TQF3 Course Specification

Section 1 General Information

1. Course Code and Title

In Thai	ICCH 223/390	เทคนิคปฏิบัติการทางเคมีอินทรีย์
In English	ICCH 223/390	Organic Chemistry Laboratory Techniques

2. Number of Credits 2 (0-4-2)
(Theory ... hrs. Self-study ... hrs Practice ... hrs. / week)

3. Curriculum and Course Type
3.1 Program of Study Bachelor of Science
3.2 Course Type Required course

4. Course Coordinator and Instructor
4.1 Course Coordinator Assoc. Prof. Dr. Pakorn Bovonsombat
Science Division MUIC
02 500 7000 ext.3519
pakorn.bov@mahidol.ac.th
(Name – Department – Contact: phone no. and e-mail address)
4.2 Instructor Assoc. Prof. Dr. Pakorn Bovonsombat

5. Trimester/Class Level
5.1 Trimester All/ Class Level
5.2 Number of Students Allowed Approximately... 24 Students

6. Pre-requisite
ICCH 221 Organic Chemistry I
ICCH 224 Integrated laboratory in Chemistry I
or with the instructor permission

7. Co-requisites
none

8. Study Site Location

Mahidol University, Salaya campus

9. Date of Preparation/Latest Revision of the Course Specifications

Day 21 **Month** August **Year** 2020

Section 2 Aims and Objectives

1. Course Goals

After completing this course, students would attain more excellent organic laboratory and laboratory skills; understand organic reactions in terms of practical handling; develop the ability to identify and determine structure using the skills acquired.

Course Goals: From the overview perspective of the course instructor, based on the principles, knowledge, and skills related to the Program, describe the learning skill the students can develop and apply for further study or work in the future according to the goals set the instructor in charge. This has to correspond to the program goals.

2. Objectives of Course Development/Revision

2.1 Course Objectives

A lab experience is essential for science majors preparing for academic research and careers in industries. This course aims to offer expertise in organic chemistry experiments, emphasizing the acquisition and practice of common organic laboratory techniques such as recrystallisation, distillation, and organic/aqueous phases extraction, and the implementation of organic reactions and employing strategies to purify products.

Course Objectives: Describe in detail the knowledge, understanding, skills, and abilities of students after the course learning achievement from the perspective of the course instructor in charge. The objectives can be written based on learning domains (cognitive, affective, psychomotor, etc.)

2.2 Course-level Learning Outcomes (CLOs)

By the end of the course, students are able to

1. CLO1 Use standard organic laboratory practices and to solve laboratory problems
2. CLO2 Use knowledge to implement organic reactions
3. CLO3 Use knowledge to obtain and purify products
4. CLO4 Communicate/present ideas effectively both oral & written forms, proper to audience groups

5. CLO5 Identify potential hazards associated to chemicals

Remarks:

A. "The course-level expected learning outcomes (CLOs)": Based on the course objectives, explain the knowledge, abilities and skills of students that can be measured and evaluated to make sure that the students get the learning experience, pass the course evaluation based on criteria defined, and achieve the objectives in section 2.1 and the performance based on the standards defined.

B. A good CLO should consist of 3 structural components:
   1. AN ACTION VERB: Identify the ability or skill that the students must perform to be observed or measured.
   2. LEARNING CONTENT: Identify the knowledge that the students will gain and apply for other courses in the program or for future work.
   3. CRITERIA OR STANDARD: Identify the criteria or standards of competency defined in the course to judge the students' achievement.

