**Microprocessor and Computer Architecture**

EG2204CT

**Year: II** **Total: 7 hours /week**

**Part: II** **Lecture: 3 hours/week**

**Tutorial: 1 hour/week**

**Practical: … hours/week**

**Lab: 3 hours/week**

**Course description:**

This course is designed to explore architecture of a microprocessor and its programming in assembly language. The student will be able to apply logics to various given problems and develop programs using assembly language construct that would help them to develop real time microprocessor-based application programs. This course also includes the concept of instruction set architecture, organization or micro architecture and concepts of computer arithmetic.

**Course objectives:**

After completion of this course students will be able to:

1. Discuss the architecture of 8085 microprocessor and assembly language programming.
2. Demonstrate the basic structure and operation of digital computer.
3. Explain microprogrammed control unit.
4. Explore the concept of pipelining.
5. Discuss data and algorithm used to perform operations on data.

**Course Contents:**

**Theory**

**Unit 1. Introduction of Microprocessor [8 Hrs.]**

1.1. Evolution of microprocessor and it's types
1.2. Microprocessor Bus organization: Data Bus, Address Bus and Control Bus
1.3. Operations of microprocessor: internal data manipulation, microprocessor initiated and peripheral or external initiated
1.4. Pin diagram and internal Architecture of 8085
1.5. Internal registers organization of 8085
1.6. Limitations of 8085

**Unit 2. Instruction Cycle and Timing Diagram [3 Hrs.]**

2.1. 8085 machine cycles
2.2. Bus timings to fetch, decode, execute instruction from memory
2.3. Memory read and write
2.4. Input/output read and write cycle with timing diagram

**Unit 3. 8085 Instruction set [12 Hrs.]**

3.1. Machine language instruction format:
  3.1.1. Single byte
  3.1.2. Two bytes
  3.1.3. Three-byte instructions
3.2. Various addressing modes
3.3. Data transfer operation and instruction
3.4. Arithmetic operation and instruction
3.5. Logical operation and instruction

3.6. Branch operation and instruction
3.7. Stack operation and instruction
3.8. Input/output and machine control operation and instruction
3.9. Simple programs with 8085 instructions

**Unit 4. Basic Computer Architecture [4 Hrs.]**

4.1. Introduction
  4.1.1. History of Computer Architecture
  4.1.2. Overview of Computer Organization
  4.1.3. Memory Hierarchy and cache
4.2. Instruction Codes
4.3. Stored Program Organization
4.4. Indirect address, computer registers
4.5. Common Bus system
4.6. Instruction sets
4.7. Instruction types

**Unit 5. Design of Microprogrammed Control Unit [10 Hrs.]**

5.1. Control Word, Microprogram, Control Memory
5.2. Control Address Register, Sequencer
5.3. Address Sequencing
5.4. Conditional Branch
5.5. Mapping of Instructions
5.6. Subroutines, Microinstruction Format, Symbolic Microinstructions
5.7. Central Processing Unit
  5.7.1. Introduction
  5.7.2. General Register Organization
  5.7.3. Stack Organization
5.8. Instruction Formats
5.9. Addressing Modes
5.10. RISC vs CISC
5.11. Pipeline and Vector Processing
  5.11.1. Arithmetic and Instruction pipeline
  5.11.2. Vector operations
  5.11.3. Matrix Multiplication, memory interleaving

**Unit 6. Computer Arithmetic [ 3 Hrs.]**

6.1. Data Representation
  6.1.1. Fixed point Representation
  6.1.2. Floating point Representation
6.2. Addition and Subtraction with Signed Magnitude Data
6.3. Addition and Subtraction with Signed 2's Complement Data
6.4. Multiplication of Signed Magnitude Data
6.5. Booth Multiplication

**Unit 7. Input Output Organization [ 5 Hrs.]**

7.1. Input-Output Interface
  7.1.1. I/O Bus and Interface Modules
  7.1.2. I/O vs. Memory Bus
  7.1.3. Isolated vs. Memory-Mapped I/O

7.2. Asynchronous Data Transfer: Strobe, Handshaking
7.3. Modes of Transfer:
  7.3.1. Programmed I/O
  7.3.2. Interrupt-Initiated I/O
  7.3.3. Direct memory Access
7.4. Direct Memory Access, Input-Output Processor, DMA vs. IOP

**Practical:** **[45 Hrs.]**

1. Demonstrate 8085 using kit/simulator
2. Implement program to perform arithmetic operations (Add, subtract, multiply and divide) on signed and unsigned two 8-bit numbers.
3. Implement a program to mask the lower four bits of content of the memory location.
4. Implement a program to set higher four bits of content of the memory location to 1.
5. Implement a program to perform Exclusive OR of two numbers.
6. Implement a program to exchange the content of two memory locations.
7. Implement program to add/subtract 16-bit numbers
8. Implement program to copy content of one memory location to another memory location.
9. Implement a program to check whether given no is odd or even.
10. Implement a program to count no of zero value in given block of data.
11. Implement algorithms for computer arithmetic using high level language like C or C++

| **Final written exam evaluation scheme** | | | |
|---|---|---|---|
| **Unit** | **Title** | **Hours** | **Marks Distribution*** |
| 1 | Introduction of Microprocessor | 8 | 14 |
| 2 | Instruction Cycle and Timing Diagram | 3 | 5 |
| 3 | 8085 Instruction set | 12 | 22 |
| 4 | Basic Computer Architecture | 4 | 7 |
| 5 | Design of Microprogrammed Control Unit | 10 | 18 |
| 6 | Computer Arithmetic | 3 | 5 |
| 7 | Input Output Organization | 5 | 9 |
| | **Total** | **45** | **80** |

* There may be minor deviation in marks distribution.

**References:**


1. Stallings W, Computer Organization and Architecture, 4th Edition, Prentice Hallof India Private Limited.
2. Malvino A.P., Brown J.A., Digital Computer Electronics, 3rd Edition, Tata McGraw Hill Hall
3. D.V, Microprocessors and Interfacing– Programming and Hardware, McGraw Hill
4. Gaonkar R, Microprocessor Architecture, Programming, and application with 8085, Penram International Publication