NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

AEC-II PROJECT REPORT

9)Design and implement single phase Half-bridge Sinusoidal PWM inverter using MOSFET subject to following conditions:

1. **Vout=9V, 50Hz, Fs=18kHz. Assume the load to be the secondary terminals of 9-0-9 transformer (IL=120mA at the primary).**
2. **Design the PWM circuit (using 555 timer) to drive the above converter.**

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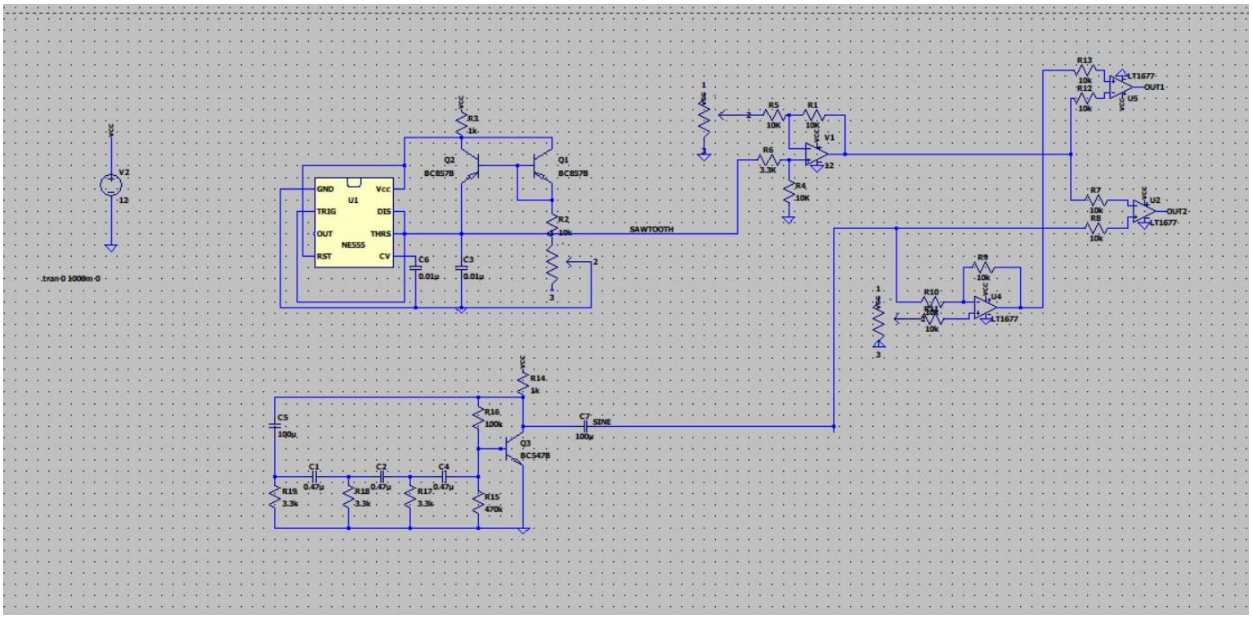
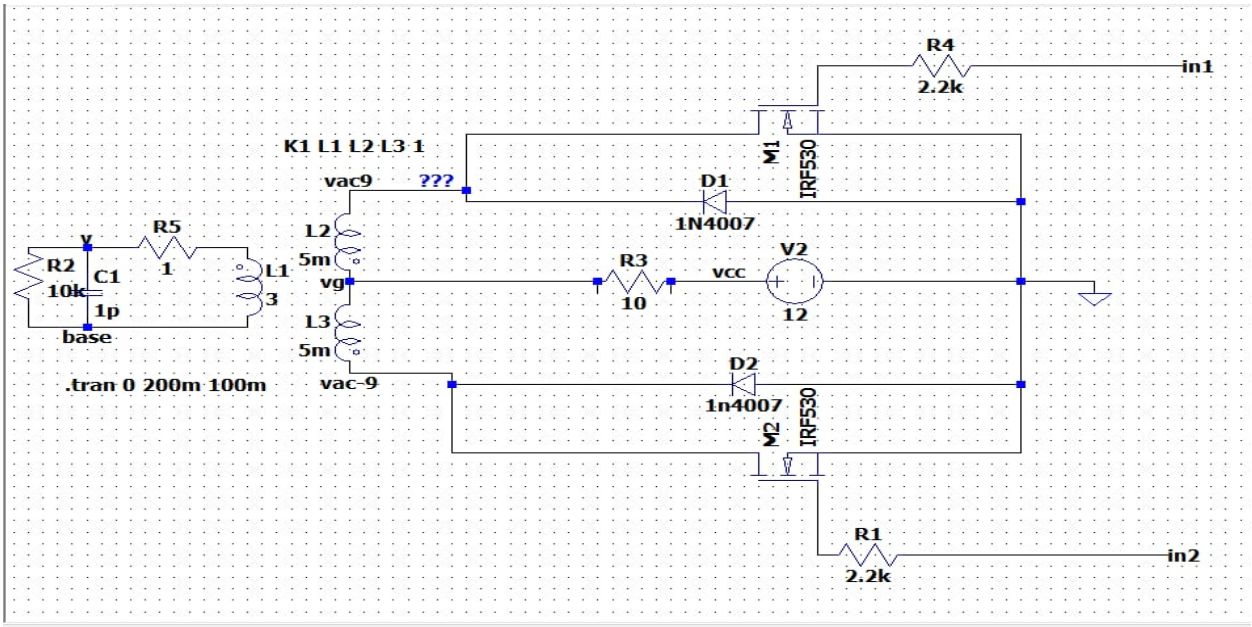
CIRCUIT DIAGRAM:



