LINEAR INTEGRATED CIRCUITS (LIC's)

LABORATORY MANUAL

III / IV B.E (ECE), I - SEMESTER

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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ELURU – 534 007

LINEAR IC's & PULSE CIRCUITS (LIC's) - LAB

III / IV B.E (ECE), I - SEMESTER

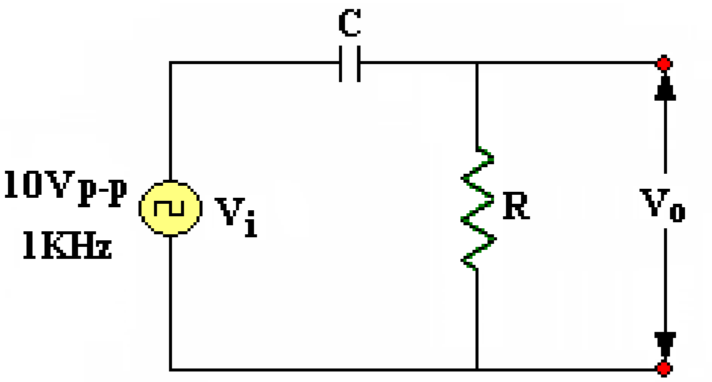
LIST OF EXPERIMENTS

1. LINEAR WAVE SHAPING
2. NON-LINEAR WAVE SHAPING
3. OP-AMP AS SQUARE WAVE GENERATOR
4. BISTABLE MULTIVIBRATOR
5. MONOSTABLE MULTIVIBRATOR
6. ASTABLE MULTIVIBRATOR
7. SCHMITT TRIGGER
8. VOLTAGE REGULATOR
9. UJT RELAXATION OSCILLATOR
10. 555 TIMER AS ASTABLE & MONOSTABLE MULTIVIBRATOR
11. OP-AMP AS ACTIVE INTEGRATOR &DIFFERENTIATOR
12. BOOT STRAP TIME BASE GENERATOR

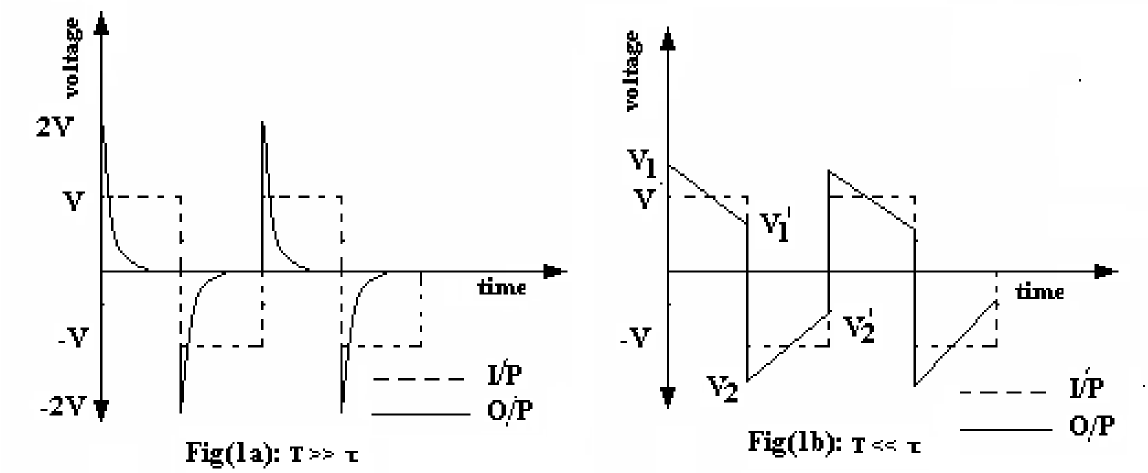
LINEAR WAVE SHAPING

CIRCUIT DIAGRAMS:

HIGH PASS RC CKT:



High Pass Rc Circuit



High Pass Rc Circuit

High pass RC ckt acts as perfect differentiator when T >> τ

Tilt: When square wave input of V volts peak is applied to a High pass RC ckt, percentage Tilt is given by

$$P = [(V_1 - V_1^1) / V] * 100$$

Where V_1 and V_1^1 are voltages indicated in Fig. The approximate expression for % Tilt when T << τ is given by

$$P = (T / 2RC) *100$$

LINEAR WAVE SHAPING

AIM: To Design a High pass and Low pass RC circuits for an I/p time period of 1 m sec and Observe the conditions under which they respectively act as Differentiator and Integrator.

APPARATUS:

S.No	Items	Range	Quantity
1	Resistors	1MΩ, 10KΩ	Each 1
2	Capacitors	0.01μf	1
3	Function Generator		1
4	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

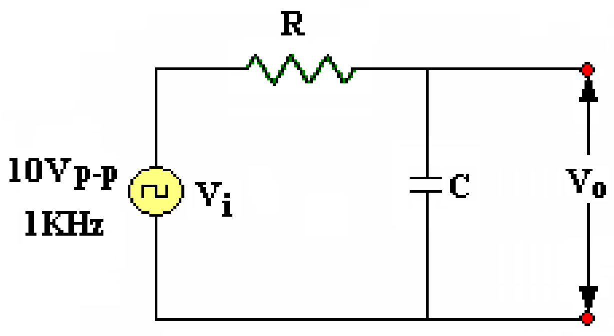
HIGH PASS RC CKT:

1. Select the values of R & C in such away that the condition T >> τ is satisfied.
2. Connect the circuit as shown in Fig.1
3. Apply 10V p-p Square wave at 1KHz from the Function Generator.
4. Observe the o/p waveform on CRO.
5. Sketch the waveform on graph sheet.
6. Now, Select the values of R & C in such away that the condition T <<τ is satisfied.
7. Repeat steps 2,3, & 4.
8. Calculate % tilt from the observed o/p.
9. Compare this with the theoretical value.
10. Sketch the waveform on graph sheet.

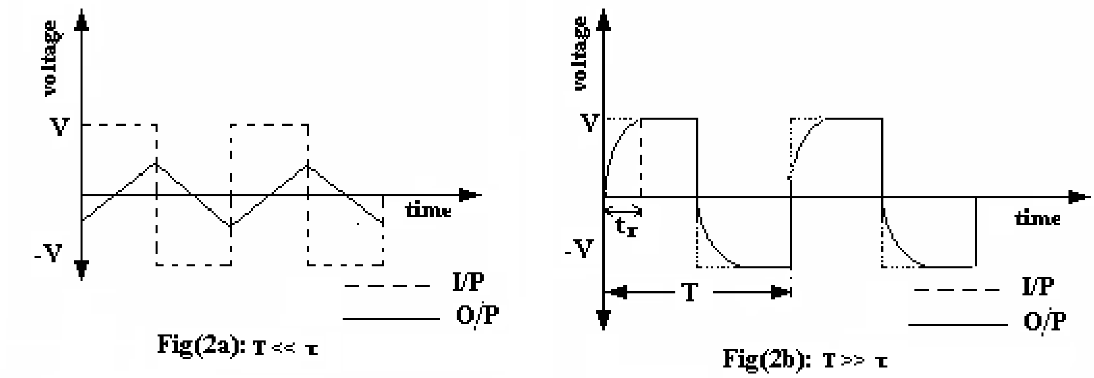
LOW PASS RC CKT:

1. Select the values of R & C in such away that the condition T >> τ is satisfied.
2. Connect the circuit as shown in Fig.2
3. Apply 10V p-p Square wave at 1KHz from the Function Generator.
4. Observe the o/p waveform on CRO.
5. Find the Rise time ‘t_r’ from the observed o/p.
6. Compare this with the theoretical value.
7. Sketch the waveform on graph sheet.
8. Now, Select the values of R & C in such away that the condition T <<τ is Satisfied.
9. Repeat steps 2,3, & 4.
10. Sketch the waveform on graph sheet.

LOW PASS RC CKT:



Low Pass Rc Circuit



Low Pass Rc Circuit

Low pass RC ckt acts as a perfect Integrator when $T << \tau$

<u>Rise time</u>: Rise time 't_r' is defined as the time it takes the voltage to rise from 10% to 90% of its final value.

The approximate expression for rise time is given by

't_r' = 2.2 RC

DESIGN:

T ----- Time period of the input waveform
τ ----- Time constant of the circuit

$\tau = RC$

$T = 1m\ sec$

(i) When $T >> \tau$

Take $T = 10\ \tau$

Choose 'C' as 0.01μf, then

$R = T/10C$

So $R = 10\ K\Omega$

(ii) When $T << \tau$

Take $T = \tau/10$

Choose 'C' as 0.01μf, then

$R = 10T/C$

So $R = 1M\Omega$

RESULT:

The responses of High pass & Low pass RC ckts are observed for a square wave input. Percentage tilt and rise time were calculated and compared with theoretical values.

