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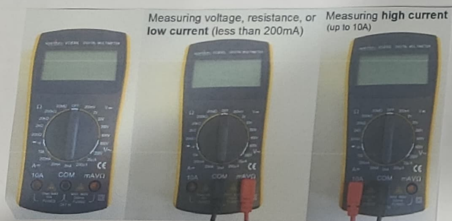
Dual Power Supply



Date 4/2/2025

Expt. No. 1

Experiment - 1

Aim - To introduce the electronics laboratory and familiarize students with basic equipments and components used in experiment.

Theory -

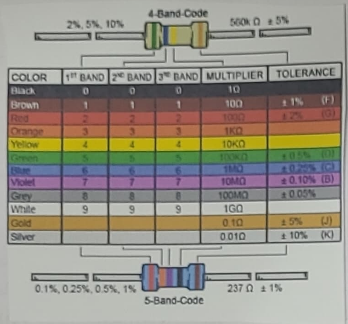
1. Cathode Ray Oscilloscope (CRO): Displays electrical signals as waveforms on a screen using a cathode - ray - tube (CRT). Measures peak voltage, frequencies and phase differences.

2. Function Generator: Generates waveforms like sine, square & triangle over a wide frequency range for testing circuits.

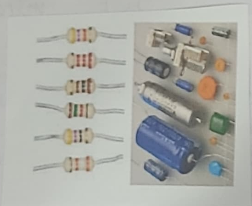
3. Dual DC power supply: Provides adjustable DC voltage & current (max 2A) with constant current / voltage modes & overload protection.

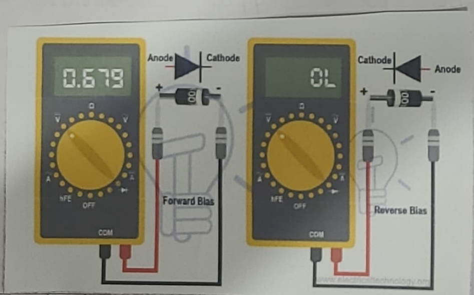
4. Digital Multimeter (DMM): Measures AC/DC voltage, currents, resistance and tests diodes / continuity. Displays readings on LCD.

Teacher's Signature



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)





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5. Resistors :- Resist current flow, measured in ohm (Ω). Values are identified by colour codes.

6. Capacitors :- Stores energy in a electric field b/w 2 plates seperated by a dielectric

7. Diodes :- Allow current in forward bias and block in reverse bias.

8. Transistors :- Three terminal devices that amplify or switch currents using a small base current.

Teacher's Signature

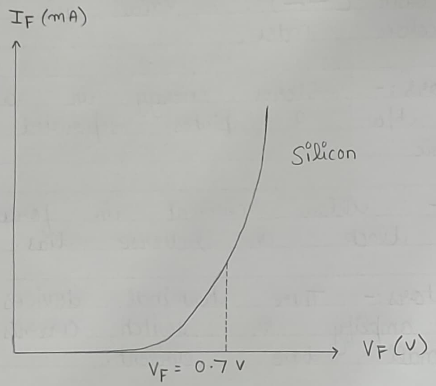

Fig-1) Forward Bias of Si Diode

Date 11/2/25

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Experiment - 2

Aim - To see Voltage Current relations in Diodes by applying a voltage across it & measure the corresponding current flowing through it.

Apparatus Required -

a) Diode
b) A DC Voltage supply
c) Bread Board
d) 1 KΩ resistor
e) 2 multimeters for measuring current & voltage
f) Connecting Wires.

Theory - A Diode is a device formed from n-type & p-type semiconductor material. The lead connected to the p-type material is called anode & lead connected to n-type material is cathode. In General cathode of diode is marked by solid line on diode. Primary function of diode is rectification. When it is forward bias it pass current & blocks in reverse bias. A General curve looks like this. (Fig - 1)

Teacher's Signature

In the forward bias region the V-I relationship is described as follows:

$$I = I_S\left(e^{V/nV_T} - 1\right)$$

$I \Rightarrow$ Forward Current
$V \Rightarrow$ Forward Voltage
$V_T = KT/q \Rightarrow$ Thermal Voltage.

