Kadi Sarva Vishwavidyalaya

Gandhinagar-382015

B.E. Semester: 7
Electronics & Communication Engineering
Subject Name: Embedded Systems
Sub Code: EC-704-B (EP 1)

A. Course Objective

The educational objectives of this course are

- To give the fundamental knowledge of embedded systems, different devices, its features and different processors architecture.
- To give the fundamental skills of operating system with programming and RTOS (Real Time Operating System).
- To introduce device driver and its application in any embedded system.
- To give detail of different networks which are used in embedded system design and flow of any embedded system design.

B. Teaching / Examination Scheme

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		IE	CIA	Pract./Viva	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus

1 **Introduction:**
Embedded system and general purpose computers, Embedded system components, Embedded System Design Process, Classification of an embedded system and Examples of an embedded system and Applications of an embedded system.

2 **Processors & Microcontrollers:**
Single purpose and General purpose processors their basic architecture, operations, application specific instruction set processors (ASIPs), Digital signal processors (DSPs), SHARC processors and ARM Processor.
Microcontrollers: Functional Block Diagram of PIC Microcontroller, Raspberry Pi & Arduino Board.

3 **Device and Communication Bus:**
IO types and examples, Serial communication devices, Parallel Device ports, Watch dog timer, Real time clock, Writing device drivers, Serial bus communication protocols, Parallel communication

using ISA, PCI, PCI-X and advanced buses, Network protocols, Wireless and mobile system protocol.

4 **RTOS :**
Operating system service, Process management, Timer and Event function, Memory management, Device File and I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt service calls, Basic design using RTOS, RTOS task scheduling models, Interrupt latency and response of tasks as performance metrics, OS security issue. OS performance, power optimization strategies for process.

5 **Interprocess Communication and Synchronization of processes, Thread and Task:**
Multiple process and thread in application, Task and Task state, Task control block, Task coding, Task scheduling, Semaphores, Semaphores for synchronization, Data sharing and deadlocks, Inter process communication, Sockets and remote procedure call.

D. Lesson Planning

Sr. No.	Lectures (Hours)	Weightage in % in Exam	Topics
1.	08	16	**Introduction:** Embedded system and general purpose computers, Embedded system components, Embedded System Design Process, Classification of an embedded system, and Examples of an embedded system and Applications of an embedded system.
2.	15	22	**Processors**: Single purpose and General purpose processors their basic architecture, operations, application specific instruction set processors (ASIPs), Digital Signal Processors, SHARC processors & ARM Processor. **Microcontrollers:** Functional Block Diagram of PIC Microcontroller, Raspberry Pi & Arduino Board.
3.	13	22	**Device and Communication Bus:** IO types and examples, Serial communication devices, Parallel Device ports, Watch dog timer, Real time clock, Writing device drivers, Serial bus communication protocols, Parallel communication using ISA, PCI, PCI-X and advanced buses, Network protocols, Wireless and mobile system protocol.
4.	15	24	**RTOS :** Operating system service, Process management, Timer and Event function, Memory management, Device File and I/O subsystem management,

			Interrupt routine in RTOS environment and handling of interrupt service calls, Basic design using RTOS, RTOS task scheduling models, Interrupt latency and response of tasks as performance metrics, OS security issue. OS performance, power optimization strategies for process.
5.	09	16	**Interprocess Communication and Synchronization of processes, Thread and Task:** Multiple process and thread in application, Task and Task state, Task control block, Task coding, Task scheduling, Semaphores, Semaphores for synchronization, Data sharing and deadlocks, Inter process communication, Sockets and remote procedure call
Total	60	100	

E. Instructional Method And Pedagogy (Continuous Internal Assessment (CIA) Scheme)

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
3. Attendance is compulsory in lectures, practicals and Tutorial which carries 05 Marks.
4. At regular intervals, different assignments to different group of students should be given. In all, a student should submit all assignments of 05 marks each.
5. Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
6. Viva Voce will be conducted at the end of the semester of 05 Marks.
7. One internal exam of 30 marks is conducted as a part of mid semester evaluation.
8. Experiments shall be performed in the laboratory related to course contents.
9. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

F. Suggested List Of Experiments:

1. An introduction to linux as an operating system.
2. To study and perform a simple c programme in linux operating system.
3. To study basic Architecture of Easypic4 Device Kit (Microchip-P16f877a).
4. Write A ‘C’program of LED Blinking For Easypic-4 Embedded Devlopment Hardware Board.
5. Write A ‘C’program of LCD Display For Easypic-4 Embedded Devlopment Hardware Board.
6. Write A ‘C’program of Counter For Easypic 4 Embedded Devlopment Hardware Board.
7. To study Easy ARMMX PRO-V7-STM32 Hardware board.
8. Write A program to interfacing different device using ARMMX PRO-V7-STM32.
9. Interfacing with PIC Microcontroller, Arduino Board and Raspberry PI.
   - Buzzer/Relay, Interface LEDs & LCDs, 7 Segment, Counter & other devices.
10. Mini Project of students choice in a group of 2 or 3 based on either PIC Microcontroller or Raspberry PI or ARMMX PRO-V7-STM32 depending on application and resource requirement.

G. Students Learning Outcomes:

On successful completion of the course:

Students recognize the role of professional societies in developing new structural software and updating current knowledge. Students are able to identify and formulate an engineering problem and to develop a solution. Students recognize the need for technical updating on a continuing basis, since the course emphasizes on the changing nature of software.

H. Recommended Study Materials:

TEXT BOOKS:

1. Computer as Components: Principles of Embedded Computing System Design
Wayne Wolf, Morgan Kaufmann Publication.
2. Embedded System: Architecture, Programming and Design by Rajkamal, TMH
3. ARM System on Chip Architecture by Steve Furber, Pearson Education

REFERENCE BOOKS:

1. Morgans Kaufmann & G.De Micheli, Reading in Hardware/software co-design system-on-silicon.

2. Frank vahid & Tony D.Givargis, System Design: Hardware/Software introduction, Wesley 2002.