ANURAG

Engineering Engineers

ANURAG INSTITUTIONS

Name of the College : Vidya Jyothi Institute of Technology

Certificate

This is to certify that the bonafide record of the practical work carried out by

Mr/Miss R. Bhoomika *Roll No.* 18911A0469

of Class B-tech IIyr Sem-2 *in the* Analog And Pulse Circuits

Laboratory during the academic year 2019 - 2020

16/1/2020

Faculty In-charge *Head of the Dept.* *External Examiner*

INDEX

AIM:

To study and calculate frequency of oscillations of Hartley oscillator. Compare the frequency of oscillations, theoritically and practically.

Apparatus:

→ Hartley oscillator Trainer kit
→ CRO
→ Function generator.
→ Power supply.

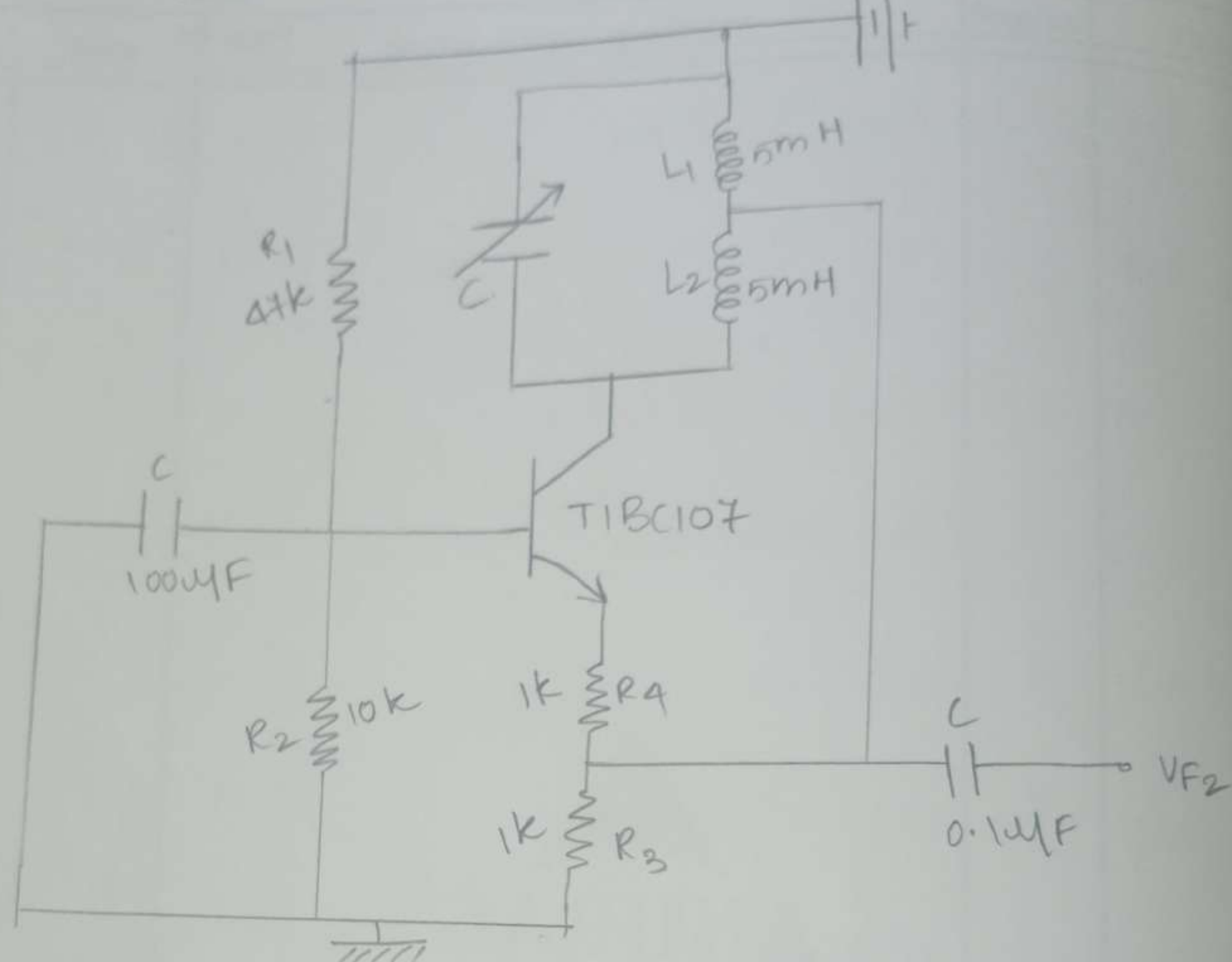
Theory:

Hartley oscillator is very popular and is commonly used as a local oscillator in radio receivers. It has two main advantages viz.... The tank circuit is made up of of L_1, L_2 and C. The coil L_1 is inductively coupled to it L_2, the combination of functions as auto transformer. The resistances R_2 & R_3 provide the necessary biasing. The capacitance C_1 blocks the d.c component. The frequency of oscillations is determined by the values of L_1, L_2 and 'C' and is given by,

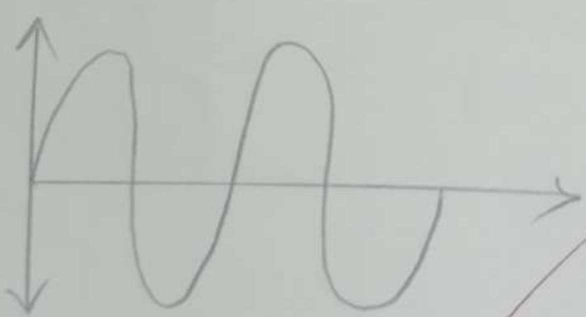
$$\boxed{f = \frac{1}{2\pi C\sqrt{L_1+L_2}}}$$

. the energy supplied to the tank circuit is of correct plane. The auto transformer provides 180° out of phase. Also another 180° is provided by the transistor. In this way, energy feedback to the tank circuit is in phase with the generated oscillations.

Circuit diagram:



Model waveform:



Procedure:

→ Connections are made as per the circuit diagram

→ Connect CRO at output terminals & observe wave form.

→ Calculate practically the frequency of oscillations by using the expressions $f = \frac{1}{T}$, where T = time period of wave form.

→ Repeat the above 2,3 - steps for different values of oscillations of Hartley oscillator.

→ Theoritically calculate the frequency using the formula

$$f = \frac{1}{2\pi\sqrt{C(L_1+L_2)}}$$

→ Compare the values of frequency of oscillations both theoritically & practically.

Result:

Hence the frequency of oscillations of Hartley oscillator is verified and calculated.

6/1/2020

Observation table

Sl. No	Capacitance C (μF)	Practical			Theoritical frequency (kHz)
		ΔV (mV)	Δt (μs)	$f = \frac{1}{\Delta t}$ (kHz)	
	0.1	200	220	4.545	5.03
	0.033	400	128	7.813	8.765

oritical calculations:

$L_T = L_1 + L_2 = 5 + 5 = 10\,mH$

$C = 0.1\,\mu F$

$$f = \frac{1}{2\pi\sqrt{L_T C}} = \frac{1}{2\pi\sqrt{10\times10^{-3}\times0.1\times10^{-6}}} = 5.03\,kHz$$

) $C = 0.033\,\mu F$

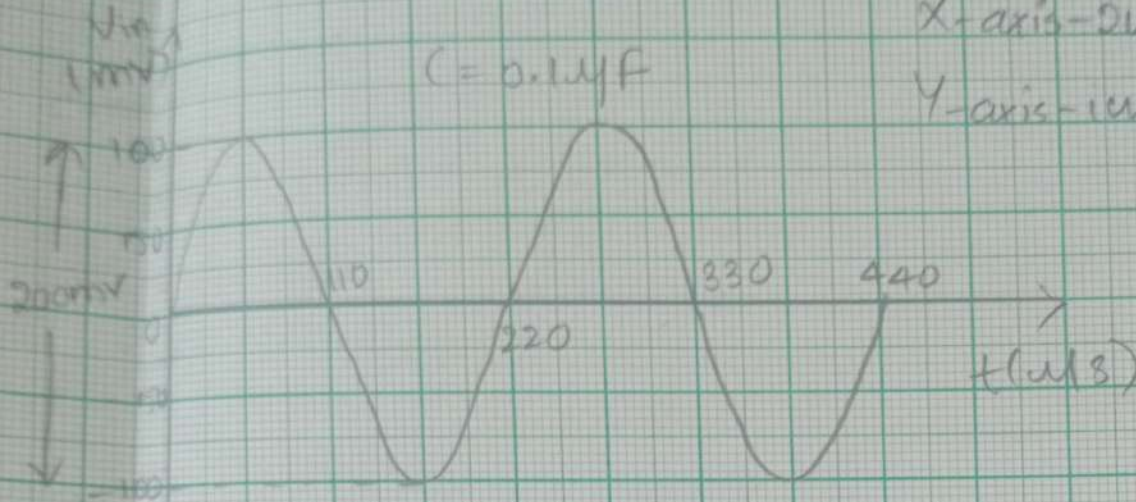
$$f = \frac{1}{2\pi\sqrt{L_T C}} = \frac{1}{2\pi\sqrt{10\times10^{-3}\times0.033\times10^{-6}}} = 8.765\,kHz$$

Hartley Oscillator

Scale:

X-axis - 2 units = 110 µs

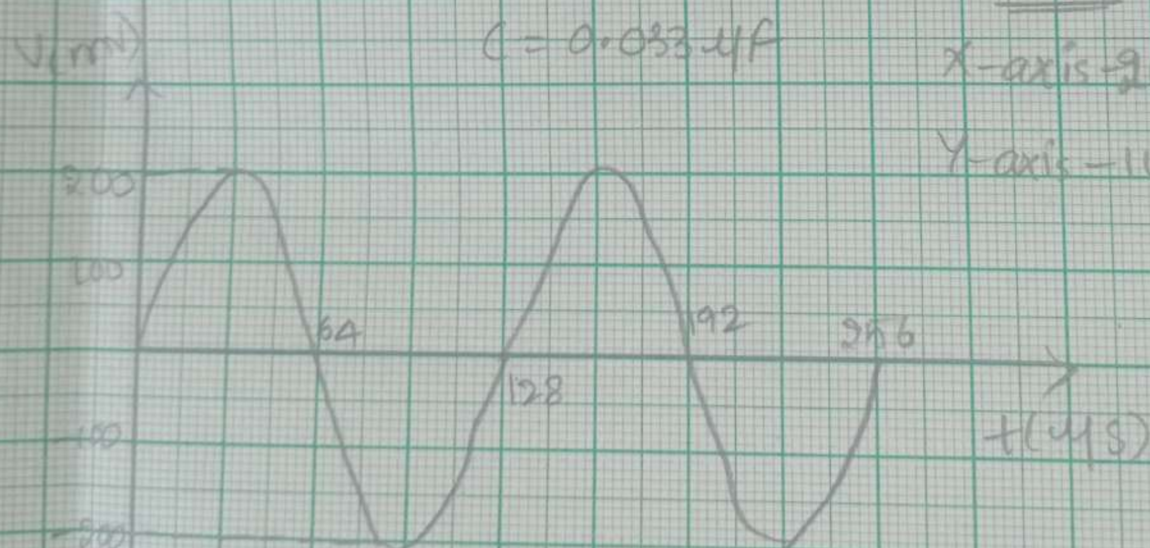
Y-axis - 1 unit = 50 mV



Scale:

X-axis - 2 units = 64 µs

Y-axis - 1 unit = 100 mV



AIM:

To study and calculate the frequency of oscillations of colpitts oscillator.

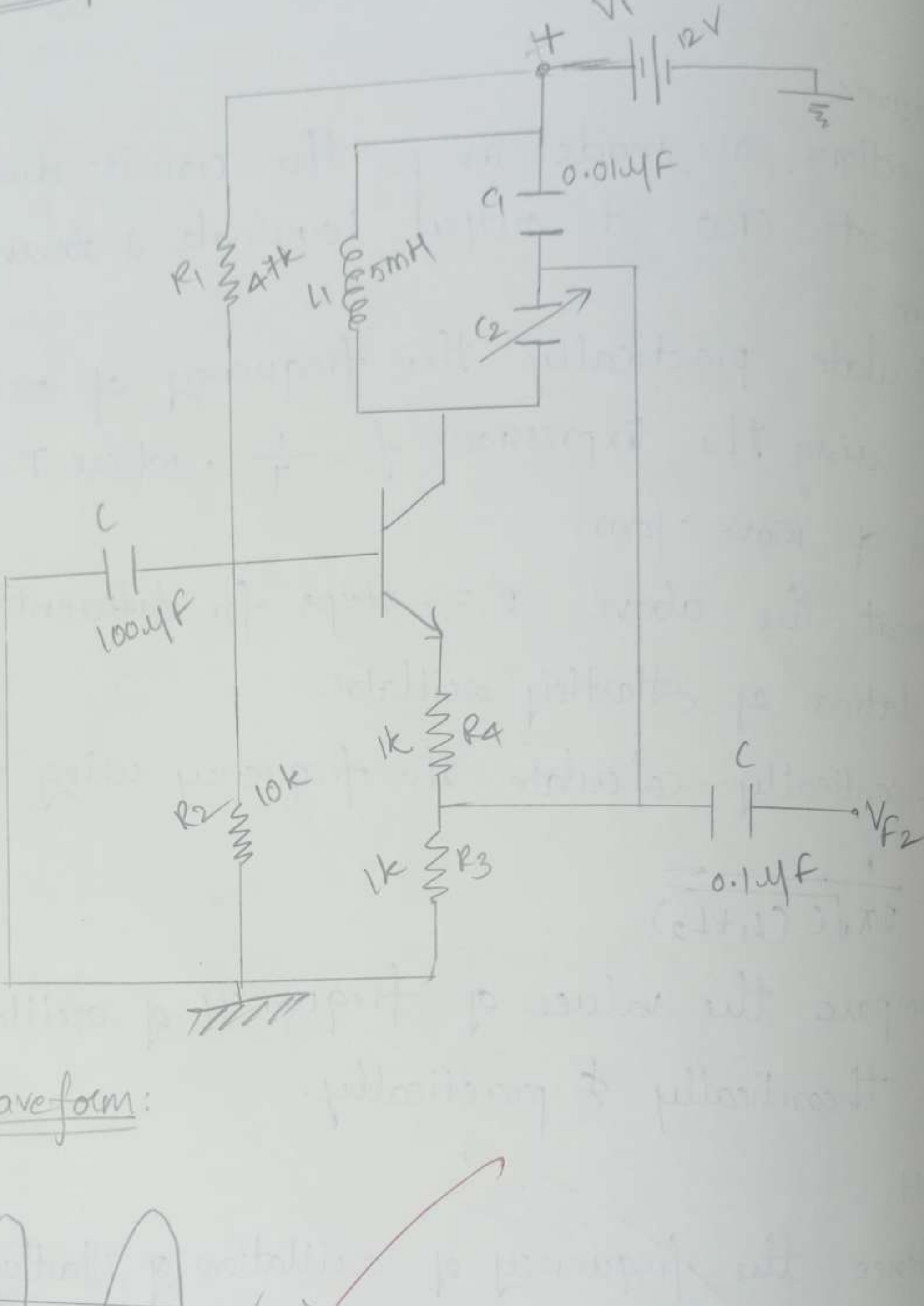
Apparatus:

→ Colpitts oscillator trainer kit
→ CRO
→ Function generator
→ Power supply.

Theory:

The tank circuit is made up of L_1 and two capacitors C_1 & C_2 values. The resistance R_2 & R_1 provides the necessary biasing. The input capacitance C blocks the D.C component. The frequency of oscillations is determined by values of L_1, C_1 & C_2 in the tank circuit. And the frequency of oscillations is given by $\boxed{f = \frac{1}{2\pi\sqrt{L_1 C_T}}}$, where $\boxed{C_T = \frac{C_1 C_2}{C_1 + C_2}}$. The energy supplied to the tank circuit is of correct phase. The tank circuit provides 180° out of phase. Also the transistor provides another 180° in this way. Energy feedback to the tank circuit is in phase with the generated oscillations.

Circuit diagram:



Model waveform:

Procedure:

→ Connections are made as per circuit diag.

→ Connect CRO output terminals & observe the waveform. Calculate practically, the frequency of oscillations by using the expressions $f = \frac{1}{T}$, where T = time period of wave-form.

→ Repeat the above step for different values of oscillation of Colpitts oscillator

→ Theoritically calculate the frequency using the formula

$$f = \frac{1}{2\pi\sqrt{LC_T}}, \quad C_T = \frac{C_1 C_2}{C_1 + C_2}.$$

→ Compare the values of oscillations both theoritically and practically.

Result:

Hence the frequency of oscillations of colpitts oscillator is verified and calculated.