C. In a CLO, more than one learning domain can be included.

D. Each course should have about 4 – 8 CLOs.

Section 3 Course Description and Implementation

1. Course Description

(In Thai)..... Course Goals should be reflected

ปฏิบัติการเคมีเพิ่มเติมสำหรับนักศึกษาที่สนใจเทคนิคปฏิบัติการทางเคมีอินทรีย์ขั้นสูง โดยการทดสอบปฏิกิริยาเคมีอินทรีย์ต่างๆ ที่หลากหลาย เพื่อเพิ่มพูนองค์ความรู้ และประสบการณ์ เช่น ปฏิกิริยาสังเคราะห์ของกรินยาด ฟรีเดล-คราฟท์ เกลือไดอะโซเนียมและดีลส์-อัลเดอร์ การวิเคราะห์โครงสร้างโมเลกุลโดยใช้สเปกโทรสโกปี

(In English) Supplementary organic laboratory practicals for those interested in developing more and advanced organic laboratory techniques through running more advanced organic reactions; Grignard synthesis; Friedel-Crafts; Diazonium salts; Diels-Alder and spectroscopic analysis

2. Number of hours per trimester

Theory (hours)	Practice (hours)	Self-study (hours)
0 (0 hours x 12 weeks)	48 (4 hours x 12 weeks)	24 hours (2 hours x 12 weeks)

3. Number of Hours per Week for Individual Advice

1 hour/week

Identify the following information: The process or method that the person in-charge uses and time allocated for individual students.

Section 4: Development of the expected learning outcomes

1. A brief summary of the knowledge or skills expected to develop in students; the course-level expected learning outcomes (CLOs)
   By the end of the course, students who successfully complete the course will be able to:
   1. CLO1 Use standard organic laboratory practices and to solve laboratory problems
   2. CLO2 Use knowledge to implement organic reactions
   3. CLO3 Use knowledge to obtain and purify products
   4. CLO4 Communicate/present ideas effectively both oral & written forms, proper to audience groups
   5. CLO5 Identify potential hazards associated to chemicals

2. How to organize learning experiences to develop the knowledge or skills stated in number 1 and how to measure the learning outcomes

ICCH 221	Teaching methods	Evaluation Methods
CLO1	Interactive lecture and laboratory practicals	Pre-lab questions, flowcharts, Lab report and Final
CLO2	Interactive lecture and laboratory practicals	Pre-lab questions, flowcharts, Lab report and Final
CLO3	Interactive lecture and laboratory practicals	Pre-lab questions, flowcharts, Lab report and Final
CLO4	Interactive lecture and laboratory practicals	Pre-lab questions, flowcharts, Lab report and Final
CLO5	Interactive lecture and laboratory practicals	Pre-lab questions, flowcharts, Lab report and Final

Section 5 Lesson Plan and Evaluation

1. Lesson Plan

2.	Topic/Details	Number of hours		Online Sessions	On-Campus	Instructors*	Note**
		In-Class sessions	Lab sessions				
1	Thr 8.00-11.50 Lab safety; separatory funnel handling	-	4	X	***	PkB	Google class-room; Preparation prior to labs: Flowcharts, review of up-loaded video of experiment, lab manual reading.
2	Thr 8.00-11.50 Extractions: Two acids and a neutral com-pound	-	4	X	***	PkB	
3	Thr 8.00-11.50 Recrystalisation of acet-anilide; melting point introduction	-	4	X	***	PkB	
4	Thr 8.00-11.50 Esterification: synthesis of meythyl benzoate	-	4	X	***	PkB	
5	Thr 8.00-11.50 Distillation of methyl benzoate	-	4	X	***	PkB	
6	Thr 8.00-11.50 Nitration of methyl benzoate	-	4	***	***	PkB	
7	Thr 8.00-11.50 Friedel-Crafts alkylation	-	4	***	***	PkB	
8	Thr 8.00-11.50 Aldehydes and ketones	-	4	***	***	PkB	
9	Thr 8.00-11.50 Aldol condesation	-	4	***	***	PkB	
10	Thr 8.00-11.50 Unknowns: via melting points	-	4	***	***	PkB	
11	Thr 8.00-11.50	-	4	***	***	PkB	

2.	Topic/Details	Number of hours		Online	On-	Instructors*	Note**
	Synthesis and reaction of Grignard reagent						
12	Thr 8.00-11.50 Synthesis of triphenyl-methanol. Continuation of Grignard reaction	-	4	***	***	PkB	
	Total	0	48		48		

