TQF 3 Course Specification

Section 1 General Information

1. Course Code and Title

In Thai ICBI 271 การปฏิบัติการทางจุลชีววิทยา

In English ICBI 271 General Microbiology Laboratory

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

3. Curriculum and Course Type

3.1 Curriculum Bachelor Degree Program (International)

3.2 Course Type Specific Course X Compulsory Course ❑ Electives

4. Course Coordinator and Lecturer

4.1 Course Responsible Lecturers Asst. Prof. Tumnoon Charaslertrangsi, Ph.D.

4.2 Lecturers Asst. Prof. Tumnoon Charaslertrangsi, Ph.D.
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5. Trimester/Class Level

5.1 Trimester 2/2022-2023

5.2 Number of Students Allowed Approximately 25 students

6. Pre-requisite ICBI 121 Biology 1 4 (3-2-7)

7. Co-requisites ICBI 214 General Microbiology 4 (4-0-8)

8. Study Site Location Mahidol University Salaya Campus

Section 2 Aims and Objectives

Course Goals

ICBI 271 General Microbiology Laboratory 2 (0-4-2) is a co-requisite course, taken with ICBI 214 General Microbiology 4 (4-0-8). This course aims to expose the students to basic microbiological techniques, including aseptic technique, microscopic examination, various staining procedures, and cultivation and identification of microbes. As such, this course emphasizes psychomotor skills, rendering awareness of biosafety and general lab safety crucial. Laboratory thinking skills such as cognitive processes, analytical skills, communications, and interpersonal skills are emphasized.

2. Objectives of Course Development/Revision

2.1 Course Objectives

The course aims to expose the students to hands-on technical skills in a standard microbiology laboratory. Course development/revision aims to improve the teaching and learning pedagogy continuously.

2.2 Course-level Learning Outcomes: CLOs

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

CLO1 – Describe knowledge in microbiology laboratory by understanding the principles underlying the technical procedures as well as comprehend the danger, risk, safety precautions, and regulations involved in working with microorganisms through writing lab reports and written assessments (Program Learning Outcome 1.1, 1.2, 1.3, 1.5)

CLO2 – Perform technical skills in the microbiology laboratory, including correctly operate and perform standard microbiology laboratory equipment and procedures (e.g., aseptic technique, prepare slides for microbiological examination, use a bright field light microscope, and use of microbiological media and test systems) (Program Learning Outcome 1.3)

CLO3 – Comprehend, interpret, and conclude qualitative, quantitative data and/or ideas (e.g., estimation of the number of microbes in a sample using serial dilution techniques; Data presentation (e.g., graphs, tables, figures, or descriptive paragraph)) in microbiology laboratory as shown from lab report submissions (Program Learning Outcome 2.1, 2.2)

CLO4 – Demonstrate proficiency in written communication of microbiology (Program Learning Outcome 3.2)

Section 3 Course Description and Implementation

1. Course Description

(Thai) ฝึกวิธีปฏิบัติการขั้นพื้นฐานในจุลชีววิทยา การดูลักษณะของเซลล์จุลินทรีย์โดยกล้องจุลทรรศน์ การย้อมสีเซลล์ การดูลักษณะโคโลนีของจุลินทรีย์บนอาหารวุ้น การตรวจวัดความเจริญของจุลินทรีย์โดยการนับเซลล์ที่โตบนวุ้นเพาะเลี้ยงเชื้อ และการนับเซลล์ด้วยฮีมาไซโตมิเตอร์ วิธีการเพาะเลี้ยงเชื้อในอาหารเหลว และอาหารแข็ง วิธีการจำแนกเชื้อแบคทีเรียโดยอาศัยอาหารเลี้ยงเชื้อจำเพาะ

(English) Basic techniques in microbiological experiments; microscopic examination of microbial cells and spores; simple staining; Gram staining; colony morphology; viable cells count; hemacytometer; cultivation on liquid and solid media; bacterial identification using selective and differential media.

