

## EMBEDDED SYSTEMS AND PROGRAMMING

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

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

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

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

Unit	Contents	CO
I	<b>INTRODUCTION TO MICROCONTROLLER:</b> Fundamentals Functions of ALU - Microprocessor - Microcontrollers – CISC and RISC – Types Microcontroller - 8051 Family - Architecture - Features and Specifications - Memory Organization - Instruction Sets – Addressing Modes.	<b>CO1</b>
II	<b>PROGRAMMING AND COMMUNICATION:</b> 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.	<b>CO2</b>
III	<b>PERIPHERAL INTERFACING:</b> 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	<b>CO3</b>
IV	<b>ARM PROCESSOR:</b> 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.	<b>CO4</b>
V	<b>SINGLE BOARD COMPUTERS AND PROGRAMMING:</b> 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	<b>CO5</b>

### 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/>