

**Course Title: Microprocessor**

**Course no: CSC-153**

**Credit hour: 3**

**Full Marks: 60 + 20 + 20**

**Pass Marks: 24 + 8 + 8**

**Nature of course:** Theory (3 Hrs.) + Lab (3 Hrs.)

**Course Synopsis:** This course contains of fundamental concepts of computer organization, basic I/O interfaces and Interrupt operations.

**Goal:** The course objective is to introduce the operation, programming and application of microprocessor

**Unit 1: Introduction (3 hrs)**

- Definition of microprocessor and its application
- Evolution of microprocessor
- Von Neumann architecture
- Basic organization of microprocessor
  - Microprocessor: Arithmetic and logic units (ALU), Control unit (CU), Registers
  - Memory
  - Input / Output
  - System bus: Data, Address and Control bus

**Unit 2: Basic Computer Architecture (10 hrs)**

- SAP – 1 architecture: Block diagram, and function of each block 2 hrs
  - 8-bit "W" bus
  - 4-bit program counter
  - 4-bit memory address register (MAR)
  - 16x8 bit memory
  - 8-bit instruction register (IR)
  - 8-bit accumulator
  - 8-bit B register
  - 8-bit adder – subtracter
  - 8-bit output register
- SAP – 1 instructions 1 hrs
  - LDA, ADD, SUB, OUT, HLT
- Fetch and execution cycle of SAP-1 instructions 2 hrs
  - Fetch cycle: Address state, Increment state, Memory state
  - Execution cycle of LDA,ADD instructions
- Microprogram 1 hrs
  - Microinstructions of SAP-1 instructions
- SAP-2 architecture: Block diagram and function of each block 2 hrs
- Architectural differences with SAP-1 0.5 hr
  - Bidirectional registers
  - Flags
- Instructions sets 1.5 hrs

### Unit 3: Instruction cycle (3hrs)

- Instruction cycle, machine cycle and T states 1 hr
  - Machine cycle of 8085 microprocessor: Op-code fetch, Memory read, memory write, I/O read, I/O write, Interrupt
- Fetch and execute operation, timing diagram 1.5 hrs
  - Timing diagram of MOV, MVI, IN, OUT, LDA, STA
- Fetch and execute overlap 0.5 hr

### Unit 4: Intel 8085/8086/8088 (8 hrs)

- Intel 8085 microprocessor 4.5 hrs
  - Functional block diagram
  - Pin configuration
  - Description of each blocks: Registers, Flag, Data and address bus, Timing and control unit, Interrupts
  - Instructions– opcode and operands
  - Addressing modes
  - Instruction and data flow
- Intel 8086/8088 microprocessor 3.5 hrs
  - Functional block diagram of 8086 microprocessor and description of each block: Registers, Flags, Address and Data bus
  - Introduction to 8088 microprocessor and its block diagram
  - Comparison with 8085 microprocessor
  - Assembly instructions- mnemonic and operands
  - Addressing modes

### Unit 5: Assembly Language Programming (9 hrs)

- Programming with Intel 8085 microprocessor 4.5 hrs
  - Instruction format
  - Instruction types: Data transfer, Arithmetic, Logic, Branching, Miscellaneous
  - Simple sequence programs, Branching, Looping
- Programming with Intel 8086 microprocessor 4.5 hrs
  - Assembly instruction format
  - Mnemonics and operands
  - Macro assembler
  - Assembling and linking
  - Assembler directives, comments
  - Instruction sets
    - Data transfer: - MOV, IN, OUT, LEA
    - Arithmetic and logic: - ADD, SUB, INC, DEC, MUL, DIV, AND, OR, XOR, NOT, CMP, DAA, AAA, ROR, RCR, ROL, RCL, SHL, SHR
    - Branching: - JMP, CALL, RET, LOOP
    - Stack: PUSH, POP
  - INT 21h functions
    - 01H, 02H, 09H, 0AH, 4CH
  - INT 10h functions
    - 00H, 01H, 02H, 06H, 07H, 08H, 09H, 0AH
  - Simple sequence programs, Branching, Looping
  - Debugging

### Unit 6: Basic I/O, Memory R/W and Interrupt Operations (6 Hrs)

- Memory read/write, Input/output read/write operation in 8085 microprocessor based system 1 hr
- Direct memory access (DMA) 1.5 hrs
  - Introduction, advantage and application
  - DMA controller 8237 interfacing
- Interrupt 1.5hrs
  - 8085 interrupt pins and interrupt priority
  - Maskable and non-maskable interrupts
  - Vector and polled
- 8259 operation 2 hrs
  - Block diagram and explanation
  - Priority modes and other features

### Unit 7: Input/ output Interfaces (6 hrs)

- Parallel communication – introduction and applications 0.5 hr
- Serial communication 1.5 hrs
  - Introduction and applications
  - Introduction to Programmable Communication Interface 8251
  - Basic concept of synchronous and asynchronous modes
- Simple I/O, strobe I/O, Single handshake I/O, Double handshake I/O 0.5 hr
- 8255A and its working 1.5 hrs
  - Block diagram
  - Modes of operation
  - Control word
- RS-232: Introduction, pin configuration (9pin and 25 pin) and function of each pin. Interconnection between DTE-DTE and DTE-DCE 1 hr
- Keyboard and display controller: Introduction o 8279 1 hr

### References:

1. Ramesh S. Gaonkar, **Microprocessor Architecture, Programming, and Applications with 8085**, Prentice Hall (For unit 1, 3, 4, 5, 6 and 7)
2. A.P. Malvino and J.A. Brown, **Digital Computer Electronics**, Tata McGraw Hill (For unit 2)
3. D.V. Hall, **Microprocessors and Interfacing – Programming and Hardware**, McGraw Hill (For unit 4, 5, 6, and 7)
4. Peter Abel, **IBM PC Assembly Language Programming**, McGraw Hill (For unit 4 and 5)