

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Computer Application

Subject Name : Fundamentals of Computer Organization

Subject Code : 610004

Objectives : Students will learn

- The elements of Computer Organization and Architecture.
- The basic knowledge necessary to understand the hardware operations of digital computers.

Prerequisites : None

Contents:

1. Basic Components of a digital computer

2. Number Systems

- Decimal System
- Bistable Devices
- Binary, Octal and Hexadecimal numbers.
- Number Base conversions
- Binary Addition, Subtraction, Multiplication, Division
- Complements
 - Use of complements to represent Negative Numbers
 - Binary Number Complements
 - Complements in other Number Systems.
- Binary codes
 - Weighted and Non-weighted codes
 - BCD Code
 - Excess Three (XS-3) Code
 - Gray Code
 - Binary to Gray & Gray to Binary
 - Error detecting and correcting codes
 - Parity and Hamming code

3. Boolean Algebra and Logic Gates

- Fundamental Concepts of Boolean Algebra
- Logical Multiplication
- AND & OR gates

- Complementation & Inverters
- Evaluation of Logical Expressions
- Basic Laws of Boolean Algebra
- Proof by Perfect induction
- Simplification of Expressions
- De Morgan's Theorems
- Basic duality of Boolean Algebra
- Derivation of a Boolean Expression
- Interconnecting gates
- Sum of Products and Product of Sums
- Derivation of Product-of-Sums expressions
- Derivation of Three input variable expressions
- NAND & NOR gates
- Map Method for Simplifying Expressions
 - K-map (Four Variables)
 - Cubes & covering
 - Don't Cares
- Design Using NAND Gates
- Design Using NOR Gates
- NAND to AND & NOR to OR gate Networks

4. Logic Design

- Flip-Flops
- Transfer Circuit
- Clocks
- Flip-Flop Designs
- Gated Flip-Flop
- Master Slave Flip-Flop
- Shift Register
- Binary Counter
- BCD Counter
- Counter Design

5. The Arithmetic-Logic Unit

- Construction of the ALU
- Integer Representation
- Binary Half-Adder
- Full-Adder
- Parallel Binary Adder
- Positive & Negative Numbers
- Addition in the 1'S Complement System
- Addition in the 2'S Complement System

- Addition and subtraction in a parallel Arithmetic Element
- Binary Coded Decimal Adder
- Shift Operations
- Binary Multiplication
- Binary Division

6. Digital Components

- Integrated Circuits
- Decoders
 - NAND gate Decoder
 - Decoder Expansion
- Encoders
- Multiplexers
- Memory Units
 - Random-Access Memory
 - Read-Only Memory
 - Types of ROMs

7. Central Processing Units

- Stack Organization (Intro.)
- Instruction Formats
- Addressing modes

8. Input-Output Organization

- Peripheral Devices
- Asynchronous Data Transfer
 - Handshaking
- Modes of Transfer
 - Programmed I/O
 - Interrupt-initiated I/O
 - Direct Memory Access (DMA)
- Direct Memory Access (DMA)

9. Memory Organization

- Memory Hierarchy
- Main Memory
 - RAM, ROM, Bootstrap Loader
- Auxiliary Memory
 - Magnetic Disk
 - Magnetic Tape
- Cache Memory (Intro)
- Virtual Memory (Intro)

10. Peripheral Devices * (Intro)

- Key Board
- Mouse
- Display Unit
- Printer (Types)
- Scanner
- OCR-OMR-MICR
- Multimedia Projector

Main Reference Book(s):

1. Digital Computer Fundamentals , Tata McGraw Hill, 6th Edition, Thomas C. Bartee
2. Computer System Architecture, PHI/Pearson Education, 3rd Edition, M. Morris Mano

Suggested Additional Reading:

1. Fundamentals of Digital circuits, PHI/Pearson Education, A. Anand Kumar

Chapter wise Coverage from the main reference book(s):

1. Digital Computer Fundamentals – Thomas C. Bartee

Chapter – 1 : 1.7

Chapter – 2 : Whole

Chapter – 3 : 3.1 to 3.23

Chapter – 4 : 4.1 to 4.9, 4.12

Chapter – 5 : 5.1 to 5.9, 5.11, 5.14, 5.16 to 5.18

2. Computer System Architecture – M. Morris Mano

Chapter – 2 : 2.1 to 2.3, 2.7

Chapter – 8 : 8.3 to 8.5

Chapter – 11 : 11.1, 11.3, 11.4, 11.6

Chapter – 1 : 12.1 to 12.3, 12.5, 12.6

* Peripheral Devices may be covered from Internet or any latest books.

Accomplishments of the student after completing the course:

Students will get the knowledge of computer organization and architecture. They will know the actual working and organization of digital computer system.