PWM Circuit



Inverter Circuit

CIRCUIT DESIGN:

SPECIFICATIONS:

- **RC Phase shift:**

  In RC phase shift oscillator, sine wave is generated.

  Frequency of circuit (sine) = f = $\frac{1}{(2\pi RC\sqrt{2N})}$

  Where, N=No. of RC Pairs

  R=resistor value

  C=capacitor value

  To obtain 50Hz,

  Assume C=0.47μF

  50=$\frac{1}{2\pi R(0.47\mu)\sqrt{2N}}$

  R=$\frac{1}{(2\pi 500.47\mu\sqrt{2})}$

  R=2.764kΩ

But due to the tolerance in the components and by applying the concept of trial and error we get, 'R=2.2kΩ' (Practically).

- **Sawtooth using 555 timer:**

  f≈ $\frac{3}{RC}$

  To obtain f=18kHz and C=0.01μF

  R≈ $\frac{3}{fe}$

  R≈ $\frac{3}{18k*0.01\mu}$**=16.66kΩ**

Frequency was changing due to the cascading of circuits. So we connected (10k+10k(pot)) = R, to change the frequency as required.

R=10k + 10k(potentiometer)

- **<u>Difference Amplifier</u>:**

Vout= $\left[1+\frac{Rf}{R1}\right]\left[\frac{R3Vin1}{R2+R3}+\frac{R2Vin2}{R2+R3}\right]-\frac{Rf}{R1}Vin2$

To obtain gain of 1.5 for Vin1:

Vout = 1.5Vin1 - Vin2

$\frac{Rf}{R1}=1$

Rf = R1

(1+1) $\left(\frac{Vin1R3}{R2+R3}\right)$**= 1.5 Vin1**

2R3 = 1.5R2 + 1.5R3

0.5R3 = 1.5R2

R3 = 3R2

Assume,

R1=10kΩ, Rf=10kΩ, R3=12kΩ

R2 = $\frac{R2}{3}$ **= 3.33kΩ**

- **Inverting Amplifier:**

  Assume Rf=R1=R2=10kΩ

  Vout = - $\frac{Rf}{R1}Vin1$

  Vout = - Vin1

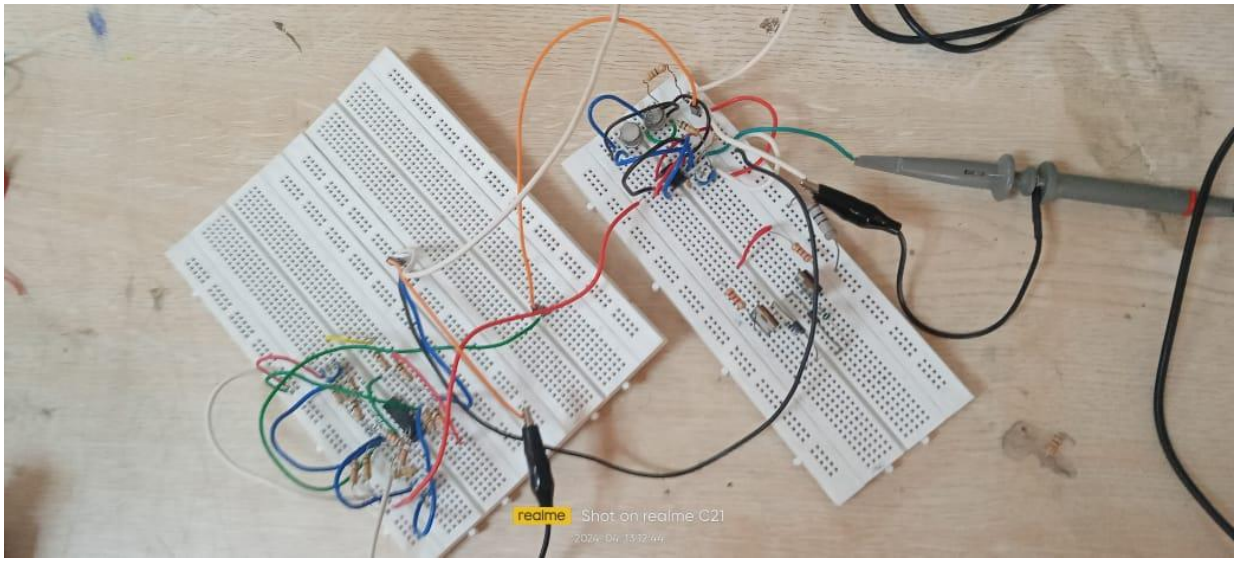
  - **Using Op-amp as an inverting amplifier.**
  - **To obtain inverted sine wave of same frequency and amplitude.**

EXPECTED RESULT:

The circuit should must be able to produce:

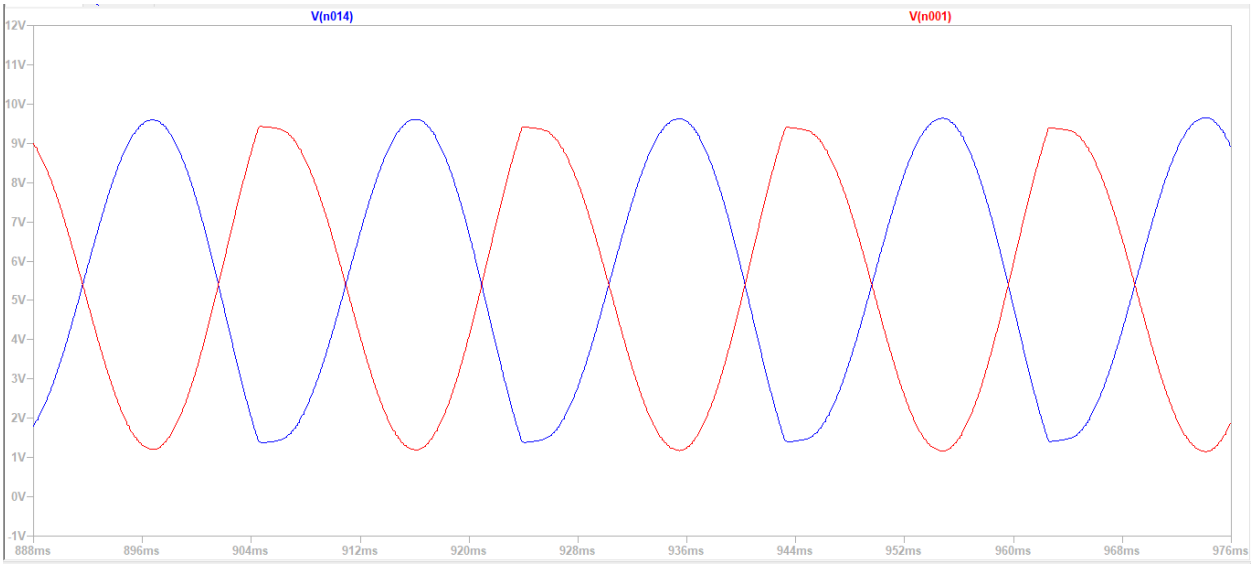
- **18kHz frequency modulated pulse from PWM**
- **9V, 50Hz input to the secondary terminals of a 9-0-9 transformer.**

