



Course 090115198

Master Thesis

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

Section 1: General Information

1. Course code and course Title

090115198 Master Thesis

2. Total credits

12 credits

3. Curriculum and course category:

Curriculum: *Master of Engineering in Chemical and Process Engineering Program*

Course category: Required Courses

- | | |
|------------------------------------------------|---------------------------------------------------|
| <input type="checkbox"/> Core Course | <input type="checkbox"/> Specific Core Course |
| <input type="checkbox"/> Industrial Internship | <input checked="" type="checkbox"/> Master Thesis |

Elective Courses

- | | | |
|-------------------------------------------|--------------------------------------------|-----------------------------------------|
| <input type="checkbox"/> General Elective | <input type="checkbox"/> Specific Elective | <input type="checkbox"/> Other Elective |
|-------------------------------------------|--------------------------------------------|-----------------------------------------|

4. Course coordinator/ instructors

Course coordinator(s): Curriculum Chairman: Asst. Prof. Dr. Suksun Amornraksa

Program Coordinator: Dr. Atthasit Tawai

Advisors:

Asst. Prof. Dr. Suksun Amornraksa

Assoc. Prof. Dr. Tawawan Kangsadan

Assoc. Prof. Dr. Unalome Wetwatana Hartley

Assoc. Prof. Dr. Malinee Sriariyanun

Dr. Atthasit Tawai

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:



Program: CPE
Degree Level: Master

Faculty/College: TGGS

8. Venue of study

- Thesis Research Center Industry
- RWTH Aachen University MoU Partner University

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

December 2021

Section 2: Course Description and Implementation

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

“Research on an interesting topic in chemical and process engineering”

The purpose of a thesis is to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the context of the program of study. The thesis should be written at the end of the program and offers the opportunity to develop more deeply into and synthesize knowledge acquired in previous studies. A thesis should emphasis on the technical, scientific and industrial application aspects of the subject matter. The overall goal of the thesis is for the student to display the knowledge and capability required for independent work.

2. Number of hours per semester

Lecture	Practice	Self-study
	720 hours/ 18 weeks (40 hours/week*)	30 hours/ semester (5 hours/3 weeks*)

*Remark: * Based on at least 18 weeks*

- Course Category: Lecture Practice Laboratory
- Course Evaluation: A-F S/U P



Program: CPE
Degree Level: Master

Faculty/College: TGGS

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
- 2. Adopting information technology-based academic advising
 Email Phone Communication Apps Meeting Online:
 Other (specify)
- 3.

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

The student will develop the intellectual skills and the multi-discipline in the research and development for industrial application by focusing on the followings:

- CLO 1 To critically and systematically integrate/apply all knowledge from the lectures in the chemical synthesis, chemical reactions and kinetics, thermodynamics, transport phenomena, process and product design courses that involve in an industrial application into the research project.
- CLO 2 To acquire more in-depth knowledge of the research project, including deeper insight into current research and development work.
- CLO 3 To use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues including planning and using adequate methods to conduct qualified tasks in given frameworks.
- CLO 4 To analyze and critically evaluate different technical, scientific and industrial solutions to evaluate the thesis work.
- CLO 5 To create the advanced/innovative/novel technologies for industrial application.
- CLO 6 To develop the soft skills such as presentation skills, leadership and teamwork, especially in the research group, and the writing skill for the publication and thesis summarizing their research methodology and findings.

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 a subject-specific course/ a specific curriculum)

ELOs/CLOs consistency	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6
LOK1 - Well-rounded Knowledge						
LOK2 - Inquiring Mind		✓				
LOK3 - Good Morale and Ethics			✓			
LOS1 - Chemical Engineering Tools Literacy						
LOS2 - Critical Thinking and Analytical Skills	✓		✓	✓		
LOS3 - Problem Solving Skills		✓	✓			
LOS4 - Communications and Collaboration Skills						✓
LOS5 - Management Skills					✓	✓
LOS6 - Commercial Awareness						
LOC1 - Process Performance Improvement						
LOC2 - Products Quality Improvement						
LOC3 - Plan and Conduct the Research	✓	✓	✓		✓	
LOC4 - Preliminary Technology Evaluation		✓		✓		

