**BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY**


**Department of Electrical and Electronic Engineering**

**Course No. :** EEE208(S) **Section :** A1

**Name of the Project:** DESIGNING OF A SIMPLE FUNCTION GENERATOR USING OP AMP

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**Group:** 08
**Level :** 02
**Term :** 02

**OBJECTIVES**

i) Transforming AC line voltage of single frequency to AC voltage of variable frequency using an oscillator.

ii) Producing different wave (sine, rectangular, triangular) shape using different combinations of operational amplifiers.

**THEORY**

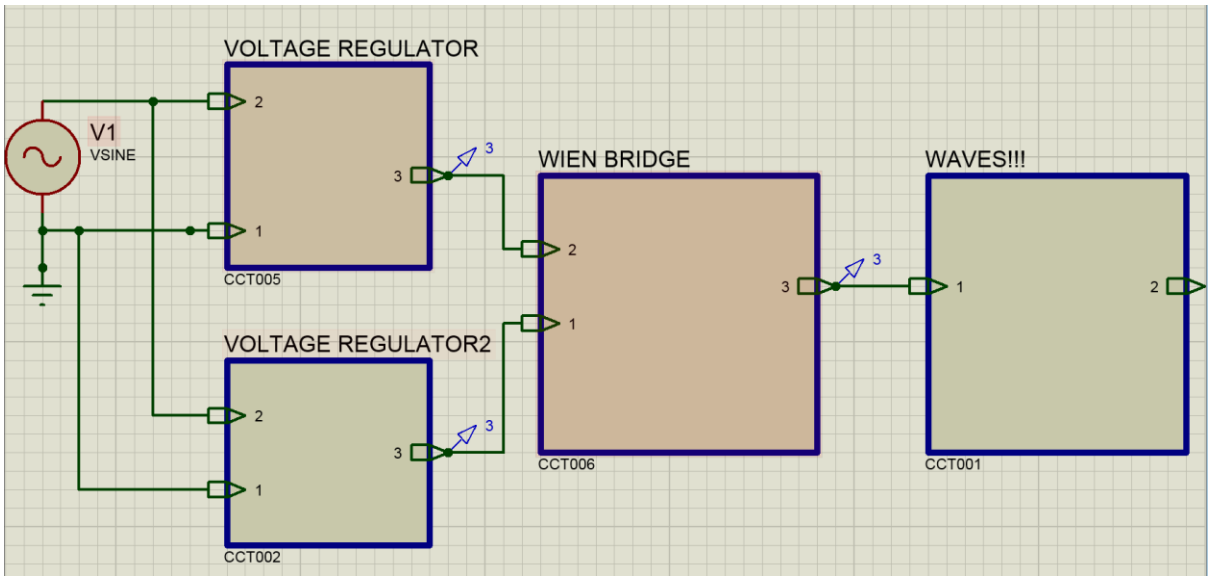
Function generator is widely used a common equipment of any electrical laboratory which could produce different type of electrical waveforms with variety range of frequencies. As our project proposal, we intended to design a simple model of a function generator using software simulation.

As an input to our function generator, 220V 50Hz AC line voltage is connected through two voltage regulators. They are providing dc power supply to the wien bridge oscillator which is used to vary the frequency of the auto generated and self-fed AC signal of the oscillator.

After fixing the frequency, different signal shape was produced through multiplier, comparator and integrator.

**DIAGRAM**

Our project was designed in proteus and the simple model has four separate portions:




i) Voltage Regulator for positive dc voltage supply

ii) Voltage Regulator for negative dc voltage supply

iii) Wien Bridge Oscillator

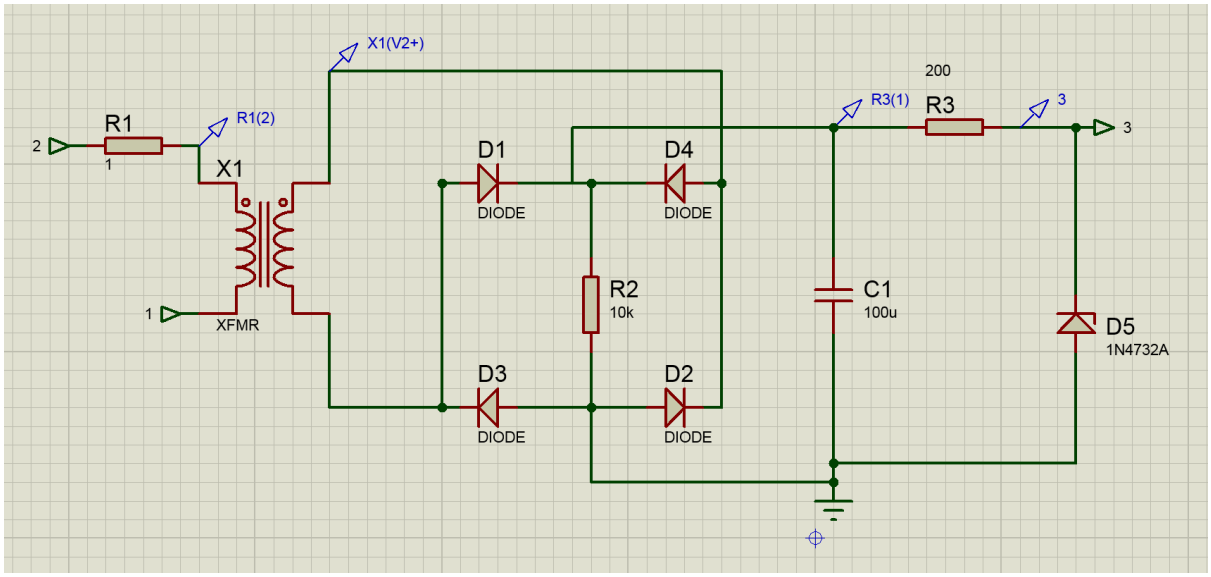
iv) Different waveshapes

Description of these segments are provided with necessary figures and mathematical calculation below.

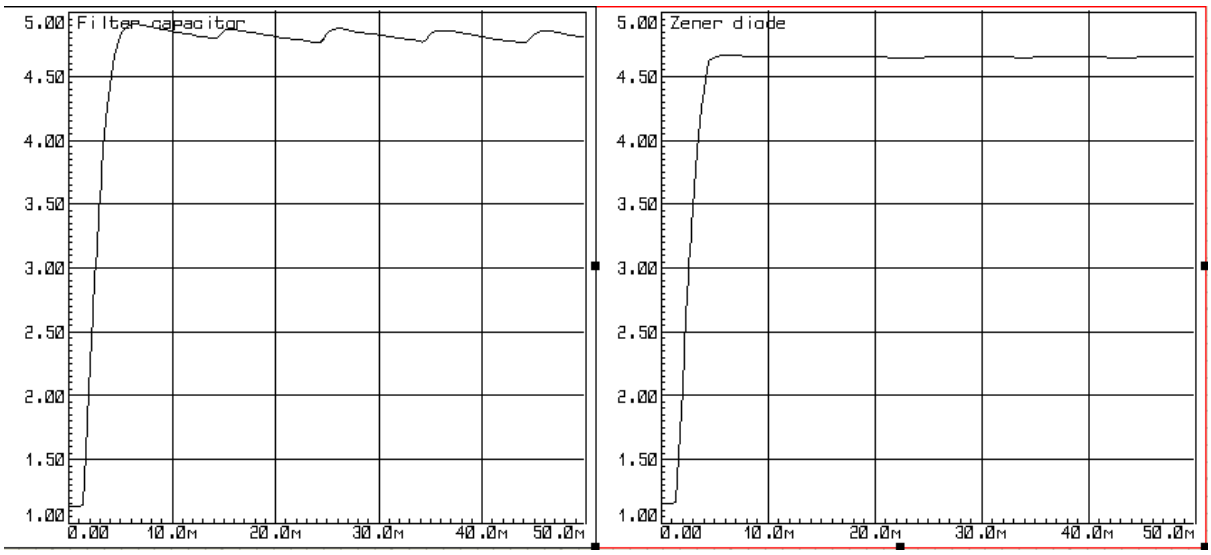
**DESCRIPTION**

**VOLTAGE REGULATOR FOR POSITIVE DC VOLTAGE SUPPLY**

Voltage regulator was used to convert ac signal into dc voltage power supply for the oscillator.




