EE Lab VIVA

Experiment 1: Introduction to Electronics Laboratory and Familiarization with Components

Experiment 1 ka main goal hai ki aap electronics lab mein use hone wale **different instruments aur components** se familiar ho jao. Isme aapko **CRO, Function Generator, Multimeter, Dual Power Supply, Resistors, Capacitors, Diodes, Transistors**, etc. ke baare mein samajhna hai. Chalo sabhi parts aur unke uses ko simple bhasha mein samjhte hain:

1. **Cathode Ray Oscilloscope (CRO)**

- **Kya hai?** CRO ek aisa instrument hai jo electrical signals (jaise voltage, current) ko graph ki form mein display karta hai. Isse hum waveforms (jaise sine wave, square wave) ko dekh sakte hain aur unke properties (jaise frequency, voltage, time period) measure kar sakte hain.
- **Uses:**
  Waveforms ko visualize karna (dekhna). Voltage, frequency, phase difference, pulse width, etc. measure karna. Electronics circuits ki working check karna.

2. **Function Generator**

- **Kya hai?** Function Generator ek aisa device hai jo different types ke electrical signals generate karta hai, jaise **sine wave, square wave, triangle wave, aur sawtooth wave**. Ye signals testing aur repairing ke kaam aate hain.
- **Uses:**
  Different waveforms generate karna. Circuits ko test karna (jaise amplifiers, filters). Frequency aur amplitude ko adjust karna.

3. **Dual Power Supply**

- **Kya hai?** Dual Power Supply ek aisa device hai jo **positive aur negative voltage** dono provide karta hai. Iska use mostly op-amps aur transistors ke circuits mein hota hai.
- **Uses:**
  Circuits ko power supply dena. Positive aur negative voltage provide karna. Overload protection provide karna (jab current 2A se zyada ho jaye, ye automatically band ho jata hai).

4. **Digital Multimeter (DMM)**

- **Kya hai?** Multimeter ek handheld device hai jo **voltage, current, resistance, capacitance, frequency**, etc. measure karta hai. Ye digital display par readings show karta hai.
- **Uses:**
  Voltage (AC/DC) measure karna. Current (AC/DC) measure karna. Resistance aur continuity check karna. Diode aur capacitor test karna.

5. **Resistors**

- **Kya hai?** Resistor ek basic component hai jo current flow ko resist karta hai. Iska resistance value **ohms (Ω)** mein measure hota hai.
- **Uses:**
  Current flow ko control karna. Voltage drop create karna. Circuits mein current limit karna.

6. **Capacitors**

- **Kya hai?** Capacitor ek component hai jo energy ko store karta hai electric field ki form mein. Iska use mostly filtering aur timing circuits mein hota hai.
- **Uses:**
  Energy store karna. AC signals ko pass karna aur DC signals ko block karna. Noise filtering aur signal smoothing mein use hota hai.

7. **Diodes**

- **Kya hai?** Diode ek semiconductor device hai jo current ko sirf ek direction mein flow hone deta hai. Iska use mostly rectification (AC to DC conversion) mein hota hai.
- **Uses:**
  AC to DC convert karna (rectification). Current flow ko control karna. Circuits mein protection provide karna.

8. **Transistors**

- **Kya hai?** Transistor ek semiconductor device hai jo 3 terminals (Base, Collector, Emitter) se bana hota hai. Iska use signal amplification aur switching mein hota hai.
- **Uses:**
  Signal amplify karna. Switching circuits mein use hota hai. Amplifiers aur oscillators mein use hota hai.

9. **Breadboard**

- **Kya hai?** Breadboard ek plastic board hai jisme holes hote hain jinke through hum components ko connect kar sakte hain. Iska use circuits ko test karne ke liye hota hai.

- **Uses:**
  Circuits ko assemble karna bina soldering ke. Components ko easily connect aur disconnect karna. Prototyping ke liye use hota hai.

Summary of Uses:

1. **CRO:** Waveforms dekhne aur measure karne ke liye.
2. **Function Generator:** Different waveforms generate karne ke liye.
3. **Dual Power Supply:** Circuits ko power supply dene ke liye.
4. **Multimeter:** Voltage, current, resistance measure karne ke liye.
5. **Resistors:** Current flow control karne ke liye.
6. **Capacitors:** Energy store karne aur filtering ke liye.
7. **Diodes:** Current flow ko ek direction mein control karne ke liye.
8. **Transistors:** Signal amplify aur switching ke liye.
9. **Breadboard:** Circuits test karne ke liye.

Experiment 2: V-I Characteristics of a Silicon Diode

Aim: Diode ka **Voltage-Current (V-I) relationship** plot karna, both forward aur reverse bias mein.

Working and Connections:

1. **Forward Bias:**
   Connection:
   Diode ke **anode (p-side)** ko positive terminal se connect karo. Diode ke **cathode (n-side)** ko negative terminal se connect karo. Series mein ek **1kΩ resistor** lagao taaki current limit ho. **Voltmeter** diode ke across connect karo (voltage measure karne ke liye). **Ammeter** series mein connect karo (current measure karne ke liye).
   Working:
   Voltage gradually increase karo (0V se 30V tak). Har voltage ke liye corresponding current note karo. **Knee Voltage (0.7V for Si diode)** ke baad current exponential increase hota hai.
2. **Reverse Bias:**
   Connection:
   Diode ke **anode (p-side)** ko negative terminal se connect karo. Diode ke **cathode (n-side)** ko positive terminal se connect karo. Voltmeter aur ammeter same tarah se connect karo.
   Working:
   Voltage increase karo, lekin current almost zero rahega (leakage current). **Breakdown Voltage** ke baad current suddenly increase hoga.

