Converter Design_Ass6

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Group Assignment – 06

Task 1

Index – AA1505
xyz

consider 0 as 5
x, y, z = 5

$V_{in} = \left(Y + Z/_{10}\right) V \pm 10\%$.

$V_{in} = \left(5 + \frac{5}{10}\right) \pm 10\% \longrightarrow V_{in}(max) = 6.05V$
$V_{in}(min) = 4.95V$

$= 5.5 \pm 10\%$.

Load current $= 50 \times Z$ mA
$= 250$ mA

$V_{out} = 16.5 \pm 10\%$.

Switching freq = 100 kHz.

$\frac{T_{ON}}{T_{off}} = \frac{V_{out} + V_F - V_{In(min)}}{V_{in(min)} - V_{sat}} = \frac{16.5 + 0.4 - 4.95}{4.95 - 0.5} = \frac{11.95}{4.90} = 2.43$ //

$T_{ON} + T_{OFF} = \frac{1}{f} = \frac{1}{100kHz} = 10\mu s$.

$T_{OFF} = \left(\frac{T_{ON} + T_{OFF}}{\left(\frac{T_{ON}}{T_{off}}\right) + 1}\right) = \frac{10\mu s}{2.43 + 1} = 2.91\mu s$

$T_{ON} = \left(T_{ON} + T_{OFF}\right) - T_{OFF} = 10\mu s - 2.91\mu s = 7.09\mu s$

$C_T = 4.0 \times 10^{-5} \times T_{ON} = 4 \times 10^{-5} \times 7.09 \mu s = \underline{283 PF}$

$I_{peak} = 2 \times I_{out max} \left[\frac{T_{ON}}{T_{off}} + 1 \right] = 2 \times 0.25 \left[2.43 + 1 \right] = \underline{1.715 A}$

$R_{sc} = \frac{0.3}{I_p} = \frac{0.3}{1.715} = 0.174 \Omega.$

$L_{min} = \left(\frac{V_{in(min)} - V_{sat}}{I_{peak}} \right) \times T_{on} = \left(\frac{4.95 - 0.5}{1.715} \right) \times 7.09 = \underline{20 \mu H}$

$C_{out} = 9 \times \frac{I_{out} \times T_{on}}{V_{Ripple}} = \frac{9 \times 0.25 \times 7.09}{0.1} = 159.5 \mu F$

Feedback R value $\quad V_{out} = 1.25 \left(1 + \frac{R_2}{R_1} \right)$

$R_2 = \frac{V_{out}}{1.25} - 1 \times R_1$

IF $\boxed{R_1 = 10K}$

$R_2 = \frac{16.5}{1.25} - 1 \times 10 \times 10^3$

$\boxed{R_2 = 118 K}$

4) Safty margines

MIN Input Voltage.
MIN Startup Voltage. at Loat
Shutdown Current.
NOIse

5) RMS Current of the input capacitor Cin can be calculated by

$I_{cin,RMS} = I_{out} \times \sqrt{(D - D^2)}$; D - PWM squar wave duty cycle.

The worst case occurs at D = 50%.

$V_{in} = 2 \times V_{out}$.
$I_{inRMS} = I_{out}/2$

7) NO. Exactly NOT matching.

8) 4 wire sensing method is an electrical impedance measuring techque that uses separate pairs of current-carring and voltage-sensing electrodes to make more accurate measurements thatn the simpler and more usual two-terminal sensing.

9) power dissipated in a resistor given by $P = V^2/R$ which means power decreses if resistence increse.

The power also given by $P = I^2R$. ; which means power incresss if resistance increses.

