**TQF 3 Course Specifications**

**Section 1 General Information**

1. Course code and course title

 Thai ICBI 316 จุลชีววิทยาสิ่งแวดล้อม

English ICBI 316 Environmental Microbiology

2. Number of credits 4 (3-2-7)

3. Program and type of subject

 3.1 Program Undergraduate Degree (International Program)

 3.2 Type of Subject Required major course

4. Course Coordinator and Course Lecturer

 4.1 Course Coordinator TBA

 4.2 Course Lecturer TBA

5. Trimester/ Year of Study

 5.1 Trimester All trimester

 5.2 Course Capacity 25 students

6. Pre-requisite ICBI 214

7. Co-requisites N/A

8. Venue of Study Mahidol University Salaya Campus

9. Date of Latest Revision May 2018

**Section 2 Goals and Objectives**

1. Course Goals

This third-year course in environmental microbiology aims to explore the interaction of microorganisms and their biotic and abiotic components in the environment. We will also examine the influence of microbes on the biogeochemical cycles and various metabolic processes. Students will read scientific articles as well as deliver discuss their papers. Students should practice becoming analytical as they apply their basic microbiology knowledge into environmental context. Practical exercises included.

1. Objectives of Course Development/Revision

 2.1 Course Objectives

Objectives of course development/revision is to align with the Biological Science Program Expected Learning Outcomes.

 2.2 Course-level Learning Outcomes (CLOs)

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

CLO1 Apply knowledge of basic microbiology into environmental microbiology

CLO2 Comprehend qualitative and quantitative data in environmental microbiology

CLO3 Able to draw meaningful conclusions from qualitative and quantitative data

CLO4 Demonstrate proficiency in oral and written communication of concepts in environmental microbiology

CLO5 Recognize emerging issues in environmental microbiology

CLO6 Demonstrate systematic and logical thinking in solving environmental problems using microorganisms (e.g., understand the potential of microbiology in solving environmental issues)

**Section 3 Course Management**

1. Course Description

(Thai) พื้นฐานทางสรีรวิทยาและนิเวศวิทยาของจุลินทรีย์ อิทธิพลจากสิ่งแวดล้อมต่อจุลินทรีย์ ผลกระทบจากกระบวนการเผาผลาญต่อสภาพแวดล้อม การหมุนเวียนในชีวธรณีเคมี และการเพิ่มขึ้นของการเกิดปฏิกิริยาจากจุลชีพ

(English) Fundamental aspect of microbial physiology and ecology, influence of environment on microorganisms, effect of microbial metabolic processes on the environment, biogeochemical cycle, microbial activity in augmentation

2. Credit hours per trimester

|  |  |  |
| --- | --- | --- |
| Lecture (Hour(s)) | Laboratory/field trip/internship (Hour(s)) | Self-study(Hour(s)) |
| 3 hr | 2 hr | 7 hr |

3. Number of hours that the lecturer provides individual counseling and guidance.

4 hours per 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)

CLO1 Apply knowledge of basic microbiology into environmental microbiology

CLO2 Comprehend qualitative and quantitative data in environmental microbiology

CLO3 Able to draw meaningful conclusions from qualitative and quantitative data

CLO4 Demonstrate proficiency in oral and written communication of concepts in environmental microbiology

CLO5 Recognize emerging issues in environmental microbiology

CLO6 Demonstrate systematic and logical thinking in solving environmental problems using microorganisms (e.g., understand the potential of microbiology in solving environmental issues)

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

|  |  |  |
| --- | --- | --- |
| ICBI 316 | Teaching methods | Evaluation Methods |
| CLO1 | Lectures and class discussion  | Written examination |
| CLO2 | Scientific literature appraisal, group discussion, oral presentation | Group discussion and oral presentation |
| CLO3 | Scientific literature appraisal, group discussion, oral presentation | Written examination, group discussion and oral presentation |
| CLO4 | Term paper | Written examination |
| CLO5 | Lectures, class discussion, scientific literature appraisal, group discussion, oral presentation, written assignment (term paper) | Written examination, group discussion |
| CLO6 | Lectures, class discussion, scientific literature appraisal, group discussion, oral presentation, written assignment (term paper) | Written examination, oral presentation  |

**Section 5 Teaching and Evaluation Plans**

1. Teaching plan

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Topic** | **Number of Hours** | **Teaching Activities/ Media** | **Lecturer** |
| **Lecture Hours** | **Lab/Field****Hours** |
| 1 | Overview and history of environmental microbiology | 3 |  | Lecture, case study | TBA |
| Introduction to lab, lab safety |  | 2 | Lecture, case study | TBA |
| 2 | Cell biology and genetics in environmental microbiology | 3 |  | Lecture, case study | TBA |
| Sampling of biomass |  | 2 | Lecture, case study | TBA |
| 3 | Biosynthesis and fueling | 3 |  | Lecture, case study | TBA |
| Isolation and identification of isolates |  | 2 | Lecture, case study | TBA |
| 4 | Metabolic diversity | 3 |  | Lecture, case study | TBA |
| Enumeration techniques |  | 2 | Lecture, case study | TBA |
| 5 | Metabolic diversity | 3 |  | Lecture, case study | TBA |
| Characterization of isolates |  | 2 | Discussion | TBA |
| 6 | Scientific literature presentation | 3 |  | Lecture, case study  | TBA |
| Characterization of isolates |  | 2 | Lecture, case study | TBA |
| 7 | Mid-term exam | 3 |  | Written examination | TBA |
| 8 | Field visit sampling  |  | 5 | Field visit sampling  | TBA |
| 9 | Advance methods in environmental microbiology; Populations, communities, and ecosystems | 3 |  | Lecture, case study | TBA |
|  | Sample processing |  | 1 |  |  |
| 10 | Applied environmental microbiology: biodeterioration, solid and liquid wastes | 4 |  | Lecture, case study | TBA |
| Characterizing isolates |  | 2 | Lecture, case study | TBA |
| 11 | Applied environmental microbiology: Bioremediation, biodegradation | 3 |  | Lecture, case study | TBA |
| Biodegradation experiment |  | 2 | Lecture, case study | TBA |
| 12 | Applied environmental microbiology: Biological pest control; Review | 5 |  | Students’ presentation | TBA |
| Biodegradation experiment |  | 2 |  | TBA |
|  | Total | 36 | 24 |  |  |