2. Number of hours per trimester

Theory (hours)	**Practice** (hours)	**Self-study** (hours)
0	48	24

3. Number of Hours per Week for Individual Advice 4 hrs

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)

The majority of the knowledge and skills in this course will be technical skills in the microbiology laboratory. The principles underlying the technical procedures and comprehend the danger, risk, safety precautions, and regulations involved in working with microorganisms will be necessary. Students will perform technical skills in the microbiology laboratory, including correctly operating and performing standard microbiology laboratory equipment and procedures (e.g., aseptic technique, preparing slides for microbiological examination, using a bright field light microscope, and use of microbiological media and test systems). The results from their operation will require interpretation and conclusion. Thus, the students will be required to comprehend qualitative, quantitative data and/or ideas (e.g., estimation of the number of microbes in a sample using serial dilution techniques; data presentation (e.g., graphs, tables, figures, or descriptive paragraph)). Drawing meaningful conclusions from the scientific data/ materials (quantitative and qualitative) will be new skills that need practicing even though the students should have been introduced in ICBI 121 Biology I. Finally, the students should demonstrate proficiency in written communication of microbiology, which is a soft skill practiced through writing lab reports.

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

CLOs	Teaching and learning experience			Learning outcomes measurements			
	Pre-lab briefing	Lab practical	Study questions	Recorded VDO assignment	Lab reports	Quizzes	Written and practical examinations
CLO1	X	X	X		X	X	X
CLO2	X	X	X	X	X	X	X
CLO3	X	X	X		X	X	X
CLO4	X	X	X		X		

Section 5 Lesson Plan and Evaluation

1. Lesson Plan

Teaching Period	Topics/Details	Number of hours		Methods: Teaching, Media	Instructor
		Theory	Practice		
1	Introduction and expectation; lab safety, lab instruments, and biohazard; Medium preparation and pour plate; inoculation and aseptic technique		4	Introduction; Laboratory exercise	TC
2	Media preparation; autoclave and waste management; aseptic technique review; microscope and wet mount; pipetting; culture inoculation		4	Pre-lab briefing; Laboratory exercise	TC
3	Examination of fungal spores; isolation and transfer fungal inoculum; microbial growth and methods to determine microbial growth; dilution and spectrophotometry		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC
4	Streak for isolation; examination of bacterial plates; simple staining; Quiz 1		4	Pre-lab briefing; Laboratory exercise; Result discussion; Written assessment	TC
5	Gram stain and endospore stain		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC
6	Serial dilution, CFU count using spread plate and pour plate technique; Experiment 1: Enumeration of microorganisms in leafy green produce		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC
7	Field trip to TBRC (optional)		4	Field trip	TC
8	Mid-term review and assessment period (i.e., lab quiz 2); Introduction to selective plating; catalase, oxidase test and indole test; hemocytometer and examination of the budding yeast; Experiment 2: Temperature inactivation of microbes OR resazurin dye reduction assay		4	Written assessment; Pre-lab briefing; Laboratory exercise; Result discussion	TC
9	TSI slant; carbohydrate fermentation tests; Kirby Bauer Disk Diffusion Assay; API 20E		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC

Teaching Period	Topics/Details	Number of hours		Methods: Teaching, Media	Instructor
		Theory	Practice		
10	Experiment 3: Essential oil and antimicrobial activity		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC
11	Guest speakers; Free session to review for practical skills exam		4	Pre-lab briefing; Laboratory exercise; Result discussion	TC
12	Summative practical skills assessment		4	In-class assessment	TC
	Total hours of the entire trimester		48		

2. Plan for Assessment of Expected Course-Level Learning Outcomes (CLOs)

2.1 Measurement and Evaluation of learning achievement

A. Formative Assessment

CLO1 – Describe knowledge in microbiology laboratory by understanding the principles underlying the technical procedures as well as comprehend the danger, risk, safety precautions, and regulations involved in working with microorganisms through writing lab reports and written assessments (Program Learning Outcome 1.1, 1.2, 1.3, 1.5)

CLO2 – Perform technical skills in the microbiology laboratory, including correctly operate and perform standard microbiology laboratory equipment and procedures (e.g., aseptic technique, prepare slides for microbiological examination, use a bright field light microscope, and use of microbiological media and test systems) (Program Learning Outcome 1.3)

