(For Counsellor's use only)

Grade,. . . . . Name . . . .

Evaluated by . . . . Enrolment Number . . . . .

EXPERIMENT 5

STUDY OF OPAMP AS DJFFERENTIATOR AND INTEGRATOR

5.1 INTRODUCTION

You might have used electronic calculators, or computers at some stage. How does a computer perform mathematial operations? In fact some electronic circuits are designed to perform the various mathematical calculations. Examples of such circuits are integrators and differentiators. In these circuits, if you apply any electrical signal in the input, you will get its integrated or differentiated form at the output. These circuits are extremely useful in computing, signal processing and signal generating applications. Operational amplifiers can be used for such applications.

Objectives

After performing the experiment you will be able to

- Integrate a sine wave or a square wave using OPAMP.
- Differentiate a sine or a square wave using OPAMP.
- Compare the expected and observed integrated and differentiated signals.

5.2 APPARATUS:

OPAMP (741)
2 power supplies (+15V and -15V)
oscillator giving sine and square waves of various frequencies
oscilloscope (CRO)
connecting wires

Hence you can get the differential output of the input. The differentiated and integrated outputs for sine and square waves are shown in Fig.5.2.

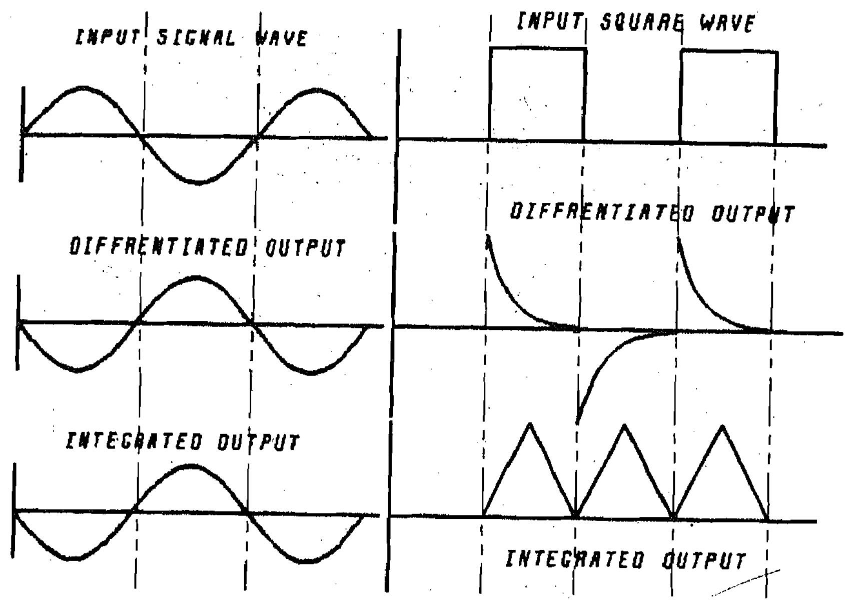

Fig.5.2

SAQ: In the above circuit, if you see an ordinary transistor amplifier in place of OPAMP, will you still get a differentiated or integrated output? Explain it in the space given below.

5.4 PRECAUTIONS

1. The potential + V should not exceed a volts.
2. Choose a good operational amplifier with low bias current, to perform the operations below correctly.

5.5 THE EXPERIMENT

5.5.1 Integrator Circuit wing OPAMP 741.

Make the circuit as shown in Fig.5.3 using OPAMP 741.

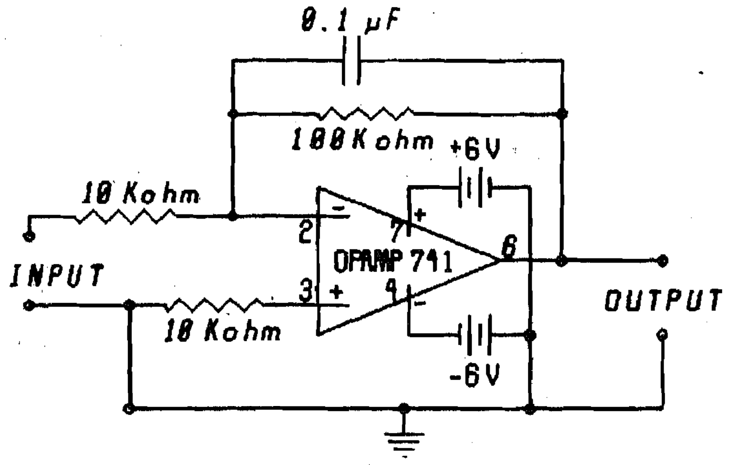

Fig.5.3

Perform the following steps to carry out the experiment.