Viva Questions:

1. **Diode forward bias mein kaise behave karta hai?**
   Forward bias mein diode current flow allow karta hai, aur knee voltage (0.7V) ke baad current exponential increase hota hai.
2. **Reverse bias mein diode kaise behave karta hai?**
   Reverse bias mein diode current flow block karta hai, lekin breakdown voltage ke baad current suddenly increase ho jata hai.

Experiment 3: Inverting and Non-Inverting Amplifier using OPAMP 741

Aim: OPAMP 741 ka use karke **inverting** aur **non-inverting amplifier** circuits banana aur unka gain calculate karna.

Working and Connections:

1. **Inverting Amplifier:**
   Connection:
   Input signal ko inverting terminal (-) se connect karo through **R1**. **Feedback resistor (Rf)** ko output se inverting terminal (-) se connect karo. Non-inverting terminal (+) ko ground se connect karo. Output ko CRO se connect karo (waveform dekhne ke liye).
   Working:
   Output voltage (V_o = -\frac{R_f}{R_1} \times V_i). Negative sign indicates **phase inversion** (input aur output 180° out of phase hote hain).
2. **Non-Inverting Amplifier:**
   Connection:
   Input signal ko non-inverting terminal (+) se connect karo. **Feedback resistor (Rf)** ko output se inverting terminal (-) se connect karo. Inverting terminal (-) ko ground se connect karo through **R1**. Output ko CRO se connect karo.
   Working:
   Output voltage (V_o = \left(1 + \frac{R_f}{R_1}\right) \times V_i). Output aur input **in-phase** hote hain.

Viva Questions:

1. **Inverting amplifier ka gain kaise calculate karte hain?**
   Gain (A_v = -\frac{R_f}{R_1}).
2. **Non-inverting amplifier ka gain kaise calculate karte hain?**
   Gain (A_v = 1 + \frac{R_f}{R_1}).
3. **Negative feedback ka kya role hai?**
   Negative feedback gain ko stabilize karta hai aur distortion ko reduce karta hai.

Experiment 4: Verification of Truth Tables of Logic Gates

Aim: Basic logic gates (AND, OR, NOT, NAND, NOR, XOR) ke **truth tables** verify karna.

Working and Connections:

1. **AND Gate (IC 7408):**
   Connection: Inputs (A, B) ko switches se connect karo. Output (Y) ko LED se connect karo through a resistor. **Truth Table:**

   | A | B | Y |

   |---|---|---|

   | 0 | 0 | 0 |

   | 0 | 1 | 0 |

   | 1 | 0 | 0 |

   | 1 | 1 | 1 |
2. **OR Gate (IC 7432):**
   Connection: Inputs (A, B) ko switches se connect karo. Output (Y) ko LED se connect karo. **Truth Table:**

   | A | B | Y |

   |---|---|---|

   | 0 | 0 | 0 |

   | 0 | 1 | 1 |

   | 1 | 0 | 1 |

   | 1 | 1 | 1 |

3. **NOT Gate (IC 7404):**
   Connection: Input (A) ko switch se connect karo. Output (Y) ko LED se connect karo.
   Truth Table:

   | A | Y |

   |---|---|

   | 0 | 1 |

   | 1 | 0 |

Viva Questions:

1. **AND gate ka output kab 1 hota hai?**
   Jab dono inputs (A aur B) 1 hote hain.
2. **OR gate ka output kab 0 hota hai?**
   Jab dono inputs (A aur B) 0 hote hain.
3. **NOT gate ka output input ka ulta kyun hota hai?**
   Kyunki NOT gate input ko invert karta hai (0 ko 1 aur 1 ko 0).

Experiment 5: Design and Implementation using NAND Gates

Aim: NAND gates ka use karke **NOT, AND, aur OR gates** implement karna.

Working and Connections:

1. **NOT Gate using NAND:**
   Connection: NAND gate ke dono inputs ko ek saath connect karo (ya ek input ko 1 se connect karo). **Working:** Output input ka complement hoga (A').
2. **AND Gate using NAND:**
   Connection: Pehle NAND gate ka output ek aur NAND gate ke input se connect karo (jo NOT gate ki tarah kaam karega). **Working:** Output (A \cdot B) hoga.
3. **OR Gate using NAND:**
   Connection: Pehle dono inputs ko alag-alag NAND gates se invert karo. Phir in dono outputs ko ek NAND gate se connect karo. **Working:** Output (A + B) hoga.

Viva Questions:

1. **NAND gate ko universal gate kyun kehte hain?**
   Kyunki NAND gate se hum koi bhi logic gate (AND, OR, NOT) implement kar sakte hain.
2. **NAND gate se NOT gate kaise banate hain?**
   NAND gate ke dono inputs ko ek saath connect karke.

3. **NAND gate se AND gate kaise banate hain?**
   NAND gate ke output ko ek aur NAND gate se connect karke (jo NOT gate ki tarah kaam karega).