Dr. RamManohar Lohia Avadh University, Ayodhya U.P.

Study and Evaluation Scheme

MCA (Master of Computer Applications)

(Effective From Session 2020-21)

Year – I Semester – I

MCA 102 – Computer Organization & Architecture

Course Details

- **Paper No.: II**
- **Course Code: MCA 102**
- **Course Title: Computer Organization & Architecture (Theory)**
- **Marks Distribution: Internal = 50, External = 100, Total = 150**

🎯 **Goal**

To learn the basic methods and provide the fundamental concepts used in the design of digital systems.

OUTCOMES

At the end of the course the student should be able to:

1. Understand the **functions of a digital computer**.
2. Reduce complex logical expressions using **Boolean algebra**.
3. Use graphical methods for simplification of logic expressions (e.g., **K-maps**).
4. Apply **design methodology** for combinational logic circuits.
5. Use **design concepts** of sequential circuits.
6. Understand structure of various **semiconductor storage devices**.
7. Illustrate basic **arithmetic and logic operations** in the computer.
8. Explain **memory organization**.
9. Describe **I/O interfacing**.
10. Explain **device subsystems**.

UNIT I — Computer Fundamentals, Data Representation & Arithmetic

- **Introduction to Computer Fundamentals:** Evolution, generations, classification, applications, components (hardware & software), booting.
- **Data Representation:** Positional numbering systems, base conversion, signed integer representation, **IEEE floating-point**, character codes.
- **Arithmetic:** Overview of fixed point and floating point addition, subtraction, multiplication, division.
- **Boolean Algebra & Digital Logic:** Boolean algebra, expressions & identities, **K-maps & minimization**, logic gates, digital components, combinational & sequential circuits.

UNIT II — Register Transfer, Memory & Arithmetic Algorithms

- **Registers & Register Transfer:** Register transfer language, bus & memory transfers, bus architecture, bus arbitration.
- **Arithmetic & Shift Micro-operations:** Arithmetic logic shift unit, design of fast adders, arithmetic algorithms (addition, subtraction, **Booth multiplication**).
- **Memory Hierarchy:** Main memory (RAM/ROM), auxiliary memory, **cache memory**, virtual memory, memory management hardware.

UNIT III — Control Design

- **Control Unit Design:** Hardwired vs microprogrammed control.
- **Fundamentals:** Register transfers, performing arithmetic/logic ops, fetch/store operations, execution of complete instruction.
- **Organizations:** Multiple-bus organization, hardwired control, **microprogramming** (microinstructions, sequencing, wide-branch addressing, next-address field, prefetching).

UNIT IV — Processor & I/O Organization

- **Processor Design / Organization:** General register organization, stack organization, addressing modes, instruction formats, data transfer & manipulation, program control, **RISC** concepts.
- **I/O Organization:** I/O interfaces, modes of transfer, **interrupts & handling**, programmed I/O, **DMA**, I/O processors, serial communication.

UNIT V — Device Subsystems, Pipelining & Advanced Topics

- **Device Subsystems:** External storage systems (disk/optical), organization of disk drives, basic I/O controllers (keyboard/mouse), **RAID architectures**, video controllers, I/O performance, SMART & fault detection, processor-to-network interfaces.
- **Advanced Architectures:** RISC & CISC, basic **MIPS** implementation, **pipelining**, instruction-level parallelism, parallel processing challenges, Flynn's classification, hardware multithreading, multicore processing.