

ASSIGNMENT 1

- List out the semi conductor products and its corresponding companies.

A semiconductor is a material that has electrical conductivity between that of a conductor and an insulator.

Following are the list of products with its specified companies:

- **Microprocessors:**
 - Intel, AMD, Qualcomm, Apple (custom-designed processors).
- **Graphics Processing Units (GPUs):**
 - NVIDIA, AMD.
- **Memory Chips:**
 - Dynamic Random-Access Memory (DRAM): Samsung, SK Hynix, Micron.
 - NAND Flash Memory: Samsung, Toshiba (now part of Kioxia), Western Digital.
- **Integrated Circuits (ICs):**
 - Texas Instruments, Analog Devices, STMicroelectronics.
- **Field-Programmable Gate Arrays (FPGAs):**
 - Xilinx (now part of AMD), Intel (Altera).
- **Analog Semiconductors:**
 - Analog Devices, Texas Instruments.
- **Power Management ICs:**
 - Texas Instruments, ON Semiconductor, Maxim Integrated.
- **Radio-Frequency Integrated Circuits (RFICs):**
 - Qualcomm, Broadcom, Skyworks Solutions.
- **Microcontrollers:**
 - Atmel (now part of Microchip Technology), STMicroelectronics, NXP Semiconductors.
- **System-on-Chip (SoC):**
 - Broadcom, MediaTek, Qualcomm, Apple.
- **Semiconductor Equipment Manufacturers:**
 - ASML, Applied Materials, Lam Research.
- **Power Semiconductors:**
 - Infineon Technologies, ON Semiconductor, STMicroelectronics.
- **Sensors (including MEMS):**

- Bosch Sensortec, STMicroelectronics, InvenSense (now part of TDK).
- **Optoelectronics** (LEDs, Laser Diodes):
 - Cree, Nichia, Osram, Finisar (acquired by II-VI Incorporated).
- **Communication Chips:**
 - Qualcomm, Broadcom, Marvell Technology.
- What are the latest laptop processors from AMD, Intel and Apple : Frequency and node.

Latest laptop processor:

- **AMD (AMD Ryzen 9 5900HX)**
Frequency : 3.3 GHz - 4.6 GHz
Node : 7nm
- **Intel (Intel Core i9-12900K)**
Frequency : 3.2GHz - 5.3GHz
Node : 10nm
- **Apple (Apple M1 Max)**
Frequency : 3.2GHz - 3.8GHz
Node : 5nm
- What are the latest mobile processors available from Qualcomm and mediatek : Frequency and node.

Latest mobile processors:

- **Qualcomm([Dimensity 9300](#))**
Frequency: 3.25GHz
Node : 6nm
- **Mediatek**
 - **Snapdragon 8 Gen 2**
Frequency : 3.2GHz
Node:4nm(TSMCs)

- **Snapdragon 8 Gen 3**

Frequency : 3.1GHz

Node:4nm(samsung)

- What are the different job roles available in vlsi field.

Following are job roles in VLSI field:

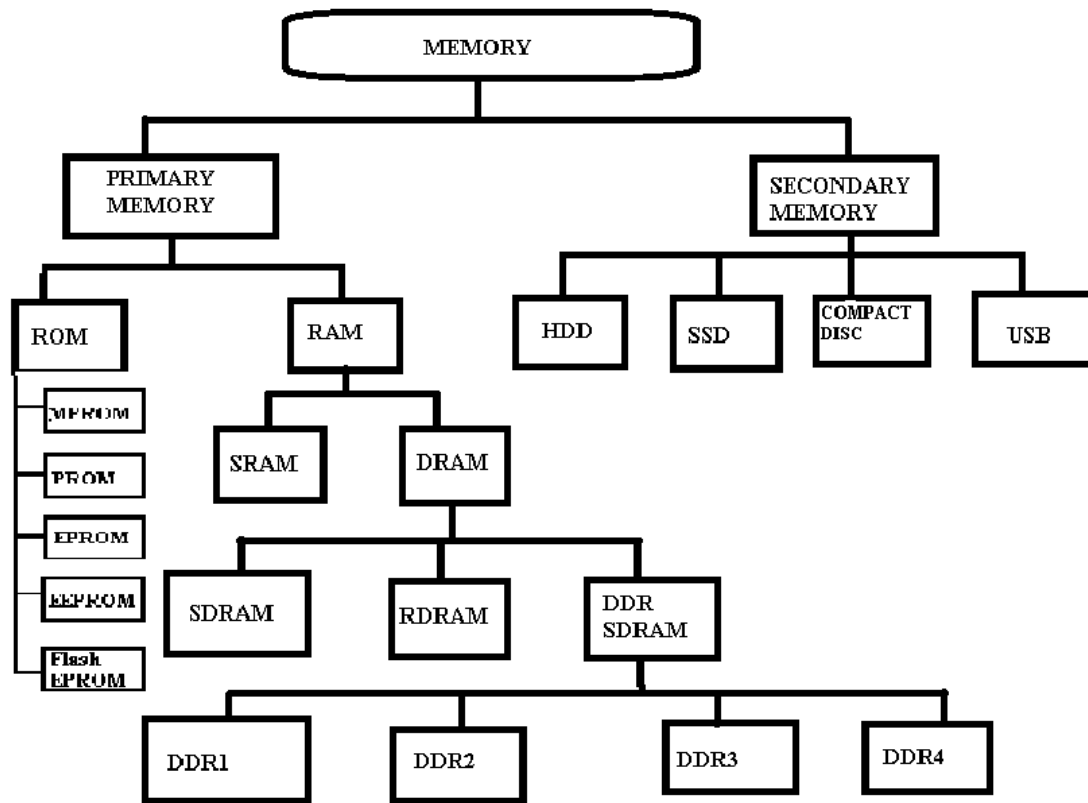
- **VLSI Design Engineer** (Responsible for designing and developing high-performance, low-power, and cost-effective integrated circuits.)
- **Physical Design Engineer** (Responsible for designing and overseeing the construction of physical products, ensuring that they are created according to engineering specifications and safety standards.)
- **ASIC Verification Engineer** (Responsible for building and implementing systems designed to test products, programs, and other tools (programming tools) to determine if they function properly as required.)
- **FPGA Design Engineer** (Responsible for designing and developing digital logic circuits, implementing new hardware architectures, and writing firmware to control and configure FPGA-based systems.)
- **Analog/Mixed-Signal Design Engineer** (Responsible for designing and optimizing analog systems to process or generate analog signals such as voltage, current, etc.)
- **DFT (Design for Testability) Engineer** (Responsible for designing and implementing testability features in semiconductor devices such as microprocessors, memory chips, and integrated circuits.)

