

**Course Syllabus**  
**MBMB 628 Biosensor technology: fundamentals and applications**  
**Academic Year 2025**

**Course ID and Name:** MBMB628 Biosensor technology: fundamentals and applications

ชมชม๖๒๘ เทคโนโลยีไบโอเซนเซอร์: พื้นฐานและการประยุกต์ใช้งาน

**Course Coordinator:** Sirapapa Boobphahom, Ph.D.

Tel: 02-441-9003-7 ext. 1203

E-mail: sirapapa.boob@mahidol.edu

**Instructors:**

1. Asst. Prof. Dr. Surapon Piboonpocanun, Ph.D.
2. Asst. Prof. Sujira Mukda, Ph.D.
3. Lecturer Sirapapa Boobphahom, Ph.D.
4. Lecturer Ekkaphot Khongkla, Ph.D.
5. Guest from Chulalongkorn University
6. Guest lecturer from Department of Biomedical Engineering, Mahidol University

**Supporting Staff:**

1. XX

**Credits:** 2 (2-0-2)

**Curriculum:** Doctor of Philosophy Program in Molecular and Integrative Biosciences (elective course)

**Semester offering:**

**Pre-requisites:** None

**Course learning outcomes (CLOs):**

By the end of this course, students are able to:

1. Integrate knowledge from basic principles of biosensing in terms of biological, chemical and optical/photonic responses (PLO1)
2. Employ principles and concepts of biochemistry integrated with nanotechnology to design biosensors (PLO1, PLO2)
3. Demonstrate scientific integrity, responsibility, and safety practices (PLO3)
4. Deliver inventive ideas about development of appropriate biosensor for point-of-care diagnostic devices (PLO4)

**Alignment of teaching and assessment methods to course learning outcome:**

Course learning outcome	Teaching method	Assessment method
1. Integrate knowledge from basic principles of biosensing in terms of biological, chemical and	(1) Lecture (2) Class discussion	(1) Written examination (2) Evaluation from In-class discussion

Course learning outcome	Teaching method	Assessment method
optical/photonic responses (PLO1)		
2. Employ principles and concepts of biochemistry integrated with nanotechnology to design biosensors (PLO1, PLO2)	(1) Lecture (2) Class discussion	(1) Written examination (2) Evaluation from In-class discussion
3. Demonstrate scientific integrity, responsibility, and safety practices (PLO3)	(1) Lecture (2) Assignments/ Exercises (3) Mini project	(1) Class Attendance (complete and punctual?) (2) Examination (cheating?) (3) Assignments (plagiarism?)
4. Deliver inventive ideas about development of appropriate biosensor for point-of-care diagnostic devices (PLO4).	(1) Group discussion (2) Assignments/ Exercises (3) Paper discussion	(1) Evaluation from direct observation during group activity (2) Assessment of assigned work

#### Course description:

Introduction to biosensor technology; Biosensors classification; Bio-receptor in biosensors; Nanomaterials for biosensor development; Techniques in biosensor fabrication; Integration of engineering and biology for design of biosensors; Design of point-of-care testing for medical screening; Applications in biomedical and clinical research.

บทนำสู่เทคโนโลยีไบโอเซนเซอร์; การจัดประเภทไบโอเซนเซอร์; ตัวรับทางชีวภาพในไบโอเซนเซอร์; วัสดุนาโนสำหรับการพัฒนาไบโอเซนเซอร์; เทคนิคในการผลิตไบโอเซนเซอร์; การรวมระหว่างวิศวกรรมและชีววิทยาสำหรับการออกแบบไบโอเซนเซอร์; การออกแบบการทดสอบ ณ จุดดูแลผู้ป่วยสำหรับการคัดกรองทางการแพทย์; การประยุกต์ใช้ในงานวิจัยทางชีวการแพทย์และทางคลินิก

