ÇANKAYA UNIVERSITY
Faculty of Engineering
Course Definition Form

This form should be used for either an elective or a compulsory course being proposed and curricula development processes for an undergraduate curriculum at Çankaya University, Faculty of Engineering. Please fill in the form completely and submit the printed copy containing the approval of the Department Chair to the Dean's Office, and mail its electronic copy to deryac@cankaya.edu.tr. Upon the receipt of *both copies*, the printed copy will be forwarded to the Faculty Academic Board for approval. Incomplete forms will be returned to the Department. The approved form is finally sent to the President's office for approval by the Senate.

Part I. Basic Course Information

Department Name	Mechanical Engineering				**Dept. Numeric Code**	1 5	
Course Code	M E 4 8 1	**Number of Weekly Lecture Hours**	3	**Number of Weekly Lab/Tutorial Hours**	0	**Number of Credit Hours**	3
Course Web Site	http://me481.cankaya.edu.tr				**ECTS Credit**	0 5	

Course Name *This information will appear in the printed catalogs and on the web online catalog.*	
English Name	INTRODUCTION TO MICROELECTROMECHANICAL SYSTEMS
Turkish Name	MİKROELEKTROMEKANİK SİSTEMLERE GİRİŞ

Course Description
Provide a brief overview of what is covered during the semester. This information will appear in the printed catalogs and on the web online catalog. Maximum 60 words.

This course covers the following topics; introduction; overview of Microelectromechanical Systems (MEMS) and microsystems, working principles of microsystems, scaling laws and miniaturization, materials for MEMS and microsystems, microfabrication techniques, transducers, ways of transduction, microsystem design and packaging.

Prerequisites (if any) *Give course codes and check all that are applicable.*	1st	2nd	3rd	4th
	☒ Consent of the Instructor	☐ Senior Standing	☐ Give others, if any.	
Co-requisites (if any)	1st	2nd	3rd	4th
Course Type *Check all that are applicable*	☐ Must course for dept.	☐ Must course for other dept.(s)	☒ Elective course for dept.	☐ Elective course for other dept.(s)

Course Classification
Give the appropriate percentages for each category.

Category	Mathematics & Natural Sciences	Engineering Sciences	Engineering Design	General Education	Other
Percentage	20%	30%	30%	20%	0%

Part II. Detailed Course Information

Course Objectives
Explain the aims of the course. Maximum 100 words.

1) To introduce the concept of scaling and MEMS
2) To introduce materials used in MEMS
3) To explain the surface micromachining and bulk micromachining methods used for fabrication of MEMS
4) To introduce capacitive, piezoelectric, thermal, and IR based sensing and actuating methods
5) To mention packaging of MEMS

Learning Outcomes
Explain the learning outcomes of the course. Maximum 10 items.

1) Comprehend concept of scaling
2) Have an understanding of microfabrication methods
3) Have an understanding of various ways of transduction

Textbook(s)
List the textbook(s), if any, and other related main course materials.

Author(s)	Title	Publisher	Publication Year	ISBN
Nadim Maluf	An Introduction to Microelectromechanical Systems Engineering	Artech House, Inc.	1999	0131274988

Reference Books
List the reference books as supplementary materials, if any.

Author(s)	Title	Publisher	Publication Year	ISBN
Sergey Edward Lyshevski	Nano- and Microelectromechanical Systems: Fundamentals of Nano- and Microengineering	CRC Press	2000	
M. Elwenspoek, R. Wiegerink	Mechanical Microsensors	Springer-Verlag	2001	
G. T. A. Kovacs	Micromachined Transducers Sourcebook	McGraw-Hill	1998	

Teaching Policy
Explain how you will organize the course (lectures, laboratories, tutorials, studio work, seminars, etc.)

There are 3 hours of lectures each week.

Laboratory/Studio Work
Give the number of laboratory/studio hours required per week, if any, to do supervised laboratory/studio work, and list the names of the laboratories/studios in which these sessions will be conducted.

There is no regular laboratory work for this course.

Computer Usage
Briefly describe the computer usage and the hardware/software requirements in the course.

Students are expected to prepare their projects using computer. ANSYS Multiphysics and COMSOL Multiphysics are used for the project.

Course Outline
List the topics covered within each week.

Week	Topic(s)
1	Overview of Microsystems, potential of microsystems
2	Working principles of currently available microsensors, actuators
3	Scaling laws
4	Materials used for common microcomponents and devices
5	Design tools
6	Surface micromachining processes
7	Surface micromachining processes
8	Bulk micromachining processes
9	Transducers; sensing and actuating
10	Capacitive ways of transduction
11	Piezoelectric ways of transduction
12	Thermal transduction
13	IR based sensors
14	Packaging methods

Grading Policy
List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.

Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage
Homework	5	15	Case Study			Attendance		
Quiz	5	15	Lab Work			Field Study		
Midterm Exam	1	20	Class Participation			Project	1	20
Term Paper			Oral Presentation			Final Exam	1	30

ECTS Workload
List all the activities considered under the ECTS.