VIVA QUESTIONS:

1. What is Linear Wave shaping?
2. What is the function of High pass RC ckt?
3. What is the function of Low pass RC ckt?
4. What is meant by Tilt?
5. What is meant by Rise time?
6. What is the condition for perfect differentiation in a High pass RC ckt?
7. What is the condition for perfect integration in a Low pass RC ckt?
8. What is the response of linear wave shaping when a sinusoidal input is applied?
9. How a high pass circuit acts as a Differentiator?
10. How a Low pass circuit acts as a Integrator?

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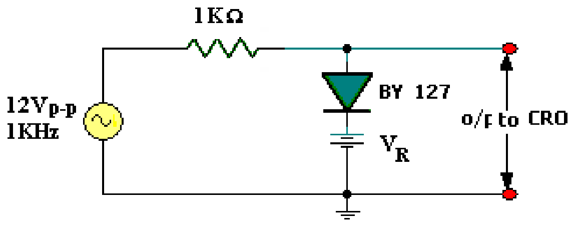
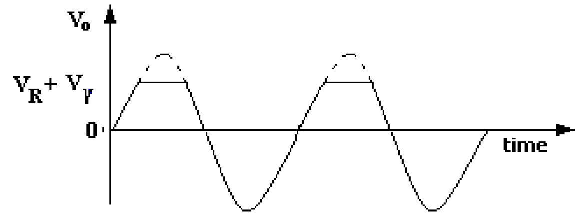
NON-LINEAR WAVE SHAPING

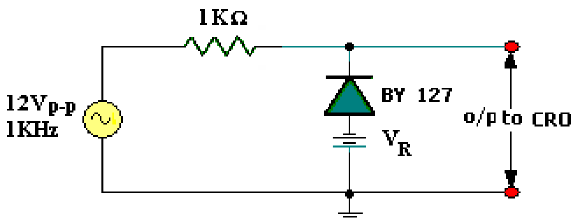
CIRCUIT DIAGRAMS:



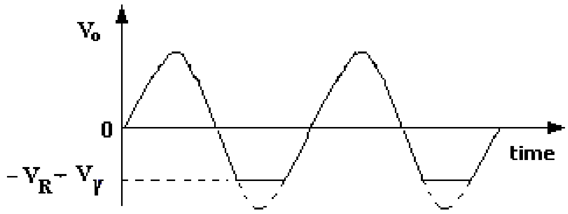
Positive Peak Clipping



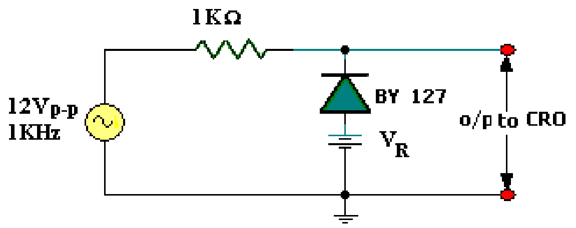
Positive Peak Clipping



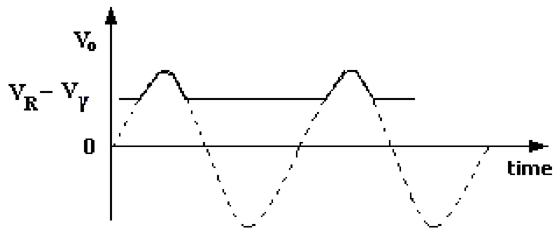
Negitive Peak Clipping



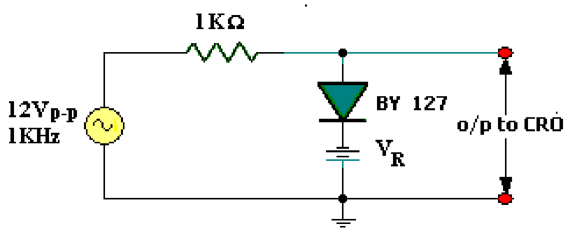
Negitive Peak Clipping



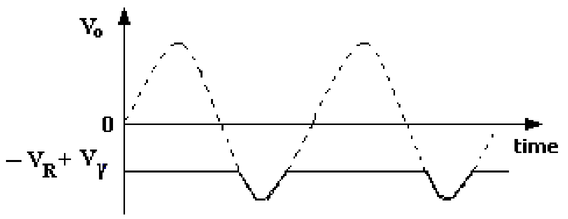
Positive Base Clipping



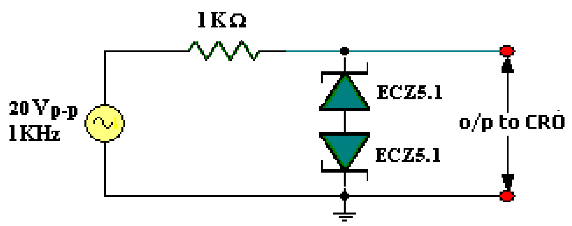
Positive Base Clipping



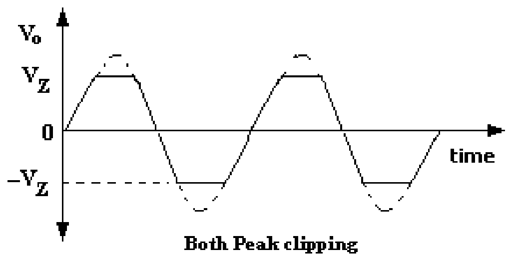
Negetive Base Clipping



Negetive Base Clipping



Both Peak clipping



Both Peak clipping

NON-LINEAR WAVE SHAPING

AIM: To Study the operation of some basic clipping and clamping circuits.

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	0–30 Volts	1
2	Diode	BY127	1
3	Resistors	1KΩ, 1MΩ	1
4	Capacitors	0.1μf	1
5	Zener Diode	ECZ 5.1	2
6	Signal Generator	(0 – 1MHz)	1
7	CRO	-	1
8	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connect the circuit as shown in Fig.1
2. Switch on the D.C power supply and set the reference voltage V_R to 2V.
3. Apply I/P Voltage of 12V p-p Sine wave at 1KHz from the Signal Generator and observe the o/p on CRO.
4. Measure the clipping levels in the O/P waveform and compare them with the theoretical values.
5. Sketch the waveforms on graph sheets to the scale.
6. Repeat the above steps for the rest of the circuits.

RESULT:

Various Clipping and Clamping circuits are constructed and their outputs are observed.

VIVA QUESTIONS:

1. What is Non-linear wave shaping?
2. What is the purpose of a Clipping circuit?
3. What are the other names of a Clipper ckt?
4. What are the applications of Clipper ckts?
5. What is a Clamping ckt?
6. What are the applications of Clamper ckts?
7. What is the difference between clipping and clamping circuits?
8. What is the need for a resistor across a diode in clamping circuits?
9. What is meant by comparator?
10. Draw the circuit diagram of a diode comparator?

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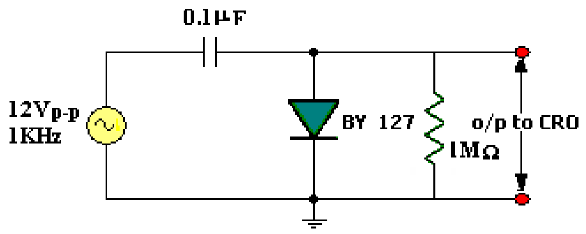
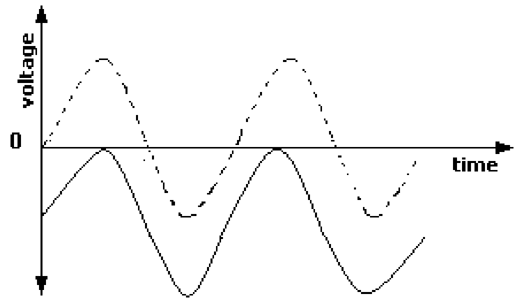
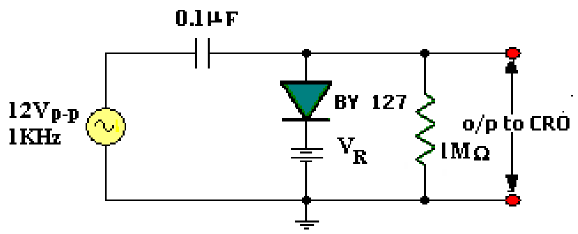