6/1/2020

Observation table:

$C_1 = 0.01\,\mu F$

Sl. No	Capacitor C_2 (μF)	Practical			Theoritical frequency (kHz)
		ΔV (V)	Δt (μs)	$f = 1/\Delta t$ (kHz)	
1.	0.001	2.28	13.80	73.10	74.654
2.	0.0022	3.84	19.20	52.47	53.00
3.	0.0033	2.92	22.00	45.45	45.196

Theoritical calculations:

$$f = \frac{1}{2\pi\sqrt{LC_T}}, \quad C_T = \frac{C_1 C_2}{C_1 + C_2}, \quad C_1 = 0.01\,\mu F$$

$$C_2 = 0.001\,\mu F, \quad C_T = \frac{0.01\times10^{-6}\times0.001\times10^{-6}}{0.01\times10^{-6}+0.001\times10^{-6}} = 9.09\times10^{-10}$$

$$f = \frac{1}{2\pi\sqrt{5\times9.09\times10^{-13}}} = 74.654\ kHz$$

$$C_2 = 0.0022\,\mu F, \quad C_T = \frac{0.01\times10^{-6}\times0.0022\times10^{-6}}{0.01\times10^{-6}+0.002\times10^{-6}} = 1.803\times10^{-9}$$

$$f = \frac{1.}{2\pi\sqrt{5\times1.803\times10^{-12}}} = 53.00\ kHz$$

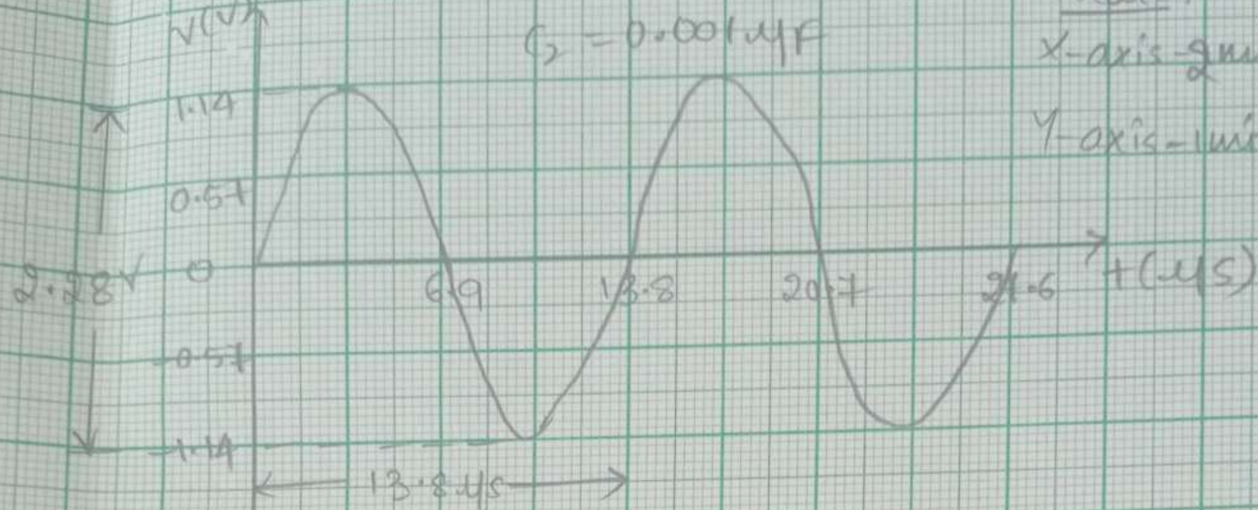
$$C_2 = 0.0033\,\mu F, \quad C_T = \frac{0.01\times10^{-6}\times0.0022\times10^{-6}}{0.01\times10^{-6}+0.0022\times10^{-6}} = 2.48\times10^{-9}$$

$$f = \frac{1}{2\pi\sqrt{5\times2.48\times10^{-9}}} = 45.196\ kHz$$

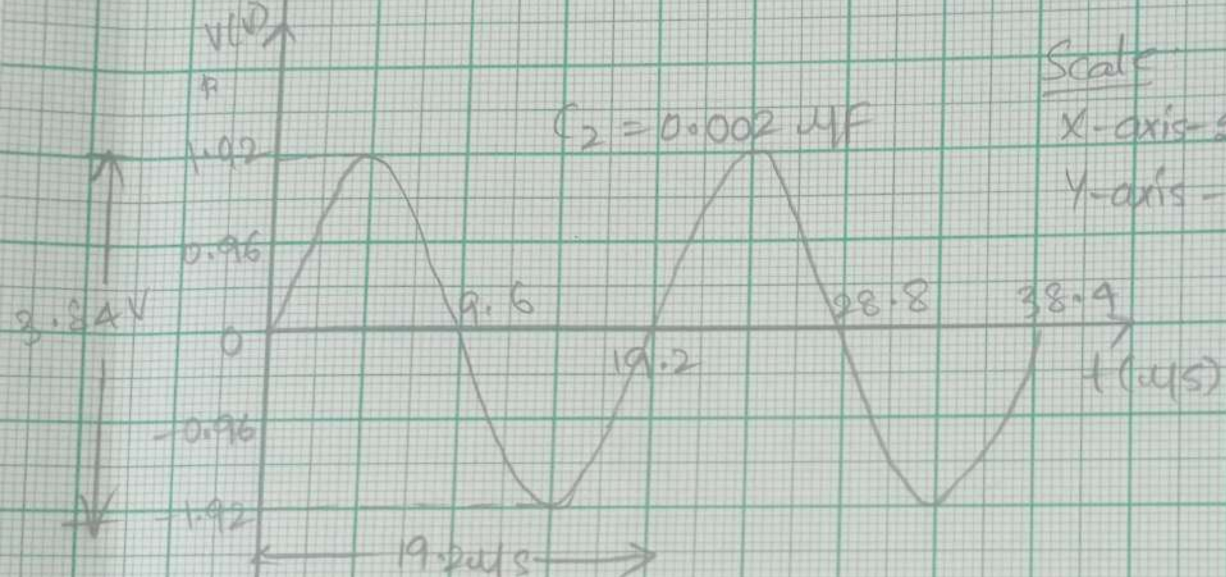
23/12/19

Colpitts Oscillator

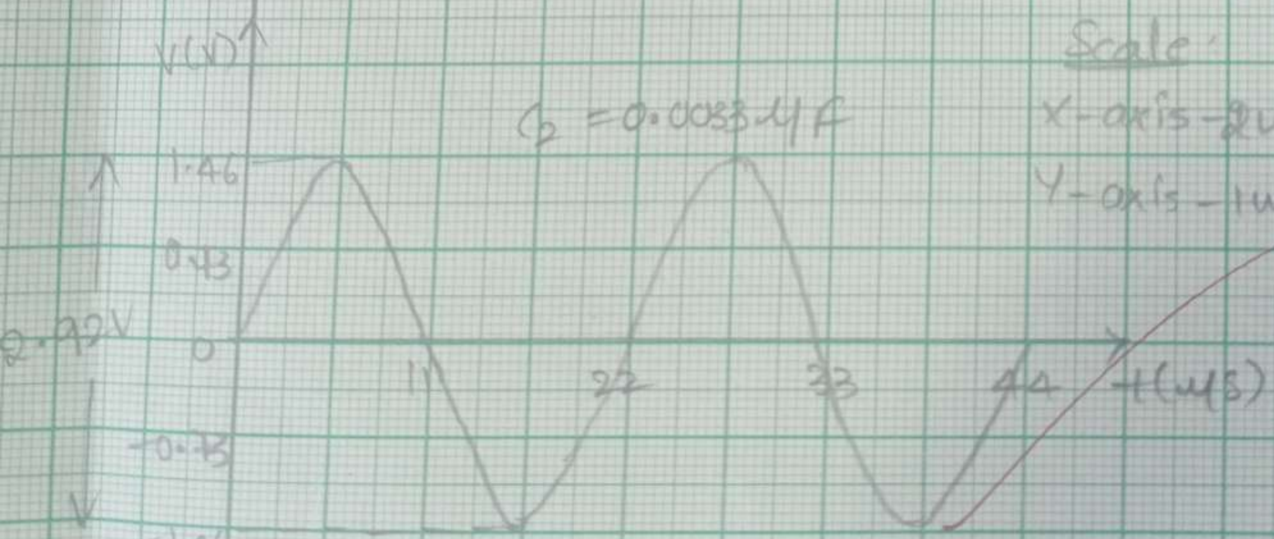
Scale:
X-axis-2unit = 6.9 μs
Y-axis-1unit = 0.57 V



Scale
X-axis-2unit = 9.6 μs
Y-axis-1unit = 0.96 V



Scale:
X-axis-2unit = 11 μs
Y-axis-1unit = 0.73 V



Title : ASTABLE MULTIVIBRATOR

Date : 30/12/2019
Page No. : 5

AIM:

To design an astable multivibrator to generate a square wave of 1kHz frequency choose C=1nf, 100nf.

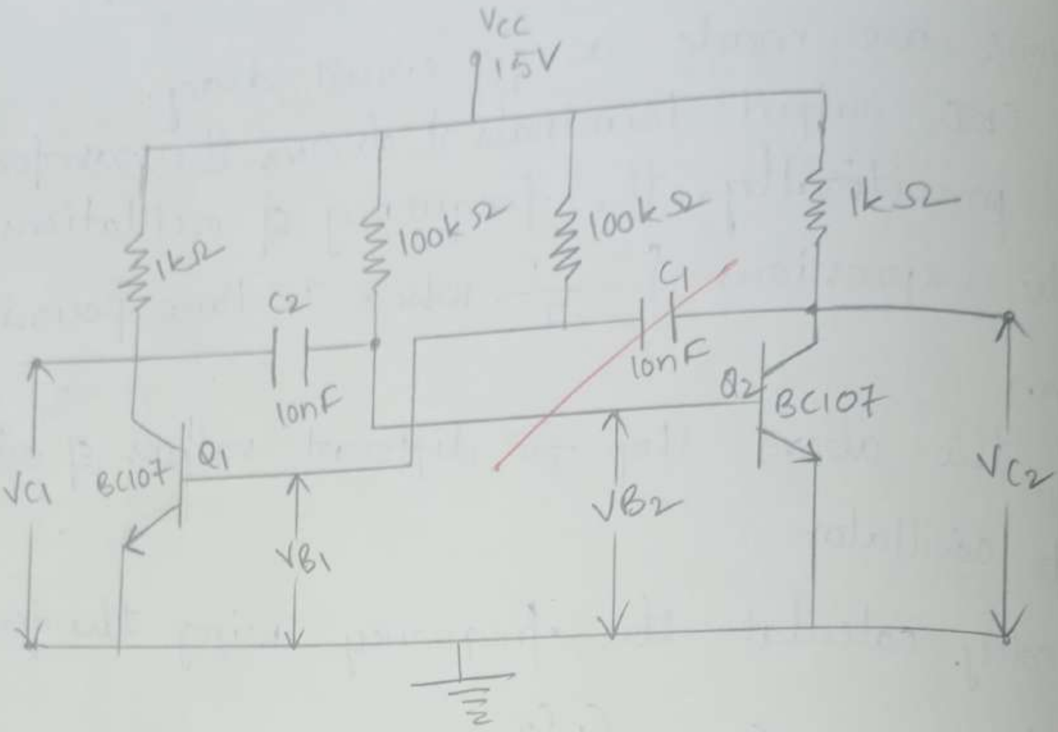
Apparatus:

1) Regulated power supply.
2) Cathode Ray oscilloscope
3) Resistors (1k Ω, 72.4k Ω)
4) Capacitors (0.1nf, 10nf, 100nf)
5) Transistor (BC107)

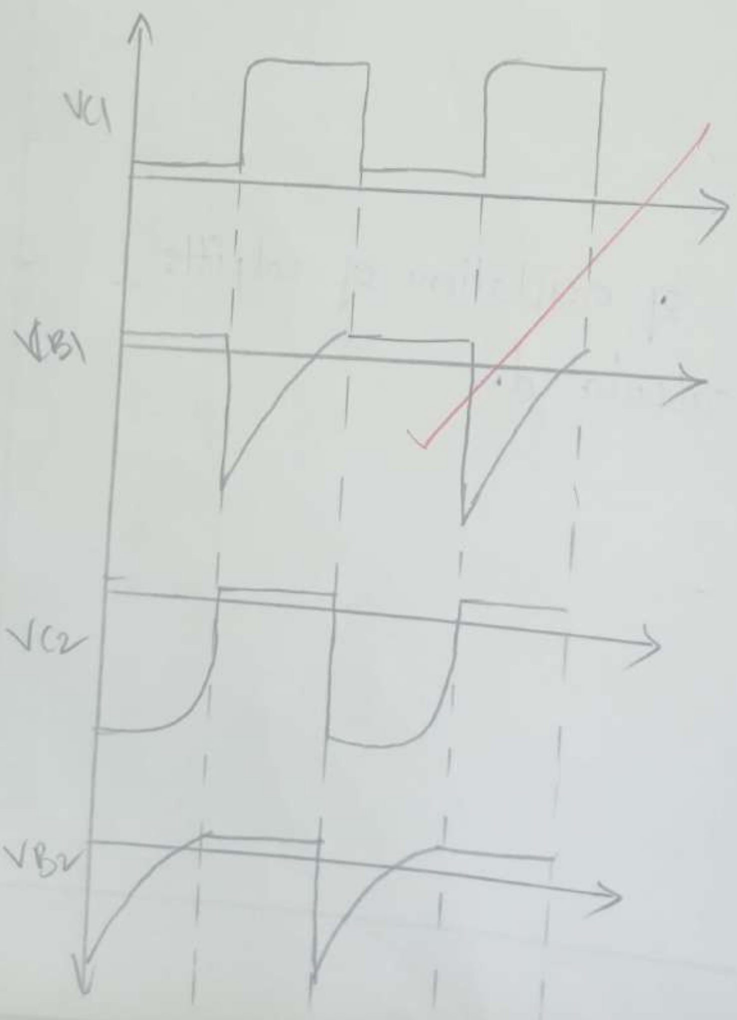
Theory:

The astable circuit has two quasi-stable states. Without external triggering signal the astable configuration will make successive transitions from one quasi-state to the other. The astable circuit is an oscillator. It is also called as free running multivibrator and is used to generate "Square Wave". Since it does not require triggerings signal, fast switching is possible.

Circuit diagram:



Expected wave forms:



Procedure:

1) Connect the circuit as shown in fig.
2) Observe the Base voltage and collector voltages of Q_1 & Q_2 on CRO in DC mode and plot them.
Verify the frequencies theoritically.

Result:

An astable Multivibrator is designed, the wave-forms are observed and verified the results theoriti-cally.

07/01/2020

Theoritical :

$$T = 0.693(R_1C_1 + R_2C_2) \qquad R_1 = R_2 = 10k$$

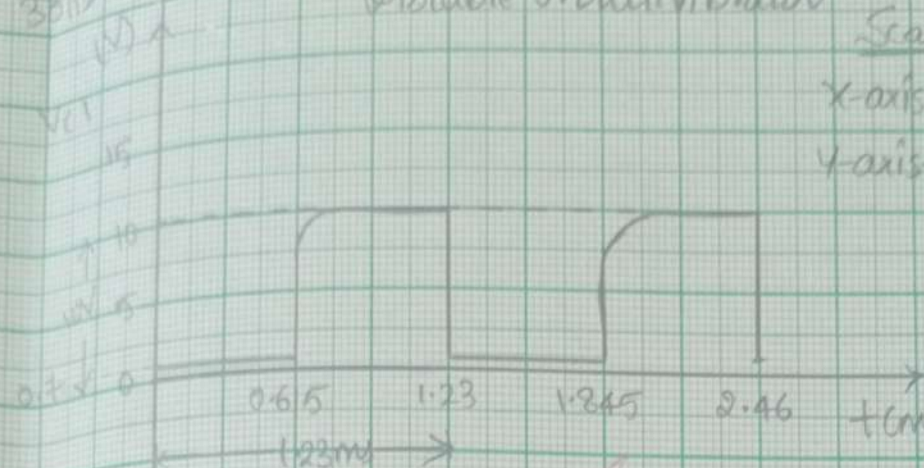
$$C_1 = C_2 = 0.1\mu F$$

$$T = 0.693[10000(0.1\times10^{-6}) + 10000(0.1\times10^{-6})]$$

$$\boxed{T = 1.38\ ms}$$

30/12/19

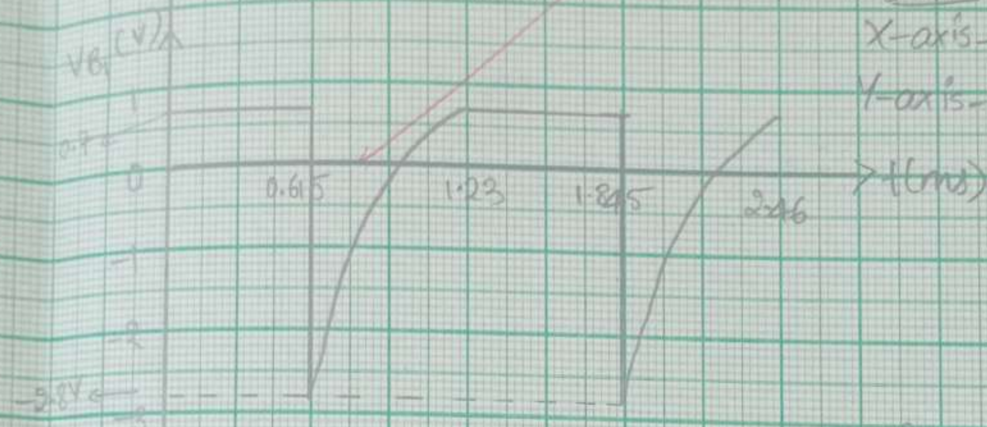
Astable Multivibrator



Scale:

X-axis - 2 units = 0.615 ms

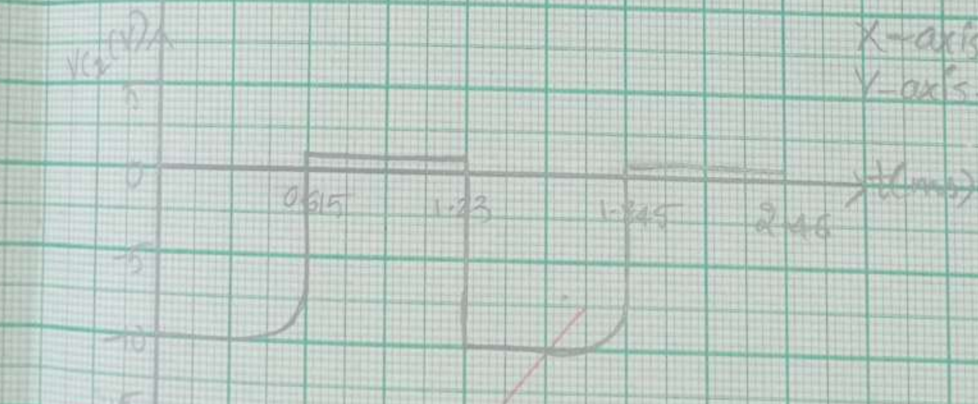
Y-axis - 1 unit = 5 V



Scale:

X-axis - 2 units = 0.615 ms

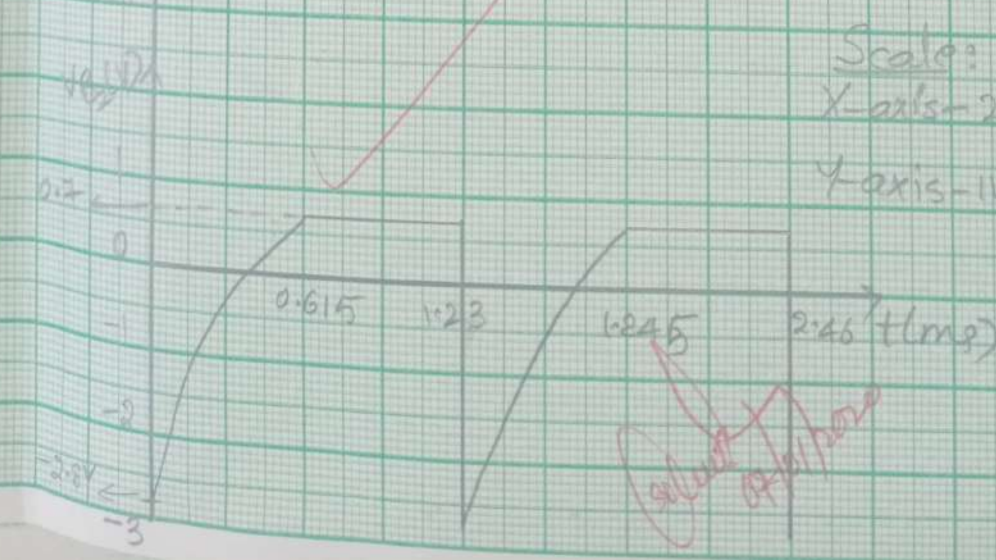
Y-axis - 1 unit = 1 V



Scale:

X-axis - 2 units = 0.615 ms

Y-axis - 1 unit = 5 V



Scale:

X-axis - 2 units = 0.615 ms

Y-axis - 1 unit = 1 V

Title : MOSFET AMPLIFIER

Date : 6/01/2020
Page No.: 7

AIM:

To study the frequency response of MOSFET amplifier

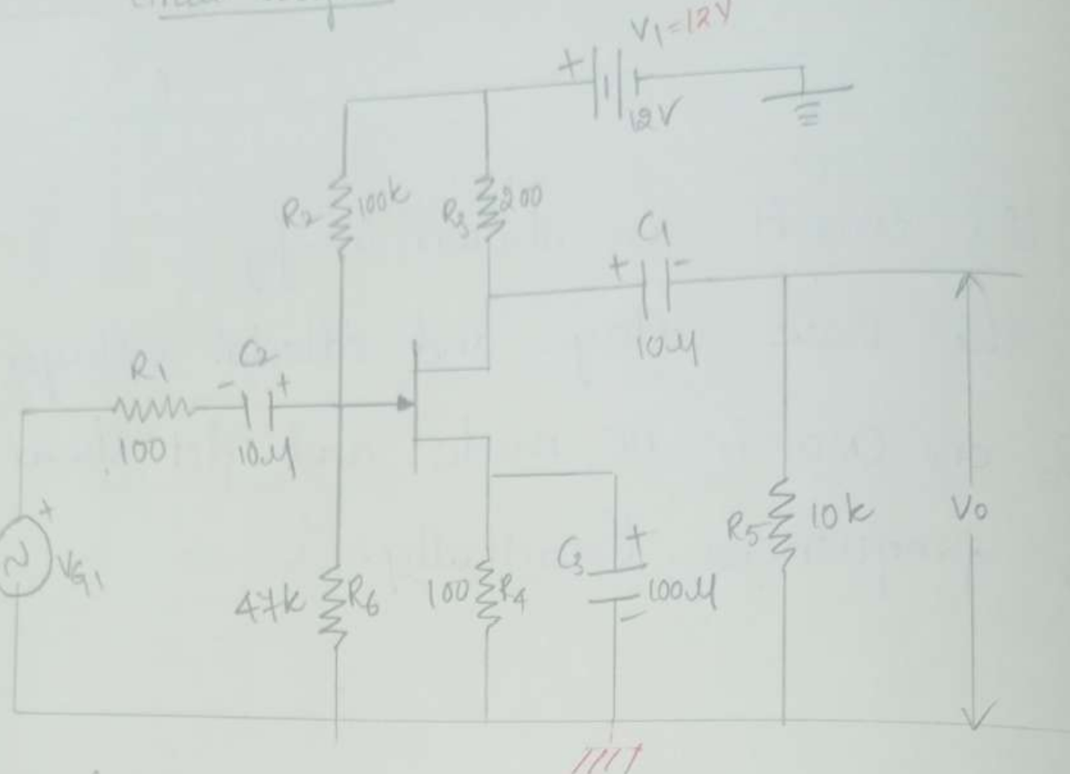
APPARATUS:

1) MOSFET amplifier trainer kit
2) CRO
3) Function generator
4) Power supply.

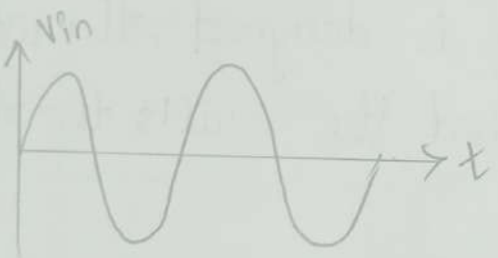
Theory:

MOSFET belongs to the family of FET. The control terminal is called the gate. Remember that the base terminal of a bipolar transistor passes a small amount of current. When FET's are used in the audio output section of an amplifier, the VGS (Voltage from gate to source) is rarely higher than 3.5 volts. When FET's are used in switching power supplies, the V_{GS} is usally much higher (10 to 15V). When the gate voltage is above approximately 5V, it becomes more efficient (which means less voltage drop across the FET & ∴ less power dessipation). MOSFET's is commonly used in electronic circuitary because they are easier to drive

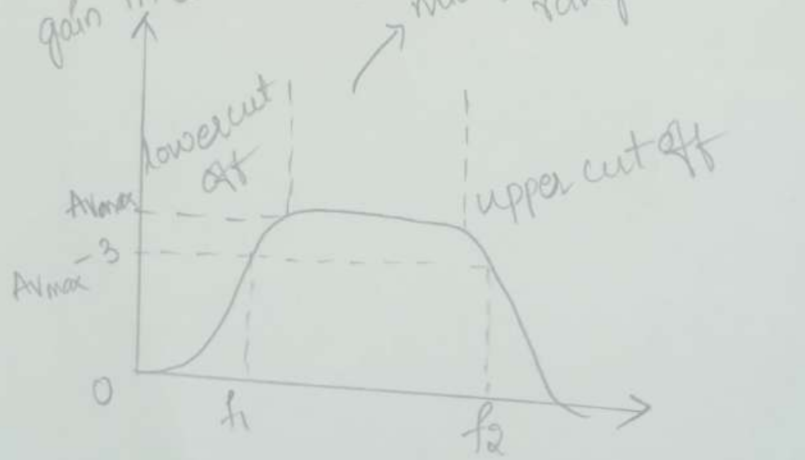
Circuit diagram:



wave form:



Frequency reponse:



in higher current applications. In high current situations where there is significant collector/emitter current, the base current may be significant. FET's can be driven by the very little current. The only current that flows from the drive circuit is the current that flows due to the capacitance. As you already know, when DC is applied to a capacitor, there is an initial surge then the current flow stops. When the gate of an FET is driven with a high frequency signal, the drive circuit essentially sees only a small value capacitor. For low to intermediate frequencies, the drive circuit has to deliver little current. At very high frequencies or when many FET's are being drivers, the drive circuit must be able to deliver more current.

Tabular column: $V_{in} = 200mV$

Sl. No	frequency (Hz)	o/p voltage (V_o)	voltage gain $Av_{max} = V_o/V_{in}$	Voltage gain in dB $20\log(V_o/V_{in})$
1.	50	400 mV	2	6.02
2.	100	500 mV	2.5	7.958
3.	300	560mV	2.8	8.943
4.	500	800 mV	4	12.041
5.	1k	970mV	4.85	13.714
6.	3k	1.1 V	5.5	14.80
7.	5k	1.14V	7	16.90
8.	10k	1.14V	7	16.90
9.	30k	1.1V	5.5	14.80
10.	50k	970mV	4.85	13.714
11.	100k	730mV	3.65	11.245
12.	30k	340mV	1.7	4.608
13.	500k	256mV	1.28	2.144
14.	1M	180mV	0.9	0

$\therefore$ Band width $= f_2 - f_1$

$= 50000 - 1000$

$= 49k$

Procedure:

→ Connections are to be made as per the circuit diagram on the bread board.

→ A signal of 1kHz frequency & 50mV peak to peak is applied at i/p of amplifier.

→ Output is taken at drain & gain is calculated by using expression $A_V = \frac{V_o}{V_i}$.

→ Voltage gain in dB is calculated by using the expression, $A_V = 20 \log (V_o/V_i)$

→ Repeat the above steps for various i/p frequencies from 10Hz to 1MHz. Is semilog graph. Plot A_V vs freq.

→ The Bandwidth of the amplifier is calculated from the graph using the expressions,

Bandwidth $= f_2 - f_1$, where f_1 is lower 3dB freq & f_2 is upper freq.

Result:

Hence the frequency response of MOSFET amplifier is verified & its band width is calculated.

27/01/20

MOSFET AMPLIFIER

Bandwidth $= f_H - f_L$

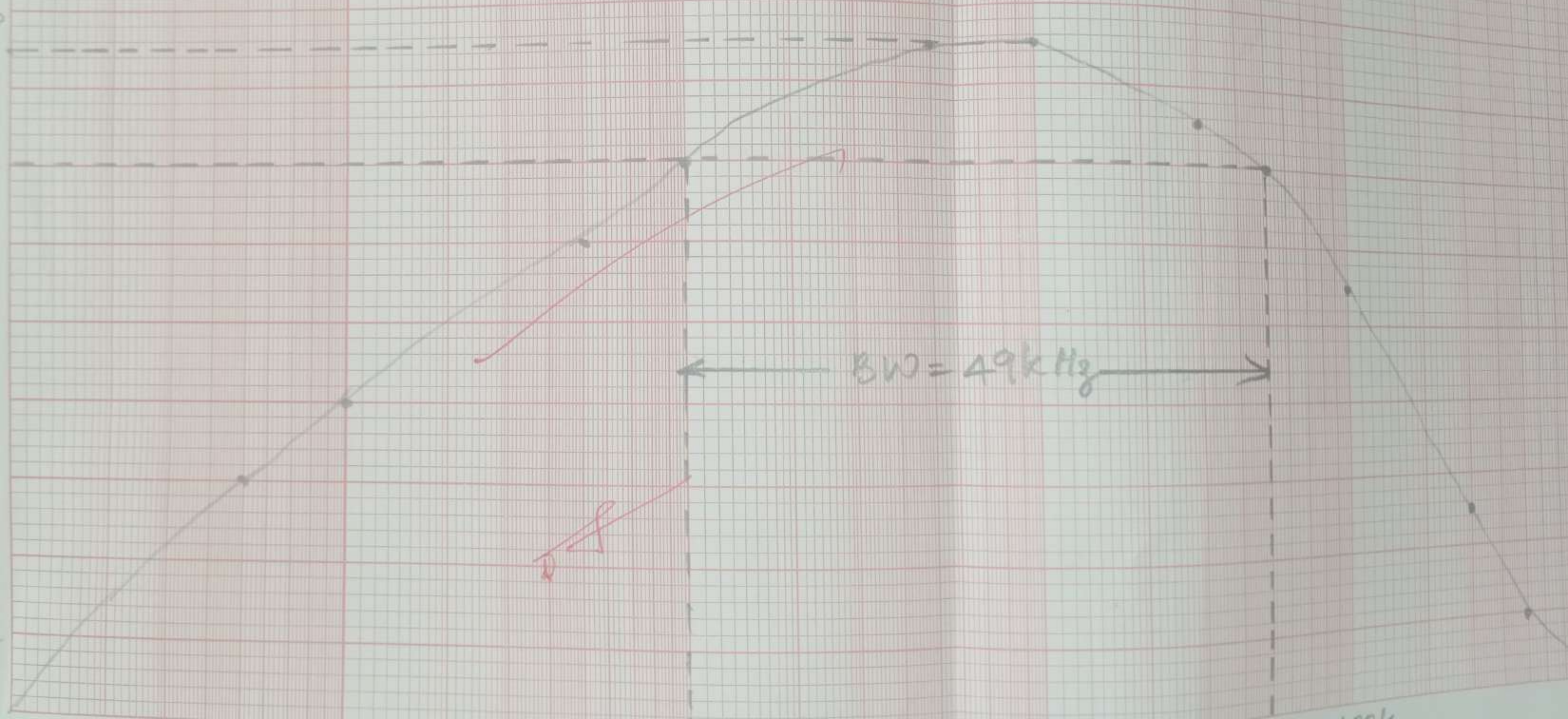
$= 50000 - 1000$

$= 49000$

$= 49\,kHz$

Scale:

Y-axis-1unit = 2 dB's



AIM: To design a monostable multivibrator for the pulse width of 0.03 sec.

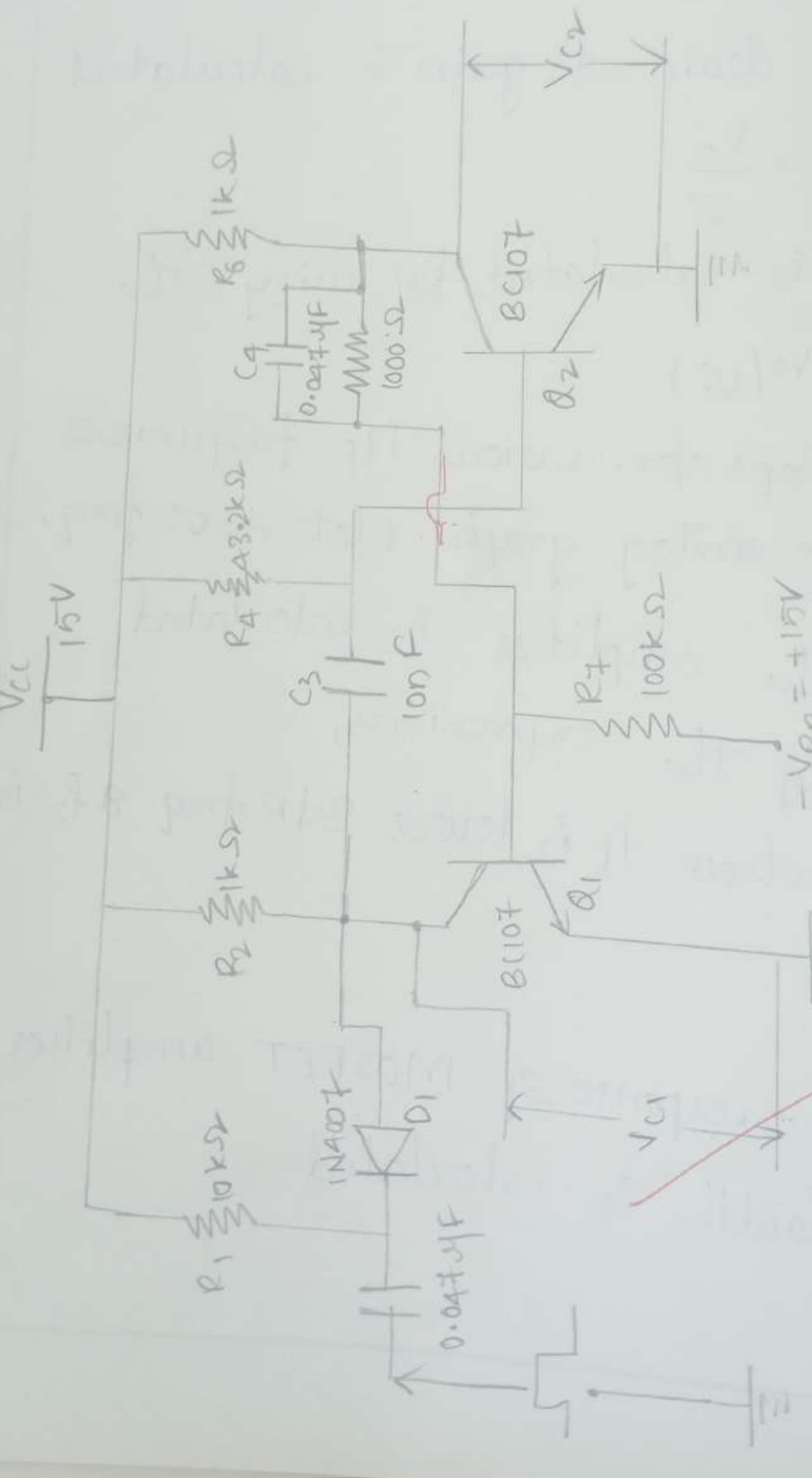
Apparatus:

1) Cathod Ray oscilloscope.
2) Function generator.
3) Connecting patch chords.
4) DC power supply.
5) Resistors (1kΩ, 10kΩ, 100kΩ, 43.2kΩ).
6) Capacitor (0.01μF, 0.047μF, 10mF).
7) Diode (IN4007)
8) Transistor (BC107)

Theory:

The monostable circuit has one permanently stable & one quasi-stable state. In the monostable configuration, a triggering signal is required to induce a transition from the stable state to the quasi-state. The circuit remains in the quasi-stable for a time equal to RC time constant of the circuit. It returns from the quasi-stable state to its stable state without any external triggering pulse. It is also called as one shot a single-cycle, a single step circuit or an univibrator.

