Micro Syllabus
Microprocessor and Computer Architecture

Course Title: Microprocessor and Computer Architecture
Course No: BIT151
Nature of the Course: Theory + Lab
Semester: II

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course aims at providing fundamental knowledge about computer architecture, instruction cycle, components of microprocessor, Intel 8085 and assembly programming.

Course Objectives:
The main objective of this course is to provide basic knowledge of components of microprocessor, block diagram and assembly language programming using Intel 8085, SAP1 and SAP2 computer architecture, timing diagrams, instruction cycles, machine cycles, control unit, central processing unit, RISC, CISC, Direct Memory Access, interrupts, serial and parallel interfaces.

Course Contents:

Unit 1	**Introduction to Microprocessor**	**6 Hours**
1.1	Definition of Microprocessor Components : Registers, ALU, Control and Timing, System Buses (Address, Data, Control), Microprocessor System with Bus Organization	1.5 Hours
1.2	SAP-1 Architecture: Block Diagram, and Function of each Block SAP-1 Instructions :LDA, ADD, SUB, OUT, HLT Fetch and Execution Cycle of SAP-1 Instructions with Timing Diagram • Fetch Cycle: Address State, Increment State, Memory State • Execution Cycle of LDA only	3 Hour
1.3	SAP-2 Architecture: Block Diagram and Functions of each Block, Architectural Differences with SAP-1 ➢ Bidirectional Registers ➢ Flags	1.5 Hour
Unit 2	**Intel 8085**	**8 Hours**
2.1	Functional Block Diagram, Pin Configuration, Description of each Block: Registers, Flag(Description of each Flag), Data and Address Bus including Bidirectional Address/Data Bus, Timing and Control Unit, Interrupts (Introduction Only), Instructions: Op-Code and Operands Addressing Modes, Instructions and Data Flow	3 Hour

2.2	8085 Instructions: Data Transfer:- MOV, IN, OUT, STA,LDA, LXI, LDAX, STAX, XCHG Arithmetic and Logic:- ADD, SUB, INR, DCR, AND, OR, XOR, CMP, RLC, RRC, RAL, RAR Branching:- JMP, JNZ, JZ, JNC, JC	2 Hours
2.3	Basic Assembly Language Programming using 8085 Instruction Sets Addition, Subtraction, Multiplication and Division, Simple Sequence Programs, Array Searching and Sorting using Branching and Looping, Conversion (BCD to ASCII)	3 Hours
Unit 3	**Micro Operations**	**3 Hours**
3.1	Arithmetic Micro Operations: Addition, Subtraction, Increment, Decrement, Hardware Implementation	1 Hour
3.2	Logic Micro Operations: AND, OR, NOT,NAND,NOR,XOR, Selective Set, Set(preset), selective Complement(toggling) ,Insert, Hardware Implementation	1 Hour
3.3	Shift Micro Operations: Logical, Circular and Arithmetic, Arithmetic Logic Shift Unit	1 Hour
Unit 4:	**Control Unit and Central Processing Unit**	**9 Hours**
4.1	Control Unit of Basic Computer and Timing Signal (Hardwired Vs. Microprogrammed)	2 Hour
4.2	Micro-operation, Micro-instruction, Micro-program: Symbolic and Binary Micro-program (FETCH and ADD)	3 Hour
4.3	Architecture of Basic Computer: Register organization, Common Bus System Instruction Format, Register Stack and Memory Stack	2 Hour
4.4	Data Transfer operations and Manipulation (Arithmetic, Logical, Shift)	1Hour
4.5	Introduction to RISC and CISC (Basic Differences)	1 Hour
Unit 5	**Fixed point Computer Arithmetic**	**5 Hours**
5.1	Signed number Representation: Signed Magnitude, 1's Complement and 2's Complement Form	0.5 Hour
5.2	Addition and Subtraction(with Numerical Example), Addition and Subtraction with Signed Magnitude Data, Hardware implementation, Hardware Algorithm, Addition and Subtraction with Signed 2's Complemented Data	2.5 Hours

