MICROPROCESSOR AND COMPUTER ARCHITECTURE

COURSE CODE: BCA 152

NATURE OF COURSE THEORY + LAB **CREDIT HRS: 3**

YEAR/SEMESTER: II /I **WORK LOAD/THEORY/LAB: 3/3 Hrs**

Course description:

This course is designed to familiarized the fundamental knowledge about computer architecture, instruction cycle, components of microprocessor, Intel 8085 and assembly programming.

Course objectives:

Upon completion of this course, students will be able to:

- Understand the basic components of a microprocessor
- Explain the block diagram of Intel 8085
- Demonstrate assembly language programming using Intel 8085
- Interpret timing diagrams, instruction cycles, and machine cycles
- Explain the role of the control unit and central processing unit (CPU)
- Differentiate between RISC and CISC architectures
- Describe the concept of Direct Memory Access (DMA)
- Explain memory organization and operations
- Understand the concept of pipelining in processors
- Describe microprogramming and microinstructions
- Perform computer arithmetic operations such as multiplication and division

Course contents:

Unit 1	**Introduction to Microprocessor**	**3 Hours**
1.1	Definition of Microprocessor Components: Registers, ALU, Control and Timing, System Buses (Address, Data, Control), Microprocessor System with Bus Organization, Application of MP	
Unit 2	**8085 Microprocessor**	**12 Hours**

2.1 Functional Block Diagram, Pin Configuration, Description of each Block: Registers, Flag (Description of each Flag), Multiplex Address data bus (Ad0-Ad7), Timing and Control Unit, Interrupts (Introduction Only), Addressing Modes, Instruction cycle, Machine cycle (Opcode, fetch, memory read, memory write) and T states, Timing diagram of MOV,LDA, STA, MVI

2.2 8085 Instruction Set
Data Transfer: - MOV, MVI, STA, LDA, LXI, LDAX, STAX, XCHG
Arithmetic: - ADD, ADI, ADC, SUB, SUI, SBB, INR, DCR, INX, DCX,
Logic: - ANA, ANI, ORA, ORI, XRA, XRI, CMA, CMP
Branching: - JMP, JNZ, JZ, JNC, JC

2.3 Basic Assembly Language Programming using 8085 Instruction Sets Addition (8 and 16 bit), Subtraction (8 and 16 bit), Multiplication (8 bit) and Division (8 bit), Simple Sequence Program, Array Searching using branching and looping

Unit 3 8086 Microprocessor **4 Hours**

3.1 Logical block diagram and components, Bus interface unit and Execution Unit, flag, pipeline concept, Memory Segmentation, Segmentation register

Unit 4 Basic Computer Architecture and Design **6 Hours**

4.1 Stored Program Organization, Computer Registers, Common bus system, Instruction set, Timing and Control-Instruction Cycle

4.2 Micro-Operation, Arithmetic Micro Operations: Addition, Subtraction, Increment, Decrement, Logic Micro Operations: AND, OR, NOT, NAND, NOR, XOR, Shift Micro Operations: Logical, Circular and Arithmetic

Unit 5 Microprogrammed Control Unit **5 hrs.**

5.1 Hardwired vs micro program CU, Control Memory, Address Sequencing, Micro-operation, Micro instruction, Micro Instruction Format, Micro-program: Symbolic and Binary Micro-program (FETCH)

Unit 6: Central Processing Unit **6 Hours**

6.1 Introduction, General Register Organization, Stack Organization,

Instruction Formats:3,2,1,0 address Instruction,

6.2 RISC and CISC architecture

Unit 7: Computer Arithmetic **3 hrs.**

7.1 Addition and Subtraction with signed magnitude data, Addition and Subtraction with signed 2's complement data, Booth Multiplication

Unit 8 Input and Output Organization and Memory Organization **5 Hours**

8.1 Introduction to Peripheral Devices, I/O interface-I/O bus and Interface Modules, Isolated versus Memory Mapped I/O, Interrupt

8.2 Direct Memory Access (DMA): Introduction, Basic DMA Procedures (DMA controller only)

8.3 Hierarchy of Memory System

8.4 Primary Memory: RAM and ROM, Memory Address Map with examples of Address Decoding.
Secondary Memory: Structure of Magnetic Disk, Cache Memory

Unit 9 Pipelining **4 Hours**

9.1 Concept of Pipelining and Flynn's Classification, Pipelining Example with Speed Up Ratio

9.2 Arithmetic Pipeline, Pipeline for Floating-point Addition and Subtraction

9.3 Instruction Pipeline: Four Segment Instruction Pipeline

9.4 Data Dependency, Handling of Branch Instruction, pipeline hazard and its solution

Laboratory Works: **48 Hours**

- Write assembly language programs using both the 8085-microprocessor trainer kit and a software-based 8085 simulators.
- Demonstrate the use of all types of instructions and various addressing modes available in the 8085-instruction set.
- Develop programs that include fundamental arithmetic operations (8-bit addition and subtraction,16-bit addition and subtraction,8-bit multiplication and division), logical operations, loops, bitwise manipulation, and branching techniques.
- Implement algorithms for computer arithmetic using high level language

Required readings

Gaonkar, R. S. (1998). *Microprocessor architecture, programming, and applications with the 8085*. Prentice-Hall, Inc.

Hall, D. V. (1986). *Microprocessors and interfacing: programming and hardware*. McGraw-Hill, Inc.

Mano, M. M. (1993). *Computer system architecture*. Prentice-Hall, Inc.