COURSE INFORMATON					
Course Title	**Code**	**Semester**	**T+P+L Hour**	**Credits**	**ECTS**
BIOSENSORS	BME 534	1	3+0+3	3	10

Prerequisites	-
Language of Instruction	English
Course Level	Master's Degree
Course Type	Restrictive Elective
Course Coordinator	
Instructors	Dr. F. Şermin UTKU
Assistants	
Goals	This course aims to provide an introduction to the fundamental principles of biosensors. It aims to enable students to design a biosensor based on the knowledge acquired during the course.
Content	The course will discuss the use of immunoassays, detection of DNA mutation, environmental toxins, metabolic activity, and in-vivo neuronal signal monitoring using biosensors. Based on recent publications, the basics of enzyme kinetics and biochemistry, electrochemical impedance spectroscopy, electrochemical biosensors, catalytic and affinity biosensors, optic sensors, surface functionalization, surface chemistry of organophosphate compounds, bio-receptors immobilization and nanobiosensors will be discussed. Main technologies used in the field of biosensors will be analyzed from a theoretical and experimental approach, to the extent that the students will design a biosensor using any of the modalities studied during the course.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
5) To be able to distinguish the different types of biosensors and the modalities used.	1,2,3,4,5,8	1,2,3,5,8,15	B,C,D
6) To extend engineering principles to electrochemical and optical biosensor development.	1,2,3,4,5,8	1,2,3,5,8,12,15	B,C,D
7) To distinguish common and different challenges of major electrochemical and optical biosensor applications.	1,2,3,4,5,8	1,2,3,5,8,12,15	B,C,D
8) To make critical design and selection decisions with respect to the target application and practical limitations.	1,2,3,4,5,8	1,2,3,5,8,12,15	B,C,D

Teaching Methods:	1:Lecture, 2:Question-Answer, 3:Discussion, 4:Application, 5:Demonstration, 6:Motivation for Demonstration, 7:Role Play, 8:Group Study, 9:Simulation, 10:Brain Storming, 11:Case Study, 12:Laboratory/Atellier, 13:Self-Study, 14:Problem Session, 15:Project Based Learning, 16:Undefined
Assessment Methods:	A:Test, B:Experiment, C:Homework, D:Project/Design, E:Performance, F:Portfolio, G:Undefined

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction to biosensors	Books, articles
2	The sensing elements	Books, articles
3	The transducing elements and methods	Books, articles
4	Enzyme kinetics and biochemistry	Books, articles
5	Electrochemical biosensors	Books, articles
6	Catalytic and affinity biosensors	Books, articles
7	Electrochemical impedance spectroscopy	Books, articles
8	Optic sensors	Books, articles
9	Surface functionalization	Books, articles
10	Surface chemistry of organophosphate compounds	Books, articles
11	Bio-receptors immobilization	Books, articles
12	Nanobiosensors	Books, articles
13	Student projects and presentations	
14	Student projects and presentations	

RECOMMENDED SOURCES	
Textbook	Chemical Sensors and Biosensors: Fundamentals and Applications, F.-G. Banica, Wiley, 2012.
Other Sources	Chemical Sensors and Biosensors, Brian R. Eggins, Wiley, 2002. Electrochemical Methods: Fundamentals and Applications, 2nd Ed., A.J. Bard, L.R. Faulkner, Wiley, 2001. Selected research papers.
MATERIAL SHARING	
Documents	Project presentations and recent articles.
Assignments	In-class presentation of articles.
Exams	Design of a biosensor.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	0	0
Projects	1	30
Assignment	3	10
Total		60
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100
Total		100

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	**Program Learning Outcomes**	**Contribution**				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modelling methods for this purpose.					**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select and use modern techniques and tools needed for engineering practice; to employ information technologies effectively.				**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.		**X**			
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.		**X**			
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.	**X**				
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	**Quantity**	**Duration (Hour)**	**Total Workload (Hour)**
Course Duration (Including the exam week)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	7	98
Proje	1	36	36
Homework	3	12	36
Final examination	1	28	28
Total course hours)			240
Total Work Load / 25 (h)			9.6
ECTS Credit of the Course			10