Initially V v/s I Graph is linear but then after reaching breakdowns, it becomes exponential

Procedure – First complete a circuit as shown in figure below with a $1\ K\Omega$ resistor & a variable DC input voltage source.

We first note the point where ammeter starts deflecting, we note this point & Gradually increase the input voltage & take the corresponding current readings. Now change direcn of voltage & get readings in reverse bias.

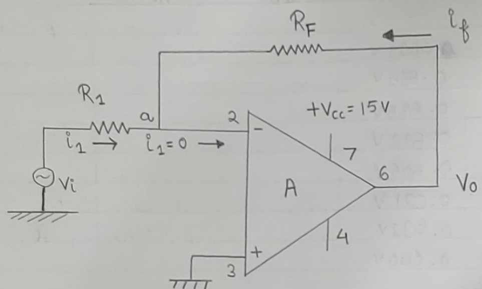
Result

Supply Voltage	V_D	I_D	V_R
0.7 V	0.509 V		
1.0 V	0.555 V		
1.5 V	0.585 V		
1.6 V	0.592 V		
2.0 V	0.605 V		
2.5 V	0.621 V		
3.0 V	0.632 V		
3.5 V	0.640 V		

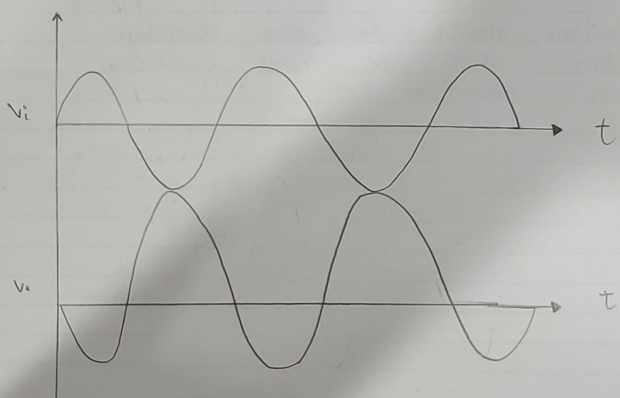
Precautions:

- Connections should be done carefully
- Readings shall be noted carefully.
- Proper connection.

Inverting Amplifier



Input & Output Waveforms



Date 13/2/25

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Experiment - 3

Aim - To design an inverting & non inverting amplifier circuit using OPAMP 741.

Equipment - CRO, Function generator, power supply, Multimeter, Bread Board & CRO probes.

Theory

1) Inverting Amplifier: The inverter is the basic building block of any circuit. The circuit is shown in figure. V_o is output voltage & is feedback to the inverting input terminal through R_F & R_1 network.

Input signal V_i (ac) is applied to inverting input terminal via R_1 & non inverting input terminal is Grounded.

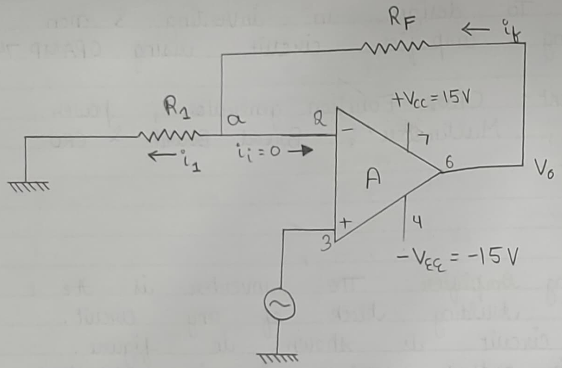
Assume an Ideal Op Amp. As $V_d = 0$, node a is at virtual Ground potential. Nodal eq^n at point a yields.

