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

Course Name	CODE	SEMESTER	T+L Hour	CREDIT	ECST
Nanofabrication for Biological Applications	BENG 529	Fall-Spring	3+0	3	10

Prerequisite Courses	N/A

Course Type	Selective
Course Language	English
Course Coordinator	Assistant Prof. Kutay İçöz
Lecturers	Assistant Prof. Kutay İçöz
Course Assistants	N/A
Course Objectives	Learning the fundamentals of materials and fabrication methods of nano/micro devices and particles. Reviewing recent literature and application of the devices to biology and medicine.
Learning Outcomes	• Learning the fundamentals of nanotechnology. • Learning the fundamentals of materials used in nanotechnology. • Learning the fabrication methods of micro/nano particles. • Detailed study of the surface chemistry and functionalization methods. • Learning the fundamentals of nanotechnology 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	Nanotechnology 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	Nano-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	Nanobiosensors: standard laboratory analysis techniques (ELISA, flow cytometry) new generation techniques (QCM, SPR), micro/nano analysis techniques, micro cantilevers,	The relevant articles from the literature

	operation modes surface stress, frequency modes. Detection mechanism and comparison of cantilevers.	
9	Nanobiosensors: 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	Nanotechnology for Cells: Definition and application areas, Single cell measurement techniques	The relevant articles from the literature
11	Midterm	
12	Nanotechnology and medical applications 1	The relevant articles from the literature
13	Nanotechnology and medical applications 2	The relevant articles from the literature
14	Nanotechnology and medical applications 3	The relevant articles from the literature
15	Nanotechnology and medical applications 4	The relevant articles from the literature
16	Final Exam	

RESOURCES	
Course Notes	Lecture Slides
Other Resources	**Course Textbook:** "Nanofabrication Handbook", Stefano Cabrini, Satoshi Kawata, 1st Edition, 2012, CRC.

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	Understanding of Life Sciences, Mathematics and Engineering at the post-graduate level, and being able to implement of this knowledge into bioengineering problems					X
2	Having the ability of developing a new scientific method or a technological product or process, and, designing experiments, implementing, collecting data and evaluating regarding these issues					X
3	Choosing technical equipment used in the applications related to bioengineering, having sufficient knowledge in adopting and using new technological equipment					X
4	Having the ability of reaching the information, using resources, contributing to the literature by transferring the process and results of scientific studies as written or verbally in the national and international environments					X
5	Having the ability of working as an individual or a team, in the teams composed of discipline or different disciplines, gaining awareness of leadership and taking responsibility			X		

6	Having advanced level of foreign language knowledge to manage efficient verbal, written and visual communication in the major field					X
7	Having the understanding of ethics in science and the responsibility in profession with the awareness of lifelong learning, being beneficial to society and sensitiveness to global issues					X
8	Being aware of the social impacts of the solutions and applications of the challenges regarding Bioengineering				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			10