Bachelor of Computer Application (BCA)

Second Semester

Microprocessor and Computer Architecture (CACS155)

Dear Students, Don't limit your knowledge horizon, it's only a reference, and you can use other resources for more knowledge.

Student's Reference Manual

Books:

1 Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5th Edition
2 M. Morris Mano, Computer System Architecture, 3rd Edition
3 William Stallings, Computer Organization and Architecture, 8th Edition (Optional)
4 William Stallings, Computer Organization and Architecture, 9th Edition

Unit 1: Fundamental of Microprocessor (5 Hrs.)

Introduction to Microprocessors, Microprocessor system with bus organization, Microprocessor architecture and operation, 8085 Microprocessor and its operation, 8085 instruction cycle, machine cycle, T states, Addressing modes in 8085, Introduction to 8086.

[Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5th Edition,

Chapter 1: 1.1 Microprocessors

Chapter 3: 3.1 Microprocessor system with bus organization

Chapter 4: 4.1 The 8085 MPU

Chapter 4: 4.2 Example of an 8085 – Based Microcomputer]

Laboratory Work:

1. Identify the 8085 Microprocessor Pinout and Signals.

Questions:

1. Define Microprocessor. Differentiate between Microprocessor and Microcontroller with example.
2. Explain microprocessor as a CPU.
3. Explain the organization of microprocessor based system with block diagram.
4. Explain the microprocessor architecture and its operations.
5. Explain the bus architecture of 8085 microprocessor.
6. Explain the 8085 microprocessor signals with block diagram.
7. Explain the 8085 microprocessor with its functional diagram.

8. Explain the opcode fetch and memory read machine cycles for MVI A, 48H with timing for execution diagram.
9. Explain the 8085 microprocessor addressing modes with example.
10. List the features of 8086 microprocessor with its block diagram.
11. Write short notes on: Control and Status Signals, Flags, Instruction Cycle, Machine Cycle, T-States.

Unit 2: Introduction to Assembly Language Programming (10 Hrs.)

Assembly Language Programming Basics, Classifications of Instructions and Addressing Mode, 8085 Instruction Sets, Assembling, Executing and debugging the Programs, Developing Counters and Time Delay Routines, Interfacing Concepts.

[Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5th Edition,

Chapter 2: 2.1 The 8085 Programming Model

Chapter 2: 2.2 Instruction Classification

Chapter 2: 2.5 Overview of the 8085 Instruction set

Chapter 2: 2.3 Instruction Data format, and Storage

Chapter 2: 2.4 How to Write, Assemble, and Execute a Simple Program

Chapter 8: Counters and Time Delays

Chapter 5: 5.1 Basic Interfacing concepts

Read chapter 6 & 7 for Programming/Lab exercise**]**

Laboratory Work:

1. Write a program to:
    a. Load an 8-bit data in register
    b. Transfer data Between registers
    c. Transfer data Specific data byte to a register
    d. Transfer data Specific data byte to a memory location
    e. Transfer data From memory location to a register
2. Write a program to add two hexadecimal numbers and display the sum at the output PORT1.
3. Write a program to subtract two 8-bit hex numbers.
4. Write a program to add two 16 bit hex numbers.
5. Write a program to subtract two 16 bit hex numbers.
6. Write a program to multiply two 8-bit hex numbers.
7. Write a program to show division using 8 –bit hex numbers.
8. Write a program to check the specific data is either even of odd.

9. Write a program to find largest number in array of data.
10. Write a program to find the smallest number in array of data.

Questions:

1. Define Assembling. Explain the merits and demerits of Assembly Language Programming.
2. Explain the 8085 Programming model.
3. Classify the 8085 Instruction Set with example.
4. Write short notes on: Instruction word size, Data format

Unit 3: Basic Computer Architecture (4 Hrs.)

Introduction: History of computer architecture, **[William Stallings, Computer Organization and Architecture, 9th Edition, Part – One, Chapter 2: "Computer Evolution and Performance"]**

Overview of computer organization, **[William Stallings, Computer Organization and Architecture, 9th Edition, Part – One, Chapter 1: "Introduction"]**

Memory hierarchy and Cache, **[William Stallings, Computer Organization and Architecture, 9th Edition, Part – Two, Chapter 4: "Cache Memory"]**

Organization of hard disk, **[William Stallings, Computer Organization and Architecture, 9th Edition, Part – Two, Chapter 6: "External Memory", 6.1: Magnetic Disk]**

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Twelve: "Memory Organization"].

