Doctor of Philosophy Program in Data Analytics and Data Science
(International Program)
Revised Program 2022

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 Data Analytics and Data Science (International Program)

ชื่อหลักสูตร : หลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการวิเคราะห์ข้อมูลและวิทยาการข้อมูล (หลักสูตรนานาชาติ)

2. Degree Title

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

ชื่อเต็ม : ปรัชญาดุษฎีบัณฑิต (การวิเคราะห์ข้อมูลและวิทยาการข้อมูล)

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

ชื่อย่อ : ปร.ด. (การวิเคราะห์ข้อมูลและวิทยาการข้อมูล)

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

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

[2] Research and studying courses requirements

5.2 Medium of Instruction: English

5.3 Students Admissions: Open for Thai and international graduates

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 Doctor of Philosophy Program in Data Analytics and Data Science (International Program) Revised Program 2022 revise form Doctor of Philosophy Program in Business Analytics and Data Science (International Program) New Program 2018

6.2 The program will be in use from the 1st semester of the academic year 2022

6.3 Committee of the Academic Council authorized/approved the curriculum at its 4/2022 meeting on April 29, 2022.

6.4 The Council of the National Institute of Development Administration authorized/approved the curriculum at its 5/2022 meeting on May 18, 2022.

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

The curriculum will be acknowledged as having obtained the quality and standard in accordance with the Higher Education Qualifications B.E., 2009, in the academic year 2024.

8. Graduate Employment Opportunities

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

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

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
xxxxxxxxxxxxxxxxx	Asst.Prof Dr.Tanasai Sucontphunt	Ph.D. (Computer Science) M.S. (Computer Science) วท.ม.(วิทยาการคอมพิวเตอร์) วศ.บ. (วิศวกรรมอุตสาหการ)	The University of Southern California, U.S.A. (พ.ศ. 2555) The University of Southern California, U.S.A. (พ.ศ. 2546) มหาวิทยาลัยมหิดล (พ.ศ. 2543) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2540)
xxxxxxxxxxxxxxxxx	Asst. Prof Dr.Ekarat Rattagan	Ph.D. (Electrical Engineering and Computer Science) วท.ม. (เทคโนโลยีสารสนเทศ) สถ.บ. (สถาปัตยกรรม)	National ChiaoTung University (NCTU), China (พ.ศ. 2559) มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี(พ.ศ. 2546) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2542)
xxxxxxxxxxxxxxxxx	Dr.Wanrudee Skulpakdee	Ph.D. (Applied Mathematics) M.Sc. (Mathematics) วท.ม. (สถิติประยุกต์) วท.บ. (คณิตศาสตร์)	Washington State University, U.S.A. (พ.ศ. 2559) Washington State University, U.S.A. (พ.ศ. 2556) สถาบันบัณฑิตพัฒนบริหารศาสตร์ (พ.ศ. 2540) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2537)

10. Program Facilities

All teaching courses will be held at the National Institute of Development Administration, 148 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 an era that which data attributes are variety, high 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 a competitive advantage and actionable plans which eventually contribute to social, economic, and national development in the long run.

The advent has heightened even more since establishing the Ph.D. curriculum in 2018. In the last couple of years, most of the business curriculums have implemented a variety of business intelligence subjects into their programs. A move toward broader data analytics could potentially serve the broader needs of society.

This curriculum aims at developing Ph.D. graduates with 21st-century skills with solid research and statistical methodology and knowledge, information technology skills, and inquiry skills. To achieve sustainable development, they can apply, analyze, solve, and provide better solutions for business, finance, insurance, logistics, industry, society, economic, and national problems. The curriculum is revised to correspond to the Graduate Program in Data Analytics and Data Science, which has since been revised into the Graduate Program in 2022.

11.2 Situation or Social and Cultural Development

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

12. Impact from 11 on the Program Development concerning the Institution's Obligation

12.1 Program Development

From the impact of external situations above, program development objectives are to produce researchers, scholars, professors, specialists, and consultants with the capability to synthesize theories for building new knowledge, transfer knowledge, and analyze complicated problems. These products must have the potential for self-development in academic and professional aspects with morality and ethics. These characteristics are reflected in various courses of the program.