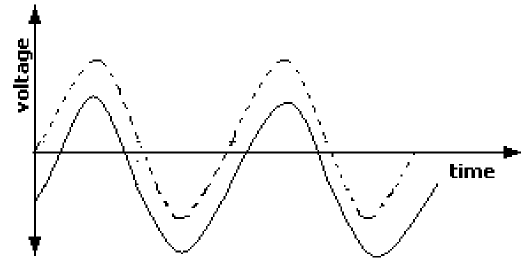
Clamping to Zero Volts



Clamping to Zero Volts



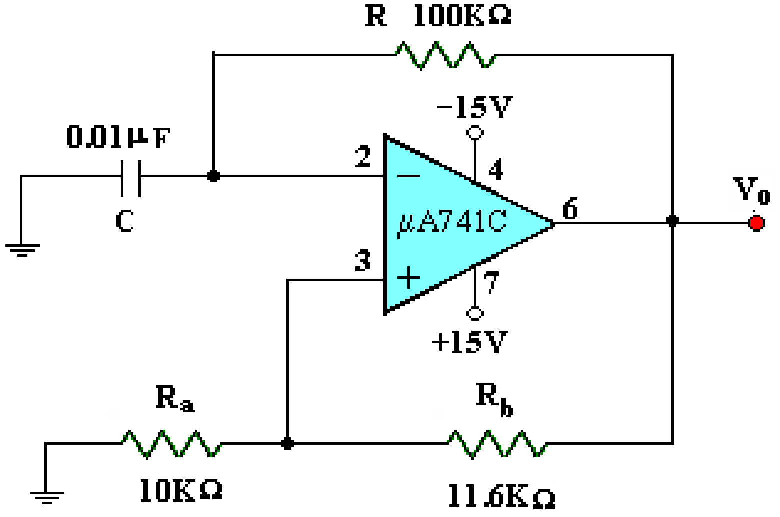
Clamping to V_R volts



Clamping to V_R volts

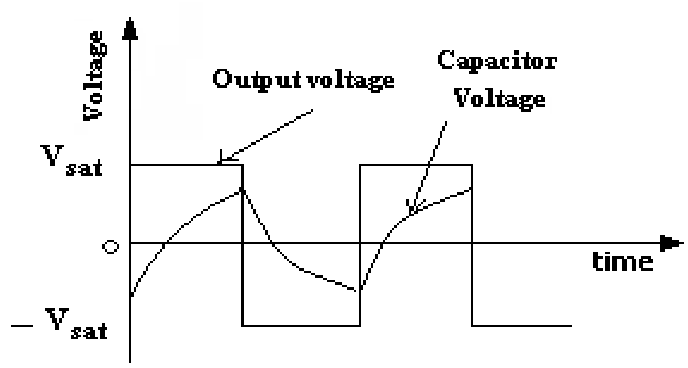
OP AMP AS SQUARE WAVE GENERATOR

CIRCUIT DIAGRAM:



Op amp as square wave generator

WAVE FORM:



Op amp as square wave generator

DESIGN:

T=2RC ln (2Ra+Rb)/Rb

F_0=1/2RC ln (2Ra+Rb)/Rb

If Rb =1.16Ra

Let Ra=10K ohm,Rb= 11.6 K ohm

F_0=1/2 RC

F_0 C =0.01µf

R=1.2 F_0C

V1=(Ra/(Ra+Rb))*Vsat

OP-AMP AS SQUARE WAVE GENERATOR

AIM: To design the square wave generator to operate at frequency F0=500Hz

APPARATUS:

S.No	Items	Range	Quantity
1	D.C power supply	15-0-15 volts	1
2	IC	µA74IC	1
3	Resistors	11.6KΩ,10kΩ,100kΩ	Each 1
4	Capacitors	0.01µf	1
5	Function generator	--	1
6	CRO	--	1
7	Bread Board & Connecting wires	--	1 Set

PROCEDURE:

1. Connect the circuit as shown in fig 1
2. Switch on the 15-0-15 v DC power supply
3. Observed the o/p wave forms and capacitor voltage on CRO
4. Compare the wave on graph sheet to the scale

RESULT: Wave forms are observed and measured values are compared with theoretical values and plotted on the graph sheets to the scale .

VIVA QUESTIONS:

1. Draw the characteristics of ideal comparator and that of a commercially available comparator
2. What are the other application op amp
3. List the different types of comparator
4. What is meaning of voltage limiting ?Show how it is obtained ?
5. Draw the circuit for converting a square wave in to a series of positive pulses?
6. What is hysteresis and What parameters determine the hystereis
7. Explain operation of a square wave generator by drawing capacitor and output voltage wave forms
8. Explain how non symmetrical square wave can be obtained?
9. How would recognize that positive feedback is being used in an op amp circuit
10. How two power supply +15v and -15v are required in an op amp circuit ?
11. What are the internal blocks of an op amp ?

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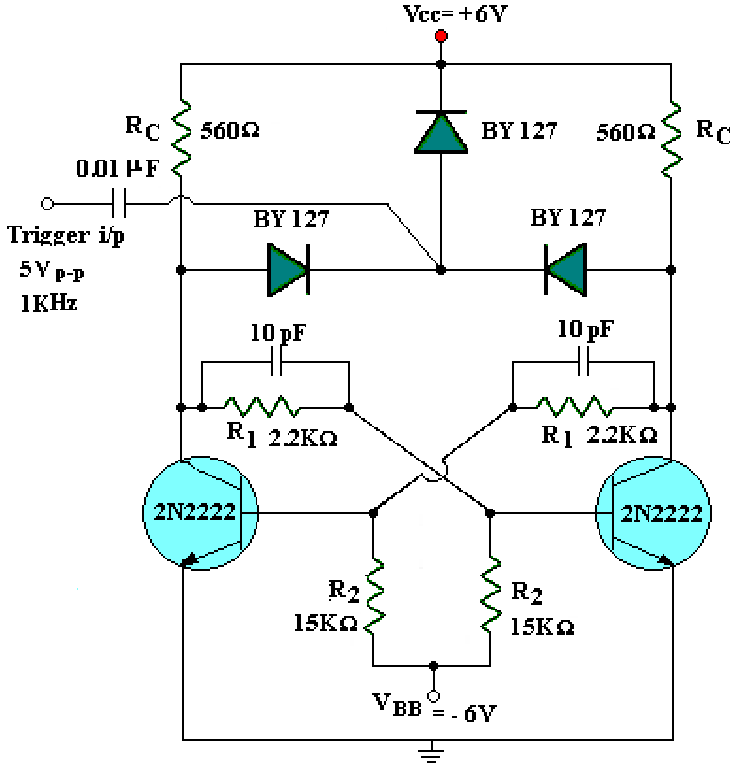
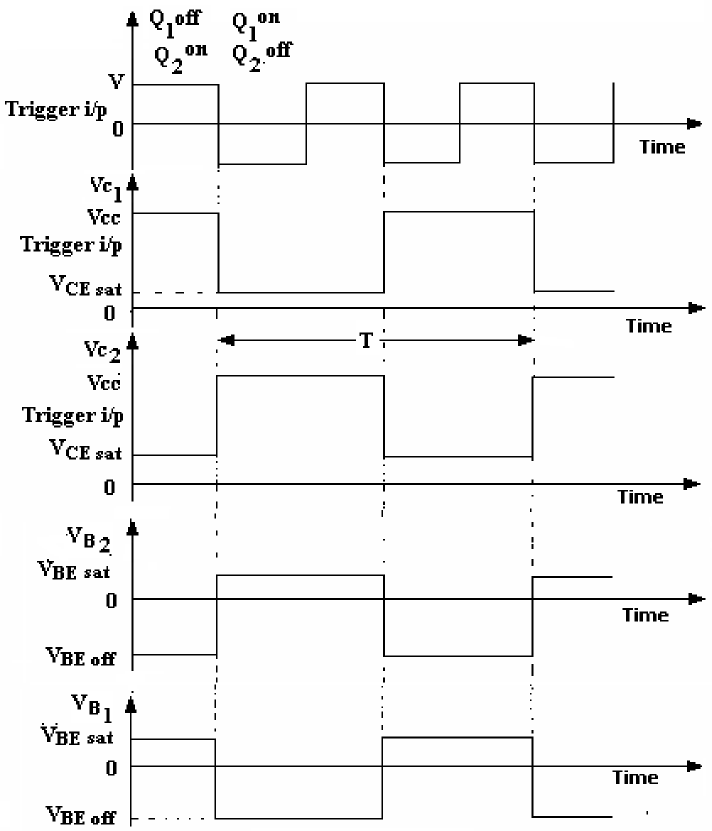
BISTABLE MULTIVIBRATOR

CIRCUIT DIAGRAM:



Bistable multivibrator

WAVEFORMS:



Bistable multivibrator

BISTABLE MULTIVIBRATOR

AIM: To verify the stable states of Bistable Multivibrator and observe the base & Collector waveforms.

APPARATUS:

S.No	Items	Range	Quantity
1	Dual Regulated D.C Power supply	0–30 Volts	1
2	Diode	BY127	3
3	Resistors	15KΩ, 2.2 KΩ, 560Ω	Each 2
4	Capacitors	0.01µf	1
5	Capacitors	10pf	2
6	Transistors	2N2222	2
7	Signal Generator	-	1
8	CRO	-	1
9	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connections are made as shown in Fig.
2. Switch on the D.C power supply and set the voltages to +6 V & -6V.
3. In the absence of steering diodes & Commutating capacitors, Verify the stable state of Multivibrator
4. After getting the stable state, connect the steering diodes and commutating capacitors
5. Apply trigger input of 5V p-p square wave at 1KHz from the function Generator.
6. Observe the waveforms at the collector and base of both the transistors.
7. Plot the waveforms on graph sheet to the scale.

