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: Siraprapa Boobphahom, Ph.D.
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Instructors:

1. Asst. Prof. Dr. Surapon Piboonpocanun, Ph.D.
2. Asst. Prof. Sujira Mukda, Ph.D.
3. Lecturer Siraprapa Boobphahom, Ph.D.
4. Lecturer Ekkaphot Khongkla, Ph.D.
5. Lecturer Tatiya Siripongpreda, Ph.D. (Guess lecturer from Faculty of Environment and Resource studies, Mahidol University)

Credits: 2 (2-0-4)

Curriculum: Master of Science Program in Molecular and integrative biosciences (elective course)
Doctor of Philosophy Program in Molecular and integrative biosciences (elective course)

Semester offering: Second semester

Pre-requisites: None

Course learning outcomes (CLOs):

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

1. Describe the principles of biosensing technology in terms of biological, chemical, optical/photonic responses, and fundamental elements of biosensor devices. (**PLO1**)
2. Apply principles and concepts of biological science integrated with sensing technology to the development of biosensors. (**PLO1, PLO2**)
3. Critically analyze and interpret research articles in the field of biosensor technology along with delivering creative ideas of the development of appropriate biosensors. (**PLO3, and PLO4**)
4. Demonstrate creativity, leadership, teamwork, responsibility, and interpersonal skills. **(PLO4)**

Alignment of teaching and assessment methods to course learning outcome:

Course learning outcome	Teaching method	Assessment method
CLO1 Describe the principles of biosensing technology in terms of biological, chemical, optical/photonic responses, and	(1) Lecture (2) In-class discussion	(1) Q/A during class (2) Quiz/short exercise (3) Evaluation from In-class discussion

Course learning outcome	Teaching method	Assessment method
fundamental elements of biosensor devices. (**PLO1**)		
CLO2 Apply principles and concepts of biological science integrated with sensing technology to the development of biosensors. (**PLO1, PLO2**)	(1) Lecture (2) In-class discussion	(1) Q/A during class (2) Quiz/short exercise (3) Evaluation from In-class discussion
CLO3 Critically analyzes and interprets research articles in the field of biosensor technology along with delivering creative ideas of the development of appropriate biosensors. (**PLO3, and PLO4**)	(1) In-class discussion (2) Paper discussion (3) Individual/group assignment	(1) Evaluation from In-class discussion
CLO4 Demonstrate creativity, leadership, teamwork, responsibility, and interpersonal skills. **(PLO4)**	(1) Lecture (2) Individual/group assignment (3) Presentation	(2) Class Attendance (complete and punctual?) (2) Discussion participation (Active?) (3) Assignments (plagiarism?) (4) Presentation performance (leadership or teamwork skills?)

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; การประยุกต์ใช้ในงานวิจัยทางชีวการแพทย์และทางคลีนิก

Date: 20 April – 1 May 2026

Time: 9.00 – 12.00 and 13.00- 16.00

Venue: Institute of Molecular Biosciences, Mahidol University, Salaya

	Activities	Topics	Time	Instructor
Monday, 20th April 2026				
0	Orientation	Orientation to this course	10.00 - 10.30	SB
1.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Introduction to biosensor technology	10.30 - 12.00	SB
2.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Biorecognition molecules and amplification Techniques	13.00 - 16.00	SB
Tuesday, 21st April 2026				
3.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Techniques for searching biomarkers	10.00 – 12.00	SM
4.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Basics of detection methods: Electrochemistry and colorimetry	13.00 - 15.00	SB
Wednesday, 22nd April 2026				
5.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Biopotentials: Ionic currents in a single cell, Action potentials	10.00 – 12.00	EK
6.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Nanomaterials for biosensor development	13.00 – 16.00	TS
Thursday, 23rd April 2026				
7.	Lecture/In-class discussion/ Quiz/short exercise/	Surface functionalization in biosensors	09.00 – 12.00	TS

	Paper discussion			
8.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Immunosensor and nucleic acid for personalized medicine	13.00 - 15.00	SP
Friday, 24th April 2026				
9.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Wearable biosensors for healthcare monitoring	09.00 - 12.00	SB
10.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Nucleic acid-based sensors	13.00 - 15.00	SB
Monday, 27th April 2026				
11.	Lecture/In-class discussion/ Quiz/short exercise/ Paper discussion	Innovative sensors for theragnostic applications	10.00 – 12.00	SB
Friday, 1st May 2026				
12.	Student presentation	- Homework review - Presentation continued	09.00 – 12.00	SB & Guest Lecturer
13.	**Student's Reflection**	To provide students opportunities to describe their learning experiences received from this course and how it can be applied to their future learning.	13.00 – 15.00	SB
	After Action Review	To collect comments and suggestions from students for further course improvements.		

Assessment Criteria:

Assessment Criteria		Description (in Details)	Scoring Rubric
1	**Attendance class (10%)**	Showing up in class (10**%**)	• Full attendance (4) • ~ 80% attendance (**3**)

Assessment Criteria		Description (in Details)	Scoring Rubric
			• ~ 60% attendance (**2**) • < 50% attendance (**1**)
2	**Assignment (30%)**	Content accuracy (10%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Creativity (10%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Sequencing information (5%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Supporting evidence (2%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Grammar and originality (2%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		On-time submission (1**%**)	• On-time (**4**) • Late (2-3) • Very late (1)
3	**Quiz / Exercise (15%)**	Depending on the correctness and completion (**15%**)	**Raw scores will be adjusted to be in a range of 0-10%**
4	**Discussion Performance (15%)**	Participation and performance (2**%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)

Assessment Criteria		Description (in Details)	Scoring Rubric
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (3**%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)
		Creative and high order thinking skills (**10%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
5	**Problem-based learning presentation (30%)**	Organization (5%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Content (10%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Subject knowledge/answering questions (10%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Presentation technique and use of visual aids (3%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Time management (2%)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)

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

Percentage	Grade	Description
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: 7th October 2025