COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
REAL-TIME SYSTEMS	**CSE538**	**1**	**3+0**	**3**	**10**

Prerequisites	-

Language of Instruction	English
Course Level	Graduate Degree
Course Type	Technical Elective
Course Coordinator	
Instructors	Prof. Sezer Gören Uğurdağ
Assistants	-
Goals	Intended to familiarize students with real-time/embedded programming tools & techniques with state-of-the-art boards (Texas Instruments EvalBOT, Zoom OMAP-L138 EVM/Experimenter Development Kit, ARM NXP LPC1768 Development Board). Through a series of laboratory exercises students acquire skills in the design/ implementation/debugging of core embedded real-time functionality. This hands-on course introduces real-time concepts and the real-time embedded development/programming/debugging techniques.
Content	Topics include I/O programming, cyclic executives, real-time principles (multi-tasking, scheduling, synchronization), real-time executives, DSPLink, DSPBIOS, RTAI, uCOS-III, MDK-ARM, and RTX.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in real-time concepts.	1	1,2,3	A,B,C,D
2) Ability to write real-time embedded applications.	5, 6	1,2,3	B,D
3) Ability to debug, verify, emulate real-time embedded systems.	5, 6	1,2,3	B,D
4) Ability to devise, select, and use modern techniques and tools needed for real-time embedded systems.	5, 6	1,2,3	B,D
5) Ability to work in a team.	6	3	B,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab (Unofficial), 4: Case-study

Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	FOREGROUND/BACKGROUND SYSTEMS VERSUS RTOS-BASED SYSTEMS, RTOS OVERVIEW	Textbook
2	CRITICAL SECTIONS OF CODE, SHARED RESOURCES, MULTITASKING, TASKS, CONTEXT SWITCHES	Textbook
3	KERNEL TYPES, KERNELS, SCHEDULERS, NON-PREEMPTIVE KERNELS, PREEMPTIVE KERNELS	Textbook
4	REENTRANT FUNCTIONS	Textbook
5	ROUND-ROBIN SCHEDULING, TASK PRIORITIES, STATIC/DYNAMIC PRIORITIES, PRIORITY INVERSION, PRIORIT INHERITANCE	Textbook
6	MUTUAL EXCLUSION, SEMAPHORES, DEADLOCK, SYNCHRONIZATION	Textbook
7	MIDTERM 1	Textbook
8	INTERTASK COMMUNICATION, MESSAGE MAILBOXES/QUEUES	Textbook
9	INTERRUPTS, INTERRUPT LATENCY/RESPONSE/RECOVERY, ISR PROCESSING TIME, NONMASKABLE INTERRUPTS, CLOCK TICK	Textbook
10	MEMORY REQUIREMENTS, ADVANTAGES/DISADVANTAGES OF REAL-TIME KERNELS	Textbook
11	EMBEDDED PROGRAMMING WITH OMAP-L138 EVM/EXPERIMENTER KIT, OVERVIEW OF OMAPL138 SOM	Textbook
12	DSP/BIOS, AUDIO PROCESSING	TEXAS INSTRUMENTS Website
13	OTHER RTOS: MDK-ARM, RTX, RTAI	Web
14	PROJECT DEMOS	-

RECOMMENDED SOURCES	
Textbook	Jean J Labrosse, Micrium's uC/OS-III: The Real-Time Kernel
Additional Resources	Donald Reay, Digital Signal Processing and Applications with the OMAPL138 Experimenter, Wiley.

MATERIAL SHARING	
Documents	http://tech.groups.yahoo.com/group/cse538/
Assignments	http://tech.groups.yahoo.com/group/cse538/
Exams	http://tech.groups.yahoo.com/group/cse538/

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	25
Assignment	5	25
Lab Work (unofficial)	10	20
Term Project	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution						
		0	1	2	3	4	5
1	Ability to reach wide and deep knowledge through scientific research in the field of Computer Science and Engineering, evaluate, interpret and apply.						**X**
2	Ability to use scientific methods to cover and apply limited or missing knowledge, and to integrate the knowledge of different disciplines.						
3	Ability to construct Computer Science and Engineering problems, develop methods to solve the problems and use innovative methods in the solution.						
4	Ability to develop new and/or original ideas and algorithm; develop innovative solutions in the design of system, component or process.						
5	Ability to have extensive knowledge about current techniques and methods applied in Computer Engineering and their constraints.						**X**
6	Ability to design and implement analytical modeling and experimental research, solve and interpret complex situations encountered in the process.						**X**
7	Ability to use a foreign language (English) at least at the level of European Language Portfolio B2 in verbal and written communication.						
8	Ability to lead in multidisciplinary teams, develop solutions to complex situations and take responsibility.						

9	Ability to pass process and the results in Computer Science and Engineering field, in national and international area in or outside of the field, systematically and clearly in written or oral form.						
10	Awareness of the social, legal, ethical and moral values, and the ability to conduct research and implementation work within the framework of these values.						
11	Awareness of the new and emerging applications in Computer Science and Engineering field, and the ability to examine them and learn if necessary.						
12	Ability to describe the social and environmental dimensions of Computer Science and Engineering applications.						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Midterm examination	1	10	10
Homework	5	10	50
Project	1	60	60
Final examination	1	10	10
Total Work Load			242
Total Work Load / 25 (h)			9.6
ECTS Credit of the Course			10