Program: ECE
Degree Level: Master

Faculty/College: TGGS

Course 090245405

Data Management and Analysis

King Mongkut's University of Technology North Bangkok

The Sirindhorn International Thai-German Graduate School of Engineering

Electrical and Computer Engineering Program

Section 1: General Information

1. **Course code and course title**

   090245405 Data Management and Analysis

2. **Total credits**

   3 credits ☐ (2-2-5) ☑ (3-0-6) ☐ (3-0-9) ☐ (2-3-7)

3. **Curriculum and course category**:

   Curriculum: *Master of Engineering in Electrical and Software Systems Engineering*

   Course category: Required Courses

   ☐ Core Course ☑ Specific Core Course

   ☐ Industrial Internship ☐ Master Thesis

   Elective Courses

   ☐ General Elective ☐ Specific Elective ☐ Other Elective

4. **Course coordinator/ Instructors**

   Course Coordinator: _____

   Instructor(s): Yodsawalai Chodpathumwan

5. **Semester/ year of study**

   ☑ Semester 1 (Aug. to Dec.) ☐ Semester 2 (Jan. to May) Academic Year: 2020

6. **Pre-requisite (if any)**

   ☑ No ☐ Yes, please provide: .....

7. **Co-requisites (if any)**

   ☑ No ☐ Yes, please provide: .....

8. **Venue of study**

   Lecture Day/Time: Monday at 13.00-16.00

   ☑ On-site: Lecture Room No.:……1102……. Floor:…11….

   ☑ TGGS, KMUTNB ☐ Faculty of Engineering, CU ☐ RWTH

   ☑ On-line*: Teaching Media: ☐ Microsoft Teams ☐ Google Meet

   ☐ Zoom ☐ Webex

   ☑ Other (specify) ……Skype……..…

Remark: * *During COVID-19, the teaching can be on-site and/or on-line according to TGGS Policy*.

9. Information for quality assurance in education

This course shows evidence of:

- Integration of research or creative activities with instruction; use of research-based learning management; knowledge management practices for learning improvement
- Integration of academic services and course implementation

10. Date of latest revision:

July 2020

Section 2: Course Description and Implementation

1. Course Description (*As written in the Official Approved Curriculum*)

Data storage, data management, and data processing. Database models including Relational model and Semi-Structured model. Statistics and exploratory data analysis. Analytics tools for big data. Data visualization.

2. Number of hours per semester

Lecture	Practice	Self-study
45 hours/ semester (*3 hours/week**)	*30 hours* (*2 hours/week**)	*75 hours/ semester* (*5 hours/week**)

Remark: * *Based on 15 weeks of lecture*

Course Category: ☑ Lecture ☐ Practice ☐ Laboratory

Course Evaluation: ☑ A-F ☐ S/U ☐ P

3. Number of hours per week for academic guidance to individual students

☐ 1. Giving academic advice (minimally number hour per week) during the office hour

☑ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ .....

The student can arrange the time via email for the meeting date/time.

☐ 2. Adopting information technology-based academic advising

☑ Email: yodsawalai.c@tggs.kmutnb.ac.th

☐ Phone:

☐ Communication Apps: Line ID:

(Please notify the lecturer when adding the line.)

☐ Meeting Online: The platform will be informed to students upon the request.

☐ Other (specify) .....

☐ 3. .....

4. Course Learning Outcomes (CLOs): Students should be able to:

CLO 1. To understand a fundamental concept of data management system, statistical analysis and machine learning

CLO 2. To demonstrate proficiency with statistical analysis of data

CLO 3. To design simple data management based on the usage requirements.

CLO 4. To apply data management and analysis concepts and methods to solve problems in real-world context and communicate the result effectively

5. The mapping between Expected Learning Outcomes (ELOs) from the curriculum and Course Learning Outcomes (CLOs)

Table 5.1 ELOs-CLOs Consistency *(for a subject-specific course/ a specific curriculum)*

ELOs/CLOs consistency	CLO 1	CLO 2	CLO 3	CLO 4
ELO1				
ELO2	✓			
ELO3		✓	✓	✓
ELO4				
ELO5		✓	✓	✓
ELO6				✓
ELO7				✓
ELO8				
ELO9				
ELO10				

Remark: All ELOs and ELOs for the course (highlighted row) are as written in the Official Approved Curriculum.