Circuit diagram

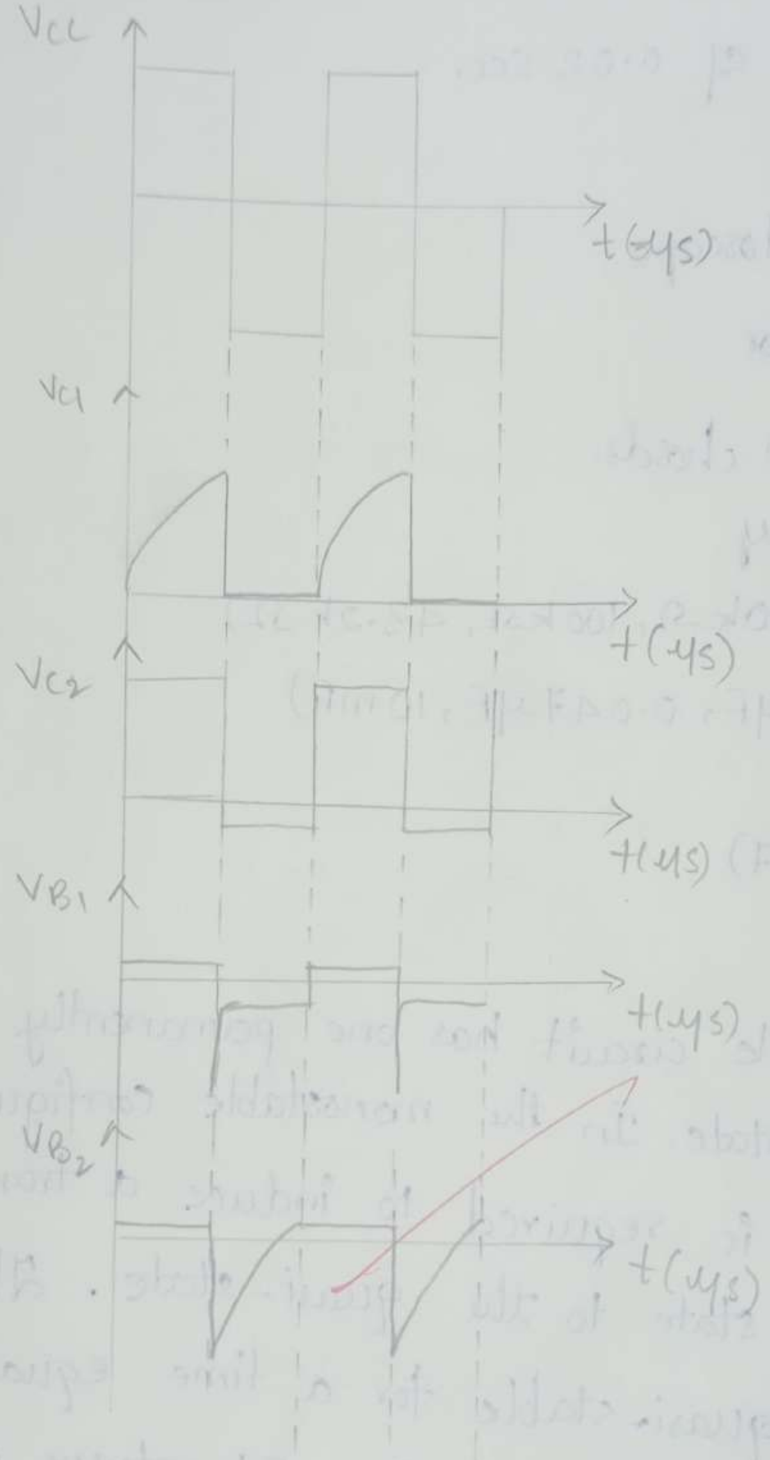


Monostable Multivibrator

Procedure:

1) Switch ON the trainer kit & observe power indication.
2) Wire the circuits as shown in the circuit diagram.
3) Calculate the pulse width (T) of the monostable multi-vibrator o/p with the selected values of R & C on the CRO. see that CRO is in DC mode.
4) Select the triggering pulses such that the frequency is less than 1/T
5) Apply the triggering i/p to the circuit & to the CRO's o/p channel-1. Connect CRO channel-2 to the collector & base of the transistor Q_1 & Q_2.
6) Adjust the triggering pulse frequency to get the stable pulse pulse on the CRO & now measure the pulse width and verify with theoritical value.
7) Obtain waveforms at different points like $V_{B_1}, V_{B_2}, V_{C_1}$ & V_{C_2}.
8) Repeat the experiment for different combinations of R & C (C = 1nf, 100nf). Calculate 'R' for same value of T = 0.3 msec.

Expected wave form:

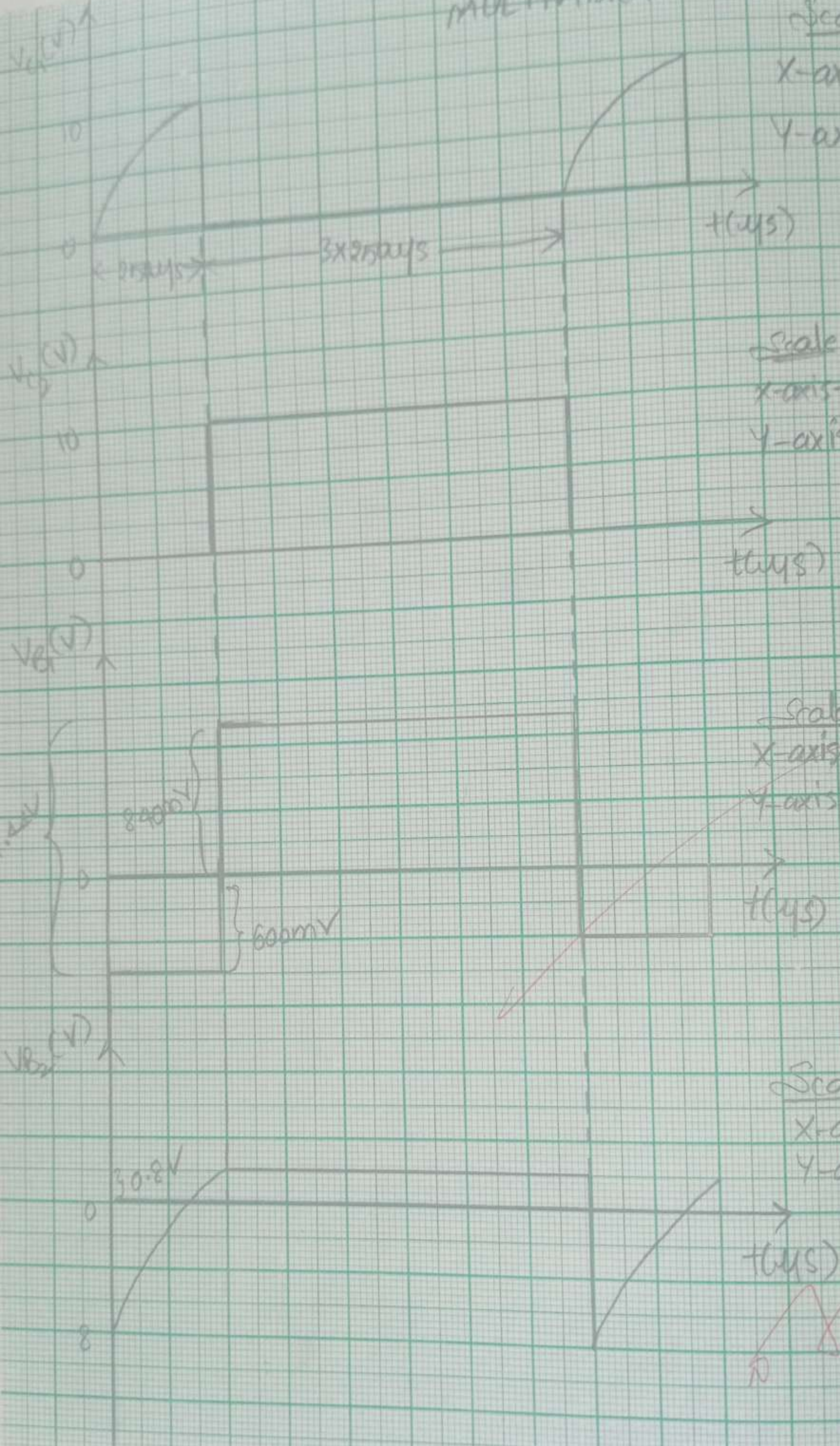


Result:

→ A collector coupled Monostable multivibrator is designed, the waveform observed and verified the results theoritically.

5/2/2020

MONOSTABLE MULTIVIBRATOR



Scale:
X-axis-2units = 250μs
Y-axis-2units = 10V

Scale:
X-axis-2units = 250μs
Y-axis-2units = 10V

Scale:
X-axis-2units = 250μs
Y-axis-1unit = 400mV

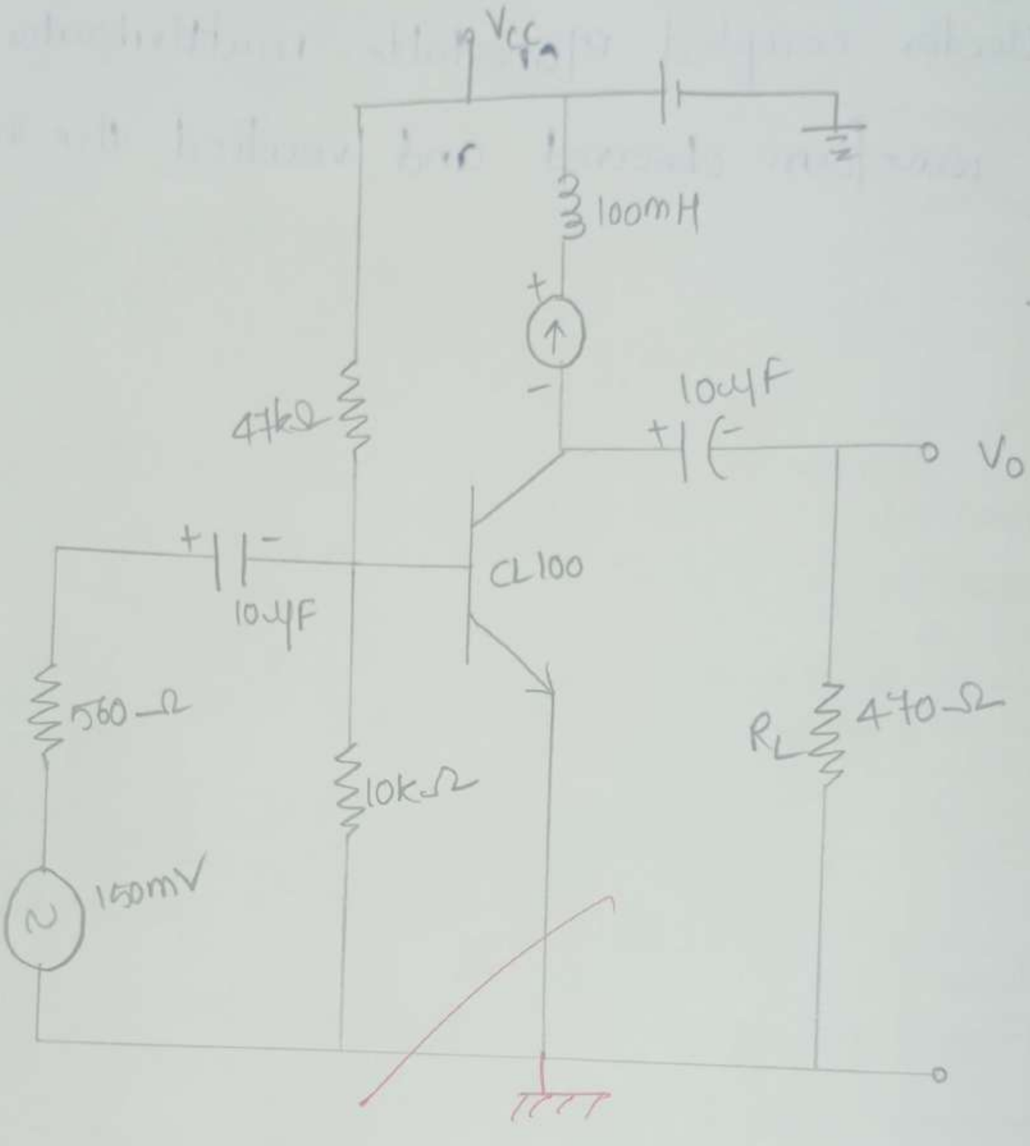
Scale:
X-axis-2units = 250μs
Y-axis-2units = 8V

Aim: To study and observe the output waveform of a Class-A power amplifier and to computed maximum output power and its maximum efficiency.

Apparatus:
1) Class-A tuned Amplifier.
2) CRO
3) Function generator.
4) Power supply.

Theory: The power amplifiers said to be class A amplifier, if the Q point should be middle of the dc load line and the input signal are selected such that the output signal is obtained for a full input signal cycle. For all values of input signal, the transistor remains in the active region and never enters into-cut off and satuation region. When an a.c slg is applied, the collector voltage varies sinusoidal hence the collector current also varies sinusoidal. The collector current flow is 360° of the i/p signal. The efficiency of the class-A amp is only 25% for transformer less & it is 50% for transformer coupled amplifier.

Circuit diagram:



Procedure:

1) Set $V_1 = 1V$ at 1kHz using the signal generator.
2) Connect ammeter (0-200)mA and note down I_C current.
3) Note down output voltage (peak to peak) from CRO.
4) Calculate P_{ac}, P_{dc}, & Effeciency (η) of a class A-power amplifier

Calculation:

→ The rms power delivered to the load P_{ac} is therefore given as,

$$P_{ac} = \frac{(V_{PP})^2}{8R_L}.$$

→ The average power drawn from the supply (P_{dc}) is given by,

$$P_{dc} = V_{CC} \times I_C.$$

→ The efficiency of a Transformer-coupled class-A amplifier is given as,

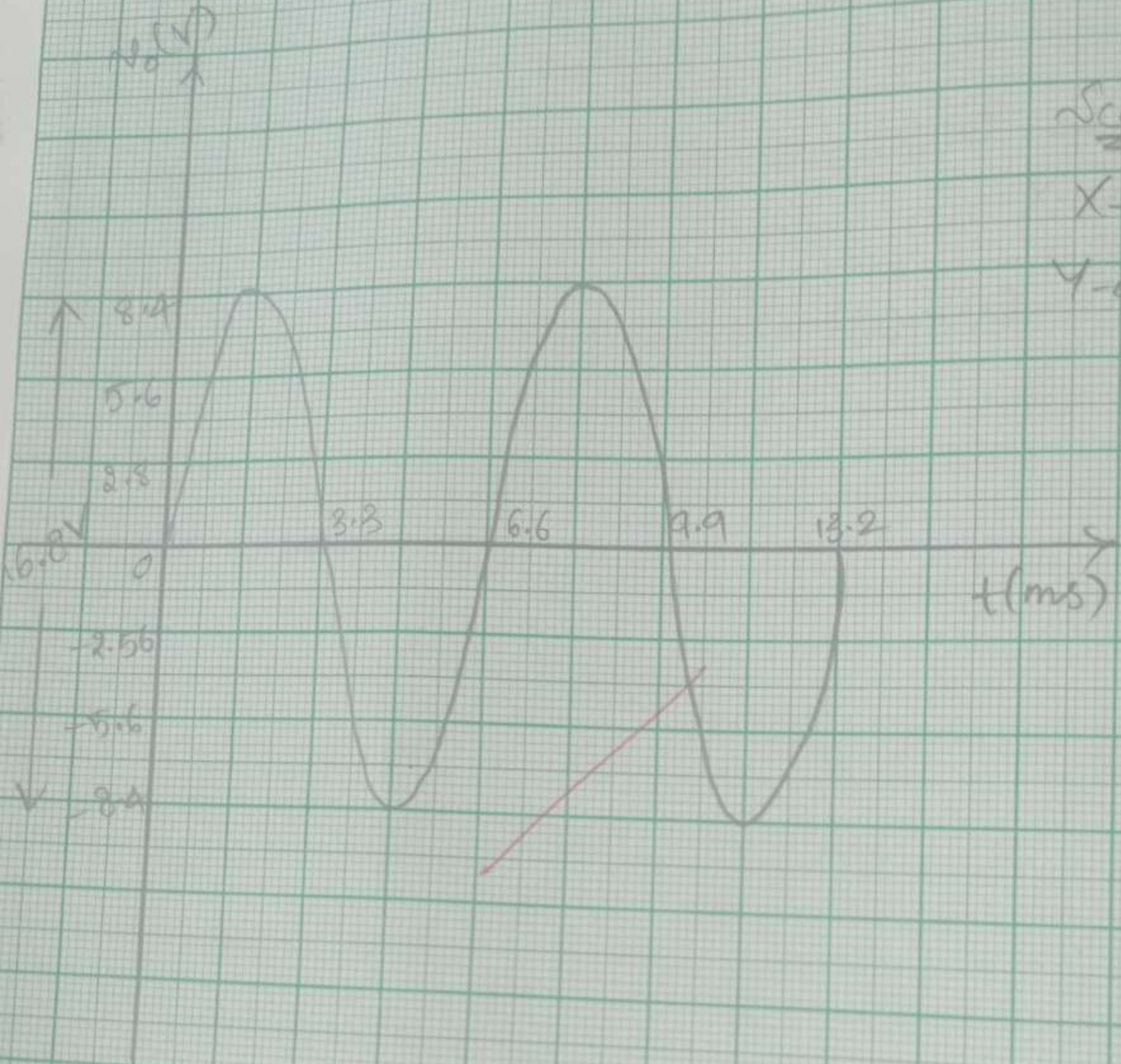
$$\eta_{max} = \frac{P_{ac}}{P_{dc}} \times 100\%.$$

Result: Observed the outputwaveform of a Class-A power amplifier with transformer load & calculated the potential efficiency (η%) of the circuit is 10.9 %.

