Computer Organization and Design

Course objectives:
To provide the organization, architecture and designing concept of computer system including processor architecture, computer arithmetic, memory system, I/O organization and multiprocessors.

1. Introduction (3 hours)
    a. Computer organization and architecture
    b. Structure and function
    c. Designing for performance
    d. Computer components
    e. Computer Function
    f. Interconnection structures
    g. Bus interconnection
    h. PCI

- 2. Central processing Unit (10 hours)
    a. CPU Structure and Function
    b. Arithmetic and logic Unit
    c. Instruction formats
    d. Addressing modes
    e. Data transfer and manipulation
    f. RISC and CISC
    g. 64-Bit Processor

- 3. Control Unit (6 hours)
    a. Control Memory
    b. Addressing sequencing
    c. Computer configuration
    d. Microinstruction Format
    e. Symbolic Microinstructions
    f. Symbolic Micro program
    g. Control Unit Operation
    h. Design of control unit

- 4. Pipeline and Vector processing (5 hours)
    a. Pipelining
    b. Parallel processing
    c. Arithmetic Pipeline
    d. Instruction Pipeline
    e. RISC pipeline
    f. Vector processing
    g. Array processing

- 5. Computer Arithmetic (8 hours)
    a. Addition algorithm
    b. Subtraction algorithm
    c. Multiplication algorithm
    d. Division algorithms
    e. Logical operation

6. Memory system (5 hours)
    a. Microcomputer Memory
    b. Characteristics of memory systems
    c. The Memory Hierarchy
    d. Internal and External memory
    e. Cache memory principles
    f. Elements of Cache design
        i. Cache size
        ii. Mapping function
        iii. Replacement algorithm
        iv. Write policy
        v. Number of caches

7. Input-Output organization (6 hours)
    a. Peripheral devices
    b. I/O modules
    c. Input-output interface
    d. Modes of transfer
        i. Programmed I/O
        ii. Interrupt-driven I/O
        iii. Direct Memory access
    e. I/O processor
    f. Data Communication processor

8. Multiprocessors (2 hours)
    a. Characteristics of multiprocessors
    b. Interconnection Structures
    c. Interprocessor Communication and synchronization

Practical:
1. Add of two unsigned Integer binary number
2. Multiplication of two unsigned Integer Binary numbers by Partial-Product Method
3. Subtraction of two unsigned integer binary number
4. Division using Restoring
5. Division using non- restoring methods
6. To simulate a direct mapping cache

References:

1. M. Morris Mano: Computer System Architecture, Latest Edition
2. William Stalling: Computer organization and architecture, Latest Edition
3. John P. Hayes: Computer Architecture and Organization, Latest Edition
4. V.P. Heuring, H.F. Jordan: Computer System design and architecture, Latest Edition
5. S. Shakya: Lab Manual on Computer Architecture and design