Instruction Codes: Stored Program Organization, Indirect address, Computer Registers, Common Bus systems, Instruction set, Timing and Control, Instruction Cycle.

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Five: "Basic Computer Organization and Design" from 5-1 to 5-5].

Questions:

1. Explain the role of John Von Neumann in development of computer.
2. Explain the Memory Hierarchy with diagram.
3. Explain the elements of cache design.
4. Explain the internal structure of Hard Disk.
5. Explain the concept of Stored Program Organization.
6. Demonstrate the theory of direct and indirect address with instruction format diagrams.
7. Define registers. Explain the basic computer registers with their uses.
8. Define Bus System. Explain the bus system construction mechanisms using Multiplexers and Three - state buffer gates.

9. Explain the instruction set design issues.
10. Explain the structure of control unit of basic computer.
11. Define Instruction cycle. Explain the instruction cycle with state diagram.

Unit 4: Microprogrammed Control (10 Hrs.)

Basic Design of Accumulator: Control of AC register, ALU organization,

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Five: "Basic Computer Organization and Design" from 5-10].

Control Memory, Address Sequencing: *Conditional Branching, Mapping of Instruction, Subroutines*, Microprogram: *Symbolic Microprogram, Binary Microprogram*, Design of Control Unit, Basic requirement of Control Unit, Structure of Control Unit, Microprogram Sequencer.

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Seven: "Microprogrammed Control" from 7-1 to 7-4].

[William Stallings, Computer Organization and Architecture, 8th Edition, Part – Four, Chapter 15 & 16].

Questions:

1. Explain the Design procedure of Accumulator Logic.
2. Explain the Gate structure for controlling the LD, INR, and CLR of Accumulator.
3. Explain the components of ALU with their functions.
4. Define the Control Unit. Explain the organization of Microprogrammed Control unit.
5. Differentiate between Hardwired and Microprogrammed Control Design.
6. Explain the address sequencing procedure.
7. Explain the conditional branching mechanism.
8. What do you mean by mapping of instructions? Explain the procedure for mapping from instruction code to microinstruction address.
9. Define Microprogram. Differentiate between Symbolic and Binary microprogram with example.
10. Explain the basic requirements for designing control unit.
11. Explain the structure of Control Unit.
12. Write the role of microprogram sequencer in microprogrammed control unit.

Unit 5: Central Processing Unit (10 Hrs.)

General Register Organization: *Control Word*, Stack Organization, Instruction formats, addressing modes.

Data Transfer and Manipulation: *Data transfer instructions, Data manipulation instructions, Arithmetic instructions, Logical and Bit Manipulation Instructions, Shift Instructions.*

Program Control: *Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupt*.

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Eight: "Central Processing Unit" from 8-1 to 8-8].

Questions:

1. Explain the Register set with common ALU. OR Explain the general register organization
2. Define control word. Explain the procedure for determining control word for specific operation.
3. Define stack. Explain the stack organization.
4. Explain the different instruction formats with examples.
5. Explain the different types of instruction addressing modes.
6. Explain the different Data Transfer and Manipulation instruction.
7. What are control instructions? Explain the different types of program control instructions with their roles.
8. Define program interrupt. Explain the types of interrupt.
9. Write short notes on: Status bit conditions, Conditional branch instructions, Subroutine Call and Return.
10. Differentiate between CISC and RISC architecture.

Unit 6: Pipeline, Vector Processing and Multiprocessors (6 Hrs.)

Parallel Processing, Pipeline Examples: Four segment instruction pipeline, Data dependency, Handling of branch instructions, vector processing, vector operations, matrix multiplication.

[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Nine: "Pipelining and Vector Processing" from 9-1 to 9-7].

