



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN 103

School of Bioinnovation and Bio-based Product Intelligence

## Course Specification

### Section 1 General Information

#### 1. Course Code and Title

In Thai

วทณว ๑๐๓ ชีวนวัตกรรมและสังคมยั่งยืน

In English

SCIN 103 Bioinnovation and Sustainable Society

#### 2. Number of Credits

3 (3-0-6) Credits

(Theory 3 hrs. Practice 0 hrs. Self-Study 6 hrs./week)

#### 3. Curriculum and Course Type

3.1 Program

Bachelor of Science Program in Bioinnovation

(International Program) (Multidisciplinary Program)

3.2 Course Type

☒ Specific Course ☐ Compulsory Course ☐ Elective Course

#### 4. Course Coordinator and Instructor

4.1 Course Responsible Instructor

1) Assoc. Prof. Dr. Kanyaratt Supaibulwatana

Department of Biotechnology, Faculty of Science, Mahidol University

272 Rama VI Rd., Ratchathewi, Bangkok 10400

Tel: 02-201-5303, e-mail: kanyaratt.sup@mahidol.ac.th

2) Dr. Papasara Chantawichitwong

School of Bioinnovation and Bio-based Product Intelligence

Faculty of Science, Mahidol University

e-mail: papasara.cha@mahidol.ac.th

4.2 Instructors

1) Assoc. Prof. Dr. Kanyaratt Supaibulwatana

Department of Biotechnology, Faculty of Science, Mahidol University

2) Asst. Prof. Dr. Sitthivut Charoensutthivarakul

Department of Pharmacology, Faculty of Science, Mahidol University

3) Dr. Stefan Schreier

School of Bioinnovation and Bio-based Product Intelligence

4) Dr. Tatpong Tulyananda

School of Bioinnovation and Bio-based Product Intelligence



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

- 5) Dr. Papasara Chantawichitwong  
School of Bioinnovation and Bio-based Product Intelligence
- 6) Asst. Prof. Dr. Siriyupa Netramai  
Invited Lecturer
- 7) Dr. Thitisilp Kijchavengkul  
Invited Lecturer
- 8) Ms. Wannisa Chuekong (Teaching assistance)  
School of Bioinnovation and Bio-based Product Intelligence

## 5. Semester/Class Level

- 5.1 Semester 1st Semester/ First Year
- 5.2 Number of Students Allowed Approximately 30 Students

6. Prerequisites None

7. Co-requisites None

## 8. Date of Preparation/Latest Revision of the Course Specifications

1 April 2026

## Section 2 Course Goals and Course Description

### 1. Course Goals

At the end of the course, students will be able to explain the philosophy, principles, and significance of natural resource management, biodiversity conservation, and sustainability in the context of global development, including the interrelationship between human activities and environmental systems. Students will also be able to discuss case studies and contemporary issues related to bioinnovation, sustainable resource utilization, and the application of bioresources, bioproducts, and biological wastes in science, technology, agriculture, industry, and environmental management. In addition, students will be able to apply knowledge of bioinnovation and sustainable development to propose creative and interdisciplinary approaches that contribute to sustainable benefits for humankind, society, and the global environment. Furthermore, students will be able to assess the benefits, opportunities, limitations, and challenges associated with the utilization of bioresources and bio-based innovations in the modern economy and sustainable society.



## 2. Course Description

(In Thai)

ปรัชญาและหลักการพื้นฐานด้านการจัดการทรัพยากรธรรมชาติ ความหลากหลายทางชีวภาพ ความสัมพันธ์ของความต้องการและการจัดหาทรัพยากรกับมนุษย์และสิ่งแวดล้อม ศักยภาพของสิ่งมีชีวิต ชีวภัณฑ์ ผลพลอยได้จากกระบวนการทางชีวภัณฑ์ และของเสียจากชีวภาพ การสร้างสรรค์และบูรณาการชีวนวัตกรรมเพื่อประโยชน์อย่างยั่งยืนต่อสังคมมนุษย์และสิ่งแวดล้อมโลก

(In English)

The philosophy and significant roles of natural resources management; biodiversity; relation of resource demand and supply with human and environment; potential of bioresources, bio-products, co-products, and biological wastes; creative strategies and integration of Bioinnovation for sustainable benefits of mankind, society and global environment.