7/12/10

3/02/2020

CLASS-A AMPLIFIER



Scale:-

X-axis - 2 units = 3.3ms

Y-axis - 1 unit = 2.8V

Title: UJT Relaxation Oscillator

Date: 24/02/2020
Page No.: 15

AIM: To study the operation of UJT Relaxation oscillator.

APPARATUS:

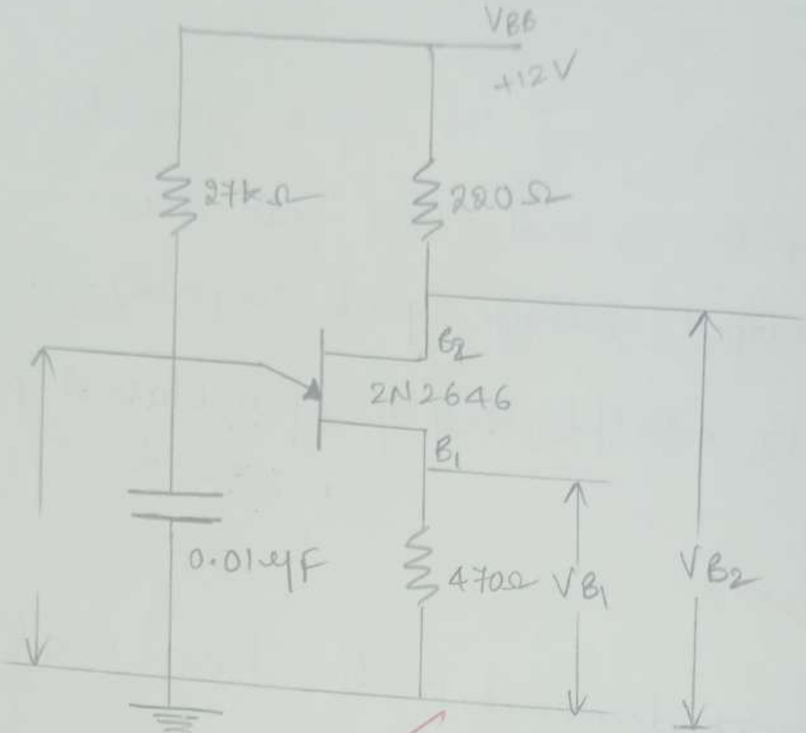
1) Resistors (27 kΩ, 1kΩ, 470Ω).
2) Capacitor (0.01 μF).
3) Cathode Ray Oscilloscope.
4) Bread board.

Theory: The UJT exhibits a -ve resistance characteristics it can be used to provide time delayed trigger pulse for activating other devices like SCR. The basic trigger circuit is shown.

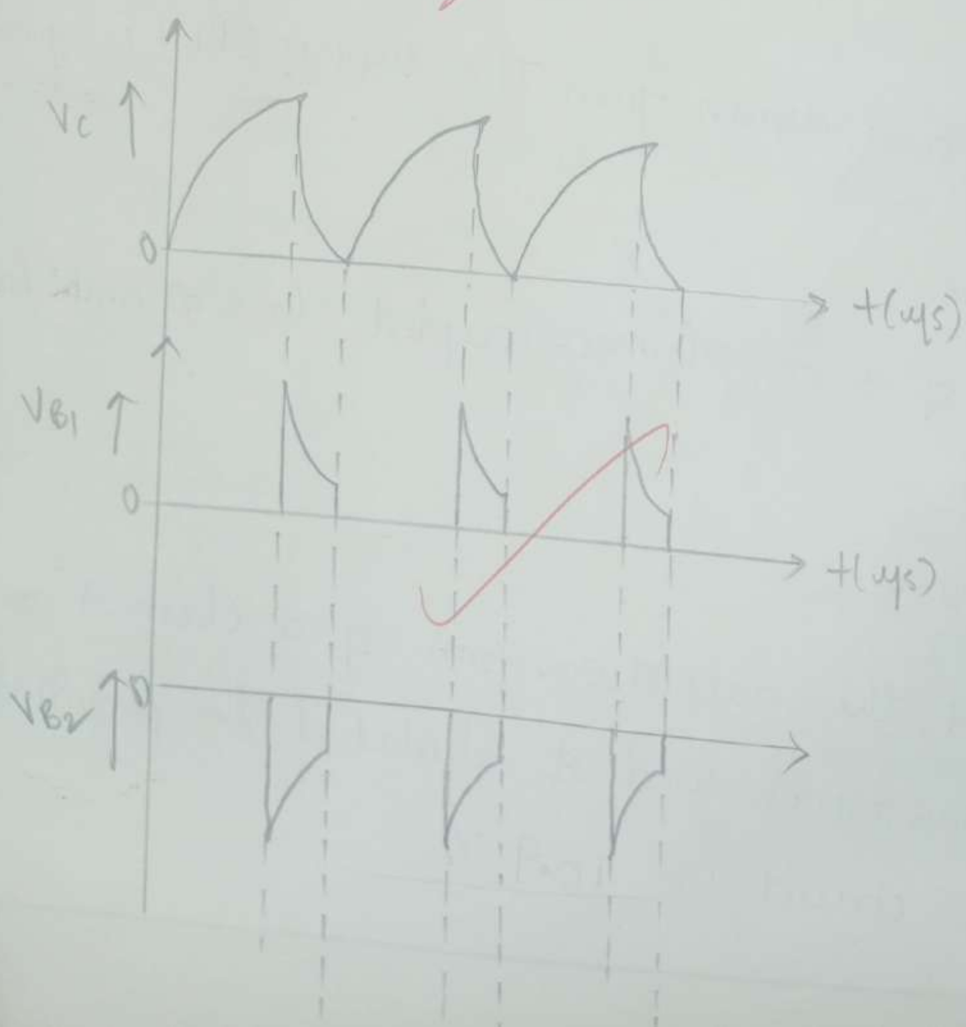
The external resistance R_{B1} & R_{B2} are the UJT base. The emitter potential V_e is varied depending on charging rate of capacitor C. The Charging resistance R_C should be such that the load line intersects the device characteristics either in region PR or in BQ, the resulting operating point will be stable & the circuit will not oscillate. This sets the maximum & minimum limits on the permissible value of R_c.

As the Capacitor charges, when the emitter voltage goes to peak point voltages $(\eta V_b + V_D)$, regeneration

Circuit diagram:



Expected wave form:



Title :

Date :

Page No. : 16

will start and the capacitor will discharge through resistor R_{B1}. The rise time of the o/p pulse will depend on the switching speed of UJT, and the duration will be proportional to the time constant $R_{B1}C$ of the discharge circuit. The emitter-base-1 diode will again be reverse biased until the capacitor is charged to $(\eta V_{b}+V_{D})$, period T is given by $T = RC \ln\left(\frac{1}{1-\eta}\right)$

Procedure:

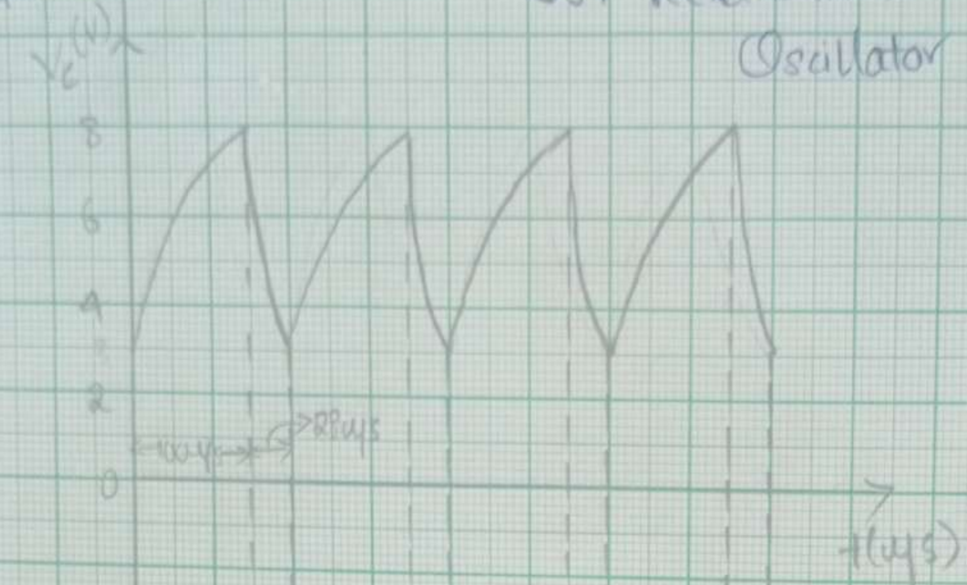
1) Connect the circuit as shown. Apply 15V DC power supply to the circuit.
2) Observe the o/p pulses on the CRO at B_1, B_2 & V_e (V_c).
3) Vary the time const. (RC) by varying capacitance value & potentiometer value (R). Observe the variations in the out pulses on the CRO at B_1 & B_2 & V_e (V_c).
4) Plot the graphs as shown in the expected wave forms.

Result: The waveforms are plotted as shown & the practical 'T' is verified to the theoritical value.

02/03/2020

24/02/2020

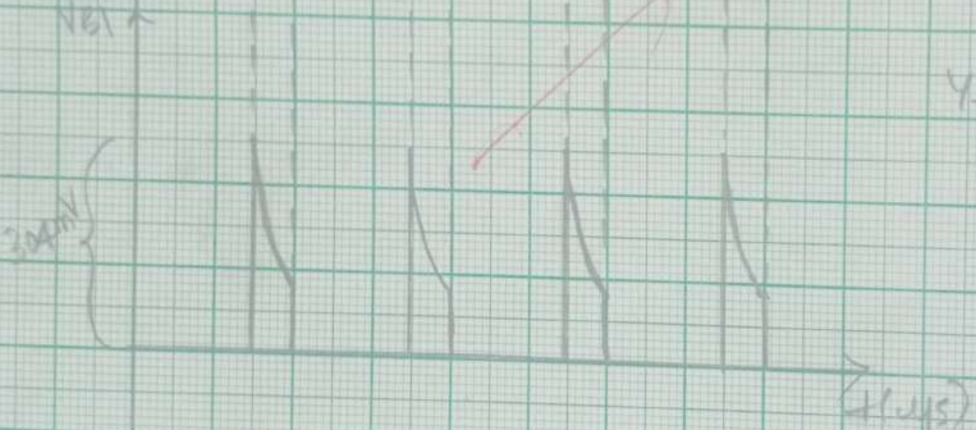
UJT Relaxation Oscillator



Scale

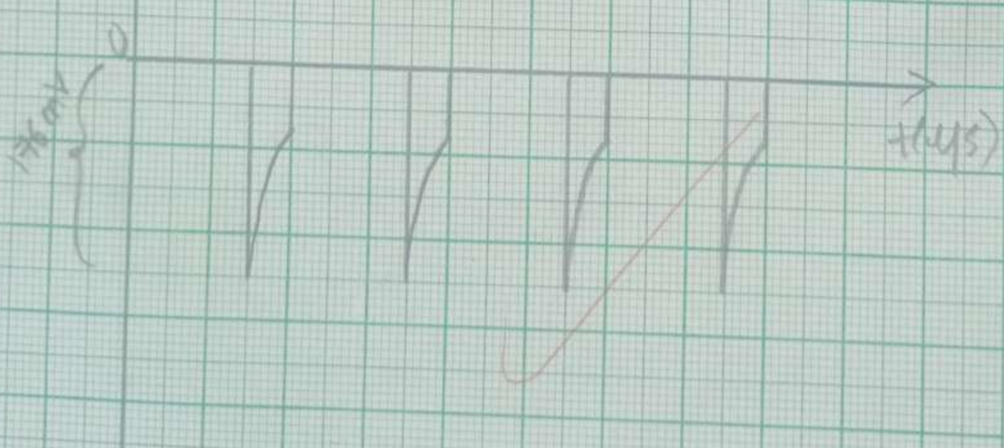
X-axis - 2 units = [illegible]

Y-axis - 1 unit = 2V



Y-axis - 2.5 units = 304mV

Y-axis - 2.5 units = 176mV

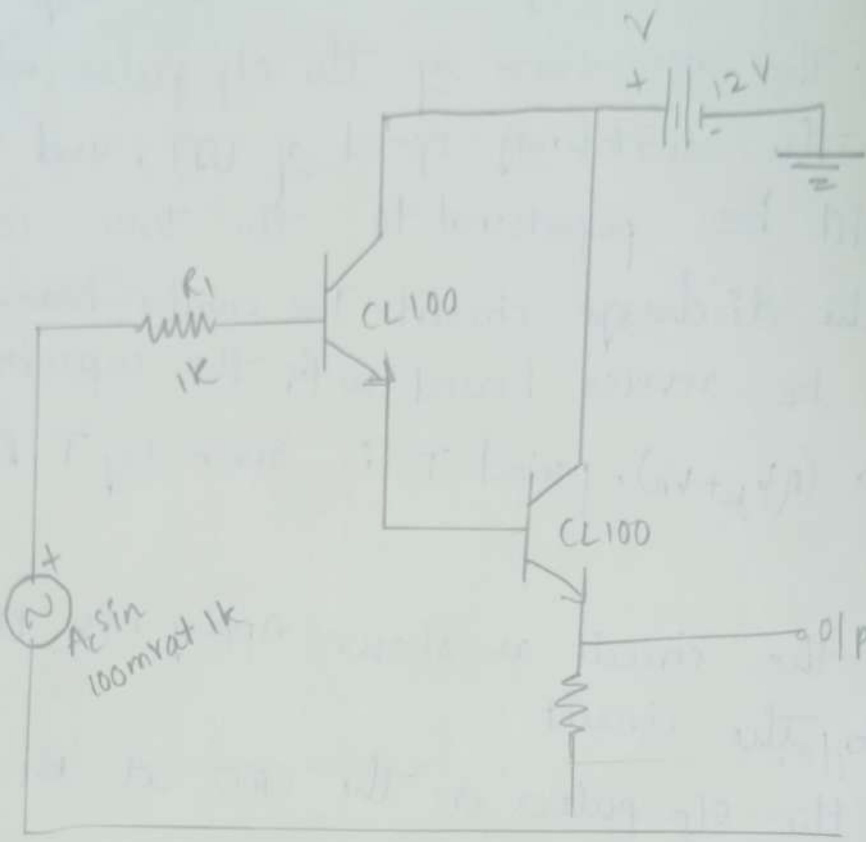


AIM: To plot the frequency of a Darlington amplifier. Calculate gain, BW.

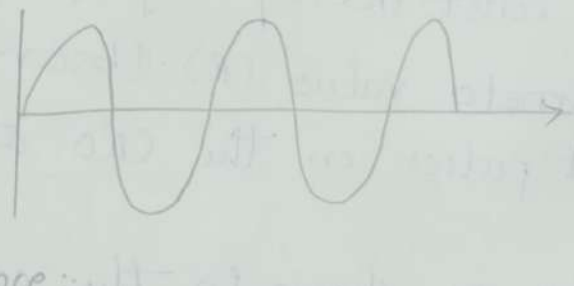
Apparatus:
→ Darlington pair Amplifier Trainer kit.
→ CRO.
→ Function generator
→ Power supply.

Procedure:
1) Connect the circuit diag. as shown in fig. Set the RPS voltage at 12V & i/p s/g amplitude 50mV, 1kHz in funⁿ generator.
2) Feed the sine waveform s/g to the i/p of the amplifier & observe an amplified voltage at the o/p without distortion.
3) By keeping i/p s/g voltage, const. 50mV, select the range switch of the FG i/p s/g frequency from (10Hz to 1MHz) in steps. Note down the o/p V_0 peak to peak amplitude of s/g for diff frequencies in tabular column.

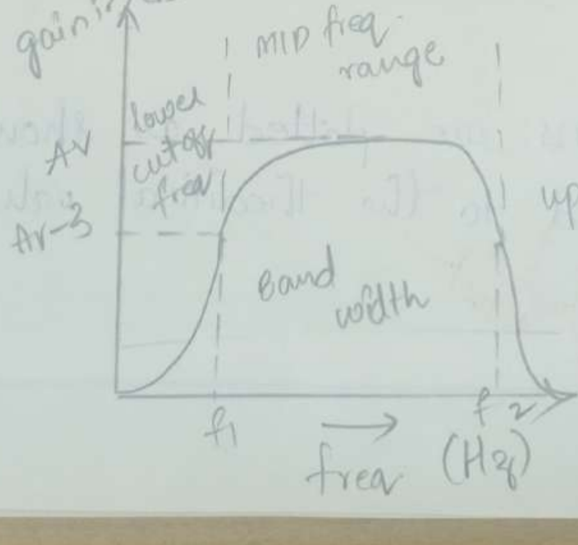
Circuit Diag:



waveform:



frequency responce:



4) Calculate the BW from the plot of graph.

