Part 1

Frequency response of amplifiers (Op-Amp)
-Experments-

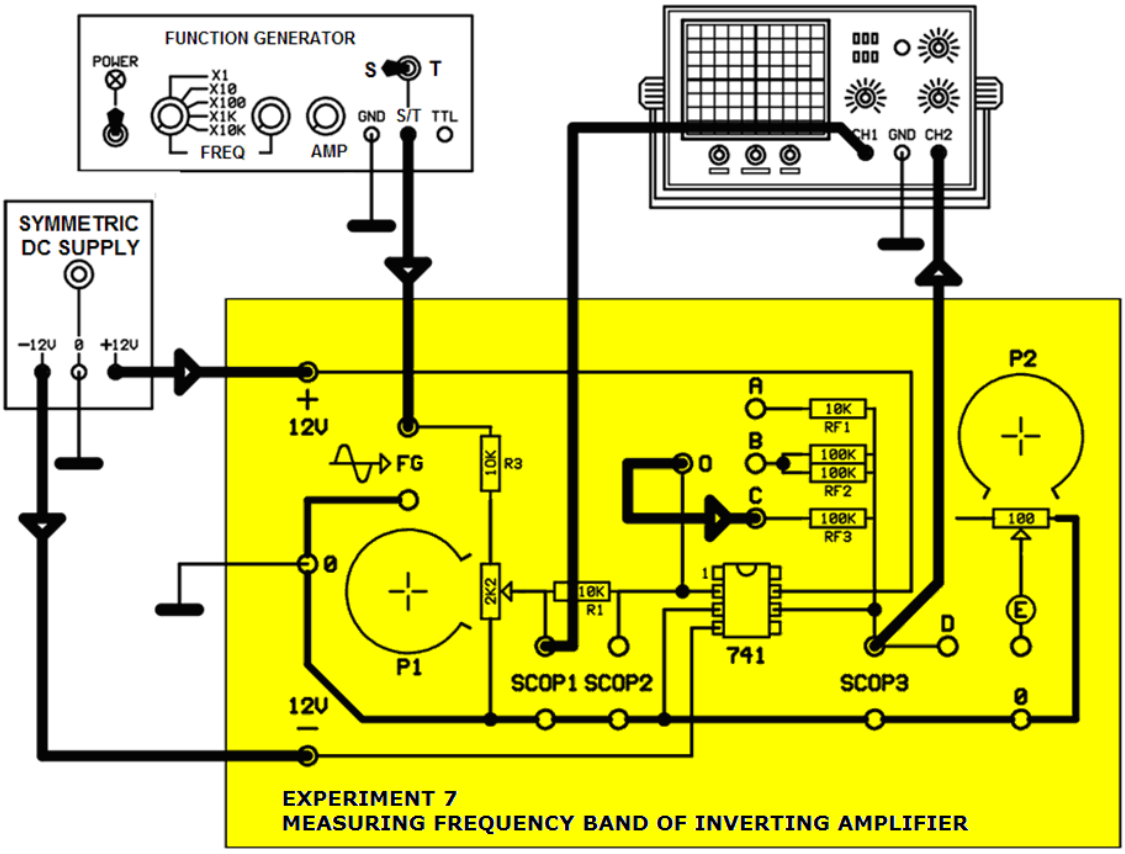
Experiment 1.7: Measuring Frequency Band Of Inverting Amplifiers.
Experiment 1.8: Analyzing Frequency-Gain Relation Of Inverting Amplifier.
Experiment 1.9: Analyzing The Phase Shift in Amplifier.
Experiment 1.10: Analyzing Input And Output Signal Range Of Operational Amplifiers.

MODULE Y-0014/01

EXPERIMENT: 1.7
MEASURING FREQUENCY BAND OF INVERTING AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure



1- Apply power to the circuit. Set the output of the function generator to sinusoidal wave with frequency 1 KHz and amplitude 1V peak to peak by using scope1 (if the amplitude can not reach to 1V, make it as bigger as it can. (**Becareful to not exceed the 1V**)).

2- Measure the amplitude of the output signal at Scope3.

The amplitude of the output signal *is* .

3- Adjust the frequency of the function generator until the amplitude of the output signal becomes $1/\sqrt{2} \cong 0.707$ of it.

Vpp (output)=

Measure the frequency at that instant.

