



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3140707

Semester – IV

Subject Name: Computer Organization & Architecture

Type of course: core course

Prerequisite: None

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Syllabus:

Sr. No.	Content	Total Hrs
1	Computer Data Representation Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit	4
2	Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, Design of Accumulator Unit.	4
3	Assembly Language Programming Introduction, Machine Language, Assembly Language Programming: Arithmetic and logic operations, looping constructs, Subroutines, I-O Programming.	8
4	Micro programmed Control Organization: Control Memory, Address sequencing, Micro program example, Design of Control Unit	4
5	Central Processing Unit Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, Data transfer and manipulation, Program control, Reduced Instruction Set Computer (RISC) & Complex Instruction Set Computer (CISC)	5
6	Pipeline And Vector Processing Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors	5
7	Computer Arithmetic Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit.	4
8	Input-Output Organization Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPU IOP Communication, Serial communication.	4
9	Memory Organization Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.	6



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10	Multiprocessors Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.	4
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## Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	15	15	15	5

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

## Reference Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Education
2. Yale N. Patt, Sanjay J. Patel, "Introduction to Computing Systems" McGraw Hill.
3. Hamacher, Vranesic, Zaky, "Computer Organization", McGraw Hill.
4. Andrew S. Tanenbaum and Todd Austin, "Structured Computer Organization", Pearson Education
5. N. D. Jotwani, "Computer system organization", McGraw Hill
6. R.S.Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085A", Penram International
7. Douglas Hall, Microprocessors and Interfacing, TMH.

## Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and explain the basic structure and functional units of a digital computer.	10
CO-2	Write assembly language programs and identify the role and working of various functional units of a computer for executing an instructions.	30
CO-3	Design processing unit using the concepts of ALU and control logic design.	25
CO-4	Design circuits for interfacing memory and I/O with processor.	25
CO-5	Comprehend the features and performance parameters of different types of computer architectures.	10



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## List of Practical:

Sr. No.	Practical Title	CO
1	Implement Booth's Algorithm	CO-1
2	Write the working of 8085 simulator GNUsim8085 and basic architecture of 8085 along with small introduction.	CO-2, CO-6
3	Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.	CO-5
4	Write an assembly language code in GNUsim8085 to implement arithmetic instruction	CO-2
5	Write an assembly language code in GNUsim8085 to find the factorial of a number.	CO-5
6	Write an assembly language code in GNUsim8085 to implement logical instructions.	CO-2
7	Design ALU using Logisim.	CO-6
8	Implement 16-bit single-cycle MIPS processor in Verilog HDL	CO-6