ABDULLAH GUL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
BIOENGINEERING DEPARTMENT
COURSE DESCRIPTION AND SYLLABUS

Course Name	CODE	SEMESTER	T+L Hour	CREDIT	ECST
FUNDAMENTALS OF BIOMEMS	ECE 641	Fall-Spring	3+0	3	7,5

Prerequisite Courses	N/A

Course Type	Selective
Course Language	English
Course Coordinator	Associate Prof. Kutay İçöz
Lecturers	Associate Prof. Kutay İçöz
Course Assistants	N/A
Course Objectives	Learning the fundamentals of materials and fabrication methods of bio micro/nano electromechanical devices. Reviewing recent literature and application of the devices to biology and medicine.
Learning Outcomes	• Learning the fundamentals of BioMEMS. • Learning the fundamentals of materials used in BioMEMS. • Learning the fabrication methods of BioMEMS. • Detailed study of the surface chemistry and functionalization methods. • Learning the fundamentals of BioMEMS based biosensors. • Learning the fundamentals of microfluidics. • Gaining the ability to understand the devices developed for cells and biomolecules.
Course Content	• Nanotechnology and its applications • Materials and specifications • Fabrication Process: Etching, Deposition and patterning • Surface properties • Nanotechnology based transduction • Microfluidics • Micro/nano biosensors • Standard laboratory methods • Micro/nano cantilevers • Biochips.

WEEKLY SUBJECTS AND RELATED PRELIMINARY PAGES

Week	Subjects	Preliminary
1	BioMEMS and its applications, market value, advantages of miniaturization	The relevant articles from the literature
2	Materials: Silicon, silicon nitride, silicon oxide, metals, polymers and their specifications Nano-Fabrication techniques: Lithography and light sensitive polymers	The relevant articles from the literature
3	Micro-Fabrication techniques: Deposition methods (spin coating, e-beam evaporation, chemical vapor deposition, sol-gel method), etching methods (wet and dry etching) deep reactive ion etching	The relevant articles from the literature
4	Surface Props developed with nanotechnology: Chemical and biological receptors, surface coating and surface chemistry	The relevant articles from the literature
5	Surface Props developed with nanotechnology: Micro patterning methods	The relevant articles from the literature
6	Midterm	
7	Microfluidic Devices and nanotechnology: Advantages. Viscosity, Reynold's Number, Laminar Flow, Flow profile, microchannel resistance, flow in pores media, diffusion, surface contact angle, wetting, electrophoresis, dielectrophoresis, electro osmosis	The relevant articles from the literature

8	Biosensors: standard laboratory analysis techniques (ELISA, flow cytometry) new generation techniques (QCM, SPR), micro/nano analysis techniques, micro cantilevers, operation modes surface stress, frequency modes. Detection mechanism and comparison of cantilevers.	The relevant articles from the literature
9	Biosensors: Interferometry and interferometric cantilevers and application areas, weight measurement of individual micro nano particles, enhancement of frequency mode operation	The relevant articles from the literature
10	BioMEMS for Cells: Definition and application areas, Single cell measurement techniques	The relevant articles from the literature
11	Midterm	
12	BioMEMS and medical applications 1	The relevant articles from the literature
13	BioMEMS and medical applications 2	The relevant articles from the literature
14	BioMEMS and medical applications 3	The relevant articles from the literature
15	BioMEMS and medical applications 4	The relevant articles from the literature
16	Final Exam	

RESOURCES	
Course Notes	Lecture Slides
Other Resources	**Course Textbook:** "Introduction to BioMEMS" by Albert Folch**.**

MATERIAL SHARING	
Documents	Lecture notes, slides
Homework	Students will be given one homework each week
Exams	2 Midterms and 1 Final Exam

RATING SYSTEM		
SEMESTER WORKS	**NUMBER**	**CONTRIBUTION**
Midterm	2	40
Homework	10	20
TOTAL	10	10
Success Rate of Semester		70
Success Rate of Final		70
TOTAL	1	30

Course Category	
Basic Sciences and Mathematics	%50
Engineering Sciences	%50
Social Sciences	%0

THE RELATIONSHIP BETWEEN THE LEARNING OUTCOMES AND PROGRAM COMPETENCE							
No	Program Outcomes	Contribution Level					
		1	2	3	4	5	
1	The skills of using mathematics, science and engineering information in advanced research,					X	
2	The skills of analysing, designing and/or implementing an original system that will be able to solve an engineering problem,					X	
3	The skills of using the required software, hardware and modern measurement equipments in their field of research					X	
4	The skills of planning independent research and implementing in detail,					X	
5	The skills of following literature, listening to and making technical presentation, writing a paper in academic level,			X			

6	The skills of innovative and interrogative thinking and finding original solutions					X

*From 1 to 5, it increasingly goes.

ECTS / WORK-LOAD TABLE			
Activities	Activities	Duration (Hour)	Total (Work-Load)
Course Duration (Including exam week: 16x total course hour)	16	3	48
Out of Class Exercise Time (Pre-study, reinforcement)	16	8	128
Searching on Internet, library study	16	3	48
Presentation	5	3	15
Homework	10	3	30
Midterms	2	15	30
Final	1	15	15
Total Work-Load			314
Total Work-Load / 30			314/30
Course ECTS Credit			7,5