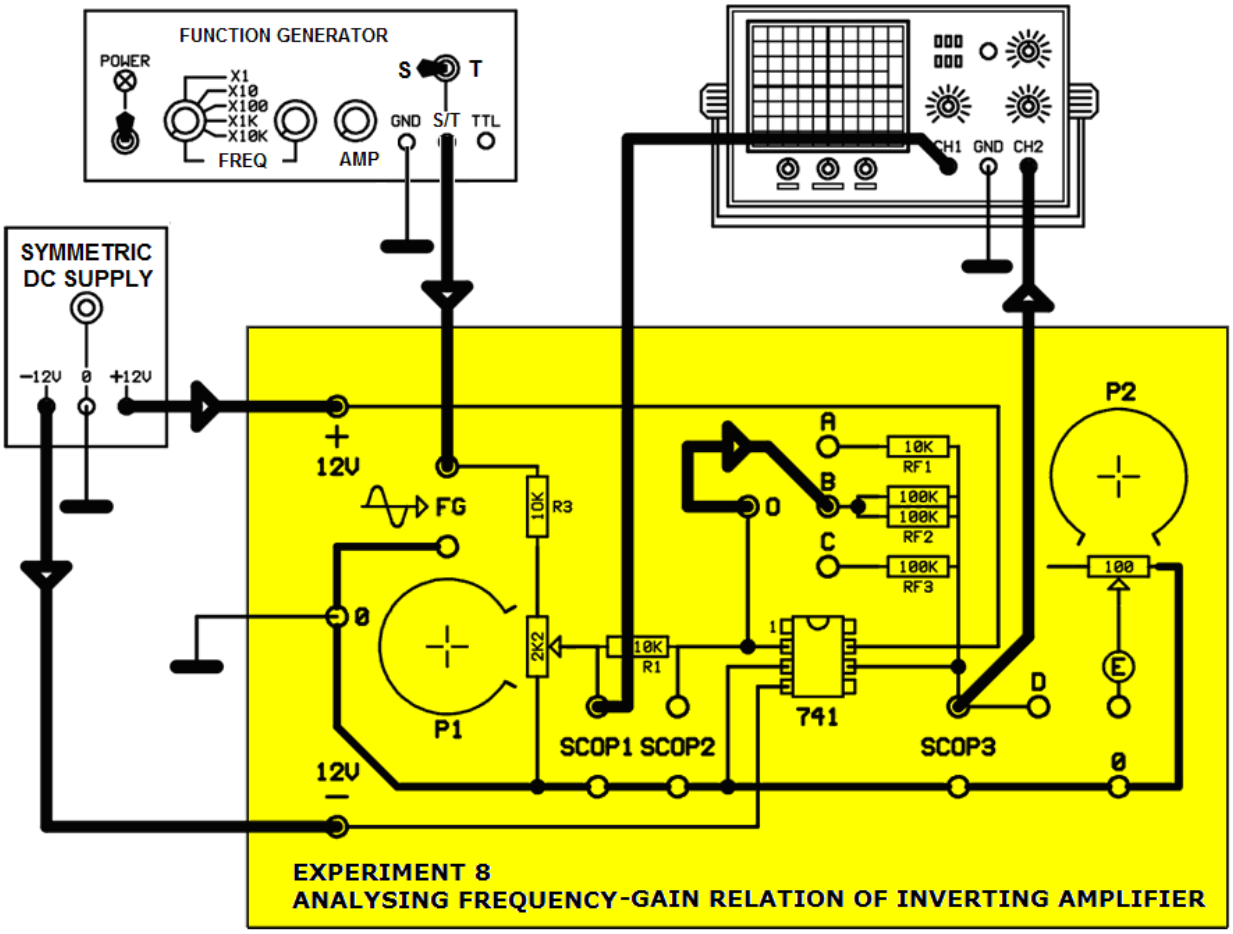
F =

4- What does this frequency value correspond to?

EXPERIMENT: 1.8
ANALYZING FREQUENCY-GAIN RELATION OF INVERTING AMPLIFIER

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure



NOTE: Let's remember the experiment results. The gain in experiment 1.7 was equal to;

$$A = \frac{RFB}{R1} = \frac{100K}{10K} = 10$$

And the band width was DC-53,6KHz. The gain in our experiment is;

$$A = \frac{RF1}{R2} = \frac{50K}{10K} = 5$$

1- Apply power to the circuit. Set the output of the function generator to sinusoidal wave with frequency 1 KHz and amplitude 1V peak to peak by using scope1. (if the amplitude can not reach to 1V, make it as bigger as it can. (**Becareful to not exceed the 1V**)).

2- Measure the amplitude of the output signal at Scope3.

The amplitude of the output signal *is* .

3- Adjust the frequency of the function generator until the amplitude of the output signal becomes $1/\sqrt{2} \cong 0.707$ of it.

Vpp (output)=

Measure the frequency at that instant.

