KHWAJA YUNUS ALI UNIVERSITY

Lab Report

Name of the Department : Computer Science and Engineering
Course Code : CSE 0714 - 1206
Course Title : Electronics Lab
Date of Submission : 20/11/24

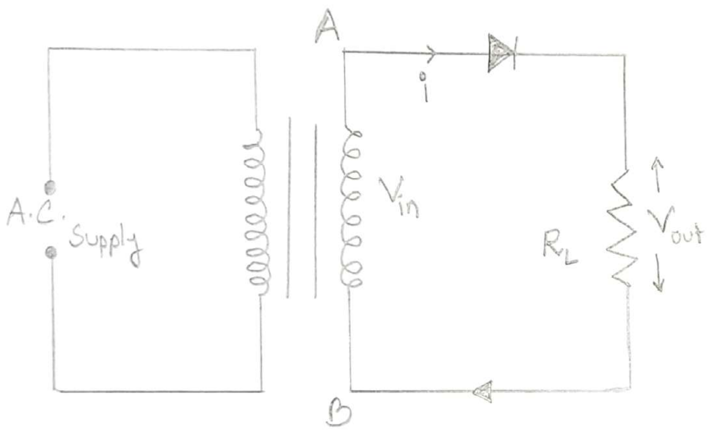
Instructor's Signature

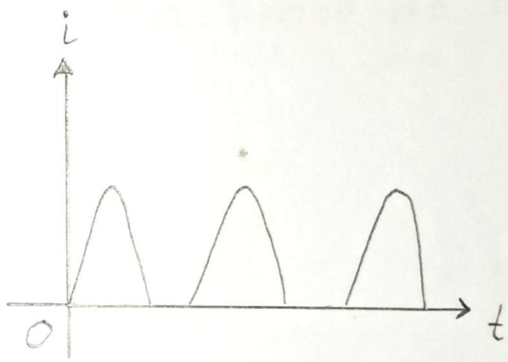
Submitted by –	Submitted to –
Name: Umme Salma **ID : 0622320205101027** CSE-16th Batch **Semester:** 2nd Year 1st Semester Khwaja Yunus Ali University	**Ishrat Zahan Raka** Lecturer Department of Computer Science and Engineering Khwaja Yunus Ali University

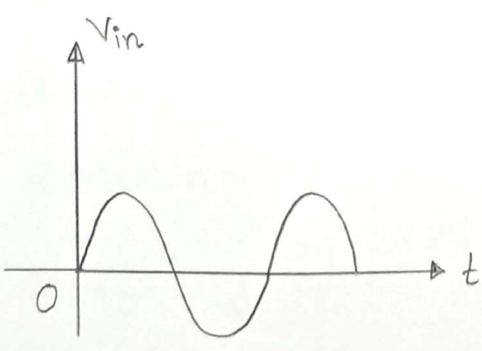
Experiment no : 01

Name of the Experiment : Design and Analysis of a Half-Wave Rectifier Circuit for AC to DC Conversion.

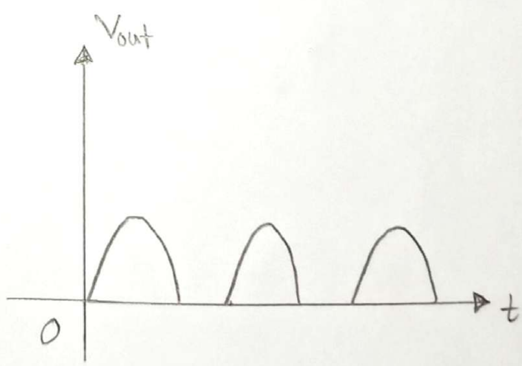
Theory : In half-wave rectification, the rectifier conducts current only during the positive half-cycles of input a.c. supply.







(i)



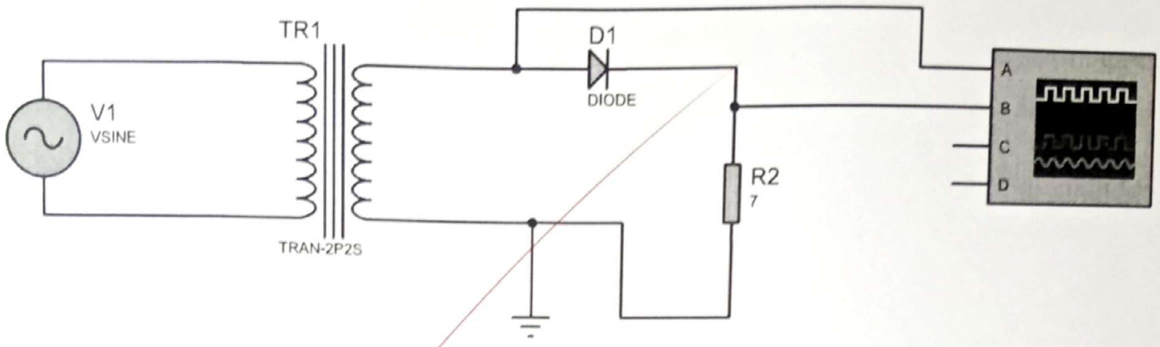
(ii)

The a.c. voltage across the secondary winding AB changes polarities after every half-cycle. During the positive half-cycle of input a.c. voltage, end A becomes positive w.r.t. end B. This makes the diode forward biased and hence it conducts current. During the negative half-cycle, end A is negative w.r.t end B. Under this condition, the diode is reverse biased and it conducts no current. Therefore, current flows through the diode during positive half-cycles of input a.c. voltage only; it is blocked during the negative half-cycles. In this way, current flows through load R_L always in the same direction. Hence d.c. output is obtained across R_L.