10) Affecting facters are,

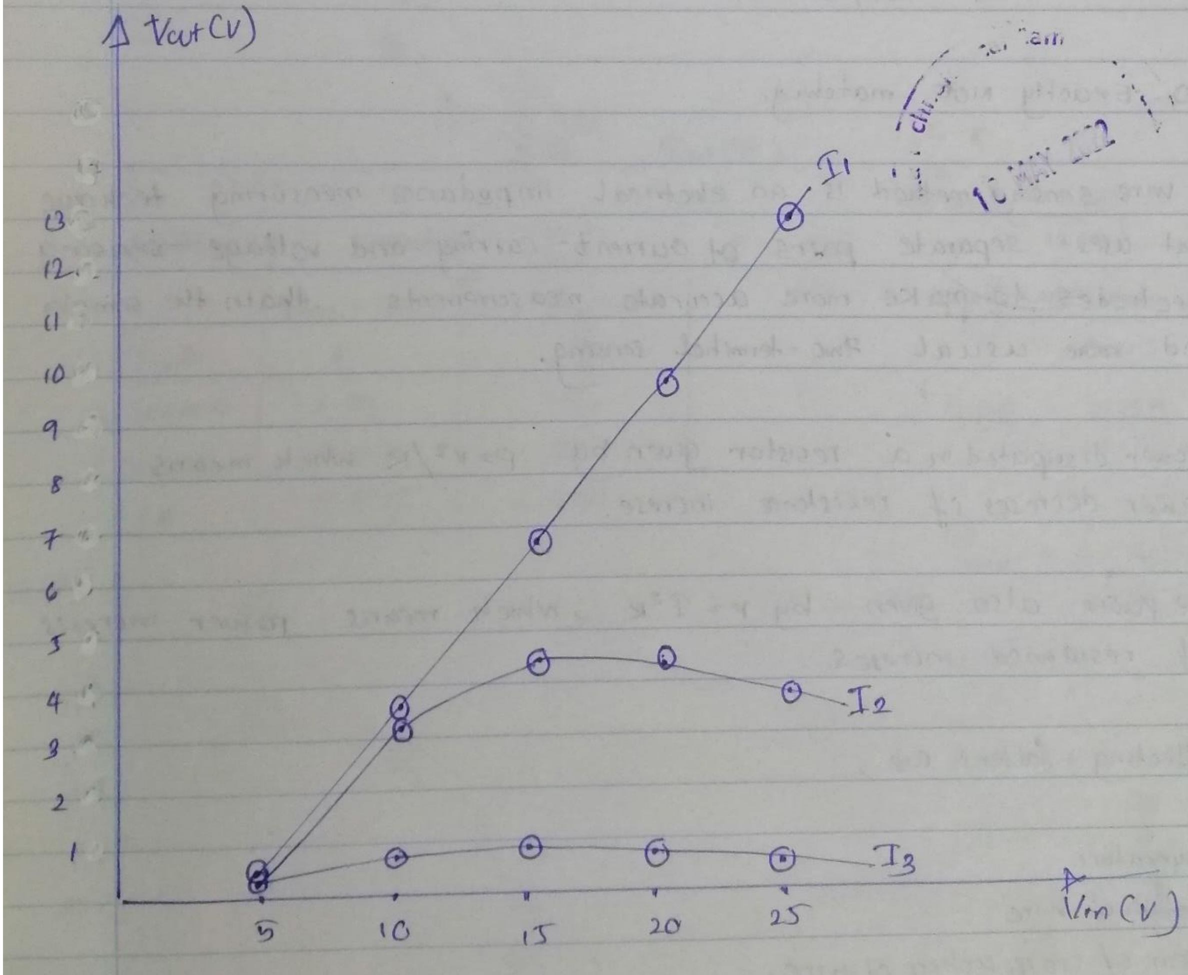
Temperature
Length of wire.
Arear of cross section of wire.
increses resistance.

decrese the length of wire.
use small Across section Area wire.

Task 2

Line Regulation.

Vin (V)	I_1 = 500mA Vout	I_2 = 1A Vout	I_3 = 1.5A Vout
5	0.37	0.21	0.2
10	3.60	3.5	0.8
15	6.64	4.31	0.82
20	9.78	4.30	0.73
25	13.00	3.9	0.72



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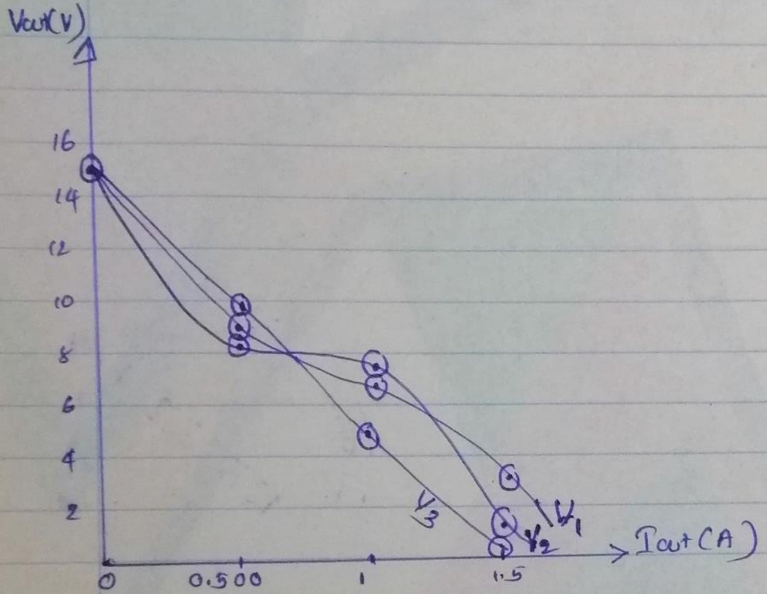
Load Regulation

	$V_{in_1} = 12V$	$V_{in_2} = 15V$	$V_{in_3} = 18V$
I_{out}	V_{out}	V_{out}	V_{out}
0	15	15	15
500 mA	9	8.3	9.31
1 A	7.1	7.21	5.1
1.5 A	3.2	1.2	0.76



10 MAY 2022

Efficiency variation (η)

$$\eta = \frac{P_{out}}{P_{in}}$$

	$V_{in_1} = 12V$	$V_{in_2} = 18V$
I_{out}	η	η
100 mA	1.93	1.3
500 mA	1.206	1.297
1 A	0.7125	0.471

