

Branch Name:	IMCA
Program Code:	CS301
Course Code	1CS3010807T
Course Title	Embedded System Design
Prerequisite Course:	Basic knowledge of C programming, digital electronics, and computer organization.

Course Objective:

1. To understand the fundamentals of embedded systems and architectures
2. To design and develop embedded applications using microcontrollers
3. To interface hardware components like sensors and actuators
4. To apply real-time concepts in embedded systems
5. To use modern tools for embedded system development

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
4	-	-	4	60	40	-	-	100

Course Contents:

Unit No	Topics	Total Hours	Weightage (%)
1	Introduction to Embedded Systems • Definition and Characteristics of Embedded Systems • General Purpose vs Embedded Systems • Applications of Embedded Systems (Automotive, Healthcare, IoT, etc.) • Components of Embedded Systems • Embedded System Design Flow	5	10
2	Microcontrollers and Architecture • Introduction to Microcontrollers • Architecture of 8-bit and 32-bit Microcontrollers • Overview of popular controllers (8051, ARM Cortex-M) • Memory Organization (ROM, RAM, Flash) • I/O Ports and Registers	10	20

3	Programming Embedded Systems • Embedded C Programming Basics • Data Types, Bit Manipulation • Interrupts and Timers • Serial Communication (UART, SPI, I2C) • Debugging Techniques	10	20
4	Interfacing and Hardware Components • Interfacing LEDs, Switches, and Displays (7-segment, LCD) • Sensor Interfacing (Temperature, Light, Motion) • Actuators (Motors, Relays) • ADC and DAC Concepts • Embedded System Design Case Studies	11	25
5	Real-Time Embedded Systems • Introduction to Real-Time Systems • Types: Hard and Soft Real-Time Systems • Scheduling Algorithms (FCFS, Round Robin, Priority) • Basics of RTOS • Embedded System Performance Optimization	12	25

Text Book

1. Raj Kamal – Embedded Systems: Architecture, Programming and Design, McGraw-Hill
2. Muhammad Ali Mazidi – The 8051 Microcontroller and Embedded Systems, Pearson

Reference Books

1. Frank Vahid – Embedded System Design
2. Steve Heath – Embedded Systems Design
3. Michael Barr – Programming Embedded Systems in C and C++

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand embedded system architecture and components	Understand (L2)
CLO2	Develop programs using microcontrollers	Apply (L3)
CLO3	Interface external devices like sensors, displays, and motors	Apply (L3)
CLO4	Apply real-time concepts in embedded applications	Analyze (L4)
CLO5	Design and implement real-world embedded projects	Create (L)

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes(POs)												Program Specific Outcomes(PS Os)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H	L	-	-	M	-	-	-	-	-	-	-	M	L
CLO2	H	M	M	-	H	-	-	-	L	-	-	-	H	M
CLO3	M	H	H	M	M	-	-	-	L	-	-	M	H	M
CLO4	M	H	M	H	M	-	L	-	-	-	-	L	M	H
CLO5	H	H	H	M	H	L	M	L	M	M	M	H	H	H

H:High, M:Medium, L:Low