Moreover, the integration and convergence among disciplines are the key factors in the current world of work and the advent of big data, data analytics, and data sciences. Hence, the curriculum and significance have been revised tremendously to reflect those trends and situations in the past few years.

Data analytics and data science major has been opened to reflect the integration between data, mathematics theories, and computing theories and align with current practice in data analytics 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). Strategy 6 (of 8 Strategies) is maintaining excellence in academic programs, academic research, and management, which reflects the needs of society. Especially, Strategy 6.3 Major and Curriculum Development are to meet community needs 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 are open for strengthening the science in data and Data Analytics and related fields and 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 the course description. Their advisor must approve the enrollment of students in each semester. In case students are from different majors, a responsible instructor

must approve registration in that course under the supervision of a 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 will prepare future data analytics and data science researchers to integrate the multiple disciplines of statistics, mathematics, business, and computer science to serve Thailand and global communities.

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 the 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 skills.

1.2.6 Having analytical and synthetic skills in integrating knowledge for new solutions correctly and creatively.

2. Development Plans

Development/Adjustment Plans	Strategies	Evidence/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 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 staff 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 staff in the curriculum - Quantity of research publication

Section 3. Educational System, Operation, and Program Structure

1. Educational System

1.1 System

A binary educational system is composed of 2 semesters: the 1st semester and 2nd semester, and optionally 3rd semester for summer. The study period is 15 weeks for the regular semester and eight weeks for the summer semester with equivalent teaching hours to the regular semester.

1.2 Summer Semester

The summer semester is subject to the consideration of the lecturer responsible for the curriculum. A summer semester is between June and July month about eight weeks.

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 by the announcement of NIDA.

2.2.2 Passing the selection procedure both paper exam and interview.

2.2.3 Have a good command of English, both written and verbal, with an English score that meets the minimum requirement of the announcement of NIDA.

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

2.3 Problems Faced by First-Year Students

As the curriculum is an English program, Thai students and international students who don't use English as the first language may have problems in English both written and verbal skills. International students may also have difficulty adjusting 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 are provided for students.

2.4.2 Lecturers are appointed to be an advisor for each student

2.4.3 Provide a pick-up car on the arrival date of international students and orientation regarding the 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	2022	2023	2024	2025	2026
Number of Admissions	5	5	5	5	5
Accumulated Number	-	10	15	17	17
Number of Graduates	-	-	2	3	5

Plan 1(1.1) 48 Credits

	2022	2023	2024	2025	2026
Year 1	2	2	2	2	2
Year 2	-	2	2	2	2
Year 3	-	-	2	2	2
Total	2	4	6	6	6
No. of expected graduates	-	-	1	1	2

Plan 2(2.1) 72 Credits

	2022	2023	2024	2025	2026
Year 1	3	3	3	3	3
Year 2	-	3	3	3	3
Year 3	-	-	3	3	3
Total	3	6	9	9	9
No. of expected graduates	-	-	1	2	3

2.6 Budget

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

Estimated expend of students per year	**Regular Program**
A student per year	110,000 Baht

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) Hybrid between the classroom and online study

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 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

The program structure is by 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 noncredit	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) are only for applicants with a Master's Degree.

Plan 1(1.1) Students are subjected to presenting a research proposal to their advisor for consideration on setting an education plan. If the advisor initially approves the proposal, it will be passed to the Ph.D. Program Committee for consideration. To better work on research, the students may take some additional studying courses in the same major of Master Program as noncredit depending on their advisor's consideration.

Plan 1(1.1) and 2(2.1) Students with a master's degree who have no background in Data Analytics and data science must take some introductory courses in the MS Program in Data Analytics and Data Science or the related major on appropriation and consideration of Ph.D. Program in Data Analytics and Data Science Committee.

In case of necessity and appropriation, the dean or advisor / responsible lecturer may require the Ph.D. 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 courses in English as noncredit in the 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 the exemption in remedial courses is by the announcement of the school / the institute except for the condition on the exemption in remedial classes in English, which is in accordance with the condition of the curriculum of English courses for graduate students.

