Global Academy of Technology

Department Of Electronics and Communication Engineering

Report On

LIC

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TITLE: VOLTAGE CONTROLLED OSCILLATOR

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AIM:

To design and construct voltage controlled oscillator. And produce square , triangle and sine waves as output.

COMPONENTS REQUIRED:

COMPONENTS	SPECIFICATIONS	QUANTITY
1. NE555 TIMER	4.5V – 15V, 200Ma,600mW	1 No.
2. uA IC 741 opamp	± 12v	1No.
3. Resistors	33k,1k,10k,3k,20k,POT 1k	Each 2 Nos.
4. Capacitors	10uF,100uF	Each 3 Nos.

EQIUPMENTS REQUIRED:

Dual Power supply 0 -30v 2A ,(+5V) , Dual channel CRO ,Patch cords/ wires , Breadboard.

Voltage Controlled Oscillator

A **voltage-controlled oscillator** (**VCO**) is an electronic oscillator whose oscillation frequency is controlled by a voltage input. The applied input voltage determines the instantaneous oscillation frequency. Consequently, a VCO can be used for frequency modulation (FM) or phase modulation (PM) by applying a modulating signal to the control input. A VCO is also an integral part of a phase-locked loop.

A **voltage-to-frequency converter** (**VFC**) is a special type of VCO designed to be very linear in frequency control over a wide range of input control voltages.

Types of VCO's

VCOs can be generally categorized into two groups based on the type of waveform produced.

- ***Linear* or *harmonic oscillators*** generate a sinusoidal waveform. Harmonic oscillators in electronics usually consist of a resonator with an amplifier that replaces the resonator losses (to prevent the amplitude from decaying) and isolates the resonator from the output (so the load does not affect the resonator). Some examples of harmonic oscillators are LC oscillators and crystal oscillators. In a voltage-controlled oscillator, a voltage input controls the resonant frequency. A varactor diode's capacitance is controlled by the voltage across the diode. Varactor is used to change the capacitance (and hence the frequency) of an LC tank. A varactor can also change loading on a crystal resonator and pull its resonant frequency.
- ***Relaxation oscillators*** can generate a sawtooth or triangular waveform. They are commonly used in integrated circuits (ICs). They can provide a wide range of operational frequencies with a minimal number of external components.

