TQF 3 Course Specifications
Section 1 General Information

1. Course code and course title

Thai ICCH 371 ชีวเคมี 1

English ICCH 371 Biochemistry I

2. Number of credits 4 (4-0-8) (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 Approximately 40 students
6. Pre-requisite ICBI 101 Biology I, ICCH 221 Organic Chemistry I
7. Co-requisites ICCH 373 Biochemistry Laboratory
8. Venue of Study Mahidol University, Salaya Campus

Section 2 Goals and Objectives

1. Course Goals

To provide an overview of biochemical principles, the structures and functions of biomolecules: amino acids, peptides, proteins, nucleic acids, carbohydrates, and lipids, as well as metabolic pathways common to prokaryotes, plants, and animals, equipping the students with the ability to analyze data from various biochemical experiments, an understanding of chemical reactions that sustain life at the molecular level, and the importance of biochemistry in the 21st century.

2. Objectives of Course Development/Revision

2.1 Course Objectives

Understanding of the principles of biochemistry and metabolic pathways is essential for the student's future endeavors in all areas of the life sciences, including applied sciences such as environmental, medical, and food sciences. This course aims to offer the basic principles of biochemistry, the structures and functions of biomolecules, their metabolisms, as well as their applications and impacts in the real world.

2.2 Course-level Learning Outcomes: CLOs

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

1. CLO 1 Describe the structure and function of biomolecules
2. CLO 2 Explain the metabolic processes and their integration
3. CLO 3 Apply biochemical concepts to solve problems in biochemistry
4. CLO 4 Apply mathematic skills to biological problems
5. CLO 5 Use effective means of communication to collaborate with peers

Section 3 Course Management

1. Course Description

โครงสร้างและหน้าที่ของชีวโมเลกุลทั้งโปรตีน คาร์โบไฮเดรต ไขมัน และกรดนิวคลีอิก การเร่งปฏิกิริยาชีวภาพ พลังงานในสิ่งมีชีวิต วิถีเมแทบอลิซึมและการควบคุมในระดับเซลล์และโมเลกุล

Structure and function of biomolecules, especially proteins, carbohydrates, lipids, and nucleic acids, biological catalysis, bioenergetics, metabolic pathways and regulations at the cellular and molecular level

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
48	0	96

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 Describe the structure and function of biomolecules
2. CLO 2 Explain the metabolic processes and their integration
3. CLO 3 Apply biochemical concepts to solve problems in biochemistry
4. CLO 4 Apply mathematic skills to biological problems
5. CLO 5 Use effective means of communication to collaborate with peers

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

ICCH 371	Teaching methods	Evaluation Methods
CLO1	Reading assignment, interactive lecture, case studies, quiz, group activities, group discussion,	Class discussion, exam
CLO2	Reading assignment, interactive lecture, case studies, quiz, group activities, group discussion	Class discussion, exam
CLO3	Reading assignment, group activities, case studies, group discussion	Class discussion, exam
CLO4	Reading assignment, demonstration, group activities, group discussion, case studies	Class discussion, exam
CLO5	Demonstration, group discussion	Observation, Peer evaluation

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	The foundations of Biochemistry Water's roles in biochemistry	4	0	Reading assignment, interactive lecture, quiz, group, activities, case studies, group discussion, demonstration	Manchuta Dangkulwanich
2	Amino acids and peptides Exploring proteins	4	0		
3	Protein function Enzyme kinetics	4	0		
4	Carbohydrates Nucleic acids and DNA-based technologies	4	0		
5	Lipids Membrane and Transport	4	0		
6	Signal Transduction Basic concepts and Design of metabolism	4	0		
7	Glycolysis and Gluconeogenesis The citric cycle	4	0		
8	Oxidative phosphorylation	4	0		
9	The light reaction of photosynthesis and the Calvin cycle	4	0		
10	Glycogen metabolism and the pentose phosphate pathway	4	0		
11	Fatty acid and Lipid metabolism	4	0		
12	Metabolism of Nitrogen-containing molecules	4	0		
	Total	48	0		

2. Plan for Assessing Course Learning Outcomes

2.1 Assessing and Evaluating Learning Achievement

a. Formative Assessment

- Worksheet
- Class discussion
- Group discussion

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Describe the structure and function of biomolecules	Midterm I	20	25
	Assignments	5	
CLO2 Explain the metabolic processes and their integration	Midterm II	20	25
	Assignments	5	
CLO3 Apply biochemical concepts to solve problems in biochemistry	Midterm II	5	35
	Final	25	
	Assignments	5	
CLO4 Apply mathematic skills to biological problems	Midterm I	5	10
	Assignments	5	
CLO 5 Use effective means of communication to collaborate with peers	Peer evaluation	5	5
			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

According to OAA standard protocols.

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials

(1) Tymoczko, J.L., Berg, J.M., and Styer L. **Biochemistry: a short course**, 3rd edition, USA: W.H. Freeman and Co.; 2015.

2. Recommended textbooks and/or other documents/materials

(1) Nelson, D.L. and Cox, M. M. **Lehninger Principles of Biochemistry** 7th Edition, USA: W.H. Freeman and Co.; 2017.

(2) Ferrier, D.R. **Lippincott Illustrated Reviews: Biochemistry** 7th Edition, USA: Wolters Kluwer; 2017.

(3) 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 I	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
(ICCH371)	R	R		R		R

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)

ICCH371	Learning Outcomes in the Chemistry Program (CH-PLOs)					
	1	2	3	4	5	6
CLO1 Describe the structure and function of biomolecules	1.5					
CLO2 Explain the metabolic processes and their integration	1.5	2.1 2.2 2.3				
CLO3 Apply biochemical concepts to solve problems in biochemistry	1.5 1.6 1.7					6.1
CLO4 Apply mathematic skills to biological problems	1.5 1.6					6.3
CLO 5 Use effective means of communication to collaborate with peers			3.1	4.1 4.2		

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

LOs	Sub LOs
	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
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