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

* Noncredit

(2) Core Course

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

DADS 6050	Epistemology and Research Methodology	3 Credits
DADS 6051	Theories and Research in Big Data Analytics	3 Credits
DADS 6052	Theories and Research in Machine Learning	3 Credits
DADS 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;

DADS 7102	Advanced Optimization Models	3 Credits
DADS 7151	Predictive Modeling in Finance	3 Credits
DADS 7103	Advanced Supply Chain Analytics	3 Credits
DADS 7204	Advanced Neural Network and Machine Learning	3 Credits

(4) Elective Courses

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

Elective Courses

DADS 7160	Advanced Big Data Management	3 Credits
DADS 7161	Modeling Techniques in Marketing Decision	3 Credits
DADS 7162	Advanced Analytics and Data Mining Applications	3 Credits
DADS 7164	Prescriptive Analytics in Data Analytics and Data Sciences	3 Credits
DADS 7165	Theories and Practices in Social Network and Media Analysis	3 Credits
DADS 7166	Theories and Practices in Spatial Data Analysis	3 Credits
DADS 7167	Theories and Models for Project/Program Evaluation	3 Credits
DADS 7251	Advanced Text Analytics and Natural Language Processing	3 Credits
DADS 7252	Advanced Distributed, Parallel, and Cloud Computing	3 Credits
DADS 7253	Advance Real-Time Analytics and Automation	3 Credits
DADS 7261	Advanced Speech Recognition	3 Credits
DADS 7262	Advanced Cognitive Analytics	3 Credits
DADS 7263	Advanced Machine Learning	3 Credits
DADS 7264	Advanced Artificial Intelligence	3 Credits
DADS 7265	Advanced Bioinformatics	3 Credits
DADS 7266	Advanced Medical Image Analytics	3 Credits

Selected Topics in Data Analytics and Data Science

DADS 8001-8010	Readings in Data Analytics and Data Science	3 Credits
DADS 8011-8020	Practicum in Data Analytics and Data Science	3 Credits
DADS 8021	Seminar in Data Analytics and Data Science	3 Credits
DADS 8801-8820	Selected Topics in Data Analytics and Data Science	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 the advisor)

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

Independent Study

DADS 9000	Independent study	3 Credits

Dissertation

DADS 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 DADS 9900 Dissertation 6-9 Credits
2	DADS 9900 Dissertation 3-15 Credits	DADS 9900 Dissertation 3-15 Credits
3	DADS 9900 Dissertation 3-15 Credits	DADS 9900 Dissertation 3-15 Credits

Remark: Students must pass the Qualifying Examination within four 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 DADS 6050 Epistemology and Research Methodology 3 Credits DADS 6051 Theories and Research in Big Data Analytics 3 Credits DADS 6052 Theories and Research in Machine Learning 3 Credits DADS 6053 Advanced Statistical Analysis 3 Credits	LC 4003 Advanced Integrated English Language Skill Development 3 Credits DADS 7102 Advanced Optimization Models 3 Credits DADS 7151 Predictive Modeling in Finance 3 Credits DADS 7103 Advanced Supply Chain Analytics 3 Credits DADS 7204 Advanced Neural Network and Machine Learning 3 Credits - Take a Qualifying Examination
2	Elective courses 3-9 Credits	Elective courses 3-9 Credits DADS 9900 Dissertation 3-15 Credits

	DADS 9900 Dissertation 3-15 Credits	
3	DADS 9900 Dissertation 3-15 Credits	DADS 9900 Dissertation 3-15 Credits

Remark: Students must pass the Qualifying Examination within six 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 (Noncredit) (3-0-6)

Course contents and teaching activities focus on the integrated skills of listening, speaking, reading, and writing, emphasizing 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 (Noncredit) (3-0-6)

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

Core Courses

DADS 6050 Epistemology 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.

DADS 6051 Theories and Research in Big Data Analytics 3 Credits (3-0-6)

Optimization algorithms for big data include convergent parallel algorithms, limited memory bundle algorithm, diagonal bundle method, convergent parallel algorithms, network analytics, Handling analytics algorithms on different platforms. Visualization issues on Big Data analytics

DADS 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 Data Analytics and data science applications.

DADS 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 Data Analytics and data science applications.

