EXPERIMENT NO. 2

AIM: Observe and plot the output Wave shape of Op-Amp R-C differentiating circuits, RC integrating circuits for square wave input.

THEORY:

(a) **Differentiator:** It is an op-amp circuit which performs the mathematical operation of differentiation. That is the output waveform is the derivative or differential of the input voltage. That is $V_o = -R_f\, C\, d(V_{in})/dt$. The differentiator circuit is constructed from basic inverting amplifier by replacing the input resistance R_i with capacitor C. This circuit also works as high pass filter.

Hints for Design of differentiator

Given f = 1 KHz

So T = 1/f = 1mS

Design equation is $T = 2\pi R_f C$

Let $C = 0.01\mu F$

Then $R_f = 15K\Omega$

Let $R_i = R_f/10 = 1.5K\Omega$

CIRCUIT DIAGRAM:

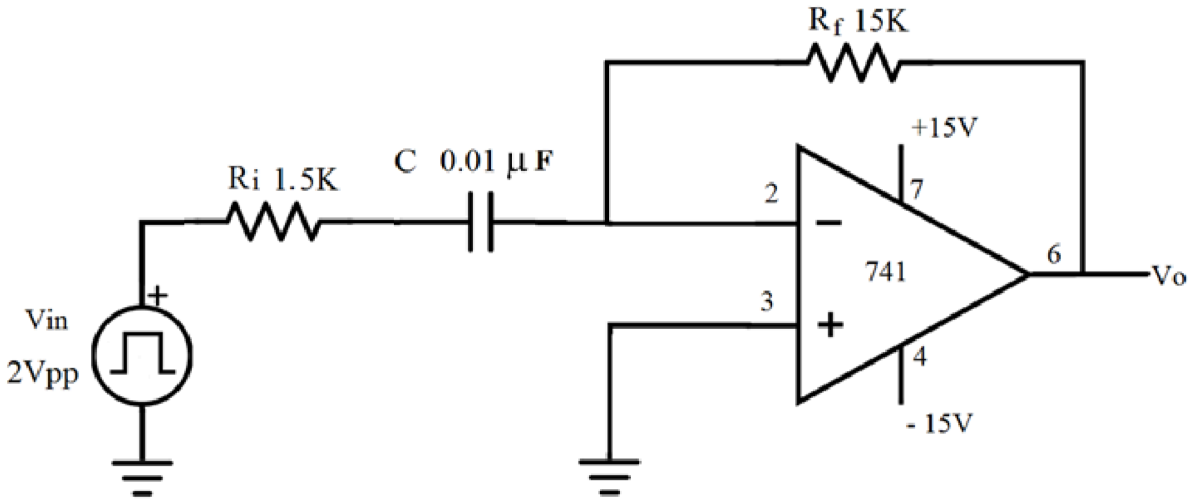

Figure 2.1: Circuit diagram of differentiator.

Observation:

Take Vin= 2Vpp, 1KHz square wave and observe output

Graph: draw the input and output waveforms on the graph.

(b) **Integrator:** It is a closed loop op-amp circuit which performs the mathematical operation of integration. That is the output waveform is the integral of the input voltage and is given by Vo = $(-1/R_fC) \int V_{in}dt$. The integrator circuit is constructed from basic inverting amplifier by replacing the feedback resistance Rf with capacitor C. This circuit also works as low pass filter.

<u>Hints for Design of integrator</u>

Given f =1 KHz

So T = 1/f = 1ms

Design equation is $T = 2\pi R_i C$

Let $C = 0.01\mu F$

Then $R_i = 15K\Omega$

Take $R_f = 10R_i = 150K\Omega$

CIRCUIT DIAGRAM:

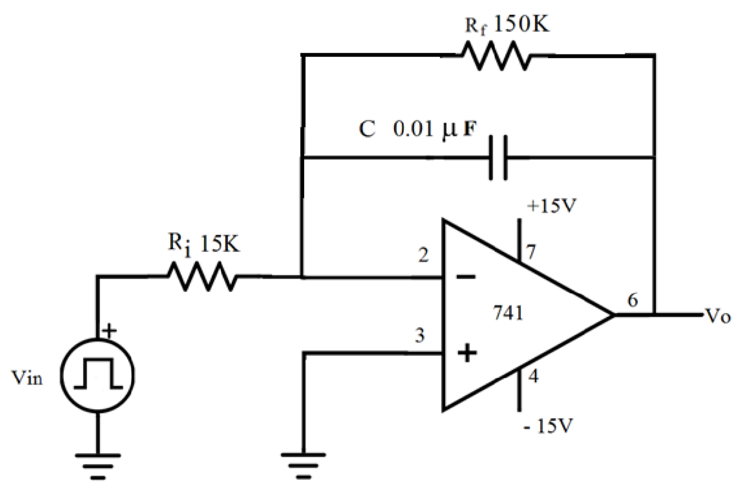

Figure 2.2: Circuit diagram of Integrator.

Observation:

Take Vin= 2Vpp, 1KHz square wave and observe output

Graph: draw the input and output waveforms on the graph.

CONCLUSION: