ECTS COURSE INFORMATION FORM

Faculty	**Faculty of Engineering**	
Program	**B.Sc. in Civil Engineering**	**Elective**
	B.Sc. in Computer Engineering	**Required**
	B.Sc. in Electrical-Electronics Engineering	**Required**
	B.Sc. in Industrial Engineering	**Elective**
	B.Sc. in Mechanical Engineering	**Elective**

Course Code	EE 306			
Course Title in English	Microprocessors			
Course Title in Turkish	Mikroişlemciler			
Language of Instruction	English			
Type of Course	Flipped Classroom/Laboratory			
Level of Course	Undergraduate			
Course Category (by % of Content)	Basic Science	Basic Engineering	Engineering Design	General Education
	0	50	50	-
Semester Offered	Spring			
Contact Hours per Week	Lecture: 3 hours	Recitation: -	Lab: 1 hour	Other:-
Estimated Student Workload	174 hours			
Number of Credits	7 ECTS			
Grading Mode	Standard Letter Grade			
Pre-requisites	EE 203 Digital System Design			
Expected Prior Knowledge	Prior knowledge in basic electronics, digital systems and Boolean algebra is expected.			
Co-requisites	None			
Registration Restrictions	Only Undergraduate Students			
Overall Educational Objective	To learn the basics of microprocessors, its components and structure, and to design a system using microprocessor and peripherals.			
Course Description	This course provides a comprehensive introduction to computer and microprocessor based systems. The following topics are covered: Binary numeral system, Input/output Interface, I/O with interrupts, direct memory access and management, microprocessor architecture; system design with the state of the art microprocessors.			
Course Description in Turkish	Bu ders bilgisayar ve mikroişlemci tabanlı sistemlere kapsamlı bir giriş sağlamaktadır. Aşağıdaki konular kapsanacaktır: İkili değer aritmetiği, Giriş/Çıkış arayüzü, Kesmeler, adresleme yöntemleri, genel mikroişlemciler ve mimarileri, modern mikroişlemcilerle sistem tasarımı.			
Course Learning Outcomes and Competences	Upon successful completion of the course, the learner is expected to: 1. comprehend the structure and basic elements of a microprocessor/microcomputer such as CPU, addressing methods, memory and memory design; 2. apply basic interfacing for microprocessor input/output; 3. use the stack operation, subprogram and interrupt service routine to solve complex microprocessor programing problems; 4. design a microprocessors-based system as a part of team.			

Relationship of the Course with the Student Outcomes	Level	Learning Outcome(s)	Assessed by
Student Outcomes	N=None S=Supportive H=High		Exam, Project, HW, Experiment, Presentation, etc.
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	H	1	Exam, Project, HW, Experiment, Quiz
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	H	3	Exam, Project, HW, Experiment, Quiz
(3) an ability to communicate effectively with a range of audiences			
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts			
(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	H	4	Exam, Project, HW, Experiment, Quiz
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	H	2	Exam, Project, HW, Experiment, Quiz
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies			

Prepared by and Date	Assist. Prof. Tuba Ayhan / December 2019	
Semester	Spring 2019-2020	
Name of Instructor	Assist. Prof. Tuba Ayhan	
Course Contents	Week	Topic
	1.	Introduction to computer systems, Number systems, binary arithmetic and data representation
	2.	The architecture of microprocessor
	3.	Instruction set: Load, Store, Addressing modes
	4.	Instruction set: logic instructions and arithmetic instructions
	5.	Instruction set: Branches and loops
	6.	Programming the microprocessor with examples
	7.	Basic I/O interface
	8.	Memory interface
	9.	Interrupts, sub-routine and stack operation
	10.	Programming practice (using interrupts)
	11.	Direct Memory Access (DMA)
	12.	Microprocessor-based system design
	13.	Arithmetic co-processors
	14.	Advanced methods in microprocessor-based system design: introduction to multi-core systems.
	15.	Final Exam/Project/Presentation Period
	16.	Final Exam/Project/Presentation Period
Required/Recommended	ARM ASSEMBLY LANGUAGE Fundamentals and Techniques, William Hohl Christopher Hinds, CRC Press, 2014	

Readings	Computer Organization and Embedded Systems, Hamacher, Vranesic, Zaky, Manjikian, 6Ed, Mgh, 2012 Barry B. Brey, The Intel Microprocessors: Pearson New International Edition, 8/E, 2013 Patterson, David A; Hennessy, John L, Computer organization and design: the hardware/software interface by The Morgan Kaufmann series in computer architecture and design., 2012, Revised 4th edition. ARM Cortex-A9 microprocessor tutorials, instruction set and DE1-SoC manuals – online.
Teaching Methods	Contact hours using "Flipped Classroom" as an active learning technique.
Homework and Projects	There will be assignments with these topics: 1. Binary arithmetic, 2. Microprocessor architecture 3. Microprocessor programming 4. Microprocessor programming with interrupts 5. Co-processors. Some will be given as quizzes, depending on the classroom/lab availability. There will be a group project on microprocessor-based system design. Forming groups with at least 1 EE and 1 CE students is encouraged. Project demo and presentations is open to all faculty members; CE and EE department members are explicitly invited.
Laboratory Work	Students will carry out experiments on the following topics: programming a microprocessor for simple I/O operation, programming a microprocessor using interrupts and sub-routines, building a microprocessor-based system on evaluation board. Students are required to get prepared for their lab work beforehand by using off-text book learning strategies, when needed. Students carry out lab work with their lab mates. Lab time is limited; therefore they need to plan their teamwork accordingly. There are at least 7 lab sessions. First lab session is not reported, is not graded.
Computer Use	Laboratory work requires computer usage for microprocessor programming. Homework assignments require using computer aided design tools and emulators, too.
Other Activities	-
Assessment Methods	Types of assessment — Number — Ratio (%) Midterm Exam — 1 — 25 Lab work and reports — 6 — 30 Project — 1 — 20 Quizzes/assignments — 7-8 — 25 Total — — 100
Course Administration	**Instructor's office and phone number**: 5th Floor, A570 **office hours:** TBA on Blackboard; email **address:** ayhant@mef.edu.tr **Policies:** • **Missing a midterm**: Provided that proper documents of excuse are presented, a make-up exam will be given for the missed midterm. Make-up exam is scheduled within the 7 days that the student does not have an excuse anymore. • **Missing a final/project**: Faculty regulations. • **Homework assignments** are due 2 weeks after it is announced. Late ones are not accepted unless a faculty approved excuse is presented. • **All exams** are in closed-notes and closed-books format. Necessary instruction set and manuals will be provided or brought by the student. • To be eligible of submitting the **final project**, you should attend 5 out of 7 lab sessions, collect 160pnt out of 800 from lab reports and homework and your midterm score should be at least 20 (out of 100). • Anyone with a final project score lower than 20 (out of 100) will fail. • **A reminder of proper classroom behavior, code of student conduct**: YÖK Regulations • **Statement on plagiarism**: YÖK Regulations http://3fcampus.mef.edu.tr/uploads/cms/webadmin.mef.edu.tr/4833_2.pdf

ECTS Student Workload Estimation

Quiz Assignment	8	2	1		24	A*(B+C+D)
Labs	6	2	2	2	36	A*(B+C+D)
Project	1	20	2		22	A*(B+C+D)
Midterm(s)	1	20	2		22	A*(B+C+D)
					0	A*(B+C+D)
Total Workload					174	
Total Workload/25					6,96	
ECTS					**7**	