Major Courses

DADS 7102 Advanced Optimization Models 3 Credits (3-0-6)

provides linear programming. Duality theory and sensitivity analysis. Combinatorial optimization. Non-linear programming theory and applications (e.g., maximum likelihood and least-squares estimators). Meta heuristics. Computer packages for optimization. Dynamic programming. Decision analysis. Markov chains. Queueing models. Introduction to simulation.

DADS 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; bankruptcy models; credit scoring models; and risk modeling.

Prerequisite: DADS 6053 or Instructor's consent

DADS 7103 Advanced Supply Chain Analytics 3 Credits (3-0-6)

methods for risk management in the supply chain, quantitative analysis for risk management, a network view of risk, risk analytics, identifying and analyzing risk, analyzing risk using Monte Carlo simulation, responding to risk, creating resilient supply chain, business continuity management.

Prerequisite: DADS 6052 or Instructor's consent

DADS 7204 Advanced Neural Network and Machine Learning 3 Credits (3-0-6)

provides a background of deep learning, deep learning software frameworks, deep learning with neural network convolutional neural network (CNN), gradient descent, backpropagation, objective and loss functions, activation functions, data preprocessing, weight initialization, batch normalization, underfitting, and overfitting problems, regularization

techniques, optimization techniques, transfer learning and fine-tuning, recurrent neural networks, deep belief network, deep Boltzman machine, representation learning, other deep learning architectures, news and updates in deep learning, and case studies of deep learning usages in actual businesses. All are taught by hands-on practices using a standard deep learning framework.

Elective Courses

DADS 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: DADS 6053 or Instructor's consent

DADS 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: DADS 6053 or Instructor's consent

DADS 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: DADS 6053 or Instructor's consent

DADS 7164 Prescriptive Analytics in Data 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, even discrete simulation.

Prerequisite: DADS 6053 or Instructor's consent

DADS 7165 Theories and Practices in Social Network and Media Analysis 3 Credits (3-0-6)

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: DADS 6053 or Instructor's consent

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

Theories and practices in spatial data analysis; geographical information system and Data Analytics; spatial sampling 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: DADS 6053 or Instructor's consent

DADS 7167 Theories 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: DADS 6050 or Instructor's consent

DADS 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 study 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: DADS 6052 or Instructor's consent

DADS 7252 Advanced Distributed, Parallel, and Cloud Computing 3 Credits (3-0-6)

Survey of distributed, parallel, and cloud computing architectures, models of parallel computation, and interconnection networks. Parallel algorithm development and analysis. Programming paradigms and languages for parallel computation. Different approaches to writing parallel 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: DADS 6052 or Instructor's consent

DADS 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 accurate time analytics and automation.

Prerequisite: DADS 6052 or Instructor's consent

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

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

Prerequisite: DADS 6052 or Instructor's consent

DADS 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: DADS 6052 or Instructor's consent

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

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

Prerequisite: DADS 6052 or Instructor's consent

DADS 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: DADS 6052 or Instructor's consent

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

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

Prerequisite: DADS 6052 or Instructor's consent

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

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

Prerequisite: DADS 6052 or Instructor's consent

Selected Topics in Data Analytics and Data Science Courses

DADS 8001-8010 Readings in Data Analytics and Data Science **3 Credits (0-0-12)**

This course intends to allow a student preparing a dissertation proposal or 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.

DADS 8011-8020 Practicum in Data Analytics and Data Science **3 Credits (0-0-12)**

Practicum in areas and issues related to and beyond those covered in other courses. Students must practice or work in a host organization under supervision. Students must write up their practicum report, a research report, software, case study, project, etc. GSAS and the host organization will announce topics before being offered.

DADS 8021 Seminar in Data Analytics and Data Science **3 Credits (2-2-5)**

Discussions on the news and current data analytics and data science issues. The discussion leaders will be lecturers, academicians, researchers, or practitioners. Each student has to participate in the discussion actively by presenting their works.