CLO3 – Comprehend, interpret, and conclude qualitative, quantitative data and/or ideas (e.g., estimation of the number of microbes in a sample using serial dilution techniques; Data presentation (e.g., graphs, tables, figures, or descriptive paragraph)) in microbiology laboratory as shown from lab report submissions (Program Learning Outcome 2.1, 2.2)

CLO4 – Demonstrate proficiency in written communication of microbiology (Program Learning Outcome 3.2)

Learning Outcomes	Performance criteria (assessment methods)	Weight distribution (Percentage)

Professionalism and conduct	Inappropriate lab attire and other misconducts	Point deduction
CLO1, 3	Two lab quizzes	10% (5% each)
CLO2	VDO assignment (2 tasks) (optional first submission)	10% (5% each)
CLO1, 3, 4	Lab reports and lab notebook submission	60%
Total		80%

B. Summative Assessment

(1) Tool and weight for measurement and evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio	(Percentage)
Final written examination			
CLO1 – Possess knowledge in the microbiology laboratory	Written assessment	2	10%
CLO3 – Comprehend qualitative, quantitative data and/or ideas		8	
Final practical skill demonstration			
CLO2 – Possess technical skills in the microbiology laboratory	Practical assessment	-	10%
Total			20%

3. Other assessments

N/A

4. 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+	Fairy 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

*Other letter grades, without credit points, are assigned as follows: I – Incomplete (awaiting evaluation); T – Transfer of credit; X – No report from the instructor; P – In progress (the study is incomplete); S – Satisfactory; U – Unsatisfactory; AU – Audit (a study which leads to no credit); W – Withdrawal

** assignment of other letter grades will follow the policies and rules outlined in Mahidol University International College Student Handbook 2022-2023.

5. Re-examination (if the course allows any.)

N/A - (Not applicable in MUIC

6. Students' Appeal

Following MUIC policy

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials

- Course Lab Manual
- Harley JP. Laboratory exercises in microbiology. 10th Ed. McGraw-Hill Education; 2016.
- Barker K. At the bench: A laboratory navigator. New York: Cold Spring Harbor Laboratory Press; 2005.
- Adams DS. Lab math: A handbook of measurements, calculations, and other quantitative skills for use at the bench. US: Cold Spring Harbor Laboratory Press; 2003.
- McGraw-Hill Connect. Virtual Lab; 2021. https://connect.mheducation.com

2. Recommended textbooks and/or other documents/materials

- Course Lab Manual
- Lab hand-outs
- Various multimedia lab skill demonstration videos

3. Other Resources

- American Society for Microbiology. Laboratory protocols. Available from <https://asm.org/Browse-By-Content-Type/Protocols>
- Online academic database (e.g., www.sciencedirect.com, isiwebofknowledge)

Section 7 Evaluation and Improvement of Course Management

1. Strategies for evaluating course effectiveness by students

To effectively improve the course, students' feedback will be beneficial to improve the system. Throughout the semester, mid-course evaluation by the students will be employed using the Start-Stop-Continue survey. End-of-the-course evaluation will be conducted in the MUIC Sky System. The assessment is required by all students. The students have the option to opt-out and input "N/A" in the course evaluation. The students will remain anonymous in the assessment.

2. Strategies for evaluating teaching methods

Obtaining students' feedback at various time points will be beneficial to evaluate the pace of the class and teaching methods. Equally significant is the improvement of the teaching method, which is described below. Another evaluation strategy is to utilize a One-Minute Paper during the end of the semester (week 10).

3. Improvement of teaching methods

The Start-Stop-Continue technique employed during the mid-course period can be used to improve the teaching method immediately. Another approach is to invite other faculty members to observe how their comments will be helpful for continuous improvement. Concerning the end of the course evaluation, it will provide an opportunity for improvement after the course but will not help during the period.

4. Verification process for evaluating students' standard achievement outcomes in the course

The learning outcome will be assessed by the attendance, oral presentation, participation, submission of the lab report, lab product outcome submission, and practical skill demonstration. These evaluations of learning outcomes are quite standard assessment pedagogies.