Theory:

The emitter follower has reasonably high i/p impedance and may be used wherever i/p impedance upto about 500k Ω is needed. For higher i/p impedance, we may use 2 transistors to form what is called a Darlington pair. When o/p is taken from Emitter terminal of the transistor, the N/w is reffered to as an emitter follower. The o/p voltage is always less than i/p voltage due to drop between base & emitter.

Result:

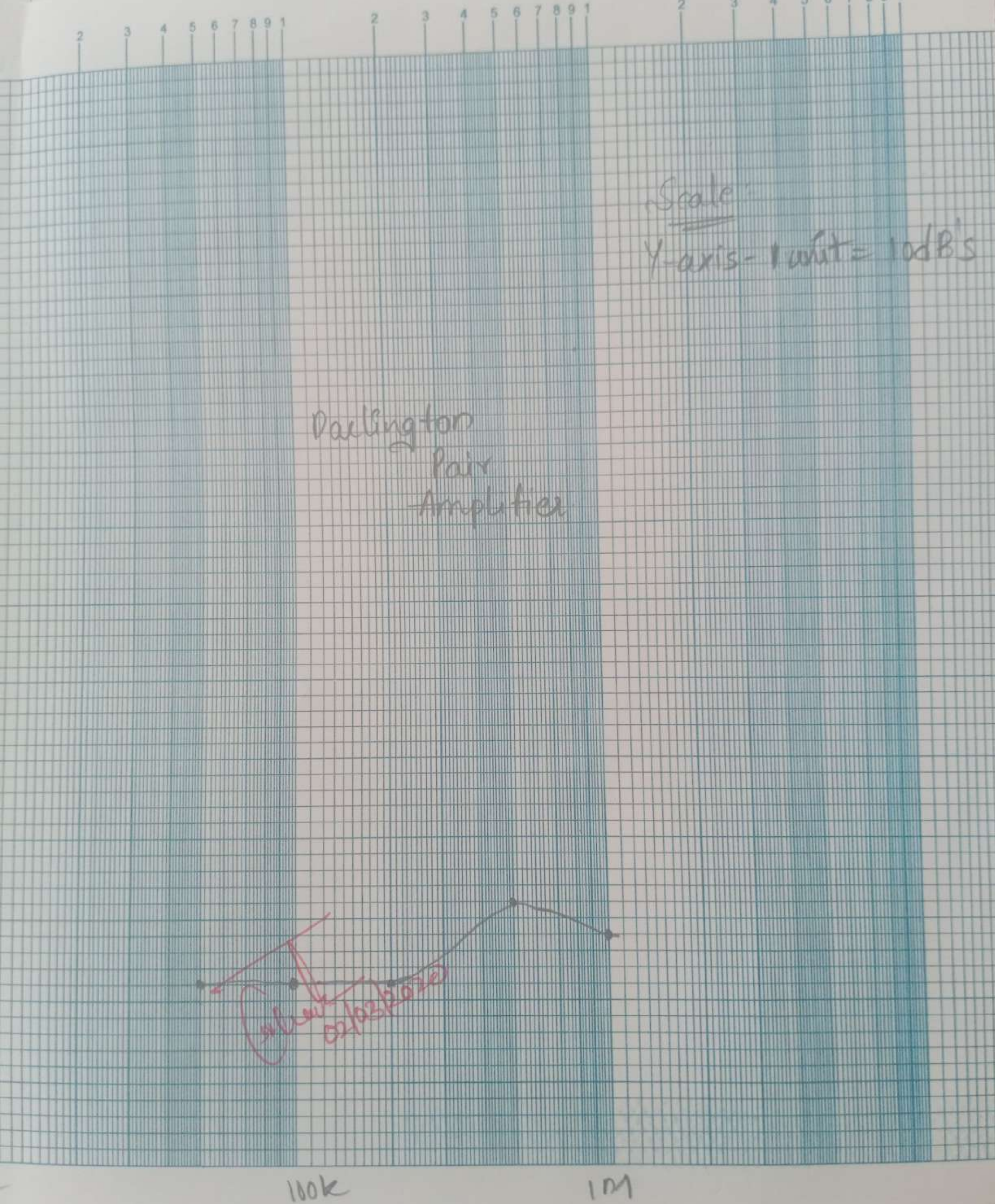
Hence the frequency response of Darlington amplifier is verified & its bandwidth is calculated

02/03/2020

Observation table: $V_{in} = 1V$

S.No	frequency (Hz)	o/p voltage (V_0)	voltage gain $A_v = V_0 / V_{in}$	in dB's $= 20\log(V_0/V_{in})$
1.	50 k	102 mV	102×10^{-3}	-19.82
	100 k	103 mV	103×10^{-3}	-19.74
	200 k	110 mV	110×10^{-3}	-19.17
	500 k	179 mV	179×10^{-3}	-14.94
	1 M	150 mV	150×10^{-3}	-16.47

(Hz)	(V)		
50 k	102 mV	102×10^{-3}	-19.82



Title : Class-C Power-Amplifier

Date : 2|3|2020
Page No. : 19

AIM: Study the Class-C Tuned amplifier & find its efficiency

Apparatus:

→ Class-C tuned amplifier kit.

→ CRO

→ Function generator.

→ Power supply.

Procedure:

→ Connections are made as shown in circuit diag.

→ Connect the i/p signal (say 15 to 18) from signal generator.

→ Connect milli ammeter to the I_c terminals.

→ By varying the i/p voltage, observe the maximum distortion less wave form.

→ Note down V_o, V_{ds}, I_s & find P_{ac} & P_{dc}

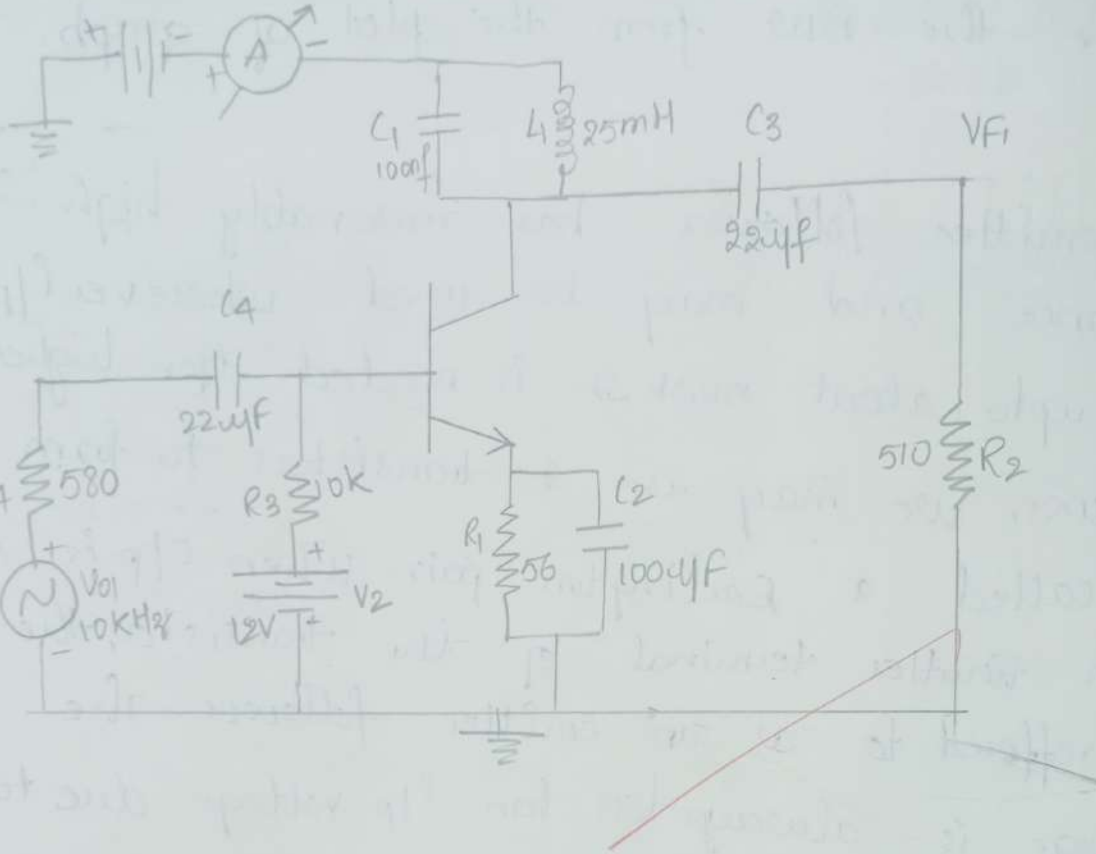
→ Calculate the AC input power using

$$P_{ac} = V_o^2 / 8R_L$$

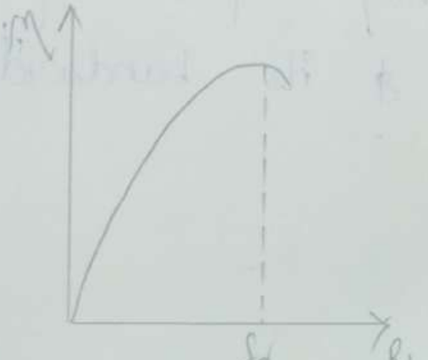
→ Calculate the DC i/p power using $P_{dc} = V_{dc} \times I_c$.

→ Calculate efficiency using $\%\eta = \frac{P_{ac}}{P_{dc}} \times 100\%$

Circuit diagram



Model graph



Title :

~~RESULT~~: THEORY: In class C operations, collector current flows for less than one half cycle of the i/p signal. The Class-C operation is achieved by reverse biasing the emitter-base junction. The opposite of fidelity is a term we mentioned earlier distortion. Therefore, a circuit that has high fidely has low distortion. In conclusion, a class A amplifier The efficiency of an amplifier refers to the ratio of output-signal power compared to the total i/p power. Since every device takes power to operate an amplifier that operates for 360° of the i/p sig uses more power than if operated for 180° of the i/p sig By using more power, an amplifier has less power available for the o/p sig; thus the efficiency of the amplier is low.

Result: The maximum i/p signal amplitude which produces undistorted o/p is 280mV. and the practical efficiency of the circuit is 10.26.

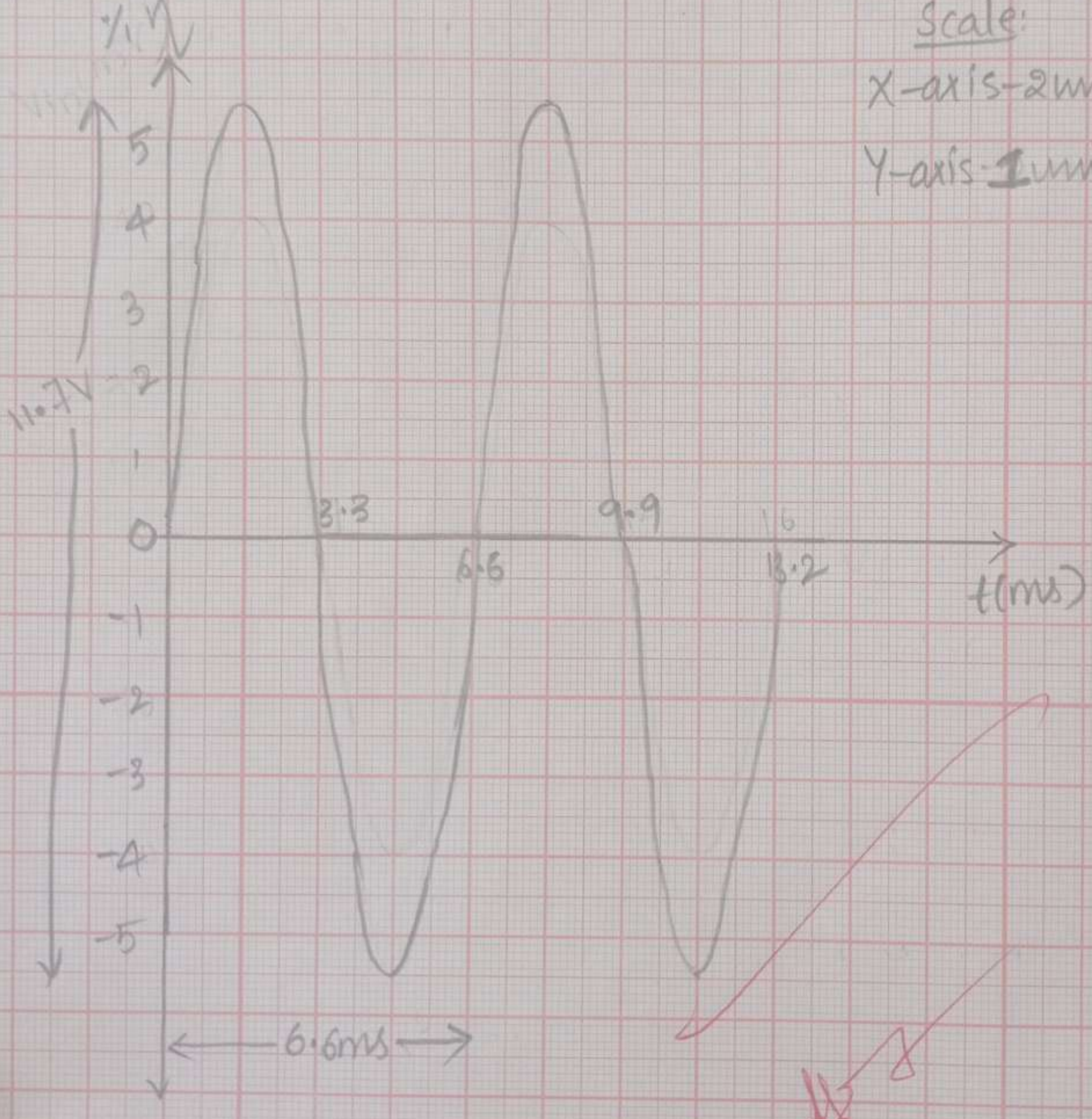
16/11/2020

Observation Table:

f (Hz)	V_o (V)	V_{dc} (V)	I_c (mA)	R_L (Ω)	$P_{ac} = \frac{V_o^2}{8R_L}$ (W)	$P_{dc} = V_{dc} I_c$ (W)	$\% \eta = \frac{P_{ac}}{P_{dc}} \times 100$
10.73k	4.48	12	3.5	510	4.919×10^{-3}	42×10^{-3}	11.71
0.88k	3.12	12	2.3	510	2.384×10^{-3}	27.6×10^{-3}	8.63
13.2k	1.96	12	2.3	510	9.415×10^{-3}	27.6×10^{-3}	3.40
15.58k	1.40	12	2.3	510	4.803×10^{-3}	27.6×10^{-3}	0.173

Class 'C' power Amplifier

Date
2/03/2020



Scale:
X-axis-2units=3.3ms
Y-axis-1units = 1V

Title: Single Tuned Voltage Amplifier Date: 2/3/2020
Page No.: 21

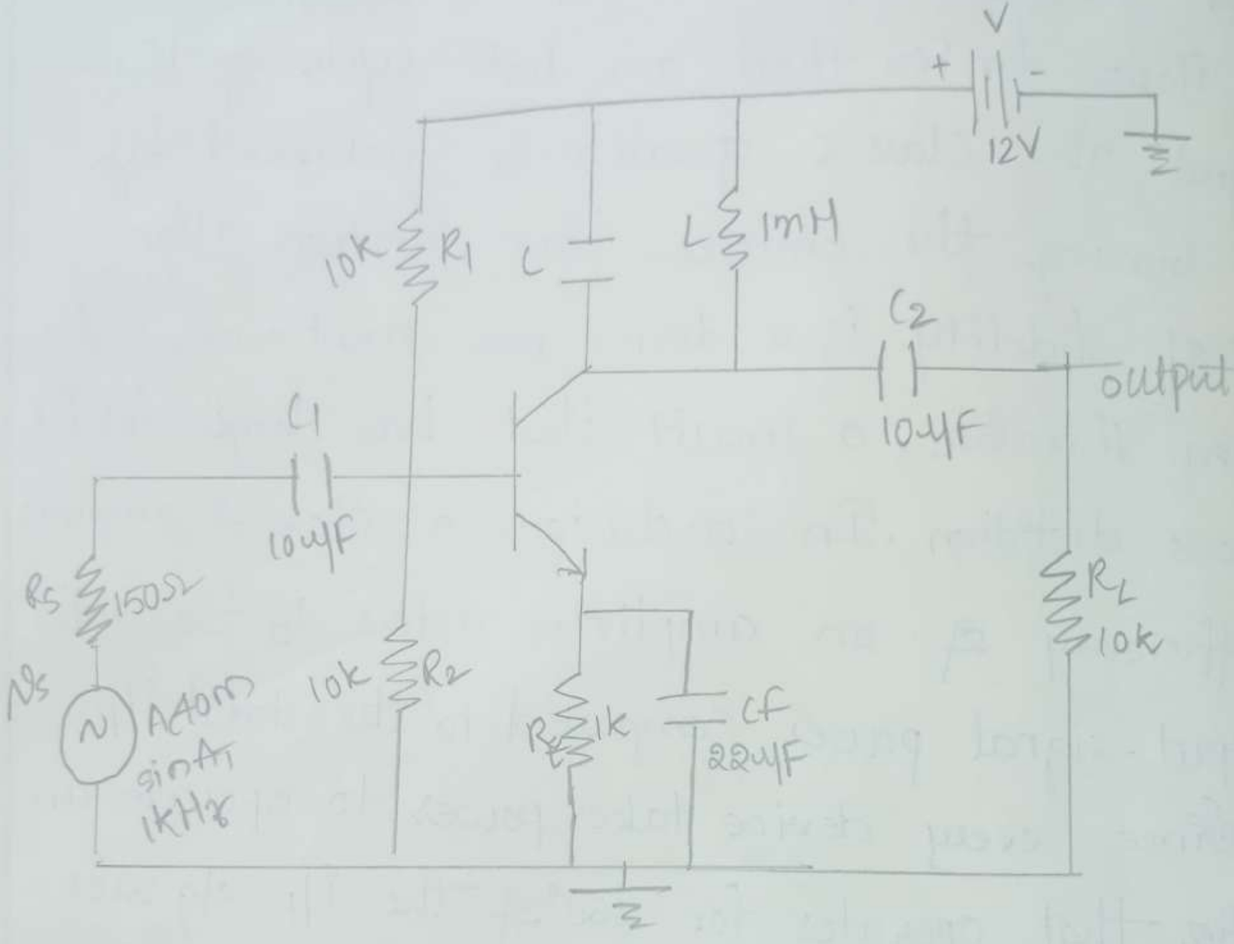
AIM: Study the operation of single Tuned voltage Amplifier & find its resonant frequency.