DADS 8801-8820 Selected Topics in Data Analytics and Data Science 3 Credits (3-0-6)

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

Independent Study

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

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

Dissertation

DADS 9900 Dissertation 36/48 Credits

A student-initiated research report on a particular topic under the 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

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
xxxxxxxxxxxxxxxxxx	Asst.Prof Dr.Tanasai Sucontphunt	Ph.D. (Computer Science) M.S. (Computer Science) วท.ม.(วิทยาการคอมพิวเตอร์) วศ.บ. (วิศวกรรมอุตสาหการ)	The University of Southern California, U.S.A. (พ.ศ. 2555) The University of Southern California, U.S.A. (พ.ศ. 2546) มหาวิทยาลัยมหิดล (พ.ศ. 2543) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2540)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr.Ekarat Rattagan	Ph.D. (Electrical Engineering and Computer Science) วท.ม. เทคโนโลยีสารสนเทศ	National ChiaoTung University (NCTU), China (พ.ศ. 2559) มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี(พ.ศ. 2546)

		สถาปัตยกรรมศาสตรบัณฑิต	จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2542)
xxxxxxxxxxxxxxxxxx	Dr.Wanrudee Skulpakdee	Ph.D. (Applied Mathematics) M.Sc. (Mathematics) วท.ม. (สถิติประยุกต์) วท.บ. (คณิตศาสตร์)	Washington State University, U.S.A. (พ.ศ. 2559) Washington State University, U.S.A. (พ.ศ. 2556) สถาบันบัณฑิตพัฒนบริหารศาสตร์ (พ.ศ. 2540) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2537)

3.2.2 Fulltime Faculty Members

เลขประจำตัวประชาชน	**ตำแหน่งทางวิชาการ/ชื่อ – สกุล**	**คุณวุฒิสูงสุด/สาขาวิชา**	**สถาบันที่สำเร็จการศึกษา**
xxxxxxxxxxxxxxxxxx	Asst.Prof Dr.Tanasai Sucontphunt	Ph.D. (Computer Science) M.S. (Computer Science) วท.ม.(วิทยาการคอมพิวเตอร์) วศ.บ. (วิศวกรรมอุตสาหการ)	The University of Southern California, U.S.A. (พ.ศ. 2555) The University of Southern California, U.S.A. (พ.ศ. 2546) มหาวิทยาลัยมหิดล (พ.ศ. 2543) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2540)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr.Ekarat Rattagan	Ph.D. (Electrical Engineering and Computer Science) วท.ม. เทคโนโลยีสารสนเทศ สถาปัตยกรรมศาสตรบัณฑิต	National ChiaoTung University (NCTU), China (พ.ศ. 2559) มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี(พ.ศ. 2546) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2542)

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
xxxxxxxxxxxxxxxxxx	Dr.Wanrudee Skulpakdee	Ph.D. (Applied Mathematics) M.Sc. (Mathematics) วท.ม. (สถิติประยุกต์) วท.บ. (คณิตศาสตร์)	Washington State University, U.S.A. (พ.ศ. 2559) Washington State University, U.S.A. (พ.ศ. 2556) สถาบันบัณฑิตพัฒนบริหารศาสตร์ (พ.ศ. 2540) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2537)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr.Worapol Pongpech	Ph.D. (Computer Science) M.E. (Image Processing) B.S. (Telecommunication)	The University of Queensland, Australia (2552) Queensland University of Technology, Australia. (2546) Portland State University, U.S.A. (2540)
xxxxxxxxxxxxxxxxxx	Dr.Thanachart Ritbumroong	วท.ด. (เทคโนโลยีสารสนเทศทางธุรกิจ) วท.ม. (เทคโนโลยีสารสนเทศทางการจัดการ) วศ.บ. (วิศวกรรมโยธา)	จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2553) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2545) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2542)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr. Arnond Sakworawich	Ph.D. (Psychometrics and Quantitative Psychology)	Fordham University, U.S.A. (2556) มหาวิทยาลัยธรรมศาสตร์ (2547)