12V

100 mV₂) $\eta = \frac{2.34W}{12 \times 0.1} = 1.95$

500 mV₂) $\eta = \frac{7.24W}{12 \times 0.5} = 1.206$

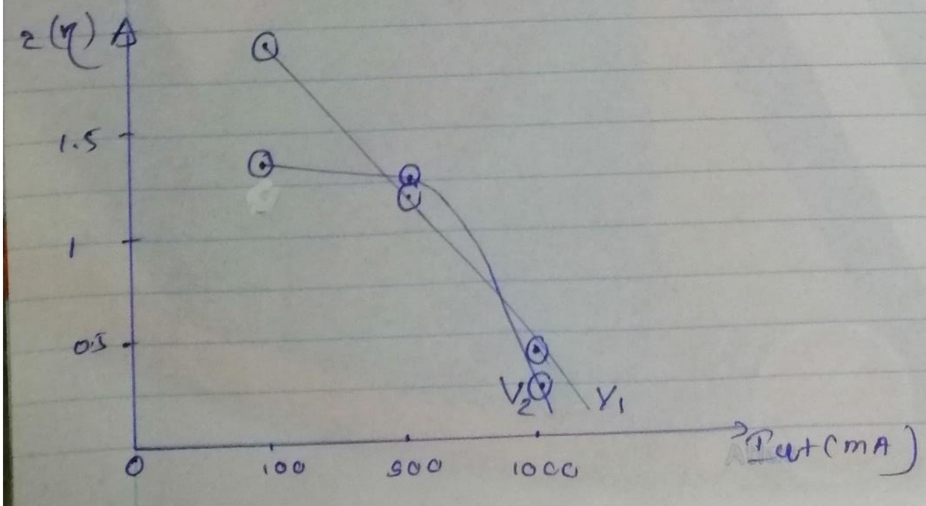
1 A ⇒ $\eta = \frac{8.55W}{12 \times 1} = 0.7125$

