



Course **090206198**

Dissertation

King Mongkut's University of Technology North Bangkok
The Sirindhorn International Thai-German Graduate School of Engineering
Electrical and Software Systems Engineering Program

Section 1: General Information

1. Course code and course Title
090206198 **Dissertation**
2. Total credits
9 credits
3. Curriculum and course category:
Curriculum: *Doctor of Engineering in Electrical and Software Systems Engineering*
Course category: **Doctoral Thesis**
4. Course coordinator/ instructors
Instructors **All lecturers**
5. Semester/ year of study
 Semester 1 (Aug. to Dec.) **Semester 2 (Jan. to May)** Academic Year: **2020**
6. Information for quality assurance in education
This course shows evidence of:
 - **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**
7. Date of latest revision
July 2020

Section 2: Course Description and Implementation

1. Course Description
Research on an interesting topic in Electrical Engineering or Software Systems or related areas.
2. Number of hours per semester



Program: **ESSE**
 Degree Level: **Doctor**

Faculty/College: **TGGS**

Lecture	Practice	Self-study
--	Full time	--

Course Category Practice Cooperative Education

Course Evaluation A-F S/U P

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

Giving academic advice (minimally 2 hour per week)

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

- CLO 1 To develop deeper knowledge, understanding, capabilities and attitudes in the context of the program of study.
- CLO 2 To comprehend research articles and synthesize technical and scientific knowledge acquired in previous studies along with industrial application aspects.
- CLO 3 To analyze engineering problems that occur in an industry or valid research issues.
- CLO 4 To propose valid solution for engineering problems that occur in an industry or valid research issues.
- CLO 5 To conduct mathematical model or mechanism employed in the proof of proposed solution or study and explain relationships between experimental results and theory in Electrical and Software Systems Engineering.
- CLO 6 To conduct independent research in a specific technical area.
- CLO 7 To display good ethics in research operations.
- CLO 8 To write research findings/outcomes and able to communicate that with other researchers in the related fields.

5. The mapping between the curriculum's Expected Learning Outcomes (ELOs) and Course Learning Outcomes (CLOs) (*Table 5.1: for subject-specific courses designed for a specific curriculum; Table 5.2 is purposed for courses designed for various curriculums*)

Table 5.1 ELOs-CLOs Consistency: for subject-specific courses for a specific curriculum

ELOs/CLOs consistency	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8
ELO1	✓		✓					
ELO2		✓						
ELO3					✓			
ELO4					✓			



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ELOs/CLOs consistency	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8
ELO5				✓				
ELO6						✓		
ELO7								✓
ELO8		✓						
ELO9							✓	

Table 5.2 Mapping of 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	CLO 6	CLO 7	CLO 8
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 experiences to develop skills/knowledge; assessment 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	<ul style="list-style-type: none"> This ability will be developed by the literature review process and the problem assignments related to the research topic given by the advisor after each meeting. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance.



Course Learning Outcomes (CLOs)	Teaching Methods compliant with CLOs	Evaluation Methods compliant with CLOs
	<p>The student will be demanded to solve the problems in their research work using scientific approaches based on stem knowledge. The student must present the obtained the solution to the advisor. Then the advisor will help verify the approach and provide further guidance to the student to develop this ability.</p>	<ul style="list-style-type: none"> The examination committee will evaluate the student's development from the report, the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 2	<ul style="list-style-type: none"> This ability will be developed by the discussion during the meeting with the advisor. When the student presents the progress of the research work, the results and relevant phenomena must be explained by referring well-accepted theories. This procedure will be iteratively repeated, so that the student gets used to the approach and automatically builds up this ability. The student will be assigned to review literature intensively in the beginning phase of the research work. The advisor gives guidance, how to conduct the literature review effectively, e.g. searching technique, reading technique. The student must report the progress to the advisor within the assigned period. The contents of the paper will be discussed in the meeting. The student's understanding will be checked and verified by the advisor. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 3	<ul style="list-style-type: none"> This ability will be developed by the literature review process and the problem assignments related to the research topic given by the advisor after each meeting. The student will be demanded to solve the problems in their research work using scientific approaches based on stem knowledge. The student must present the obtained the solution to the advisor. Then the advisor will help verify the approach and provide further guidance to the student to develop this ability. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report, the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 4	<ul style="list-style-type: none"> This ability will be developed in the details work of the research projects. The student will report the designed circuits or software to the advisors for verification. The advisor gives appropriate guidance following the technical correctness, safety and standard. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.