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
		ศศ.ม. (จิตวิทยาอุตสาหกรรมและองค์การ) บธ.ม. (ธุรกิจระหว่างประเทศ) บธ.บ. (การบริหารทรัพยากรมนุษย์และองค์การ)	สถาบันบัณฑิตพัฒนบริหารศาสตร์(2544) จุฬาลงกรณ์มหาวิทยาลัย (2541)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr. Preecha Vichitthamaros	Ph.D. (Management of Technology) M.B.A. (Management of Technology) สถ.ม. (สถิติ) สถ.บ. (สถิติคณิตศาสตร์)	Asian Institute of Technology, Thailand (พ.ศ. 2545) Asian Institute of Technology, Thailand (พ.ศ. 2538) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2534) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2532)
xxxxxxxxxxxxxxxxxx	Assoc. Prof Dr.Duanpen Teerawanviwat	Ph.D. (Sociology) M.A. (Sociology) ค.ม. (วิจัยการศึกษา) ค.บ. (วิทยาศาสตร์ทั่วไป)	University, of Hawaii U.S.A. (พ.ศ. 2532) University of Florida, U.S.A. (พ.ศ. 2524) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2519) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2517)
xxxxxxxxxxxxxxxxxx	Assoc. Prof Dr.Pachitjanut Siripanich	Ph.D. (Statistics) M.S. (Math-Statistic) วท.บ. (คณิตศาสตร์)	Oregon State University, U.S.A. (พ.ศ. 2530) Carleton University, Canada.

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
			(พ.ศ. 2520) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2517)
xxxxxxxxxxxxxxxxxx	Assoc. Prof Dr.Kannapha Amaruchkul	Ph.D. (Industrial Engineering) M.S. (Industrial Engineering and Operations Research) B.A. (Mathematics)	The University of Minnesota-Twin Cities, U.S.A. (พ.ศ.2550) The University of California, Berkeley, U.S.A. (2546) Princeton University, U.S.A. (2544)
xxxxxxxxxxxxxxxxxxx	Assoc. Prof Dr. Surapong Auwatanamongkol	Ph.D. (Computer Science) M.S. (Information and Computer Science) วิศวกรรมศาสตรบัณฑิต (วิศวกรรมไฟฟ้า)	Southern Methodist University, U.S.A. (พ.ศ. 2534) Georgia Institute of Technology, U.S.A. (พ.ศ. 2525) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2521)
xxxxxxxxxxxxxxxxxxx	Assoc. Prof Dr.Ohm Sornil	Ph.D. (Computer Science and Applications) M.S. (Computer Science) วศ.บ. (วิศวกรรมไฟฟ้า) (เกียรตินิยมอันดับสอง)	Virginia Polytechnic Institute and State University, U.S.A. (พ.ศ. 2544) Syracuse University, U.S.A. (พ.ศ. 2540) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2536)
xxxxxxxxxxxxxxxxxx	Asst. Prof Dr.Sukanya Suranauwarat	Ph.D. (Computer Science and	Kyushu University, Japan. (พ.ศ.2545)

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
		Communication Engineering) M.E.(Computer Science and Communication Engineering) B.E. (Computer Science and Communication Engineering)	Kyushu University, Japan. (พ.ศ.2542) Kyushu University, Japan. (พ.ศ.2540)
xxxxxxxxxxxxxxxxxx	Asst. Prof. Dr.Pramote Luenam	Ph.D. (Information Systems) M.S. (Information Systems) บธ.ม. (การจัดการ) วท.ม. (วิทยาการคอมพิวเตอร์) วศ.บ. (ชลประทาน)	The University of Maryland at Baltimore County (UMBC), U.S.A. (พ.ศ.2551) The University of Maryland at Baltimore County (UMBC), U.S.A. (พ.ศ. 2545) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2541) จุฬาลงกรณ์มหาวิทยาลัย (พ.ศ. 2536) มหาวิทยาลัยเกษตรศาสตร์ (พ.ศ. 2530)
xxxxxxxxxxxxxxxxxx	Assoc. Prof Dr.Pramote Kuacharoen	Ph.D. (Electrical and Computer Engineering) M.S. (Electrical and Computer Engineering)	Georgia Institute of Technology, U.S.A. (พ.ศ. 2547) Georgia Institute of Technology, U.S.A. (พ.ศ. 2544)

เลขประจำตัวประชาชน	ตำแหน่งทางวิชาการ/ชื่อ – สกุล	คุณวุฒิสูงสุด/สาขาวิชา	สถาบันที่สำเร็จการศึกษา
		B.S. (Computer and Systems Engineering)	Rensselaer Polytechnic Institute, U.S.A. (พ.ศ. 2538)

3.2.3 Invited Lecturers / Special Lecturer

Occasionally, there will be invited lectures/special lecturers from the public and private sector nationally and internationally.