2. Plan for Assessing Course Learning Outcomes

 2.1 Assessing and Evaluating Learning Achievement

 a. Formative Assessment

* + Mid-term examination 30%
	+ Scientific literature group presentation 15%
	+ Assignments and lab reports 20%
	+ Final examination 35%

b. Summative Assessment

 (1) Tools and Percentage Weight in Assessment and Evaluation

|  |  |  |
| --- | --- | --- |
| Learning Outcomes | Assessment Methods | Assessment Ratio (Percentage) |
| CLO1  | Written Examination – MCQ, short answer, long answer | 60 |
| CLO2 | Scientific literature group discussion | N/A |
| CLO3  | N/A |
| CLO4  | Written Examination – MCQ, short answer, long answer | 10 |
| CLO5 | Scientific literature group discussion; Lab reports | N/A |
| CLO6 | Written examination | 30 |
| Total | 100% (35% of final grade) |

(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 |

\*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 (study which leads to no credit); W – Withdrawal

\*\*Assignment of other letter grades will follow the policies and rules set forth in Mahidol University International College Student Handbook 2017-2018.

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

 N/A - (Not applicable with MUIC)

3. Student Appeals

 Student’s appeal process will be according to the policy set forth by MUIC and those stated in the Student Handbook

**Section 6 Teaching Materials and Resources**

1. Textbooks and/or other documents/materials

Madigan MT, Martinko JM, Bender KS, Buckley DH, Stahl DA. Brock Biology of Microorganisms. 14th Ed. Pearson Benjamin Cummings Publishers; 2012.

2. Recommended textbooks and/or other documents/materials

Online scientific database

3. Other Resources (If any)

N/A

**Section 7 Evaluation and Improvement of Course Management**

1. Strategies for evaluating course effectiveness by students

 Post course evaluation by students using the SKY System. Post course evaluation include course content, course management (management of teaching, learning, and grading), qualification and responsibility, teaching techniques and methods, and overall satisfaction.

2. Strategies for evaluating teaching methods

Student’s feedback using Start-Stop-Continue. Post course evaluation.

3. Improvement of teaching methods

Student’s verbal feedbacks and post course evaluation. Faculty peer observation of teaching

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

Analysis of grade distribution of written examination (e.g., mean, median, mode, standard deviation)

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

Review the course before each trimester and address the teaching and learning concerns

**Appendix**

**Alignment between Courses and Program**

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

|  |  |
| --- | --- |
| Environmental microbiology  | Program Learning Outcomes (PLOs) |
| PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 |
|  ICBI 316 | P | P | P |  | P/R | P/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 PLOs

|  |  |
| --- | --- |
| ICBI 316 | Program Learning Outcomes (PLOs) |
| PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 |
| CLO1 Apply knowledge of basic microbiology into environmental microbiology | 1.2 |  |  |  |  |  |
| CLO2 Comprehend qualitative and quantitative data in environmental microbiology |  | 2.1 |  |  |  |  |
| CLO3 Able to draw meaningful conclusions from qualitative and quantitative data  |  | 2.2 |  |  |  |  |
| CLO4 Demonstrate proficiency in oral and written communication of concepts in environmental microbiology |  |  | 3.1, 3.2 |  |  |  |
| CLO5 Recognize the emerging issues in environmental microbiology |  |  |  |  | 5.2 |  |
| CLO6 Demonstrate systematic and logical thinking in solving environmental problems using microorganisms (e.g., Understand the potential of microbiology in solving environmental issues) |  |  |  |  |  | 6.3, 6.4 |

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

|  |  |
| --- | --- |
| PLOs | SubPLOs |
| PLO1 Apply discipline-specific knowledge and technical skills in biological sciences | 1.2 Apply knowledge in environmental microbiology  |
| PLO2 Appraise scientific information critically | 2.1 Comprehend qualitative, quantitative data and/or ideas |
| 2.2 Draw meaningful conclusions from the scientific data/ materials (quantitative and qualitative) |
| PLO3 Demonstrate proficiency in oral and written communication of scientific concepts | 3.1 Demonstrate proficiency in oral communication of concepts in environmental microbiology |
| 3.2 Demonstrate proficiency in written communication of concepts in environmental microbiology  |
| PLO5 Possess moral and ethical values | 5.2 Recognize emerging ethical issues in biological science |
| PLO6 Able to integrate different disciplines to formulate solutions for novel situations | 6.3 Demonstrate systematic and logical thinking |
| 6.4 Understand the potential for knowledge transfer towards innovation |