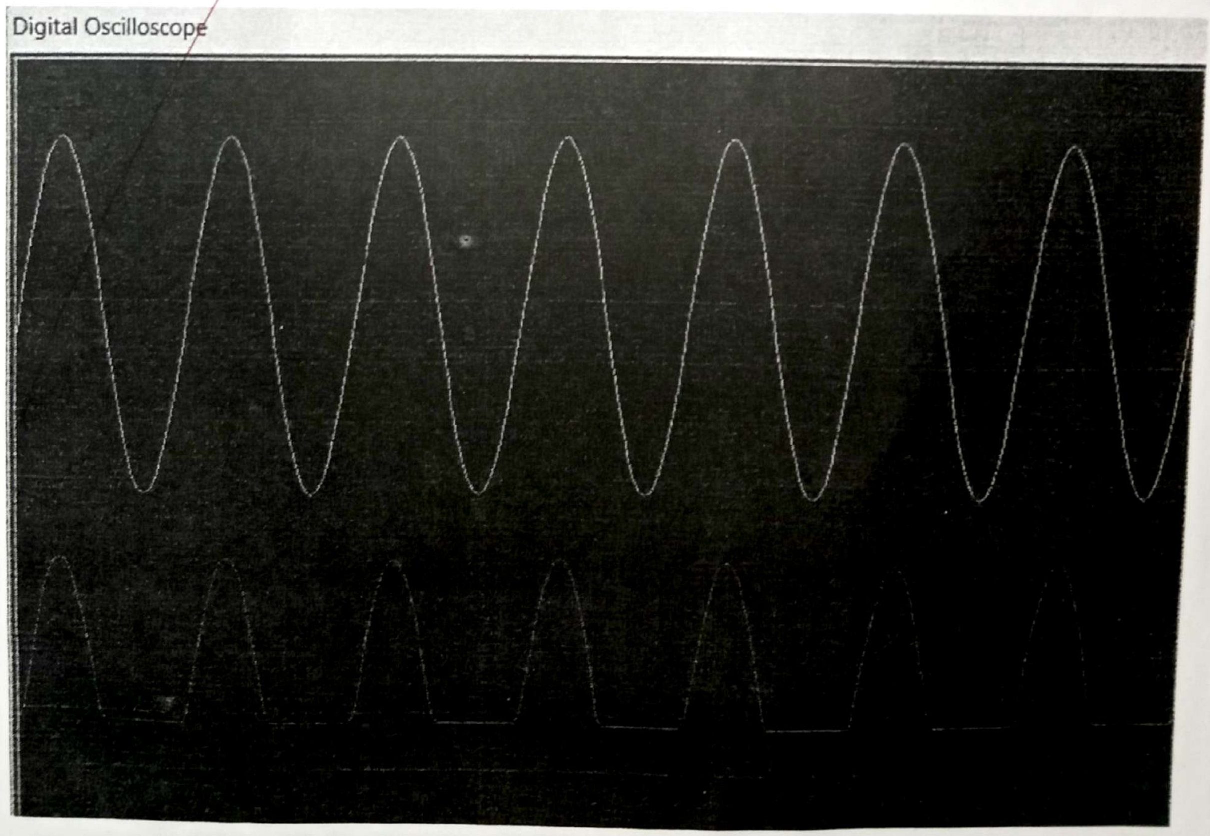
Required Component:

1. AC power supply
2. Oscilloscope
3. Diode
4. Resistors
5. Connecting wire
6. Transformer
7. Proteus software

Circuit diagram :



Result :



Precaution :

1. Ensure the diode is connected with the correct polarity.

2. Avoid using excessively high AC input voltage as it can damage the diode.

3. Use a proper load resistor value to avoid overloading the circuit.

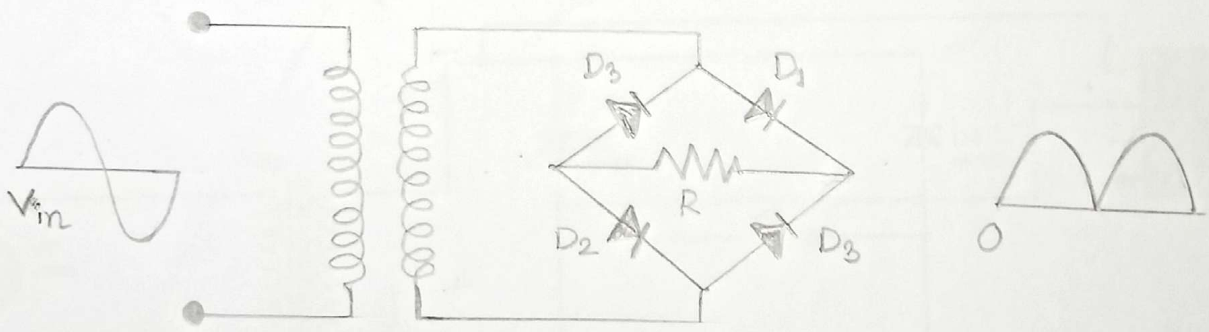
4. Check the oscilloscope probes are correctly placed at the output for waveform observation.

5. Ensure proper grounding in Proteus to avoid simulation errors.

Experiment no : 02

Name of the experiment : Design and Analysis of a Full-Wave Rectifier Circuit for AC to DC Conversion.

Theory : The circuit of a full wave bridge rectifier uses four diodes D_1, D_2, D_3 and D_4 connected as shown in Fig. 1. During the positive half cycle of secondary voltage, the diodes D_1 and D_2 are forward-biased and D_3 and D_4 are reverse-biased. Therefore, the diodes D_1 and D_2 conduct and current flow through load resistor R_L.