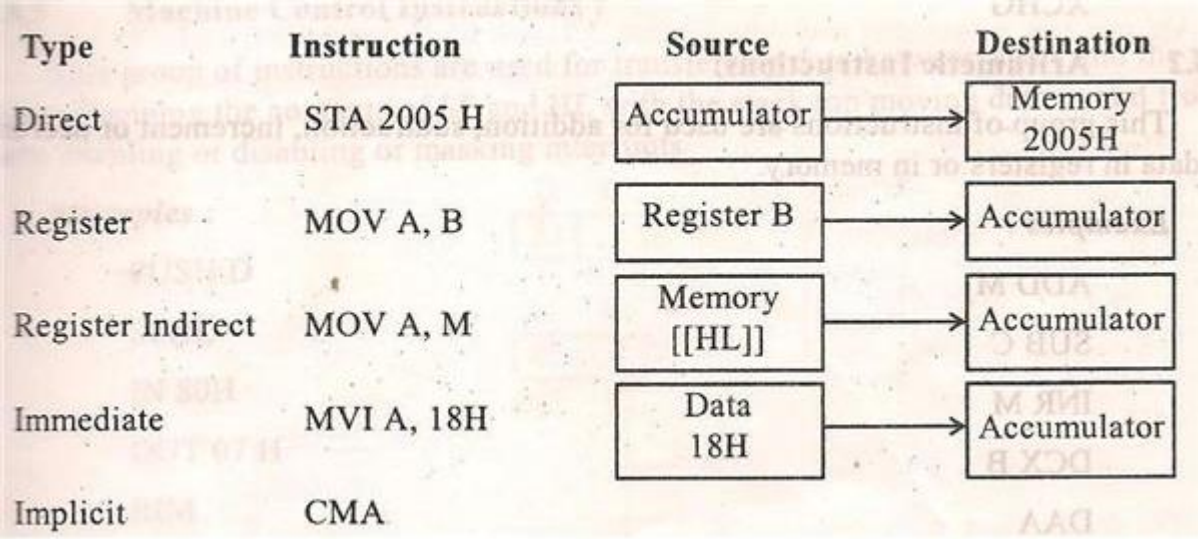
[M. Morris Mano, Computer System Architecture, 3rd Edition, Chapter Thirteen: "Multiprocessors" from 13-1 to 13-2].

Questions:

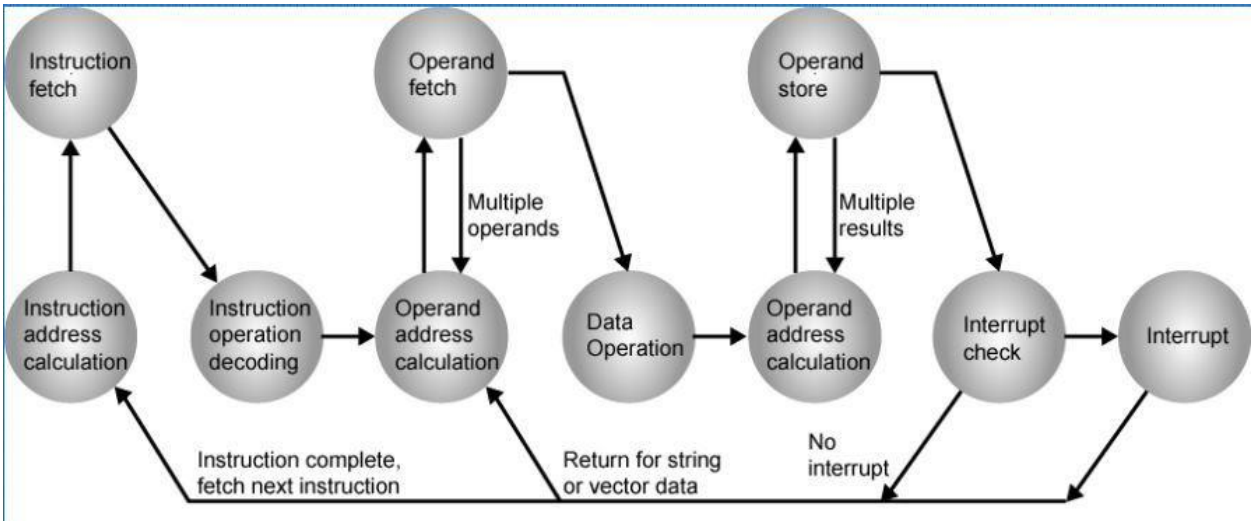
1. What is parallel processing? Explain the benefits of parallel processing.
2. Explain the classifications of parallel processing by M. J. Flynn.
3. What is pipelining? Explain the role of pipelining in computing.
4. Define instruction pipeline. Explain the four segment instruction pipeline.
5. Explain the different pipeline hazards (conflicts)?

6. How to handle the branch instruction in pipeline? Explain.
7. Define vector processing. Explain the application areas of vector processing.
8. Explain the characteristics of multiprocessor system.
9. Explain the interconnection structure of multiprocessor system.
10. Write short notes on: Arithmetic pipeline, vector operations, matrix multiplications.

Addressing Modes in 8085



Instruction Execution Cycle State Diagram:



8086 Microprocessor Block Diagram