Digital Design Internship

(4 Weeks)

Week 1

Combinational Circuits - Introduction to Digital Electronics - Overview of digital vs. analog systems, Logic levels and binary systems. Boolean Algebra and Logic Gates, Basic logic gates (AND, OR, NOT), Derived gates (NAND, NOR, XOR, XNOR), Truth tables and Boolean expressions, Simplification Techniques, Karnaugh Maps (K-Maps).
Design of Combinational Circuits - Half Adder and Full Adder, Subtractors: Half Subtractor and Full Subtractor, Multiplexers and Demultiplexers, Encoders and Decoders, Practical Lab Sessions, Designing and testing simple combinational circuits using software tools.

Week 2

Sequential Circuits- Introduction to Sequential Circuits, Difference between combinational and sequential circuits, Latches and Flip-Flops (SR, D, JK, T), Clocking and edge triggering
Design of Sequential Circuits - Synchronous vs. Asynchronous circuits, Counters (Binary, BCD, Up/Down), Shift Registers (Serial-in-Serial-out, Serial-in-Parallel-out), State diagrams and state tables. Memory Elements - RAM, ROM, and storage elements
Practical Lab Sessions - Designing flip-flop based circuits

Week 3

ALU Overview: Structure and architecture of the Arithmetic Logic Unit (ALU), its role within the CPU.
Design of Arithmetic and Logical Units - Binary addition, subtraction, Ripple Carry Adder, Functionality of basic ALU operations (AND, OR, ADD, SUB, etc.), Flags/Status Bit

Week 4

ALU Project - Final ALU Design Project, Review of all concepts covered in the previous weeks, Detailed design of a complete ALU
Project Presentation and Evaluation, Students present their ALU designs, Evaluation of design, functionality.