III Year I Semester	L	T	P	C
Code: 20EC5721	3	1	0	4

INTRODUCTION TO EMBEDDED SYSTEMS

Course Objectives:

1. To provide an overview of Design Principles of Embedded System.
2. To understand the role of sensors, actuators and communication bus protocols.
3. To provide a clear understanding of various embedded firmware approaches.
4. To understand the necessity of real-time operating systems in correlation with hardware systems.
5. To get familiar with AtMega16 microcontroller architecture and Programming.

UNIT I: Introduction to Embedded Systems

Definition of Embedded Systems, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Typical Embedded System: Core of the Embedded System: General Purpose and Domain-Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).

UNIT-II: Embedded Hardware Design

Microcontrollers: 8051, PIC, AVR, ARM. Sensors and Actuators, ADCs and DACs, Communication Interface: Onboard and External Communication Interfaces. Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real-Time Clock, and Watch dog Timer.

UNIT-III: Embedded Firmware Design

Embedded Firmware Design Approaches and Development Languages. Embedded Software Development Tools, Cross-compilation – Types of files generated, Software and Software Debugging tools, Integrated Development Environment: Keil IDE and Microchip AVR Studio.

UNIT-IV: RTOS Based Embedded System

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Scheduling Algorithms and Task Scheduling. Device Drivers, Real-Time Tasks and Real-Time Systems, Types of Real-Time Tasks, Real-Time Operating Systems, Real-Time Scheduling Algorithms, Rate Monotonic Algorithm, Earliest Deadline First Algorithm, Qualities of Good RTOS, Methods to Choose an RTOS.

UNIT- V: Programming ATMEGA16 Microcontroller

Features of Atmega16 Microcontroller, Architecture and Register set of Atmega16. Pin configuration ofAtmega16. Introduction to AVR Studio, Programming and Interfacing: I/O Port Programming, Timers and Counters, Serial Communication, PWM, ADC, SPI and I2C protocols.

Course Outcomes:

A student who successfully fulfils this course requirement will be able to:

S. No	Course Outcome	BTL
1.	Understand the basic concepts of embedded systems and their applications.	L2
2.	Analyze the role of sensors and actuators, communication busses and protocols in embedded systems design.	L4
3.	Analyze various embedded firmware development approaches, methods and tools.	L4
4.	Investigate the role of real-time operating systems concepts and algorithms for embedded systems development.	L5
5.	Apply and develop Embedded C programming using AtMega16 Microcontroller.	L6

Correlation of Cos with Pos & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-								2	
CO2	3	2	1	-	-								3	
CO3	2	2	1	-	1								2	1
CO4	3	2	2	2	-								3	
CO5	2	2	3	1	2								2	2

Text Books:

1. Embedded Systems, An integrated Approach–Lyla B.Das, Pearson.
2. Introduction to Embedded Systems –Shibu K.V, McGraw Hill.
3. Embedded C Programming and the Atmel AVR, Cengage Learning India Private Limited.

Reference Books:

1. Embedded Systems: Architecture, Programming And Design -RajKamal, McGraw Hill.
2. Embedded System Design-Frank Vahid, Tony Givargis, John Wiley.
3. An Embedded Software Primer- David E. Simon, Pearson Education.