Through input 2, ac line voltage of 220V 50Hz supply was provided. A step down transformer of 35:1 turn ratio was used to step down the voltage to 220/35 = 6.3V amplitude. A full wave bridge rectifier was used to rectify the voltage with amplitude of 6.3-(2*0.7) = 4.9 V approximately. As a filter capacitor is added, this considerably reduced the pulsating nature of the unipolar output of the rectifier. Later a Zener diode of 4.7V 53mA rating was used to reduce the variation further. Output plot was like this:

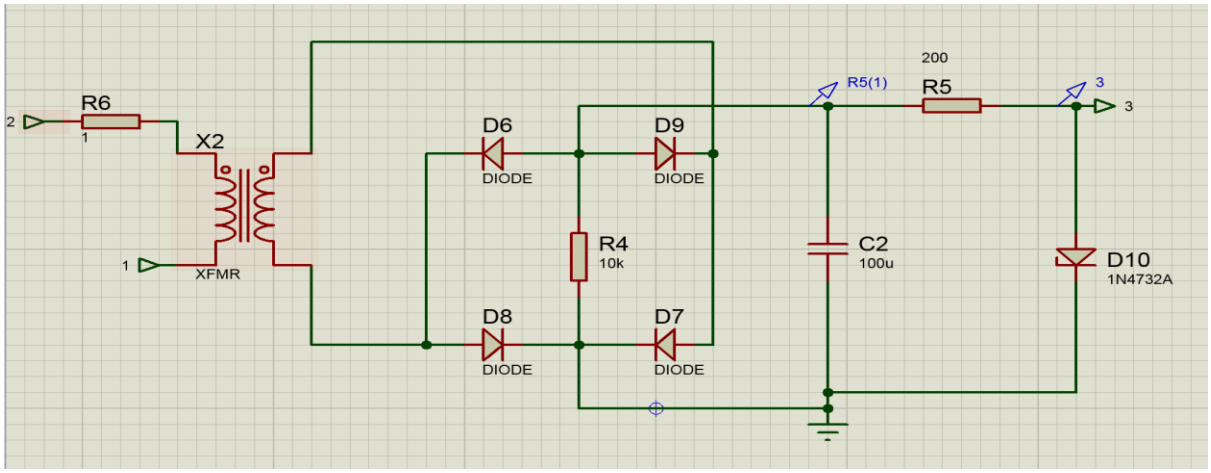


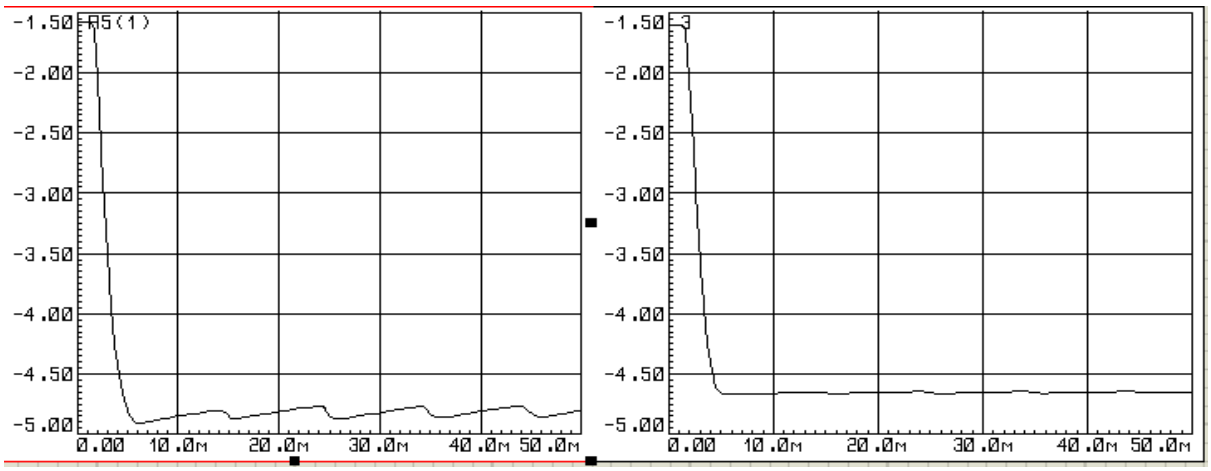

As f = 50Hz , C = 100uF , R = 10k ohm and peak voltage, Vp = 4.9V

Ripple voltage, Vr will be $\frac{Vp}{2fCR} = 0.05\ V$ . Thus the amplitude will vary between 4.85 to 4.9 V

As the Zener diode's voltage rating is 4.7V , output voltage will have an almost constant 4.7 V dc value.