Apparatus:
→ Single Tuned voltage amplifier kit.
→ CRO
→ Function generator.
→ Power supply.

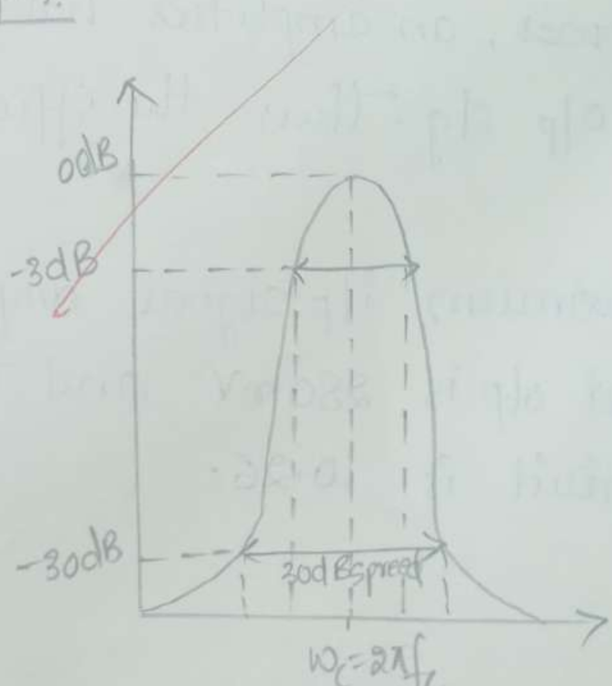
Procedure:
1) Connect the circuit as per the circuit diag.
2) Apply the maximum undistorted i/p signal.
3) Vary the frequency conveniently and note down the o/p voltage
4) Calculate the gain of resonant frequency.
5) Plot the curve between gain & resonant frequency
6) Calculate the resonant frequency & compare it with the theoritical value.

Theory: A tuned amplifier uses one or more parallel tuned LC circuit as the load impedence. The basic tuned circuit is also reffered as tank circuit operation and it produces oscillations at any or at required frequency. Tuned amplifiers are used for amplifying

Circuit diagram:



Expected graph:



electrical signal consisting of either a ~~signal~~ single radio frequency (>30KHz) or a narrow band of frequencies in the RF region. Tuned ampliers are properly reffered to as RF amplifiers. The resonant frequency of tuned amplifiers is given by,

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Result:

Hence the single tuned voltage amplifier is verified and its resonant frequency calculated.

16/11/2020

Observation table:

SL.No	i/p (kHz) frequency	i/p voltage V_{in} (V)	o/p voltage V_{out} (V)	Gain $= \frac{V_o}{V_{in}}$	Gain in dB $= 20\log\left(\frac{V_o}{V_{in}}\right)$
1.	700	1	1V	1	0
2.	800	1	1.8	1.8	5.106
3.	900	1	6.5	6.5	16.25
4.	1000	1	1.5	1.5	3.52

Theoritical:

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

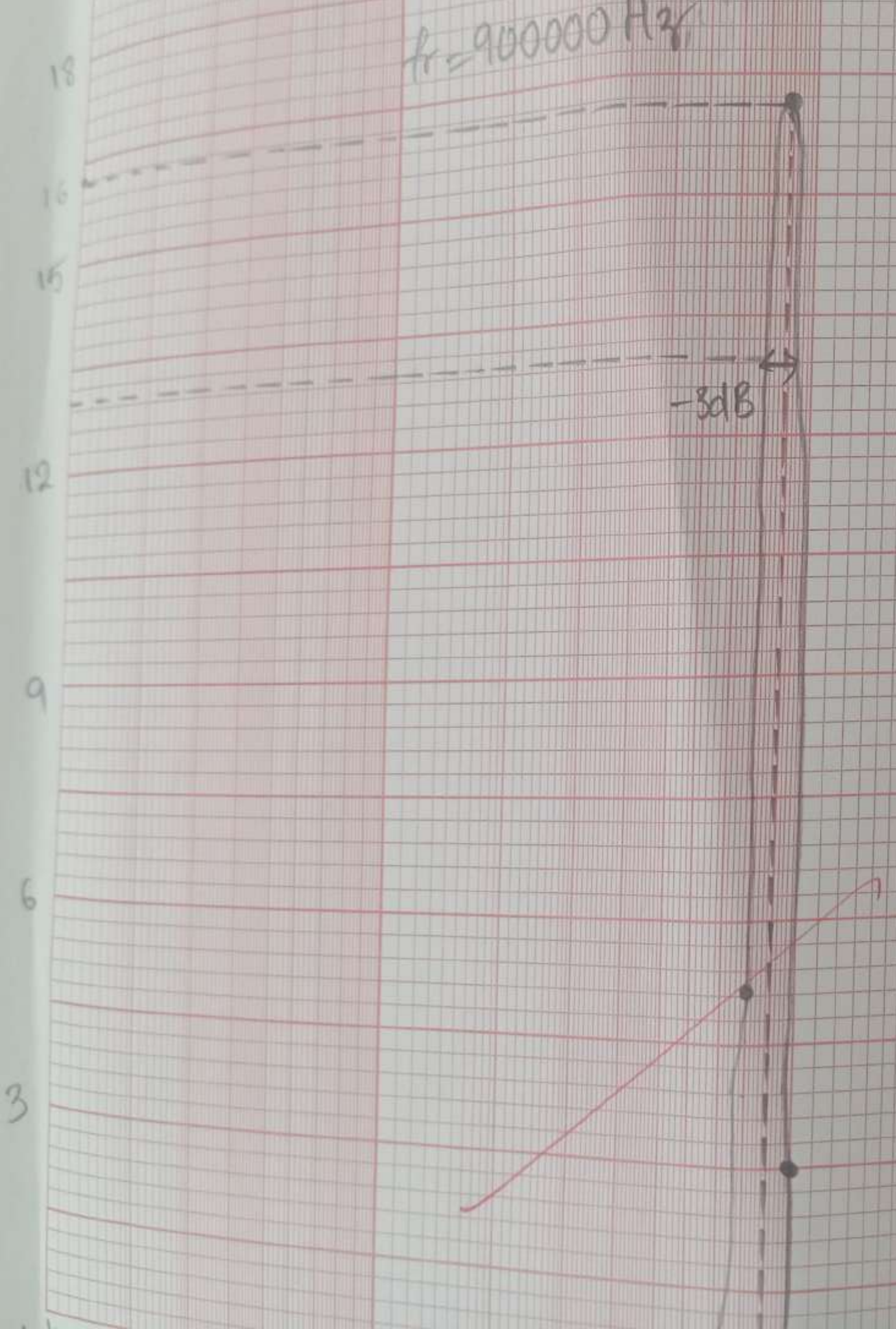
$L = 0.01mH$ & $C = 0.0033\mu F$

$$f_r = \frac{1}{2 \times 3.14 \times \sqrt{0.01 \times 0.0033 \times 10^{-9}}}$$

$$\boxed{f_r = 876563.50 Hz}$$

2/3/2020

Single Tuned Voltage Amplier



Title : Bistable Multivibrator

Date : 12/11/2020
Page No. : 23

AIM:

(a) To design bistable multivibrator circuit & verify the operation.

(b) Obtain the resolving time of bi-stable multivibrator and verify theoritically.

Choose $R_1 = 10k\Omega$, $C = 0.3 \mu F$, $V_{CE(sat)} = 0.2V$, $I_{E(max)} = 15mA$

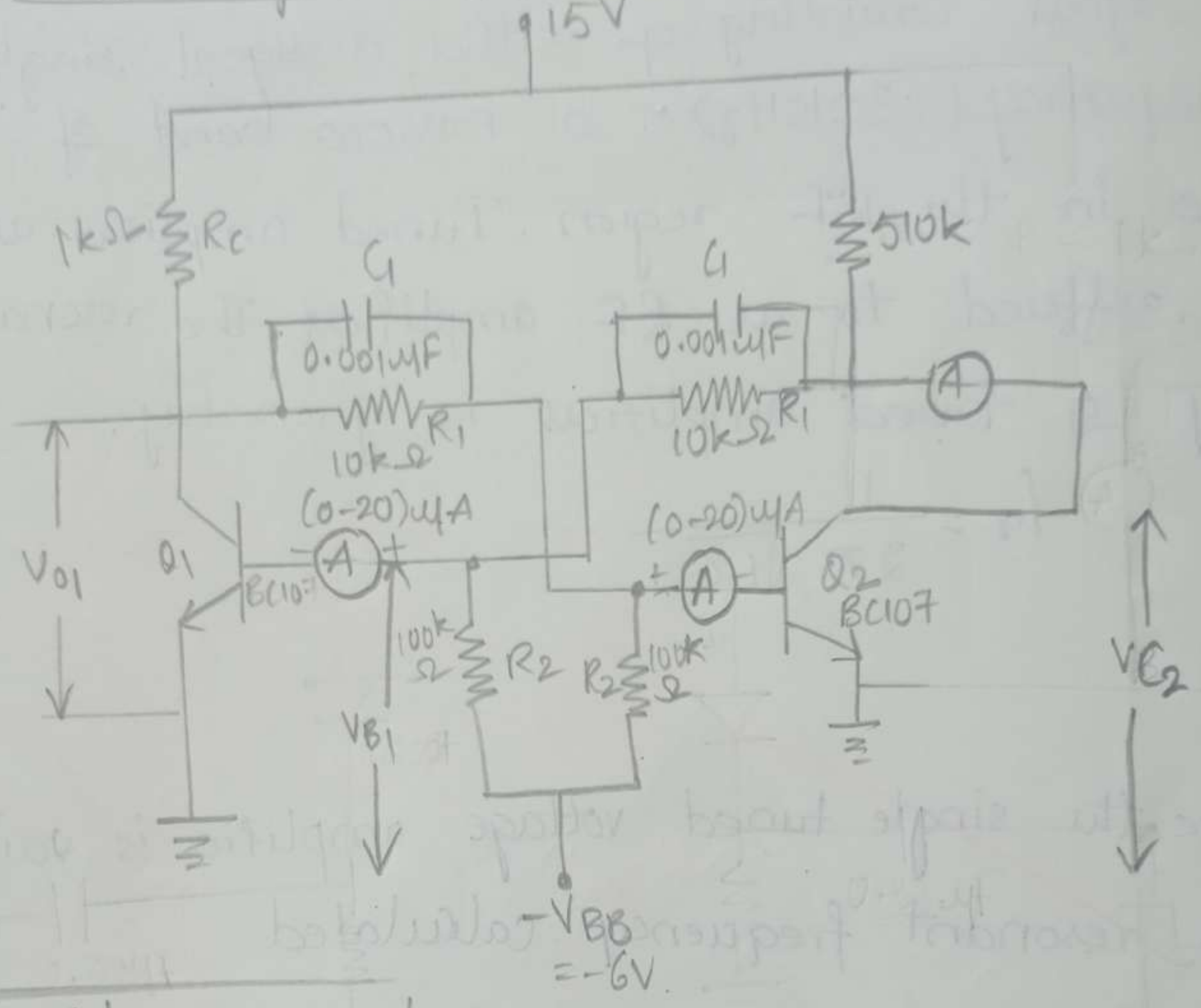
$V_{CC} = 15V$, $V_{BB} = 15V$, $V_{B1} = -1.2V$.

Apparatus:

1) Cathode Ray oscilloscope.
2) Function generator.
3) Connecting patch chords
4) DC - power supply.
5) Resistors ($1k\Omega$, $10k\Omega$, $100k\Omega$)
6) Capacitors ($0.001 \mu F$, $0.33 pF$).
7) Diode (IN4007)
8) Transistor (BC107).

Theory: A Bistable multivibrator is one which can exist indefinitely in either of two stable states & which can be induced to make an abrupt transition from one state to other by means of external excitation.

Circuit diagram:



$Q_1 = ON$

$V_{B_1} = 0.7V$

$I_{B_1} = 131.3 \mu A$

$I_{C_1} = 9.5 mA$

$V_{C_1} = 0.09V$

$Q_2 = OFF$

$V_{B_2} = -0.88 V$

$I_{B_2} = 0$

$I_{C_2} = 0$

$V_{C_2} = 4.5V$

The Bistable circuit is also called as bistable multivibrator, Eccles Jordon circuit, Trigger circuit, Scale-of-2-toggle, flip-flop & Binary.

A bistable multivibrator is used in many digital operations such as counting and the storing of binary information. It is also used in the generation & processing of pulse-type waveform. They can be used to control digital circuits and as frequency divides. There are two o/p's available which are complements of one another i.e, when one o/p is high the other is low and vice versa.

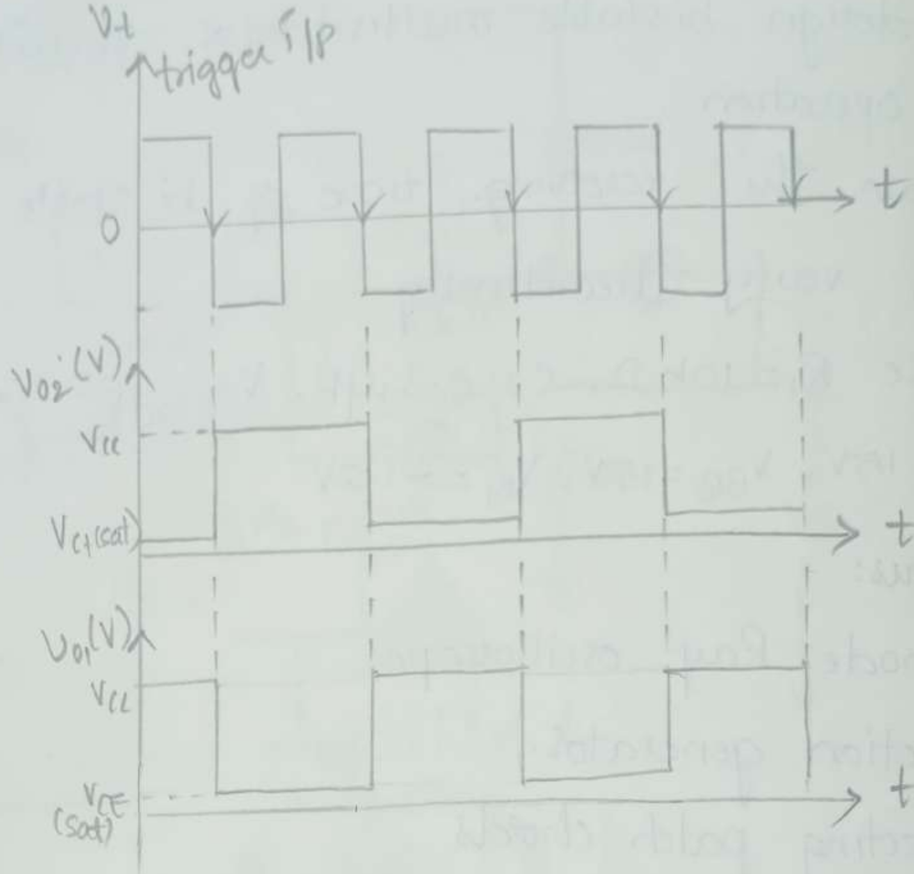
Procedure:

1) Switch ON the system and observe for the power LED indications.

2) Apply two square waves with same frequency or different frequency at terminals T_1 & T_2. You may observe symmetrical or Assymmetrical square wave respectively. Observe both i/p & o/p waveform on CRO.

3) Set the i/p frequency at 500 Hz.

Expected waveform:



Design:

Let $V_{cc} = 5V$, $V_{BB} = -6V$

$I_{cmax} = 10mA$, $h_{fe} = 50$

As one transistor goes into statuation and other to cut off, neglecting saturation voltage,

$$R_c = \frac{V_{cc}}{I_{max}} = \frac{5}{10} = 0.5\,k\Omega$$

To ensure a loop gain in excess of unity during the Transition between states the unequality

4) Until you get 500Hz at o/p, increases the trigger i/p amplitude. Note down the i/p amplitude, this is the minimum step pulse required for trigger the bi-stable multivibrator with the given circuit parameters.