PROCEDURE

(i) Connect the oscillator output to y-y terminals of the oscilloscope and adjust The amplitude of the sine wave to 0.5V and frequency to 1K Hz.

(ii) Disconnect the oscillator from the oscilloscope and connect it to the input of the circuit.

(iii) Connect the oscilloscope to the output of the circuit.

(iv) Synchronise the output signal on the screen of the oscilloscope.

(v) Measure the output signal amplitude and frequency.

(vi) Change the frequency and amplitude of the input signal and again measure the output voltage and frequency repeating steps (i) - (vi).

(vii) Repeat the experiment using square wave input from the oscillator.

(viii) Record your observations in the following table.

OBSERVATION TABLE I

For sine-wave input.,

Serial	INPUT volts	INPUT freq.	OUTPUT volts	OUTPUT freq.
1				
2				
3				
4				
5				

OBSERVATION TABLE II

For square-wave input.

Serial	INPUT volts	INPUT freq.	OUTPUT volts	OUTPUT freq.
1				
2				
3				
4				
5				

SAQ:

What do you observe in the output of the circuits as displayed on the screen of the oscilloscope, compare it with the input and record your findings in the space given below.

5.5.2 Differentator Circuit using OPAMP 741

PROCEDURE

Make the circuit as shown in Fig.5.4.

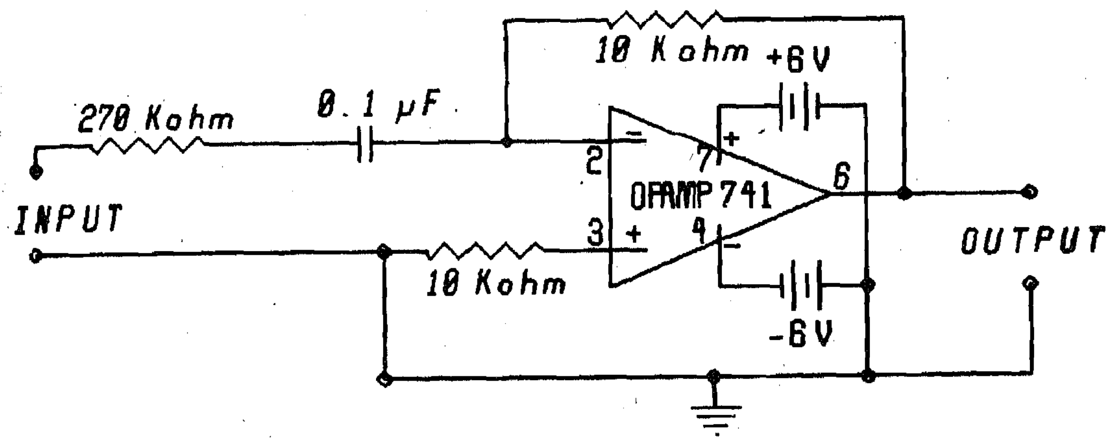

Fig.5.4

Follow the same procedure as mentioned in the previous opamp experiment and record your observations in a similar table both sine and square inputs. Compare the outputs with corresponding inputs and record your finding in the space given below.

OBSERVATION TABLE III

For sine-wave input.

Serial	INPUT volts	INPUT freq.	OUTPUT volts	OUTPUT freq.
1				
2				
3				
4				
5				

OBSERVATION TABLE IV

For square-wave input.

Serial	INPUT volts	INPUT freq.	OUTPUT volts	OUTPUT freq.
1				
2				
3				
4				
5				

SAQ:
What do you observe in theoutput of thecircuits as displayed on the screen of the oscilloscope. compare it with the input and record your findings in the space given below,

SAQ: In the abovccxpcriment of **integrator** circuit with a square wave input, connect its output to the differentiating circuit. What do you observe in the output on the screen. Explain your tidings in the space given below.

5.6 CONCLUSIONS

You have **found** out how to integrate and **differentiate sinusoidal** and square wave forms.

a) What happens to the fast-rising portions of the wave form after integration?

b) Find that if the input oscillates equally in positive and negative voltages the output of the integrator is zero. Explain this in **simple** terms.

c) What happened to the constant of integration in this case?

d) What response do you get when you apply a d.c. voltage to the input of the differentiator?

e) Which circuit smooths the waveform?

f) Which circuit picks up sharp variations in the input?