Course Learning Outcomes (CLOs)	Teaching Methods compliant with CLOs	Evaluation Methods compliant with CLOs
CLO 5	<ul style="list-style-type: none"> The student will be assigned to build a mathematical model to represent the behaviors of the system of interest, so that the student can get insight and understanding of the considered research problem. Using the built mathematical model, the student can derive the solution for the considered problem systematically. The advisor will give the guidance and help verifying the correctness of the model. When the student reports the progress of the research work with experimental results. The student must verify the correctness of the results and compare them to the theoretical results. The advisor help develop this ability by giving guidance or giving examples how to analyze and find reasons. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 6	<ul style="list-style-type: none"> The research work will be assigned in the form of project, which needs planning and collaborations to different partners. So the student develops the ability to manage the project together with teamwork skill, when contacting to partners. The advisor will accompany the student to run the research project and adjusts the level of guidance accordingly to let the student become more self-relying gradually. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 7	<ul style="list-style-type: none"> The advisor gives appropriate guidance to the student. The students' behaviors and attitude will be observed in different occasions, e.g. conference presentations, meetings, defense examination, when he expresses professional opinion during the presentations to the public and answering questions. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.
CLO 8	<ul style="list-style-type: none"> This ability will be practiced, when the student reports the progress to the advisor. The advisor will observe the development and gives appropriate guidance. This ability can be also developed by doing rehearsals of the presentations of the research work for conferences or examinations. The advisor will observe the rehearsals and give comments for improvement. 	<ul style="list-style-type: none"> The advisor assesses this ability at every meeting and gives the appropriate guidance. The examination committee will evaluate the student's development from the report the presentation, and questioning the students. This ability will be assessed by the report presented in the qualification, proposal, progress, and defense examination.



Section 4: Learning Activities

1. Student activities

In the first year, the student will be assigned to do literature review intensively in the interested research field to find out the state-of-the-art. The results of the literature review will help the student to formulate the research topic. During this period, the student will have regular consultant meetings with the advisor for reporting the progress and obtaining necessary guidance. In this first year period, the student should prepare himself ready for the qualification examination. The student may start the research work in this first year, when possible.

At the end of first year, the student must take a qualification examination. When passing the qualification examination, the student proceeds with the research work. The student will have regular consultant meetings with the advisor for reporting the progress and obtaining necessary guidance. For following-up the progress of the students, there are three examinations in the following:

- Doctoral Thesis Proposal Examination
- Doctoral Thesis Progress Examination
- Doctoral Thesis Defense Examination

During the course of the research work, the student can attend additional activities organized by the curriculum, e.g. block-lecture by visiting professors, advanced course on specific topics, public seminar, excursion and short research stay in industry or abroad. As a graduation requirement, the student has to publish his works in two international journal publications. The student may also present his work in conferences to gain more experiences, when possible.

2. Reports or assignments

Reports or assignments	Deadline
Regular assignments given by supervisor	as determined by supervisor
Literature review report for qualification examination	At the end of the first year before the qualification examination.
Doctoral Thesis Proposal	In the second year of study, not earlier than the given period by the regulation.
Doctoral Thesis Progress Report	After passing the thesis proposal not earlier than the given period by the regulation.
Doctoral Thesis (Dissertation)	After passing the thesis progress not earlier than the given period by the regulation.
Final Doctoral Thesis Submission	After the Doctoral Thesis defense examination.

3. Monitoring student learning outcome in an internship experiences

The student will be evaluated by the following process:

- (1) Qualification examination



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- (2) Thesis proposal examination
- (3) Thesis progress examination
- (4) Thesis defense examination

For each examination, a committee will be appointed for evaluation. The supervisor will be one member of the examination committee. In the evaluation, the supervisor together with the committees will monitor the student's developed skills according to ELOs.

4. Duties and responsibilities of a workplace internship mentor

This is only relevant, when the student has to conduct the research work in the industry site for a long period. The supervisor will regularly visit the industry site to observe and give guidance to the student. The supervisor also communicates with the company's responsible person to follow-up the progress of the students.