F =

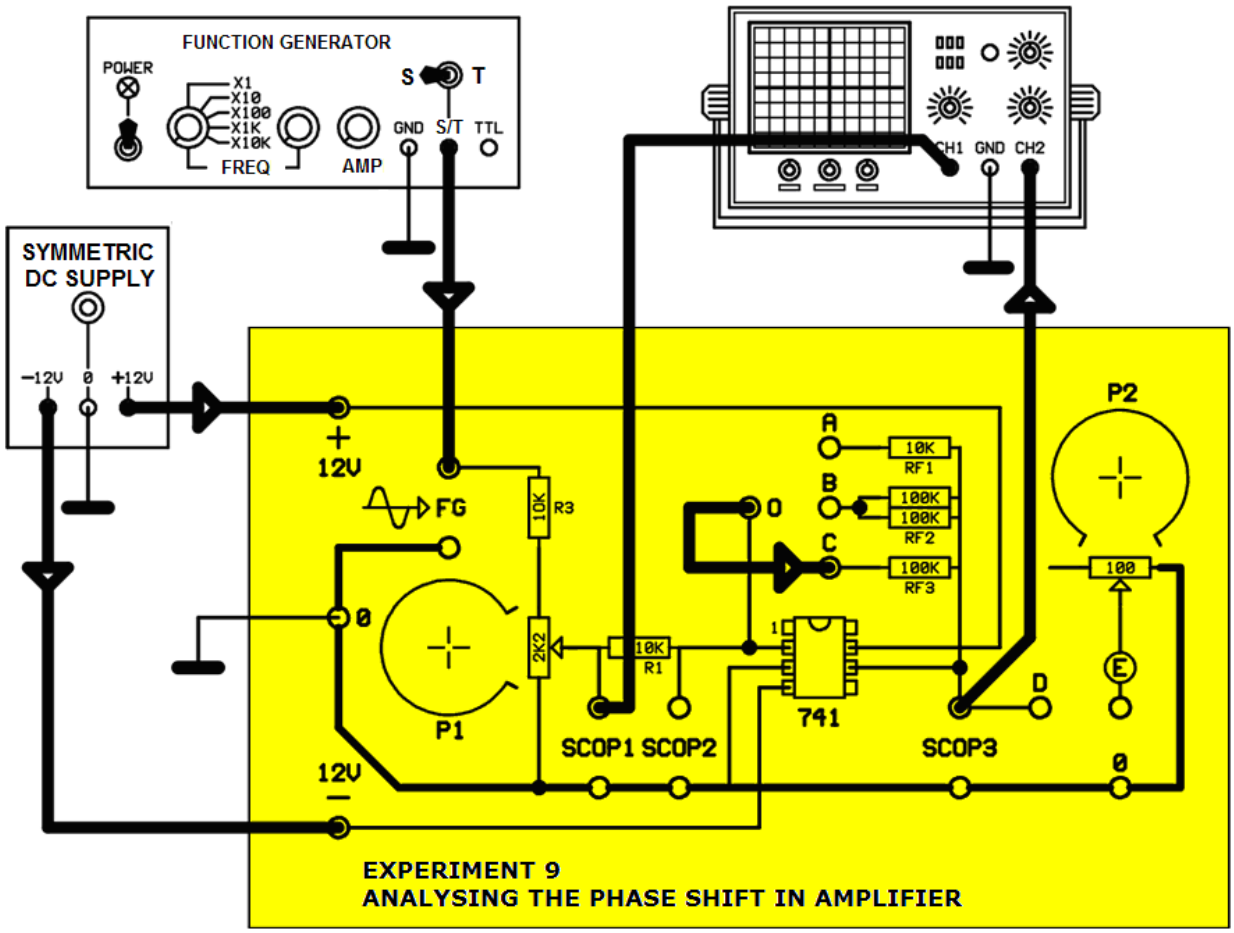
4- What does this frequency correspond to?

5- How do we explain the relationship between the gain and the frequency bandwidth if we compare the results of this experiment with the results of the experiment 1.7?

EXPERIMENT: 1.9
ANALYZING THE PHASE SHIFT IN AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure



1- Apply power to the circuit. Set the output of the function generator to sinusoidal wave with frequency 1 KHz and amplitude 1V peak to peak by using scope1. (if the amplitude can not reach to 1V, make it as bigger as it can. (**Becareful to not exceed the 1V**)).

2- Is the input signal maximum when the output signal is minimum? Draw the signals. Measure the phase difference between the input and output signals.

3- Set the frequency of the function generator to 50KHz. At that frequency, is the input signal maximum when the output signal is minimum?

4- Set the frequency of the function generator to 100KHz. At that frequency, does the duration between the maximum point of the input signal and the minimum point of the output signal change?

Draw the signals. Measure the phase difference between the input and output signals.

5- What does the delay between the input and output signals indicate?

