Assignment (1)

1) What Does Integrated Circuit (IC) Mean?

- An integrated circuit is also known as a chip or microchip.
- Integrated circuits are the building blocks of most electronic devices and equipment.
- (IC) is a small semiconductor-based electronic device consisting of fabricated transistors, resistors and capacitors.

2) How many transistors in a gate?

- 2,3,4 or 5 transistors per gate.

3) What is the relationship between transistors and gates?

- Logic gates can be built using transistors, they act as switches rather than amplifiers.

4) What are the classifications of IC?

- **SSI (Small Scale Integration)**
  - ✓ Ten to hundreds of transistors per chip.
  - ✓ < 12 gates per chip.
- **MSI (Medium Scale Integration)**
  - ✓ Hundreds to thousands of transistors per chip.
  - ✓ 12 – 99 gates per chip.
- **LSI (Large Scale Integration)**
  - ✓ Thousands to several hundred thousand transistors per chip.
  - ✓ 100:9999 gates per chip.
- **VLSI (Very Large-Scale Integration)**
  - ✓ Up to 1 million transistors per chip.
  - ✓ 10000: 99999 gates per chip.
- **UVLSI (Ultra Very Large-Scale Integration)**
  - ✓ This represents a modern IC with millions and billions of transistors per chip.
  - ✓ 100000:999999 gates per chip.

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5) Discuss the Types of ICs, based on the method or techniques used in manufacturing them.

- Thin and thick film IC
- Monolithic ICs
- Hybrid or multi chip ICs

	Thin and thick film ICs	Monolithic ICs	Hybrid or Multi-Chip ICs
Manufacturing Method	The passive components like resistors and capacitors are integrated, but the transistors and diodes are connected as discrete components to form a complete circuit.	All circuit components and their interconnections are to be formed in a single thin wafer layer	More than one individual chips are interconnected. • The active components that are contained in this kind of ICs are diffused transistors or diodes. • The passive components are the diffused resistors or capacitors on a single chip.

6) What Does Very Large-Scale Integration (VLSI) Mean?

- Very Large-Scale Integration (VLSI) refers to the process of designing and fabricating integrated circuits (ICs) that enables the integration of millions, or even billions, of transistors onto a single chip, leading to highly complex and powerful electronic systems..

7) What are The Advantages of VLSI Technology?

- Reduced size for circuits.
- Increased cost-effectiveness for devices.
- Improved performance in terms of the operating speed of circuits.
- Requires less power than discrete components.
- Higher device reliability.
- Requires less space and promotes miniaturization.

8) Discuss The Design Process of a VLSI IC, write up to 3 lines for every design step.

- **Front-End Design Steps**
  - ✓ Problem Specification.
    - ✌ Identify the problem that the design is intended to solve, define requirements and constraints, and establish design goals.
  - ✓ Architecture Definition.
    - ✌ Define the overall structure and organization of the design, including major functional blocks, interfaces, and data flow.
  - ✓ Functional Design.
    - ✌ Define the functions of each block in detail, including inputs, outputs, and behavior in response to inputs.
  - ✓ Logic Design.
    - ✌ Design digital circuits that implement the functions defined in the functional design step using hardware description languages (HDL) or logic gates.
  - ✓ Circuit Design.
    - ✌ Design analog and mixed-signal circuits that implement the functions defined in the functional design step, such as amplifiers, filters, and voltage regulators.
  - ✓ Physical Design.
    - ✌ Create the layout of the circuits by placing components on the PCB and routing interconnects between them. Simulate and verify the design to ensure it meets performance and reliability requirements.
- **Back-End Design Steps**
  - ✓ Wafer Processing.
    - ✌ Create a silicon wafer with a uniform layer of material on its surface to build electronic circuits.
  - ✓ Lithography.
    - ✌ Create a pattern on the surface of the wafer by exposing it to light through a mask and etch away the exposed areas.
  - ✓ Etching.
    - ✌ Remove material from the wafer using a chemical or physical process to create the desired shapes and structures of the electronic circuits.
  - ✓ Ion Implantation.
    - ✌ Implant ions into the wafer to alter its electrical properties.
  - ✓ Metallization.
    - ✌ Deposit a layer of metal on the wafer's surface to make electrical contacts between different parts of the electronic circuit.
  - ✓ Assembly and Packaging.

- ✌ Assemble and package the ICs into their final form, test them to ensure they meet the required specifications and standards, and ship them to customers.

9) Mention some of the most common VLSI devices.

- The Microprocessor.
- The Microcontroller.

10) Mention five of the real time applications of VLSI which are used in homes.

- Mobile Phone
- Digital Camera
- Smart Watch
- Computers
- External Hard

11) Discuss how do PCBA and PCB relate to each other.

- You cannot create a PCBA without a PCB.
- PCB manufacturing is the first step in the process, and PCBA manufacturing builds upon that first step.

	PCB (Printed circuit board)	**PCBA (Printed circuit board assembly)**
What is PCB & PCBA in electrical?	It is a blank board that does not contain electronic components.	It is a functional board that contains or attaches different electronic components.
Manufacturing	The simple process is occurred for the manufacturing PCB as compared to the PCBA.	There are more processes and components required for the manufacturing PCBA.
Cost	The PCB is cheap and easily available in the market.	The PCBA is costlier than the PCB.
how PCBs and PCBAs are packaged	packaged using vacuum-packaging	require the use of compartmental or anti-static packaging.

12) What is Moore's law?

- Moore's law is the observation that the number of transistors in a dense integrated circuit (IC) doubles about every two years.

13) What is Moore's law, Explain with graph.

- Moore's law is a prediction made by Gordon Moore in 1965 that the number of transistors on a microchip double approximately every two years, while the cost per transistor is halved. This prediction has driven the exponential growth of computing power over the past several decades, enabling the development of more powerful and efficient computers.