- **STA (Static Timing Analysis) Engineer** (As name suggest it is responsible for verifying whether the various circuit timing are meeting the various timing requirements.)
- **RTL (Register Transfer Level) Engineer** (responsible for designing and modeling complex digital circuits to build quality hardware models.It verifies upto register level by breaking its architechture.)
- **CAD (Computer-Aided Design) Engineer** (Responsible for designing, developing, testing, and maintaining tools and systems used for computer-aided design processes)
- **Characterization Engineer** (A Characterization Engineer is responsible for providing technical assessment of difficult or complex system/electronic circuit/device physics problems encountered on spaceflight projects.)
- **System-on-Chip (SoC) Architect** (Responsible for designing and developing integrated circuits that contain all the required components and circuits of a particular system)
- **VLSI Project Manager** (Responsible for managing teams throughout the entire span of a project which is technical or involves engineering.)

5. Why there is a shift from BJT - MOSFET - FINFET in detail.

BJTs (Bipolar Junction Transistors) were the first type of transistor invented and used in the early days of electronics. It has high power consumption and low input impedance. Later on MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) were introduced as a replacement for BJTs.It has high input impedance and low power dissipation(consumption).It is voltage controlled device i.e., it can be turned Off and On by applying voltage to gate.They are limited in achieving higher speed and emergence of short channel effect. To overcome this FINFET is introduced,FinFETs are new-generation transistors that use a tri-gate structure.

6.Evolution of memory technology.



- There are drastic changes in memories till this era, with different specifications and functionality
- Initially, it is era of **vaccum tubes** (1940s-50s) it had less storage, more power consumption and bulky in size. By overcoming few problems such as energy efficient and non-volatile **magnetic core memory** was introduced (1950s-70s) and storage of data bits in magnetized metal core.
- Later on **Transistors** were introduced to replace vaccum tubes, it reduced the size of computer and memory.
- **Ic (integrated circuits)** were introduced which increased the speed and reduced the size(by placing multiple transistors on single chip).
- **DRAM** it stores the data in capacitors.Provides higher storage density and faster access time compared to previous memories and volatile in nature.

- **Flash memory**(1980s-90s) it is non-volatile memory, used to in storage devices like USB drives, memory cards, and solid-state drives (SSDs).
- Then **evolution of DRAM** with improvements in speed and efficiency , Synchronous DRAM (**SDRAM**), Double Data Rate (**DDR**), and more, have been introduced.DDR4 and DDR5 are the latest standards, offering higher data transfer rates and lower power consumption.
- **Several non-volatile memory** technologies (2000s-), such as MRAM (Magnetic RAM), Phase-Change Memory (PCM), and 3D XPoint, have emerged.These technologies aim to combine the speed of traditional volatile memory with the non-volatility of storage devices.
- **Cloud and Distributed Computing** (2000s-) Cloud-based storage and computing services allow users to access and store data remotely.
- **Quantum memory systems** (on going) is a principle of quantum mechanics to perform computations at an unprecedented scale and are being explored for their potential to revolutionize computing capabilities.

These are the few memory development till now, later on there may be many changes.

