Numbering Systems:

- There are different types of number systems in like decimal number system (the most common), binary number system, octal number system, and hexadecimal number system.
- The decimal number system is the most commonly used number system in everyday life. It has 10 digits from 0 to 9.
- The binary number system has only two digits 0 and 1.
- The octal number system has eight digits from 0 to 7.
- The hexadecimal number system has sixteen digits from 0 to 9 and A to F.
- To convert any number system to decimal, we do:
- Identify the base of the given number.
  Convert the number to base 10 by multiplying each digit with the base raised to the power of the digit number, starting from the rightmost digit with power 0.
  Add the products to get the decimal equivalent.
- the hexadecimal digits can be represented by 4 bits in binary system
- 1 Byte= 8bits
- 2^8 = 256 the range that can be represented in 8 bits is from (0 to 255)
- We can represent negative numbers by using the leftmost digit (bit no 7) of the number as a special value to represent the sign, if it 0 = positive, if it 1 = negative.

Electrical engineering basics:

- Voltage is the measure of electrical potential energy per unit charge in an electrical circuit. It is measured in volts (V).
- Current is the flow of electric charge through a conductor or circuit. It is measured in amperes (A).
- Resistance is the opposition to the flow of electric current through a conductor or circuit. It is measured in ohms (Ω).
- Ohm's Law states that the current through a conductor between two points is directly proportional to the voltage across the two points.
- The relationship between voltage, current, and resistance can be expressed mathematically as V = IR.

- If there is no resistance, the current in the wire is very large. No matter how thick the wire is, it melts because of the large current.
- The difference between DC and AC is that the DCis constant in intensity and direction with the change of time and the AC is variable in intensity and direction with the change of time.
- Current flow is from positive to negative.
- A series circuit is a circuit where the components are connected end-to-end in a line. In a series circuit, all components have the same current flowing through them. There is only one path for the current to flow.

- A parallel circuit is a circuit where all components are connected across each other's leads. In a parallel circuit, each component has its own path for the current to flow.
- In series circuits, voltage division rule is V2=VR2/R1+R2

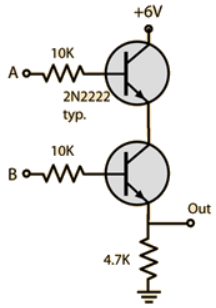
- In parallel circuits, current division rule is I2=IR1/R1+R2

Logic Design Basic Concepts:

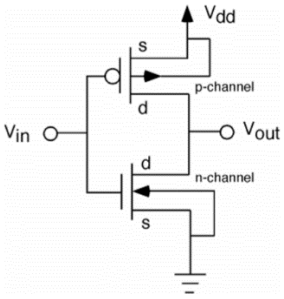
- The transistor is an electrical switch with three terminals. When it connected to a signal or voltage, it acts like a switch.
- There are two main types of transistors:

  PNP -NPN

- In NPN the emitter is connected to a ground point, In PNP the emitter is connected to the conductor feed
- The main difference between a regular transistor and a FET is that the former is a current-controlled device while the FET is a voltage-controlled device.
- Analogue circuitry is typically used for a signal that is continuous in nature, such as audio or video.
- Digital circuitry is typically used for a signal that is discrete in nature, such as computer data.
- AND Gate using transistors:



- NOT Gate using transistors:



Memory Maps:

- There are two types of memory:

Volatile and Non-volatile

- In the volatile memory the data is deleted when the system is shut down (EX: RAM)
- In the volatile memory the data is stored even if the system is shut down (EX: HDD, Flash, SD Cards, EEP ROM)
- Latches and Flip-Flops are basic type of memories
- 8Bit = 1Byte
- 1024Byte=Kilo Byte
- 1024Kilo Byte=Mega Byte
- 1024 Mega Byte= Giga Byte
- 1024 Giga Byte =Tera Byte
- Data Bus consists of a number of lines that refer to the width of the data bus
- The address bus is used to identify a particular location in memory. Each I/O device has a unique ID, which is the address of that component.
- The width of the address bus determines the amount of memory the system can address.
- The memory map means the addresses to communicate with all the microcontroller terminals
- The difference between 32-bit and 64-bit depends on the data bus and comes from the difference in the internal structure, the width of the memory addresses and the width of the busses.