Uka Tarsadia University

B. Tech.

Semester IV

MICROPROCESSORS AND MICROCONTROLLERS
CE4020

EFFECTIVE FROM July-2022

Syllabus version: 1.00

Subject Code	Subject Title	Teaching Scheme			
		Hours		Credits	
		Theory	Practical	Theory	Practical
CE4020	Microprocessors and Microcontrollers	3	2	3	1

Subject Code	Subject Title	Theory Examination Marks		Practical Examination Marks	Total Marks
		Internal	External	CIE	
CE4020	Microprocessors and Microcontrollers	40	60	50	150

Objectives of the course:

- To introduce basics of microprocessors with their architectures and internal working.
- To expose students with 8051 microcontroller system and its assembly, and C programming.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: Understand various microprocessors and explicit working of 8086 microprocessor.
CO2: Apply assembly instruction of 8086 and understand special architectural features.
CO3: Understand and apply primary level peripheral interfacing with 8086.
CO4: Explain memory management in advanced processors and RISC architecture.
CO5: Understand microcontrollers and explain internals of 8051 microcontroller with its instruction set.
CO6: Apply C programming on 8051 microcontroller and interfacing of peripherals with 8051 microcontroller.

Sr. No.	Topics	Hours
	Unit – I	
1	**Introduction to Microprocessors:** Microprocessor family, The advanced processors, Register organization of 8086, Architecture, Signal description of 8086, Physical memory organization, General bus organization, I/O addressing capability, Special processor activity, Minimum, and Maximum mode 8086 system and timings.	6

Unit – II		
2	**8086 Instruction Set and Assembler Directives:** Machine language instruction formats, Addressing modes of 8086, Instruction set of 8086, Assembler directives and Operators, Assembly language programming with 8086. **Special Architectural Features and Related Programming:** Introduction to stack, Stack structure of 8086, Interrupts and Interrupt Service Routine, Interrupt cycle of 8086, Non Maskable interrupt, Maskable interrupt, Interrupt programming, Macros, Timing, Delays.	8
Unit – III		
3	**Basic Peripheral Interfacing with 8086:** Semiconductor memory interfacing, Dynamic RAM interfacing, Interfacing I/O ports, Interfacing ADC converters, Stepper motor interfacing.	8
Unit – IV		
4	**Microprocessor with Memory Management and Protection:** Salient features of 80286, Internal architecture of 80286, Signal description of 80286, Real addressing mode, Protected Virtual Address Mode (PVAM), Privilege, Protection, Special operations, 80286 bus interface, Basic bus operations, Fetch cycle of 80286. **RISC Architecture:** History of RISC processors, Hybrid architecture, Advantages of RISC, Features of RISC processors, Design issues of RISC processors, performance issues in pipelined systems.	9
Unit – V		
5	**Introduction to 8051 microcontrollers:** General architecture of microcontroller, MCS-51 family, Microcontroller packaging, Pins and signals in 8051, Internal architecture of 8051, Program memory and Data memory organization, System clock, I/O ports and Special Function Registers (SFRs), Power management, Addressing modes and data move operations, Instruction set of 8051, Interrupts and Serial communication.	7
Unit – VI		
6	**8051 programming in C:** Data types and Time delay, I/O programming, Logic operations, Data conversion, Accessing code ROM space, Data serialization, Programming timers and timer interrupts, Counter programming. **Interfacing with 8051:** Interfacing LCD, Keyboard interfacing, Parallel and serial ADC/DAC	7

	interfacing, Sensor interfacing, Interfacing 8051 to external memory, Interfacing actuators.	

Sr. No.	Microprocessors and Microcontrollers (Practicals)	Hours
1	Write an 8086 assembly for addition of two 16 bit numbers.	4
2	Write an 8086 assembly for arranging given data in ascending and descending order.	2
3	Write an 8086 assembly for transfer block of memory from one place to another.	2
4	Write an 8051 assembly language program to copy byte starting from 60H to location 40H onwards.	2
5	Write an 8051 assembly language program to shift a block of 8 bytes of data 1 byte up, presently located from 50H to 57H. So that the data is available from 51H to 58H.	2
6	Twenty bytes of data are stored in location from 7FH to 6CH of internal RAM. Write an 8051 assembly language program to Count the number of those bytes, which contains 00H, and store this number of null bytes in RAM location 6BH.	4
7	Sixteen consecutive bytes starting from 50H have unsigned integer. Develop an 8051 assembly code to add all these 16 integers and store the 8 – bit sum in memory location 60H.	2
8	Develop an 8051 assembly language program to generate and store natural number starting from 1 to 'N' terms and also find the sum of these numbers. Assume that the value of 'N' is stored in location 30H. Store generated natural numbers from 40H. Leave the sum in the accumulator.	2
9	Write an 8051 assembly code to create a new array by removing only those integers that are perfectly divisible by 4 from an array, starting from 31H. Location 30H contains number of terms of this array. The new array is to be created from the location 60H. At return, the accumulator should indicate number of terms found. Original locations with digits divisible by 4 should be replaced by null.	2
10	Write an 8051 C program to send values 00 – FF to port P1.	4
11	LEDs are connected to bits P1 and P2. Write an 8051 C program that shows the count from 0 to FFH (0000 0000 to 1111 1111, in binary) on LEDs.	4

Text books:

1. K M Bhurchandi and A K Ray, "Advanced Microprocessors and Peripherals", TMH Publication, Third Edition.
2. Subrata Ghosal, "8051 Microcontroller – Internals, Instructions, Programming with Interfacing", Pearson publication.

Reference books:

1. John E. Uffenbeck – "Microcomputers and Microprocessors: The 8080,8085 and Z-80 Programming, Interfacing and Troubleshooting", Prentice Hall PTR.
2. William Kleitz – "Microprocessor and Microcontroller fundamentals. The 8085 and 8051 Hardware and Software", Prentice Hall PTR.
3. K. Uma Rao and Andhe Pallavi – "The 8051 Microcontrollers, Architecture, Programming and Applications", Pearson education.
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay – "The 8051 Microcontroller & Embedded System using assembly and C by", Person Education.

Course objectives and Course outcomes mapping:

- To introduce basics of microprocessors with their architectures and internal working: CO1, CO2, CO3, and CO4.
- To expose students with 8051 microcontroller system and its assembly, and C programming: CO5 and CO6.

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
1	Introduction to Microprocessors	✓					
2	8086 Instruction Set, Assembler Directives, and Special Architectural Features		✓				
3	Basic Peripheral Interfacing with 8086			✓			
4	Microprocessor with Memory Management, Protection, and RISC Architecture				✓		
5	Introduction to 8051 microcontrollers:					✓	
6	8051 programming in C and Interfacing						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: A recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓	✓			✓	
PO2						✓

PO3	✓	✓		✓	✓	✓
PO4		✓	✓			✓
PO5		✓	✓			✓
PO6						
PO7						
PO8						
PO9						
PO10						
PO11						
PO12						