RESULT:

Stable states of Bistable Multivibrator are verified and waveforms at the base & collector of the transistors are observed.

VIVA QUESTIONS:

1. Describe the principle of fixed-bias Binary?
2. What is a stable state?
3. What is the role of commutating capacitors in the Binary?
4. Explain the working of steering diode arrangement in the binary?
5. What are the different types of triggering?
6. What is the difference between symmetrical triggering and asymmetrical triggering?
7. What are the applications of Bistable Multivibrator?

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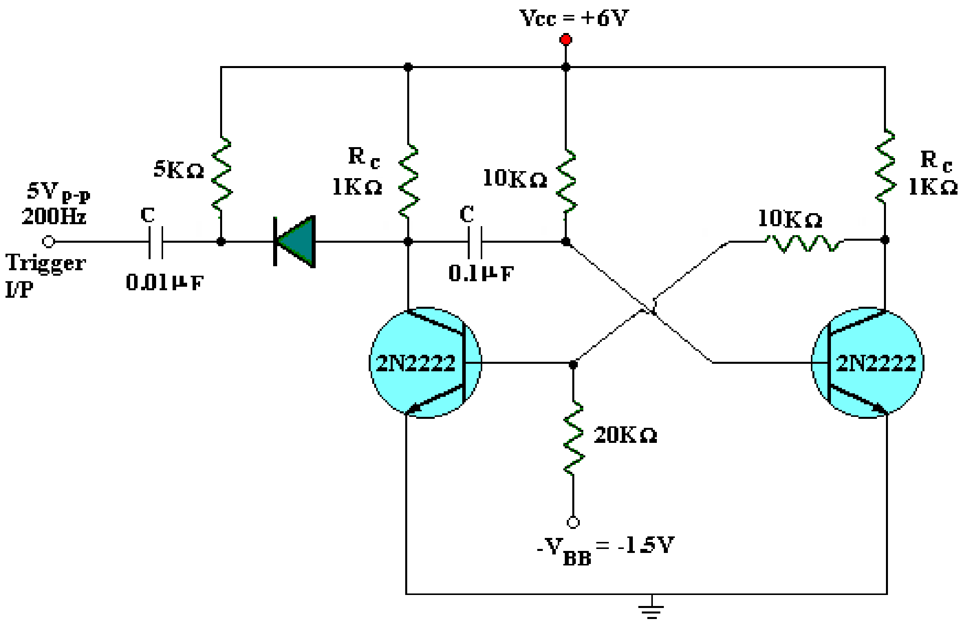
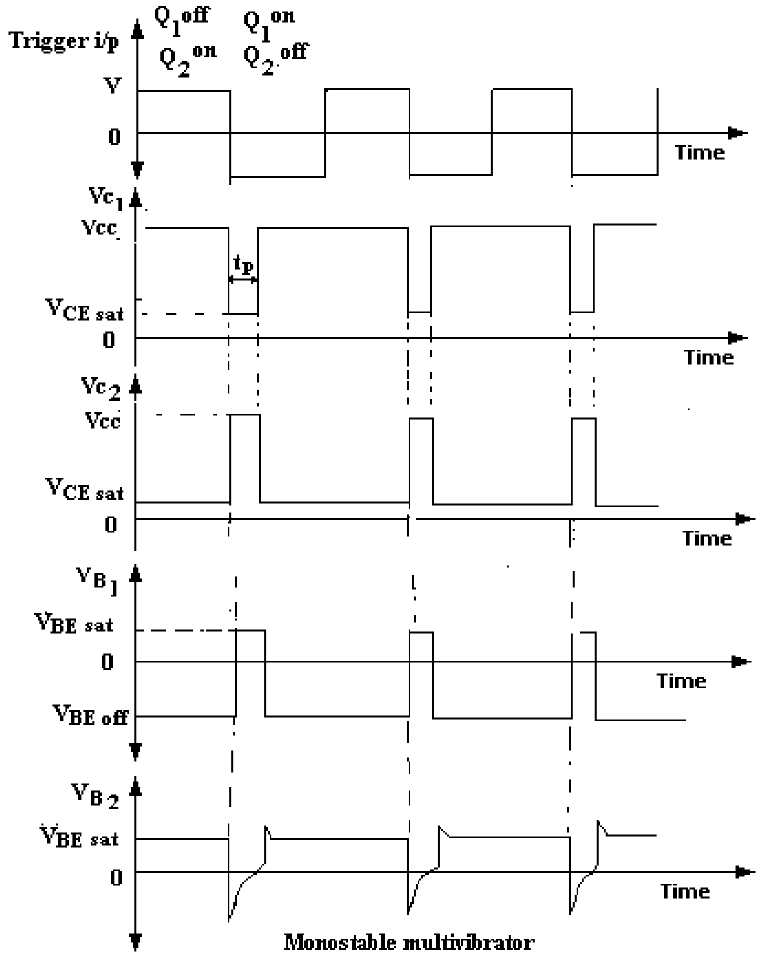
MONOSTABLE MULTIVIBRATOR

CIRCUIT DIAGRAM:



Monostable Multivibrator

WAVEFORMS:



Monostable multivibrator

MONOSTABLE MULTIVIBRATOR

AIM: To design a Monostable Multivibrator to produce a pulse of required width.

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	0–30 Volts	1
2	Resistors	1KΩ, 10KΩ	Each 2
3	Resistors	5KΩ, 20KΩ	Each 1
4	Capacitors	0.01μf, 0.1μf	Each 1
5	Transistors	2N2222	2
6	Signal Generator	-	1
7	Diode	BY127	1
8	CRO	-	1
9	Bread Board & Connecting wires	-	1 Set

DESIGN:

T ---- Time period of the Quasi-stable state OR Pulse width of o/p waveform

T = 0.69RC, Take T = 1m sec, Choose 'C' as 0.1μf, then

R = T/0.69C, So R = 10 KΩ

PROCEDURE:

1. Connections are made as shown in Fig.
2. Switch on the D.C power supply and set the voltages to +6 V and –1.5V.
3. Verify the stable state of a Monostable Multivibrator, i.e. according to the ckt configuration Q_1 must be OFF & Q_2 should be ON.
4. After getting the stable state, Apply trigger input of 5V p-p square wave at 200 Hz from the function Generator.
5. Observe the waveforms at the collector and base of both the transistors.
6. Measure the o/p pulse width and compare it with the required value.
7. Plot the waveforms on graph sheet to the scale.

RESULT:

Collector and Base waveforms of Monostable Multivibrator are observed and o/p pulse width is compared with the required value.

VIVA QUESTIONS:

1. What are the other names of Monostable Multivibrator?
2. Explain the working of Monostable Multivibrator?
3. Monostable Multivibrator has how many stable states?
4. What is a quasi-stable state?
5. What are the applications of Monostable Multivibrator?
6. What are the initial states of a Monostable Multivibrator?
7. Which type of Triggering is used in Monostable Multivibrator?
8. What is the effect of temperature on Monostable Multivibrator?
9. Which type of feedback is present in Monostable Multivibrator?
10. Derive the expression for pulse width?
11. What is the difference between Monostable Blocking oscillator and Monostable Multivibrator?
12. Define "Overshoot"?