18V

100 mV ⇒ $\eta = \frac{2.34W}{18 \times 0.1} = 1.3$

500 mV₂) $\eta = \frac{11.68W}{18 \times 0.5} = 1.297$

1A ⇒ $\eta = \frac{8.48W}{18 \times 1} = 0.471$



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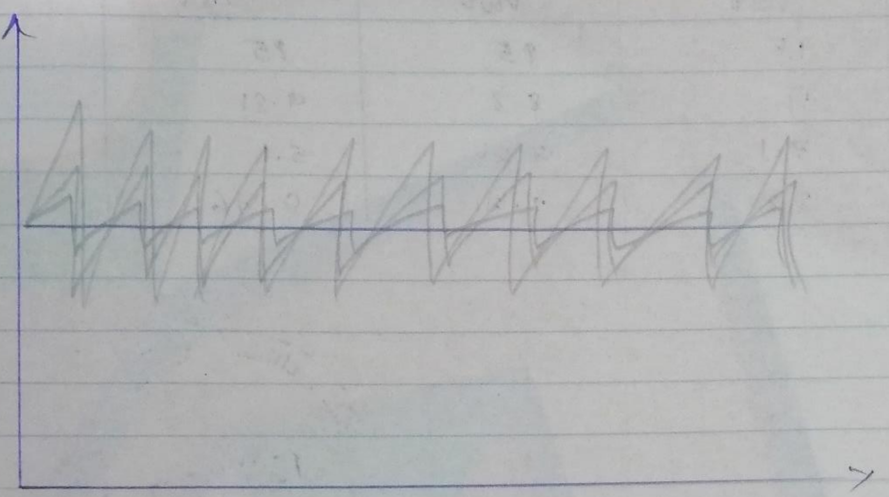
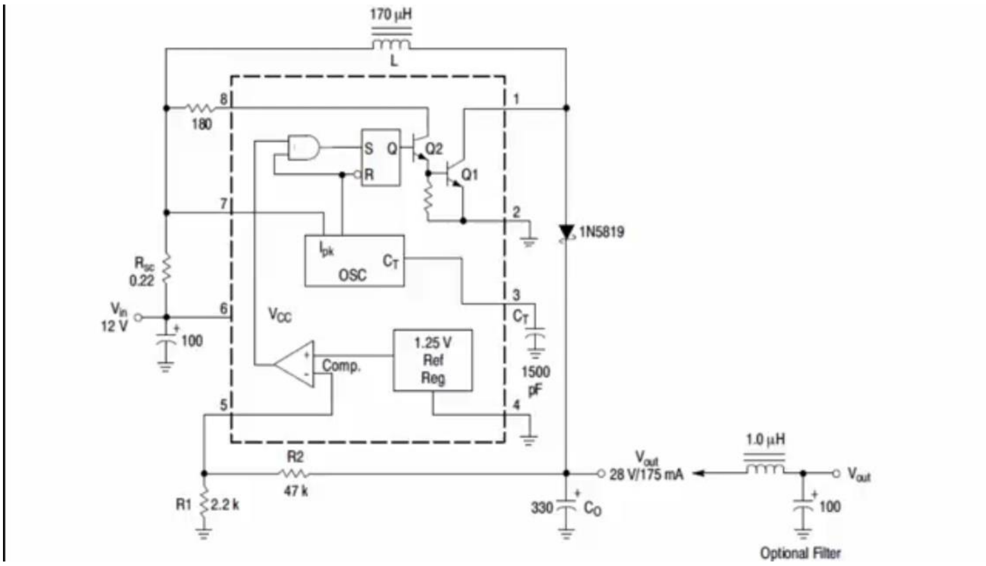
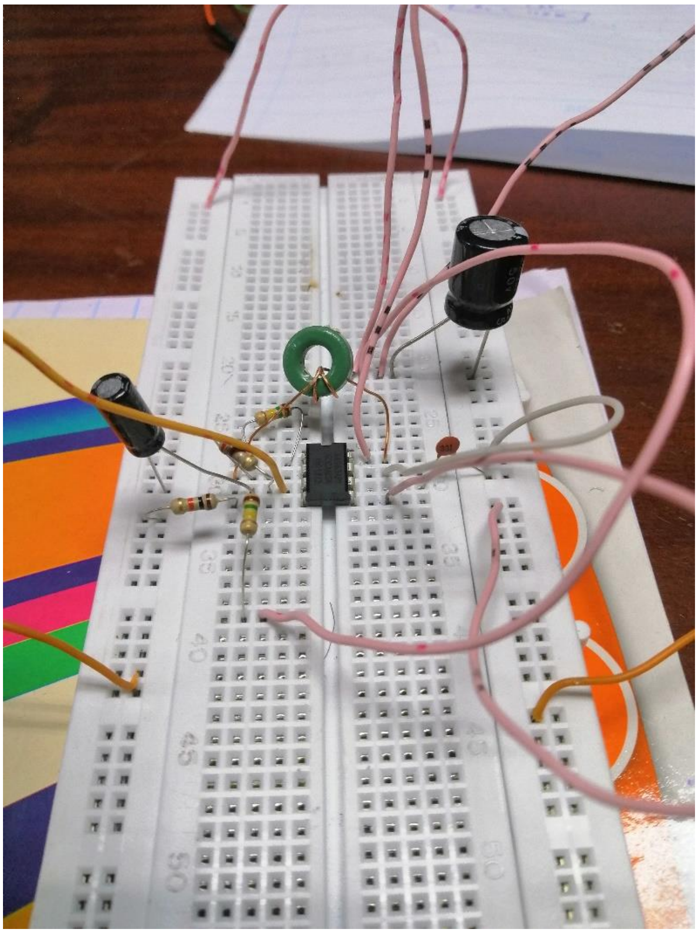
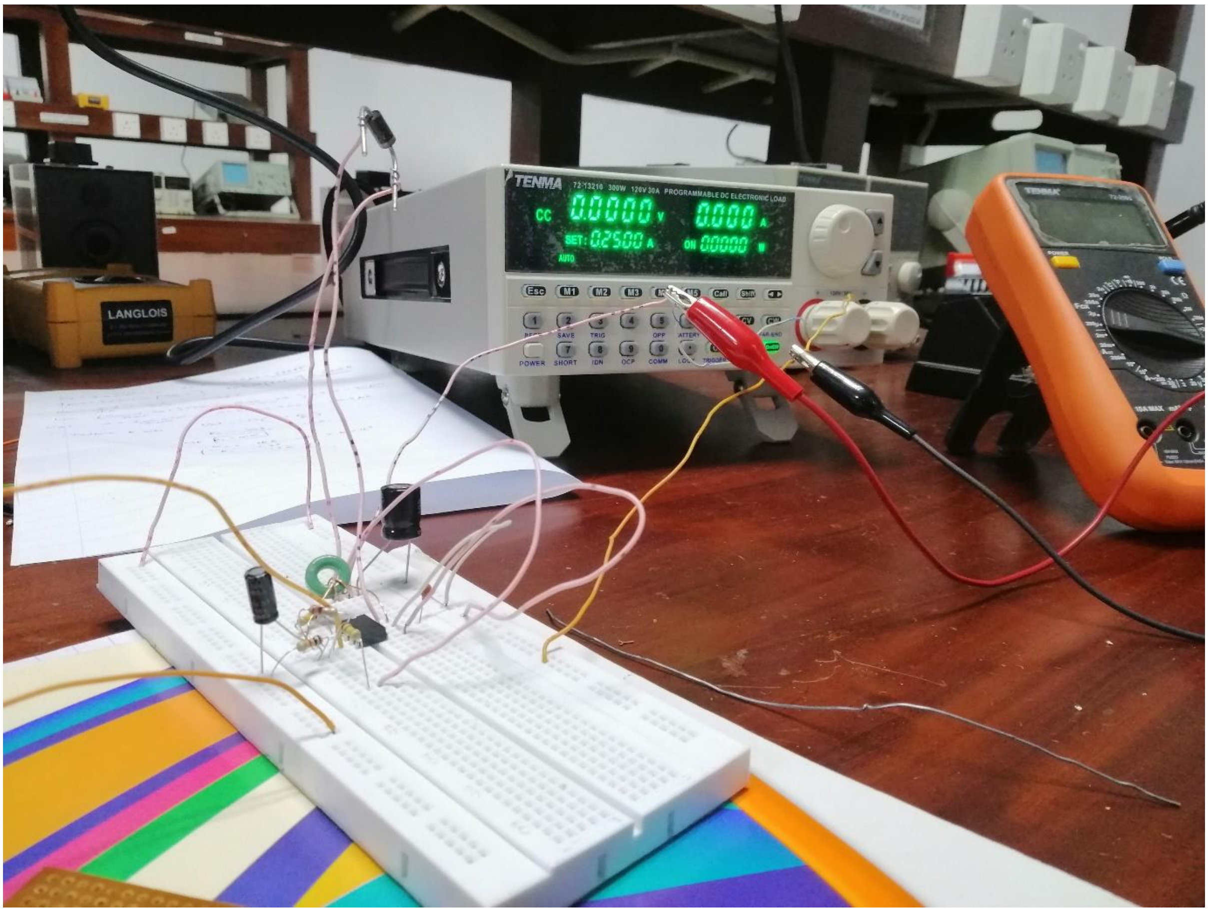
Output ripple variation.