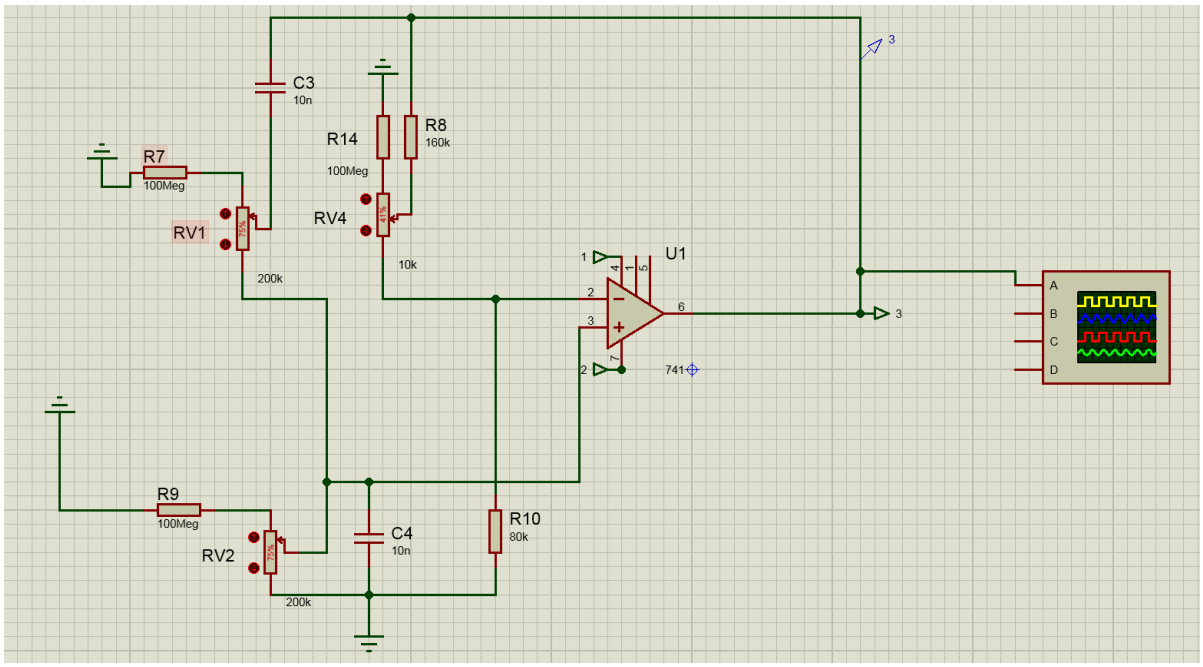
For negative dc supply, we just interchange the position of diode.