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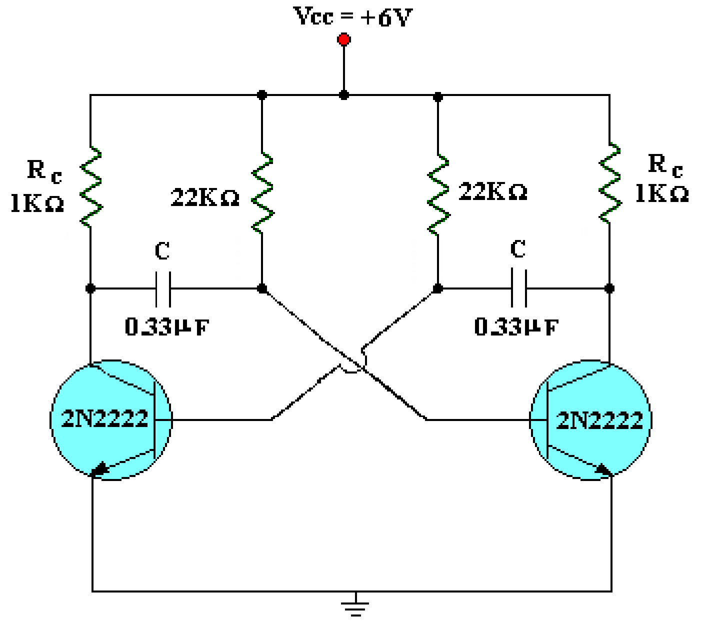
ASTABLE MULTIVIBRATOR

CIRCUIT DIAGRAM:



Astable multivibrator

DESIGN:

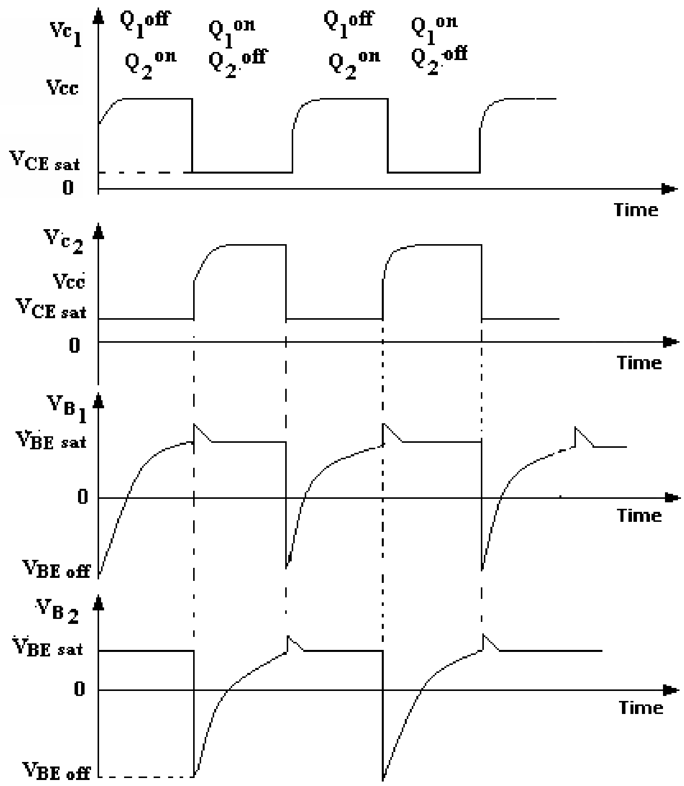
T ---- Time period of the o/p waveform, F ---- Frequency of oscillations

T = 1.38RC, Given F = 100 Hz, T = 1 / F

Choose 'C' as 0.33μf, then, R = T / 1.38 C

So R = 22KΩ, Choose R_C such that $h_{fe} .R_C > R$

WAVEFORMS:



Astable multivibrator

ASTABLE MULTIVIBRATOR

AIM: To design an Astable Multivibrator to produce a square wave of 100 Hz.

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	0–30 Volts	1
2	Resistors	1KΩ, 22KΩ	Each 2
3	Capacitors	0.33μf	2
4	Transistors	2N2222	2
5	Signal Generator	-	1
6	CRO	-	1
7	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connections are made as shown in Fig.
2. Switch on the D.C power supply and set the voltage to +6 V.
3. Observe the waveforms at the collector and base of both the transistors.
4. Measure the frequency of oscillations from the observed waveform and compare it with the required value.
5. Plot the waveforms on graph sheet to the scale.

RESULT:

Astable Multivibrator is designed and its o/p waveforms are observed.

VIVA QUESTIONS:

1. What is the other name of Astable Multivibrator?
2. Explain the working of Astable Multivibrator?
3. What is a quasi-stable state?
4. What are the applications of Astable Multivibrator?
5. Explain Hoe Astable Multivibrator can be used as a voltage to frequency converter?
6. For a symmetrical circuit how can you say that one transistor is on and one transistor if off?
7. Derive the equation for a time of an Astable Multivibrator?
8. Which type of biasing present in Astable Multivibrator?
9. How Astable acts as a free running oscillator?
10. Define time constant?

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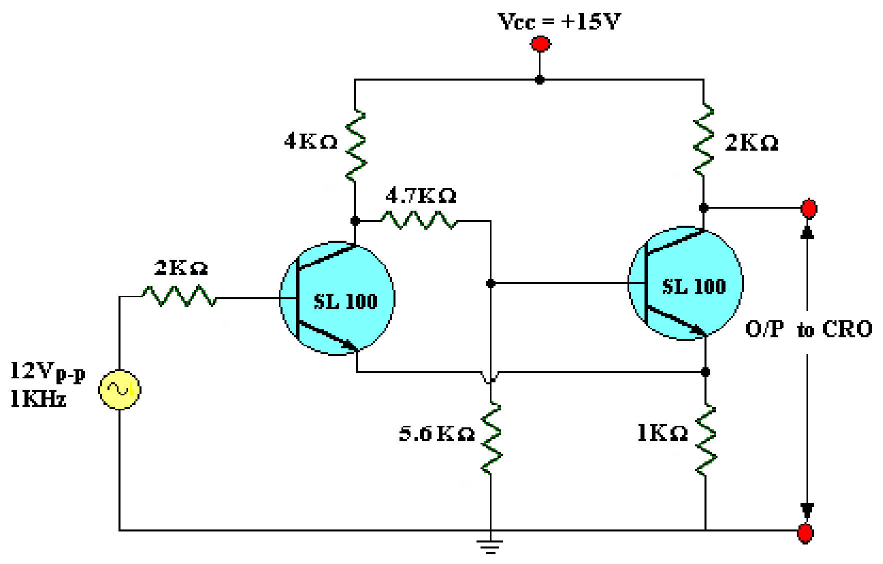
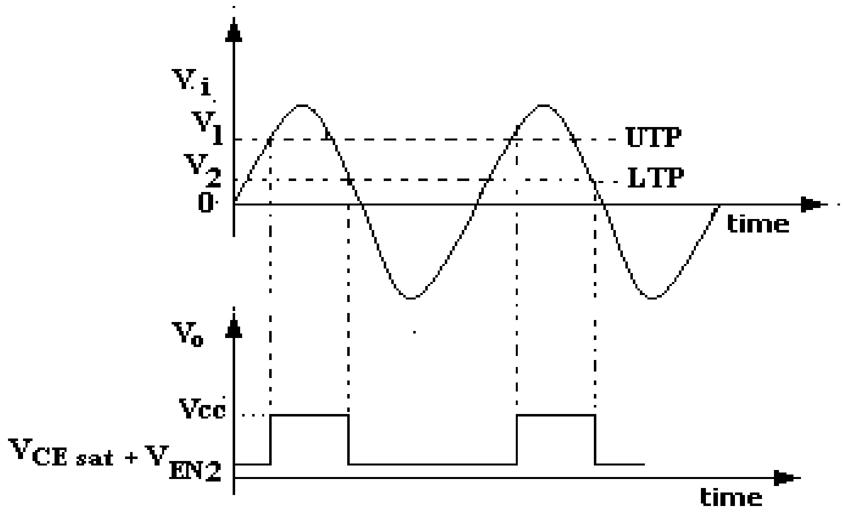
SCHMITT TRIGGER

CIRCUIT DIAGRAM:



Schmitt Trigger

WAVEFORMS:



Schmitt Trigger

CALCULATIONS:

UTP ---- Upper triggering potential, LTP ---- Lower triggering potential

UTP is defined as the I/P voltage at which transistor 'Q_1' begins to conduct

LTP is defined as the I/P voltage at which transistor 'Q_2' resumes conduction.

Let UTP = V_1 & LTP = V_2

From the ckt, Initially 'Q1' is OFF & 'Q_2' is ON

$UTP = V_1 = V_{BE1} + V_{EN2}$ Where

$V_{EN2} = [(V_{CC} - V_{CEsat}) Re] / (R_{C2} + Re)$, V_{BE1} is V_{Beoff}

When the I/P crosses UTP point, 'Q1' is ON & 'Q_2' is OFF

$LTP = V_2 = V_{BE1} + V_{EN1}$ Where

$V_{EN1} = [(V_{CC} - V_{CEsat}) Re] / (R_{C1} + Re)$, V_{BE1} is V_{BEsat}

Find the UTP & LTP of the ckt using above expressions.

SCHMITT TRIGGER

AIM: To study the operation of Schmitt Trigger ckt and calculate it's lower & upper triggering points.

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	(0–30) Volts	1
2	Resistors	2KΩ	2
3	Resistors	1KΩ, 5.6KΩ, 4KΩ, 4.7KΩ	Each 1
4	Transistors	SL100	2
5	Signal Generator	-	1
6	CRO	-	1
7	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connections are made as shown in Fig.
2. Switch on the D.C power supply and set the voltage to +12 V.
3. Apply 12V p-p Sine wave at 1K Hz from the function Generator.
4. Observe the o/p square waveform on CRO.
5. Identify the amplitude of the I/p when the o/p rises suddenly, Which is called UTP
6. Identify the amplitude of the I/p when the o/p falls suddenly, Which is called LTP
7. Compare the identified UTP & LTP's with the theoretical values.
8. Plot the waveforms on graph sheet to the scale.