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

Practicum in Data 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 show the expertise in the subject with good quality for publication in an academic journal. The process of working on students' dissertations must be under the 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 school's lecturer or an expert from within or outside the institute. The dissertation defense must consist of at least one expert from outside the institute and a chairperson of the dissertation defense committee (can't be dissertation advisor and co-advisor).

5.2 Learning standards

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

An appointment for dissertation consultancy is made and recorded. Proposal presentation and progress are also made for improved work on the dissertation and the giving information on the website.

5.6 Evaluation Process

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

Section 4. Learning Outcomes, Teaching Strategies and Evaluation

1. Development of Students' Special Characteristics

PROGRAM OBJECTIVE

To develop highly effective professionals for data analytics and data science with proficient data and statistical literacy, information technology literacy, and business acumen to transform data both for inside and outside organizations into actionable knowledge.

Special Characteristics	Strategies or Students' Activities
Possess proficient statistical and data literacy.	Emphasize hands-on experience analyzing actual data through the computer lab, homework, workshop, research project, term papers. Pedagogy will focus on the real use-case and case study so that study can learn to solve real practical problems in data analytics and data science.
Possess proficient information technology literacy.	Pedagogy will foster the use of information technology, computer programming, database management with intensive computer laboratories and projects from various industries.
Possess business acumen to apply business analytics and data science into actionable knowledge from data both inside and outside the organization.	Case study and self-inquiry methods will be adopted in every class. Experiential learning via laboratory and dissertation processes brings in various organizations' actual data and business problems.
Create new knowledge in data analytics and data science.	Students will go through the advising and mentoring process. Students and advisors will work closely on their research to create new knowledge and get published internationally.
Possess proficient statistical and data literacy.	Emphasize hands-on experience analyzing actual data through the computer lab, homework, workshop, research project,

	term papers. Pedagogy will focus on the real use-case and case study so that study can learn to solve real practical problems in data analytics and data science homework, workshop, research project, term papers. Pedagogy will focus on the real use-case and case study so that study can learn to solve real practical problems in data analytics and data science.

2. Learning Outcomes Development

2.1 Morality and Ethics

2.1.1 Moral and Ethical Outcomes

Work and make a decision complied with professional ethics and code of conduct.

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, and not falsely claiming on others' work.

2.1.3 Strategies in Evaluating Moral and Ethical Learning Outcomes

Assessment can be performed on the 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

Understand concepts, theories, and knowledge in data analytics and data science necessary for self and lifelong learning.

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 and give opinions in the related field of study to improve positive thinking skills systematically.

2.2.3 Strategies in Learning and Knowledge Evaluation

Evaluation of students' knowledge will be done by subtest or oral test for discussion and sharing knowledge in the class. Additionally, the review can also be done by the difficulty 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

1. Apply data Analytics and data science theories and knowledge into practical problems.
2. Solve data analytics and data science problems with analytical and creative thinking.
3. Create new knowledge in data analytics and data science.

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 classroom.

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, and examination.

2.4 Interpersonal Skills and Responsibilities

2.4.1 The Outcomes of Interpersonal Skills and Responsibilities Development

Present and communicate knowledge and concepts in data analytics and data science to effectively target the audience.

2.4.2 Teaching Strategies to Develop Interpersonal Skills and Responsibilities

Working in groups and individuals is assigned in each course's learning for creating students' responsibility toward the group and themselves. Students also practice giving and accepting others' opinions.

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

Use information technology effectively to solve real practical data analytics and data science problems.

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 actual 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 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 five domains of learning Thai Qualifications Framework for Higher Education (TQF) as follows

1. Moral and Ethics	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 data analytics and data science necessary for self and lifelong learning
3. Intellectual Skills	ELO 3: Apply data analytics and data science theories and knowledge into practical problems.
	ELO 4: Solve data analytics and data science problems with analytical and creative thinking.