5. Duties and responsibilities of the advisor / faculty supervisor

The thesis advisor regularly meets student to assist or give guidance during the office hour and the regular research group meeting. In each meeting, the thesis advisor will observe and evaluate the performance of student in each aspect and the student will be informed in order to improve those aspects. Moreover, the student will be evaluated during the Proposal Progress and Defense Examinations by the thesis committee. The thesis committee will provide the comments on the TGGS Evaluation Form and finally provide the grade on the Doctoral Thesis Defense Examination Evaluation Form.

6. Preparation in guiding and assisting the students

In addition to the advisor, the TGGS academic affair is available for students for providing consultancy in topics of procedures, formalities, appeal etc. The TGGS Doctoral Thesis Guidelines and Procedures will be provided to students in the TGGS student handbooks.

7. Facilities and support required by the workplace

TGGS has laboratories and equipment adequate for conducting advanced research in different field as listed below:

- (1) RF & Microwave Laboratory
- (2) High Voltage Laboratory
- (3) Energy Conversion Laboratory
- (4) Mobile Communications and Embedded Systems Laboratory
- (5) Enterprise Software Laboratory
- (6) Machine Vision Laboratory
- (7) Communication Networks Laboratory



- (8) Power Grid Analytics Laboratory
- (9) Image Processing Laboratory
- (10) Electrical laboratory building

The students have the access to the listed laboratory above according to their research field. It is also possible for the students to access all technical equipment and facilities from different laboratories. The KMUTNB library offers the students good access to many databases of research publications, which are helpful for literature review.

Section 5: Planning and Preparation

1. Work place identification

In general, the students conduct their research work in the laboratories in TGGS building, if necessary the student can also conduct research in the industry sites.

2. Student preparation

- (1) At the beginning of the first semester, the student will attend an orientation meeting. The student will be informed about objectives of doctoral thesis, course structure, graduation requirement, appeal procedures, etc.

3. Advisor/ supervisor preparation

The TGGS advisor will be informed about the guideline of doctoral thesis before starting the doctoral thesis.

4. Preparation of mentor at work place

This is only relevant when, the students are sent to conduct research in the industry's sites. The supervisor in the company will be informed about the framework of the Doctoral Thesis and the Guidelines and. In addition, the TGGS supervisor will keep communication with the company's supervisor by regular visits, E-mails and phone.

5. Risk management

None

Section 6: Student Evaluation

1. Evaluation criteria



The students will be evaluated based on the ELOs together with the progress of the research works. The evaluation criteria can be summarized as,

- Completeness of the research work
- Correctness of the research work
- Difficulty level of the research work
- Ability to present and to give argument
- Ability to conduct research work independently
- Skills in writing reports
- Skills in communication, presentation and Q&A.

2. Evaluation process

The student will be evaluated by the following examinations.

- Qualification examination
- Thesis proposal examination
- Thesis progress examination
- Thesis defense examination

For each examination, an examination committee will be appointed to evaluate the student. In these examinations, the student must submit a paper work in the form of report and give an oral presentation to the examination committee. The thesis committee will evaluate the student's performance from the submitted report, presentation and interviewing. The committee will give the evaluation result for each examination on the TGGS Evaluation Form and submit it to the TGGS academic affairs.

3. Responsibilities of monitoring and student evaluation by the mentor

Not applicable.

4. Responsibilities of evaluation by the faculty in charge

The thesis advisor regularly meets student to assist or give guidance during the office hour and the regular research meeting. Each meeting, the thesis advisor will evaluate the performance of student in each aspects and the student will be informed in order to improve those aspects. The advisor will evaluate the student as a member of the examination committee.

5. Conclusion of assessment discrepancies

The evaluation results will be discussed during this meeting and students will be informed in order to improve those aspects. Since the grade is assigned for each evaluation, the advisor and the thesis committee can observe the improvement of the student's performance.



Section 7: Evaluation and Improvement of an Internship Program

1. Evaluation process conducted by:

1.1 Student intern

Evaluation survey by student will be conducted at the end of each semester.

1.2 Mentor at work place

Only relevant when the student conducts research works outside TGGS, the advisors collect the comments and bring them to discussions in the meeting for reviewing the operation of the curriculum held at the end of each semester.

1.3 Advisor/ teacher in charge

Advisors provide feedbacks in the meeting for reviewing the operation of the curriculum held at the end of each semester.

1.4 Others

Evaluation survey by graduates will be conducted at the end of each semester.

2. Review of evaluation procedures and improvement planning

The evaluation results and feedbacks from stakeholders will be discussed in the meeting for reviewing the operation of the curriculum held at the end of each semester.