*PkB = Associate Professor Pakorn Bovonsombat

** Lab 3504, maximum capacity of class = 12-20 students

*** to be determined

2. Evaluation of the CLOs

2.1 Measurement and Evaluation of learning achievement

a. Formative assessment

- Pre-lab flowcharts
- Laboratory practical performance
- Class discussion
- Reflective questions
- Answer comparison

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Use standard organic laboratory practices and to solve laboratory problems	Practicals	10	30
CLO2 Use knowledge to implement organic reactions	Prelabs	20	
CLO3 Use knowledge to obtain and purify products	Practicals	30	30
CLO4 Communicate/present ideas effectively both oral & written forms, proper to audience groups	Final (on-campus)	40	40
CLO5 Identify potential hazards as-			

sociated to chemicals			
TOTAL			100

(2) Measurement and evaluation

Grade	Achievement	Final Score (% Range)	GPA
A	Excellent	90-100	4.0
B+	Very good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly good	75-79	2.5
C	Fair	70-74	2.0
D+	Poor	65-69	1.5
D	Very Poor	60-64	1.0
F	Fail	Less than 60	0.0

Judgment of the learning outcomes in the general education courses

a. Use the symbols O, S, and U or the A, B, … and F.

b. Identify the judgment standard for each symbol.

c. Identify the symbol deemed as "pass."

(3) Re-examination (if the course allows any)

N/A - (Not applicable with MUIC)

Re-examination: Explain the situation in which the course will provide students with re-examination and the judgement of the re-examination results.

3. Students' Appeal In writing to the Associate Dean of Academic Affairs

Identify the following information: The method or channel the students will appeal to the course, the staff member who receives the appeals and processes or procedures

Section 6 Teaching Resources

1. Required Texts

1) Louis F. Fieser, L.F. and Williamson, K.L. **Organic Experiments**, 6th Edition, USA: D.C. Heath and Company; 1987.

2. Suggested Materials

1) Vollhardt, K.P.C. and Schore, N.E. Organic chemistry structure and function 6th Edition USA: W.H. Freeman and Company; 2011.
2) Morrison, R.T., Boyd, R.N. and Boyd, R.K. Organic chemistry 6th Edition USA: Addison-Wesley; 1992.
3) Streitweiser, A., Heathcock, C.H. and Kosower, E. Introduction to organic chemistry 4th Edition USA: MacMillan; 1992.
4) **Other Resources (if any)**
Lab manual, Handouts

Section 7 Evaluation and Improvement of Course Implementation

1. **Strategy for Course Effectiveness Evaluation by Students**

   1.1 Student feedback of instructors, teaching methods and materials, and course content through MUIC student evaluation forms

2. **Strategy for Teaching Evaluation**

   2.1 Evaluation of effectiveness based on student evaluation scores and comments

   2.2 Evaluation through peer observations by co-instructor or other Division faculty

3. **Teaching Improvement**

   3.1 Adjustments based on student feedback, personal observations, comments from peer observations and discussions with supervisor and/or other Division faculty in one-on-one and/or group meetings as specified by MUIC guidelines

4. **Verification of Standard of Learning Outcome for the Course**

   4.1 Verification through student performance on assessments based on MUIC/Division standards

Describe the process used to verify student achievement in accordance with the course learning outcomes, such as the passing score test, test analysis, or assignment. The processes may be different for different courses or for different learning outcomes.

5. **Revision Process and Improvement Plan for Course Effectiveness**

   5.1 Course instructors (and coordinator/supervisor) will meet to discuss results of student evaluations and student performance based on learning outcomes in order to identify point for improvement

   5.2 Strategy for improvement set according to MUIC/Division guidelines

Remarks:

a. Identify ways to gain information used as input to evaluate the course effectiveness. The information includes teaching assessment, such as data from classroom observers and a teaching team or the student's academic performance. Also identify the analysis methods of the input data for teaching and course management improvement.

b. Describe mechanisms and methods to improve the course teaching and effectiveness such as an Executive Board Meeting to review and improve the course (which is reported in the TQF5 in every trimester), classroom research, and workshops for teaching improvement.