## Section 3 Course Objectives, Course-level Learning Outcomes and Course Implementation

### 1. Course Objectives

The objectives of this course are to provide students with knowledge, concepts, and principles related to natural resource management, sustainability, and bioinnovation in the context of global development. The course aims to promote understanding of the interrelationship between human activities, environmental systems, biodiversity conservation, and resource utilization, as well as the potential of bioresources, bioproducts, and biological wastes as drivers of innovation. In addition, the course encourages students to integrate multidisciplinary scientific and technological approaches to develop creative and sustainable solutions that contribute to environmental management, sustainable industry, agriculture, energy systems, and the well-being of society and the global environment.

### 2. Course-level Learning Outcomes: CLOs

After successful completion of this course, students will be able to:

- 1) CLO1: Explain the concepts and principles of bioinnovation and sustainable society, including climate systems, biodiversity, natural resource flows, and the impacts of human activities on the environment in the context of sustainability.
- 2) CLO2: Analyze the roles and importance of bioinnovation in agriculture, food, energy, environmental management, health, and wellness through case studies and contemporary issues related to sustainable society.
- 3) CLO3: Apply knowledge of bioinnovation and sustainability to propose appropriate solutions or innovations for addressing problems and challenges related to quality of life, society, and the global environment through problem-based learning approaches.



4) CLO4: Evaluate the benefits, opportunities, limitations, and challenges associated with the utilization of bioresources and bio-based innovations in the context of the modern economy and sustainable development.

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

The course is organized using active learning strategies that emphasize lectures, case study analysis, classroom discussion, presentations, and individual assignments to support the achievement of the CLOs. Active lectures are used to introduce key concepts and principles related to bioinnovation, sustainability, biodiversity conservation, and natural resource management. Case studies are incorporated to encourage students to analyze real-world situations and contemporary issues associated with sustainable development, environmental management, agriculture, food systems, energy, health, and industry. Oral presentations and individual assignments are designed to strengthen students' communication, critical thinking, creativity, and problem-solving skills through the application of bioinnovation concepts to sustainability-related challenges. Classroom participation and collaborative discussions are also encouraged to enhance student engagement and interdisciplinary learning experiences.

The learning outcomes are assessed using both formative and summative evaluation methods that align with the CLOs. Students' understanding of concepts and principles is evaluated through written examinations, while analytical thinking, application of knowledge, and evaluation skills are assessed through case study discussions, individual assignments, and presentations. Classroom attendance, participation, and learning behavior are continuously monitored throughout the course to evaluate student engagement and contribution to collaborative learning activities. These assessment methods are designed to ensure that students are able to explain, analyze, apply, and evaluate concepts related to bioinnovation and sustainable society in accordance with the intended learning outcomes of the course.

| CLOs | Teaching and learning experience |            |                   | Learning outcomes measurements                         |              |                       |
|------|----------------------------------|------------|-------------------|--------------------------------------------------------|--------------|-----------------------|
|      | Active Lecture                   | Case Study | Oral Presentation | Class Attendance, Participation, and Behavior in Class | Written Exam | Individual assignment |
| CLO1 | ✓                                | ✓          |                   | X                                                      | X            |                       |
| CLO2 | ✓                                | ✓          |                   | X                                                      | X            | X                     |
| CLO3 | ✓                                | ✓          |                   | X                                                      | X            | X                     |
| CLO4 | ✓                                | ✓          | ✓                 | X                                                      |              | X                     |