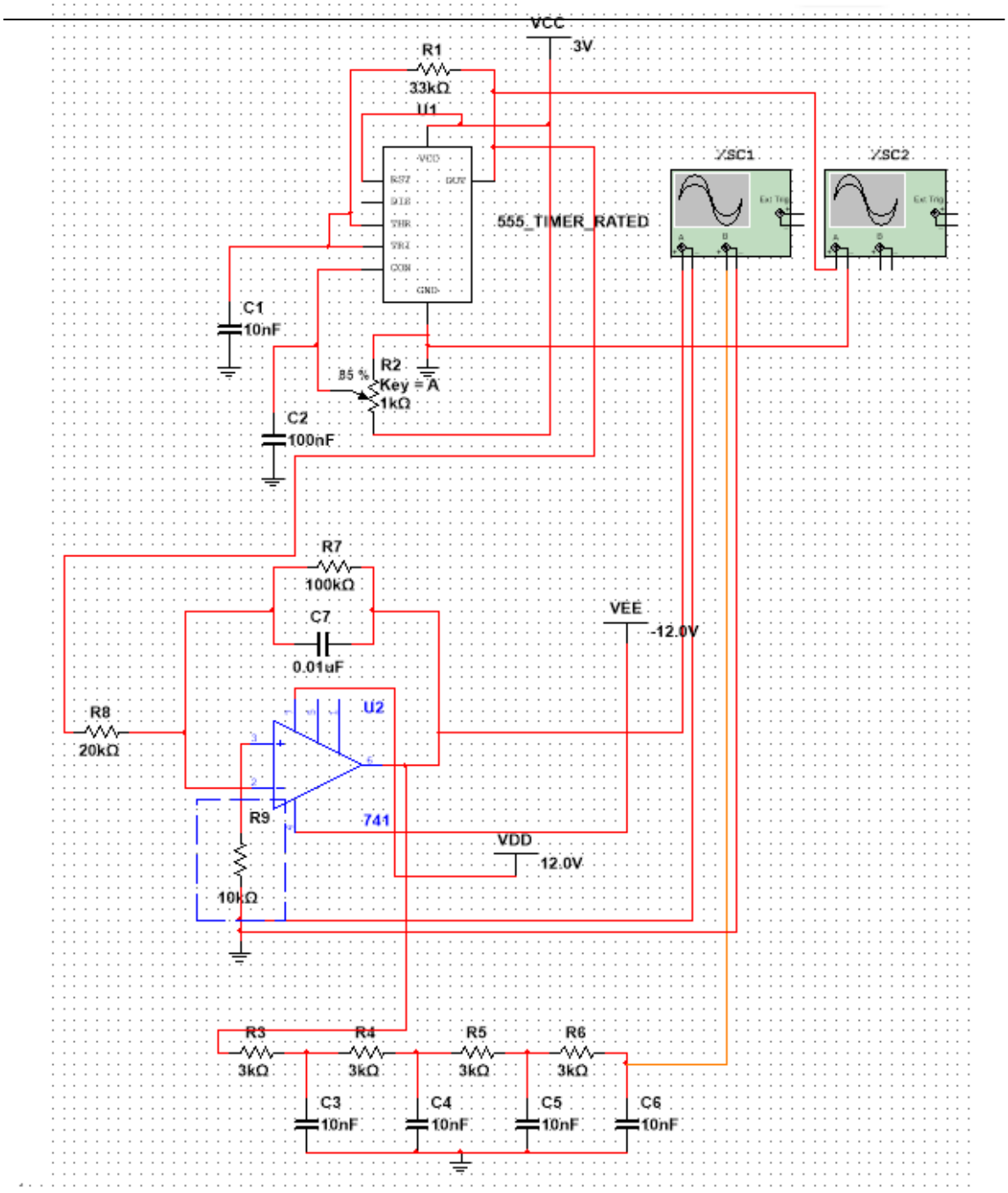
Working Principle

Here in our project we have used relaxation voltage controlled oscillator where the output of this relaxation VCO which is square wave.

For every change of voltage using the potentiometer gives a corresponding change in the pulse width of the square wave, this intern changes the time period of the square wave making the frequency vary accordingly.

The VCO works as an astable multivibrator where the refference voltage is varied but not kept constant as in case of the astable multivibrator,and so it corresponds to a proportional change in the time period making the frequency varry

Circuit Diagram



Circuit Design

VCO(*produces square wave*)

1. Pin number 1 of ic 555 is an active low pin or the ground pin and so pin number 1 is connected directly to ground.
2. Pin number 8 is a power supply pin and is connected to Vcc of 5 Volts.
3. Since we are configuring circuit as astable multi vibrator wherein both T-on and T-off are both unstable, we use the trigger pin and so pin number 2 (trigger pin) is connected to ground via capacitor which is a part of the timer circuit.
4. Pin number 5 being the voltage control pin is used to vary the voltage via a potentiometer in order to obtain variation in frequency, so the variable end of potentiometer is connected to pin number 5, one of the ends is connected to Vcc and the other to ground. A capacitor of 100nF is connected to this pin in order to remove the noise input to the circuit.
5. Pin number 6 being the threshold pin is connected to a 33K ohm resistor, when the voltage increases above 2/3 of Vcc to threshold pin then then output goes low
6. The output is based on the charging and discharging of the capacitor **C** connected to pin 2 >>when the capacitor charges from 1/3 to 2/3 of Vcc the output is high which gives T-on
   >>when the capacitor discharges from 2/3 to 1/3 of Vcc the output is low which gives T-off