Date: XX

Time: XX

Venue: Institute of Molecular Biosciences, Mahidol University, Salaya

	Activities	Description	Time	Instructor
<b>Monday, xxx xx, 20xx</b>				
1.	Lecture and Discussion	Introduction to biosensors	9.00-11.00	SB
2.	Lecture and Discussion	Biorecognition molecules and amplification Techniques	13.00-15.00	EK
3.	Lecture and Discussion	Techniques for searching biomarkers	9.00-11.00	SM
4.	Lecture and Discussion	Basics of detection methods: Electrochemistry and colorimetry	13.00-15.00	Guess
5.	Lecture and Discussion	Nanomaterials for biosensor development	9.00-11.00	Guess
6.	Lecture and Discussion	Biosensors for the detection of bacterial and viral clinical pathogens	13.00-15.00	SB
7.	Lecture and Discussion	Surface functionalization in biosensors	9.00-11.00	Guess
8.	Lecture and Discussion	Immunoassay-based detection	9.00-11.00	SP
9.	Lecture and Discussion	Wearable biosensors for healthcare monitoring	13.00-15.00	SB
10.	Lecture and Discussion	Biopotentials: Ionic currents in a single cell, Action potentials	9.00-11.00	EK
11.	Lecture and Discussion	Nucleic-based biosensor	13.00-15.00	Guess
12.	Paper discussion	Novel nanocomposites integrate with molecular biology for biosensor design	9.00-12.00	SB
13.	Student presentation	- Homework review - Presentation continued	13.00-16.00	SB
14.	<b>Student's Reflection</b>	To provide students opportunities to describe their learning experiences received from this course and how it can be applied to their future learning.	9.00-12.00	SB/EK

	<b>After Action Review</b>	To collect comments and suggestions from students for further course improvements.		
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**Assessment Criteria:**

Assessment Criteria		Description (in Details)	Scoring Rubric
1	<b>Class Attendance (5%)</b>	Showing up in the class (5%)	<ul style="list-style-type: none"> <li>• Full attendance (4)</li> <li>• ~ 80% attendance (3)</li> <li>• ~ 60% attendance (2)</li> <li>• &lt; 50% attendance (1)</li> </ul>
2	<b>Assignment (20%)</b>	Content accuracy (5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Creativity (5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Sequencing of information (2.5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Supporting evidence (2.5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Grammar and originality (3%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		On-time submission (2%)	<ul style="list-style-type: none"> <li>• On-time (4)</li> <li>• Late (2-3)</li> </ul>

Assessment Criteria		Description (in Details)	Scoring Rubric
			<ul style="list-style-type: none"> <li>• Very late (1)</li> </ul>
3	Quiz / Exercise (10%)	Depending on the correctness and completion (10%)	<b>Raw scores will be adjusted to be in a range of 0-10%</b>
4	Discussion Performance (20%)	Participation and performance (5%)	<ul style="list-style-type: none"> <li>• Active (4)</li> <li>• Fairly active (2-3)</li> <li>• Inactive (1)</li> </ul>
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (5%)	<ul style="list-style-type: none"> <li>• Active (4)</li> <li>• Fairly active (2-3)</li> <li>• Inactive (1)</li> </ul>
		Creative and high-order thinking skills (10%)	<ul style="list-style-type: none"> <li>• Highly expressed (4)</li> <li>• Fairly expressed (2-3)</li> <li>• Not shown (1)</li> </ul>
5	Reflection (10%)	Knowledge sharing (2.5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Inventive and creative thinking skills (2.5%)	<ul style="list-style-type: none"> <li>• Highly expressed (4)</li> <li>• Fairly expressed (2-3)</li> <li>• Not shown (1)</li> </ul>
		Communication skills (2.5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (2.5%)	<ul style="list-style-type: none"> <li>• Active (4)</li> <li>• Fairly active (2-3)</li> <li>• Inactive (1)</li> </ul>
6	Presentation (35%)	Organization (5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Content (10%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> </ul>

Assessment Criteria		Description (in Details)	Scoring Rubric
			<ul style="list-style-type: none"> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Subject knowledge/answering questions (10%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Presentation technique and use of visual aids (5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>
		Time management (5%)	<ul style="list-style-type: none"> <li>• Excellent (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Need to be improved (1)</li> </ul>

Student's achievement will be graded using symbols: A, B+, B, C+, C, D+, D, and F, based on the criteria as follows:

Percentage	Grade	Description
80–100	A	Excellent
75–79	B+	Very Good
70–74	B	Good
65–69	C+	Fairly Good
60–64	C	Fair
55–59	D+	Poor
50–54	D	Very Poor
0–49	F	Fail

Date of Revision: 15 April 2024