EXPERIMENT NO.6

TITLE: OP-AMP AS INTEGRATOR.

OBJECTIVES:

1. To assemble the circuit of integrator using op-amp IC 741.
2. To observe and plot the output voltage waveform of integrator for sine wave and square wave input.

LAB REQUIREMENTS:

Breadboard, Op-amp IC 741, Resistors (R1/RF), Capacitor(Cf), DC regulated Dual power supply (0-30V), Function Generator, CRO/DSO and connecting wires/Probes.

CIRCUIT DIAGRAM:

Practical Integrator:

THEORY:

A circuit in which the output voltage waveform is the integral of the input voltage waveform is known as integrator. Such circuit is obtained by using a basic inverting amplifier configuration if the feedback resistor R_F is replaced by a capacitor C_F. The output voltage of the integrator circuit is given as-

$$v_o = -\frac{1}{R_1.C_F}\int_0^t v_{in}\ dt + C$$

Where C is the constant of integration and is proportional to the value of output voltage v_o at time t=0 sec.

The frequency (f_b) at which the gain of integrator is 0dB is given by-

$$f_b = \frac{1}{2\pi . R_1 . C_F}$$

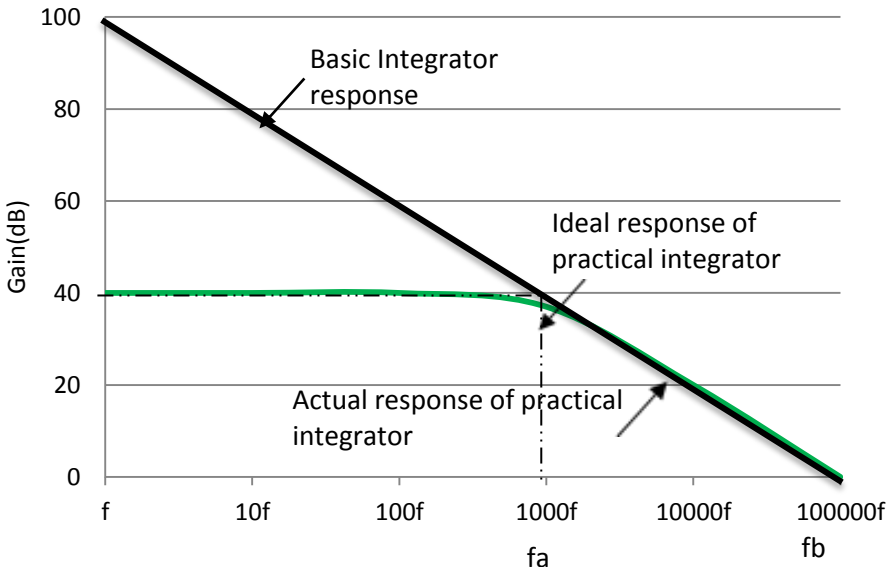
When $v_{in} = 0$, the basic integrator works as an open loop amplifier because capacitor C_F acts as open circuit to the input offset voltage v_{io} which produces error voltage at the output of integrator. Hence to reduce the effect of error voltage at the output , a resistor R_F is connected across the feedback capacitor C_F. Thus R_F limits the low frequency gain and minimizes variations in the output voltage.

The gain limiting frequency of the (f_a) of the practical integrator is given by-

$$f_b = \frac{1}{2\pi . R_F . C_F}$$

The circuit acts as an integrator between f_a and f_b.

Frequency Response of basic and practical integrator:



EXPERIMENTAL PROCEDURE:

1. Refer the Pin Diagram of op-amp IC741 & assemble the basic integrator circuit as per circuit diagram on the breadboard.
2. Apply V_{CC} & V_{EE} = ±15V from DC regulated dual power supply.
3. First calculate the frequency 'fb' by using the formula stated above.
4. Now apply AC input sine wave signal of suitable amplitude & frequency≤ fb from the function generator.
5. Observe the output voltage waveform on oscilloscope.
6. Similarly, Now apply AC input sine wave signal of suitable amplitude & frequency≤ fb from the function generator.
7. Now connect resistor R_F across C_F.

8. Observe the effect of R_F on the output voltage waveform.
9. Note down the readings in the observation table.
10. Plot the input & output voltage waveform on graph paper.

OBSERVATION TABLE:

Sr. No.	Input Voltage Amplitude (Vp-p)	Input Voltage Frequency	R1	C1	R_F	Output Voltage Amplitude (Vp-p)
1						
2						
3						
4						
5						

CALCULATIONS:

RESULT:

1. For a sine wave input to an op-amp integrator produces_____ output.
2. For a square wave input to an op-amp integrator produces_____ output.

EVALUATION (BY TEACHER):

Excellent/Good/Average/Poor