

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tut.	Theory	TW/ Practical	Tut.	Total
TEITC503	Microcontroller and Embedded Systems	04 Hrs./Week	02 Hrs./Week	---	04	01	---	05

Course Code	Course Name	Examination Scheme								
		Theory Marks					TW	Practical	Oral	Total
		Internal Assessment			End Semester Exam					
TEITC503	Microcontroller and Embedded Systems	Test1 (T1)	Test2 (T2)	Average of T1 & T2		End Semester Exam	25	-	25	150
		20	20	20	80					

**Pre-requisites: Fundamentals of Computer, Digital Logic Circuits, Computer Organization and Architecture**

**Course Objectives:**

<b>CEO 1</b>	To conceptualize the basics of embedded systems
<b>CEO 2</b>	To conceptualize the basics of organizational and architectural issues of a microcontroller.
<b>CEO 3</b>	To learn programming techniques used in microcontroller.
<b>CEO 4</b>	To understand basic concept of ARM processor
<b>CEO 5</b>	To understand fundamentals of real time operating system

**Course Outcomes:**

<b>A</b>	Ability to understand basic structure embedded systems
<b>B</b>	Ability to understand basic structure microcontroller.
<b>C</b>	Ability to understand basic concepts used in embedded system.
<b>D</b>	Ability to program microcontroller.
<b>E</b>	Ability to design conceptual embedded system.

**Detailed Syllabus:**

<b>Module</b>	<b>Detailed Contents</b>	<b>Hours</b>
<b>1</b>	<b>Introduction to Embedded Systems:</b> 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.	<b>06</b>
<b>2</b>	<b>The Microcontroller Architecture:</b> Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.	<b>08</b>
<b>3</b>	<b>Assembly Language Programming of 8051:</b> Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and ISR.	<b>10</b>
<b>4</b>	<b>ARM 7 architecture:</b> Architectural inheritance, Detailed study of Programmer's 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.	<b>10</b>
<b>5</b>	<b>Embedded / Real Time Operating System:</b> Architecture of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management, Priority inversion problem. Off-the-Shelf Operating Systems, Embedded Operating Systems, Real Time Operating System (RTOS) and Handheld Operating Systems.	<b>8</b>
<b>6</b>	<b>Embedded System - Design case studies:</b> Digital clock, Battery operated smart card reader, Automated meter reading system, Digital camera.	<b>06</b>

**Text Books:**

1. The 8051 microcontroller & Embedded systems, M. A. Mazidi, J. G. Mazidi, R. D. McKinlay, Pearson
2. The 8051 microcontroller & Embedded systems, Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning
3. Embedded / real – time systems: concepts, design & programming, Black Book, Dr. K. V. K. Prasad, Dreamtech press, Reprint edition 2013
4. Introduction to embedded systems, Shibu K. V., McGraw Hill
5. ARM System on chip Architecture, Steve Furber, Pearson, edition second

**Reference Books:**

1. Embedded systems an integrated approach, Laya B. Das, Pearson, Third impression, 2013
2. ARM system developer's guide, Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann Publishers
3. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiley
4. ARM Technical Reference manual

**Term Work:** 25 Marks (Total marks) = 15 Marks (Experiment and Case Studies) + 5 Marks (Assignments) + 5 Marks (Attendance)

The faculty should conduct eight programming practicals/experiments based on the above syllabus and two case studies based on recent trends in embedded systems.

**Oral examination will be based on the above syllabus.**

**Theory Examination:**

- Question paper will comprise of 6 questions, each carrying 20 marks.
- Total 4 questions need to be solved.
- Q.1 will be compulsory, based on entire syllabus.
- Remaining question will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.