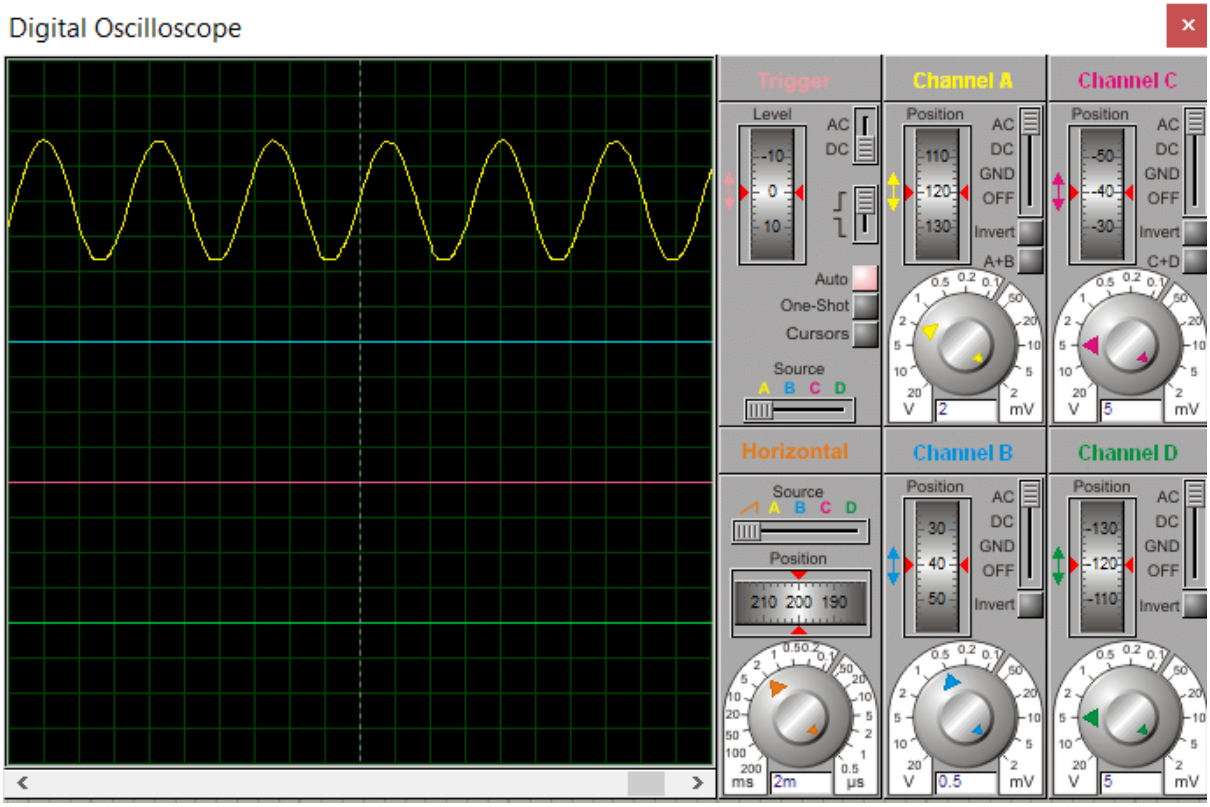

**WIEN BRIDGE OSCILLATOR:**

We used a simple wien bridge oscillator to vary the frequency of the ac sinusoidal signal that is produced by the oscillator.



For wien bridge oscillator, frequency = $\frac{1}{2\pi RC}$ Thus by varying the value of RV1 AND RV2 200k potentiometers. But as we know to get a stable output plot R10 should be half of R8 and as we use R10= 80k ohm ; thus R8 will be 160k ohm. But as we are using potentiometer here, some current will pass towards the ground. To limit the current 100 mega ohm is connected in that direction. Also due to this reason to ensure stable graph later, an extra potentiometer RV4 is inserted which can be varied to tune the signal.

For example if we want to generate 150 hz, R will be $\frac{1}{2\pi*150*C}$ here C is 10 nF. Thus value of R is 106.103 k ohm. As we are using 200k POT, 106k ohm will be found for 51% of the value. (0.52*200k=105k ohm) Corresponding plot is



