

EMBEDDED SYSTEMS AND PROGRAMMING

Course code	23ME4702D	Year	IV	Semester	I
Course category	Professional Elective - V	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Basic Electrical and Electronics Metallurgy and Material science,
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks :	100

Course Outcomes: At the end of the course students will be able to

CO's	Statement	Blooms Level	Units
CO1	Explain the architecture, organization, instruction sets, and addressing modes of 8051 microcontrollers and distinguish between microprocessors, microcontrollers, CISC, and RISC systems.	L2	1
CO2	Develop assembly language and embedded C programs for 8051 microcontrollers using timers, counters, interrupts, and communication protocols such as serial, I2C, SPI, and CAN.	L3	2
CO3	Interface peripheral devices with 8051 microcontrollers and implement embedded control applications using displays, ADC/DAC, sensors, motors, relays, and PWM-based control.	L3	3
CO4	Describe the architecture, instruction set, pipelining, operating modes, and basic programming of ARM7 processors for embedded applications.	L3	4
CO5	Explain single board computer architecture, embedded design concepts, real-time systems, and Python-based GPIO interfacing for embedded applications.	L3	5

Contribution of Course outcomes towards the achievement of program outcomes & Strength of correlations (High :3, Medium:2, Low:1)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	2	-	-	-	1	-	1	2	1
CO2	3	3	2	1	3	-	-	-	1	-	1	2	2
CO3	3	3	3	1	3	1	-	1	1	1	1	3	3
CO4	3	2	2	1	2	-	-	-	1	-	1	2	2
CO5	2	2	2	1	3	1	-	1	2	1	2	2	3

Unit	Contents	CO
I	INTRODUCTION TO MICROCONTROLLER: Fundamentals Functions of ALU - Microprocessor - Microcontrollers – CISC and RISC – Types Microcontroller - 8051 Family - Architecture - Features and Specifications - Memory Organization - Instruction Sets – Addressing Modes.	CO1
II	PROGRAMMING AND COMMUNICATION: Fundamentals of Assembly Language Programming – Instruction to Assembler – Compiler and IDE - C Programming for 8051 Microcontroller – Basic Arithmetic and Logical Programming - Timer and Counter - Interrupts – Interfacing and Programming of Serial Communication, I2C, SPI and CAN of 8051 Microcontroller – Bluetooth and WI-FI interfacing of 8051 Microcontroller.	CO2
III	PERIPHERAL INTERFACING: I/O Programming – Interfacing of Memory, Key Board and Displays – Alphanumeric and Graphic, RTC, interfacing of ADC and DAC, Sensors - Relays - Solenoid Valve and Heater - Stepper Motors, DC Motors - PWM Programming – Closed Loop Control Programming of Servomotor – Traffic Light	CO3
IV	ARM PROCESSOR: Introduction ARM 7 Processor - Internal Architecture – Modes of Operations – Register Set – Instruction Sets – ARM Thumb - Thumb State Registers – Pipelining – basic programming of ARM 7 - Applications.	CO4
V	SINGLE BOARD COMPUTERS AND PROGRAMMING: System on Chip - Broadcom BCM2711 SoC – SBC architecture - Models and Languages – Embedded Design – Real Time Embedded Operating Systems - Real Time Programming Languages -- Python for Embedded Systems- GPIO Programming – Interfacing	CO5

Learning Resource
Text books:
TEXT BOOKS:
1. Frank Vahid and Tony Givagis, “Embedded System Design”, 2011, Wiley.
2. Kenneth J. Aylala, “The 8051 Microcontroller, the Architecture and Programming Applications”, 2003.
Reference books
1. Muhammad Ali Mazidi and Janice GillispicMazdi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, 2006.
2. Simon Monk, Programming the Raspberry Pi, Second Edition: Getting Started with Python McGraw Hill TAB; 2nd edition,2015
3. James W. Stewart, “The 8051 Microcontroller Hardware, Software and Interfacing”, Regents Prentice Hall, 2003.
4. John B. Peatman, “Design with Microcontrollers”, McGraw Hill International, USA, 2005.

E-Resources & other digital Material:

1. <https://gpiozero.readthedocs.io/>
2. <https://docs.python.org/3/>
3. <https://www.raspberrypi.com/documentation/>