16CS402 EMBEDDED SYSTEMS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

CS	WA/RA	SSH	SA	S	BS
5	5	40	8	5	2

Course Description and Objectives:

This course emphasizes on comprehensive treatment of embedded hardware and real time operating systems along with case studies, in tune with the requirements of Industry. The objective of this course is to enable the students to understand embedded-system programming and apply that knowledge to design and develop embedded solutions.

Course Outcomes:

The student will be able to:

- understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
- get familiarized with programming environment to develop embedded solutions.
- write programs using Embedded C.
- program ARM microcontroller to perform various tasks.
- understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.

SKILLS:

- ü *Development and Simulation of embedded system applications.*
- ü *Programming the ARM processors.*
- ü *Design of microcontroller based embedded system.*
- ü *Interfacing of various peripherals with ARM processors.*

ACTIVITIES:

- *Identify hardware and software components to build an embedded system.*
- *Porting of OS on to 8051/ ARM processor board.*
- *Demonstrate the interfacing of peripherals with 8051/ARM microcontroller.*
- *Demonstrate Deadlock situation in RTOS.*
- *Demonstrate Inter-task communication methods in RTOS.*

UNIT - 1 **L-09**

INTRODUCTION TO EMBEDDED SYSTEMS: Definition, Applications of ES, Embedded Hardware Units and Devices, Embedded Software, Design Metrics in ES, Challenges in ES Design, Host and Target machines and Getting Embedded Software into the Target System.

UNIT - 2 **L- 09**

ARCHITECTURE OF 8051 AND ITS PROGRAMMING WITH C: 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts and Programming 8051 using Embedded C.

UNIT - 3 **L- 09**

ARM- EMBEDDED PROCESSOR: History, Architecture, Interrupt vector, Programming the ARM, ARM Assembly language, Instruction set, Conditional Execution, Arithmetic and Logical Compare.

UNIT - 4 **L- 09**

ARM PROGRAMMING: Assembly programming, General structure of assembly language, Writing programs, Branch and load and store instructions, Read-only and read/write Memory, Multiple Register Load and Store.

UNIT - 5 **L- 09**

REAL TIME OPERATING SYSTEMS: Introduction**,** Tasks and Task States, Tasks and Data, Reentrancy, Semaphores and Shared Data, Basic Design Principles, Inter Process Communication-Message Queues, Mailboxes and Pipes; Timer Functions, Events, Memory Management and Interrupt Routines in an RTOS Environment.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- program an embedded microcontroller in Assembly Language.
- program an embedded microcontroller in C.
- program ARM microcontroller to perform various tasks.
- write I/O Interface programs for hardware control.

LIST OF EXPERIMENTS: Total Hours: 30

1. Write a program to:
   a. implement Arithmetic and Logical operations.
   b. perform Control operations.
   c. find sum of n natural numbers.
   d. evaluate the value of the given series.
   e. count 0's and 1's in a given register.
   f. perform 24-bit shift.
   g. arrange values of n registers in ascending and descending order.
2. Identify the status of switches using I/O interface.
3. Write a program for serial communication.
4. Write a program for encryption/ decryption.
5. Write a program to process the data provided by the sensors using 8051 and display

the data on PC monitor.

6. Port RTOS (MuCOS) on to 89C51 board and verify.
7. 4-Digit, 7-segment LED Display on ESA MCB 51.
8. Stepper Motor on ESA MCB 51.
9. Traffic Lights on ESA MCB 51.
10. Simulate an elevator movement using RTOS on 89C51 board.
11. Familiarization of ARM programming model using ARM kit.
12. Take parallel input from port P1 convert it into serial and send it via P0.0.

TEXT BOOKS:

1. Raj Kamal, "Embedded Systems", 2nd edition, Tata McGraw Hill, 2009.
2. Lyla B Das, "Embedded Systems an Integrated Approach", 1st edition, Pearson, 2012.

REFERENCE BOOKS:

1. David E. Simon, "An Embedded Software Primer", 1st edition, Pearson Education, 2008.
2. Wayne Wolf, "Computers as Components-principles of Embedded Computer system Design", 1st edition, Elseveir, 2009.
3. Labrosse, "Embedding system building blocks", 2rd edition, CMP Publishers, 2007.
4. Kenneth J. Ayala and Thomson, "The 8051 Microcontroller", 3rd edition, Thompson Delmar Learning, 2008.
5. Frank Vahid, Tony Givargis and John Wiley, "Embedded System Design, Microcontrollers", 3rd edition, Pearson Education, 2008.