Lab Report 2

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AIM :

Rectify an Ac signal from function generator and plot the observations with and without filter for both half-wave and full wave rectifier using Op-amp.

MATERIALS USED :

S.no.	Name of apparatus	Range	Quantity
1	Function generator	- V	1
2	Resistor	1KΩ	5-6
3	Breadboard	-	1
4	Connecting wires	-	4(accordingly)
5	Diode IN4007	-	2
6	IC lm358	-	1

THEORY :

Operational- amplifier $(OP-amp)$***:***

An Operational Amplifier (Op-Amp) is a versatile electronic component that amplifies the difference between two input voltages. It can also perform many other functions like amplification, summing, integrating, differentiation, filtering etc.

Half wave precision rectifier :

A half-wave precision rectifier is a circuit that converts an AC input signal to a unidirectional (DC) output, allowing only half of the input waveform (positive or negative) to pass. Unlike simple diode rectifiers, precision rectifiers use commercial amplifiers (op-amps) to provide accurate rectification even at very small inputs, although conventional rectifiers will not be rectified due to their low voltage.

Full wave precision rectifier :

A full-wave precision rectifier is a circuit that converts the positive and negative of an AC input signal into a unidirectional output, effectively doubling the frequency of the input signal. Precision rectifiers can rectify small signals using operational amplifiers (op-amps) and diodes, overcoming the disadvantages of simple diode rectifiers.

