



SYLLABUS FOR EE 454 – MICROPROCESSORS

TED UNIVERSITY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Academic Year & Semester

2025 Spring

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Course Code	EE 454	Course Title	Microprocessors
Type of Course	☐ Compulsory ☒ Elective	Semester	☐ Fall ☒ Spring ☐ Summer
Credit Hours / ECTS credits	(2+0+2) 3 Credits / 5 ECTS	Pre-requisite	EE 222
		Co-requisite	NONE
Mode of Delivery	☒ Face-to-face ☒ Distance learning	Language of Instruction	☒ English ☐ Turkish
Course Level	☒ Undergraduate ☐ Graduate (MS) ☐ Graduate (PhD)	Year of Study	☐ First Year ☐ Sophomore ☐ Junior ☒ Senior
			☐ Masters ☐ Doctorate

Course Coordinator	Dr. Kurtuluş Erinc Akdoğan E-mail: erinc.akdogan@tedu.edu.tr Room: F-324 Phone: +90 (312) 585 0000		
Office Hours	By appointment via e-mail		
Teaching Assistant(s)	Res. Asst. Gülce Turhan E-mail: gulce.turhan@tedu.edu.tr Room: A420		
	Res. Asst. Bengisu Ünalın E-mail: bengisu.unalan@tedu.edu.tr Room: A420		
Office Hours	Gülce Turhan	Thursday (12:00-13:00)	
	Bengisu Ünalın	Monday (11:00-12:00)	
Course Schedule	Section 01	Wednesday (12:00-14:00) @F117, Friday (14:00-16:00) @A311-L	

Catalog Description	Microprocessor and microcontroller architecture. ARM Assembly programming language. Registers, memory, and addressing modes. Concepts of subroutine, stack, interrupt, timer, and general-purpose input and output (GPIO). Experiments on loops, subroutines, stacks, GPIO, and interrupts.
Course Objectives	The main objective of the course is to provide students with the ability to understand general microprocessor and microcontroller architecture, interact with the hardware of architecture through software composed of architecture's instruction set in Assembly language, introduce the concepts of subroutine, stack, interrupt, timer and general-purpose input and output (GPIO) and provide hands-on experience to apply concepts by writing codes in Assembly language using an integrated development environment (IDE) and testing codes on a development kit.
Required Reading	Valvano, J. (2019). <i>Introduction to ARM Cortex-M Microcontrollers</i> . Fifth Edition.
Suggested / Recommended Reading	Yiu, J. (2014). <i>The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors</i> . Newnes.
Software Usage	Assembly and Keil µVision IDE
Course Learning Outcomes (LOs)	Having successfully completed this course, students will be able to: LO-1: Identify and list the fundamental components comprising the abstract general system architecture of microprocessors and microcontrollers. Describe the functioning of these components within an ARM microprocessor-based microcontroller.



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LO-2: Explain the organization of the ARM Assembly Programming Language by examining the mechanisms behind data transfer between registers and memory within the microcontroller. Analyze these operations about different addressing modes utilized.

LO-3: Utilize the instruction set of the Assembly Programming Language to implement various computational tasks, including arithmetic, logical, and branching instructions on the microprocessor of the selected development kit.

LO-4: Examine and deconstruct the concepts of subroutines, stacks, interrupts, timers, and general-purpose input and output (GPIO) in the context of microcontroller programming. Analyze their roles and interactions within the system architecture.

LO-5: Verify the written codes for the concepts covered in the course by assessing and justifying their correctness and effectiveness. Evaluate the code's functionality, efficiency, and potential limitations. Recommend and write new codes for required tasks based on the previously analyzed codes throughout the course and laboratory.

LO-6: Arrange a code development environment to write, build, and debug code and to transfer assembled code to the selected development kit. Develop code solutions in collaboration with peers for specific tasks to experiment with the concepts studied in the course such as subroutines, loops, nested subroutines, stack, GPIO, and interrupt by modifying given codes throughout the course and laboratory preliminary works. Debug and compile the developed code on the selected development kit.

Course Evaluation

Course feedback survey will be conducted in the last two weeks of the semester.

Course Web Page

The class has already been enrolled in Moodle (<https://lms.tedu.edu.tr/>). All announcements and course-related materials will be posted on the Moodle course page.

