School of Innovation

Department of Embedded Systems , Devices & Automation

Assignment Title	PCB DESIGN FOR IoT-ENABLED SMART POOL MONITORING
Course Name	EMBEDDED SYSTEMS
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Student Roll No	23ECB54
Year	2ND
Department	ELECTRONICS AND COMMUNICATION ENGINEERING

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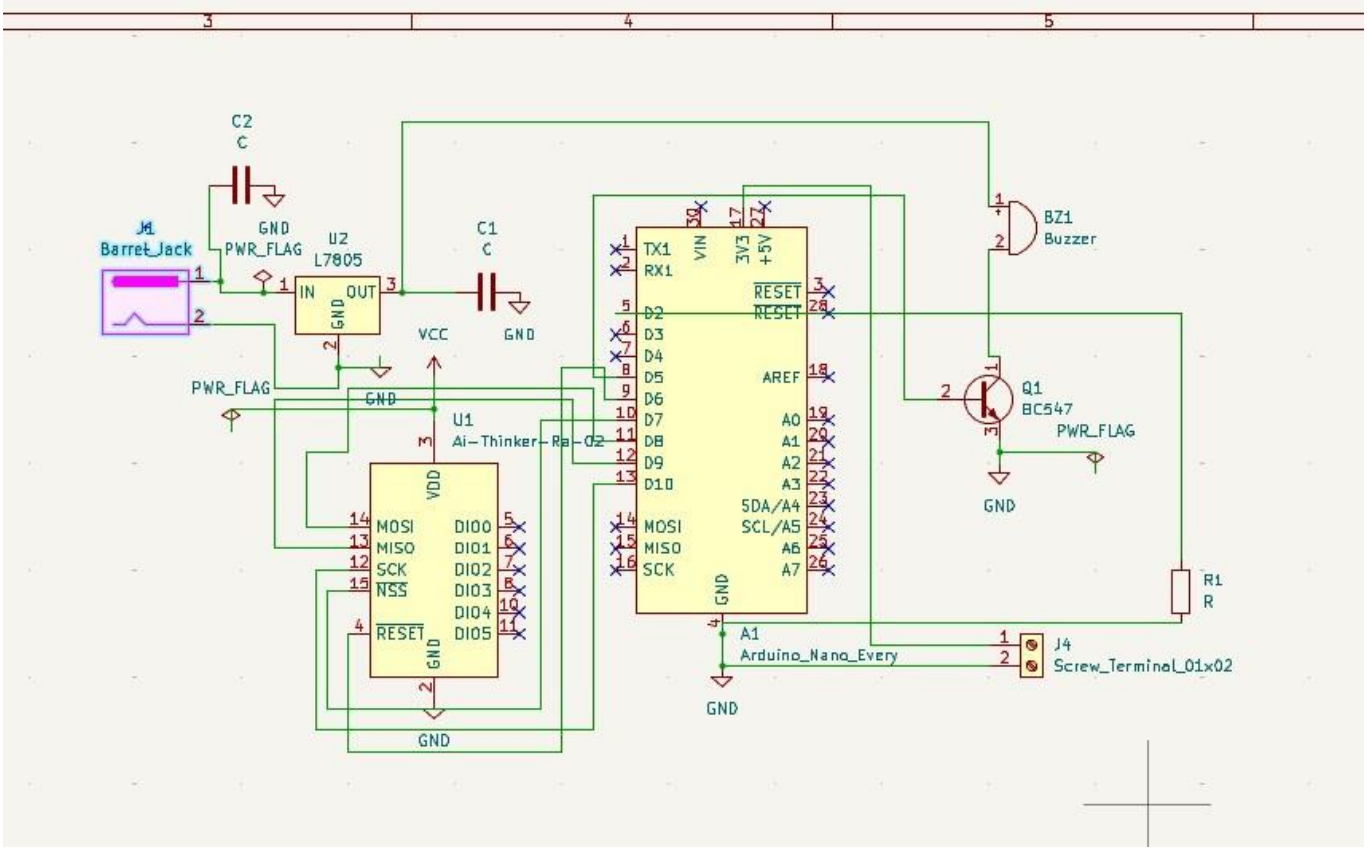
SCHEMATIC DESIGN DOCUMENTS:

1)CIRCUIT DIAGRAM:



2)COMPONENT LIST:

Item No.	Component	Footprint	Quantity
1	Barrel Jack Connector	Barrel Jack	1
2	Voltage Regulator	L7805 (TO-220)	1

3	Capacitor	Through Hole (C1, C2)	2
4	Wi-Fi Module	Ai-Thinker ESP-02	1
5	Microcontroller Board	Arduino Nano Every	1
6	Buzzer	BZ1 (2-pin)	1
7	NPN Transistor	BC547 (TO-92)	1
8	Resistor	Through Hole (R1)	1

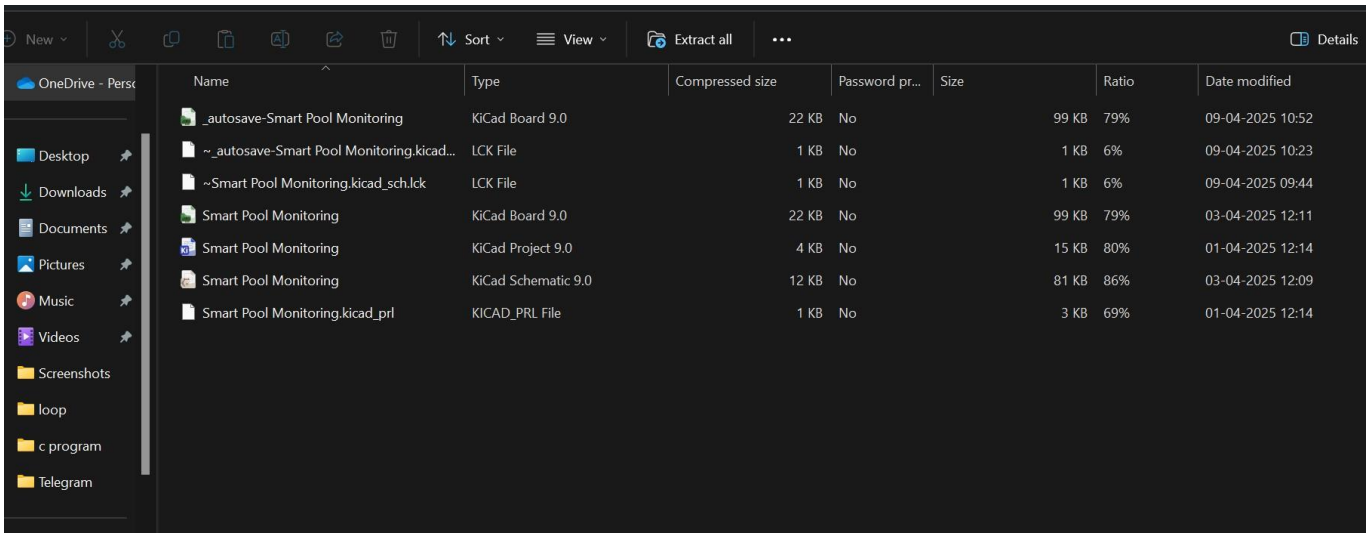
3)Netlist file:

Net Name	**Connected Components and Pins**
GND	J1-2, U2-2 (GND), C1-2, C2-2, U1-8 (GND), A1-29, Q1-3 (E), R1-2, J4-2
VCC	U2-3 (OUT), U1-7 (VDD)
Net-(J1-1)	J1-1, U2-1 (IN)
Net-(C1-1)	C1-1, A1-27 (VIN)
Net-(A1-D2)	A1-5 (D2), Q1-2 (B)
Net-(Q1-C)	Q1-1 (C), BZ1-2
Net-(BZ1-1)	BZ1-1, A1-4 (+5V)

Net-(R1-1)	R1-1, J4-1
Net-(U1-DIO0)	U1-5 (DIO0), A1-2 (D10)
Net-(U1-DIO1)	U1-6 (DIO1), A1-3 (D9)
Net-(U1-DIO2)	U1-7 (DIO2), A1-6 (D8)
Net-(U1-DIO3)	U1-10 (DIO3), A1-7 (D7)
Net-(U1-DIO4)	U1-11 (DIO4), A1-8 (D6)
Net-(U1-DIO5)	U1-12 (DIO5), A1-9 (D5)
Net-(U1-RESET)	U1-4 (RESET), A1-28 (RESET)
Net-(U1-MOSI)	U1-15 (MOSI), A1-14
Net-(U1-MISO)	U1-16 (MISO), A1-15
Net-(U1-SCK)	U1-17 (SCK), A1-16
Net-(U1-NSS)	U1-13 (NSS), A1-10 (D4)