RESULT:

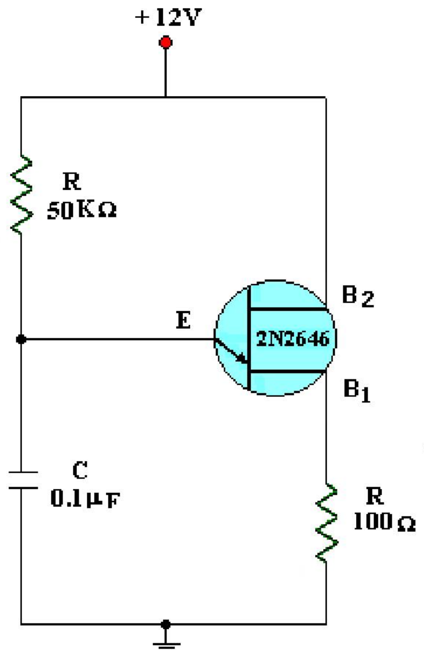
Square wave o/p of a Schmitt Trigger ckt is observed for a Sinusoidal input.
UTP & LTP's are compared with the theoretical values.

VIVA QUESTIONS:

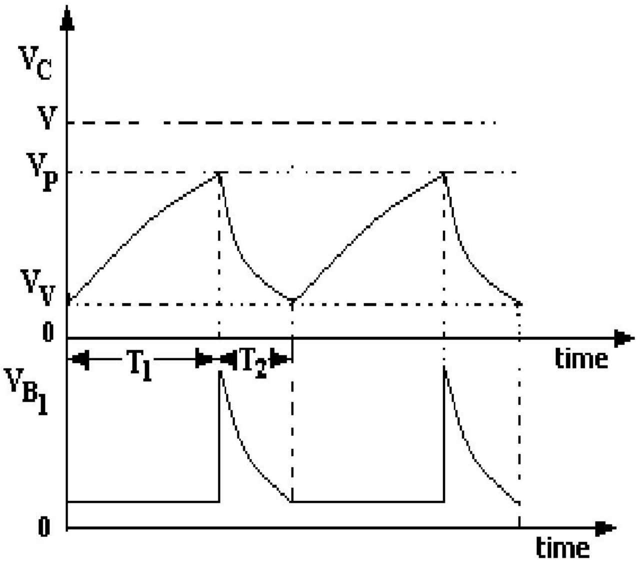
1. Define UTP & LTP?
2. What is the other name of a Schmitt Trigger ckt?
3. Explain the working of Schmitt Trigger ckt?
4. Explain Hysterisis with Schmitt Trigger?
5. What are the applications of Schmitt Trigger?

UJT RELAXATION OSCILLATOR

CIRCUIT DIAGRAM & WAVEFORMS:



UJT Relaxation oscillator



UJT wave forms

DESIGN:

T1----charging time period

T2 ----discharging time period

F -----frequency of oscillations

F=1/T

$F=1/[RC \ln [(1/(1- \eta))]$

$\eta = R_{B1}/(R_{B1}+R_{B2})$

$R_{B1}=3k\ \Omega$, $R_{B2}=2k\ \Omega$

Vp=0.7+[(RB1+R1)V]/[RB1+RB2+R1]

There fore Vp=8v

UJT RELAXATION OSCILLATOR

AIM: To determine the frequency of oscillations of **UJT** relaxation oscillator .
Given RBB =5K Ω ,ή =.6Vv =1v and RB1=100Ω

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	0–30 Volts	1
2	Diode	BY127	1
3	Resistors	50K Ω 100 Ω	Each 1
4	Capacitors	0.1μf	1
5	Un-junction transistor		1
6	CRO	-	1
7	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connections are made as shown in fig.
2. Switch on the DC power supply and set the voltage to +12v
3. Observe the wave forms across capacitor and at base B1.
4. Measure the frequency of oscillations from the observed wave forms and compare it with the theoretical valve.
5. Plot the wave forms on graphs sheets to the scale.

RESULT:

Capacitor and base wave forms are UJT relaxation oscillator are observed and the frequency of oscillation is compared with theoretical value.

VIVA QUESTIONS:

1. What is an UJT?
2. What is difference between UJT and FET?
3. Explain the working of UJT relaxation oscillator?
4. what are the applications of UJT relaxation oscillator?
5. Can we use UJT as an amplifier?
6. Draw the inner circuit diagram of UJT?
7. Define peak voltage?
8. What are the methods or what is the correction for the circuit to improve linearity in the output wave forms?
9. Derive the equation for the time period of the output wave form.
10. Define intrinsic stand off ratio.

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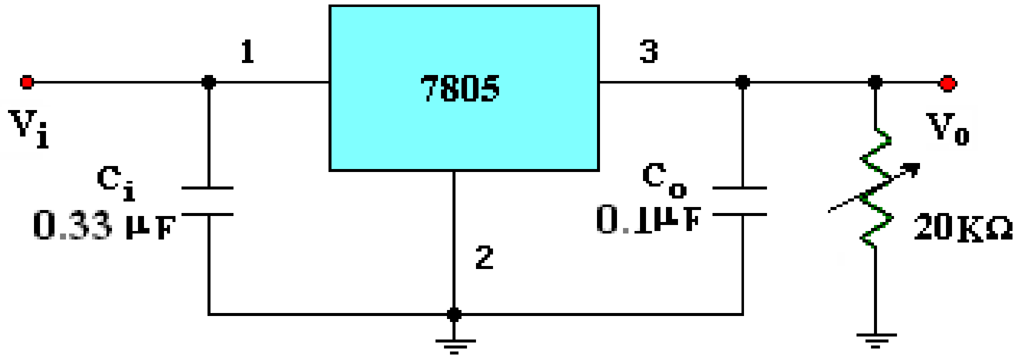
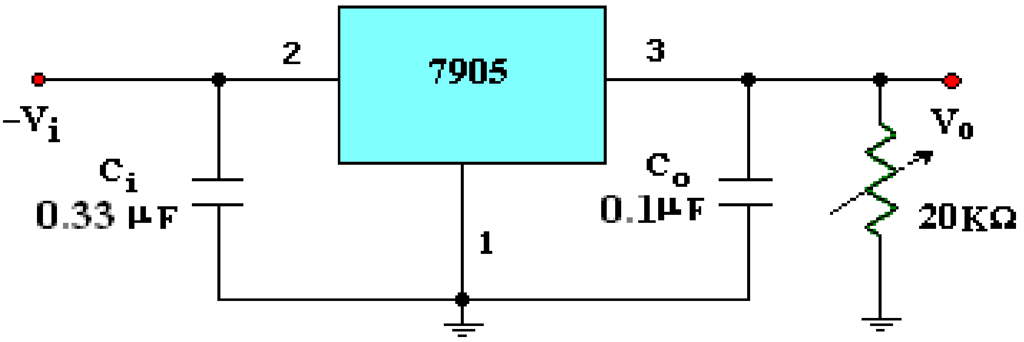
VOLTAGE REGULATOR

CIRCUIT DIAGRAM:



Voltage regulator



Voltage regulator

VOLTAGE REGULATOR

AIM: To Study and Verify 3- terminal positive & negative voltage regulators

APPARATUS:

S.No	Items	Range	Quantity
1	Regulated D.C Power supply	0–30 Volts	1
2	Voltage Regulator	7806, 7906	Each 1
3	Potentiometer	20KΩ	1
4	Capacitors	0.33μf, 0.1μf	Each 1
5	Multivibrator		
6	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

1. Connections are made as shown in Fig.
2. Keeping load resistance R_L constant, vary the I/P voltage in steps (From 5 to 30V) and observe the o/p voltage.
2. Tabulate the readings in the form shown in table1.
3. Keeping I/P voltage Vin constant, vary the load resistance in steps and observe the o/p voltage.
4. Tabulate the readings in the form shown in table2.
5. Perform the above procedure for various regulators.

TABULAR FORMS:

TABLE1: R_L = 20KΩ

S.No	Vin (Volts)	Vo (Volts)
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	
10	10	

TABLE2: Vin = 5V

S.No.	R_L (KΩ)	Vo (Volts)
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	
10	10	

RESULT: Voltage Regulators are verified both by changing I/P voltage and load resistance

VIVA QUESTIONS:

1. What is a Voltage Regulator?
2. What are the advantages of adjustable voltage regulators over the fixed voltage regulators?
3. What is voltage reference? Why it is needed?
4. What is the function of a series pass transistor?
5. What voltage options are variables in 78XX and 79XX voltage regulators?
6. Show the standard representation of IC voltage regulator?
7. List and explain the characteristics of three terminal IC voltage regulators?
8. Explain the important parameters of 78XX regulator?
9. Explain the protections used in 78XX?
10. What are the Limitations of three terminal voltage regulators?

