OSTİM TECHNICAL UNIVERSITY
INSTITUTE OF SCIENCES
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE SCHEDULE FORM
2023-2024 SPRING

EEE308 MICROPROCESSORS

Course Unit Name	Course Unit Code	Semester	Lecture Hr	Practice Hr	Lab Hr	Credit	ECTS
MICROPROCESSORS	EEE308	Spring	2	0	2	3	4

Course Details	
Language of Instruction	English
Level of Course Unit	Bachelor's Degree
Program	ELECTRICAL & ELECTRONICS ENGINEERING
Mode of Delivery	Face to Face
Type of Course Unit	Compulsory
Objectives of the Course	The aim of this course is to explain the instruction set architectures of microprocessors (assembly and c commands, addressing modes, command formats, run times etc.), internal structure of microprocessor, memory hierarchy and programming input/output ports. PIC microcontroller family is to be investigated as sample.
Course Content	Microprocessor based systems. An introduction to the PIC microprocessor family. Software Architecture: addressing modes. Data transfer instructions. Arithmetic, logical, bit manipulation, program transfer, and processor control instructions. Software and hardware interrupts. An introduction to the programming. Programming applications. Hardware architecture: hardware details of the PIC. Memory system design. I/O system design. Special hardwares (ADC / DAC / PWM / UART / I2C / INTERRUPTS) of PIC/dsPIC family. Communication programming with RS232 / RS485 / TCP-IP / MODBUS.
Course Method and Techniques	Lectures, Homework's
Prerequisites and Corequisities	
Course Coordinator	Dr. Hüseyin KÖSE
Name of Lecturer(s)	Dr. Hüseyin KÖSE
Assistants	
Work Placement(s)	Classroom

Recommended or Required Reading
1. "Embedded C Programming Techniques and Applications of C and PIC MCUS", by Mark Siegesmund, 1st Edition - September 19, 2014. 2. CCS C Compiler Manual, November 2021, online free pdf. 3. Design reference notes and data sheets of Microchips.

Course Category					
Mathematics and Basic Sciences	:		Education	:	
Engineering	:		Science	:	
Engineering Design	:	x	Health	:	
Social Sciences	:		Profession	:	

Weekly Detailed Course Contents		
Week No	**Topics**	**Pre-study & Materials**
1	PIC microcontrollers: History and features of Microchip and PIC/dsPIC series microcontrollers. General Description of a microprocessor system, working principles, logic algorithms, environment units.	Lecture book & Presentations
2	C Compilers and Development System: An introduction to MPLAB C and CCS C. How to use a C compiler to program a microchip. Remembering C language	Lecture book & Presentations
3	PIC Architecture & Programming: Hardware description of PIC18F and dsPIC30F/dsPIC33EP series. RAM, ROM, MIPS, other important hardware design features. Reading a microprocessor datasheet effectively.	Lecture book & Presentations
4	I/O Port Programming: Programming input or output ports. Port forwarding, register mapping, pin assignments, direct accessing to registers. Bit manipulation commands. 8bit, 16bit, 32bit variables, hexadecimal and decimal values. Sample programs.	Lecture book & Presentations
5	ADC and DAC: Reading an analog value from input ports using ADC unit of microprocessors. ADC and DAC hardware, working principles, register settings. Understanding sampling frequency, calculation period, average and rms calculations. Understanding DAC unit and working principles. Sample programs.	Lecture book & Presentations
6	Timers and Interrupts: Understanding Timers, working principles, timer interrupts, interrupt routines, interrupt vector definitions, priorities of interrupts, semaphore technique.	Lecture book & Presentations
7	**Midterm Exam**	
8	PWM and CCP: PWM signal generating, duty-cycle, dead-time, PWM modes, SPWM, SVPWM. Capture and Compare hardware, register setting, programming CCP. Sample programs.	Lecture book & Presentations
9	I2C and SPI: I2C and SPI interfaces of microprocessors. USB communication hardware. EEPROM, RTC, and other I2C or SPI communicated environment devices. Sample programs.	Lecture book & Presentations
10	LCD and Keypad Interface: Interfacing with an LCD. LCD hardware, working principle, library code examples. Using a button or keypad. Sample programs.	Lecture book & Presentations
11	Serial Port Programming: UART hardware description. Serial communication between microprocessors. RS232/RS485/TCP-IP hardware and MODBUS protocol. Sample programs	Lecture book & Presentations

