TQF 3 Course Specifications
Section 1 General Information

1. Course code and course title

Thai	ICCH 226 ปฏิบัติการชีวเคมี
English	ICCH 226 Biochemistry Laboratory

2. Number of credits 2 (0-4-2) (Lecture/Lab/Self-study)
3. Program and type of subject
   - 3.1 Program Bachelor of Science (Chemistry)
   - 3.2 Type of Subject Required Major course
4. Course Coordinator and Course Lecturer
   - 4.1 Course Coordinator Manchuta Dangkulwanich, PhD
   - 4.2 Course Lecturers Manchuta Dangkulwanich, manchuta.dan@mahidol.edu
5. Trimester/ Year of Study
   - 5.1 Trimester All trimesters (excluding summer session) / for all students in all International College Undergraduate Programs
   - 5.2 Course Capacity 20 students
6. Pre-requisite ICCH 224 Integrated Laboratory Techniques in Chemistry I
7. Co-requisites ICCH 225 Biochemistry
8. Venue of Study Mahidol University, Salaya Campus

Section 2 Goals and Objectives

1. Course Goals

To provide laboratory experience of various techniques in biochemistry both in *skill-building approach*, where students follow well-define procedures to master techniques, which reinforce the principles, and in *inquiry-based approach*, where students self-design, complete experiments, and draw conclusions to answer certain research-like questions. The course will also emphasize laboratory report writing skills.

2. Objectives of Course Development/Revision

2.1 Course Objectives

Having a lab experience is essential for science majors preparing for both academic research, and for careers in biotechnological, pharmaceutical, and food industries. This course aims to offer experience in biochemistry experiments, including error and statistical analysis of experimental data, identification and reactions of various biomolecules, spectroscopic methods, electrophoretic techniques, chromatographic separations, isolation and characterization of biological materials, and enzyme kinetics.

2.2 Course-level Learning Outcomes: CLOs

By the end of the course, students will be able to (CLOs)

1. CLO 1 Use standard laboratory practice in biochemistry
2. CLO 2 Communicate their experiments with appropriate data, graphs, and written documents
3. CLO 3 Design and conduct biochemical assays or experiments to answer scientific questions

Section 3 Course Management

1. Course Description

ปฏิบัติการด้านชีวเคมี ความคลาดเคลื่อนและการวิเคราะห์ผลการทดลองด้วยสถิติ สมบัติทางกายภาพและทางเคมีของชีวโมเลกุล วิธีทางสเปคโตสโกปี อิเล็กโทรโฟรีซิส การแยกด้วยโครมาโทกราฟฟี การแยกและวิเคราะห์ชีววัตถุและจลศาสตร์ของเอนไซม์

Laboratory practicals in biochemistry, error and statistical analysis of experimental data, physical and chemical properties of biomolecules, spectroscopic methods, electrophoretic techniques, chromatographic separations, isolation and characterization of biological materials, and enzyme kinetics

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
0	48	24

3. Number of hours that the lecturer provides individual counseling and guidance.
1 hour/week

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to:

1. CLO 1 Use standard laboratory practice in biochemistry
2. CLO 2 Communicate their experiments with appropriate data, graphs, and written documents
3. CLO 3 Design and conduct biochemical assays or experiments to answer scientific questions

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

ICCH 372	Teaching methods	Evaluation Methods
CLO1	Laboratory experiments	Performance, lab record
CLO2	Demonstration, class discussion	Individual and group reports
CLO3	Laboratory experiments	Practical exam, individual report

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Number of Hours		Teaching Activities/ Media	Lecturer
		Lecture Hours	Lab/Field Trip/Internship Hours		
1	Introduction Laboratory safety	0	4	Reading assignments, videos, lab briefing, demonstration, discussion	Manchuta Dangkulwanich
2	Exp1.1: pH and buffer Exp1.2: Amino acid titration	0	4		
3	Exp2.1: UV-Vis spectrophotometry Exp2.2: Thymol blue at different pH	0	4		
4	Laboratory report writing workshop	0	4		
5	Exp3.1: Test for various biomolecules Exp3.2: Glucose oxidase assay	0	4		
6	Exp4.1: Lipid emulsification and degree of unsaturation Exp4.2: Cholesterol assay	0	4		
7	Exp5.1: Protein and amino acid Exp5.2: Ion-exchange chromatography	0	4		
8	Exp6.1: Chromatographic separation of amino acids Exp6.2: SDS-PAGE	0	4		
9	Exp7: Amylase activity at different pH	0	4		
10	Exp8.1: Solvent precipitation of protein Exp8.2: Protein concentration assay	0	4		
11	Exp9: Enzyme kinetics	0	4		
12	Self-design experiments	0	4		
	Total	0	48		

Notes: All laboratory hours are conducted on campus.