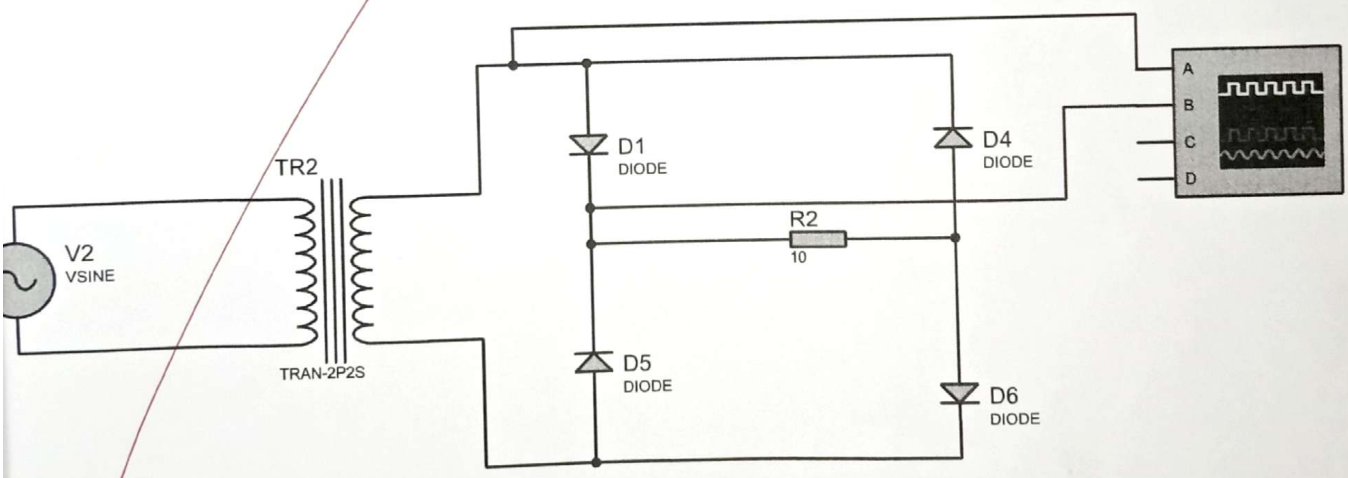


During positive half-cycles, D_1 and D_2 are forward-biased and D_3 and D_4 are reversed-biased. During the negative half cycle, the diodes D_3 and D_4 are forward-biased and D_1 and D_2 are reversed-biased. Therefore the diodes D_3 and D_4 conduct and current flows through the load resistor R_L in the same direction.

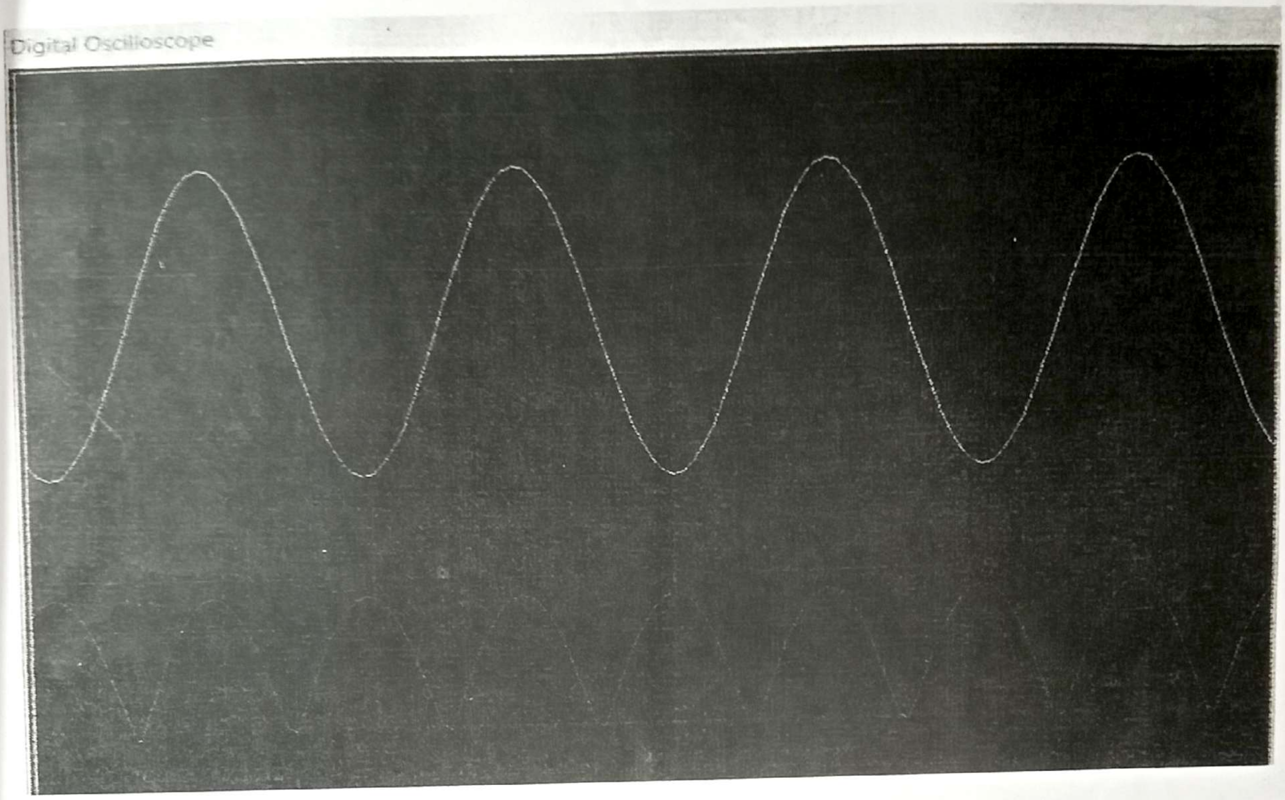
Required Components :

1. AC power supply
2. Oscilloscope
3. Diode
4. Resistors
5. Connecting Wire
6. Transformer
7. Proteus software

Circuit diagram :



Result :



Precautions :

