411 CPE Course Syllabus

Course Code	CPE 411
Course Name	Embedded and Real Time System
Credit Hours	1
Contact Hours	2
Instructor Name	Dr. Ahmed Said

Text Book (title, author, and year)
1 Jane W. S. Liu, Real-Time Systems, Prentice Hall, 2000. 2. Piny Li & Caroline Yao , Real Time concepts for embedded systems ; CMP Books; 2003 3. J. E. Proakis, D. G. Manolakis; Digital Signal Processing, 4th ed.; Prentice Hall; 2006 4..Rajkannal,Embedded systems, TATA McGraw-Hill.,2009 5.S. J. Chapman, MATLAB Programming for Engineers, Thomson, 2007 6..Rajib Mall, Real-Time Systems Theory and Practice, Pearson, 2007.

Specific Course Information	
Catalog Description	The course describes the characteristics of a real-time computing system. Concepts of time critical I/O and real-time deadlines are emphasized, as are the important aspects of real-time operating systems, scheduling and the practical implementation of embedded systems.
Prerequisites	CPE220 Microprocessor and Interfacing
Co-requisites	NIL
Required/Elective	required

Course Learning Outcomes	
1	The ability apply knowledge of interface sensors, actuators about 8051 microcontroller architecture and bus organization, and networks in embedded systems.
2	The ability to Use a Real-Time Operating System to implement an embedded system design
3	Students will be expected to write and practice Programs using MATLAB & LABVIEW.
4	The ability to understand system requirements, to define, formulate and analyze the problem and Test, debug, and verify that the design meets the desired specifications
5	Ability to develop mini projects

Mapping course LOs to the SLO.												
Course LOs #	Student Learning Outcomes											
	a1	a2	b1	b2	b3	b4	b5	c1	c2	c3	d1	d2
1												
2												
3												
4												
5												

List of Theory Topics

- Introduction to Embedded: Definition, Scope, importance, major disciplines of Embedded systems, and applications.
- Embedded-systems and microcontroller technology, architecture, and Peripherals.
- Digital-signal processing (DSP) on embedded systems Overview of digital-filter theory. Digital filter implementation, Signal conditioning and data conversion, Finite word-length effects.
- Digital-signal processing (DSP) on embedded systems Realization structures and models implementation analysis and synthesis
- Real-time operating systems (RTOS)
- Introduction to real-time processing Basic components of an RTOS, Cooperative and preemptive multitasking. Synchronization and communication among tasks and Applications.
- Task scheduling Algorithms: Introduction. Preemptive scheduling, Non preemptive scheduling, parallelizable task scheduling. Priority driven preemptive scheduling approach.
- Task scheduling Algorithms scheduling independent periodic tasks.
- High-speed ADC/DAC. High-resolution A/DAC Interfaces used in embedded systems: USB. CAN, 12C, Suppon circuitry (watch-dog timers, VDD. PWM), Low-power design. Batteries and DC/DC conversion

List of Lab Experiments

- Introduction of Lab VIEW Programming, Familiarization of LABVILIW Block Diagram and Front Panel and Practice with simple examples Implement Arithmetic Operations in Lab view.
- Exercises Building VI, Temperature LOG VI, Determine Warnings VI.
- Vision Machine: Shape and Display.
- SbRIO (Single Board Real Time Input Output): Accessing I/O
- Cluster data & Generate Global, Comparison of numbers, State Machine
- Vision Machine : Snap and Safe to Image File
- SbRIO (Single Board Real Time Input Output): FPGA Application12. Formula node VI (Roots of Quadratic Equation with Sub-VI in LabVIEW.
- Stepper Motor Control VI