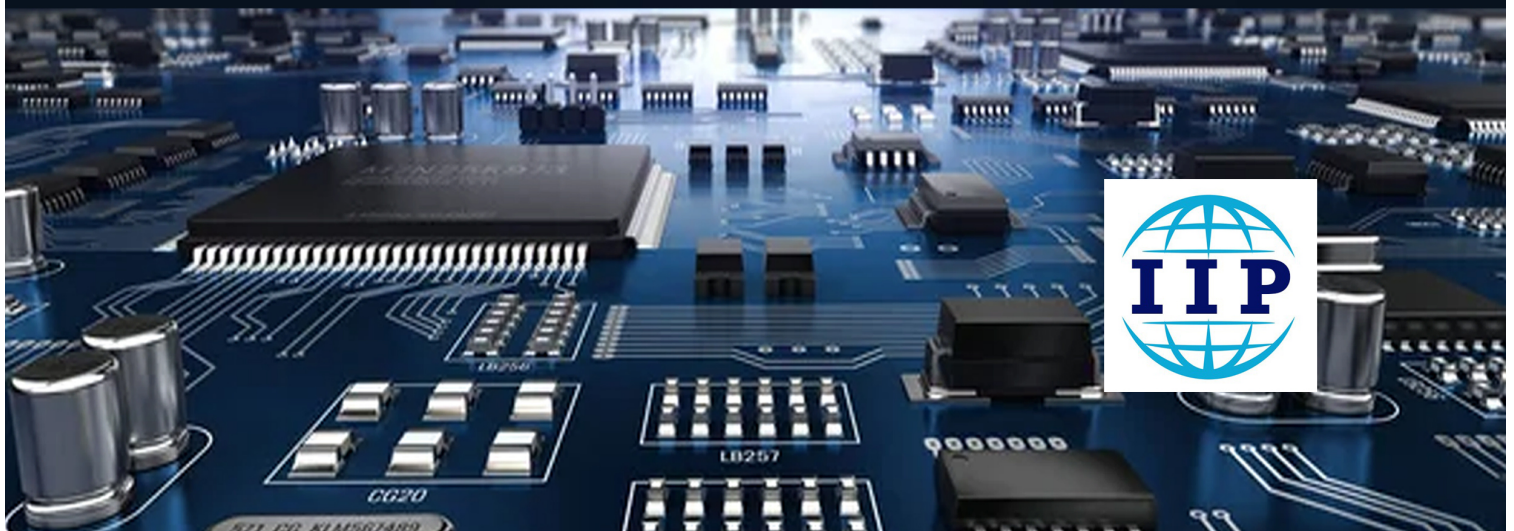


# Computer Organization and Architecture

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# Computer Organization and Architecture

First Edition

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## Preface

This book is intended for students in Computer Science Engineering, Information Technology, Electrical and Mechanical engineering. It emphasizes on the integration of hardware, software, algorithms and programming languages etc. to enhance the performance of the system. The material covered in the book is suitable for one semester course on “Computer Organization & Assembly Language” and another semester course on “Computer Architecture”. It focuses on a basic syllabus on digital logic design and an introductory course on high- level computer language.

Computer architecture deals with the design of computers, data storage devices, and networking components that store and run programs, transmit data, and drive interactions between computers, across networks, and with users. It uses parallelism and various strategies for memory organization to design computing systems with very high performance. It requires strong communication between computer scientists and computer engineers, since they both focus fundamentally on hardware design. The main take away from this book is in building the undertaking yourself.

In this book, we have constructively raised the fundamentals of Computer Organization & Assembly Language with all the necessary concepts with respect to building real time applications.

**Chapter 1: Number System:** Data Types, Complements, Fixed-Point Representation, Binary and other codes, Error Detection Codes.

**Chapter 2: Logic Gates and Boolean Algebra:** Map Simplification

**Chapter 3: Sequential and Combinational Circuits:** Adder- Subtractor, Multiplexer, Demultiplexer, Decoder, Encoders, Flip-Flop Registers, Counters.

**Chapter 4: Basic Computer Organization:** Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input -Output & Interrupts, Complete Computer Description & Design of Basic Computer.

**Chapter 5: Register Transfer and Microoperations:** Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.

**Chapter 6: Processor and Control Unit:** Hardwired vs Micro programmed, Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, RISC, CISC.

**Chapter 7: Data Transfer schemes and Memory Hierarchy:** Program Control, Interrupt, DMA Transfer, I/O Processor. Processor Vs Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.

**Chapter 8: Parallelism and Multithreading:** Types of Parallelism, Introduction to Instruction Level Parallelism, Parallelism processing challenges, Applications, SISD, SIMD, MISD, MIMD.

**Chapter 9: Indian Contribution to Computer System Architecture:** Contributions of reputed scientists of Indian origin – Dr. Vinod Dham, Father of Intel Pentium Processor, Dr. Ajay Bhat, Co-Inventor of USB Technology, Dr. Vinod Khosla, Co-founder of Sun Microsystems, Dr. Vijay P Bhatkar, architect of India's national initiative in supercomputing.

**Chapter 10: Lab Experiments:** To study basic gates (AND, OR, NOT), binary to grey code, half adder, full adder, universal gates (NAND, NOR), Flip Flop- RS, JK and DeMorgan's Theorem.

## **Acknowledgement**

A good book requires a lot of efforts and knowledge. Knowledge comes only from prolonged reading, subject expertise, and most importantly, from teaching that subject. The coordination among authors while self-reviewing was also important in writing this book because constructive criticism is must for a successful team. This book could not be completed without the regular feedback, suggestions, and motivation by few people.

We would like to thank to our parents for their motivational and inspirational support to complete every task of our life. Last but not the least, Mr. Binu Vargis as a milestone who gave the valuable time and shared his knowledge in writing a book with us which emerged as “facts”

We are thankful to subscribers of our Online and Offline paltforms because their positive comments were being a sort of suggestions for us. Our family and friends are also part of this because their continuous support and encouragement always motivated us for hard work.

Finally, we are deeply grateful to INSC International Publishers for prompt and efficient processing of the work and made this book possible.

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