Program: Science Innovation

Program Level



Bachelor



Graduate Diploma



Master



Higher Graduate Diploma



Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

## Section 4 Lesson Plan and Evaluation

### 1. Lesson Plan

Day Wednesday Time: 09.00-12.00, Room SC1-158, Mahidol University, Salaya Campus

| date            | Topics/ Details/Date                                                                                                                                                               | Number of hours       |                      | Teaching method<br>/Media                                                                                                                                                                         | Instructors                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|                 |                                                                                                                                                                                    | Classroom<br>sessions | Practice<br>Sessions |                                                                                                                                                                                                   |                                                      |
| 5 Aug.<br>2026  | Introduction and class assignment<br>- Roles of Bioinnovation for Sustainable Development Goals (SDGs)<br>- Bioinnovation: Perspective and Challenge for Profit, People and Planet | 3                     | 6                    | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Real-world case analysis.<br><b>Assignment:</b> Individual/group assignment.                                    | Assoc. Prof. Dr. Kanyaratt Supaibulwatana            |
| 19 Aug.<br>2026 | Bioresource and sustainable management<br>Natural resource challenges & management: Socio-economic aspects of bioresources, environment & innovation                               | 3                     | 6                    | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Sustainable lifestyles based on BCG and zero-waste concepts.<br><b>Assignment:</b> Waste management assignment. | Assoc. Prof. Dr. Kanyaratt Supaibulwatana            |
| 26 Aug.<br>2026 | Innovation in Food safety & Food security                                                                                                                                          | 3                     | 6                    | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Food safety and food security analysis.<br><b>Assignment:</b> Food innovation assignment.                       | Invited speaker<br>Asst. Prof. Dr. Siriyupa Netramai |
| 2 Sep.<br>2026  | Smart biodegradable material and its roles in global environments                                                                                                                  | 3                     | 6                    | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Biodegradable material applications analysis.<br><b>Assignment:</b> Sustainable material assignment.            | Invited speaker<br>Dr. Thitisilp Kijchavengkul       |
| 9 Sep.<br>2026  | Smart and Intelligent packaging                                                                                                                                                    | 3                     | 6                    | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Bio-based materials and packaging analysis.<br><b>Assignment:</b> Packaging innovation assignment.              | Invited speaker<br>Asst. Prof. Dr. Siriyupa Netramai |



Program: Science Innovation

Program Level



Bachelor



Graduate Diploma



Master



Higher Graduate Diploma



Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

| date         | Topics/ Details/Date                                                                                          | Number of hours    |                   | Teaching method /Media                                                                                                                                                                                                                                                           | Instructors                                    |
|--------------|---------------------------------------------------------------------------------------------------------------|--------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
|              |                                                                                                               | Classroom sessions | Practice Sessions |                                                                                                                                                                                                                                                                                  |                                                |
| 16 Sep. 2026 | Biofuels of the future                                                                                        | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Biofuel technology analysis.<br><b>Assignment:</b> Future biofuel assignment.                                                                                                                  | Dr. Stefan Schreier                            |
| 23 Sep. 2026 | Green architecture & sustainable buildings: The cutting-edge technology to build houses                       | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Green building technology analysis.<br><b>Assignment:</b> Sustainable building assignment.                                                                                                     | Dr. Stefan Schreier                            |
| *            | Midterm Examination (30 September 2026)                                                                       |                    |                   |                                                                                                                                                                                                                                                                                  | Assoc. Prof. Dr. Kanyaratt Supaibulwatana      |
| 7 Oct. 2026  | Innovations and Future Trends for Space and Extraterrestrial Environments: A Roadmap for Resource Utilization | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Strategic Technology Roadmap for Extraterrestrial Self-Sufficiency.<br><b>Assignment:</b> How does each team mitigate the risk of severe mechanical wear caused by highly abrasive lunar dust. | Dr. Tatpong Tulyananda                         |
| 14 Oct. 2026 | Artificial intelligence in bioinnovation research                                                             | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Artificial intelligence in bioinnovation research.<br><b>Assignment:</b> AI application analysis in bioinnovation research.                                                                    | Asst. Prof. Dr. Narin Nuttawut                 |
| 21 Oct. 2026 | Green chemistry and sustainability                                                                            | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Green chemistry application analysis.                                                                                                                                                          | Asst. Prof. Dr. Sitthivut Charoensutthivarakul |



Program: Science Innovation

Program Level ☒ Bachelor

☐ Graduate Diploma

☐ Master

☐ Higher Graduate Diploma

☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

| date         | Topics/ Details/Date                                                 | Number of hours    |                   | Teaching method /Media                                                                                                                                                                                       | Instructors                                                                                     |
|--------------|----------------------------------------------------------------------|--------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|              |                                                                      | Classroom sessions | Practice Sessions |                                                                                                                                                                                                              |                                                                                                 |
|              |                                                                      |                    |                   | <b>Assignment:</b> Sustainability assignment.                                                                                                                                                                |                                                                                                 |
| 28 Oct. 2026 | Technology Trends and future of medical devices                      | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Medical device technology trend analysis.<br><b>Assignment:</b> Future medical technology assignment.                      | Dr. Stefan Schreier                                                                             |
| 4 Nov. 2026  | Drug discovery for good health and wellness                          | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and discussion.<br><b>Case study:</b> Drug discovery and wellness analysis.<br><b>Assignment:</b> Drug development assignment.                                   | Asst. Prof. Dr. Sitthivut Charoensutthivarakul                                                  |
| 11 Nov. 2026 | Introduction to preventive medicine and nutraceutical innovation     | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and group discussion.<br><b>Case study:</b> Nutraceutical products and disease prevention.<br><b>Assignment:</b> Functional food and nutraceutical presentation. | Dr. Papasara Chantawichitwong                                                                   |
| 18 Nov. 2026 | Sustainable wellness in modern society                               | 3                  | 6                 | <b>Active learning:</b> Interactive lecture and group discussion.<br><b>Case study:</b> Public health and preventive healthcare practices.<br><b>Assignment:</b> Health promotion project.                   | Dr. Papasara Chantawichitwong                                                                   |
| 25 Nov. 2026 | Project-based conferences: Bioinnovation and Sustainable Development | 3                  | 6                 | <b>Assignment:</b> Project presentation assignment.                                                                                                                                                          | Assoc. Prof. Dr. Kanyaratt Supaibulwatana<br>Dr. Papasara Chantawichitwong Ms. Wannisa Chuekong |