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

After the end of the course, the students will have the opportunity to provide feedback and evaluation of the course via an online evaluation system, MUIC Sky System. The results and comments will be used to improve the course preparation for the next semester. Also, some changes may become more aligned with the curriculum.

Appendix

Relations between the course and the program

Table 1 Relations between the course and the PLOs

General Microbiology Laboratory	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
ICBI 271	P	P	P			

Table 2 Relations between CLOs and PLOs

ICBI 271	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1 - Describe knowledge in microbiology laboratory by understanding the principles underlying the technical procedures as well as comprehend the danger, risk, safety precautions, and regulations involved in working with microorganisms	1.1, 1.2, 1.3, 1.5					
CLO2 – Perform technical skills in the microbiology laboratory, including correctly operate and perform standard microbiology laboratory equipment and procedures (e.g., aseptic technique, prepare slides for microbiological examination, use a bright field light microscope, and use of microbiological media and test systems)	1.3					
CLO3 – Comprehend, interpret, and conclude qualitative, quantitative data and/or ideas (e.g., estimation of the number of microbes in a sample using serial dilution techniques; Data presentation (e.g., graphs, tables, figures, or descriptive paragraph)) in the microbiology laboratory		2.1, 2.2				
CLO4 – Demonstrate proficiency in written communication of microbiology			3.2			

Table 3 PLOs and SubPLOs that the course is responsible for

Program Learning Outcomes (PLOs)	SubPLOs
1. Apply knowledge and technical skills of diverse biological disciplines to address health, societal and environmental issues	1.1 Explain the fundamental and detailed knowledge of biological sciences
	1.2 Apply knowledge in biological sciences to address health, societal and environmental issues
	1.3 Perform experimentation in laboratory or field
	1.4 Apply technical skills in biological sciences to address health, societal and environmental issues
	1.5 Integrate biological sciences knowledge and technical skills across different disciplines to solve problems in biological sciences
2. Critically appraise information from scientific articles/journals, biological research methodology, and experimentation to draw a meaningful conclusion from the materials	2.1 Explain qualitative and quantitative data and/or ideas in basic biological sciences
	2.2 Draw meaningful conclusion from the learning materials such as scientific articles, research methodology, and scientific findings
	2.3 Retrieve relevant scientific information independently from textbooks, literatures, and databases
	2.4 Manage scientific literatures using a reference-management program
	2.5 Assess the scientific relevance of information acquired to the objective at hand
3. Proficient in oral and written communication of biological sciences concepts formally and informally to both scientific community and general audience	3.1 Proficient in oral communication of ideas, concepts, and findings in biological sciences to both the scientific community and the wider society
	3.2 Proficient in written communication of ideas, concepts, and findings biological sciences to both the scientific community and the wider society
4. Apply scientific integrity, professionalism, and competencies to function independently as well as as a team player	4.1 Maintain data integrity using appropriate tools and acceptable methods
	4.2 Work independently or coordinate with others to complete tasks at hand

	4.3 Apply concepts of lab and fieldwork safety when carrying out the tasks
	4.4 Set, plan and accomplish the assigned project in a timely manner
5. Apply moral and ethical values when dealing with issues relating to humans, animals, and the environment, enabling actions based on moral and ethical judgment	5.1 Recognize ethical issues in human and animal experimentation
	5.2 Recognize emerging ethical issues in biological sciences
	5.3 Apply accepted ethical standards to resolve ethical dilemma
	5.4 Implement the course of action in accordance with moral and ethical judgment
6. Demonstrate innovative mindset to formulate and create solutions for situations relevant to oneself, the well-being of others, and the natural environment	6.1 Formulate lines of enquiry to drive problem-solving relevant to oneself, the well-being of others, and the natural environment
	6.2 Formulate a process for data acquisition based on scientific methodology
	6.3 Demonstrate systematic and logical thinking in formulating solutions through the application of knowledge and technical skills acquired from the different biological science disciplines
	6.4 Explain the potential for knowledge transfer to innovation
	6.5 Create networks to learn from others and create new ideas