks to the practice in the laboratory.

2.5.3 Evaluation Strategies Concerning skills in Numerical Analysis, Communication and Information Technology

Evaluation will be done by the result of correctness in using techniques, analytic approaches, clarity in the interpretation and discussion, and accuracy and clarity in the presentation of academic works.

Expected Learning Outcomes (ELO) comply with 5 domains of learning Thai Qualifications Framework for Higher Education (TQF) as follows

1. Moral and Ethnics	ELO 1: Work and make a decision complied with professional ethics and code of conduct.
2. Knowledge	ELO 2: Understand concepts, theories, and knowledges in business analytics and data science necessary for self and life long learning
3. Intellectual Skills	ELO 3: Apply business analytics and data science theories and knowledges into practical problems.
	ELO 4: Solve problems in business analytics and data science with analytical and creative thinking.
	ELO 5: Create new knowledge in business analytics and data science.
4. Interpersonal Skills and Responsibilities	ELO 6: Present and communicate knowledges and concepts in business analytics and data science to target audience effectively.
5. Skill in Numerical Analysis, Communication and Use of Information Technology	ELO 7: Use information technology effectively to solve real practical problem in business analytics and data science.

3. Curriculum Mapping

● Main Objective ○ Secondary Objective

Courses	Thai Qualifications Framework for Higher Education (TQF)						
	1.Moral and Ethics	2. Knowledge	3. Intellectual Skills			4. Interpersonal Skills and Responsibilities	5. Skill in Numerical Analysis, Communication and Use of Information Technology
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7
LC 4003 Advanced Integrated English Language Skill Development	○	●	○			●	○
LC 6000 Advanced Reading and Writing in English for Graduate Studies	○	●	○			○	
BADS 6050 Epistemiology and Research Methodology	●	●	●			●	
BADS 6051 Theories and Research in Big Data Engineering	○	●	●	●		○	●
BADS 6052 Theories and Research in Machine Learning	○	●	●	●		○	●
BADS 6053 Advanced Statistical Analysis	○	●	●	●		○	●
BADS 7150 Advanced Marketing Models	○	●	○	○		○	○
BADS 7151 Predictive Modeling in Finance	○	●	○	○			○
BADS 7250 Advanced Image Analytics	○	●	○	○		○	●

Courses	Thai Qualifications Framework for Higher Education (TQF)						
	1.Moral and Ethics	2. Knowledge	3. Intellectual Skills			4. Interpersonal Skills and Responsibilities	5. Skill in Numerical Analysis, Communication and Use of Information Technology
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7
BADS 7152 Business Information Visualization and Descriptive Analytics	○	●	●	●		●	●
BADS 7160 Advanced Big Data Management	●	●	○	○			●
BADS 7161 Modeling Techniques in Marketing Decision	○	●	○	○		○	●
BADS 7162 Advanced Analytics and Data Mining Applications	○	●	○	○			○
BADS 7163 Advanced Customer Relationship Management Analytics	○	●	○	○		○	○
BADS 7164 Prescriptive Analytics in Business Analytics and Data Sciences	○	●	○	○			○
BADS 7165 Theories and Practices in Social Network and Media Analysis	○	●	○	○			○
BADS 7166 Theories and Practices in Spatial Data Analysis	○	●	○	○			○
BADS 7167 Thoeries and Models for Project/Program Evaluation	●	●	○	○		○	

