**SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**

(Approved by AICTE, New Delhi & Affiliated to JNTUH.)

**Kondapur(V), Ghatkesar(M), Medchal(Dist)**

# Course Hand Out

## Subject Name: Computer Organization and Architecture

**Prepared by: Ms. G. Radha Devi, Assistant Professor, CSE**

**Year, Semester, Regulation: II Year- I Sem (R18)**

## UNIT -I

## KEY POINTS:

- **Digital electronic computer** is a computer machine which is both an electronic computer and a digital computer. Examples of digital electronic computers include the IBM PC, the Apple Macintosh as well as modern smartphones.

- **Computer Organization** refers to the level of abstraction above the digital logic level, but below the operating system level. A closely related term, computer architecture, emphasizes the engineering decisions and tradeoffs that must be made in order to produce a "good" design.

- **Computer design** is concerned with the hardware design of the computer. Once the computer specifications are formulated, it is the task of the designer to develop hardware for the system. Computer design is concerned with the determination of what hardware should be used and how the parts should be connected.

- In **computer** engineering, computer architecture is a set of rules and methods that describe the functionality, organization, and implementation of computer systems. Some definitions of architecture define it as describing the capabilities and programming model of a computer but not a particular implementation.

- In computer science, **register transfer language** (RTL) is a kind of intermediate representation (IR) that is very close to assembly language, such as that which is used in a compiler. It is used to describe data flow at the register-transfer level of an architecture.

- A **computer bus** (often simply called bus) is part of most computers. Its role is to transfer data, signals, or power between some of the components that make up a computer. The size or width of a bus is how many bits it carries in parallel.

- An **instruction code** is a group of bits that instruct the computer to perform a specific operation. The operation code of an instruction is a group of bits that define operations such as addition, subtraction, shift, complement, etc.

- Register is one of a small set of data holding places that are part of a **CPU Registers** are used by the CPU for Performing the Operations.

- A **micro-operation** is an elementary operation performed with the data stored in registers. **Arithmetic Micro- operations** perform arithmetic operation on numeric data stored in registers. The basic arithmetic micro operations are:- Addition, Subtraction, Increment, Decrement.

- **Logic micro operation** specifies binary operations on the strings of bits in registers. The others can be created from combination of these. The hardware implementation of logic micro operation requires the insertion of the most important gates like AND, OR, EXOR, and NOT for each bit or pair of bits in the registers.

- **Shift Micro-operations** - logical, circular, arithmetic. During a shift-right operation the serial input transfers a bit into the leftmost position. The information transferred through the serial input determines the type of shift. There are three types of shifts: logical, circular, and arithmetic.

- **Computer instructions** are a set of steps or documentation that includes information on how to operate, perform, or otherwise maintain particular computer software or hardware.

- The **instruction cycle** (also known as the fetch–decode–execute cycle or simply the fetch-execute cycle) is the cycle which the central processing unit (CPU) follows from boot-up until the computer has shut down in order to process instructions.

- **Computer Instructions:**
  1. **Memory Reference** – These instructions refer to memory address as an operand. The other operand is always accumulator.
  2. **Register Reference** – These instructions perform operations on registers rather than **memory** addresses.
  3. **Input/Output** – These instructions are for communication between computer and outside environment.

## SHORT QUESTIONS:

1. Define digital computer.

2. Write about memory read and memory write operations.

3. Write short notes on three state buffers.

4. Write decrement and increment micro-operations of 4-bit arithmetic circuit with the help of function table.

5. Write subtraction micro-operation of 4-bit arithmetic circuit with the help of function table.

6. Discuss in brief about micro-instruction.

7. Draw a diagram that shows the register transfer implementation along with the timing diagram.

8. Discuss in short about I/O instructions.

9. Write about decode phase of instruction cycle.

10. Write about timing signal.

## LONG QUESTIONS:

1. What is digital computer? Discuss briefly on various types of computers.

2. What is micro-operation? Write about register transfer language.

3. With the help of block diagrams, explain about Half Adder, Full Adder and Parallel Adder.

4. What is a logic micro-operation? Discuss in detail about various types of logic microoperations. Also give the hardware implementation of logic micro-operations.

5. Define instruction code and operation code. With the help of examples, explain direct and indirect addressing.

6. Draw and explain about the instruction cycle state diagram.

7. With the help of examples, explain in detail about various types of memory-reference instructions.

8. Explain briefly about input-output configuration.

9. What is program interrupt? Draw and explain the flowchart of interrupt cycle.

10. Define computer organization, computer design and computer architecture.

## FILL IN THE BLANKS:

1. Registers are **Temporary** storage devices.

2. A sequence of events and dependencies among events are described using **Timing signals.**

3. **Instruction cycle** is a process of executing a program by allowing each instruction through a cycle in a sequential manner.

4. **CLA** register reference instruction is used to clear the content of accumulator.

5. **Interrupt** is an asynchronous event that halts the normal program execution and diverts the program flow temporarily.

6. Microoperations applied to the hardware logic circuits such as gates that perform information transfer among registers is known as **Register transfer.**

7. A common bus system can be implemented using **Tri-state or three-state gates** instead of multiplexers.

8. The binary operations for bit strings present in a register are specified by the **Logic Microoperations.**

9. **Shift microoperations** are used to shift the contents of a register to the left or right.

10. **Memory-reference instruction** whose execution requires the access of memory.

## MULTIPLE CHOICE QUESTIONS:

1._____symbol represents "the contents of PC are transferred to AR".

**[B]**

(a)INCPC (b) PCTAR

(c)PCT (d) ACTDR

2. The function that allows register transfer under a predetermined condition is _____.

**[A]**

(a)Control function (b) Logic function

(c) System function (d) Transfer function

3. The symbolic form used to denote transfer of content of register R1 into register R2 is_____. **[B]**

(a)R1 ← R2 (b) R2 ← R1

(c) R2 → R1 (d) None of the above

4._____set of lines which are capable of establishing communication among devices.
**[A]**

(a)Timing signals (b) Bus

(c)Select signals (d) Binary values

5. In instruction cycle, if_____control moves to the next instruction cycle leaving the programmer to continue with his work.
**[B]**

(a) I ∑ N= 1 (b) I ∑ N= 0

(c) I ∑ N= 2 (d) I ∑ N= 3

6. The function that allows register transfer under a predetermined condition is _____.
**[A]**

(a)Control function (b) Logic function

(c)System function (d) Transfer function

7. Register transfer denoting memory write operation is _____.
**[C]**

(a) M[DR] (b)DR[M]{AR}

(c) M{[AR]}DR (d)[AR]{DR}

8. Which of the following is the type of computers?
**[D]**

(a)Personal computer (b) Super computers

(c)Work stations (d) All of the above

9. The category of microoperations use for several transfer of data is_____.
**[B]**

(a)Arithmetic microoperations (b) Shift microoperations

(c)Logic microoperations (d) Arithmetic logic microoperations

10. The computer register used to hold address of instruction is_____.
**[C]**

(a) Address register (b) Accumulator

(c)Program counter (d) Instruction register