5) Now slowly increase the frequency and at one particular frequency the circuit does not respond and the o/p dissappears Just lesser than this freq, the circuit again responds, this is the maximum allowable frequency.

6) Sketch o/p wave forms, sample o/p waveform as shown.

Result:

Bistable multivibrator circuit is designed & the o/p waveforms are observed.

16/11/2020

$R_1 < h_{fe} R_c$ must be satisfied

$R_1 < 50 \times 0.5 k\Omega < 25 k\Omega \simeq 20 k\Omega$

Let V_{BE} (cut off) be $-1V$

$$\frac{-V_{BB}}{R_1 + R_2} \times R_1 = -1 \Rightarrow \frac{-5 \times 20k}{20k + R_2} = -1 \Rightarrow R_2 = 80k$$

Let the maximum frequency for which bistable responds be $f_{max} = 1kHz$

$$1kHz = \frac{R_1 + R_2}{2 \times R_1 R_2 C_1}.$$

$$C_1 = 0.03\mu f \simeq 0.01 \mu f$$

Observation:

$V_{B_1} = -0.82V$	$I_{B_1} = 0$
$V_{C_1} = 4.88V$	$I_{B_2} = 134.2\mu A$
$V_{B_2} = 0.71V$	$I_{C_1} = 0$
$V_{C_2} = 0.11V$	$I_{C_2} = 9.4 mA$

Title : Schmitt Trigger

Date : 12/11/2020

Page No. : 26

AIM: To design the circuit of schmitt trigger with UTP = 3V, LTP = 1.5V, V_{CC} = 15V, R_S = 1kΩ, R_{C_2} = 3k, R_1 = 15k, R_2 = 4.7k

To obtain the UTP & LTP values practically & verify it theoritically.

To obtain square wave from the sine wave.

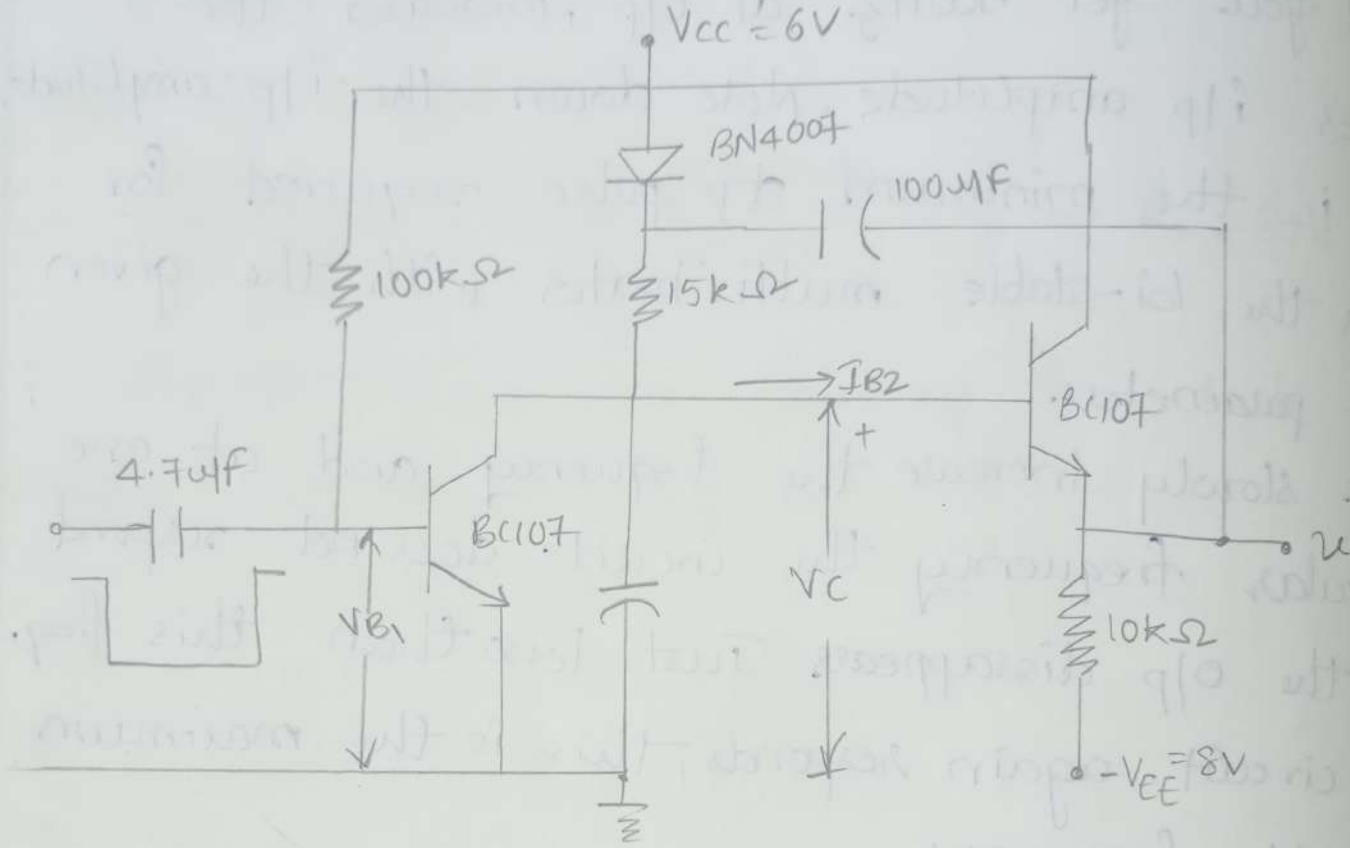
Apparatus:

1) CRO
2) Function generator
3) DC power supply
4) Resistors (1kΩ, 15kΩ, 3.3kΩ, 2.2kΩ, 4.7kΩ).
5) Capacitors (10μF, 1μF)
6) Diode (IN 4007)
7) Transistor (BC107)
8) Connecting patch chords.

Theory:

Schmitt Trigger is an emitter coupled binary trigger circuit. It is termed a binary trigger circuit since two stable states occur. The transistor Q_1 may be ON & Q_2 OFF or vice versa. In the absence of an

Circuit diagram:

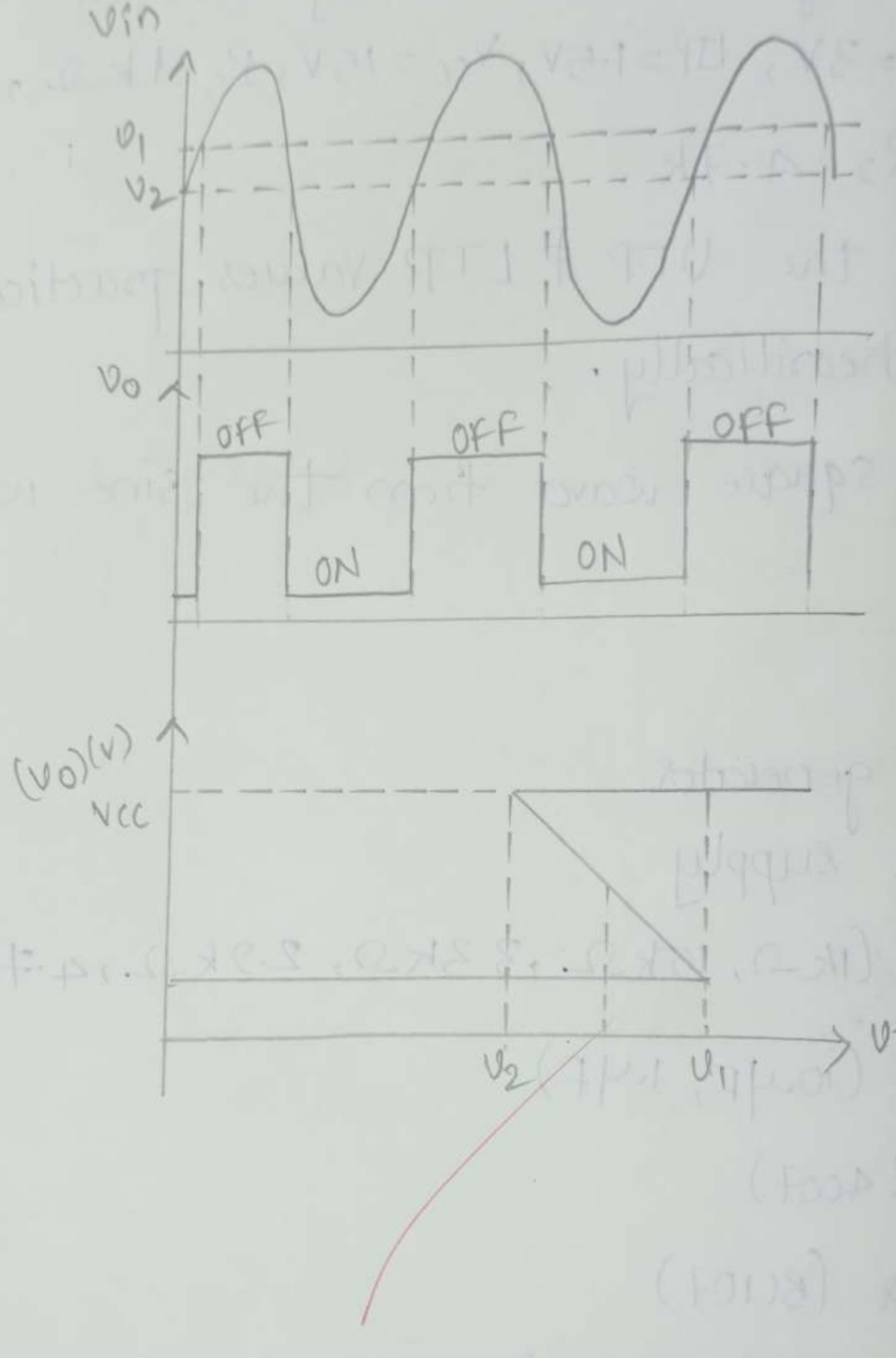


i/p to transistor Q_1 the voltage divider Network along with R_4 maintains the base of Q_2 at a slightly +ve potential relative to the emitter & thereby Q_2 operates in the saturation region. Owing to the current flow in Q_2, the voltage developed across the common emitter resistor, R_e maintains Q_1 at cut-off. Since the base of Q_1 is at ground potential, it is -ve relative to the emitter. thus the stable state in the absence of a signal is Q_2 ON & Q_1 off & the o/p voltage is in the low state. The switching action may be started by raising or lowering the biase on Q_1.

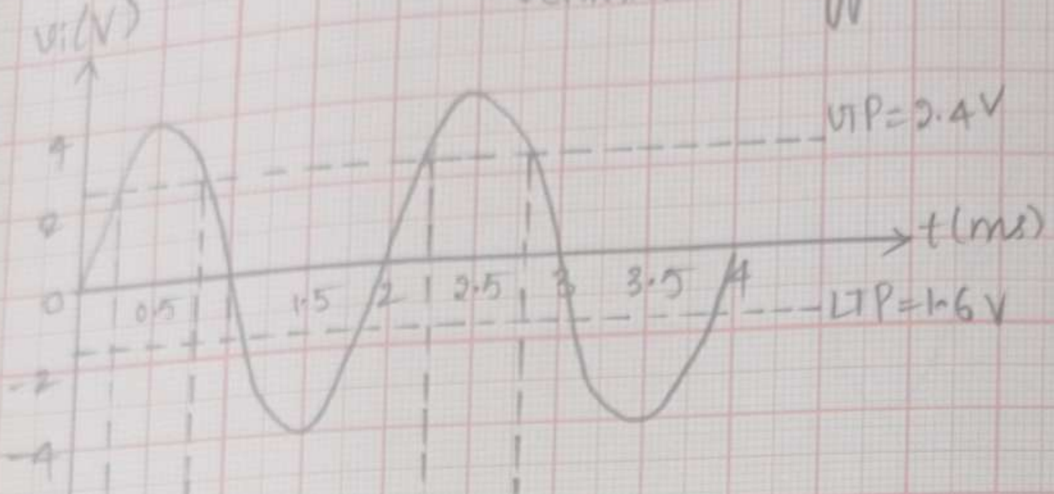
Procedure:

1) Connect the circuit as shown in fig.
2) With $V_i = 0V$, measure the o/p voltage.
3) Slowly increases, the i/p voltage from 0V to maxi-mum & observe the o/p for the transmission.
4) Obtain the voltage at which the low to high transition is occured & this is the UTP & now measure the i/p voltage.

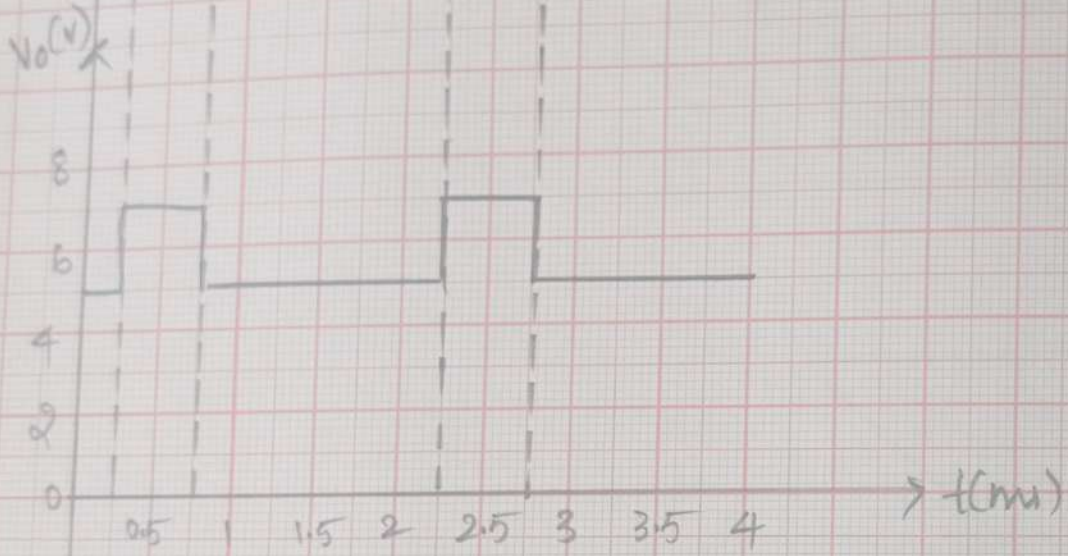
Expected wave forms:



Schmitt's Trigger

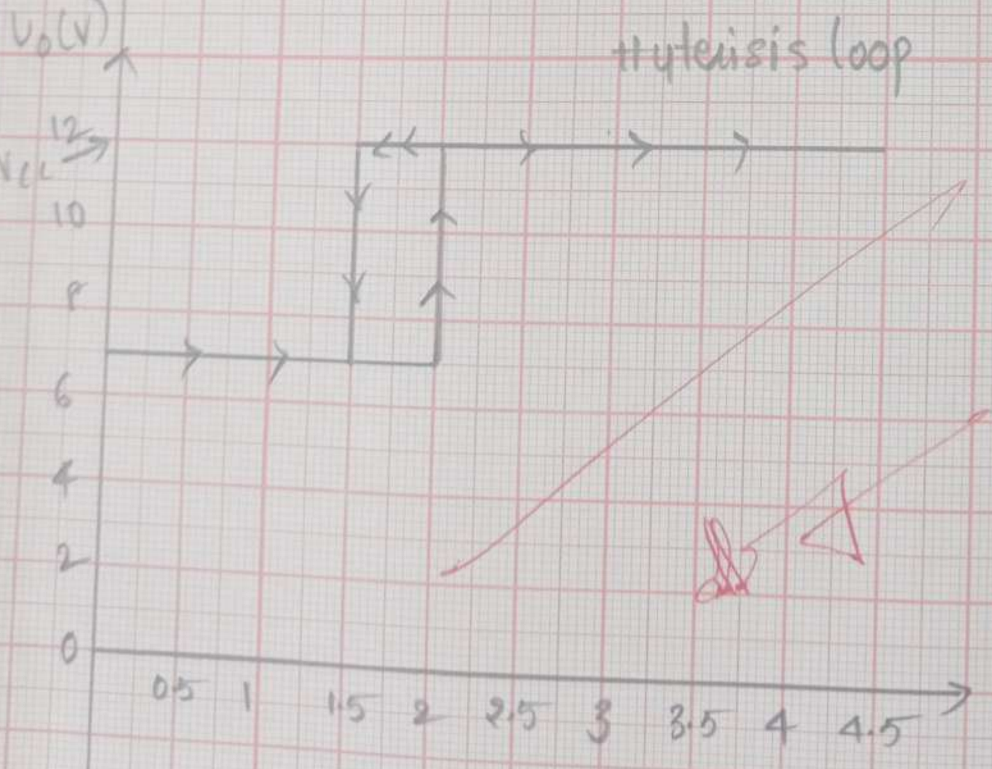


Scale
X-axis-1unit = 0.5ms
Y-axis-1unit = 2V



Scale:
X-axis-1unit = 0.5ms
Y-axis-1unit = 2 V

Hysteresis loop



Scale:
X-axis-1unit = 0.5ms
Y-axis-1unit = 2V.

5) Now slowly decrease the i/p voltage & observe the high to low transition at the o/p, the i/p voltage at this point is called the LTP.

6) Apply a sine wave i/p to the circuit

7) Observe the i/p & o/p wave form on CRO.

8) Vary the i/p frequency & comment on the results obtained.

9) Repeat the experiment with different R_2.

10) Verify the result theoritically.

Result:

Schmitt trigger circuit is designed. UTP, LTP values are calculated & hysteresis loop is observed.

16/11/2020