HARDWARE CIRCUIT:

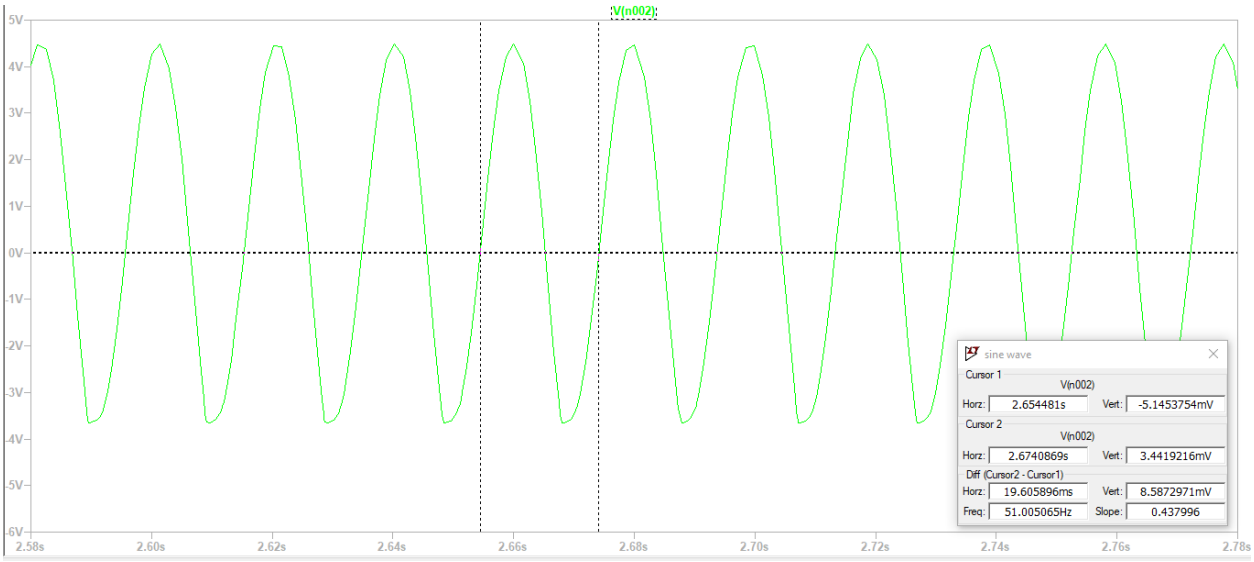


SIMULATION RESULTS:

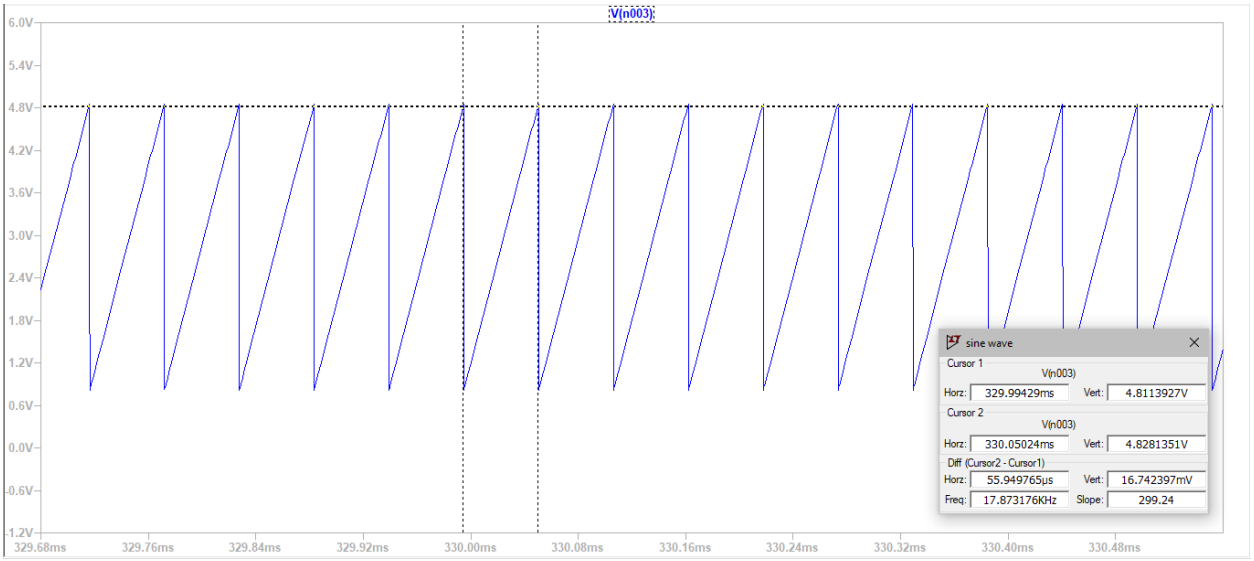
Inverting Amplifier:



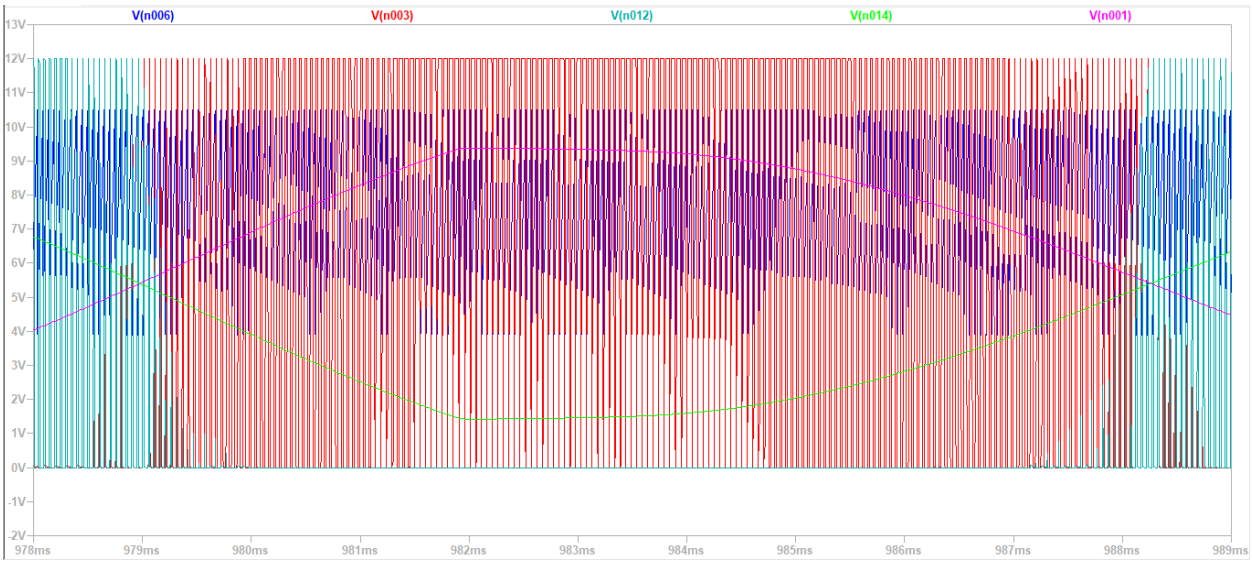
Sine wave:



Sawtooth:

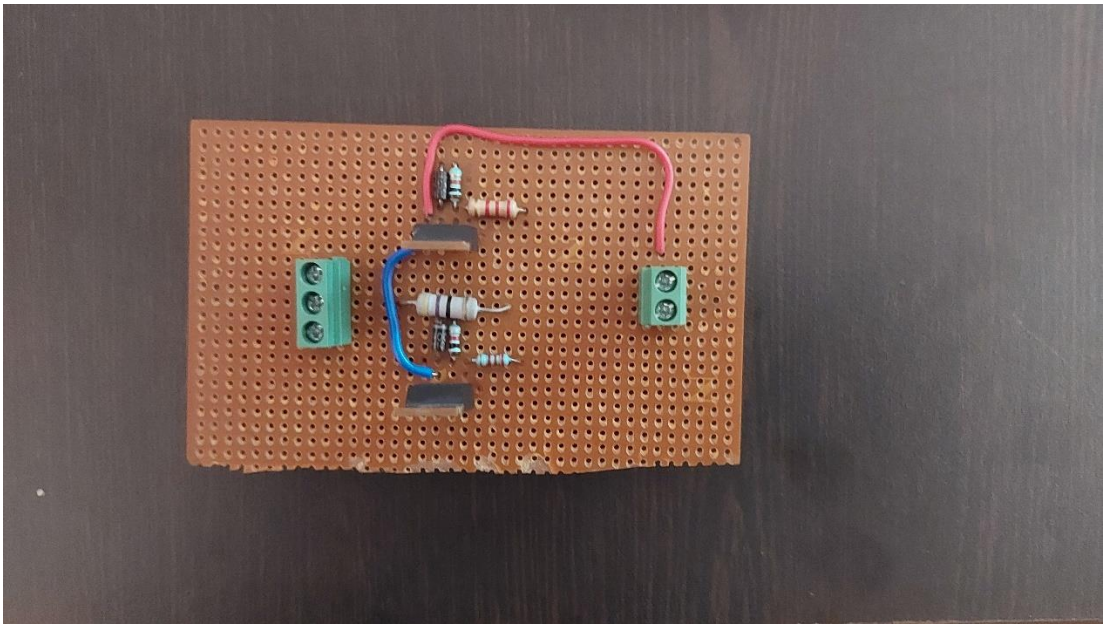


Comparator:

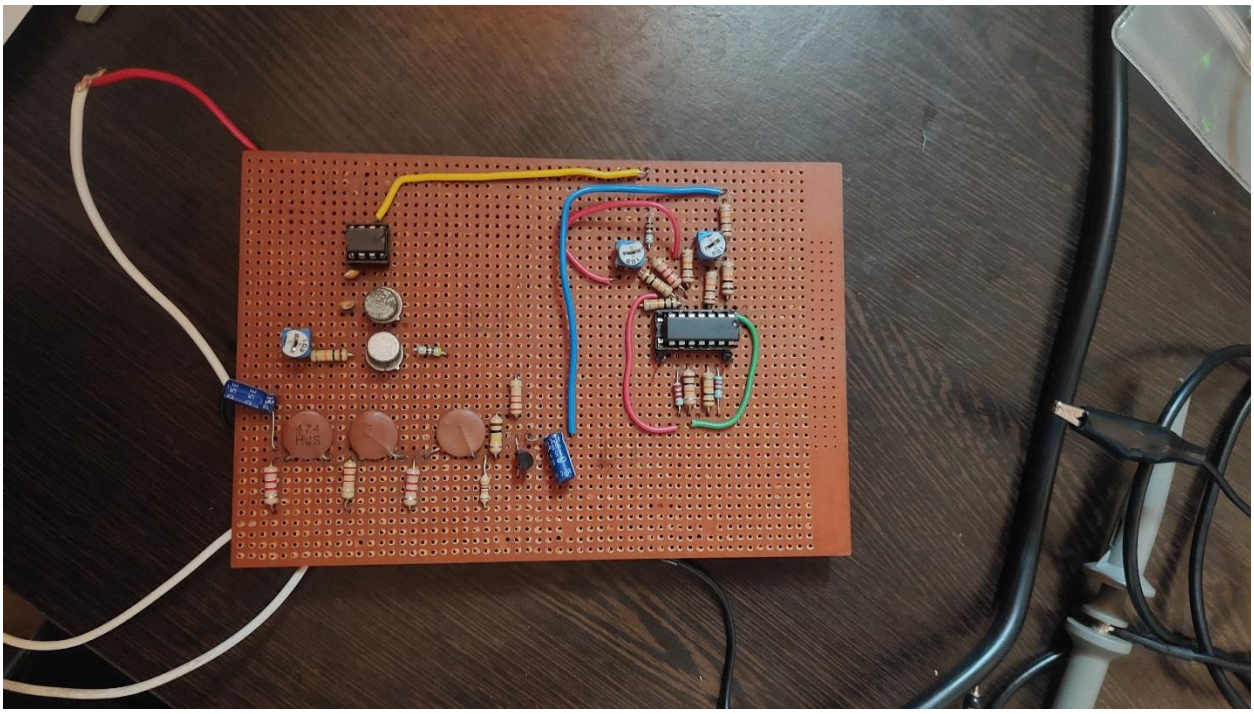


Hardware model:

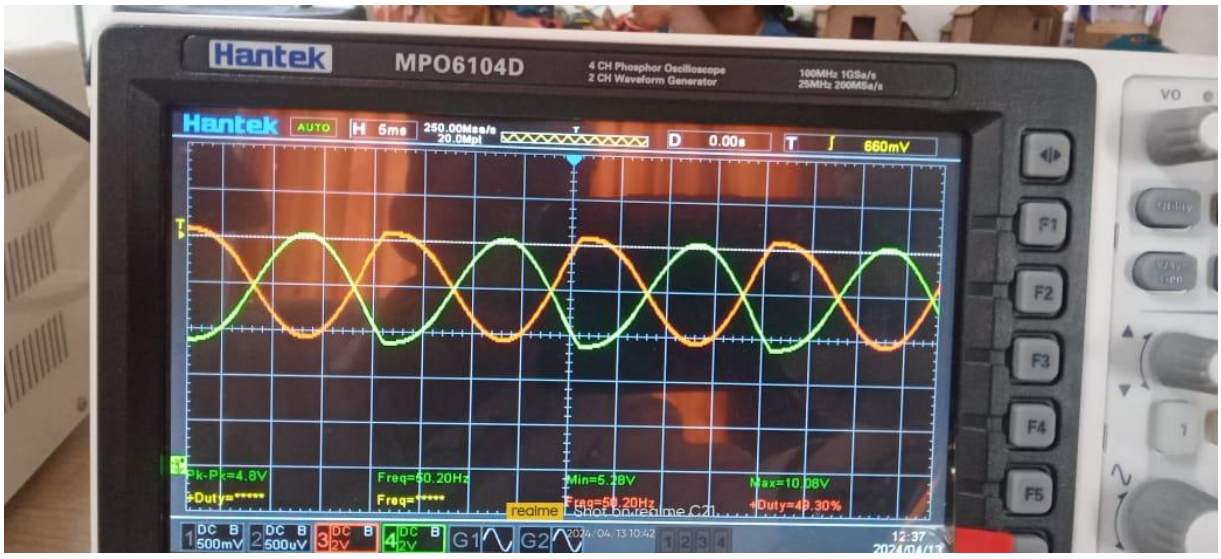
Inverter:

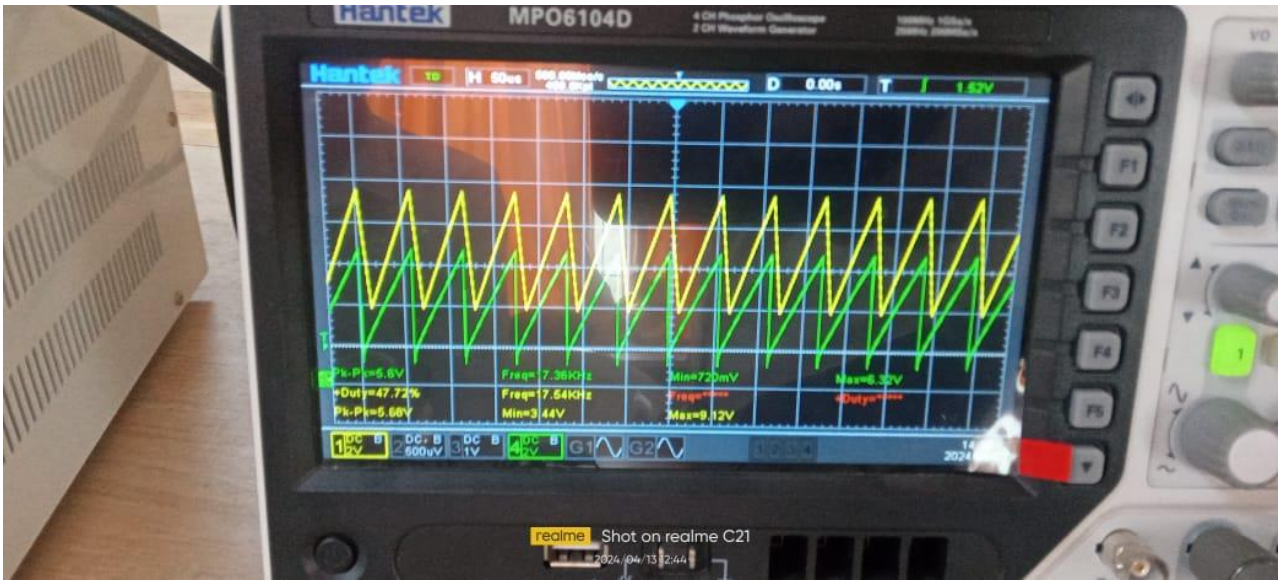


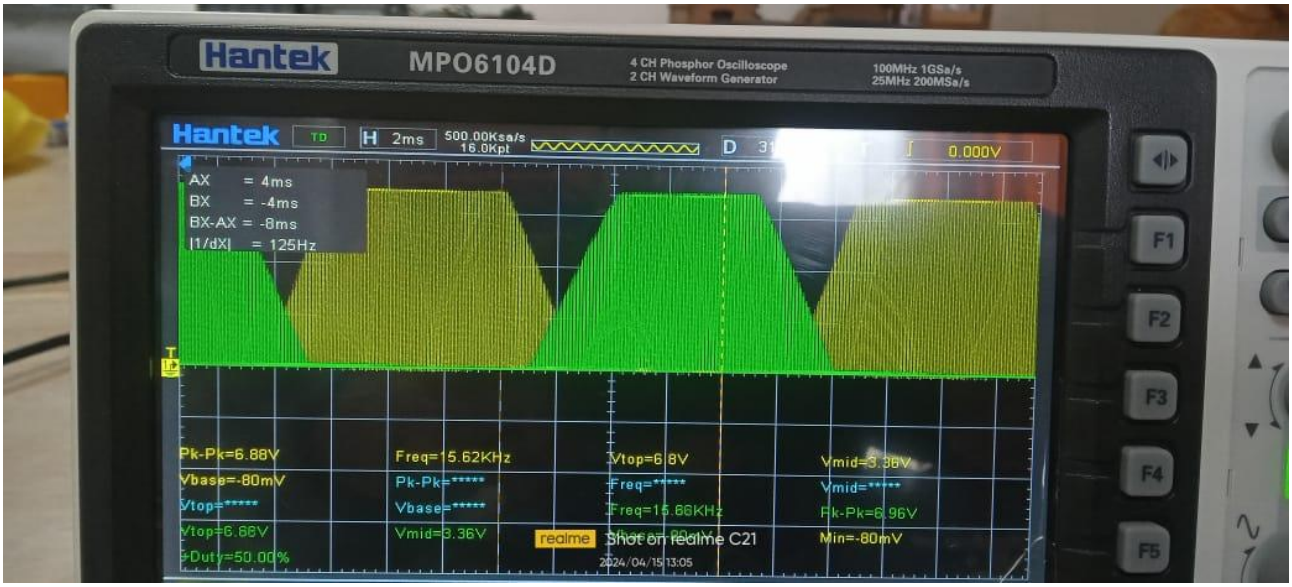
PWM Circuit:



Hardware output:




Hantek
MPO6104D
realme Shot on realme C21


Hantek
MPO6104D
4 CH Phosphor Oscilloscope
2 CH Waveform Generator
100MHz 1GSa/s
25MHz 200MSa/s
AX = 4ms
BX = -4ms
BX-AX = -8ms
|1/dX| = 125Hz
Pk-Pk=6.88V
Vbase=-80mV
Vtop=*****
Vtop=6.88V
+Duty=50.00%
Freq=15.62KHz
Pk-Pk=*****
Vbase=*****
Vmid=3.36V
Vtop=6.8V
Freq=*****
Freq=15.66KHz
Vmid=3.36V
Vmid=*****
Pk-Pk=6.96V
Min=-80mV
realme Shot on realme C21

RESULT:

The generated output waveform closely matches the desired output.