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

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
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">• Learning by doing• Regular meeting with thesis advisor• Group discussion with research team	<ul style="list-style-type: none">• Observation and evaluation by thesis advisor throughout the period.• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report
CLO 2	<ul style="list-style-type: none">• Literature review from texts, research journals and other publications• Regular meeting with thesis advisor• Group discussion with research team	<ul style="list-style-type: none">• Observation and evaluation by thesis advisor throughout the period.• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report
CLO 3	<ul style="list-style-type: none">• Learning by doing• Regular meeting with thesis advisor• Group discussion with research team	<ul style="list-style-type: none">• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report
CLO 4	<ul style="list-style-type: none">• Learning by doing• Regular meeting with thesis advisor• Group discussion with research team	<ul style="list-style-type: none">• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report
CLO 5	<ul style="list-style-type: none">• Learning by doing• Regular meeting with thesis advisor• Group discussion with research team	<ul style="list-style-type: none">• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report
CLO 6	<ul style="list-style-type: none">• Learning by doing• Thesis' proposal, progress, and final presentations.• Thesis report	<ul style="list-style-type: none">• Evaluation of the thesis' proposal, progress, and final presentations.• Evaluation of thesis report

Section 4: Learning Activities

**1. Student activities**

All students must register and perform the thesis project within 6 months with a maximum of 3 months extension. Prior starting the thesis work, during the second semester of the first academic year, the results of selected thesis topic are announced in advance to the student. So that the student can discuss about the objective, scope, methodology and expected results for the project. The period to start working on the thesis project will be announced after the internship report have been submitted to the curriculum chairman/program coordinator.

The student will be integrated in the thesis advisor's research group in which the student will have regular meetings with the thesis advisor and his/her research group to discuss about the progress and obstacle of the thesis work. While solving the problem, the student will seek the assistant/guidance from other colleagues in the research group with fellow Master Students, PhD Students, Research Assistants and/or Engineers or other research group. Moreover, the student will participate in the research group's orientation, lab tour and safety training during the second semester of the first academic year prior registering for the thesis proposal as well as social activities throughout the thesis work period. This will strengthen the relationship among the co-researchers.

Besides the student performs the actual experiments and obtains the correlations from the experiments, the engineering calculations, modeling, computer simulations will be used as a tool to solve the engineering problems.

The list of specific qualifying activities depends on the field of study and is part of the prevailing regulations for each course. This list may be supplemented by individual agreement between the thesis advisor and the supervisor/mentor, if activities shall be covered which are not listed as standard topics.

The standard topics are:

- Literature Review
- Master Thesis Proposal Examination
- Start with Thesis Work and Preparation of Master Thesis: Methodology, Results and Discussions, Conclusions, Suggestions/Recommendations and Future Work.
- Master Thesis Progress Examination
- Continuation of Thesis Work and Preparation of Master Thesis: Methodology, Results and Discussions, Conclusions, Suggestions/Recommendations and
- Future Work
- Master Thesis Defense Examination and Master Thesis Submission

Since the student will be treated as one of thesis advisor's researchers, the student must follow his/her regulations and rules along with the TGGS-CPE regulations and rules. In addition, the student must consider the morality, confidentiality and engineering ethics in every step in solving the



Program: CPE
Degree Level: Master

Faculty/College: TGGs

engineering problems. The advisor will regularly give advice or guidance to the student and discuss every aspects of the thesis.

2. Reports or assignments

Audit visit: Responsible advisors pay a visit every 6 weeks to assist or give guidance to students and the main objectives of each time for students are described as follows:

Reports or assignments	Deadline
Literature Review	Prior the Master Thesis Proposal Examination Deadline: by the end of the second semester of the first academic year.
Master Thesis Proposal Examination	By the end of the second semester of the first academic year. Officially counting as Day 1.
Master Thesis Progress Examination	30 days after the thesis topic is approved from the Master Thesis Proposal Examination. (Possible to be on the Month No. 2, 3, 4 or 5)
Master Thesis Defense Examination	30 days after passing the Master Thesis Progress Examination. (Possible to be on the Month No. 3, 4, 5 or 6)
Final Master Thesis Submission	By the end of Month No. 6

Remark: Number of meetings and deadlines can be redesigned to suit the company working style.

3. Monitoring student learning outcome in a master thesis research work

The thesis advisor will regularly meet the student to discuss about the progress and obstacle of the thesis work, update literature review from texts, research journals and other publications, and evaluate the student's performance; critically and systematically thinking skills; interpersonal and professional working relationship and working atmosphere; and analytical, communications and IT skills, from the following items:

- The student's weekly/monthly report
- The student's thesis proposal, progress and final presentations
- The student's thesis report

Moreover, the student will be evaluated during the TGGs Master Thesis 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 Master Thesis Defense Examination Evaluation Form.