1. Confirm that all four diode in the bridge are correctly oriented and properly connected.

2. Ensure the AC input voltage is within the safe operating range of the diodes and transformer.

3. Use a transformer that provides the correct voltage and current ratings.

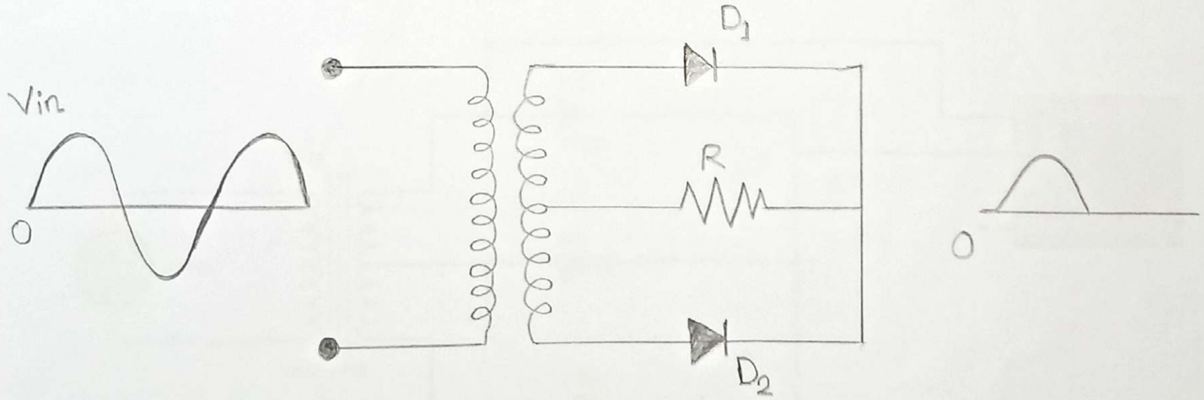
4. Avoid using a load resistor with very low resistance, which could cause excessive current through the diodes.

5. Verify the circuit ground connection to prevent floating nodes.

Experiment no : 03

Name of the experiment : Design and Analysis of a Center-Tapped Full-Wave Rectifier Circuit.

Theory : The circuit of a center-tapped full wave rectifier uses two diodes D_1 and D_2. During the positive half cycle of secondary voltage, the diode D_1 is forward-biased and D_2 is reverse-biased. Therefore, the diode D_1 conducts and current flows through load resistor R_L as shown in Fig. 1.

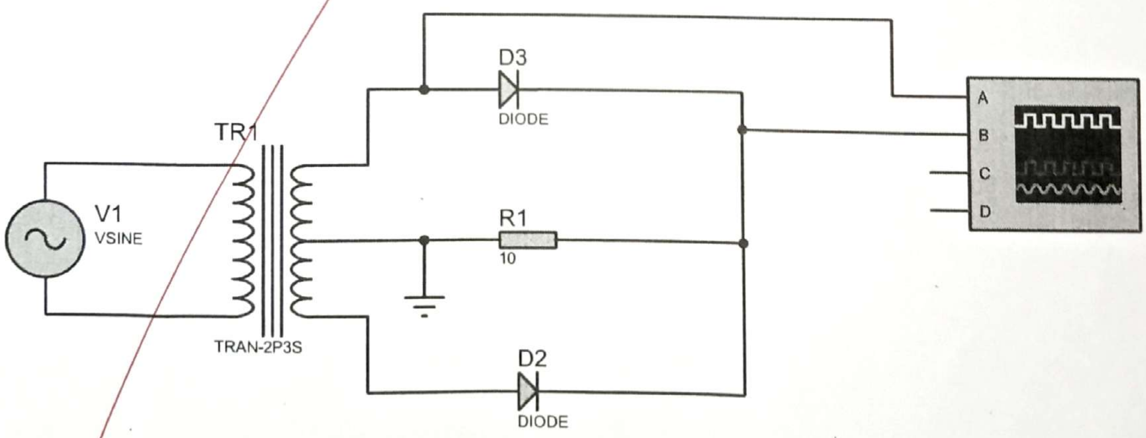


During positive half-cycles, D_1 is forward-biased and D_2 is reverse-biased. During the negative half cycle, diode D_2 becomes forward-biased and D_1 reverse-biased. In this case, D_2 conducts and current flow through the load resistor R_L in the same direction.

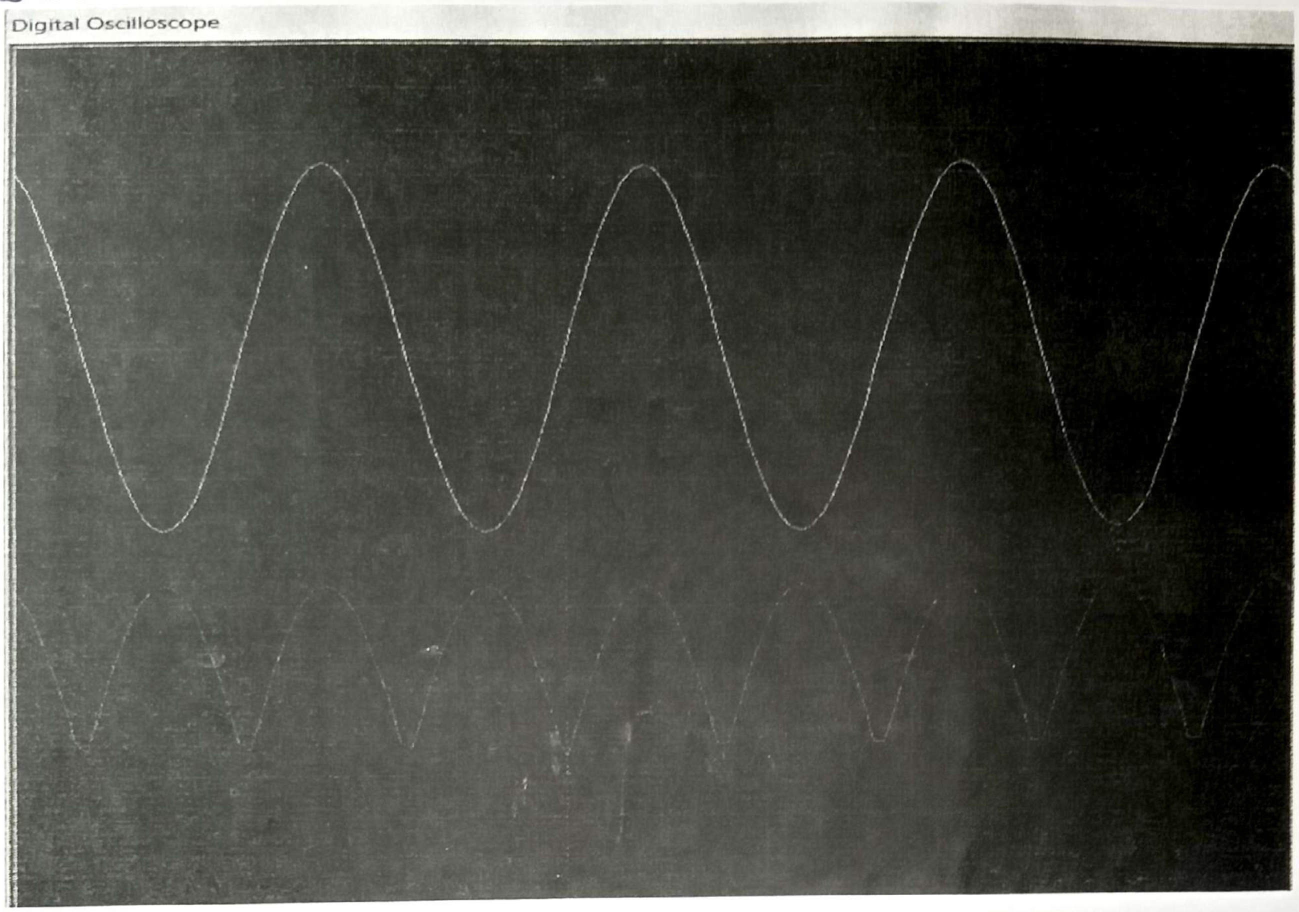
Required Components :