Some Useful Website References

<https://users.ece.utexas.edu/~valvano/>

Learning Activities & Teaching Methods

☒ Brainstorming
☒ Case Study/Scenario Analysis
☒ Collaborating
☐ Concept Mapping
☒ Demonstrating
☒ Discussions / Debates
☐ Drama / Role Playing
☒ Experiments
☐ Field Trips
☐ Guest Speakers

☒ Hands-on Activities
☒ Inquiry
☐ Microteaching
☐ Oral Presentations / Reports
☐ Peer Teaching
☐ Predict-Observe-Explain
☒ Problem Solving
☒ Questioning
☒ Reading

☐ Scaffolding / Coaching
☐ Seminars
☐ Service Learning
☐ Simulations & Games
☒ Telling / Explaining
☐ Think-Pair-Share
☐ Video Presentations
☒ Web Searching
☐ Other(s):

Assessment Methods & Criteria

☐ Case Studies / Homework	(...%)	☐ Presentation (Oral, Poster)	(...%)
☒ Lab Assignment	(35%)	☐ Project	(...%)
☐ Observation	(...%)	☐ Quiz	(...%)
☐ Oral Questioning	(...%)	☐ Self-evaluation	(...%)
☐ Peer Evaluation	(...%)	☒ Test/Exam	(65%)
☐ Performance Project (Written, Oral)	(...%)	☐ Other(s):	(...%)

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	☐ Portfolio	(...%)	
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Student Workload	☐ Case Study Analysis	(... hrs)	☐ Online Discussion	(... hrs)
	☒ Course Readings	(28 hrs)	☐ Oral Presentation	(... hrs)
	☐ Debate	(... hrs)	☐ Poster Presentation	(... hrs)
	☐ Demonstration	(... hrs)	☐ Report on a Topic	(... hrs)
	☒ Exams/Quizzes	(42 hrs)	☐ Research Review	(... hrs)
	☐ Field Trips/Visits	(... hrs)	☐ Resource Review	(... hrs)
	☒ Hands-on Work	(24 hrs)	☐ Team Meetings	(... hrs)
	☒ Lab Applications	(28 hrs)	☐ Web Designs	(... hrs)
	☒ Lectures	(28 hrs)	☐ Work Placement	(... hrs)
	☐ Mock Designs	(... hrs)	☐ Workshop	(... hrs)
	☐ Observation	(... hrs)	☐ Other(s):	(... hrs)
	Total Workload			150 hrs

TENTATIVE OUTLINE				
<i>Any changes and updates will be announced on the course web page.</i>				
Week	Topics	LOs	Textbook Reading	Assignments
1	Generic Microprocessor Architecture	1	Ch. 1	
2	Generic Microprocessor Architecture	1, 2	Ch. 1	
3	Representation of Numbers	1	Ch. 3	
4	Introduction to ARM Microprocessors	1, 2	Ch. 2, 3	Exp#1
5	Introduction to ARM Assembly	3	Ch. 3	
6	ARM Assembly Instructions-Data Processing, Branch and Control	3, 5, 6	Ch. 3	Exp#2
7	Directives	2, 3	Ch. 3	
8	Ramadan Feast (No Lecture)			
9	Arithmetic Instructions, Conditional Branching, Link Register and Subroutines	4, 5, 6	Ch. 3, 5	Exp#3
10	Subroutines, Parameter Passing, Stack, Nested Subroutine Calls	4, 5, 6	Ch. 3	Exp#4
11	23 April National Sovereignty and Children's Day (No Lecture)			Midterm (25.04.2025)
12	Memory, General Purpose Input/Output (GPIO): Output	4, 5, 6	Ch. 4, 9	Exp#5



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13	General Purpose Input/Output (GPIO): Input	4, 5, 6	Ch. 4	Exp#6
14	Interrupts	4, 5, 6	Ch. 9	Exp#7
15	Timers	4, 5	Ch. 4	
16	Serial Interface	4, 5	Ch. 8	
FINAL EXAMS WEEK (<i>date and time to be announced later</i>).				

COURSE ASSIGNMENTS & GRADING

A. Midterm Exam [30%]

There will be a single closed-book & closed-note midterm exam, which will be taken in the 10th week.