$$i_i + i_f = 0, \quad \frac{V_i}{R_1} + \frac{V_o}{R_F} = 0$$

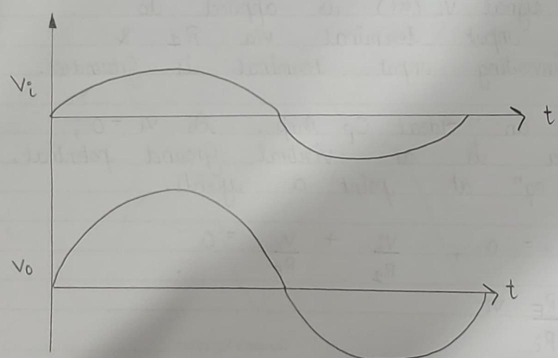
$$V_o = -\frac{R_F}{R_i} V_i$$

Teacher's Signature

Non-inverting Amplifier



Input & Output Waveforms



2) Non-inverting Amplifier :- When ac is applied and circuit provides input signal without inverting it, such a circuit is called non-inverting amplifier.

As Vd at input terminal of Op Amp is zero, voltage at node 'a' is v_i, same as input voltage applied to non-inverting input terminal. R_F & R_1 forms a potential divider.

$$i_1 = i_f, \quad \frac{v_i}{R_1} = \frac{V_o - v_i}{R_F}, \quad \frac{v_i}{R_1} + \frac{v_i}{R_F} = \frac{V_o}{R_F}$$

$$V_o = \left\{ 1 + \frac{R_F}{R_1} \right\} V_i$$

Observations

(i) Inverting Amplifiers

S.no	Resistors		Input		Output Voltage	Gain
	R_L	R_F	Voltage	Freq		
1.	1KΩ	10KΩ	10 mV	1KHz	-100 mV	-10
2.	1KΩ	10KΩ	20 mV	1KHz	-200 mV	-10
3.	1KΩ	10KΩ	30 mV	1KHz	-300 mV	-10
4.	1KΩ	10KΩ	40 mV	1KHz	-400 mV	-10
5.	1KΩ	10KΩ	50 mV	1KHz	-500 mV	-10
6.	1KΩ	10KΩ	60 mV	1KHz	-600 mV	-10
7.	1KΩ	10KΩ	70 mV	1KHz	-700 mV	-10

Teacher's Signature

(ii) Non - Inverting Amplifier

S.no	Resistors		Input		Output	Gain
	R_L	R_F	Voltage	Frequency	Voltage	
1	1KΩ	10KΩ	10 mV		110 mV	+11
2	1KΩ	10KΩ	20 mV		220 mV	+11
3	1KΩ	10KΩ	30 mV		330 mV	+11
4	1KΩ	10KΩ	40 mV		440 mV	+11
5	1KΩ	10KΩ	50 mV		550 mV	+11
6	1KΩ	10KΩ	60 mV		660 mV	+11
7	1KΩ	10KΩ	70 mV		770 mV	+11

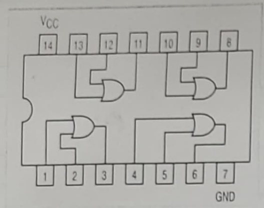
Calculations & Result:

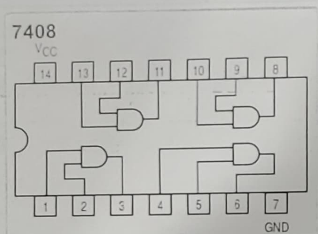
$R_1 = 1K\Omega$ & $R_F = 10K\Omega$ {Inverting Amplifier}
Gain = −10

$R_1 = 1K\Omega$ & $R_F = 10K\Omega$ {Non Inverting Amplifier}
Gain = 11

Precautions -
- All Connections should be done carefully
- Avoid excessive input signals
- Ensure proper polarity

Conclusion- The experiment successfully demonstrates the functionality of both inverting & non inverting amplifier using an OPAMP 741.





Date 22/2/25

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Experiment - 4

Aim - To verify the truth tables of logic gates (OR, AND, NOT, NAND, NOR, XOR), using their respective ICs.