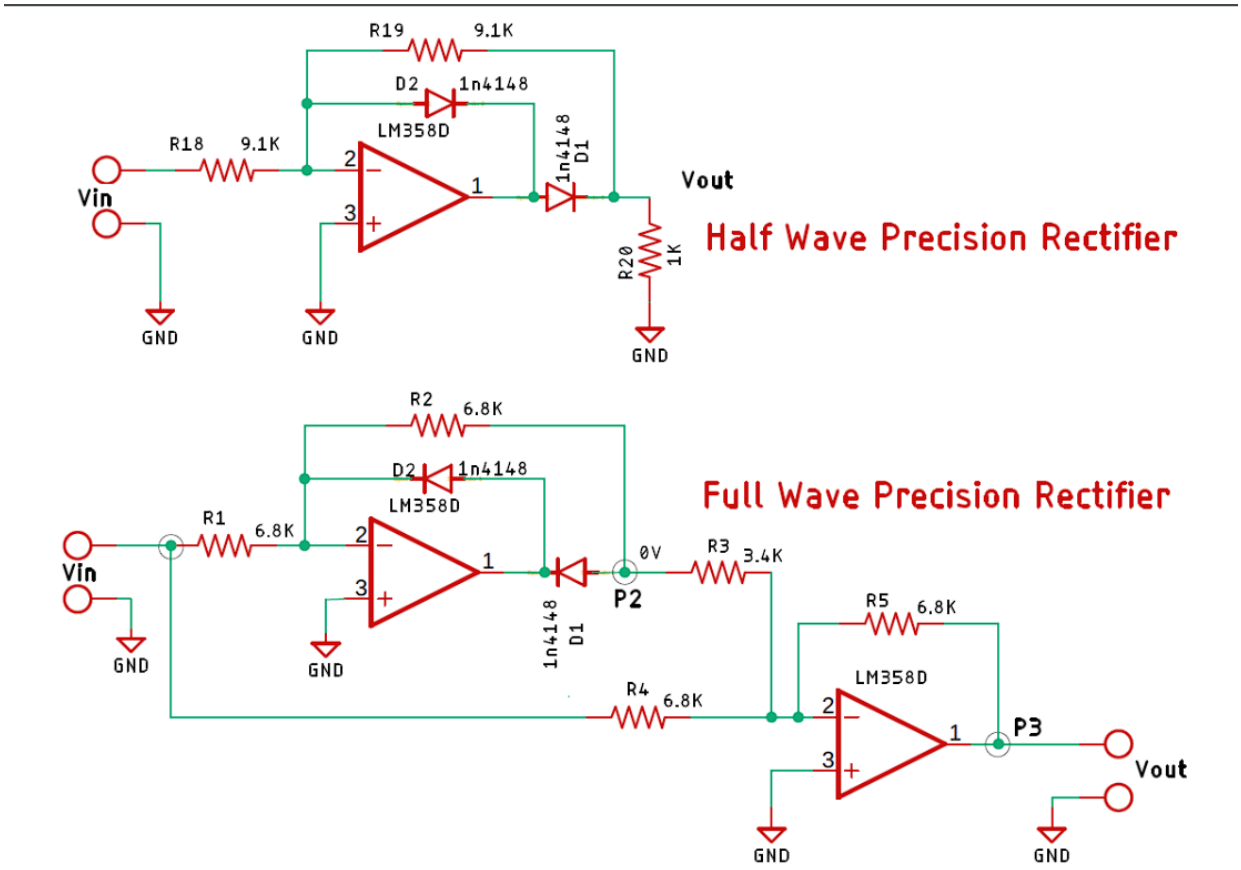

Fig. 0: from:https://circuitdigest.com/electronic-circuits/half-wave-and-full-wave-precision-rectifier-circuit-using-op-amp

OBSERVATION :

Half-wave rectifier (without filter):

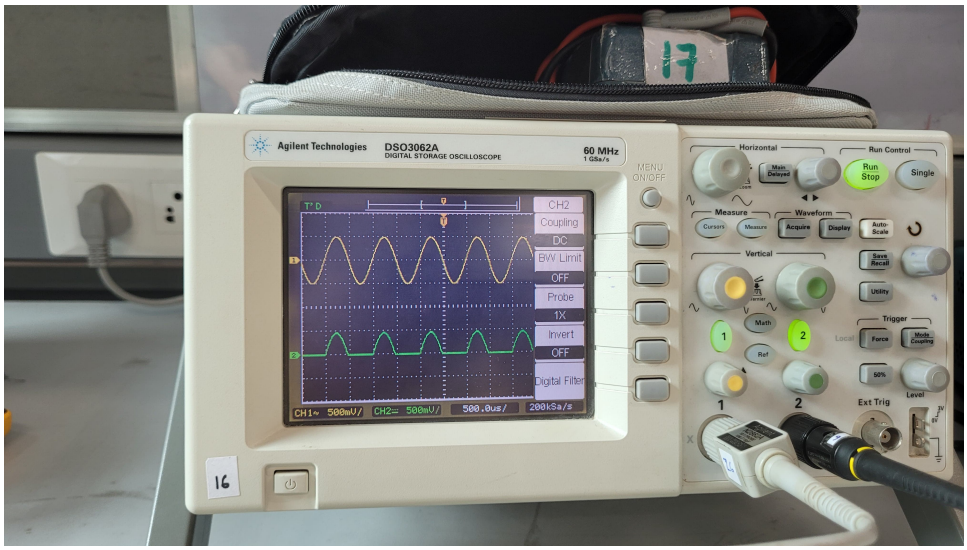

Fig. 0: Half-wave rectifier

Half-wave rectifier (with filter):

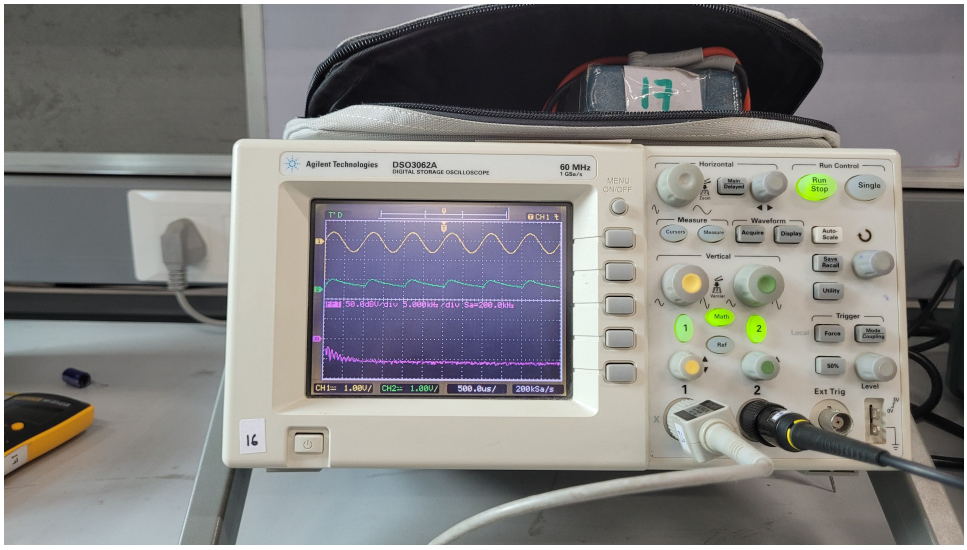

Fig. 0: Half-wave rectifier

FFT:

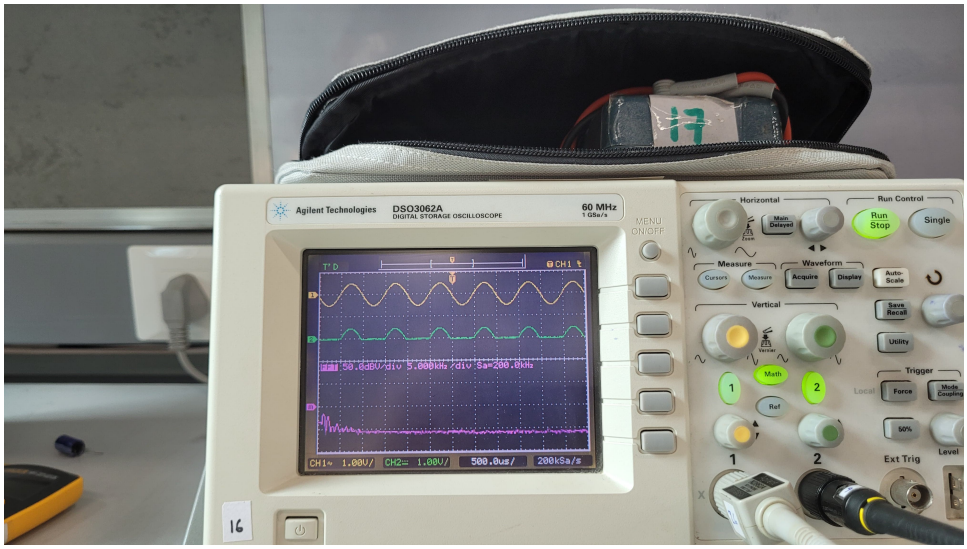

Fig. 0: FFT

Half-wave rectifier (without op-amp):