B. Final Exam [35%]

There will be a cumulative closed-book final exam covering all topics. The date and time of the final exam will be announced at the end of the semester.

C. Lab Assignments [35%]

There will be 7 experiments, each contributing 5% to the overall grade. For each experiment, you will be required to prepare a prelab report, a final report, and attend a post quiz.

Lab Grading: Lab Performance [10%], Preliminary reports [30%], Final lab reports [40%], Lab Quiz [20%]

COURSE ASSESSMENTS & LEARNING OUTCOMES MATRIX

Assessment Methods	Course Learning Outcomes
Quizzes	LO# 1–6
Lab Assignments	LO# 1–6
Midterm Exam	LO# 1–4
Final Exam	LO# 1–6

COURSE POLICIES

I. Attendance

- Regular class attendance is expected for all students at the University. You are not required but advised to attend all classes.
- Please send your professor a brief e-mail to explain your absence in advance.
- Your absence will not reduce your attendance rate *if and only if* you have a legitimate reason for missing a class (such as illness, death in the family, a traffic accident, *etc.*). In case of a disease or emergency, you must supply formal documentation that supports your claim.
- Classes start at the hour. Please be respectful of your classmates by being on time.
- All electronic equipment should be turned off and kept out of sight before the lecture starts.

II. Make-up Policy

There will be a single make-up for experiment and a single make-up exam for the Midterm and Final Exam which will be available if and only if you have a legitimate reason for missing the exam (such as illness, death in the family, a traffic accident, *etc.*). In case of an illness or emergency, you must supply a formal documentation that supports your claim. The topics for the make-up exam are from everything that is covered in class at the time of the exam. There will be no make-up for the quizzes or the term project.



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III. Late Submission Policy

Late submissions of preliminary work and experiment report will be penalized %10 for each day. not be graded. Missed quizzes without any clarification will result in a grade of zero (0).

IV. Cheating & Plagiarism

Collaboration is strongly encouraged; however, the work you hand in must be solely your own. Cheating and plagiarism are severe offenses and will be penalized accordingly by the university disciplinary committee. Cheating has a comprehensive description which can be summarized as "acting dishonestly." Some of the things that can be considered cheating are the following:

- Copying answers on exams, home works and lab works,
- Using prohibited material on exams,
- Lying to gain any advantage in class,
- Providing false, modified, or forged data in a report,
- Plagiarizing (see below),
- Modifying graded material to be re-graded,
- Causing harm to colleagues by distributing false information about an exam, homework, or lab.

All of the following are considered plagiarism (www.plagiarism.org):

- Turning in someone else's work as your own,
- Copying words or ideas from someone else without giving credit,
- Failing to put a quotation in quotation marks,
- Giving incorrect information about the source of a quotation,
- Changing words but copying the sentence structure of a source without giving credit,
- Copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not.

V. Disability Support

If you have a disabling condition that may interfere with your ability to complete this course successfully, please contact Dr. Kurtuluş Erinç Akdoğan (erinc.akdogan@tedu.edu.tr).

VI. Student Development and Psychological Counseling Center

Student Development and Psychological Counseling Centre is mandated with providing crisis intervention and supportive listening services to the campus community. The Center conducts individual counseling, group guidance studies, workshops, seminars, and orientation studies for all students in need. You may apply to the Center in order to deal with all your current problems. For further information and/or questions: ogrencidanismamerkezi@tedu.edu.tr <http://csc.tedu.edu.tr/>.

VII. TEDU Without Barriers Unit

Please inform the TEDU Without Barriers Unit and the instructor of the course about the specific issues in case you have a physical or mental disability and are having trouble with anything related to this course such as accessing the material, participating in the class, taking notes, preparing for, attending or managing to complete the exams. Your situation will be reviewed by commission, in accordance with the principle of confidentiality, and if deemed appropriate, facilitating measures will be taken so that you can take the course more efficiently. For further information and/or questions: engelsiz@tedu.edu.tr <https://www.tedu.edu.tr/engelsiz-tedu>

Prepared By	Dr. Kurtuluş Erinç Akdoğan	Date	03/02/2023
Revised By	Dr. Kurtuluş Erinç Akdoğan	Rev. Date	03/04/2025



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