1. AC power supply
2. Oscilloscope
3. Diode
4. Resistors
5. Connecting Wire
6. Transformer

Circuit diagram :



Result :



Precautions :

1. Ensure the transformer has a center tap and that it is connected to the ground.

2. Confirm the two diodes are oriented correctly for proper conduction during alternate half-cycles.

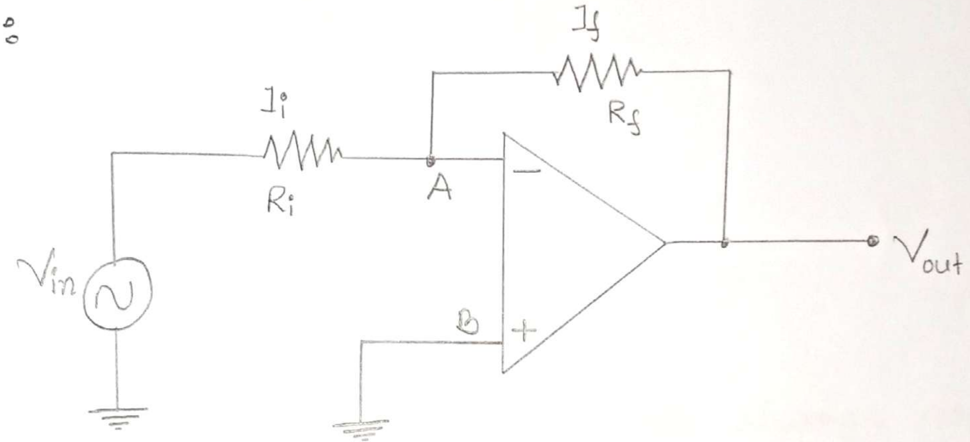
3. Ensure no short circuits between the center tap and other components.

4. Properly connect the oscilloscope to observe output waveforms accurately.

Experiment no : 04

Name of the Experiment : Design and Analysis of an Inverting Operational Amplifier Circuit with Voltage Gain Control.

Theory :



From fig, it shows the inverting operational amplifier. The input signal is applied to the inverting terminal via R_i and the non-inverting terminal is grounded. Let us derive a relationship between the input voltage V_{in} and the output voltage V_{out}. First, since $V_A = V_B$ and V_B is grounded, $V_A \approx 0$.

Since the current flowing into the inverting input of an ideal op-amp is zero, the current flowing through R_i must be equal in magnitude and opposite in direction to the current flowing through R_f.

So, $I_f = I_{in}$

$$\Rightarrow \frac{V_{in} - V_A}{R_i} = \frac{V_A - V_{out}}{R_f}$$

$$\Rightarrow \frac{V_{in} - 0}{R_i} = \frac{0 - V_{out}}{R_f}$$

$$\Rightarrow \frac{V_{in}}{R_i} = \frac{-V_{out}}{R_f}$$

$$\Rightarrow \frac{V_{out}}{V_{in}} = -\frac{R_f}{R_i}$$

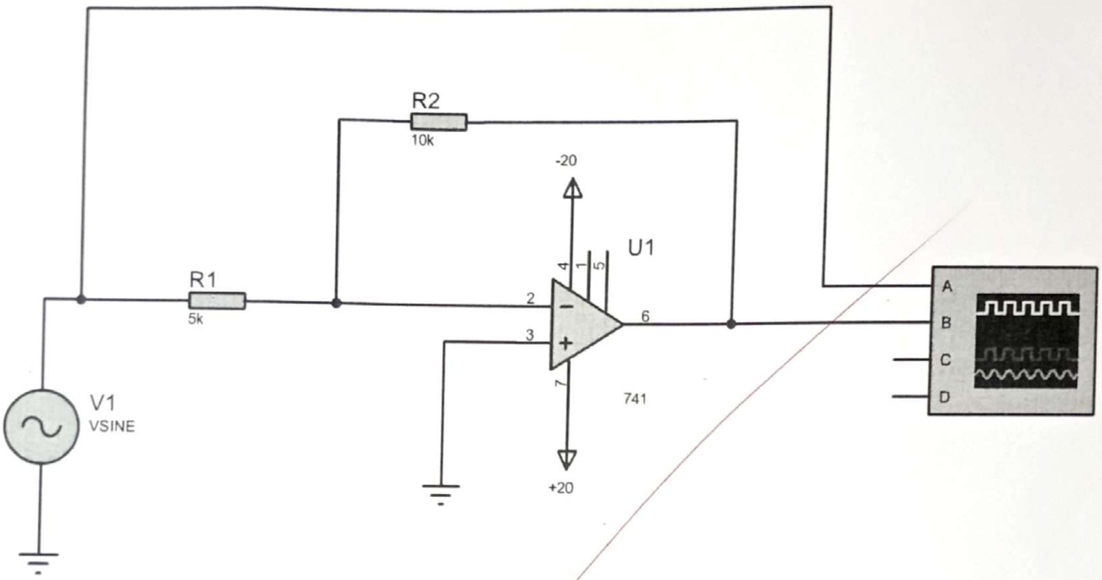
$$\therefore V_{out} = \left(-\frac{R_f}{R_i}\right) \times V_{in}$$

The gain of inverting amplifier is always negative.