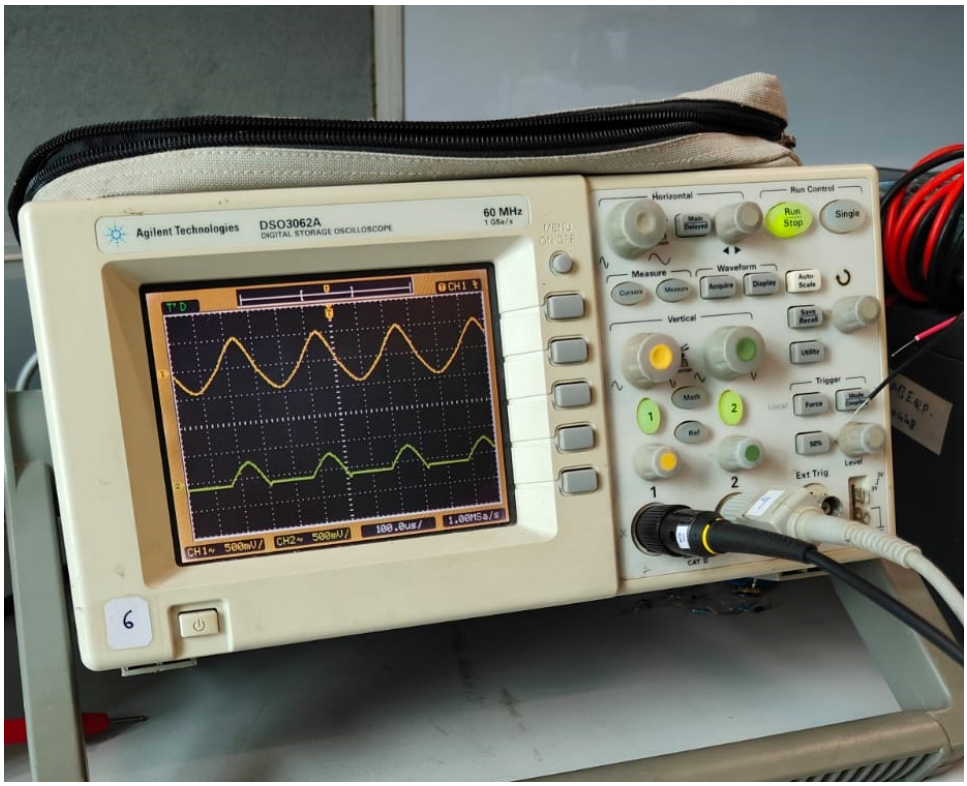

Fig. 0: Half-wave rectifier

From the plot above we can observe that the output wave (green wave) is 0.7V less than the input wave (yellow).In a practical rectifier circuit, the output waveform will be 0.7

volts less than the applied input voltage, and the transfer characteristic will look like the figure in the diagram. But in a precision rectifier, we use an op-amp to compensate for the

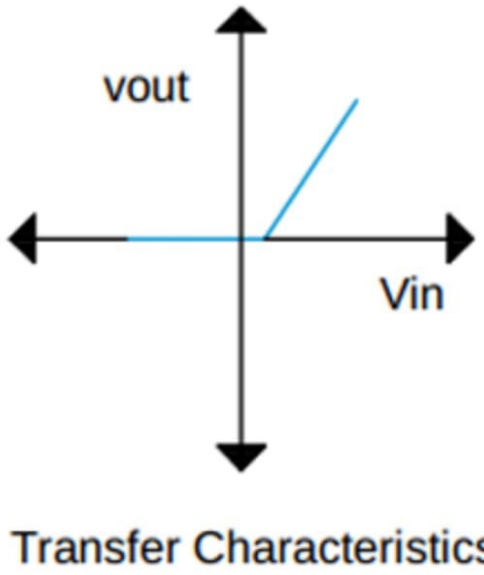

Fig. 0: Transfer characteristics

voltage drop across the diode, that is why we are not losing the 0.6V or 0.7V voltage drop across the diode. The feedback from the output of the diode and the op-amp compensates for any voltage drop across the diode. So, the diode behaves like an ideal diode.

Full-wave rectifier (without filter):

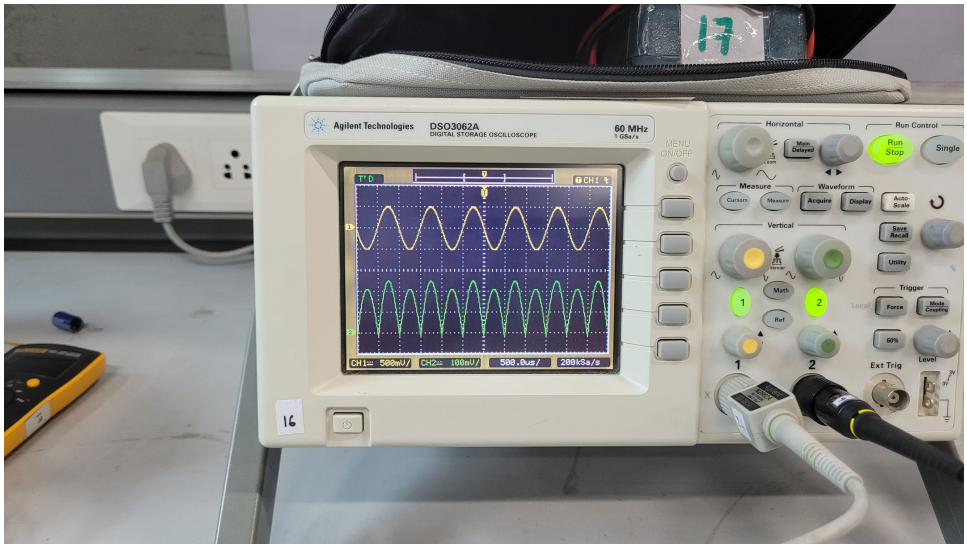

Fig. 0: Full-wave rectifier

Full-wave rectifier (with filter):