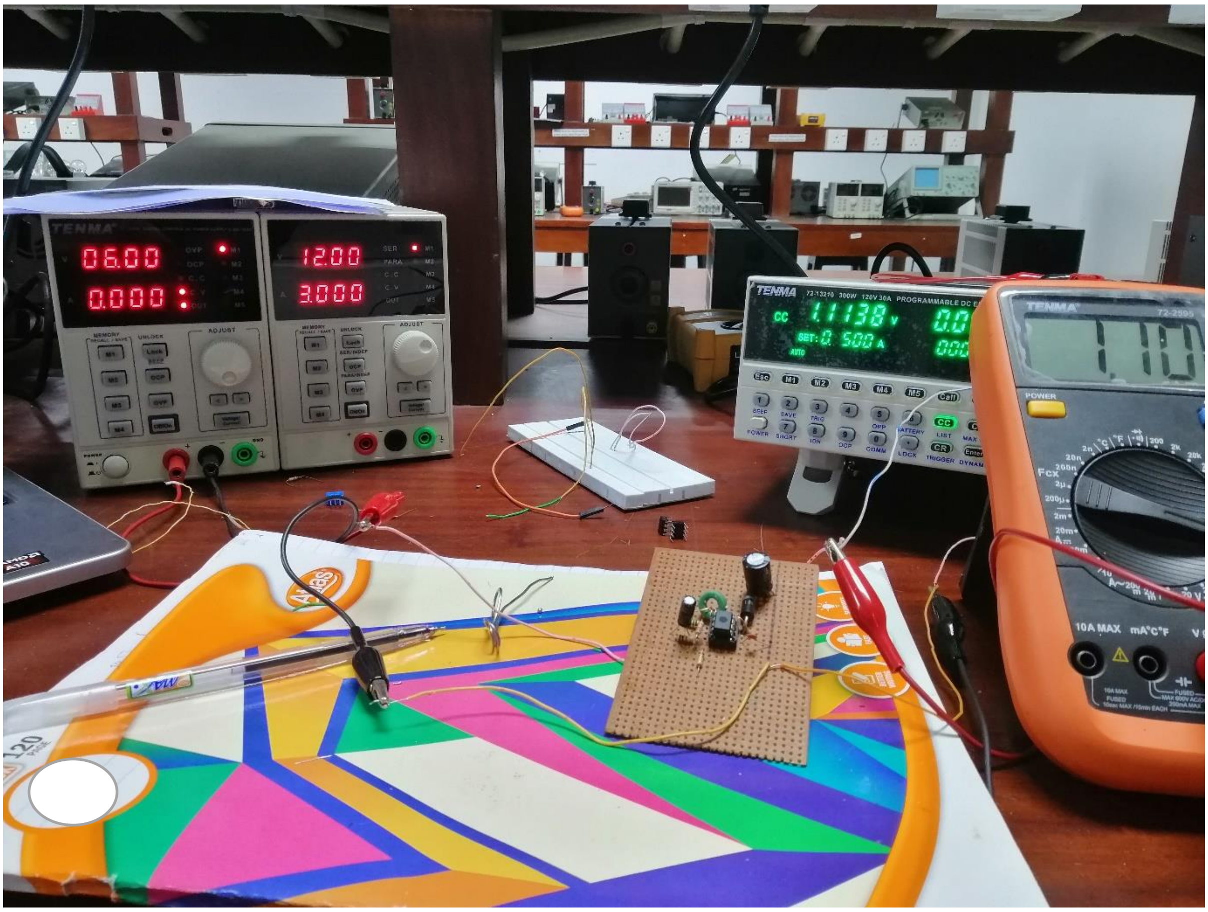


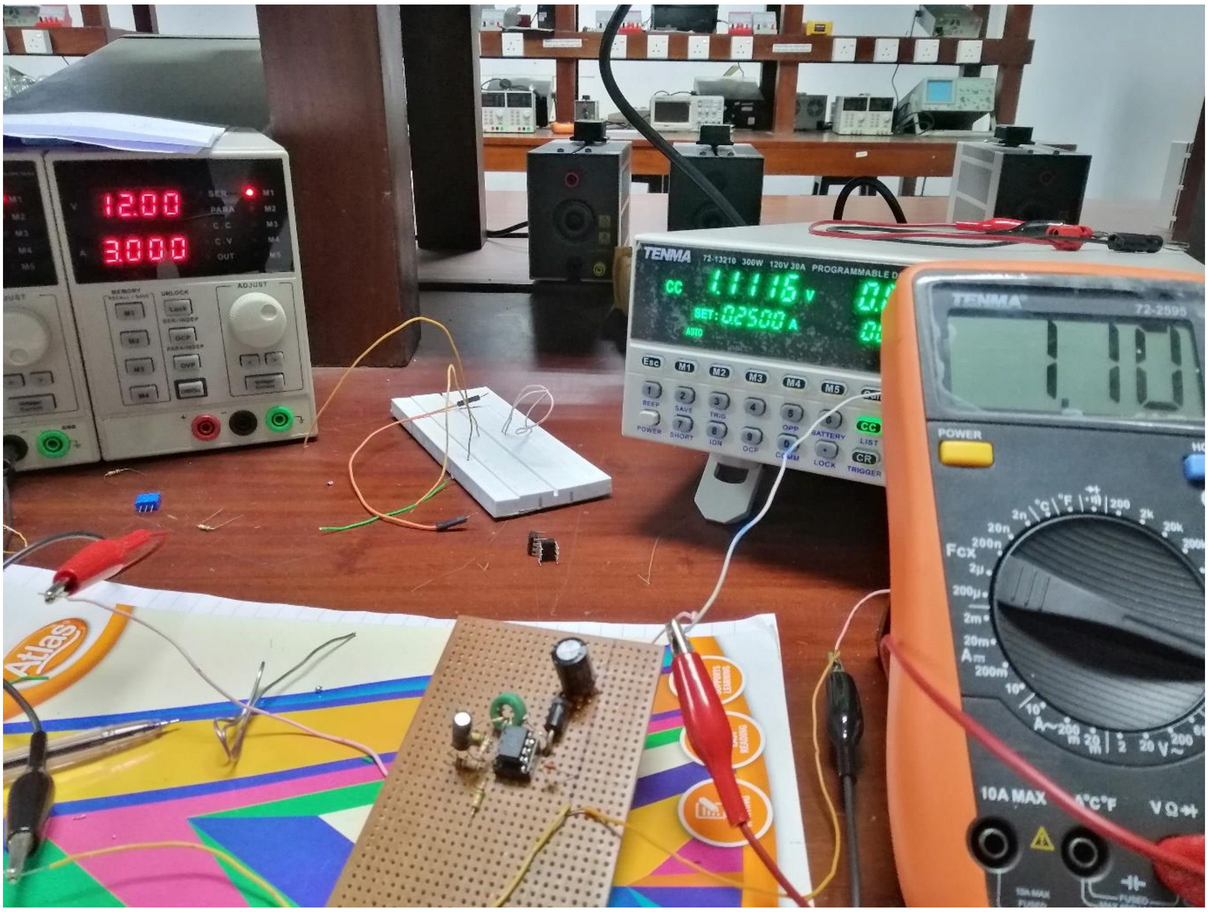
Circuit Diagram

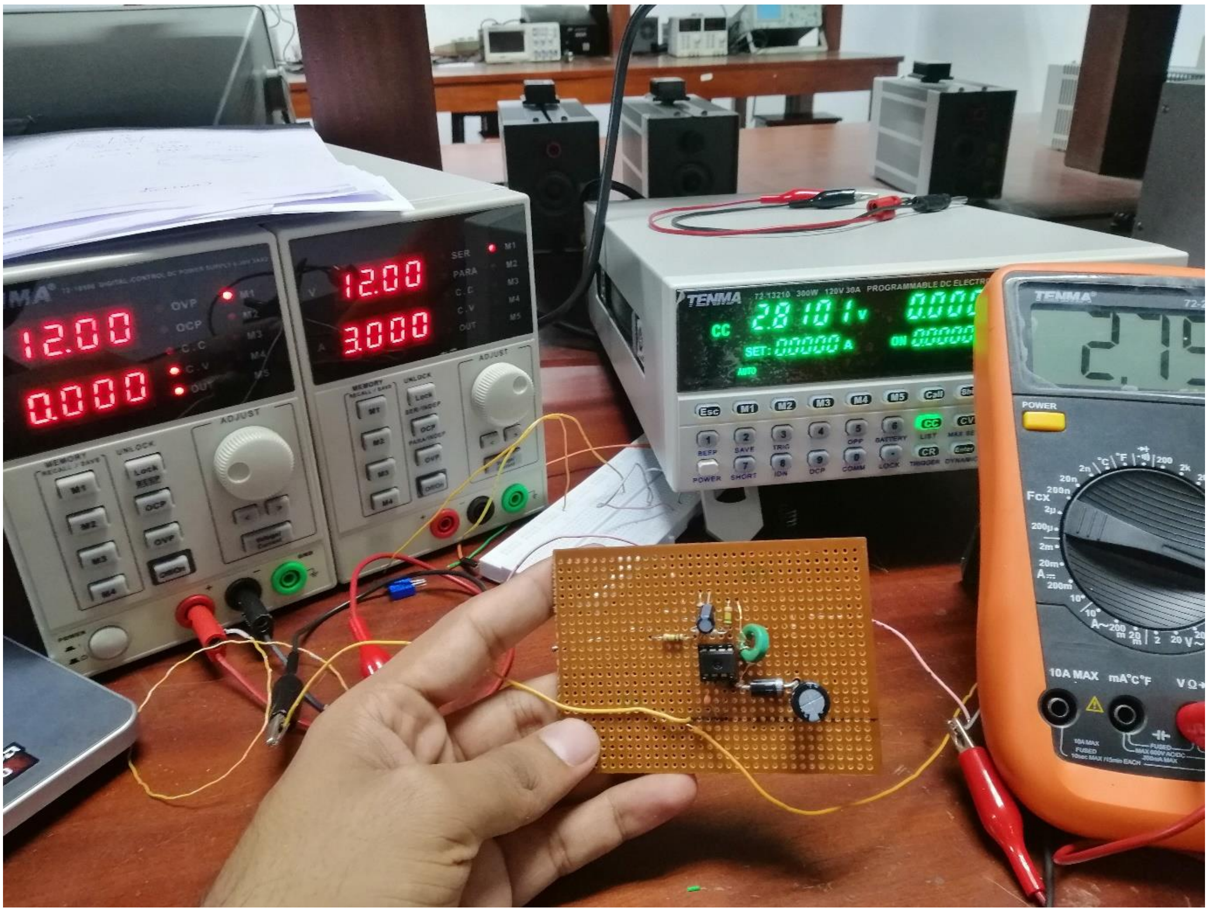


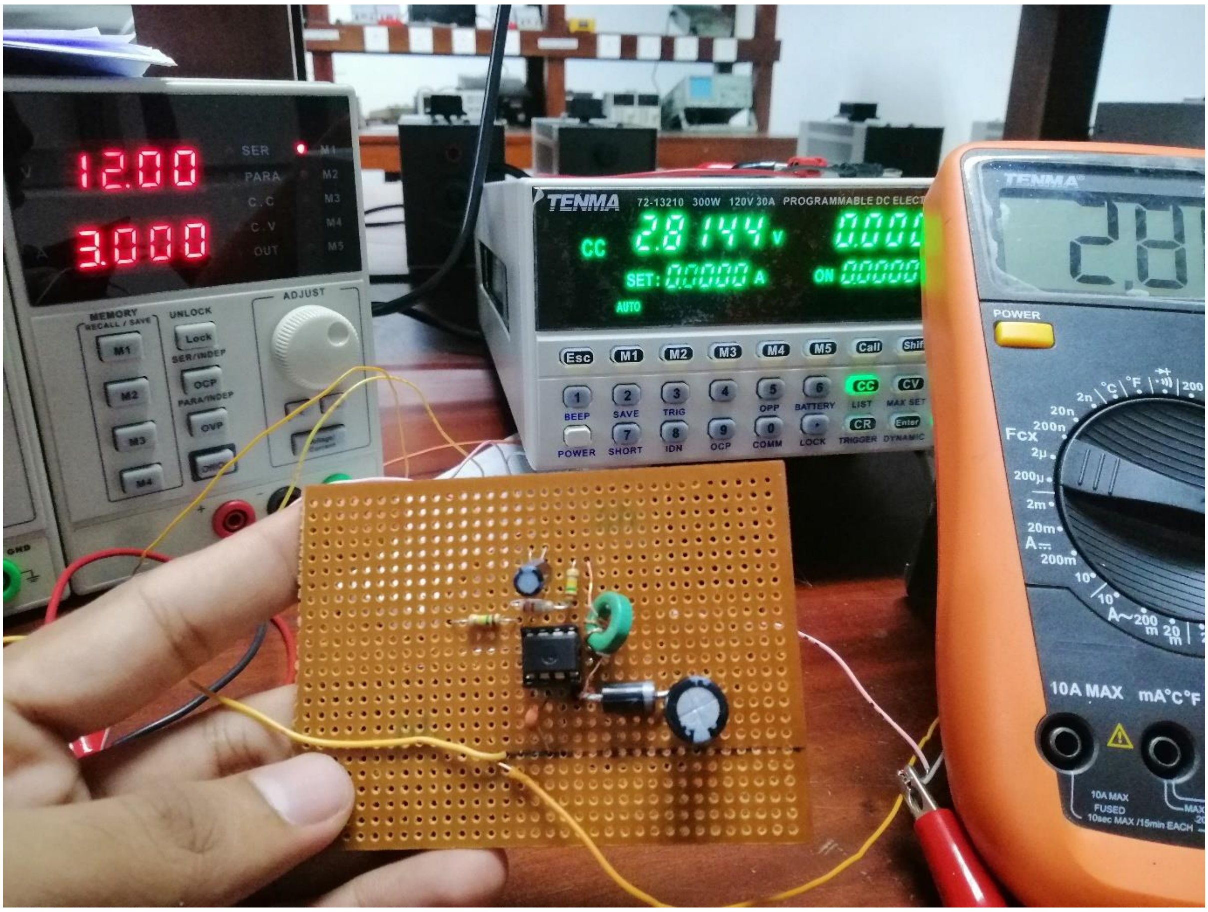