Table 5.2 Mapping desirable characteristics of KMUTNB graduates and CLOs *(for non-specific courses designed for various curriculums)*

Consistency between desirable characteristics of KMUTNB Graduates- CLOs	CLO 1	CLO 2	CLO 3	CLO 4
1. **Professional credentials with critical thinking skills**			✓	✓
2. **Integrity and social responsibility**				
3. **Innovative and technopreneur mindset**				✓

Consistency between desirable characteristics of KMUTNB Graduates- CLOs	CLO 1	CLO 2	CLO 3	CLO 4
4. **Global Competence**			✓	

Section 3: Student Improvement in relation to Course Learning Outcomes (CLOs)

Organizing learning to develop skills/ knowledge; evaluation of CLOs in accordance with the ones identified in Section 2.4

Course Learning Outcomes (CLOs)	Teaching Methods compliant with CLOs	Evaluation Methods compliant with CLOs
CLO 1	• Lecture* • Individual assignment	• Assignment evaluation • Exam****
CLO 2	• Lecture* • Individual assignment	• Assignment evaluation • Exam****
CLO 3	• Lecture* • Individual assignment • Case studies	• Assignment evaluation • Exam****
CLO 4	• Lecture* • Individual assignment • Case studies • Group or individual project	• Assignment evaluation • Exam**** • Presentation

*Remark: * Lecture on the concept of the topic is introduced with basic or fundamental definitions, visualization and correlations. For the complicated equation, the derivation from the basic laws can be shown to students. So, the students do not memorize the equations but understand the basic concept and basic equation. The lecturer will introduce the advanced and new concepts, technologies, and findings to students from publications such as journals and websites and from the research and industrial experiences.*

*** Active learning by asking questions related to the topic in the lecture and encouraging the students to response to the questions. If the students cannot response with answers, then the lecturer will give some guidance until the students can response.*

**** Quiz in the closed-book format on the basic concepts and equations with simple problem solving to evaluate their learning. The solution will be given to students after grading, so they can identify their mistakes and weakness.*

***** Exam on the basic concepts and equations with simple problem solving in the closed-book format as a review, whereas the complicated/integrated problem solving will be worked in the open-book format.*

Section 4: Lesson Plan and Evaluation

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1. **Lesson Plan**

Week	Topics/Details	CLOs	Hours	Learning and teaching activities; teaching media (if any)	Lecturer
1	**Introduction** - Definition of data science - History of data analysis - Challenges in data management and analysis	CLO 1	3.0	• Lecture presentation slides • Q&A	Yodsawalai
2-4	**Database Management Systems (DBMS)** - Definition of data - Overview of DBMS - Data models **Relational Databases** - Relational model - RDBMS architecture - SQL - E/R model	CLO 1 CLO 3	9.0	• Lecture presentation slides • Q&A • Assignment #1	Yodsawalai
5	**Semi-structured Databases** - XML - Comparison between XML and RDBMS	CLO 1 CLO 3	3.0	• Lecture presentation slides • Q&A • Assignment #1	Yodsawalai
6	*Midterm Exam*		3.0	Paper-based examination	
7	**MapReduce** - Abstraction and concepts **NoSQL** - NoSQL categorization - CAP Theorem - PACELC - Query capabilities - Common techniques in NoSQL databases	CLO 1 CLO 3	3.0	• Lecture presentation slides • Q&A • Assignment #2	Yodsawalai
8-9	**Modeling and Statistical Analysis** - Review of basic probability and statistics - Probabilistic model - Probabilistic distribution - Statistical inference - Central-Limit Theorem - Hypothesis Testing - Probability sampling - Bayesian Statistics	CLO 2	6.0	• Lecture presentation slides • Q&A • Assignment #2	Yodsawalai