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

| date | Topics/ Details/Date                | Number of hours    |                   | Teaching method /Media | Instructors                                     |
|------|-------------------------------------|--------------------|-------------------|------------------------|-------------------------------------------------|
|      |                                     | Classroom sessions | Practice Sessions |                        |                                                 |
| *    | Final Examination (9 December 2026) |                    |                   |                        | Assoc. Prof. Dr.<br>Kanyaratt<br>Supaibulwatana |
|      | Total                               | 45                 | 90                |                        |                                                 |

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

### 2.1 Measurement and Evaluation of learning achievement

#### A. Formative Assessment

- In-class questions, quizzes, and assignments: To evaluate students' understanding, analytical thinking, and application of knowledge related to bioinnovation and sustainability.
- Case study discussion and presentation: To assess critical thinking, problem-solving, and communication skills through analysis of real-world situations.
- Observation of participation and engagement: To assess students' involvement in classroom discussion, collaborative activities, and learning processes.

#### B. Summative Assessment

Summative assessment evaluates students' learning outcomes through written examinations, individual assignments, case study analysis, and classroom participation, focusing on the understanding, application, and evaluation of concepts related to bioinnovation, sustainability, and bioresource management.

#### (1) Tool and weight for measurement and evaluation

| Learning Outcomes                                                                                                                                                                                                                                | Evaluation Method*                                     |              |                       | Weight<br>(Percentage) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------|-----------------------|------------------------|
|                                                                                                                                                                                                                                                  | Class Attendance, Participation, and Behavior in Class | Written Exam | Individual assignment |                        |
| 1) CLO1: Explain the concepts and principles of bioinnovation and sustainable society, including climate systems, biodiversity, natural resource flows, and the impacts of human activities on the environment in the context of sustainability. | 5                                                      | 30           | -                     | 35                     |
| 2) CLO2: Analyze the roles and importance of bioinnovation in agriculture, food, energy, environmental management, health, and wellness through case studies                                                                                     | 5                                                      | 20           | -                     | 25                     |





Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

|                                                                                                                                                                                                                                                                |           |           |           |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------------|
| and contemporary issues related to sustainable society.                                                                                                                                                                                                        |           |           |           |            |
| 3) CLO3: Apply knowledge of bioinnovation and sustainability to propose appropriate solutions or innovations for addressing problems and challenges related to quality of life, society, and the global environment through problem-based learning approaches. | 5         | -         | 25        | 30         |
| 4) CLO4: Evaluate the benefits, opportunities, limitations, and challenges associated with the utilization of biore-sources and bio-based innovations in the context of the modern economy and sustainable development.                                        | -         | 10        | -         | 10         |
| <b>รวม</b>                                                                                                                                                                                                                                                     | <b>15</b> | <b>60</b> | <b>25</b> | <b>100</b> |

## (2) Grading Rules

A (Excellent): 80-100%

B+ (Very Good): 75-79%

B (Good): 70-74%

C+ (High Satisfactory): 65-69%

C (Satisfactory): 60-64%

D+ (Pass): 55-59%

D (Minimal Pass): 50-54%

F (Fail): below 50%

## (3) Measurement and Evaluation

1. Class Attendance, Participation, and Behavior in Class (15%)
2. Written Exam (60%)
3. Individual assignment (25%)

## 2.2 Re-examination (if the course allows any.)

If a student fails to meet the course requirements, the course coordinator may consider allowing remedial assessment depending on the student's class attendance, participation, and classroom behavior. A passing grade from the remedial assessment cannot exceed a "D" for the overall course grade. However, if the student re-enrolls in the course, the final grade will reflect the performance achieved during the repeated enrollment.