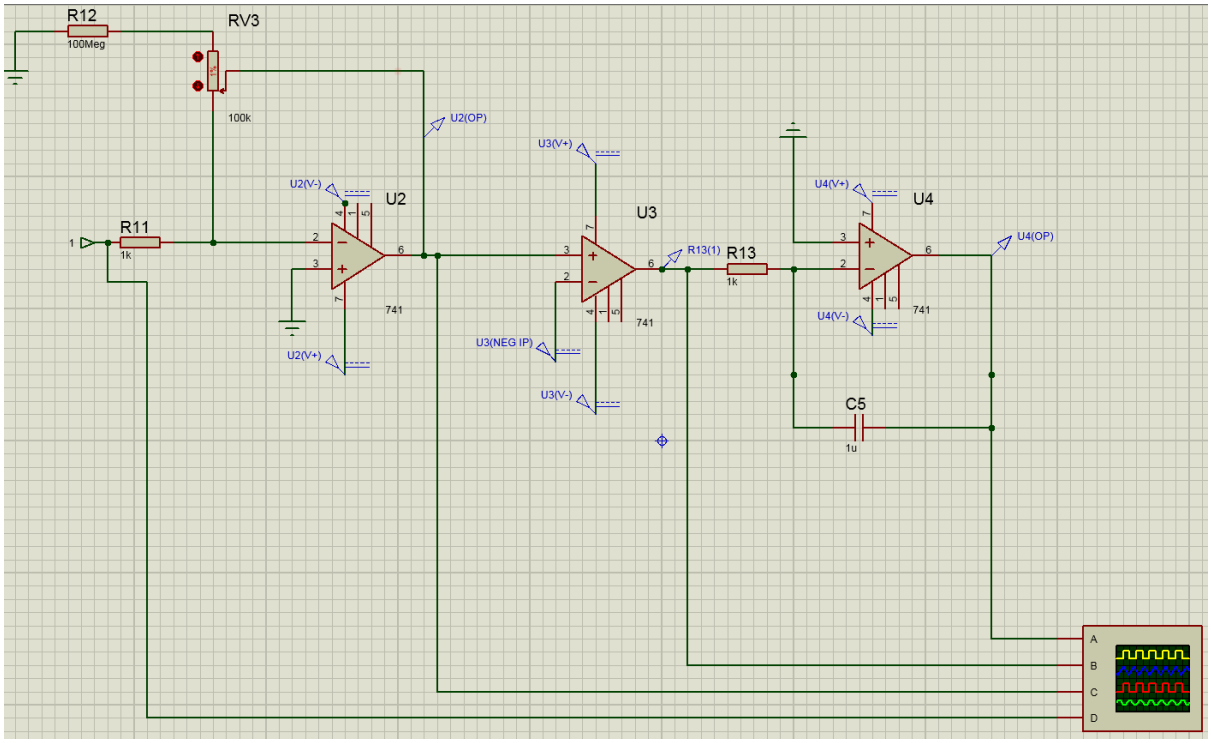

Here in the oscilloscope each signal passes between 3 to 3.5 reading in the time axis. Thus considering 3.25 reading and for each reading 2mS, time period will be (3.25*2)mS = 6.5mS. Thus frequency, f = $\frac{1}{6.5m}$ = 153.85 Hz ; which is almost 150 Hz.

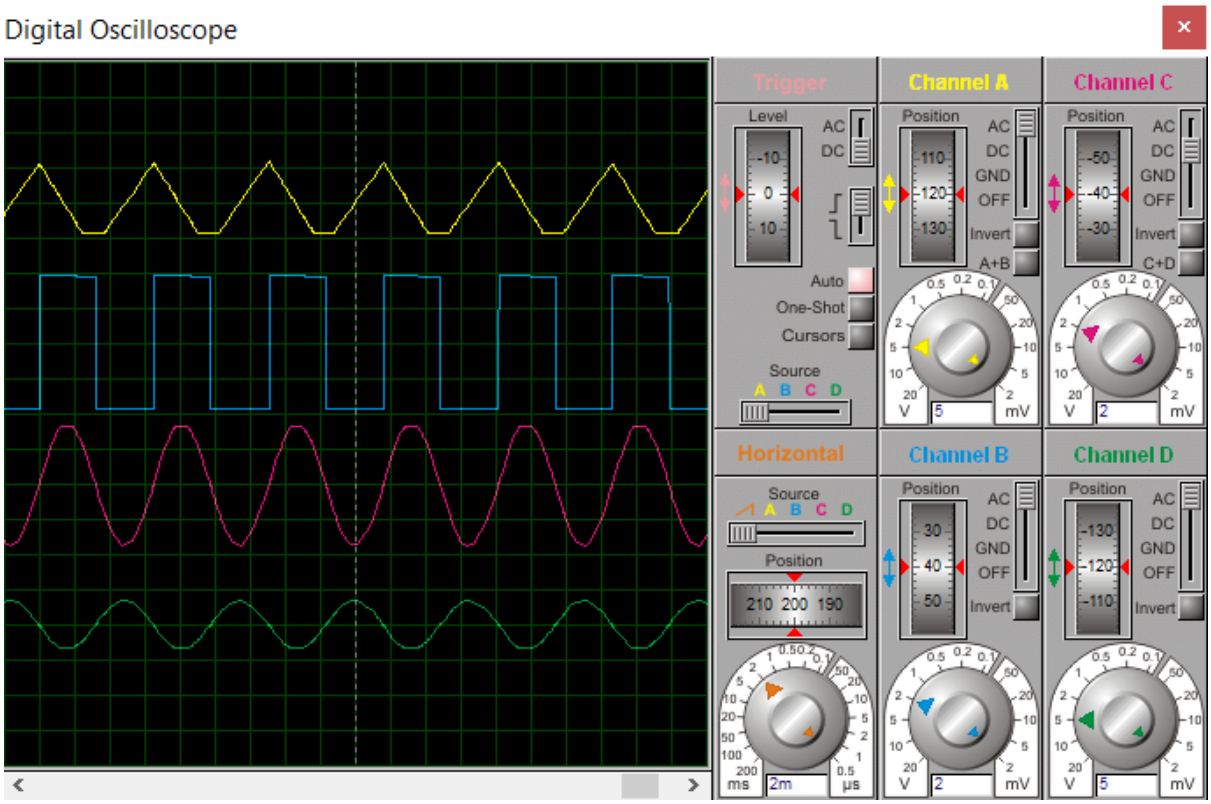
**DIFFERENT WAVESHAPE:**

To display the wave we use an inverting multiplier to magnify the signal, a comparator to generate square wave and an integrator to generate triangular shape.

