

Department	Electrical and Computer Engineering
Course Number	EE 475
Course Title	Hardware and Software Engineering for Embedded Systems
Course Designation	Required for CpE, Elective for EE
University Catalog Description	F 3 cr. LEC 2 LAB 1 PREREQUISITE: EE 371 and CS 201. -- Topics in embedded system design, real-time operating systems, high level language programming of embedded systems, software and hardware tradeoffs, and laboratory experience with embedded systems.
Faculty Coordinator	Randy M. Larimer
Prerequisite by Topic	Microcontroller hardware and software, C programming Language
Textbook	<i>"Software and Hardware Engineering – Assembly and C Programming for the Freescale M68HCS12 Microcontroller"</i> , Frederick M. Cady, 2 nd edition, 2008 and; <i>"Micro C/OS-II – The Real-Time Kernel"</i> , Jean J. Labrosse, 2 nd edition, 2002
Course Objectives	To produce graduates who understand the basic operation of a real-time operating system and can program a real-time embedded system in the C language
Course Learning Outcomes	At the conclusion of EE 475, students are expected to be able to: 1) Be able to explain real-time concepts such as preemptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, synchronization, interrupt latency and response time, and semaphores. 2) Describe how a real-time operating system kernel is implemented. 3) Explain how tasks are managed. 4) Explain how the real-time operating system implements time management. 5) Discuss how tasks can communicate using semaphores, mailboxes, and queues. 6) Be able to implement a real-time system on an embedded processor.
Topics Covered	1) Review of the C language 2) Foreground/Background Systems, Critical Sections 3) Interrupts, Multitasking, Context Switching, Scheduling 4) Reentrancy, Task Priorities, Mutual Exclusion 5) Semaphores, Intertask Communications 6) uC/OS-II Kernel and internal structure 7) Tasks, Task states, Task control blocks, Task scheduling and management 8) Message mailboxes and queues, Memory allocation.
Class/Laboratory Schedule	EE 475 meets two times/week for 50 minutes plus a two-hour lab session.
Professional Component (Criterion 5)	This course gives the student the ability to analyze and solve engineering problems related to real-time embedded systems.
ECE Program Outcomes	c. An ability to design a system, component, or process to meet desired needs. e. An ability to identify, formulate, and solve engineering problems. g. An ability to communicate effectively. k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice. n. An ability to program microcontroller/microcomputer systems using assembly and high level languages. q. An ability to implement real-time systems.
Total Credit Hours	3
Prepared by	Randy M. Larimer 5/18/2009