## 3. Students' Appeal

If a student wishes to appeal the evaluation of a course, the following procedures apply:



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

---

1) Course Level: The student should contact the course instructor directly to clarify any concerns or questions regarding the assessment results.

2) Department / Program Level: If the course instructor confirms the assessment results, the student may contact the program coordinator to request a review of the evaluation. If the appeal is found to have valid grounds, the program management committee will consider the appeal and notify the student of the decision.

3) Faculty Level: If both the course instructor and program coordinator confirm the assessment results, the student can visit the Academic Affairs Office to fill out an Ap-peal/Re-test Form within 5 days of the official grade announcement.

Students may submit formal complaints or academic appeal directly to:

International Education and Administration Unit, Division of Salaya Campus  
Room SC1-116, SC1-Building, Faculty of Science (Salaya Campus), Mahidol University  
999 Phuttamonthon 4 Road, A. Phuttamonthon, Nakhon Pathom 73170, Thailand  
E-mail: scsim@mahidol.ac.th; Phone: +66 2 4419820 ext. 1199

If it is considered that a case exists, the matter will be investigated in accordance with the procedures, and the complainant informed of the outcome.



## Section 5 Teaching Resources

### 1. Required Texts

1. Holmberg, J. 1998. Backcasting — a natural step when operationalizing sustainable development. Greener Management International. no. 23.
2. Azar, C., Holmberg, J and Robèrt, K.-H., 1999. Fossil fuels and corporate economic risk assessment. Perspectives. Volume 14, Number 1, March 2000.
3. Broman, G., Holmberg, J., and Robèrt, K-H., 1999. Simplicity without Reduction – Thinking Upstream Towards the Sustainable Society. Interfaces, International Journal of the Institute for Operations Research and the Management Sciences, Volume 30, No 3, May-June 2000.
4. Holmberg, J., Lundqvist, U., Robert, K.-H., and Wackernagel, M., 1999. The Ecological Footprint from a Systems Perspective of Sustainability. Int. J. Sustain. Dev. World Ecol. 6, 17-33.
5. Holmberg, J., Lundqvist, U., Robert, K.-H., 1999. An Approach to Sustainable Product Development in SMEs. In: R. Hillary (ed.) SMEs and the Environment. Greenleaf publishing, Sheffield, United Kingdom, pp. 158-170.
6. Messerle, H. K., 1999. Eco-Effectiveness and Sustainability. ATSE Focus, No108, 16-20. November/December, 1999.
7. Robèrt, K.-H., 2000. Tools and concepts for sustainable development, how do they relate to a framework for sustainable development, and to each other? The Journal of Cleaner Production. Volume 8 (3) 2000, 243-254.
8. Waage, S., Smith, T., Stanley-Jones, M., Girshick, S., Meydbray, O., Shah, R. High technology and Turn-Arounds: Impacts of the Past and Options for the Future. International Journal for Sustainable Business. Vol. 11, Issue. 2004. ISSN 1066-7938.
9. Sajor Edsel E., Resurreccion, Bernadette P., Rakshit Sudip K. Bio-innovation and Poverty Alleviation: Case Studies from Asia. SAGE Publications Pvt. Ltd; First edition (November 8, 2014). ISBN-13: 978-8132119722. 349 p.
10. Kearney C. and Langer L. Effective Leadership through Bioentrepreneurship and Bioinnovation. Journal of Commercial Biotechnology 24(2), 2018. DOI: 10.5912/jcb843

### 2. Suggested Materials

None

### 3. Other Resources (if any)

None



## Section 6 Evaluation and Improvement of Course Implementation

### 1. Analysis and Evaluation of Course Implementation

#### A. Data for Analysis

Students' learning outcomes are evaluated through classroom participation, written examinations, individual assignments, case study analysis, and presentation activities. In addition, students provide feedback on course content, teaching methods, learning activities, course management, and overall satisfaction through course evaluation forms conducted during and at the end of the semester.

#### B. Course Effectiveness Evaluation

Course effectiveness is evaluated using students' learning outcomes, classroom engagement, assignment performance, and course evaluation results. Feedback from students and instructors is used to assess the appropriateness of teaching methods, learning materials, assessment strategies, and the alignment between Course Learning Outcomes (CLOs), learning activities, and evaluation methods.