**4. Duties and responsibilities of a workplace mentor for the master thesis research work**

Only relevant for Master Thesis Project with the industry. The supervisor/mentor regularly meets student to assist or give guidance during the office hour and the regular research group meeting. Each meeting, the supervisor/mentor will evaluate the performance of student in each listed aspects and the student will be informed in order to improve those aspects. Moreover, the student will be evaluated during the TGGS Master Thesis 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 Master Thesis Defense Examination Evaluation Form.

5. Duties and responsibilities of the advisor / faculty supervisor

The thesis advisor regularly meets student to assist or give guidance according to the teaching methodology listed in Item 3 Learning Outcome Development during the office hour and the regular research group meeting. Each meeting, the thesis advisor will evaluate the performance of student in each listed aspects and the student will be informed in order to improve those aspects. Moreover, the student will be evaluated during the TGGS Master Thesis 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 Master Thesis Defense Examination Evaluation Form.

6. Preparation in guiding and assisting the students

- 6.1 Orientation Day (During the second semester of the first academic year):
 - The TGGS Master Thesis Guidelines and Procedures will be provided to students.
 - Lab Tour and Safety Training
- 6.2 Regular Friday Master Research Project Progress Meeting (Scheduled once a week every semester):
 - All TGGS-CPE lecturers, research assistants, engineers and students (all levels including new students) must attend.
 - Students doing the master thesis give the presentation of their work to the audience including the new students.
 - New students will discuss all the issues with students whom had been doing the thesis.
- 6.3 Course Work: Provide all the skills that students need during the master thesis. For exam
 - Research and Presentation Skills: Students will have to do the projects in all the courses and then they have to present their findings to the audience.



- Computer Programming Skill: Students will learn how to write the computer programming in solving engineering problems within the related courses.
- Computer Simulation Skill: Students will learn how to use the computer simulation tools such as Aspen Plus and/or Computational Fluid Dynamics in solving engineering problems within the related courses.

7. Facilities and support required by the workplace

The program currently has 4 laboratories including computer lab, Bioprocess Engineering Laboratory, Catalysis & Reaction Engineering Laboratory, System & Control Laboratory, and Novel Technology Research Lab, respectively. For computer lab, it is well equipped with PC computers and work stations and LAN and Wi-Fi connections. Each computer was installed with software required for CPE teaching and research (Aspentech, ANSYS Fluent, COMSOL Multiphysics, Mathcad, Mathematica, Visual Fortran, and Visual Studio) which allow students to develop their computational and simulation skills.

The analytical lab has GCs, MS, GCMS, HPLC, Spectrophotometer, UV-VIS, and other basic instruments and analyzers besides equipments, instruments and analyzers in each research group.

Section 5: Planning and Preparation

1. Work place identification

Based on each master thesis topic.

2. Student preparation

To review and gain understanding of the objectives of the master thesis and prepare the students for the thesis work, the orientation will be held prior the master thesis period. In order to have a success thesis, students must have the following skills which are taught in the related courses:

- 2.1 Research skill
- 2.2 Experimental skill including in the laboratory and simulations
- 2.3 Solving problems skill
- 2.4 Presentation skill
- 2.5 Writing the project and/or technical report skill
- 2.6 Social skill

3. Advisor/ supervisor preparation



The curriculum chairman/program coordinator will assign the lecturer to be the thesis advisor for his/her interest research topic and provide the master thesis plan for 6 months in advance. The thesis advisor must be familiar with the TGGS Master Thesis Guidelines and Procedures and following the procedures and regulations very closely. In addition, the advisor must regularly meet the student to assist or give guidance.

4. Preparation of mentor at work place

Only relevant for Master Thesis Project with the industry. Since, the supervisor/mentor are already familiar with the industrial project; he/she only needs to understand the TGGS Master Thesis Guidelines and Procedures and following the procedures and regulations very closely. In addition, the supervisor/mentor must regularly meet the student to assist or give guidance.

5. Risk management

The lecturers will announce the master thesis topic in advance during the second semester of the first academic year. The student will make the appointment with the lecturers of his/her interested topics during the given week and have a discussion on the research background, objective, and scope. Then, the student will select the first 3 choices of the announced master thesis topics. The lecturers will discuss and select the appropriate student for their master thesis project.