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Week	Topics/Details	CLOs	Hours	Learning and teaching activities; teaching media (if any)	Lecturer
10-11	**Basic Machine Learning** - Intro to machine learning - Decision tree - Linear classifier - Perceptron algorithm - SVM - Unsupervised learning - Ensemble algorithms - Model evaluation	CLO 2 CLO 4	9.0	• Lecture presentation slides • Q&A • Assignment #2 • Tutorial • Projects	Yodsawalai
12	*Midterm Exam*		3.0	Paper-based examination	
13	**Data Cleaning**	CLO 2	3.0	• Lecture presentation slides • Q&A • Assignment #2	Yodsawalai
14	**Data visualization**	CLO 2 CLO 4	3.0	• Lecture presentation slides • Q&A	Yodsawalai
15	Final Review		3.0	• Lecture presentation slides • Q&A • Project presentation and discussion	Yodsawalai
16	*Final Exam*		3.0	• Paper-based examination	
		Total	48.0		

2. **Evaluation Plan** (**in accordance with OBE** 2 **mapping framework**)

Course Learning Outcomes (CLOs)	Evaluation Methods	Week of Evaluation	Percentage of Evaluation
CLO 1, 2, 3, 4	2 Assignments	5, 13	20%
CLO 4	1 Project	15	20%
CLO 1, 2, 3	3 Exams	6, 12, 16	60%

Section 5 Teaching/Learning Resources

Textbooks and materials

- R. Schutt, and C. O'Neil. “Doing data science: Straight talk from the frontline.” O'Reilly Media, Inc., 2013.
- H. Garcia-Molina. “Database systems: the complete book.” Pearson Education India, 2008.
- F. Gessert, and N. Ritter. “Scalable data management: NoSQL data stores in research and practice.” 2016 IEEE 32nd International Conference on Data Engineering. IEEE, 2016.
- X. Chu, et al. “Data cleaning: Overview and emerging challenges.” Proceedings of the 2016 International Conference on Management of Data. ACM, 2016.
- E. Brewer. “CAP twelve years later: how the rules have changed.” Computer. 2012.
- X. Liu, N. Iftikhar, and X. Xie. “Survey of real-time processing systems for big data.” Proceedings of the 18th International Database Engineering & Applications Symposium. ACM, 2014.
- M. Stonebraker, and J. Hellerstein. “What goes around comes around.” Readings in Database Systems 4, 2005.
- J. Gray. “The transaction concept: Virtues and limitations.” VLDB. Vol 81. 1981.
- S. Pal, et al. “Indexing XML Data Stored in a Relational Database.” VLDB, 2004.

Section 6 Course Evaluation and Improvement

1. **Course evaluation by students**

The students will have an opportunity to evaluate the effectiveness of the course in a form of paper survey and group interview at the end of each semester. The results of survey and interview including the grading will be reviewed by the curriculum meeting to evaluate the course’s effectiveness.

2. **Strategies for assessing learning management**

The students will have an opportunity to evaluate the teaching of the course in a form of paper survey and group interview at the end of each semester. The results of survey and interview including the grading will be reviewed by the curriculum meeting to evaluate the teaching as well as returning to the lecturer for further improvement.

3. **Improvement schemes of course implementation**

The evaluation from the students including the grading will be submitted to the curriculum meeting for reviewing and brainstorming to improve teaching of each course. Comments and suggestions given by the curriculum meeting will be informed to the responsible lecturer of each course.

4. **Verification of students’ learning outcomes, referred to OBE 2 and 3**

The grading of this course will be evaluated and reviewed by the Department meeting and the TGGS executive board meeting in order to verify its appropriateness before the final approval.

5. Course review and improvement plans

The results of the grading evaluation and student evaluation will be submitted to the curriculum meeting for reviewing and brainstorming to improve the effectiveness of the offered courses. Comments and suggestions will be informed to the responsible lecturer of each course.

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