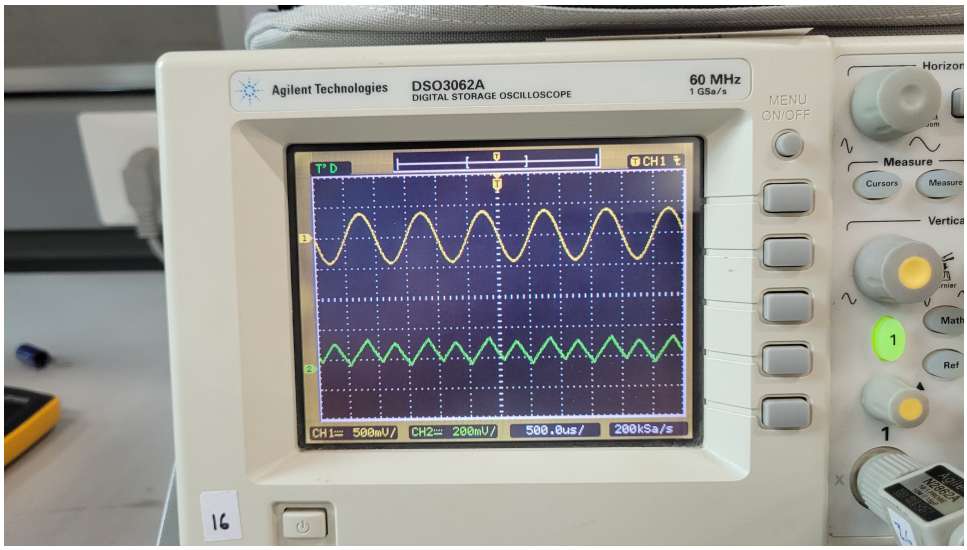

Fig. 0: Full-wave rectifier

FFT Full-wave (without filter):