Courses	Thai Qualifications Framework for Higher Education (TQF)						
	1.Moral and Ethics	2. Knowledge	3. Intellectual Skills			4. Interpersonal Skills and Responsibilities	5. Skill in Numerical Analysis, Communication and Use of Information Technology
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7
BADS 7168 Advanced Poll and Public Opinion Survey Methodology	●	●	●	●		○	
BADS 7251 Advanced Text Analytics and Natural Language Processing	○	●	○	○			○
BADS 7153 Advanced Human Resource Analytics	○	●	○	○		○	○
BADS 7252 Advanced Distributed, Paralell, and Cloud Computing	○	●	○	○			○
BADS 7253 Advance Real Time Analytics and Automation	○	●	○	○		○	○
BADS 7261 Advanced Speech Recognition	○	●	○	○			○
BADS 7262 Advanced Cognitive Analytics	○	●	○	○			○
BADS 7263 Advanced Machine Learning	○	●	○	○			○
BADS 7264 Advanced Artificial Intelligence	○	●	○	○			○
BADS 7265 Advanced Bioinformatics	○	●	○	○			○
BADS 7266 Advanced Medical Image Analytics	○	●	○	○			○

Courses	Thai Qualifications Framework for Higher Education (TQF)						
	1.Moral and Ethics	2. Knowledge	3. Intellectual Skills			4. Interpersonal Skills and Responsibilities	5. Skill in Numerical Analysis, Communication and Use of Information Technology
	ELO1	ELO2	ELO3	ELO4	ELO5	ELO6	ELO7
BADS 8001-8010 Readings in Business Analytics and Data Science	○	●	○	○			
BADS 8011-8020 Practicum in Business Analytics and Data Science	○	●	○	○		○	
BADS 8021 Seminar in Business Analytics and Data Science	○	●	○	○		○	
BADS 8801-8820 Selected Topics in Business Analytics and Data Science	○	●	○	○		○	
BADS 9000 Independent study	○	●	●	○		●	
BADS 9900 Dissertation	●	●	○	○	●	○	○

Section 5. Student Evaluation Guidelines

1. Regulation and Grading Criteria

The grading system for the courses listed in the program conforms to the standard stated in the educational regulations of the National Institute of Development of Administration. Computation of grade point averages will be as follows:

A = 4.0 (Excellent)
A- = 3.7 (Very Good)
B+ = 3.3 (Good)
B = 3.0 (Fairly Good)
B- = 2.7 (Almost Good)
C+ = 2.3 (Fair)
C = 2.0 (Almost fair)
C- = 1.7 (Poor)
D = 1.0 (Very poor)
F = 0 (Failure)
W = Withdrawal
I = Incomplete
S = Satisfactory
U = Unsatisfactory
AU = Audit
P = Pass
IP = In progress
T = Terminate
TR = Transfer, work with which there is no comparable grade

2. Standard Verification of Students' Achievement

Verification of students' achievement will be evaluated by the result of standard examination, learning outcomes in each course, qualifying examination, assignment, presentation and the final evaluation at the end of the semester. Adtionally, verification of achievement also made on consideration of thesis/dissertation's advancement.

3. Guidelines for the Completion of the Program

3.1 Students eligible for graduation from the program must have the following qualifications.

3.1.1 Students complete credits and courses as prescribed in the curriculum

3.1.2 A cumulative GPA of at least 3.00 throughout the course

3.1.3 Pass the qualification examination within 4 semesters after the registration as a student for students of Plan 1(1.1) and 6 semesters after the registration as a student for students of Plan 2(2.1). Students who studied in both plan will be entitled for the qualification examination up to 3 times

3.1.4 Pass the dissertation proposal

3.1.5 Pass the dissertation final examination

3.1.6 Results of the dissertation have been published in international journals listed in the international database in accordance with National Institute of Development Administration's Regulation on Education Year 2014 and Ministry of Education's Announcement on Standards for Curriculum of Graduate Studies Year 2015

Section 6. Faculty Development

1. Preparation for New Lecturers

1.1 Allocate a supporting budget for encouraging the instructors to broaden their knowledge and experiences to promote teaching and research continually, supporting further education, training, and professional visits to the various academic, attending academic conferences both locally and / or internationally, or taking leave to gain additional experience

1.2 Hold a meeting for new lecturers introduction to be known by all lecturers and academic support staffs as well as giving information in detail about all curriculums in the school and all curriculum responsible lecturers.