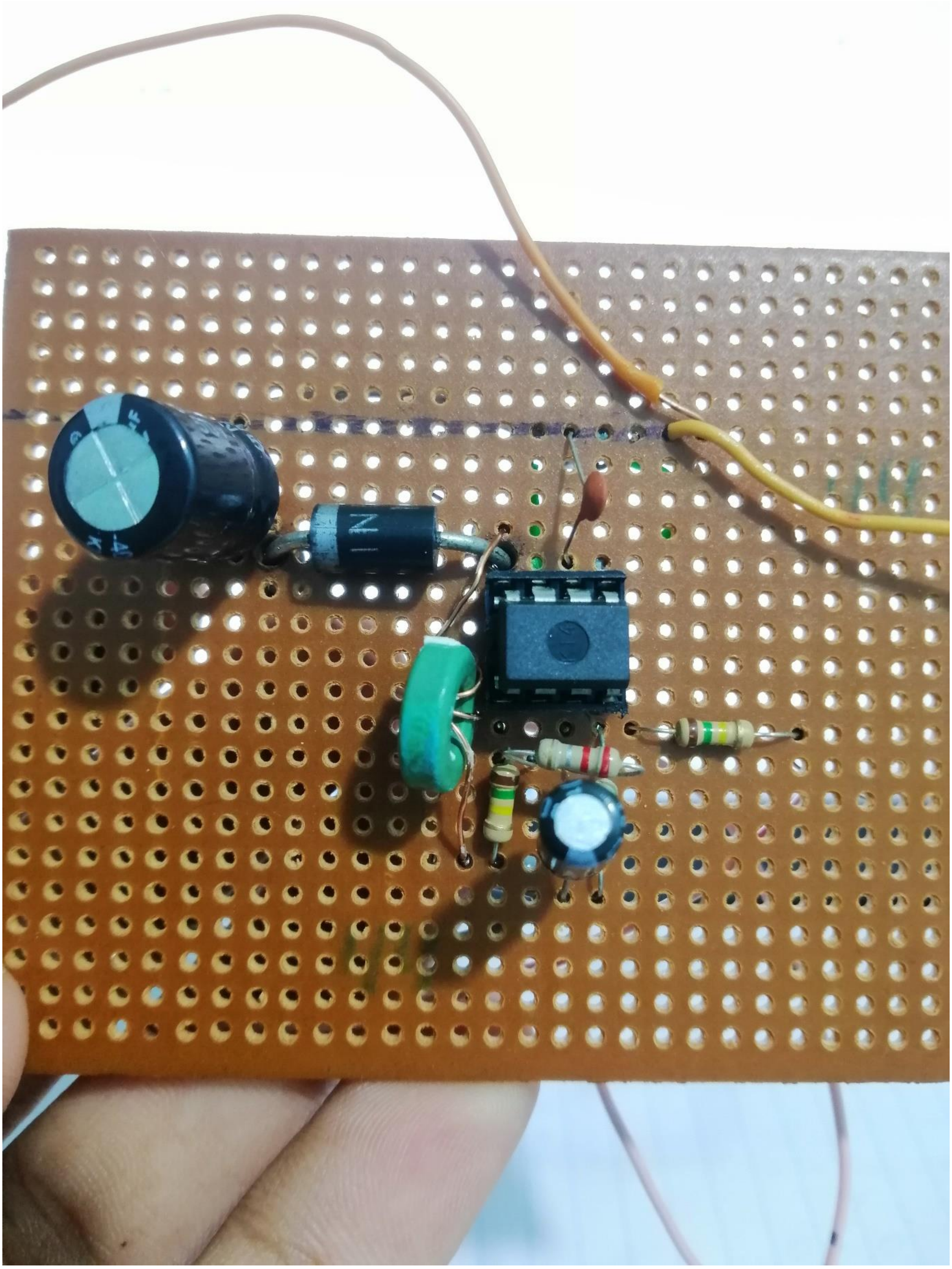
Breadboard implementation


TENMA
06.00
0.000
12.00
3.000
TENMA
1.1138 V
SET: 0.500 A
TENMA
1.10


12.00
3.000
TENMA
1.1116 V
SET: 0.2500 A
TENMA
1.10


12.00
0.000
12.00
3.000
TENMA
SET: 0.0000 A


12.00
3.000
TENMA
72-13210 300W 120V 30A PROGRAMMABLE DC ELEC
SET: 0.0000 A
10A MAX



Converter Circuit