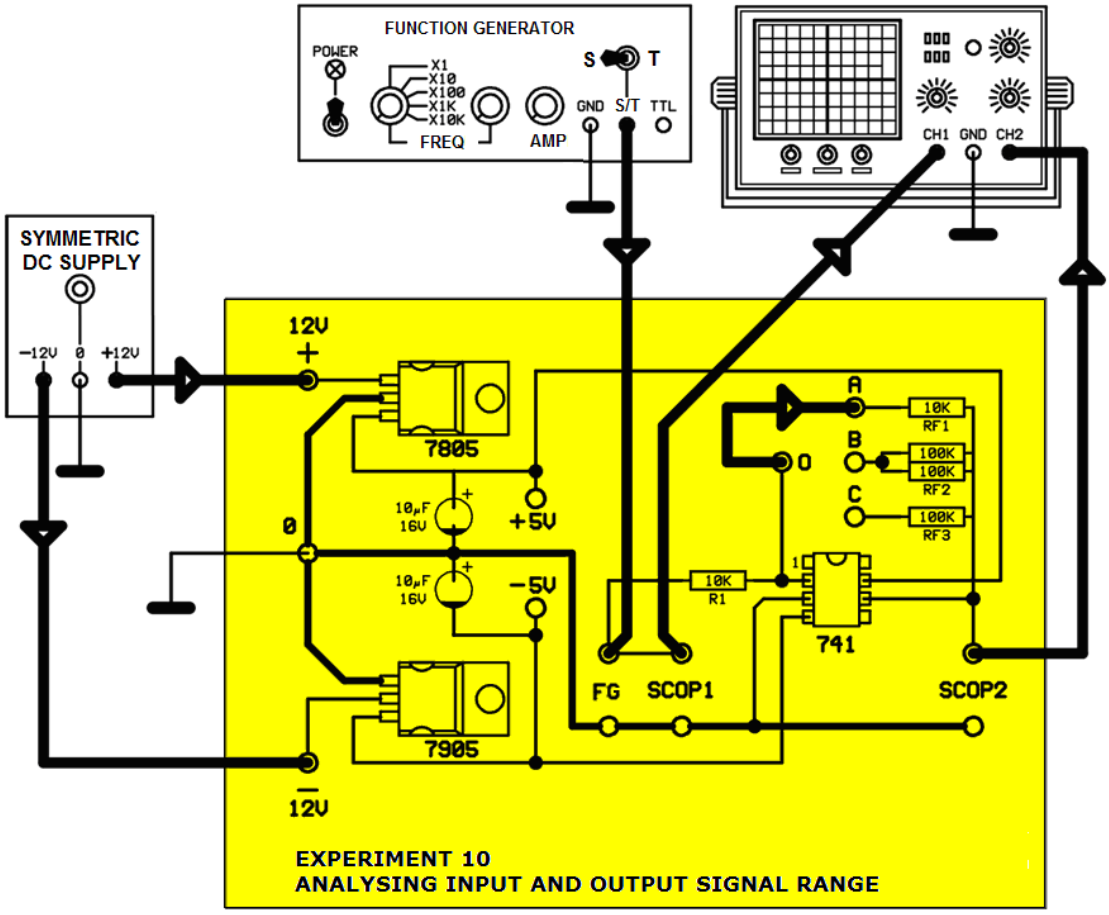
6- How do you explain the relation between the frequency and the phase shift?

EXPERIMENT: 1.10

ANALYZING INPUT AND OUTPUT SIGNAL RANGE OF OPERATIONAL AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure



1- Set the amplitude of the function generator to minimum. Apply power to the circuit.

2- Check the voltages -5Volts and +5Volts with respect to the ground by using a voltmeter.

3- Set the output of the function generator to sine 1KHz with minimum amplitude **(zero)**.

4- Increase the input voltage up to the output wave form is clipped from both sides. At that instant, read the amplitude of the output voltage.

Vpp =
$V_{positive\_alternate}$ =
$V_{negative\_alternate}$ =

5- Why is the output signal clipped before the positive power supply value?

6- Read the amplitude of the input signal at that instant.

Vin =

7- What is the gain of the operational amplifier? Why?

Gain = $\frac{V_o}{V_{in}}$ =

Because...

8- Set the amplitude of the function generator to minimum. Open the short circuit between the points O-A. Short the points O-B. What is the gain of the circuit? Calculate through resistor values.

9- Increase the input voltage up to the output wave form is clipped from both sides. At that instant, read the amplitude of the output voltage.

10- The output signal is clipped at the same voltage determined at "5" again (also at "9"). So, what is the relation between the output signal, gain and the supply voltage?

11- Read the amplitude of the input signal at that instant.

12- What determines the input signal range?

NOT: The experiment is performed for the positive signal values. The experiment may be repeated by shorting the points O-C.