### 2. Revision Process and Improvement Plan for Course Effectiveness

Feedback and evaluation data collected from students and instructors are reviewed and analyzed to identify strengths, limitations, and areas for improvement in course implementation. The results are used to improve course content, teaching strategies, case study selection, learning activities, and assessment methods to better support students' understanding of bioinnovation, sustainability, and interdisciplinary problem-solving skills. Course revision discussions among instructors are conducted before and after each semester to ensure continuous course development and alignment with program objectives and current global sustainability trends.

### 3. The self-assessment report of the course

The course coordinator collects and summarizes students' academic performance, course evaluation results, and feedback from instructors and students. The information is reviewed during course meetings involving all instructors responsible for the course to evaluate the effectiveness of teaching methods, learning activities, and assessment strategies. The findings are used to develop recommendations and action plans for improving course content, instructional approaches, and student learning experiences in future academic years.



Program: Science Innovation

Program Level ☒ Bachelor☐ Graduate Diploma☐ Master☐ Higher Graduate Diploma☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

## Appendix

### 1. Relations between the course and the program

**Table 1** Relations between the course and the PLOs

| Bioinnovation and Sustainable Society | Program-Level Learning Outcomes (PLOs) |      |      |      |      |      |      |      |      |
|---------------------------------------|----------------------------------------|------|------|------|------|------|------|------|------|
|                                       | PLO1                                   | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 |
| SCGI198                               | I                                      |      | I    | I    |      | I    | I    | I    |      |

**Table 2** Relation between CLOs and PLOs

| SCBT271                                                                                                                                                                                                                                       | Program-Level Learning Outcomes (PLOs) |      |             |      |      |      |      |             |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------|-------------|------|------|------|------|-------------|------|
|                                                                                                                                                                                                                                               | PLO1                                   | PLO2 | PLO3        | PLO4 | PLO5 | PLO6 | PLO7 | PLO8        | PLO9 |
| CLO1: Explain the concepts and principles of bioinnovation and sustainable society, including climate systems, biodiversity, natural resource flows, and the impacts of human activities on the environment in the context of sustainability. | 1.1                                    |      |             |      |      |      |      | 8.1         |      |
| CLO2: Analyze the roles and importance of bioinnovation in agriculture, food, energy, environmental management, health, and wellness through case studies and contemporary issues related to sustainable society.                             | 1.1,<br>1.2                            |      |             |      |      |      | 7.1  | 8.1         |      |
| CLO3: Apply knowledge of bioinnovation and sustainability to propose appropriate solutions or innovations for addressing problems and                                                                                                         | 1.3,<br>1.4                            |      | 3.1,<br>3.4 | 4.2  |      | 6.3  | 7.2  | 8.2,<br>8.3 |      |



Program: Science Innovation

Program Level



Bachelor



Graduate Diploma



Master



Higher Graduate Diploma



Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

|                                                                                                                                                                                                                        |     |  |  |     |  |                     |  |     |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--|--|-----|--|---------------------|--|-----|--|
| challenges related to quality of life, society, and the global environment through problem-based learning approaches.                                                                                                  |     |  |  |     |  |                     |  |     |  |
| CLO4: Evaluate the benefits, opportunities, limitations, and challenges associated with the utilization of biore-sources and bio-based inno-vations in the context of the modern economy and sus-tainable development. | 1.2 |  |  | 4.3 |  | 6.1,<br>6.2,<br>6.3 |  | 8.2 |  |

**Table 3** PLOs and SubPLOs that the course is responsible for

| PLOs                                                                                                                                                                                                                                         | SubPLOs                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PLO 1: Knowledge Integration and Scientific Problem Solving</b><br>Apply and synthesize knowledge in bioinnovation and relevant sci-ences to identify, analyze, and propose responsible solutions to real-world challenges.               | 1.1 Identify and analyze problems related to bioinnovation using interdisciplinary scientific concepts.<br>1.2 Collect, evaluate, and interpret scientific information from reliable sources.<br>1.3 Propose feasible, evidence-based solutions using interdis-ci-plinary approaches.<br>1.4 Apply scientific reasoning to address problems with consid-ering of societal and environmental responsibility. |
| <b>PLO 3: Independent Research, Innovation, Professional Con-duct, and Ethics</b><br>Design and conduct independent research or innovation projects under professional ethical stand-ards, demonstrating originality and research integrity. | 3.1 Identify a research question or innovation challenge relevant to bioinnovation.<br>3.4 Manage research/project tasks, timelines, and deliverables with professional accountability in managing research/project tasks, timelines, and deliverables with professional accountabil-ity.                                                                                                                   |
| <b>PLO 4: Scientific Communication</b>                                                                                                                                                                                                       | 4.2 Present scientific and innovation-related content using ap-                                                                                                                                                                                                                                                                                                                                             |