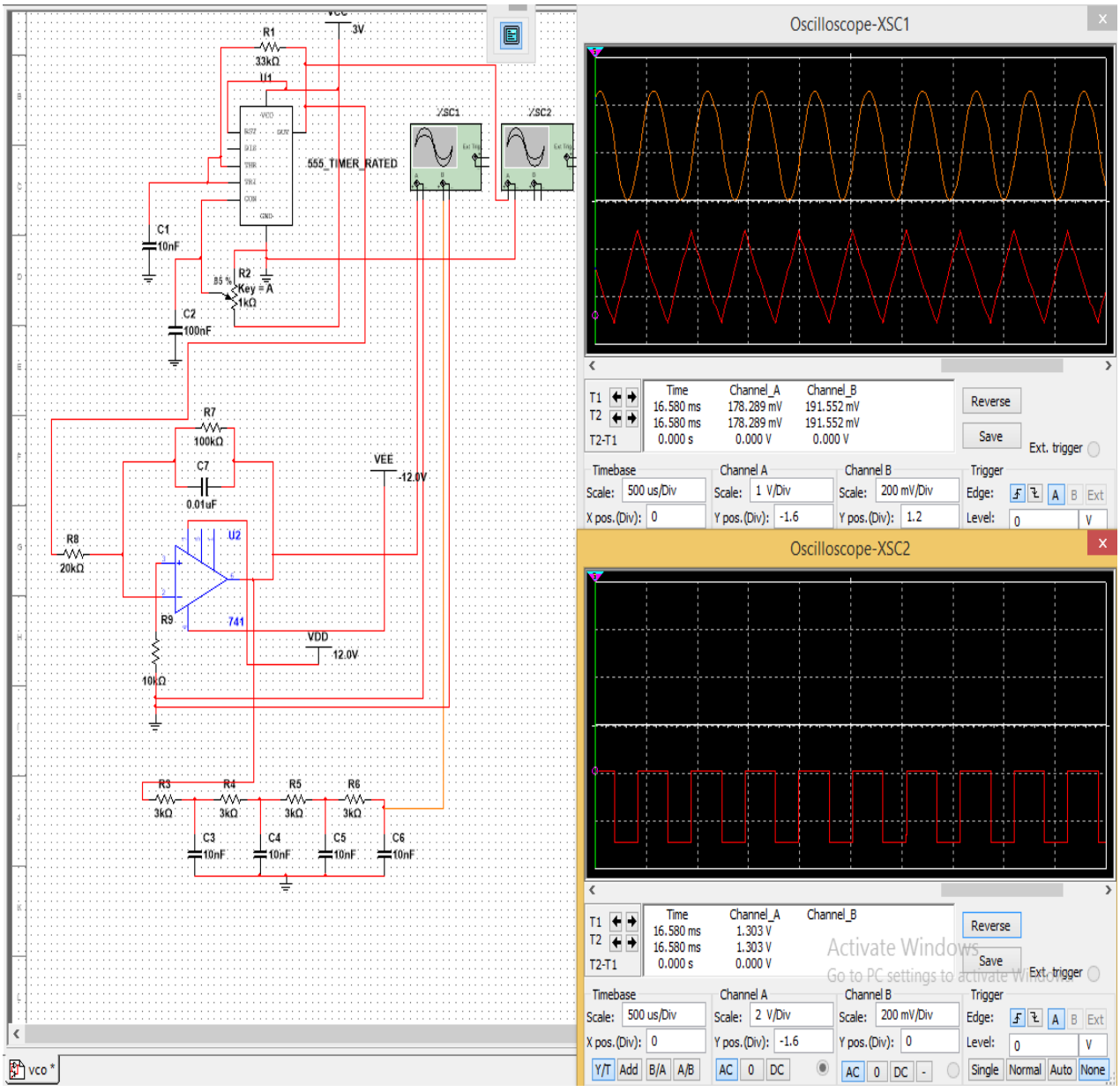
To produce triangle wave

The square wave output is now passed through an integrator designed with a frequency of 5K Hz
As the range of the square wave VCO is from 1Hz to 4.4K Hz in order to get equivalent triangular wave

To produce a sine wave
The triangle wave obtained from the output of the integrator is passed through 3 RC lowpass sections, these three sections smoothens the tip of the triangular wave by slow discharging of the capacitor along with the resistor to give a smooth peak

Now the vco is able to produce an efficient frequency varying output of ***SQUARE WAVE,TRIANGLE WAVE*** *and* ***SINE WAVE*** *in accordance to the change of the control voltage applied*

Simulated Output Waveform



Output Tabular column

Voltage	Frequency
1V	
2V	
3V	
4V	

RESULT:

Voltage controlled oscillator is designed and constructed. And obtained square, triangle and sine waves as output using integrator and converters.

Acknowledgement

We Amogh R, Gowrav S, Gokul Sai R and Harish Nayaka are thankful to you Sushma mam for giving us an opportunity to showcase our project on VCO and its application as a function generator and understand the concept to its full extent.
Thank you, Mam.