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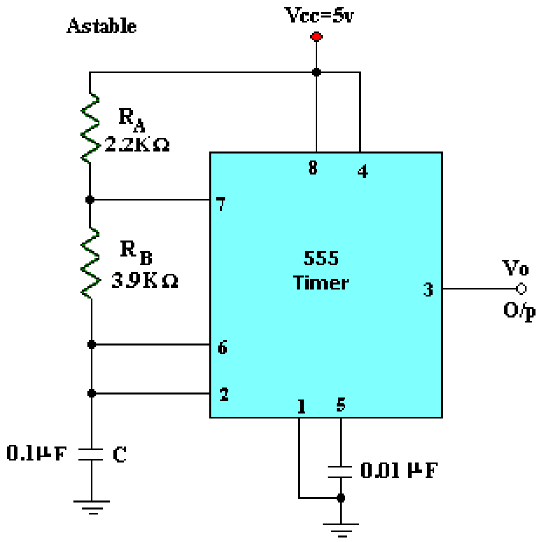
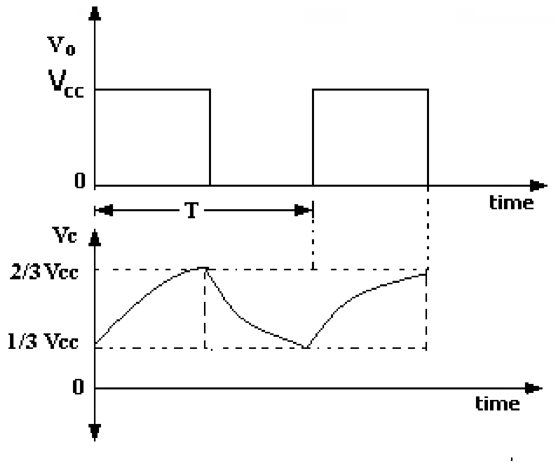
555 TIMER AS ASTABLE &

MONOSTABLE MULTIVIBRATOR

CIRCUIT DIAGRAMS:

ASTABLE MULTIVIBRATOR:





Astable wave forms

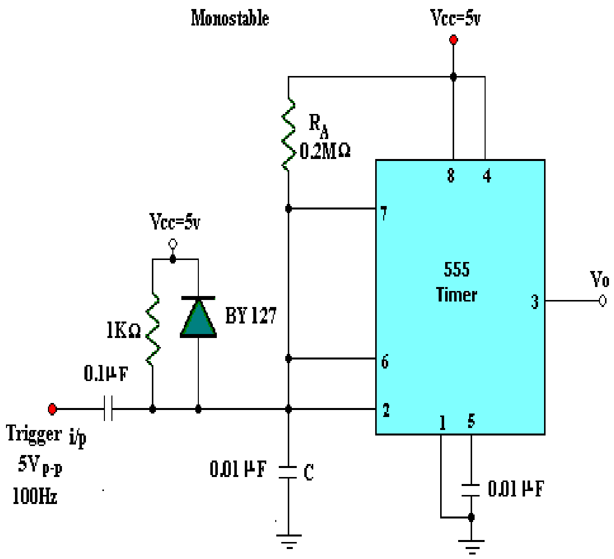
T --- Time period of the o/p waveform, F --- Frequency of Oscillations

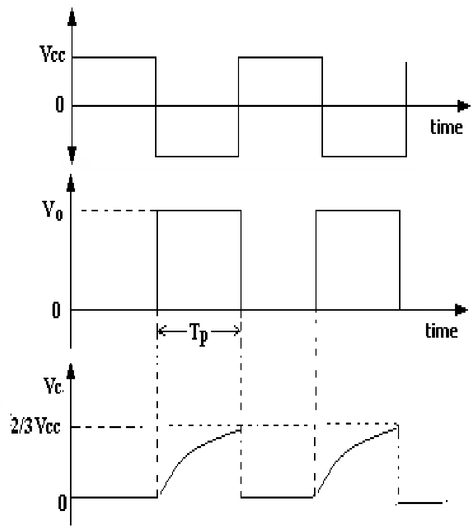
$T = 0.69(R_A + 2R_B)C$, $F = 1/T$

$F = 1.45 / (R_A + 2R_B)C$, % Duty Cycle = $[(R_A + R_B)/(R_A + 2R_B)]*100$

t_p -- o/p pulse width, $t_p = 1.1\ R_AC$

MONOSTABLE MULTIVIBRATOR:





Monostable waveforms

555 TIMER AS ASTABLE & MONOSTABLE MULTIVIBRATOR

AIM: To Verify the operations of Astable & Monostable Multivibrators using 555 timer

APPARATUS:

S.No	Items	Range	Quantity
1	555 Timer IC	-	1
2	Resistors	2.2KΩ, 3.9KΩ, 1KΩ, 0.2MΩ	Each 1
3	Capacitors	0.01μf	2
4	Capacitors	0.1μf	1
5	Diode	BY127	1
6	CRO	-	1
7	Function Generator	-	1
8	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

ASTABLE MULTIVIBRATOR:

1. Connect the circuit as shown in Fig.1
2. Switch on the D.C power supply and set the voltage to 5V.
3. Observe the o/p waveform at pin 3 using CRO & also observe the waveform across Capacitor (at pin 6).
2. Measure the frequency of oscillations from the observed o/p and compare it with theoretical value.
3. Measure the Duty Cycle (Ton/ (Ton + Toff)) from the observed o/p and compare it with theoretical value.
4. Sketch the waveforms on graph sheet.

MONOSTABLE MULTIVIBRATOR:

1. Connect the circuit as shown in Fig.2
2. Switch on the D.C power supply and set the voltage to 5V.
3. Apply trigger signal of 5V p-p Square wave at 100 Hz from the Function Generator.
4. Observe the o/p waveform at pin 3 using CRO & also observe the waveform across Capacitor (at pin 6).
5. Measure the o/p pulse width 't_p' and compare this with the theoretical value.
6. Sketch the waveforms on graph sheet.

RESULT:

Monostable and Astable operations using 555 timer are verified.

VIVA QUESTIONS:

1. Define Duty Cycle?
2. What are the other applications of 555 timer?
3. Draw the internal circuit diagram of 555 timer?
4. Explain the operation of 555 timer?
5. Explain the function of reset?
6. Derive the expression for time delay of monostable multivibrator?
7. Discuss the applications of timer in monostable multivibrator?
8. Give methods for obtaining symmetrical square wave?
9. what are the modes of operation of a 555 timer?
10. Discuss the operation of a FSK generator using timer?
11. Draw the circuit of Schmitt trigger using timer and explain its operation?

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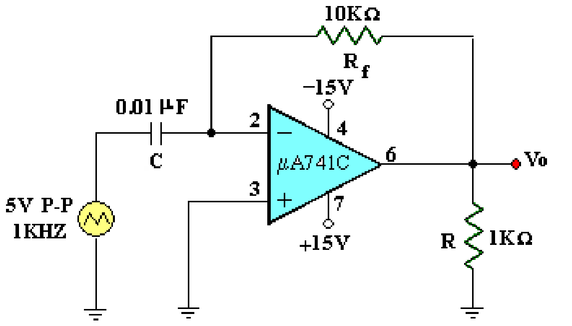
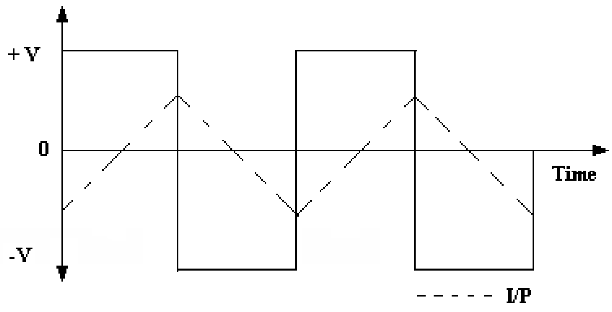
OP-AMP AS ACTIVE INTEGRATOR & DIFFERENTIATOR

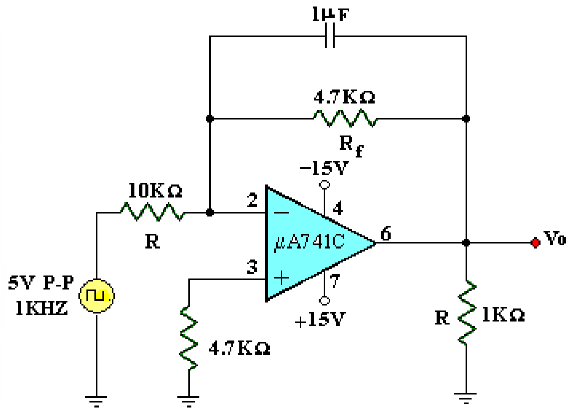
CIRCUIT DIAGRAMS:



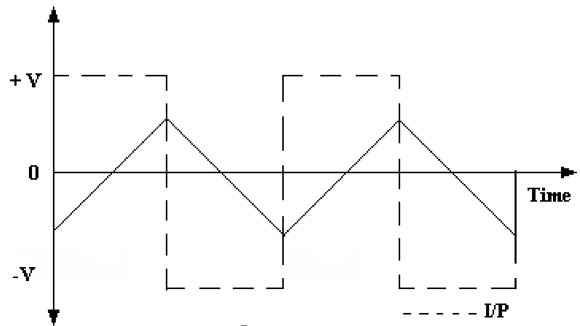
Differentiator Circuit



Differentiator



Integrator Circuit



Integrator

OP-AMP AS ACTIVE INTEGRATOR & DIFFERENTIATOR

AIM: To Observe the Op-Amp as a Differentiator and Integrator.

