D. Syllabus Detailing and Learning objectives

Module	Chapter	Detailed Content	Syllabus Detailing	Learning Objectives
Module 1	CH 1 Introduction to Embedded Systems (6-Hours)	Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC..	**Purpose**: To make students understand basic Embedded Systems and its functional units. Also to make students understand different application areas of Embedded Systems **Scope –** **1. Academic Aspects-** Understanding Embedded System, Its application areas, categories of embedded system, Specialties of Embedded System . **2. Technology Aspect-** Understand basics of Embedded Systems **3. Application Aspect-** Application of Embedded Systems in real world. **Students Evaluation** – 1. Theory Questions to be asked on Embedded Systems 2. Case study to be given to differentiate between embedded system and general computing systems	1. To define Embedded Systems **(R)** 2. To describe the fundamentals of Embedded System**(R)** 3. To Compare r RISC & CISC **(A)** 4. To Differentiate Between General Computing system & Embedded Systems **(A)** 4. To list various application of Embedded System. **(AN)**
	CH 2 The Microcontroller Architecture (08-Hours)	Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.	**Purpose** – This chapter gives introduction to 8051 microcontroller, its architecture and pin configuration. Detailed insight of memory organization, Input /Output Ports, Counter and Timers, Serial communication and Interrupts.	1.To categorize various microcontrollers. **[AN]** 2.To explain architecture of 8051 microcontroller.**[A]** 3. Draw he pin diagram of 8051 microcontroller and identify the components in it..**[R]**

			Scope – **1. Academic Aspects-** Understanding the architecture of 8051 microcontroller with different ports. **2. Technology Aspect-**Architecture and pin configuration of 8051microcontroller **3. Application Aspect-** Application of 8051 microcontroller **Students Evaluation** 1. Questions on detailed architecture of 8051 can be asked. 2. Pin configuration of 8051 can be draw. 3. Students can explain Counters, Interrupts and memory organization of 8051 microcontroller.	4. To explain the terms like memory organization, serial communication of 8051. **(A)** 5. To list different input & output ports of 8051 microcontroller. **(AN)** 6. To compare microcontroller and microprocessor. **(U)**
Module 3	**Chapter 3 Assembly Language Programming of 8051** (Hours -10)	Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and ISR.	**Purpose-** This chapter is focused on the details of the 8051 microcontroller, its addressing modes. It also gives detail about development tools and assembler of 8051.It mainly focuses on programming of 8051 microcontroller. **Scope –** **1. Academic Aspects-** Understanding of different instruction set o 8051,different addressing modes, etc **2. Technology Aspect-** Students will be able to learn programming of 8051 **3. Application Aspect-** Students should understand different instruction set of 8051 **Students Evaluation –** 1. Theory Questions to be asked on different instruction set of 8051 microcontroller. 2. Lab experiments based on various arithmetic operations using 8051 microcontroller.	1. list addressing mode of 8051 and explain in detail **(A)** 2. List the instruction set and explain their use. **(U)** 3. Describe development tools of 8051 microcontroller. **(R)** 4. Illustrate the working of Timer and Counter.**(AN)**

	Chapter 4 ARM 7 architecture (Hours -10)	Architectural inheritance, Detailed study of Programmers model, ARM Development tools, Instruction set: Data processing, Data transfer, Control flow .Addressing modes. Writing simple assembly language programs. Pipelining, Brief introduction to exceptions and interrupts handling.	**Purpose-** This chapter gives the overview of ARM7 architecture. It focuses on Instruction set, addressing modes of ARM7. It shows how to write assembly language program. It explain how to handles exceptions & interrupts. **Scope -** **1. Academic Aspects-** Understanding the ARM7 architecture, different types of Instruction set, addressing modes. **2. Technology Aspect-** Detailed study of Programmers model. **3. Application Aspect-** Students should understand how to write assembly language program. **Students Evaluation –** 1. Theory Questions to be asked on ARM7 architecture, hierarchy, types of Instruction set, Pipelining. 2. Lab experiments for implementation various operations using RAM7. 3. Corresponding viva questions can be asked for Instruction set, Addressing modes.	1. Name the different addressing modes and describe in detail. **(R)** 2. Classify the instruction set of ARM7 and show their usage. **(A)** 3. Draw the architecture of ARM7 and determine the role of each component. **(AN)** 4. Describe the concept of pipelining and classify their levels. **(U)** 5. Explain the concept of exception and interrupts handling. **(E)** 6. Design a assembly language program to illustrate various arithmetic operations. **(C)**
Module 5	**Chapter 5** - Embedded / Real Time Operating System (Hours -08)	Architecture of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management, Priority	**Purpose –** To make students understand basics of Real Time Operating system. Also to make students understand concept of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management. **Scope –** **1. Academic Aspects-** Understanding basics of Real Time Operating system. **2. Technology Aspect-** Understand basics concept of kernel, Task and Task	1. To describe the fundamentals and technological aspects real time operating systems. **(R)** 2. To list and explain different types of operating systems.**(U)** 3. To draw and explain the architecture of kernel.**(R)** 4. Compare I/O data transfer techniques and summarize their performance. **[AN]**

		inversion problem. Off-the-Shelf Operating Systems, Embedded Operating Systems, Real Time Operating System (RTOS) and Handheld Operating Systems	scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management . **3. Application Aspect-** Interrupts, peripheral devices ,I/O systems. and their use for computers. **Student Evaluation -** 1. Theory Questions to be asked on interrupts, peripheral devices, signals and I/O devices. 2. Explaining architecture of kernel.	5. Discuss the need for Memory management.**(U)**
Module 6	**Chapter 6 -** Embedded System - Design case studies (Hours -6)	Digital clock, Battery operated smart card reader, Automated meter reading system, Digital camera.	**Purpose –** To make students understand basics of embedded system. **Scope –** **1. Academic Aspects-** Case study on real world embedded system architecture. **2. Application Aspect-** Different application of embedded systems **Student Evaluation -** 1. Theory Questions to be asked on application of embedded system.	1. To describe different application of embedded system. **(AN)** 2 Describe Battery operated smart card reader **(AN)** 3.Explain Digital camera in detail.**[U]** 4. Discuss Automated meter reading system **(A)**