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN103

School of Bioinnovation and Bio-based Product Intelligence

|                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communicate scientific concepts, research findings, and innovation ideas clearly and responsibly to academic, professional, and public audiences.                                                                        | appropriate formats and digital tools.<br>4.3 Adapt and justify communication for diverse audiences with awareness of ethical, social, and economic implications.                                                                                                                                                                                     |
| <b>PLO 6: Entrepreneurship, Intellectual Property and Regulatory Knowledge</b><br>Explain, apply, and evaluate concepts of entrepreneurship, intellectual property, and regulatory frameworks relevant to bioinnovation. | 6.1 Describe and apply key concepts in entrepreneurship, business models, and intellectual property related to bioinnovation.<br>6.2 Interpret biosafety, biosecurity, and industrial regulations relevant to bioinnovation processes.<br>6.3 Propose improvements to processes or products based on regulatory, safety, and IP considerations.       |
| <b>PLO 7: Digital and AI Literacy</b><br>Use digital technologies and AI tools ethically, responsibly, and effectively in scientific work, communication, and innovation.                                                | 7.1 Use digital platforms and AI-assisted tools to search, evaluate, and manage scientific information.<br>7.2 Apply data analysis, modeling, or digital tools to support laboratory work, research, or innovation development.                                                                                                                       |
| <b>PLO 8: Global Citizenship and Sustainable Development (SDGs)</b><br>Apply principles of global citizenship, sustainability, and SDGs when analyzing problems or developing bioinnovative solutions.                   | 8.1 Analyze the role of bioinnovation in addressing global challenges and contributing to relevant SDGs.<br>8.2 Apply sustainability principles and responsible innovation practices in research or project development.<br>8.3 Apply cultural awareness, inclusiveness, and global-mindedness when working with diverse communities or stakeholders. |



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN 103

School of Bioinnovation and Bio-based Product Intelligence

## 2. Rubric scoring\*

### Rubric for Class Attendance, Participation, and Behavior in Class

| Items                                          | Description                                                                       | CLOs       | 1                                           | 2                                                  | 3                                                        | 4                                                                | 5                                                                                         |
|------------------------------------------------|-----------------------------------------------------------------------------------|------------|---------------------------------------------|----------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>1. Class Attendance</b>                     | Student attends class regularly and punctually.                                   | CLO1-CLO3  | Rarely attends class or frequently absent.  | Attends less than 60% of classes and often late.   | Attends most classes but occasionally absent or late.    | Attends regularly with good punctuality.                         | Attends all or nearly all classes and is consistently punctual.                           |
| <b>2. Participation in Class Activities</b>    | Student actively participates in discussions, exercises, and learning activities. | CLO2, CLO3 | No participation.                           | Participates only when prompted.                   | Participates occasionally in activities and discussions. | Frequently participates and contributes relevant ideas.          | Consistently engages and makes meaningful contributions to class activities.              |
| <b>3. Asking Questions and Engagement</b>      | Student demonstrates curiosity and engagement through questions and interactions. | CLO2, CLO3 | Shows no engagement or questioning.         | Rarely asks questions or interacts.                | Occasionally asks relevant questions.                    | Frequently asks thoughtful questions and engages in discussions. | Consistently demonstrates strong curiosity through insightful questions and interactions. |
| <b>4. Respectful and Professional Behavior</b> | Student demonstrates respect toward instructors, peers, and learning environment. | CLO3       | Frequently displays inappropriate behavior. | Occasionally demonstrates unprofessional behavior. | Generally, behaves appropriately with minor issues.      | Consistently respectful and professional.                        | Serves as a positive role model for professional and respectful behavior.                 |
| <b>5. Teamwork and Collaboration</b>           | Student works effectively with peers during group activities.                     | CLO3       | Does not cooperate with group members.      | Limited contribution to teamwork.                  | Participates in group work with moderate contribution.   | Actively contributes and collaborates well with peers.           | Demonstrates leadership, encourages others, and enhances team performance.                |
| <b>6. Responsibility and Preparedness</b>      | Student comes prepared for class and completes assigned tasks on time.            | CLO1-CLO3  | Unprepared and fails to complete tasks.     | Rarely prepared and frequently misses assignments. | Adequately prepared and completes most tasks.            | Well-prepared and consistently completes tasks on time.          | Exceptionally prepared and consistently exceeds expectations.                             |





Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN 103

School of Bioinnovation and Bio-based Product Intelligence

### Rubric for Individual Assignment

| Items                                                                | Description                                                                                                     | CLOs | 1                                        | 2                                                               | 3                                                          | 4                                                           | 5                                                                                                                 |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------|------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>1. Understanding of Bioinnovation and Sustainability Concepts</b> | Student demonstrates understanding of bioinnovation, sustainability, and related concepts.                      | CLO3 | No understanding demonstrated.           | Limited understanding with major misconceptions.                | Basic understanding with some inaccuracies.                | Good understanding with minor errors.                       | Comprehensive and accurate understanding.                                                                         |
| <b>2. Analysis of Issues and Case Studies</b>                        | Student analyzes bioinnovation-related issues using scientific reasoning and evidence.                          | CLO3 | No meaningful analysis.                  | Limited or superficial analysis.                                | Basic analysis with some supporting evidence.              | Good analysis supported by relevant evidence.               | Deep, critical, and evidence-based analysis.                                                                      |
| <b>3. Application and Innovation Proposal</b>                        | Student applies knowledge to propose solutions or innovations for sustainability challenges.                    | CLO3 | No solution proposed.                    | Solution is unrealistic or poorly justified.                    | Solution is partially feasible with limited justification. | Feasible and logical solution with supporting evidence.     | Innovative, feasible, and well-justified solution supported by evidence.                                          |
| <b>4. Evaluation of Opportunities and Challenges</b>                 | Student evaluates benefits, limitations, and impacts of bioinnovation from multiple perspectives.               | CLO3 | No evaluation provided.                  | Limited evaluation with weak reasoning.                         | Basic evaluation with some supporting arguments.           | Well-balanced evaluation considering multiple perspectives. | Comprehensive and insightful evaluation integrating scientific, economic, social, and environmental perspectives. |
| <b>5. Use of Evidence and Information Sources</b>                    | Student uses reliable scientific information and references appropriately.                                      | CLO3 | No evidence or references used.          | Limited use of sources; references incomplete or inappropriate. | Uses some relevant sources with minor citation errors.     | Uses reliable sources and appropriate citations.            | Uses diverse, high-quality sources and accurate citations throughout.                                             |
| <b>6. Presentation and Communication Skills</b>                      | Student presents information clearly and effectively using appropriate communication methods and digital tools. | CLO3 | Unable to communicate ideas effectively. | Presentation lacks clarity and organization.                    | Adequate communication with some organizational issues.    | Clear, organized, and engaging presentation.                | Highly effective, professional, and engaging presentation.                                                        |
| <b>7. Response to Questions and Discussion</b>                       | Student demonstrates understanding through responses to questions and participation in discussion.              | CLO3 | Unable to answer questions.              | Answers are unclear or mostly incorrect.                        | Answers basic questions with limited explanation.          | Answers questions accurately and confidently.               | Provides insightful, accurate, and well-supported responses.                                                      |



Program: Science Innovation

Program Level ☒ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor

Course name: Bioinnovation and Sustainable Society

Faculty of Science

Course code: SCIN 103

School of Bioinnovation and Bio-based Product Intelligence

### Reflective Questions

1. Which concept or part of the lecture do you understand most deeply, and why do you feel you understand it so well? (To assess deep understanding and self-awareness in learning.)
2. Are there any points you still find unclear or wish to learn more about? What strategies will you use to improve your understanding? (To stimulate critical thinking and planning for further learning.)
3. How can you connect the knowledge from today's lesson to real-life situations or your future profession? Provide examples. (To foster application of knowledge in real-world contexts.)

### 3. Relations between the course and Sustainable Development Goals (SDGs)

- ☐ SDG1 No poverty
- ☐ SDG2 Zero Hunger
- ☒ SDG3 Good Health and Well – being
- ☐ SDG4 Quality Education
- ☐ SDG5 Gender Equality
- ☐ SDG6 Clean Water and Sanitation
- ☐ SDG7 Affordable and Clean Energy
- ☐ SDG8 Decent Work and Economic Growth
- ☐ SDG9 Industry, Innovation and Infrastructure
- ☐ SDG10 Reduced Inequalities
- ☐ SDG11 Sustainable Cities and Communities
- ☐ SDG12 Responsible Consumption and Production
- ☐ SDG13 Climate Action
- ☒ SDG14 Life Below Water
- ☒ SDG15 Life on Land
- ☐ SDG16 Peace, Justice and Strong Institutions
- ☐ SDG17 Partnerships for the goals