	ELO 5: Create new knowledge in data analytics and data science.
4. Interpersonal Skills and Responsibilities	ELO 6: Present and communicate knowledge and concepts in data analytics and data science to effectively target the audience.
5. Skill in Numerical Analysis, Communication and Use of Information Technology	ELO 7: Use information technology effectively to solve real practical data analytics and data science problems.

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	○	●	○			○	
DADS 6050 Epistemology and Research Methodology	●	●	●			○	○
DADS 6051 Theories and Research in Big Data Analytics	○	●	●	●		○	●
DADS 6052 Theories and Research in Machine Learning	○	●	●	●		○	●
DADS 6053 Advanced Statistical Analysis	○	●	●	●		○	●
DADS 7102 Advanced Optimization Models	●	●	●	●		○	●
DADS 7151 Predictive Modeling in Finance	○	●	●	●		○	●

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
DADS 7103 Advanced Supply Chain Analytics	○	●	●	●		○	●
DADS 7204 Advanced Neural Network and Machine Learning	○	●	●	●		●	●
DADS 7160 Advanced Big Data Management	●	●	●	●		○	●
DADS 7161 Modeling Techniques in Marketing Decision	○	●	●	●			●
DADS 7162 Advanced Analytics and Data Mining Applications	○	●	●	●		○	●
DADS 7164 Prescriptive Analytics in Data Analytics and Data Sciences	○	●	●	●			●
DADS 7165 Theories and Practices in Social Network and Media Analysis	○	●	●	●		○	●
DADS 7166 Theories and Practices in Spatial Data Analysis	○	●	●	●		○	●
DADS 7167 Theories 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
DADS 7251 Advanced Text Analytics and Natural Language Processing	○	●	●	●		○	●
DADS 7252 Advanced Distributed, Parallel, and Cloud Computing	○	●	●	●			●
DADS 7253 Advance Real-Time Analytics and Automation	○	●	●	●		○	●
DADS 7261 Advanced Speech Recognition	○	●	●	●			●
DADS 7262 Advanced Cognitive Analytics	○	●	●	●		○	●
DADS 7263 Advanced Machine Learning	○	●	●	●			●
DADS 7264 Advanced Artificial Intelligence	○	●	●	●			●
DADS 7265 Advanced Bioinformatics	○	●	●	●			●
DADS 7266 Advanced Medical Image Analytics	○	●	●	●			●
DADS 8001-8010 Readings in Data Analytics and Data Science	○	●	●	●		○	
DADS 8011-8020 Practicum in Data Analytics and Data Science	○	●	●	●		○	

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
DADS 8021 Seminar in Data Analytics and Data Science	○	●	●	●		○	○
DADS 8801-8820 Selected Topics in Data Analytics and Data Science	○	●	●	●		○	○
DADS 9000 Independent study	○	●	●	●		●	○
DADS 9900 Dissertation	○	●	●	●	●	○	○

Expected learning outcomes at the end of each year of the study

Year	Expected learning outcomes
1	**1. Level of Application of Knowledge** At the Doctoral degree level, students demonstrate the capacity to undertake pure and applied research at an advanced level and contribute to developing academic or professional skills, techniques, tools, practices, ideas, theories, approaches, and materials. At the end of the first year, students should have taken all the courses necessary to carry out the research.
2	**2. Depth & Breadth of Knowledge** At the Doctoral degree level, students demonstrate a thorough understanding of a substantial body of knowledge at the forefront of their academic discipline or professional practice, including relevant expertise outside the field and profession. At the end of the second year, students should be able to identify a potential research problem and potential solution. The students should demonstrate this to the program committee.
3	**3. Research Outcomes** At the Doctoral degree level, students demonstrate the ability to conceptualize, design, and implement research for the generation of new knowledge, applications, or understanding at the forefront of the discipline and to adjust the research design or methodology in the light of unforeseen problems; the ability to make informed judgments on complex issues in specialist fields, sometimes requiring new methods; and the ability to produce original research, or other advanced scholarship, of a quality to satisfy peer review, and to merit publication. At the end of the third year, the students should have a working solution and at least a topic publication.