Appendix

Relations between the course and the program

Table 1 Relations between the course and the PLOs

Organic chemistry Laboratory Techniques	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
ICCH390			R	P	P	P

Table 2 The relationship between CLOs and Program LOs (Number in table = Sub LOs)

ICCH 221	Learning Outcomes in Chemistry Program					
	PLO1	PLO2	PLO3	PLO4	PLO5	PO6
CLO1 Use standard organic laboratory practices and to solve laboratory problems	1.6					6.3
CLO2 Use knowledge to implement organic reactions	1.7	2.2				
CLO3 Use knowledge to obtain and purify products	1.6 1.7					6.2
CLO4 Communicate/present ideas effectively both oral & written forms, proper to audience groups		2.1	3.1 3.2 3.3	4.1 4.5		6.1
CLO5 Identify potential hazards associated to chemicals					5.2 5.3	

Table 3 The description of Program LOs and Sub LOs of the course

LOs	**Sub LOs**
1. Apply knowledge in both basic and applied chemistry	1.1 Identify and apply concepts related to physical, organic, analytical, inorganic chemistry and biochemistry to solve problems at under-

LOs	Sub LOs
and related scientific disciplines to systematically solve problems involving chemistry in academia and industry	graduate level. 1.2 Use appropriate mathematical, statistical and computational tools to analyze information and solve problems. 1.3 Synthesize information to arrive at logical reasoning in the context of chemistry.
2. Retrieve and appraise scientific literature critically and integrate information for problem solving and scientific research	2.1 Retrieve relevant scientific information from electronic and printed sources independently. 2.2 Analyze and draw meaningful conclusion from the learning materials. 2.1 Manage scientific literatures using reference management software in research.
3. Communicate concepts of chemistry and other sciences using effective excellent English in both written and oral forms to present ideas or solutions purposefully to both the scientific community and the public both locally and globally.	3.1 Communicate ideas and findings effectively in both oral and written forms, proper for audience groups to exchange, debate, demonstrate alternative counterviews as part of a collaboration, scientific discussions or research presentation 3.2 Prepare and deliver a purposeful and organized oral presentation with appropriate visual aids and give credits to others' original works 3.3 Prepare written documents to communicate information, ideas, and results of experiments under standard academic honesty guidelines
4. Demonstrate moral and appropriate conduct as a collaborative scientist with integrity, professionalism and ethics	4.1 Demonstrate moral and appropriate behavior 4.2 Recognize ethical issues related to chemistry research and professional practices 4.3 Identify national and global current issues and their relations to chemistry 4.4 Apply internationally and nationally accepted ethical standards to resolve issues and conflicts 4.5 Collaborate effectively with others as a responsible team member
5. Apply the principles of chemical safety practices for health and the environment in accordance with OSHA and MU standards	5.1 Understand and follow established safety protocols from MU and OSHA such as appropriate use of PPEs, fire alarm, fire extinguishers and other emergency equipment 5.2 Identify potential hazards associated to chemicals and use this information for proper storage or disposal of the chemicals 5.3 Assess risks associated to chemical experiments or processes, plan for prevention and mitigation or propose safer alternatives
6. Apply laboratory techniques and instrumentations in chemistry and other sciences to experiment, verify theory or formulate meaningful original solutions to novel situations, as part of theoretical discussion, experimentation, analysis, or research	6.1 Identify and apply appropriate procedures such as synthesis, extraction, separation, purification, formulation, measurement, quantitation and characterization of chemical compounds 6.2 Understand, predict and interpret chemical spectra from various chemical analysis instruments, including UV-Vis spectrophotometer, FTIR, mass spectrometry, and NMR 6.3 Predict and reason the relationship between structure and reactivity by chemical reasoning and computational/theoretical approach 6.4 Integrate obtained skills and knowledge in pure and applied chemistry and related disciplines to independently formulate his/her own solution to situations/problems