--------: **Microprocessors and Microcontrollers**

Course No.	Title of the Course	Course Structure	Pre-Requisite
	Microprocessors and Microcontrollers	**3-0-2**	**Digital Logic Design**

COURSE OUTCOMES (COs):
CO1: Analyze the architecture and functional elements of the Intel 8085 microprocessor.
CO2: Develop assembly language programs using the Intel 8085 instruction set.
CO3: Compare the architectures, addressing modes, and functionalities of Intel 8085 and Intel 8086 microprocessors for various applications.
CO4: Design and implement assembly language programs using advanced programming techniques for Intel 8086.
CO5: Understand AVR microcontroller architecture for developing simple embedded applications.

Unit No.	Topics
Unit 1	**Unit 1: Introduction to Microprocessor 8085** Introduction to Microprocessors, Evolution of the Microprocessor, Elements of a microprocessor, Elements of a microprocessor-based system, Applications of microprocessors, Brief idea of a microcontroller, Intel 8085 Microprocessor Architecture, 8085 Instruction Set and Programming, Overview of instruction set, Classification of instructions, Addressing modes, Machine cycles and timing diagrams,
Unit 2	**Unit 2: Instruction Set, Programming and Interfacing with 8085** Assembly Language Programming, Looping, branching, and subroutines, Delay routines and counters, Advanced arithmetic and logical operations, Interrupts in 8085, Types of interrupts, Handling interrupts, Interrupt-driven I/O, Memory and Peripheral Interfacing, RAM and ROM interfacing, Memory mapping and decoding, I/O interfacing. Introduction to programmable peripheral ICs. 8255 PPI. Programming Mode 0. Data transfer using handshake signals (Mode 1 and Mode 2)
Unit 3	**Unit 3: Intel 8086 Microprocessor Architecture** Architecture of 8086 Microprocessor, 16-bit microprocessor overview, Bus Interface Unit (BIU) and Execution Unit (EU), Segment registers and memory segmentation, Registers and flags in 8086, 8086 Instruction Set and Programming, Instruction set overview, Addressing modes, Machine cycles, Assembly language programming (basic operations), Arithmetic and logic operations.
Unit 4	**Unit 4: 8086 Interrupts** Interrupts in 8086, Types of interrupts, Interrupt vector table, Interrupt handling and programming techniques. Direct Memory Access (DMA) basics and applications. Advanced Assembly Language Programming, Nested loops and subroutines
Unit 5	**Unit 5: AVR Microcontroller and Introduction to Arduino** Introduction to Microcontrollers, Overview of microcontroller architectures, Comparison of microprocessor vs microcontroller, AVR Microcontroller Architecture, General architecture of AVR microcontrollers, Registers and memory structure, Input/output control and timers, Programming AVR Microcontrollers, Basic introduction to AVR assembly programming, Writing simple programs (LED blink, delay routines), Introduction to Arduino, Basic concepts of Arduino platform, Architecture of Arduino boards (Arduino Uno, Mega), Setting up Arduino IDE, Writing and uploading programs (basic examples),

Suggested Readings:

1. Ramesh S. Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085" Penram International Publishers.
2. Brey, B.B., “The Intel Microprocessors”, 6th Ed., Pearson Education. 2003.
3. Yu-Cheng Liu and Glenn A. Gibson, “Microprocessor Systems: The 8086/8088 Family Architecture, Programming, and Design"
4. M. A. Mazidi, S. Naimi, and S. Naimi, *AVR Microcontroller and Embedded Systems: Using Assembly and C*. Upper Saddle River, NJ, USA: Pearson Education, 2010.
5. H.-W. Huang and L. Chartrand, *The AVR Microcontroller and Embedded Systems: Using Assembly and C*, 2nd ed. Florence, KY, USA: Delmar Cengage Learning, 2017.