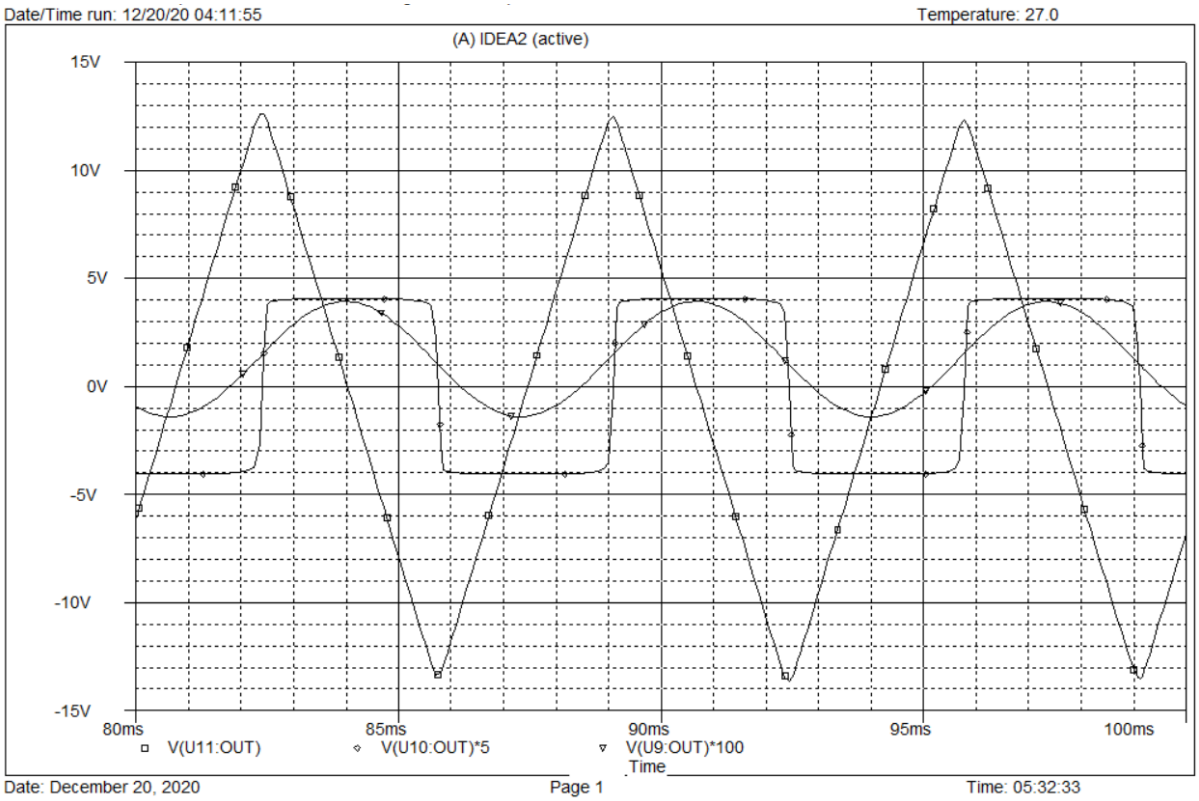
As we use a 100k POT for the multiplier, magnification should be done carefully to avoid clipping.

Corresponding diagram and oscilloscope view is given here:




Here the triangular output has some distortion at the end of the signal. Possible reason could be the square wave was slightly asymmetric as the comparator negative terminal voltage was grounded. If the comparator negative terminal voltage was at the mid-point, distortion-less triangular output will be created. In pspice by providing 12.5 mV, we get this output:




Here the triangular wave have much smaller distortion.

**CONCLUSION:**

Our target was to design a simple function generator which can be run through power supply line connection, the frequency of the ac signal can be varied and different waveshape can be produced. Though for the inverter, comparator and integrator, we use dc bias to avoid complexities, those can be achieved through the connections with the voltage regulator too. Also by tuning comparator's negative terminal voltage, we can reduce the distortion too which was shown in the pspice.