2. Plan for Assessing Course Learning Outcomes

2.1 Assessing and Evaluating Learning Achievement

a. Formative Assessment

- Class discussion
- Group discussion

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Use standard laboratory practice in biochemistry	Attendance	20	60
	Lab notebook	20	
	Performance	20	
CLO2 Communicate their experiments with appropriate data, graphs, and written documents	Reports	20	20
CLO3 Design and conduct biochemical assays or experiments to answer scientific questions	Lab exam	20	20
			100

(2) Grading System

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

(3) Re-examination (If course lecturer allows to have re-examination)

N/A - (Not applicable with MUIC)

3. Student Appeals

N/A

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials

Laboratory manuals prepared by the instructor.

2. Recommended textbooks and/or other documents/materials

Selected readings from pertinent scientific journals and textbooks or video clips, as posted on the course's e-learning site

3. Other Resources (If any)

N/A

Section 7 Evaluation and Improvement of Course Management

1. Strategies for evaluating course effectiveness by students

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

2. Strategies for evaluating teaching methods

    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. Improvement of teaching methods

    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 process for evaluating students' standard achievement outcomes in the course

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

5. Review and plan for improving the effectiveness of the course

    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

Appendix

Alignment between Courses and General Education courses

Table 1 The relationship between course and Program Learning Outcomes (PLOs)

Biochemistry Laboratory	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
(ICCH373)			P	P	P	P

Note: Indicate the level of CLOs by letter I, R, P or M. Using the information as shown in the Curriculum Mapping of TQF2.

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

ICCH373	Learning Outcomes in the Chemistry Program (CH-PLOs)					
	1	2	3	4	5	6
CLO1 Use standard laboratory practice in biochemistry				4.1	5.1 5.2 5.3	
CLO2 Communicate their experiments with appropriate data, graphs, and written documents			3.1 3.3			
CLO3 Design and conduct biochemical assays or experiments to answer scientific questions						6.3

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

LOs	**Sub LOs**
1. Apply appropriate chemistry knowledge and technical skills to solve problems	1.1 Identify and apply concepts related to physical chemistry to solve problems 1.2 Identify and apply concepts related to organic chemistry to solve problems 1.3 Identify and apply concepts related to analytical chemistry to solve problems 1.4 Identify and apply concepts related to inorganic chemistry to solve problems 1.5 Identify and apply concepts related to biochemistry to solve problems 1.6 Use appropriate technical skills to solve problems 1.7 Synthesize information to arrive at logical reasoning in the context of chemistry
2. Appraise scientific information critically	2.1 Retrieve information independently 2.2 Draw meaningful conclusion from the learning materials 2.3 Assess the relevance of the information 2.4 Manage scientific literatures using reference management software

LOs	Sub LOs
3. Demonstrate proficiency in oral and written communication of scientific concepts	3.1 Communicate/present ideas effectively both oral & written forms, proper to audience groups 3.2 Prepare a purposeful oral presentation 3.3 Prepare written documents to communicate information/ideas
4. Apply scientific integrity and professionalism	4.1 Demonstrate moral and appropriate behavior 4.2 Recognize ethical issues related to chemistry 4.3 Identify national & global current issues and their relations to chemistry 4.4 Apply accepted ethical standards to resolve issues 4.5 Collaborate effectively with others as a responsible team member
5. Apply standard chemical safety and practice in research and industry	5.1 Use proper PPE 5.2 Identify potential hazards associated to chemicals 5.3 Assess risks associated, plan for prevention and mitigation
6. Formulate solutions for novel situations	6.1 Connect, synthesize and/or transform ideas or solutions within a particular framework 6.2 Integrate alternative, divergent, or contradictory perspectives or ideas in the solution of a problem or question 6.3 Create an original explanation or solutions to the situations/problems 6.4 Articulate the rationale for and consequences of his/her solution