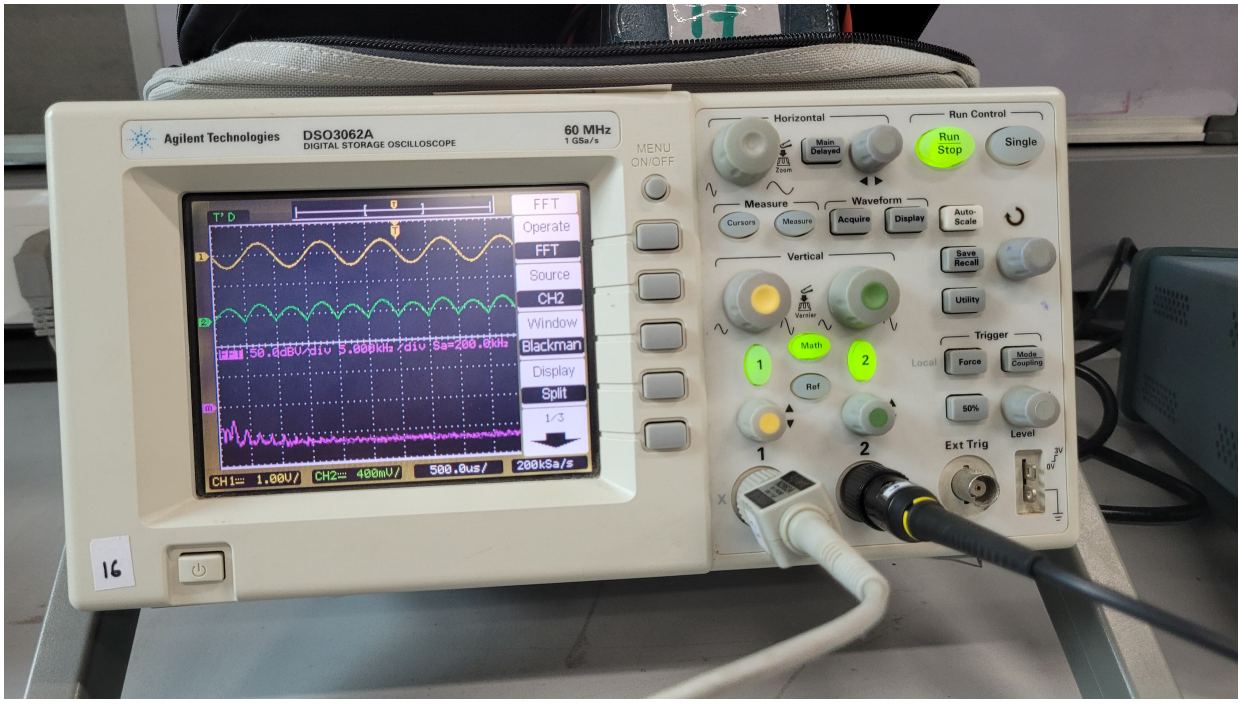

Fig. 0: FFT

FFT Full-wave (with filter):

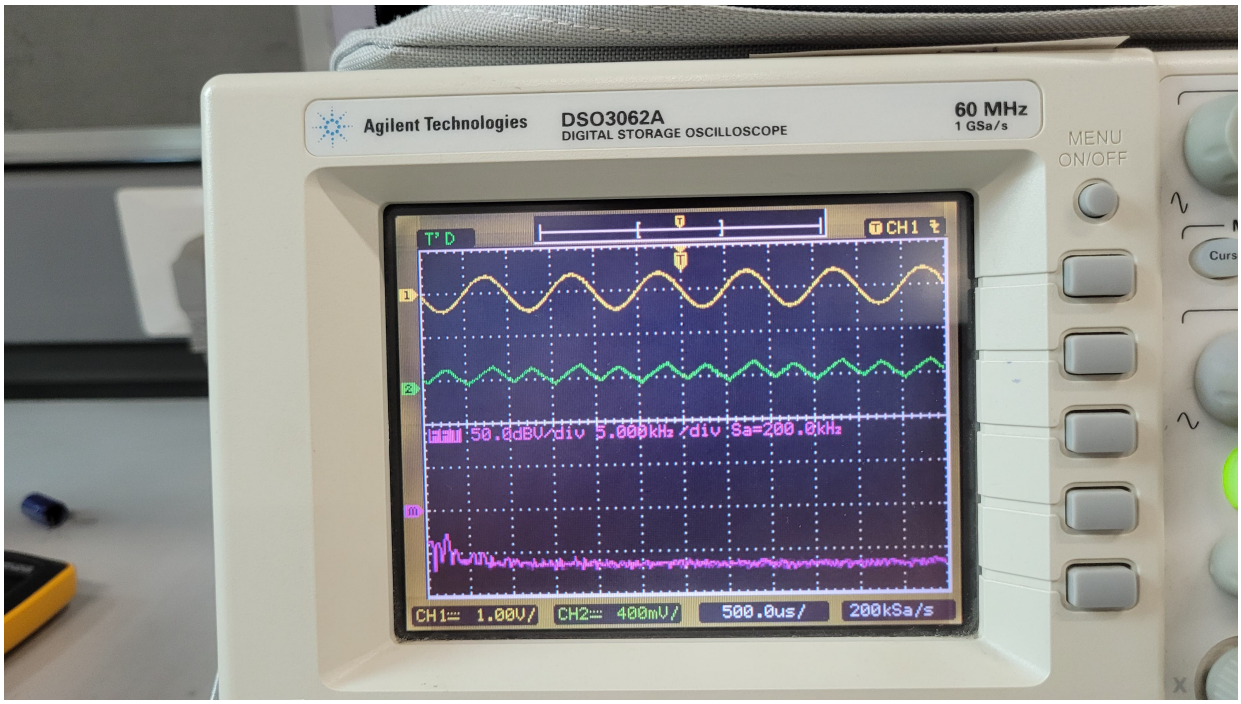

Fig. 0: FFT

RESULT :

We looked at half-wave rectifiers with and without filters. The half-wave rectifier effectively converts AC input to DC output. This experiment shows how to use an RC filter with a full wave generator to smooth out a sine waveform. The rectifier converts the AC input to pulsating DC, and the filter reduces the fluctuations and produces a stable DC output. This demonstrates its importance in many electronic systems.