PESIT Bangalore South Campus

Hosur road, 1km before Electronic City, Bengaluru -100

Department of Computer Science and Engineering

COURSE INFORMATION

SUBJECT: Computer Organization (15CS34)
FACULTY: Mrs.Shanthala P.T and Mrs. Jyothi U Desai

No. of Sessions:56

Objectives :

To learn about the basic organizational aspects of computers, machine instructions, addressing modes, I/O Organization, standard interfaces, working of dynamic memories, static memories ,number systems, representations ,design and working of control unit .

- Understand the basics of computer organization: structure and operation of computers and their peripherals.
- Understand the concepts of programs as sequences or machine instructions.
- Expose different ways of communicating with I/O devices and standard I/O interfaces.
- Describe hierarchical memory systems including cache memories and virtual memory.
- Describe arithmetic and logical operations with integer and floating-point operands.
- Understand basic processing unit and organization of simple processor, concept of pipelining and other large computing systems.

Pre-requisites:

A student is expected to know about basic hardware and number system in computer science.

Session #	Module & Chapter #	Topic to be covered	% of Portions covered Cumulative
1	Module 1 Chapter 1 & 2 Basic Structures of Computers & Machine instructions and programs .	**Basic operational concepts**: Bus structures:	20%
2		**Performance: -** processor clock, Basic performance equation .	
3		Clock rate, performance measurement.	
4		Machine Instructions and Programs: **Memory locations and addresses:** **:** byte addressability, big-endian and Little-endian assignments, word Alignment, accessing Numbers, characters, and Character Strings	
5		**Memory Operations.**	

6	Textbook 1: Ch 1: 1.3, 1.4, 1.6.1, 1.6.2, 1.6.4, 1.6.7. Ch 2: 2.2 to 2.10, 2.12	**Instructions and instructions sequencing:** Register transfer notation, assembly language notation, basic instruction types, instruction execution and Straight-Line Sequencing, branching, condition codes, generating memory addresses.	
7		**Addressing modes:** implementations of variables and constants, indirection and pointers.	
8		**Assembly language**: assembler directives, assembly and execution of programs	
9		Basic input and output Operations,	
10		Stacks and Queues,	
11		**Subroutines**: Subroutine nesting & processor stack , Parameter passing, the Stack frame.	
12		**Additional instructions:** logic instructions, shift **&** rotate instruction, multiplication & division. Encoding of machine instruction.	
13-15	**Module 2** **Chapter 4 Input/Output Organization** Textbook 1: Ch 4: 4.1, 4.2: 4.2.1 to 4.2.5, 4.4 to 4.7.	**Accessing I/O devices**: **Interrupts:** Interrupt hardware, enabling & disabling interrupts, Handling multiple devices,	**40%**
16		Controlling device requests, exceptions;	
17		**DMA** : bus arbitration.	
18-19		**Buses**: Synchronous and asynchronous buses, discussion.	
20-21		**Interface circuits**: Parallel & Serial port:	
22		**Std IO interfaces**: PCI and SCSI bus	
23		USB	
24-28	**Module 3** Chapter 5 **The memory system** Textbook 1: Ch 5: 5.1 to 5.4, 5.5.1, 5.5.2, 5.6, 5.7, 5.9	**Basic concepts:** **Semiconductor RAM memories**: Internal organization, Static memories, synchronous & asynchronous DRAM's , structure of large memories , memory system considerations, Rambus memory	**60%**
29		**Read only memories**: ROM, PROM, EPROM and EEPROM. Flash memory; speed, size and cost.	
30		Cache memories: Mapping functions, Replacement algorithms.	
31		**performance consideration:** interleaving, Hit rate and Miss Penalty	
32		Caches on the processor Chip, other enhancements	
33		**Virtual memories**: address translation.	
34		Secondary storage: magnetic hard disks, optical disks, magnetic tape systems	

35-40	**Module 4** **Chapter 6:** **Arithmetic** **Textbook 1: Ch 2: 2.1, Ch 6: 6.1 to 6.7**	**Arithmetic:** Numbers, Arithmetic Operations and Characters, **Addition and subtraction of signed numbers:** Fetching a word from memory , storing a word in memory;	**80%**
41		**Design of fast address**: carry-look ahead addition.	
42-43		**Multiplication of Positive numbers**: **signed operand multiplication**: booth algorithm	
44		**Fast multiplication:** bit-pair recording of multipliers carry-save addition of summands. integer division.	
45		**Floating point numbers and operations:** IEEE standard for floating point numbers, arithmetic operations on floating point numbers, guard Bits and truncation, implementing floating point operations.	
46	**Module 5** **Chapter 7,8,9,12** **Basic processing unit, Pipelining, Embedded Systems & Large Computer Systems** **Textbook 1: Ch 7: 7.1 to 7.5, Ch 9:9.1 to 9.3, Ch 12:12.3**	Some fundamental concepts: register transfers, performing an arithmetic and logic operations, fetching word from memory, storing a word in memory	**100%**
47		Execution of a complete instruction: branch instructions	
48		Multiple bus organization, hard-wired control: a complete processor	
49-50		**Micro programmed Control:** micro instructions, microprogramming sequencing, wide branch addressing, micro instruction with next-address field, prefetching microinstructions, emulation	
51		**Basic Concepts Of Pipelinig:** Role of Cache Memory, Pipeline Performance	
52		**Examples of Embedded Systems:** Microwave Oven, Digital Camera, Home Telemetry **Processor Chips For Embedded Applications**	
53		**Simple Microcontroller:** Parallel I/O ports, Serial I/O Interface, Counter/Timer, Interrupt Control Mechanism	
54		**Forms of Parallel Processing:** Classification of Parallel Structures, Array Processors	
55-56		**The Structure Of General Purpose Multiprocessors**	

Course outcomes:

After studying this course, students will be able to:

- Acquire knowledge of - The basic structure of computers & machine instructions and programs, Addressing Modes, Assembly Language, Stacks, Queues and Subroutines.
  - Input/output Organization such as accessing I/O Devices, Interrupts.
  - Memory system basic Concepts, Semiconductor RAM Memories, Static memories, Asynchronous DRAMS, Read Only Memories, Cache Memories and Virtual Memories.
  - Some Fundamental Concepts of Basic Processing Unit, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control and Micro programmed Control.
  - Pipelining, embedded and large computing system architecture.
- Analyse and design arithmetic and logical units.
- Apply the knowledge gained in the design of Computer.
- Design and evaluate performance of memory systems
- Understand the importance of life-long learning

Book Type	Titlle & Author	Publication Information Edition
Text Book	Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.	5th
Reference Books:	William Stallings: Computer Organization & Architecture, Pearson, 2015.	9th Edition,