Objective of the course

The course is divided into two parts :one part dealing with the designing of digital computer using Verilog and the other one dealing with the architecture aspect of computers .By end of this course you will be able to understand the basic components of computer and how these components are organized and structured and how can we design these components using simple Programming . The overview of the course is as followed:

Chapter 1

- **Functional elements and structure of digital computer**
- **Evolution and future scope of digital computers.**
- **Difference between computer organization and computer architecture.**
- **How hardware and software are related.**
- **Von Neumann model in computer system.**

Chapter 2

- **Data representation in computer system. (binary, octal, decimal, hexa decimal).**
- **Positioning number system and floating point system.**
- **Inter conversion of bases.**
- **Arithmetic operation on these data.**
- **Arithmetic operation using signed numbers, one's complement two's complement.**
- **Character codes for error detection and correction are covered briefly.**

Chapter 3

- **Classic presentation of digital logic and how it relates to**

- **Logic gates representation and designing.**
- **Covers both combinational and sequential logic in detail.**

- **Implementation of Kmaps in a special “Focus On” section to minimize the circuits.**

- **illustrates basic computer organization and introduces many fundamental Concepts, including the fetch-decode-execute cycle, the data path,**
Clocks and buses, register transfer notation, and of course, the CPU. includes a program counter, an accumulator, an instruction register, 4096 bytes of memory, and two addressing modes.
- **Assembly language is introduced to reinforce the concepts of instruction format, instruction mode,data format, and control that are presented earlier.**
- **Finally, Intel and MIPS architectures are compared to reinforce the concepts in the chapter**.

PART 2

Chapter 1

- **Introduction to CAD tools.**
- **Introduction to Verilog.**
- **Introduction of Xilinx as simulator**.

Chapter 2

- **Design of Arithmetic Circuits using CAD tools /Verilog.**

Chapter 3

- **Combinational circuits and Building Blocks.**
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- **Verilog for Combinational Circuits.**
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- **Use of the conditional operator, if else statement, The case statement, the for-loop Verilog operators.**
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Chapter 4

- **Designing of storage elements with CAD tools**
- **blocking and non-blocking assignments, combinational circuits.**

Chapter 5

- **Design of finite state machine using CAD tools.**

Chapter 5

- **instruction set architectures, including**
- **Instruction formats, instruction types, and addressing modes.**
- **Instruction-level pipelining is introduced as well. Real-world ISAs (including Intel, MIPS, andJava) are presented to reinforce the concepts presented in the chapter.**

Chapter 6

- **covers basic memory concepts, such as RAM and the various memory Devices,**
- **and also addresses the more advanced concepts of the memory**

- **This chapter gives a thorough presentation of direct mapping, associative mapping, and set-associative mapping techniques for cache. It also provides a detailed look at overlays, paging and segmentation, TLBs, and the various algorithms and devices associated with each.**

Chapter 7

- **I/O fundamentals, bus communication and protocols, and typical external storage devices, such as magnetic and optical disks, as well as the various formats available for each are discussed in this chapter**
- **DMA, programmed I/O, and interrupts are covered as well.**
- **In addition, various techniques for exchanging information between devices are introduced.**
- **RAID architectures are covered in detail, and various data compression formats are introduced.**

Chapter 8

- **Operating system s from its history design and services are discussed in this chapter.**
- **discusses the various programming tools available (such as compilers and assemblers) and their relationship to the architecture of the machine on which they are run.**

Chapter 9

- **provides an overview of alternative architectures that have emerged in recent years. RISC, Flynn's Taxonomy, parallel processors, instruction-level parallelism, multiprocessors, interconnection networks, shared memory systems,**
- **cache coherence, memory models, superscalar machines, neural networks,**
- **systolic architectures, dataflow computers, and distributed architectures are covered.**

Chapter 10

- **An overview of embedded systems with its hardware and software is discussed here.**