2)PCB Layout Files:

1)PCB Layout Design Files:



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2)Drill File(NC File):

The **tabulated summary** of drill data:

Hole Diameter (mm)	Quantity	Plated (PTH)	Typical Purpose
0.300	20	Yes (PTH)	Signal vias
0.800	16	Yes (PTH)	Component leads (passives, headers)
1.000	24	Yes (PTH)	Component pins (e.g., IC sockets, headers)
1.016	4	Yes (PTH)	Mounting holes (screws/standoffs)

Key Observations:

1. **Plating**: All holes are **plated through-hole (PTH)** 2.
Size Distribution:

- **0.3mm**: High-density vias (likely for fine-pitch components or dense routing). ○ **1.0mm**: Consistent with standard through-hole component leads (e.g., resistors, connectors).
- **1.016mm**: Matches imperial sizing (40 mil) for mechanical mounting.

3. **Design Hints**:
   - The **30 holes of 1.0mm** suggest a **dual-row 15-pin connector** (common in headers or I/O interfaces). ○ **2x 1.016mm holes** are likely for **PCB mounting** (check alignment with enclosure specs).

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3)Pick and Place (Component placement data)

Ref	Val	Package	PosX	PosY	Rot	Side
A1	Arduino_Nano_Every	Arduino_Nano_Every	81.26	-67.55	0	top
U1	Ai-Thinker-Ra-02	ESP_Module	60.50	-70.00	0	top
U2	L7805	TO-220	40.00	-65.00	90	top
C1	Capacitor	Radial_Capacitor	45.00	-60.00	0	top
C2	Capacitor	Radial_Capacitor	35.00	-60.00	0	top
Q1	BC547	TO-92	95.00	-65.00	0	top
BZ1	Buzzer	Buzzer_12mm	100.00	-60.00	0	top
R1	Resistor	IAL-0.3	110.00	-55.00	0	top
J1	Barrel_Jack	BarrelJack	25.00	-70.00	0	top
J4	Connector	Screw_Terminal_01x02	115.00	-65.00	0	top
A1	Arduino_Nano_Every	Arduino_Nano_Every	81.26	-67.55	0	top
U1	Ai-Thinker-Ra-02	ESP_Module	60.50	-70.00	0	top