1.3 New lecturers must attend seminar for curriculum development once a year.

1.4 Appoint lecturer to be responsible lecturer of the curriculum.

1.5 Encourage new lecturers to work on research related to the courses they teach.

1.6 Encourage new lecturers to produce a research work published in academic journals both in national and international level.

2. Knowledge and Skills Development for Lecturers

2.1 Development of Teaching Skills, Assessment and Evaluation

2.1.1 Encouraging the instructors to broaden their knowledge and experiences to promote teaching and research continually supporting further education, training, and professional visits to the various academic, attending academic conferences both locally and / or internationally, or taking leave to gain additional experience

2.1.2 Being a spectator in some courses

2.1.3 Encouraging new lecturers to attend or take part in academic seminars held by the institute or other organizations

2.1.4 Arranging a meeting for teaching staffs once a year for a common understanding of course's objectives, content, teaching approach, media preparation, documentation and assessment.

2.1.5 Encouraging lecturers to develop research proposals, produce research works published in international academic journal and present in international conference especially in the topic related to the taught courses.

2.2 Academic and Professional Development

2.2.1 Development such as principles in writing textbooks, research proposals and proposals development

2.2.2 Encouraging lecturers to present a research work for budget allocation in researching.

2.2.3 Arranging an academic seminar for knowledge integration among lecturers

2.2.4 Encouraging for attendance in abroad training in the related field of study

Section 7. Quality Assurance of the Curriculum

1. Standard regulations

Curriculum management is regulated perpetually to be consistent with TQF and AUN-QA or any other professional guidelines and standards (if exist). For instance, the Instructors who are responsible for the curriculum will monitor and advice program's staff to plan the teaching and learning management with Graduate School of Applied Statistics managements. Moreover, program's professors keep track and collect data for curriculum improvement on a yearly basis by carrying out satisfaction evaluation towards curriculum and teaching among newly graduates

2. Graduates

Quality of program graduates is consistent with TQF including learning outcomes, students'presentation and publications. Besides, program continually set feedback mechanism from various stakeholders, evaluate curriculum and improve quality, follow up newly graduates' hiring rate, and evaluate stakeholders' satisfaction.

3. Students

Admission process also includes rudimentary course(s) as well as a clear policy for selection ratio and updated selection criteria. Students are supervised for their doctoral dissertation and learning with their own advisee during the office hours.

GSAS facilitates students' learning, researching, and well-being. Graduate School of Applied Statistics monitors and compare qualifying exam passing rate and dropout rate for future improvement.

4. Faculties

Graduate School of Applied Statistics manages and develop faculties since recruitement process. Graduate School of Applied Statistics selects faculties effectively and transparently. Faculties are qualified with knowledge, expertise, and continual academic advancement. Faculties' succession planning is carried out and appropriate student-teacher ratio is regulated. GSAS also monitors, maintains, compares, and develop faculties' numbers and types of faculties' research and publications.

5. Curriculum, teaching, and learner evaluation

Curriculum, course description, and course syllabus are updated regularly as well as learning and teaching in all courses offered is well-planned and improved. Students are assessed and evaluated their performance with various evaluation methods. Curriculum is monitored and managed to be complied with TQF. Expected learning outcomes are clarified and written and should be aligned with NIDA's mission and vision.

Expected learning outcomes reflect stakeholder's demand. Curriculum is designed to facilitate learning to achieve expected learning outcomes. Teaching strategies facilitate life-long learning. Students get their feedback on their performance on time in order to improve themselves.

6. Facilities

The appropriate and sufficient physical and technology facilities and resources are planned and involved by Graduate School of Applied Statistics, program's professors, and NIDA to facilitate the expected learning outcomes. Facilities and resources are evaluated by professors and students for improvement.

There is the clear plan for support staffs' management including competency identification, competency assessment, training, and development in order to facilitate teaching, learning, and researching. Library, resources, computer laboratory, laboratory devices, and infrastructure for information technology are updated and sufficient for learning, teaching, and researching. All facilities' quality and services are evaluated by students and professors perpetually.