12	Sensor and other Applications: Industrial sensors, feedbacks, optocoupler circuits, closed loop control applications with microprocessors, PLC programming, other microprocessor applications like DSP Texas, ARM, AVR, intel, Raspberry kits, Arduino kits etc…	Lecture book & Presentations
13	Examples	Lecture book & Presentations
14	Examples	Lecture book & Presentations
15	Examples	Lecture book & Presentations
16	**Final Exam**	

Course Learning Outcomes	
No	**Learning Outcomes**
C1	Know the instruction set architecture, registers, ROM or RAM usage.
C2	Can use assembly or c commands and write their own programs.
C3	Understand the internal structure and hierarchy of PIC/dsPIC/others.
C4	Can program input / output ports and ADC / PWM / UART /I2C units.
C5	Can make a project using microprocessor / microcontroller.

Programme Outcomes	
No	**Outcomes**
P01	An ability to identify, formulate, and solve complex electrical and electronics engineering problems by applying principles of engineering, science, and mathematics.
P02	Ability to identify, define, formulate and solve complex electrical and electronics engineering problems; ability to select and apply appropriate analysis and modeling methods for this purpose.
P03	The ability to design a complex system, process, device or product to meet specific requirements under realistic constraints and conditions; ability to apply modern design methods for this purpose.
P04	Ability to develop, select and use modern techniques and tools necessary for the analysis and solution of complex problems encountered in electrical and electronics engineering applications; ability to use information technologies effectively.
P05	Ability to design and conduct experiments, collect data, analyze and interpret results for the investigation of complex electrical and electronics engineering problems or discipline-specific research topics.
P06	Ability to work effectively in disciplinary and multi-disciplinary teams; individual working skills.
P07	Ability to communicate effectively in Turkish orally and in writing; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and produce reports, to make effective presentations, to give and receive clear and understandable instructions.
P08	Awareness of the necessity of lifelong learning; the ability to access information, follow developments in science and technology, and constantly renew oneself.
P09	Behaving in accordance with ethical principles, awareness of professional and ethical responsibility; knowledge of standards used in engineering practice.
P10	Knowledge of business practices such as project management, risk management and change management; awareness of entrepreneurship, innovation; information about sustainable development.
P11	Information about the effects of electrical and electronics engineering practices on health, environment and safety in universal and social dimensions and the problems of the era

	reflected in the field of engineering; awareness of the legal consequences of engineering solutions.

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab	16	%20
Practice		
Fieldwork		
Course-specific internship (if any)		
Quiz/Studio/Criticize		
Homework		
Presentation		
Project		
Report		
Seminar		
Midterm Exam	1	% 20
Final Exam	1	% 60
	Total	**%100**
Contribution of Midterm Studies to Success Grade		% 40
Contribution of End of Semester Studies to Success Grade		% 60
	Total	**% 100**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hr)**	**Total Work Load**
Weekly Theoretical Course Hrs (Including the exam week: 16 x total course hours)	16	2	32
Lab	16	2	32
Practice			
Course-specific internship (if any)			
Fieldwork			
Out-of-class study time			
Presentation/Seminar Preperation			
Project			
Report			
Homework			
Quiz/Studio/Criticize			
Midterm Exam and Preperation for Midterm	1	20	20
Final Exam and Preperation for Final Exam	1	20	20
Total Workload			**104**
ECTS Credit	**(104 /25) =**		**4.16**

Contribution of Course Learning Outcomes to Programme Outcomes											
Contribution: 1: Very Slight 2:Slight 3:Moderate 4:Significant 5:Very Significant											
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**
C1	3	3			3	3		3			
C2	3	3			4	4		4			
C3	3	4	3	3	4	4		4			3
C4	4	4	3	3	5	4		5			3
C5	4	4	3	3	5	4		5			3