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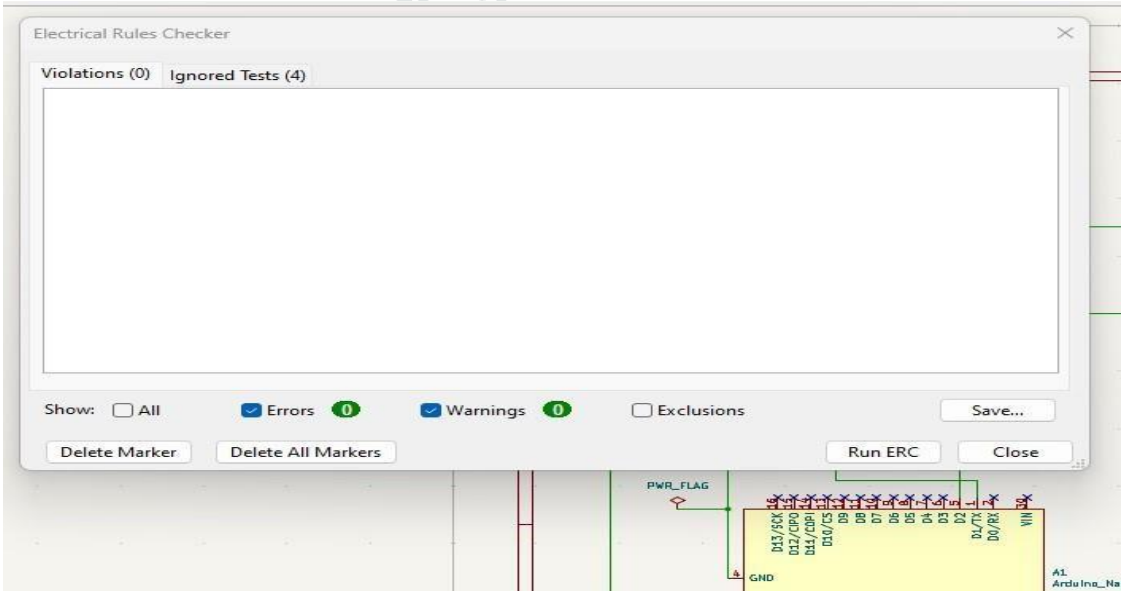
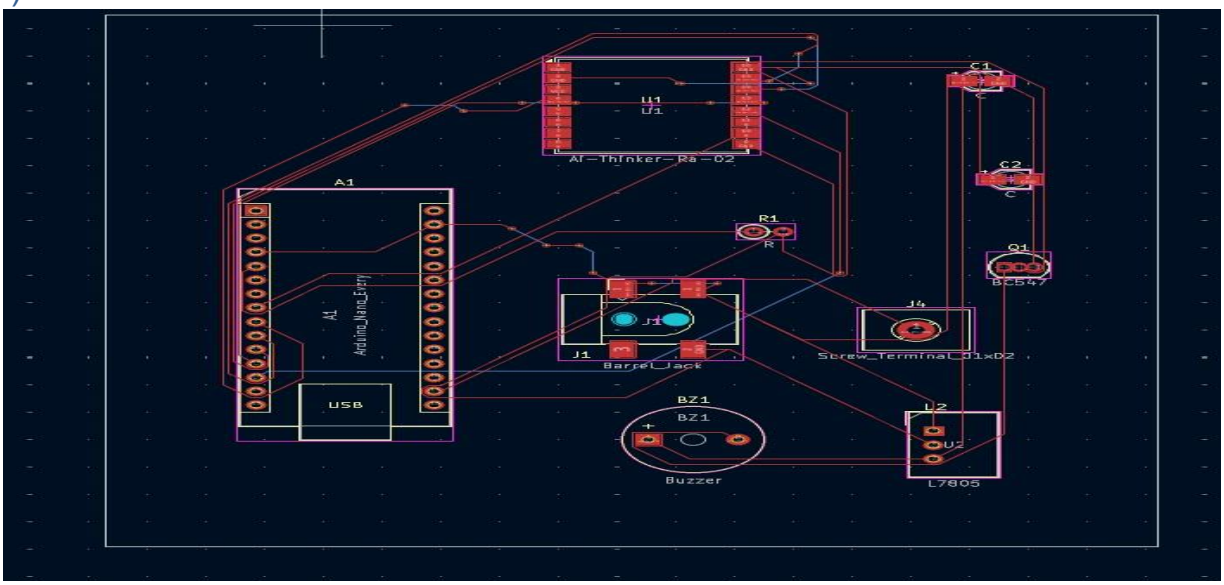
3)Testing and Validation Reports:

1)ERC:



2)DRC:



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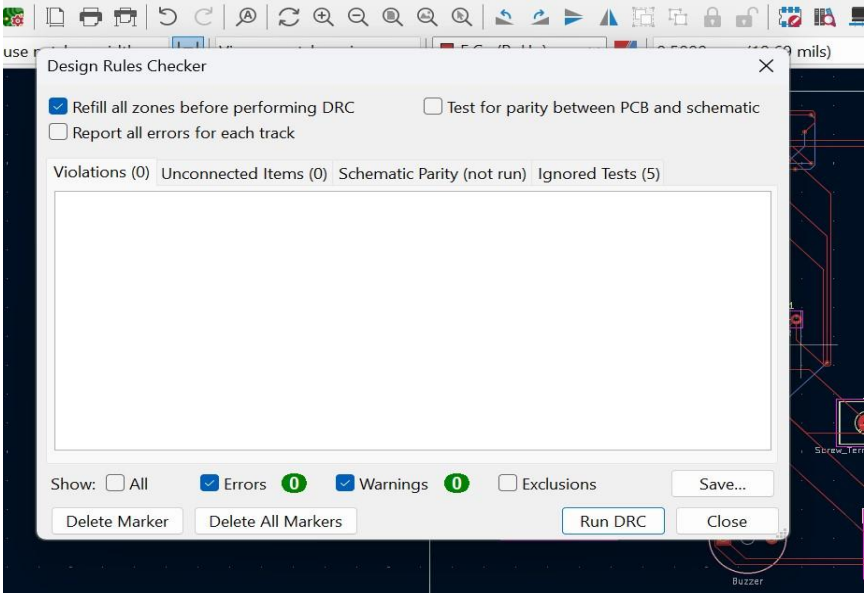
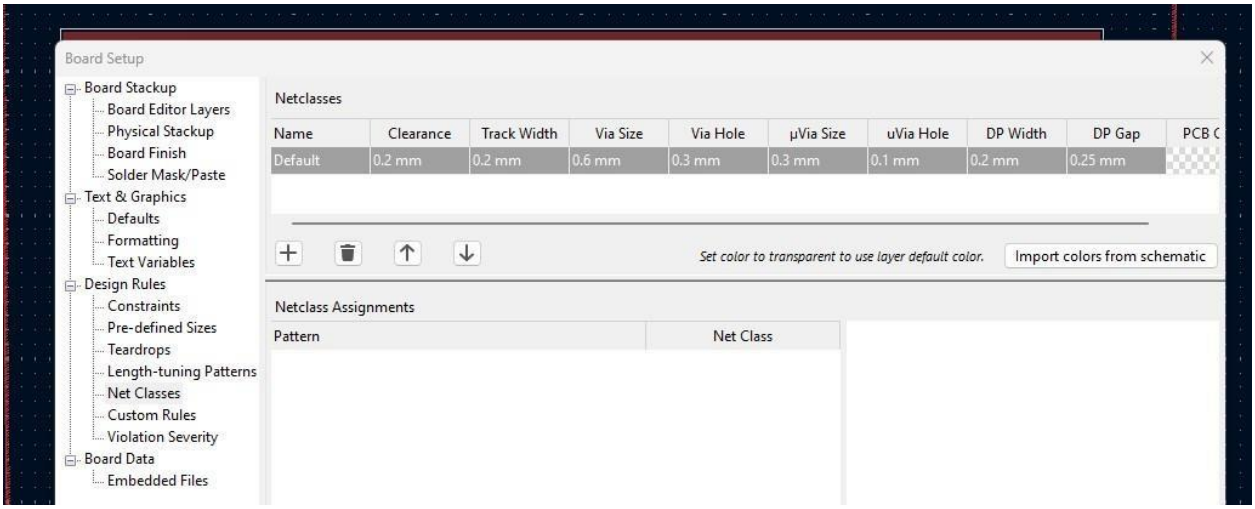


3)Track Width Calculation:



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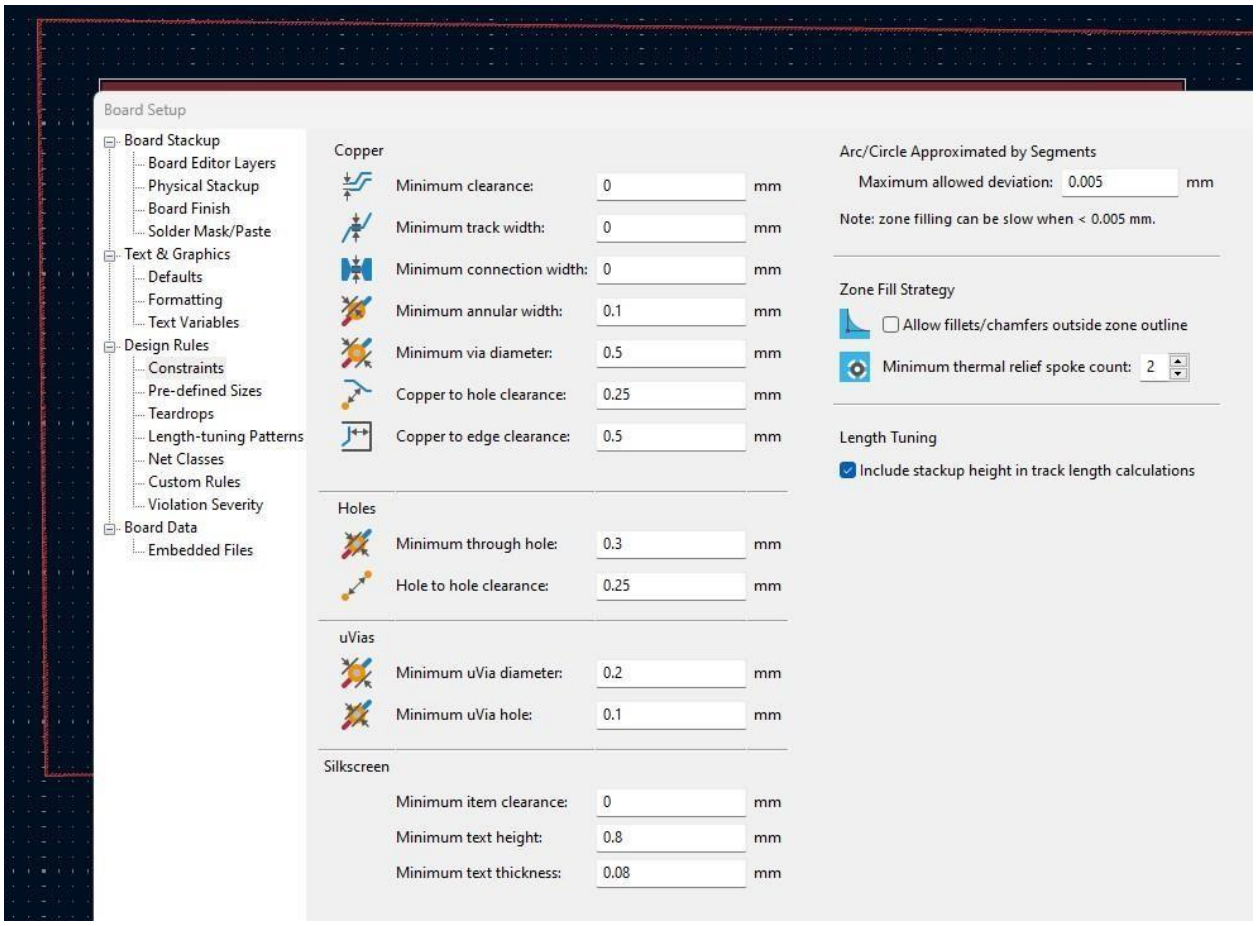
4)PCB Design constraints with PCB Way capabilities:



5)Answer the following:

1)

Role of Passive and Active Components in a PCB Circuit:

Passive components (like resistors, capacitors, and inductors) do not require power to operate and cannot amplify signals; they control voltage/current, store energy, and filter signals. Active components (like transistors and ICs) require power and can amplify, switch, and control electrical signals. Both work together to ensure proper circuit operation.

2)

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Function of Resistors, Capacitors, and Inductors in a PCB:

Resistors: Limit current and divide voltages.
Capacitors: Store and release electrical energy; used for filtering and timing.
Inductors: Store energy in magnetic fields; used in filtering, energy storage, and RF circuits.

3)
Surface Mount Devices (SMD) vs Through-Hole Components:

SMD: Mounted directly on PCB surface.
***Advantages*:** Smaller, lighter, suitable for high-density designs. ***Disadvantages*:** Harder to handle and repair manually.

Through-hole: Leads inserted into holes and soldered on the other side.
***Advantages*:** Strong mechanical bond, good for prototyping.
***Disadvantages*:** Larger, takes more space and time to assemble.

4)
Contribution of Integrated Circuits (ICs) to PCB Functionality:

ICs contain many components (transistors, resistors) in a small chip and perform complex functions like processing, amplification, and memory storage.
Examples:
Microcontroller ICs (e.g., ATmega328) for control tasks.
Op-amp ICs (e.g., LM741) for signal amplification.

5)
Importance and Types of Connectors in PCBs:

connectors allow different parts of a circuit or external devices to connect and communicate.
Types include:
Pin headers (for internal connections),
USB connectors (for data/power),
SMA connectors (for RF signals),
Edge connectors (for plugging PCBs into slots).