B. CO-PO & CO-PSO MAPPING TABLE

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	2	2					2	2	1	2	3	3
CO2	3	3	1	2	2					1	1	1	2	2	3
CO3	3	3	1	2	2					2	2	1	2	3	3
CO4	3	3	1	2	2					2	2	1	3	2	3
CO5	3	3	1	2	2					2	2	1	3	2	3

C. THEORY LECTURE PLAN

UNIT	COURSE CONTENT:	Lecture No.
Unit-I: (O7)	Introduction to Microprocessors, Evolution of the Microprocessor, Elements of a microprocessor, Elements of a microprocessor-based system	01
	Applications of microprocessors, Brief idea of a microcontroller	02
	Intel 8085 Microprocessor Architecture	03
	8085 Instruction Set and Programming, Overview of instruction set, Classification of instructions,	04-06
	Addressing modes, Machine cycles and timing diagrams	07
Unit-II: (08)	Assembly Language Programming, Looping, branching, and subroutines, Delay routines and counter	08-09
	Advanced arithmetic and logical operations	10
	Interrupts in 8085, Types of interrupts, Handling interrupts	11
	Interrupt-driven I/O, Memory and Peripheral Interfacing,	12
	RAM and ROM interfacing, Memory mapping and decoding, I/O interfacing	13-14
	Introduction to programmable peripheral ICs. 8255 PPI. Programming Mode 0. Data transfer using handshake signals (Mode 1 and Mode 2)	15
Unit-III: (09)	Architecture of 8086 Microprocessor	16
	16-bit microprocessor overview, Bus Interface Unit (BIU) and Execution Unit (EU), Segment registers and memory segmentation	17-18
	Registers and flags in 8086	19
	8086 Instruction Set and Programming, Instruction set overview	20-21

	Addressing modes, Machine cycles	22
	Assembly language programming (basic operations), Arithmetic and logic operations.	23-24
Unit-IV: (07)	Interrupts in 8086, Types of interrupts, Interrupt vector table	25
	Interrupt handling and programming techniques	26
	Direct Memory Access (DMA) basics and applications	27
	Advanced Assembly Language Programming,	28-30
	Nested loops and subroutines	31
Unit- V: (9)	Introduction to Microcontrollers, Overview of microcontroller architectures, Comparison of microprocessor vs microcontroller	32
	AVR Microcontroller Architecture, General architecture of AVR microcontrollers, Registers and memory structure, Input/output control and timers	33-34
	Programming AVR Microcontrollers, Basic introduction to AVR assembly programming, Writing simple programs (LED blink, delay routines),	35-37
	Introduction to Arduino, Basic concepts of Arduino platform, Architecture of Arduino boards (Arduino Uno, Mega), Setting up Arduino IDE,	38-39
	Writing and uploading programs (basic examples),	40

D. PRACTICAL CLASS PLAN

1. Write and execute an assembly language program for addition and subtraction of two 8-bit numbers using the Intel 8085 microprocessor.
2. Write a program for interfacing an LED with the 8085 microprocessor and control it using a delay loop. Connect the LED to the SOD pin of 8085.
3. Demonstrate interrupt handling by implementing an interrupt-driven I/O program on the 8085.
4. Multiply and divide 8-bit numbers using repeated addition and subtraction.
5. Calculate the factorial of a number using recursion.
6. Write an assembly language program to perform multiplication and division of 16-bit numbers using the Intel 8086 microprocessor.
7. Write an 8086 assembly program to reverse a string stored in memory.
8. Write an 8086 assembly program to sort an array of numbers in ascending order using the bubble sort algorithm.
9. Write an 8086 assembly program to Interface the 8255 PPI (Programmable Peripheral Interface) to control LEDs and read switches.
10. Write an embedded C (use AVR-GCC) program to toggle an LED after a pushbutton is pressed and released, on an Arduino board (Nano or Uno).
11. Write an embedded C (use AVR-GCC) program to print and scroll text messages on a 16x2 LCD using an Arduino board (Nano or Uno)

12. Write an embedded C (use AVR-GCC) program to read a temperature sensor (LM35) and print the temperature on a 16x2 LCD as well as the serial monitor using an Arduino (Nano or Uno).
13. Write an embedded C (use AVR-GCC) program to control the position of a servo mechanism using an Arduino (Nano or Uno).