Required components :

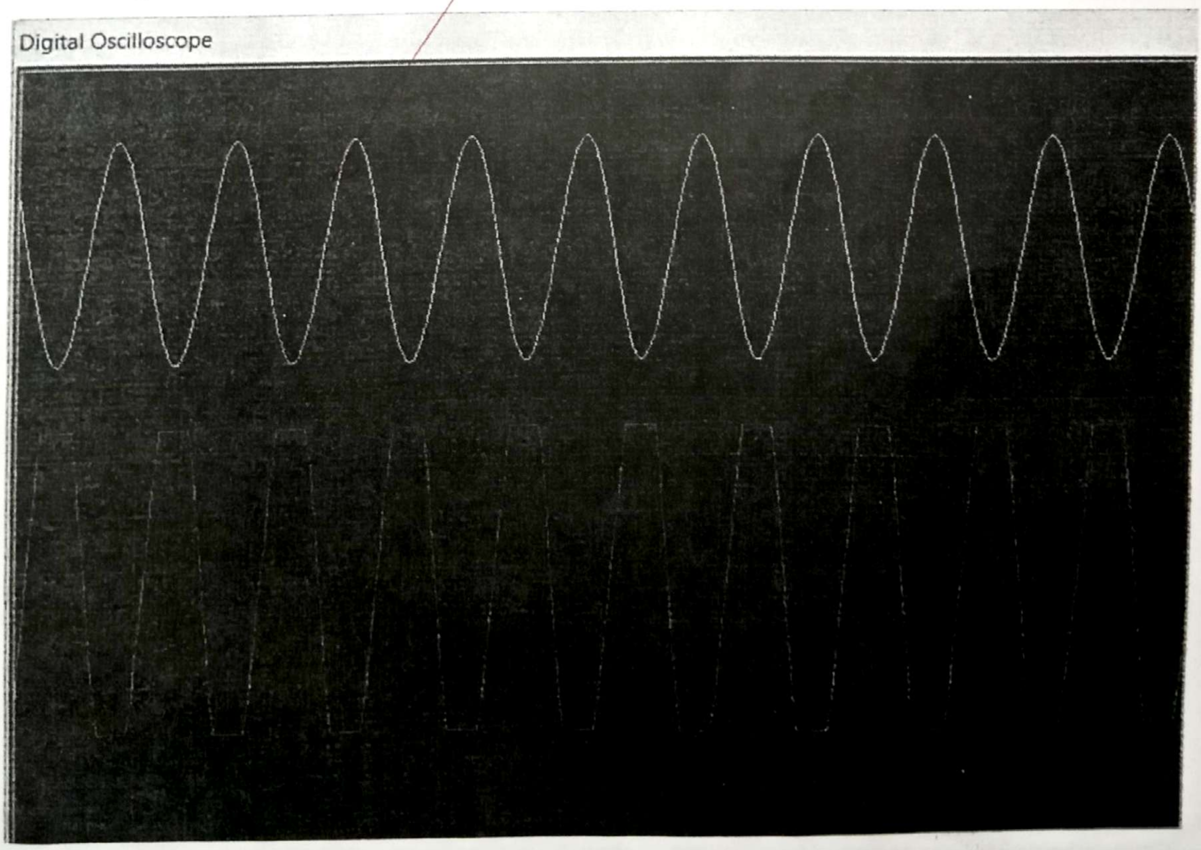
1. 741 op-amp
2. ~~DC~~ power supply
3. Oscilloscope
4. Resistor
5. Functional generator
6. Power
7. Ground

Circuit diagram :



Result :

Inverting:



Precautions :

1. Confirm the op-amp is powered with the correct supply voltage.

2. Verify that the inverting input (-) is connected to the signal source through a resistor and the feedback loop is correctly configured.

3. Ensure the non-inverting input (+) is connected to the ground for proper inverting operation.

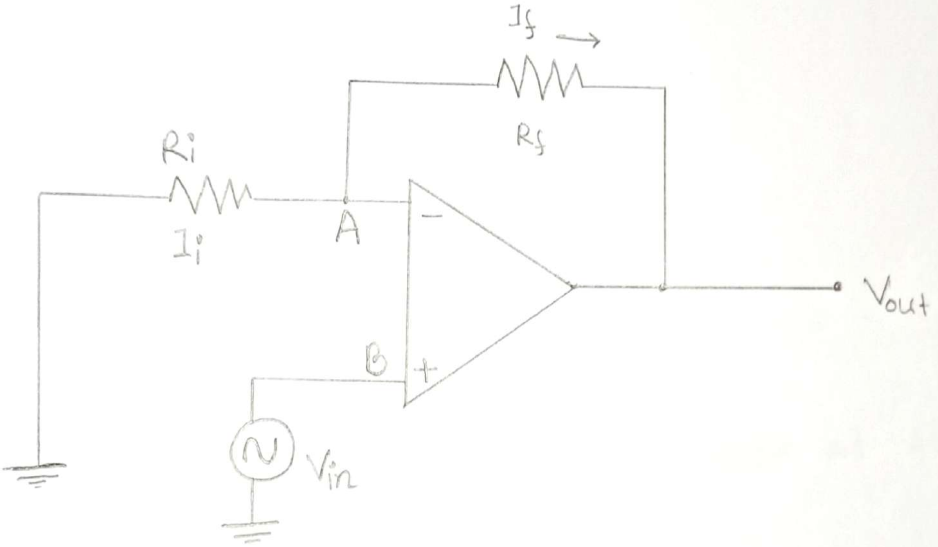
4. Use resistors with accurate values to achieve the desired gain.

5. Monitor the output voltage to ensure it does not saturate due to incorrect resistor selection.

Experiment no- 05

Name of the experiment : Design and Analysis of Non-Inverting Operational Amplifier Circuit with voltage gain control.