APPARATUS:

S.No	Items	Range	Quantity
1	IC	μA741C	1
2	D.C Power supply	15-0-15 Volts	1
3	Resistors	4.7KΩ	2
4	Resistors	1KΩ, 10KΩ,	Each 1
5	Capacitors	1μF, 0.01μF	Each 1
6	CRO	-	1
7	Function Generator	-	1
8	Bread Board & Connecting wires	-	1 Set

PROCEDURE:

INTEGRATOR:

5. Connect the circuit as shown in Fig.1
6. Switch on the 15-0-15 V D.C power supply.
7. Apply 5V p-p Square wave at 1KHz from the Function Generator.
8. Observe the o/p waveform on CRO.
9. Sketch the waveforms on graph sheet to the scale.

DIFFERENTIATOR:

1. Connect the circuit as shown in Fig. 2
2. Switch on the 15-0-15 V D.C power supply.
3. Apply 5V p-p Triangular wave at 1 KHz from the Function Generator.
4. Observe the o/p waveform on CRO.
5. Sketch the waveforms on graph sheet to the scale.

RESULT:

The waveforms of Differentiator and Integrator are observed and plotted on the graph sheets to the scale.

VIVA QUESTIONS:

1. What is an Op-Amp?
2. What are the other applications of Op-Amp?
3. What are the ideal characteristics of an Op-Amp?
4. Why two power supplies +15 V and –15 V are required in an Op-Amp?
5. What are the internal blocks of an Op-Amp?
6. What is the origin for slew rate?
7. What is meant by virtual around?
8. Define CMRR?
9. Define offset voltage and offset currents for an OP-Amp?
10. What are the limitations of an ordinary OP-Amp Differentiator?
11. Explain why integrators are preferred over differentiator in analog computers?

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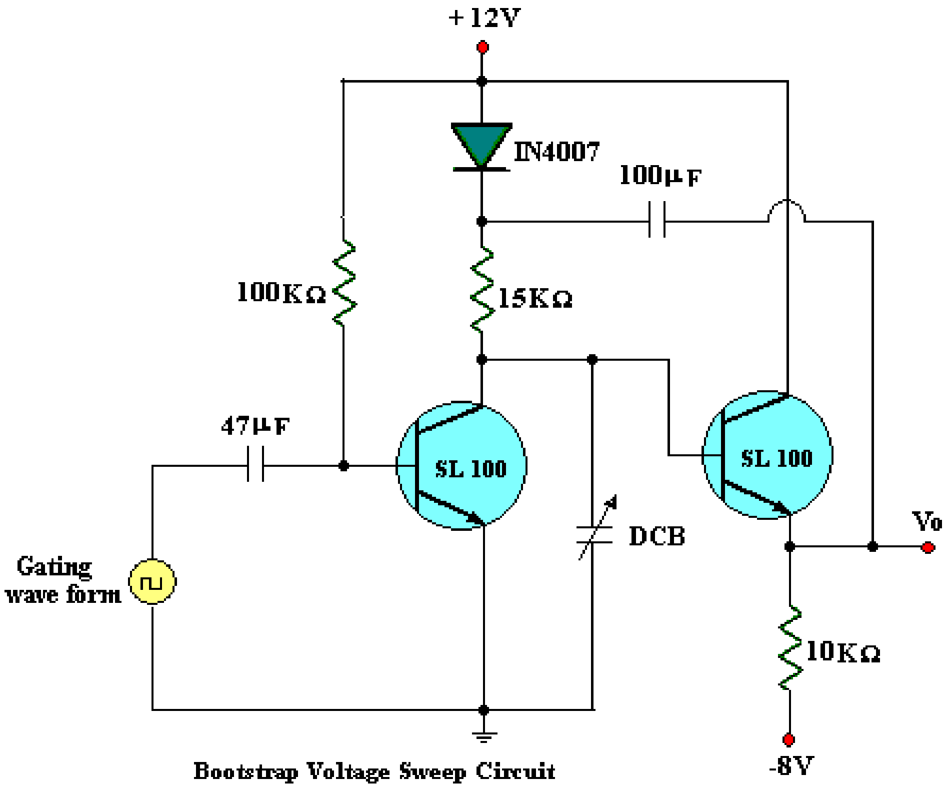
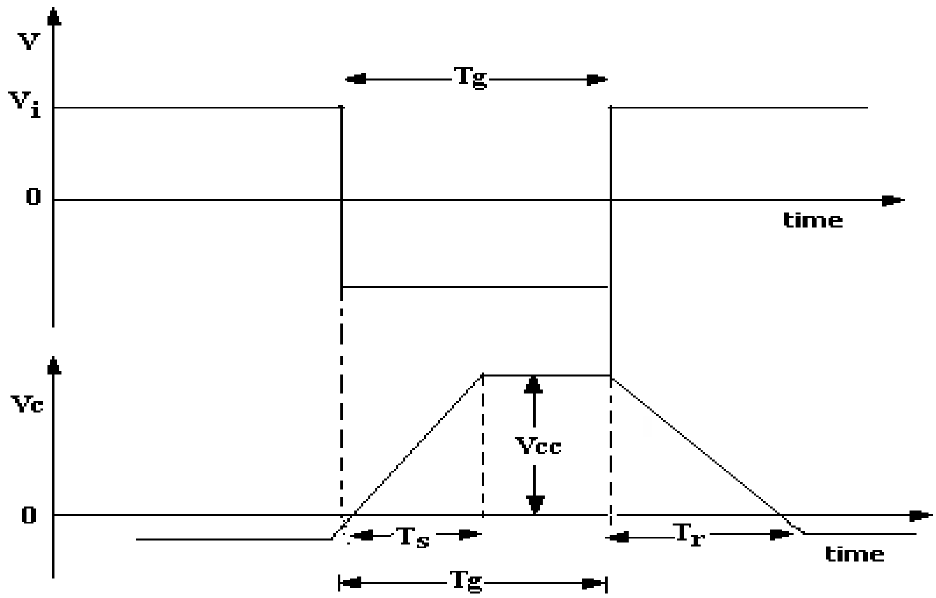
BOOT STRAP TIME BASE GENERATOR

CIRCUIT DIAGRAM:



Bootstrap Voltage Sweep Circuit

WAVE FORMS:



Bootstrap Voltage Sweep Circuit

BOOT STRAP TIME BASE GENERATOR

AIM: To observe the output waveform of bootstrap time base generator and determine the sweep time Ts and the restoration time Tr.

APPARATUS:

S.No	Items	Range	Quantity
1	D.C power supply	(0-30V)	1
2	Diode	IN 4001	1
	Transistors	2N2222 / SL100	2
3	Resistors	15kΩ, 100kΩ,10KΩ	Each 1
4	Capacitors	47μf, 100μf	Each 1
5	Function generator	--	1
6	CRO	--	1
7	Bread Board & Connecting wires	--	1 Set

PROCEDURE:

1. Connections are made as shown in fig
2. Switch on the DC power supply and set the voltages to +20v and -10v
3. Apply gating input of 1v p-p square wave at 1.4KHz from the function generator
4. Observe the output wave forms
5. Measure the sweep time Ts and restoration time Tr and compare it with theoretical values
6. Plot the waveforms on graph sheet to the scale .

DESIGN:

$$V_s = \frac{V_{cc}\,T_g}{RC}$$

Where vs =sweep speed
Tg=half time period of gating waveform
Ts=RC(sweep time)

$$T_r = \frac{(CV_s)/V_{cc}}{(h_{fe}/R_b)-(1/R_a)}$$

Where Tr =Resoration time

RESULT: Output waveform observed and measured values are compared with

Theoretical values

VIVA QUESTIONS:

1. What are the different types of methods to generate linear sweep waveforms?
2. what is the condition to get an output which varies linearly with the time?
3. In a boot strap technique justly whether the charging current is maintained constant?
4. Explain the operation of boot strapping?
5. Define voltage and current time base generators?
6. What are the applications of time base generators?
7. Define recovery time in bootstrap technique?

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