5.3	Multiplication Algorithm: Hardware Implementation for Signed Magnitude Data, Booth Multiplication Algorithm (with Numerical Example)	1 Hour
5.4	Division Algorithm: Hardware Implementation for Signed Magnitude Data, Hardware Algorithm (Restoring Only)	1 Hour
Unit 6	**Input and Output Organization**	**5 Hours**
6.1	Introduction to Peripheral Devices, I/O interface-I/O bus and Interface Modules, Isolated versus Memory Mapped I/O	1 Hour
6.2	Direct Memory Access (DMA): Introduction, Basic DMA Procedures (DMA controller only)	2 Hours
6.3	I/O Processor, Data Communication Processor: Character Oriented Protocol and Bit Oriented Protocol	2 Hours
Unit 7	**Memory Organization**	**5 Hours**
7.1	Hierarchy of Memory System	1 Hour
7.2	Primary Memory: RAM and ROM, Memory Address Map with examples of Address Decoding. Secondary Memory: Structure of Magnetic Disk	1.5 Hours
7.3	Virtual Memory: Concept, Address Mapping with Pages, Basic Idea about Page Fault and page Replacement	1.5 Hours
7.4	Memory Management Hardware: Segmented Page Mapping (Introduction) , Memory Protection	1 Hour
Unit 8	**Pipelining**	**4 Hours**
8.1	Concept of Pipelining and Flynn's Classification, Pipelining Example with Speed Up Ratio	1 Hour
8.2	Arithmetic Pipeline , Pipeline for Floating-point Addition and Subtraction	1 Hour
8.3	Instruction Pipeline: Four Segment Instruction Pipeline	1 Hour
8.4	Data Dependency, Handling of Branch Instruction	1 Hour

Laboratory Works:
The laboratory works should be carried out in 8085 trainer kit. The programming should include arithmetic operation, base conversion, conditional branching etc.

Kit

1. Data swap and data transfer programs
2. 8 bit addition and subtraction
3. 16 bit addition and subtraction
4. 8 bit division and multiplication

Kit/Simulator

5. Series generation : odd-even, multiples of integers
6. BCD to ASCII
7. Searching largest/smallest value in an array
8. Ascending/ Descending sorting of array
9. Program involving bitwise AND, bitwise OR, bitwise X-OR, RLC, RRC

Text Books:
1. Ramesh S. Gaonkar: Microprocessor Architecture, Programming, and Applications with 8085, prentice Hall
2. Morris Mano: Computer system Architecture, Third Edition, prentice Hall

Reference Books:
1. Malvino: Digital Computer system Electronics (An introduction to Microcomputers)
2. Douglas V. Hall: Microprocessor and Interfacing programming and Hardware, McGraw Hill

Model Question

Course Title: Microprocessor and Computer Architecture **Full Marks: 60**
Course No: BIT151 **Pass Marks: 24**
Semester: II **Time: 3 hours**

Section A

Attempt any two Questions. **[2 x 10 = 20]**

1. What is Microprocessor? Draw a well labeled block diagram of 8085 microprocessor and explain it. (1 + 9)
2. Explain the components of SAP 1 computer with its block diagram. What are different instructions available in SAP 1 computer? (8 + 2)
3. What is micro-operation and micro-instruction? Create a symbolic and binary micro-program for FETCH and ADD operation. (2 + 4 + 4)

Section B

Attempt any eight questions. **[8 x 5 = 40]**

4. What is DMA? Explain the basic DMA process.
5. Write a program to perform 8 bit multiplication in 8085 processor. (Assume data and memory yourself).
6. Explain 4 segment instruction pipeline.
7. Differentiate between RISC and CISC computer.
8. Perform multiplication of (-9) x (-13) using Booth's Multiplication algorithm.
9. Explain about memory hierarchy in computer.
10. What is flag? What are different flags available in 8085 microprocessor?
11. Differentiate between microprogrammed and hardwired control unit.
12. Write short notes: (Any two) (2 x 2. 5 = 5)

    a. Flynn's Classification

    b. Memory protection

    c. Memory Mapped I/O