Apparatus - Logic Gates ICs (eg:- 7400 for NAND). Breadboard, Connecting Wires, Power supply, Push Buttons.

Procedure & Table :-

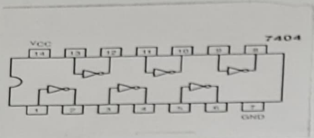
OR GATE - Truth Table

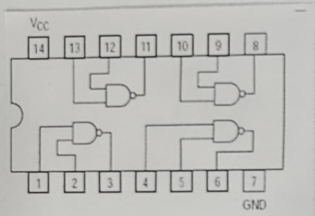
Input		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

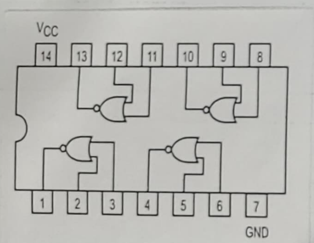
AND GATE - Truth Table

Input		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Teacher's Signature







NAND GATE - Truth Table

Input		OUTPUT
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

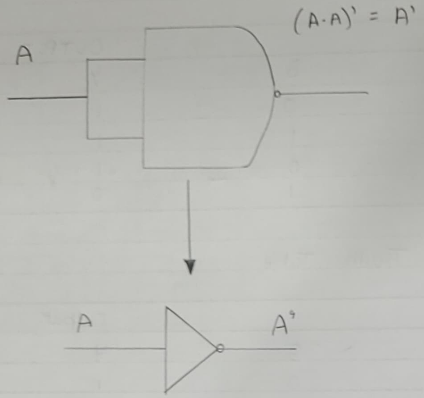
NOR Gate - Truth Table

Input		Output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

XOR Gate - Truth Table

Input		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Teacher's Signature



Implementing NOT gate using NAND gate

Date 26/2/25

Expt. No. 5

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Experiment - 5

Aim:- Design & implementation using NAND Gate

Apparatus:- Connecting Wires, Gates, Breadboard & Power Supply

Theory:- AND, OR, NOT is called basic Gates as their logical operation cannot be simplified further. NAND & NOR Gates are called universal Gates as using only NAND or only NOR, any logic function can be implemented. Using NAND or NOR Gates & De Morgan's Theorems, different basic Gates & Ex-OR Gates are realized.

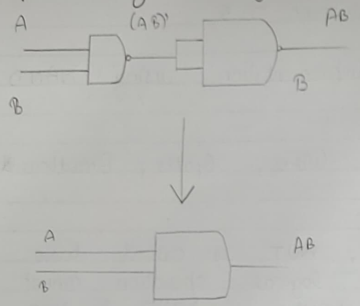
i) Implementing NOT gate using NAND gate

The figure shows 2 ways in which a NAND gate can be used as an inverter (NOT gate).

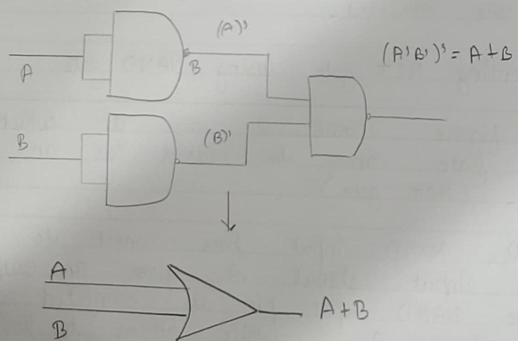
1) All NAND input pins connect to the input signal A gives an output.
2) One NAND input pin is connected to input signal A, while others to logic 1. Output will be A'.

Teacher's Signature

Implementing AND gate using NAND gate.



Implementing OR gate using NAND gate



ii) Implementing AND gate using NAND gate

An AND gate can be replaced by a NAND gates as shown in figure.

iii) Implementing OR gate using NAND gate

An OR gate can be replaced by NAND Gates as shown in figure.

Result :- Using the procedures mentioned before, we can use NAND gate.