Theory :



From fig, it shows the non-inverting operational amplifier. The input signal is applied to the non-inverting input (+). and R_i is grounded. Let us derive a relationship between the input voltage V_{in} and the output voltage V_{out}.

Assume that, not at saturation, the potential at point A is same as V_{in}. Since the input impedence of op-amp is very high, all of the current that flows through R_f is equal to R_i.

So, $I_{in} = I_f$

$$\Rightarrow \frac{0 - V_A}{R_i} = \frac{V_A - V_{out}}{R_f}$$

$$\Rightarrow \frac{0 - V_{in}}{R_i} = \frac{V_{in} - V_{out}}{R_f}$$

$$\Rightarrow V_{in} R_i - V_{out} R_i = - V_{in} R_f$$

$$\Rightarrow V_{in} (R_i + R_f) = V_{out} R_i$$

$$\Rightarrow \frac{V_{out}}{V_{in}} = \frac{R_i + R_f}{R_i \cancel{+ R_f}}$$

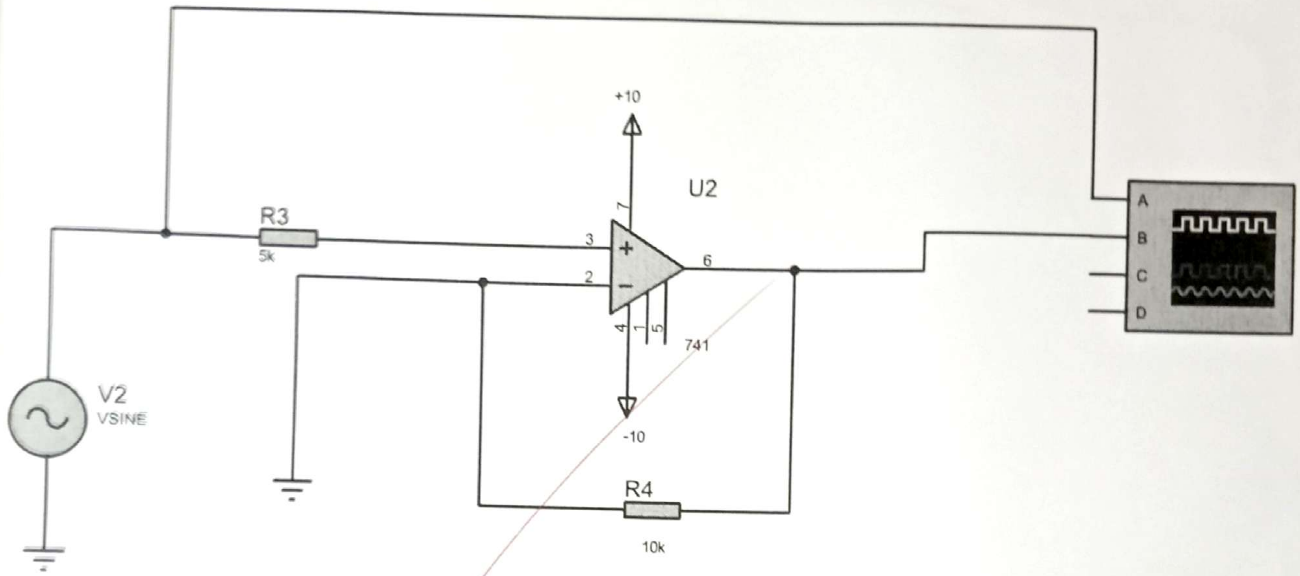
$$\therefore V_{out} = V_{in} \times \left(1 + \frac{R_f}{R_i}\right)$$

If the output voltage increases, the voltage at the inverting input will also increase.

Required Components :

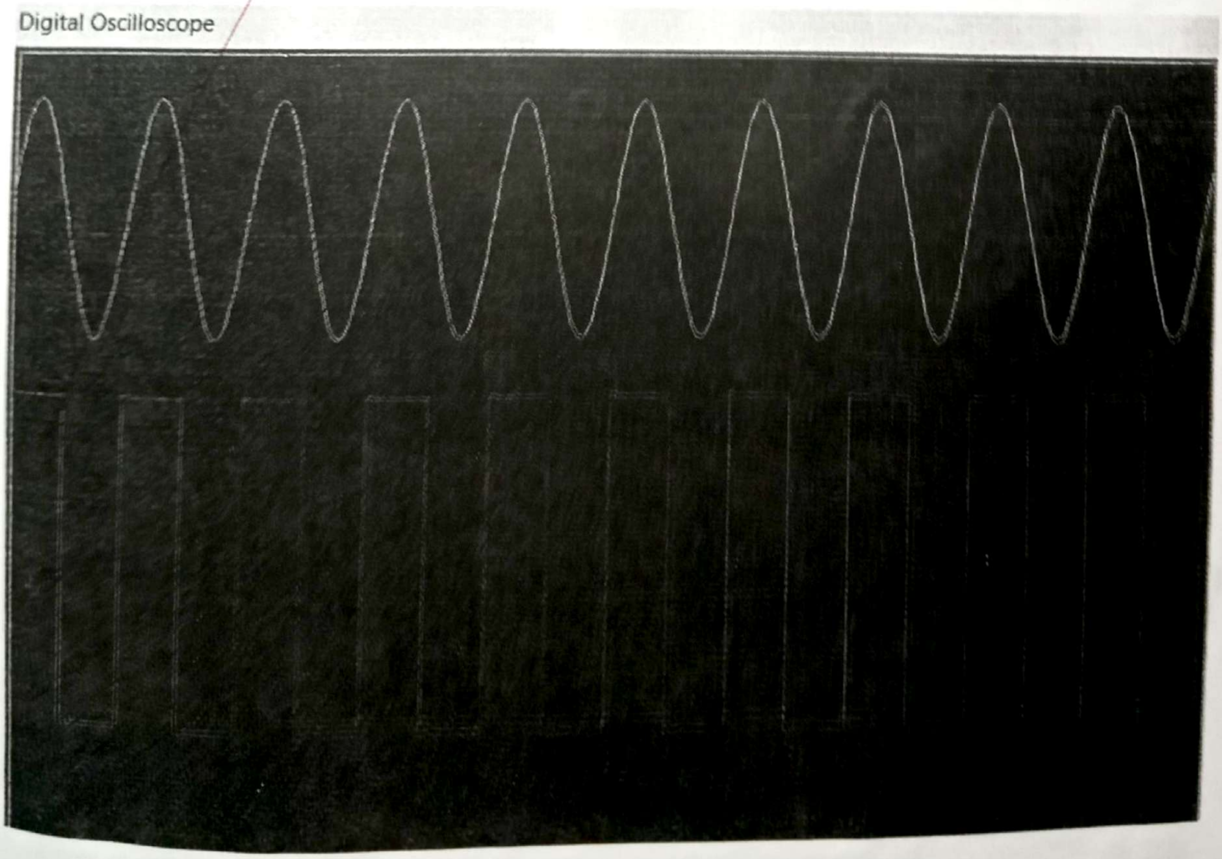
1. 741 OP-amp
2. ~~DC~~ power supply
3. Oscilloscope
4. Resistor
5. Functional generator.
6. Power
7. Ground

