**Name:** Maaz Habib

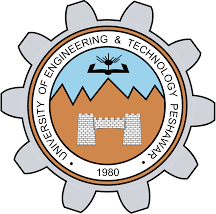
**Lab Course Title:** Circuit and System II

**Semester: 3rd Semester (2022)**

**Registration No.** 20pwcse1952

# CS Lab

**Department of Computer System Engineering**



**Submitted to: Engr. Faiz Ullah**

**University of Engineering & Technology, Peshawar Department of Computer System Engineering**

**CS II Lab # 10**

**Integrator using 741-op-amp**

**Aim:**

To design and simulate an Integrator circuit and observe output with different input waveforms.

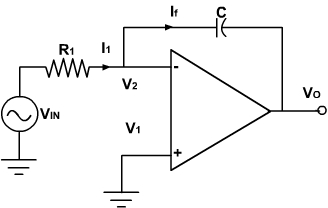
**Components required:**

Function generator, CRO, Regulated Power supply, resistor, capacitor, 741 IC, connecting wires.

# Theory:

The circuit in fig 1 is an integrator, which is also a low-pass filter with a time constant=R1C. When a voltage, Vin is firstly applied to the input of an integrating amplifier, the uncharged capacitor C has very little resistance and acts a bit like a short circuit (voltage follower circuit) giving an overall gain of less than 1, thus resulting in zero output. As the feedback capacitor C begins to charge up, its

reactance Xc decreases and the ratio of Zf/R1 increases producing an output voltage that continues to increase until the capacitor is fully charged. At this point the ratio of feedback capacitor to input resistor (Zf/R1) is infinite resulting in infinite gain and the output of the amplifier goes into saturation. (Saturation is when the output voltage of the amplifier swings heavily to one voltage supply rail or the other with no control in between). The circuit design generates triangular wave providing square wave as input to the integrator. Hence, the integrator circuit generates integral output with respect to the input waveform.



### The integrator Circuit

**Procedure:**

1. Connect the circuit as shown in the circuit diagram.
2. Give the input signal as specified.
3. Switch on the power supply.
4. Note down the outputs from the CRO
5. Draw the necessary waveforms on the graph sheet.

# Observations:

1. Observe the output waveform from CRO. A square wave will generate a triangular wave and sine wave will generate a cosine wave.
2. Measure the frequency and the voltage of the output waveform in the
3. Compare the calculated output voltage with the experimentally observed voltage from the output waveform.
4. Observe outputs of the integrator circuit using different input waveforms.

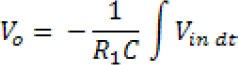
# Observations:

1. Give any input voltage.
2. Give frequency.
3. Rf = 22Kohm.
4. R1 = 10Kohm.
5. Cf = 0.1 ninoF
6. DC voltage at 7 pin of 741 is 15 V and at 4 pin is -15.

# Calculations:

If input Vin = 2.09 sin (2\*50\*t)

Output of the integrator will be equal to



### Thus,





Hence theoretically, output voltage should be 4.72V and phase difference between input outputs should be 90°.

Experimentally phase difference observed is about 92 and output voltage 4.31V.

# Result:

The integrator circuit design output waveforms have been studied.

# Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vin** | **Frequency** | **V0 Theo.** | **V0 Exp.** | **Error** |
| 1V | 1KHz | 0.15cos2π\*103t | 0.5V | 5.66 % |
| 2V | 1KHz | 0.318cos2π\*103t | 0.13V | 2.5 % |
| 1V | 2KHz | 0.07cos4π\*103t | 0.08 | 14.2 % |
| 2V | 1.5KHz | 0.212cos3π\*103t | 0.21V | 0.94 % |
| 2.5V | 2.5KHz | 0.159cos5π\*103t | 0.16V | 0.6 % |

## **Circuit diagram:**

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