Activity	Quantity	Duration (hours)	Total Workload (hours)
Attending Lectures (*weekly basis*)	14	3	42
Attending Labs/Recitations (*weekly basis*)	-	-	-
Preparation beforehand and finalizing of notes (*weekly basis*)	14	**0.5**	**7**
Collection and selection of relevant material (*once*)	1	2	2
Self study of relevant material (*weekly basis*)	14	1	14
Homework assignments	5	**4**	**20**
Preparation for Quizzes	5	1	5
Preparation for Midterm Exams (*including the duration of the exams*)	1	8	8
Preparation of Term Paper/Case Study Report (*including oral presentation*)	-	-	-
Preparation of Term Project/Field Study Report (*including oral presentation*)	1	**14**	**14**
Preparation for Final Exam (*including the duration of the exam*)	1	10	10

TOTAL WORKLOAD / 25	122/25=4.88
ECTS Credit	**5**

Total Workloads are calculated automatically by formulas. To update all the formulas in the document first press CTRL+A and then press F9.

Program Qualifications vs. Learning Outcomes

Consider the below program qualifications determined in terms of learning outcomes of all the courses in the curriculum and capabilities. Look at the learning outcomes of this course given above. Relate these two using the Likert Scale by marking with X in one of the five choices at the right..

No	Program Qualifications	Contribution				
		0	1	2	3	4
ME-01	Adequate knowledge in mathematics, science and engineering subjects pertaining to Mechanical Engineering; ability to use theoretical and applied information in these areas to model and solve Mechanical Engineering problems.			X		
ME-02	Ability to identify and define complex Mechanical Engineering problems; ability to select and apply proper analysis tools and modeling techniques for formulating and solving such problems.			X		
ME-03	Ability to design a complex system, process, product or a machine under realistic constraints and conditions, in such a way as to meet the requirements; ability to apply modern design methods for this purpose.			X		
ME-04	Ability to devise, select, and use modern techniques and computing tools needed for Mechanical Engineering practice; ability to employ and make use of information technologies effectively with the use of engineering design software.				X	
ME-05	Ability to design and devise experimental setup, conduct experiments, gather data, analyze and interpret results for investigating Mechanical Engineering problems.	X				
ME-06	Ability to search databases and other information sources effectively; ability to identify and extract effectively the required information and knowledge from literature and other sources.			X		
ME-07	Ability to work efficiently in teams; ability to collaborate effectively in intra-disciplinary and multidisciplinary teams; ability to take responsibility within teams.			X		
ME-08	Ability to work individually, to take independent initiatives, and to create original inferences.			X		
ME-09	Ability to communicate effectively in Turkish, both orally and in writing.	X				
ME-10	Knowledge of a minimum of one foreign (English in particular) at a fluency level enough to follow easily Mechanical Engineering knowledge presented in that language and enough to communicate effectively with collogues.				X	
ME-11	Ability to report the findings, conclusions and interpretations related to a project work, ability to write technical reports, to prepare and conduct effective presentations.				X	
ME-12	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to keep continuously self improved.				X	
ME-13	Awareness of professional and ethical responsibility issues.	X				
ME-14	Capability to grasp business life practices such as project management, risk management, change management and strategic management.	X				
ME-15	Awareness of environmental issues, occupational safety and health, and their legal consequences. Knowledge about contemporary issues and the global and social effects of engineering practices; awareness of the legal consequences of engineering solutions			X		
ME-16	Awareness of entrepreneurship, innovation, and sustainable development.		X			

Contribution Scale to a Qualification: **0**-None, **1**-Little, **2**-Medium, **3**-Considerable, **4**-Largest

Part III New Course Proposal Information

State only if it is a new course

Is the new course **replacing** a former course in the curriculum**?**	Yes ☐	No ☒	Former Course's Code	Former Course's Name
Is there any similar course which has content **overlap** with other courses offered by the university**?**	Yes ☐	No ☒	Most Similar Course's Code	Most Similar Course's Name
Frequency of Offerings *Check all semesters that the course is planned to be offered.*	☒ Fall	☒ Spring	☐ Summer	
First Offering	Academic Year 2014/2015		Semester ☐ Fall	☒ Spring
Maximum **Class Size** Proposed	30	Student **Quota** for Other Departments	-	Approximate **Number of Students** Expected to Take the Course: 60

Justification for the proposal *Maximum 80 words*
As a contemporary subject, the area of microelectromechanical systems (MEMS) is rapidly growing. Therefore, this course is designed to introduce the students basic fabrication methods of microsystems and MEMS based transducers.

Part IV Approval

	Faculty Member *Give the Academic Title first.*	Signature	Date
Proposed by	Asst. Prof. Dr. Ender Yıldırım		
	Prof. Dr. Taner Altunok		

Departmental Board Meeting Date		Meeting Number		Decision Number	
Department Chair	Prof. Dr. Can ÇOĞUN	Signature		Date	

Faculty Academic Board Meeting Date		Meeting Number		Decision Number	
Dean	Prof. Dr. Celal Zaim ÇİL	Signature		Date	

Senate Meeting Date		Meeting Number		Decision Number	