Circuit diagram:



Result:

Non-Inverting:



Precautions :

1. Ensure the non-inverting input (+) is connected to the ~~if~~ input signal source.

2. Select resistors for the feedback loop to achieve the desired gain without saturating the output.

3. Power the op-amp with suitable supply voltages to handle the expected output range.

4. Check that the oscilloscope probes are correctly placed to observed the output waveform.

5. Avoid overdriving the input signal to prevent distortion.

Experiment no : 06

Name of the Experiment : Investigating the Functionality of a Transistor as an Electronic Switch.

Theory : A transistor is a three-terminal semiconductor device primarily used for switching and amplification purposes. When operating as a switch, the transistor works in either of the two states :

1. Cutoff region : The transistor acts as an open switch. and no current flows through the collector-emitter circuit.

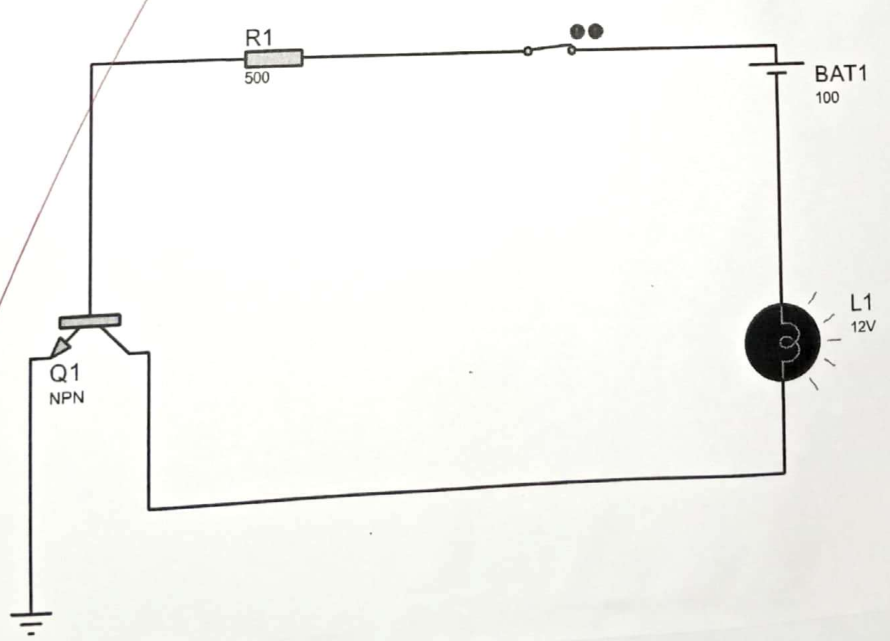
2. Saturation region : The transistor acts as a closed switch, allowing maximum current to flow through the collector-emitter circuit.

This property is widely used in low-voltage applications due to the transistor's low power consumption and high efficiency.

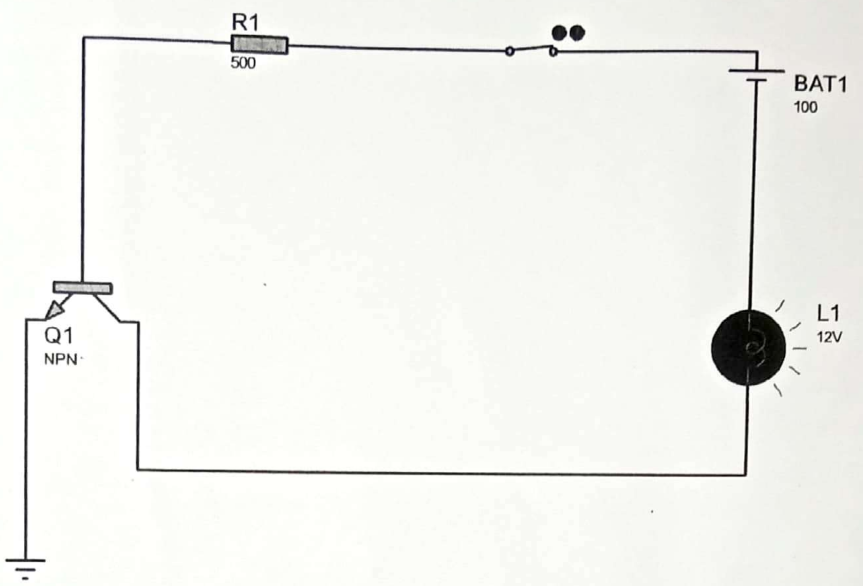
Required components :

1. NPN transistor
2. LED
3. Power Supply
4. Connecting wires

Circuit diagram :



Result :



Precautions :

1. Ensure the transistor is correctly configured as NPN or PNP.

2. Use a base resistor of appropriate value to control the base current and prevent damage to the transistor.

3. Avoid excessive power dissipation in the transistor by choosing suitable load and power supply.

4. Ensure the transistor is driven fully into saturation (ON) or cutoff (OFF) to operate as a switch.

5. Monitor the collector-emitter voltage to verify proper switching operation.