Program: ECE
Degree Level: Master

Faculty/College: TGGS

Course 090245352

Advanced Software Engineering

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**

   090245352 Advanced Software Engineering

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 Computer 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): Dr. Sansiri Tanachutiwat

5. **Semester/ year of study**

   ☑ Semester 1 (Aug. to Dec.) ☐ Semester 2 (Jan. to May) Academic Year: 2021

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: Friday at 9.00 AM - 12.00 PM

   ☐ On-site: Lecture Room No.: 1103 Floor: 11

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

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

   ☐ Zoom ☑ WebEx

   ☐ Other (specify) .....

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:

- ☐ Development of implementation from previous practices, e.g. the improvement of class teaching, course content, content classification and methods used for learning assessment
- ☐ Involvement from professional bodies/ external agencies in instruction; thus Enhancing student academic and professional experiences
- ☐ 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
- ☐ Combination of cultural heritage preservation efforts into instruction or student activities

10. Date of latest revision:

August 2021

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Section 2: Course Description and Implementation

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

Modern software development process. Techniques for specifying software requirements and coding robust programs. Automated software testing. Software project management techniques.

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 ☐ .....

Wednesdays at 13.00-14.00

The student can arrange the time other than the office hour via email or instant messages for the meeting date/time.

☐ 2. Adopting information technology-based academic advising

☐ Email: sansiri.t@tggs.kmutnb.ac.th

☐ Phone: 0615593980

☐ Communication Apps: Line ID: ajsansiri

☐ Meeting Online: Google Classroom/WebEx. A meeting id and url will be created upon request.

☐ Other (specify) .....

☐ 3. .....

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

CLO 1. To understand the theoretical concepts in the followings:

- Software development process, e.g. water-fall, iterative, incremental processes as well as advanced software development process, e.g. agile, DevOps processes.
- Requirement engineering for software projects.
- Design Patterns and software refactoring process.
- Coding for robust programs.

- Software testing including design of test sets and automatic software testing.
- Software project management techniques.

CLO 2. To apply the knowledge of the software engineering to actual software development problems including at the industries.

CLO 3. To analyze source code, identify code smell and improve existing software by apply the knowledge of software engineering to actual the software engineering problems.

CLO 4. To analyze software requirement for industrial applications.

CLO 5. To create or improve software based on stakeholder feedback.

Remark: 1. Guidelines according to Bloom's Taxonomy is available at https://courses.dcs.wisc.edu/design-teaching/PlanDesign_Fall2016/2-Online-Course-Design/2_Learning-Objectives-Alignment/6_objectives_blooms-taxonomy.html

2. For the master level course, CLOs should be "apply" and "analyze" or possibly to consider the doctoral CLOs "evaluate" and "create". "Remember" and "Understand" are for the undergraduate level courses, however, they can be implemented only at the beginning of the course.

3. CLOs can be defined as many as appropriated for the course.

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	CLO 5
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	CLO 5
1. Professional credentials with critical thinking skills		✓	✓		
2. Integrity and social responsibility				✓	✓
3. Innovative and technopreneur mindset				✓	✓
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* • Active learning** • In-class exercises • Individual and/or group assignment • Additional reading assignments from research and/or literature journals	• Assignment evaluation • Assessment of assigned exercises • Exam***
CLO 2	• Case studies, project-based learning • In-class exercises • Individual and/or group assignment • Additional reading assignments from research and/or literature journals • Group discussions	• Assignment evaluation • Assessment of assigned exercises • Exam***
CLO 3	• Lecture on how to apply theoretical concepts to the industrial applications • Demonstration on the use of computer software for simulations and/or writing	• Assignment evaluation • Assessment of assigned exercises • Computer project to determine the thermodynamic properties of the simple chemical system