- 5.1 The student will select the first 3 choices of the announced master thesis topics.
- 5.2 The student is selected by the thesis advisor based on his/her background that appropriate to the master thesis project.
- 5.3 The student has been supervised by the thesis advisor and the supervisor/mentor that are familiar with the project.
- 5.4 The thesis advisor and the supervisor/mentor have clearly planned the project tasks for the student.
- 5.5 The student receives the orientation, lab tour and safety training from the program and the thesis advisor's research group prior starting the thesis work.
- 5.6 The student will participate in the Regular Friday Master Research Project Progress Meeting (Scheduled once a week every semester) to exchange the ideas and discuss about the project.
- 5.6 The responsible thesis advisor and supervisor/mentor must regularly meet the student to assist or give guidance.

Section 6: Student Evaluation

1. Evaluation criteria



According to the Regulations for Examination in the Master of Science Programs (REM) of The Sirindhorn International Thai-German Graduate School of Engineering (TGGGS)

2. Evaluation process

TGGGS Master Thesis Proposal, Progress and Defense Examinations. The evaluation procedure is according to the Regulations for Examination in the Master of Science Programs (REM) of The Sirindhorn International Thai-German Graduate School of Engineering (TGGGS)

3. Responsibilities of monitoring and student evaluation by the mentor

Only relevant for Master Thesis Project with the industry. The supervisor/mentor regularly meets student to assist or give guidance during the office hour and the regular research group meeting. Each meeting, the supervisor/mentor will evaluate the performance of student in each listed aspects and the student will be informed in order to improve those aspects. Moreover, the student will be evaluated during the TGGGS Master Thesis Proposal, Progress and Defense Examinations by the thesis committee. The thesis committee will provide the comments on the TGGGS Evaluation Form and finally provide the grade on the Master Thesis Defense Examination Evaluation Form.

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 group meeting. Each meeting, the thesis advisor will evaluate the performance of student in each listed aspects and the student will be informed in order to improve those aspects. Moreover, the student will be evaluated during the TGGGS Master Thesis Proposal Progress and Defense Examinations by the thesis committee. The thesis committee will provide the comments on the TGGGS Evaluation Form and finally provide the grade on the Master Thesis Defense Examination Evaluation Form.

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 a Master Thesis Research Work**1. Evaluation process conducted by:****1.1 Student**

The student will evaluate the Master Thesis course using the TGGGS Course Evaluation form.



Program: CPE
Degree Level: Master

Faculty/College: TGGs

1.2 Supervisor at work place

Only relevant for Master Thesis Project with the industry. The supervisors/mentors will evaluate the student using the TGGs Master Thesis Proposal, Progress and Defense Examination Evaluation Forms in which they can provide additional comment.

1.3 Advisor/ teacher in charge

The thesis advisor will evaluate the student using the TGGs Master Thesis Proposal, Progress and Defense Examination Evaluation Forms in which they can provide additional comment.

1.4 Others

None

2. Review of evaluation procedures and improvement planning

None



Program: CPE
Degree Level: Master

Faculty/College: TGGS

Instruction for OBE 4 Preparation
Section 1: General Information

Topic	Description
1. Course code/ title	XXXXXXXXXX Course title (Thai and English)
2. Number of credits	Credits (Lecture/Practice/Self-study Hours)
3. Course category	Specify the program of study and course classification e.g. general core courses for several disciplines, required, major, electives, specific elective categories
5. Semester / year of study	Specify semester/ year of study consistent with the curriculum
8. Information for quality assurance in education	Put check marks in the appropriate boxes

Section 2: Course Description and Implementation

Topic	Description
1. Course description	As defined in Program Specification (OBE2)
2. Time length per week	Indicate lecture hours – lab/practice hours – self study hours
3. Time length per week for individual academic consulting	Identify time and modes of consultation outside classroom, e.g. <i>consulting via mobile phone, e-mail, social media</i>
4. Course Learning Outcomes: CLOs	Complete the form (●) in accordance with the statements of responsibilities in OBE2 (program specification) and fill out the Table indicating the ELOs-CLOs Consistency
5. Expected Learning Outcomes of the study program(ELOs)	Define ELOs as specified in OBE2, section 4 (Table 5.1 -Specific course for a particular program; Table 5.2- Course for multiple programs) Put check marks to the ones that apply.

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

Topic	Description
Teaching methods, learning experience and assessment in line with CLOs	See statements in OBE2 (Program specification) section 4. ELOs can be applied to determine course implementation and learning outcomes assessment on the basis of CLOs.