7. Key Performance Indicators

Key Performance Indicators	Year 1	Year 2	Year 3	Year 4	Year 5
(1) No less than 80% of faculty members participate in the planning, monitoring and revisising of the curriculum.	x	x	x	x	x
(2) There is program specification designed in accordance with TQF2 form of Thai Qualifications Framework or Program's Qualifications (if any)	x	x	x	x	x
(3) Course specification of each course designed in accordance with TQF3 form and TQF4 form is issued no longer than 2 weeks after the first day of opening semester or before the first day of aclass for Block-coursed courses.	x	x	x	x	x
(4) Course report of each course designed in accordance with TQF5 form and TQF6 form is issued within 30 days after the last day of grade submission of each semester.	x	x	x	x	x
(5) Program report designed in accordance with TQF7 form is issued within 60 days after the last day of grade submission of each semester.	x	x	x	x	x
(6) No less than 25% of courses offered in each academic year have a mechanism to variety student's achievement as stipulated in A TQF3 form and TQF4 form.	x	x	x	x	x
(7) There are development and improvement of teaching / learning, teaching strategies and evaluation of learning based on the previous year evaluation of TQF7.		x	x	x	x
(8) All new faculty members (if any) are given orientation and suggestations regarding teaching.	x	x	x	x	x
(9) All full-time faculty members are offered academic/professional development at least once a year.	x	x	x	x	x

Key Performance Indicators	Year	Year	Year	Year	Year
(10) At least 50% supporting staff are offered academic/professional development at least once a year.	x	x	x	x	x
(11) The level of final year student satisfaction/new graduate on the curriculum quality must be on average no less than 3.5 out of 5				x	x
(12) The level of employer satisfaction on graduate quality must be on average no less than 3.5 of 5					x
(13) Activities, academic advising and student supports are assigned for promoting Expected Learning Outcomes.	x	x	x	x	x
Total key performance indicators(number)	10	11	11	12	13
The mandatory key performance indicators(sequence)	1-5	1-5	1-5	1-5	1-5
Total of must pass indicators (number)	10	11	11	12	13

Evaluation Criteria

The standardized curriculum must achieve goals in KPI No. 1 – 5 and reach goals achievement 80% of all KPI by consideration on number of KPI

Section 8. Evaluation and Improvement of Program Administration

1. Evaluation of Teaching Efficiency

1.1 Evaluation of Teaching Strategies

Process of evaluation and revision on planned strategy for teaching development will be considered by the result of evaluation on students by lecturer in the aspect of content comprehension, problem analysis skill. The evaluation will be done by subtests, observation on student's behavior, discussion, and class participation which are collected by teaching evaluation form for an improvement in teaching methodology. Education evaluation of students will be done in the mid-term and final-term for measuring student's content comprehension in the taught course and education development in the future.

2. Overall Program Evaluation

The overall curriculum evaluation can be done by survey on satisfaction of new graduate toward working related to the part of the objectives of the curriculum, weakness and strength of the curriculum for an improvement of the curriculum, education management in overall courses as follows,

2.1 Evaluation of the curriculum in all courses at the end of academic year

2.2 Evaluation of the curriculum bi-annually

2.3 Participation of students in giving comment toward the curriculum revision in all courses

3. Evaluation of Program Administration

Evaluation is made as accorded in the Section 7 No. 7 by the committee of 3 members composed of at least 1 expert in the field of study.

4. Revisoin of Evaluation Results, Plan to Improve Program and Teaching Strategies

4.1 Evaluation on result in teaching of lecturer in each courses at the end of the semester

4.2 A meeting for Ph.D. Program Committee and students twice an academic year

4.3 Improvement and modernization on course content

4.4 Revision on some courses in the curriculum bi-annually

The strategy is considered in the aspects of academic development, personel development and campaign for drawing interest in the curriculum