Course Learning Outcomes (CLOs)	Teaching Methods compliant with CLOs	Evaluation Methods compliant with CLOs
	the computer code for numerical simulations • In-class exercises • Group discussions on project updates • Mentoring on the problem solving	
CLO 4	• Case studies, project-based learning • In-class exercises • Individual and/or group assignment • Additional reading assignments from research and/or literature journals • Group discussions	• Assignment evaluation • Assessment of assigned exercises • Exam***
CLO 5	• Case studies, project-based learning • In-class exercises • Additional reading assignments from research and/or literature journals • Group discussions on project updates • Mentoring on the problem solving	• Assignment evaluation • Assessment of assigned exercises • Class project to extend an opensource software for a selected platform related to the industrial applications

*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.*

**** 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.*

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Section 4: Lesson Plan and Evaluation

1. **Lesson Plan**

Week	Topics/Details	CLOs	Hours	Learning and teaching activities; teaching media (if any)	Lecturer
1	Overview, Project Discussion, Software Engineering Foundation		3.0	Lecture, Case studies, Q&A	
2	Software Processes	CLO1	3.0	Lecture, Case studies, Q&A	
3	Requirement Engineering	CLO1, CLO4	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
4	Object Orientation Concept	CLO1, CLO2	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
5	Project Presentation 1	CLO5	3.0	Student Presentations, Q&A	
6	Object Orientation Analysis	CLO2, CLO3, CLO4	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
7	Software Design, Information Hiding, Object Orientation Design	CLO1, CLO2, CLO3, CLO4	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
8	Design Pattern	CLO1, CLO2, CLO3	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
9	Midterm Exam		3.0	Exam	Dr. Sansiri
10	Project Presentation 2	CLO5	3.0	Student Presentations, Q&A	Dr. Sansiri
11	Refactoring	CLO1, CLO2, CLO3	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
12	Programming	CLO1, CLO2,	3.0	Lecture, Case studies, Q&A	Dr. Sansiri

Week	Topics/Details	CLOs	Hours	Learning and teaching activities; teaching media (if any)	Lecturer
		CLO3, CLO4			
13	Quality Assurance, Testing, Verification	CLO1, CLO3	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
14	Project Management	CLO1	3.0	Lecture, Case studies, Q&A	Dr. Sansiri
15	Project Presentation 3	CLO5	3.0	Student Presentations, Q&A	Dr. Sansiri
16	Final Exam	CLO1	3.0	Exam	Dr. Sansiri
17	Project Delivery	CLO5	3.0	Student Presentations, Q&A	
		Total	51.0		

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	Individual assignment	1-17	20%
CLO 1	Group assignment	5, 7, 15, 17	50%
CLO 1, 2, 4	Midterm exam	9	15%
CLO 1, 2, 3, 4, 5	Final exam	16	15%

Section 5 Teaching/Learning Resources

Textbooks and materials

Main Text:

S. Tanachutiwat, Lecture Notes in Advanced Software Engineering

Important documents and Information

[1] IEEE Computer Society, “Software Engineering Body of Knowledge,” online, available at www.computer.org/web/swebok/v3

Additional Documents

[1] CMMI Product Team 7, Software Engineering Institute, CMMI for Development version 1.2, CMU/SEI-2006-TR-008, August 2006.

[2] H. Lichter, TGGS Course Software Engineering (Presentation), RWTH Aachen

[3] USC-CSE, Homework 1 Defect Amplification Model (Presentation), Center for Software Engineering, University of Southern California.

[4] C. Ebert, R. Dumke, M. Bundschuh and A. Schmietendorf, Best Practices in Software Measurement: How to use metrics to improve project and process performance, Springer Berlin Heidelberg, 2005.

[5] R. E. Park, W. B. Goethert and W. A. Florac, Goal-Driven Software Measurement- A Guidebook, CMU/SEI-96-HB-002, August 1996.

[6] M. Barbacci, M.H. Klein, T. A. Longstaff and C. B. Weinstock, Quality Attributes, CMU/SEI-95-TR-021, December 1995.

[7] J. Brosseau, Software Quality Attributes, Clarrus Consulting Group Inc., 2007.

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.