A LAB MANUAL

on

POWER ELECTRONICS LAB
(20A02401P)

Prepared by

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SREE RAMA ENGINEERING COLLEGE

Approved by AICTE, New Delhi – Affiliated to JNTUA, Ananthapuramu
Accredited by NAAC with 'A' Grade
An ISO 9001:2015 & ISO 14001:2015 certified Institution
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Department of Electrical and Electronics Engineering

POWER ELECTRONICS LAB (20A02401P)

II B.Tech II Semester (R20) EEE

List of Experiments

1. Single Phase Fully controlled converter with R and RL load
2. Single Phase AC Voltage Controller with R and RL Loads
3. Single Phase Cycloconverter with R and RL loads
4. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
5. Single Phase Half controlled converter with R and RL load
6. DC Jones chopper with R and RL Loads
7. Single Phase series inverter with R and RL loads
8. Study of Characteristics of SCR, MOSFET & IGBT
9. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
10. Single Phase dual converter with RL loads

Additional Experiments:

1. P-Spice Simulation Of Resonant Pulse Commutation Circuit
2. P-Spice Simulation Of Single-Phase Ac Voltage Controller Using RLE Loads

EXPERIMENT NO: **01** DATE:

1-PHASE FULLY CONTROLLED BRIDGE CONVERTER

AIM:

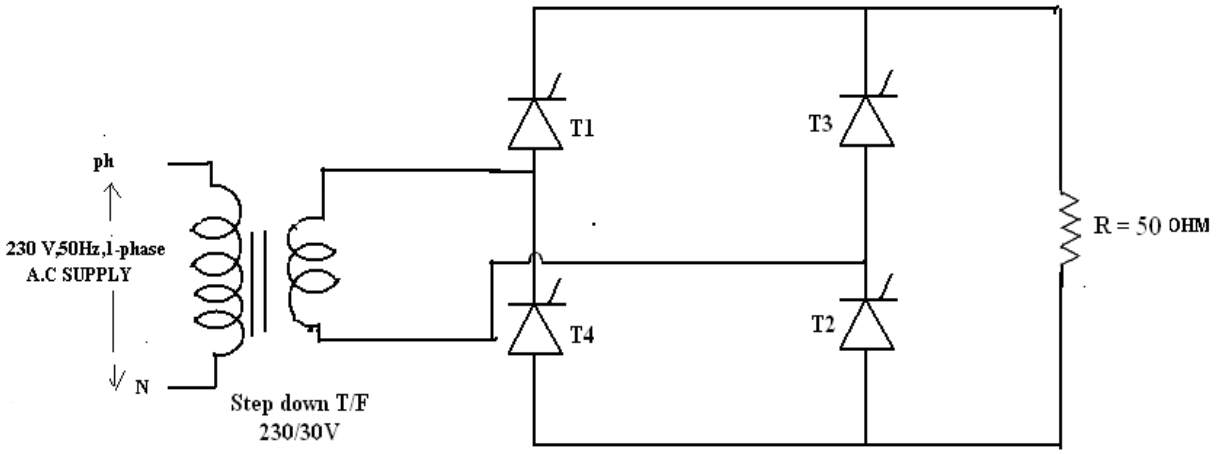
To convert AC supply to variable DC supply by changing the firing angles of thyristers.
To observe the input and output waveforms by using CRO & calculate voltage and currents for different firing angles.
To draw the input and output waveforms for different firing angles.

APPARATUS:

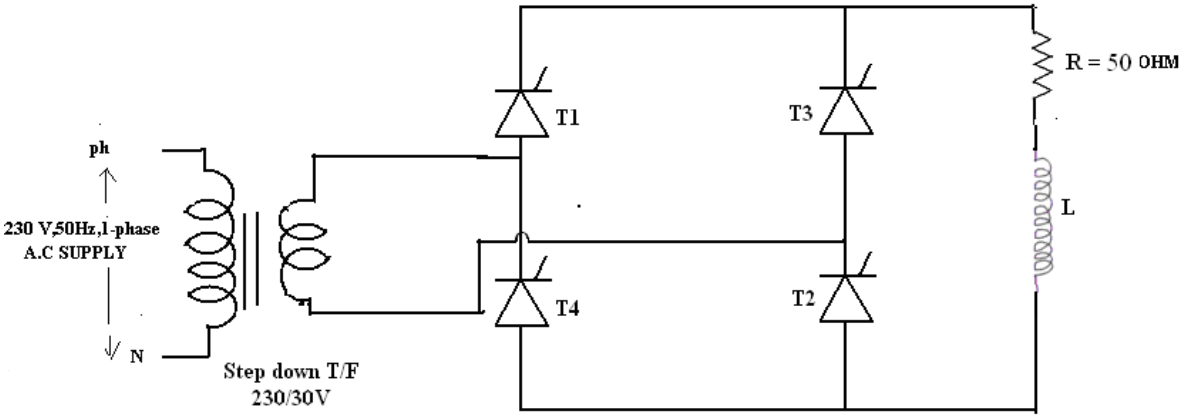
1. Thyristors-TYN612-4 no
2. Single phase fully controlled bridge firing kit
3. Rheostat-50 ohms
4. Loading inductor 10mH, 25mH&50mH
5. CRO
6. Connecting wires

CIRCUIT DIAGRAM:

SINGLE PHASE FULLY CONTROLLED BRIDGE CONVERTER WITH R-LOAD

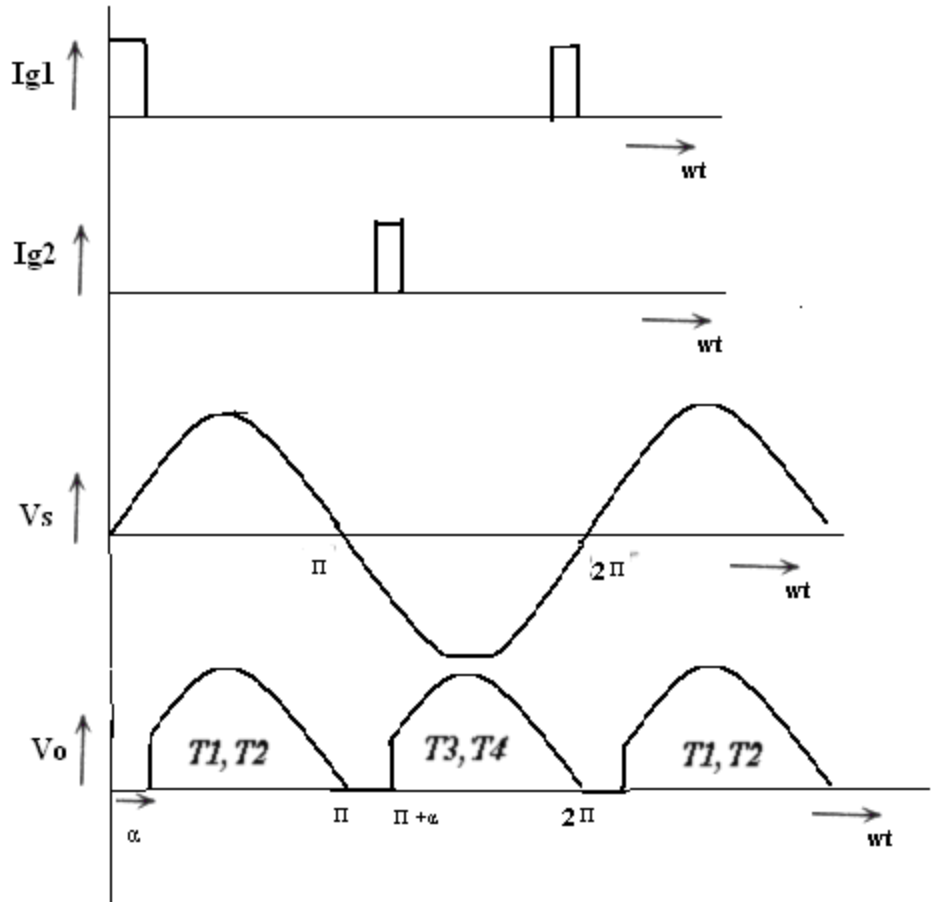


SINGLE PHASE FULLY CONTROLLED BRIDGE CONVERTER WITH RL-LOAD

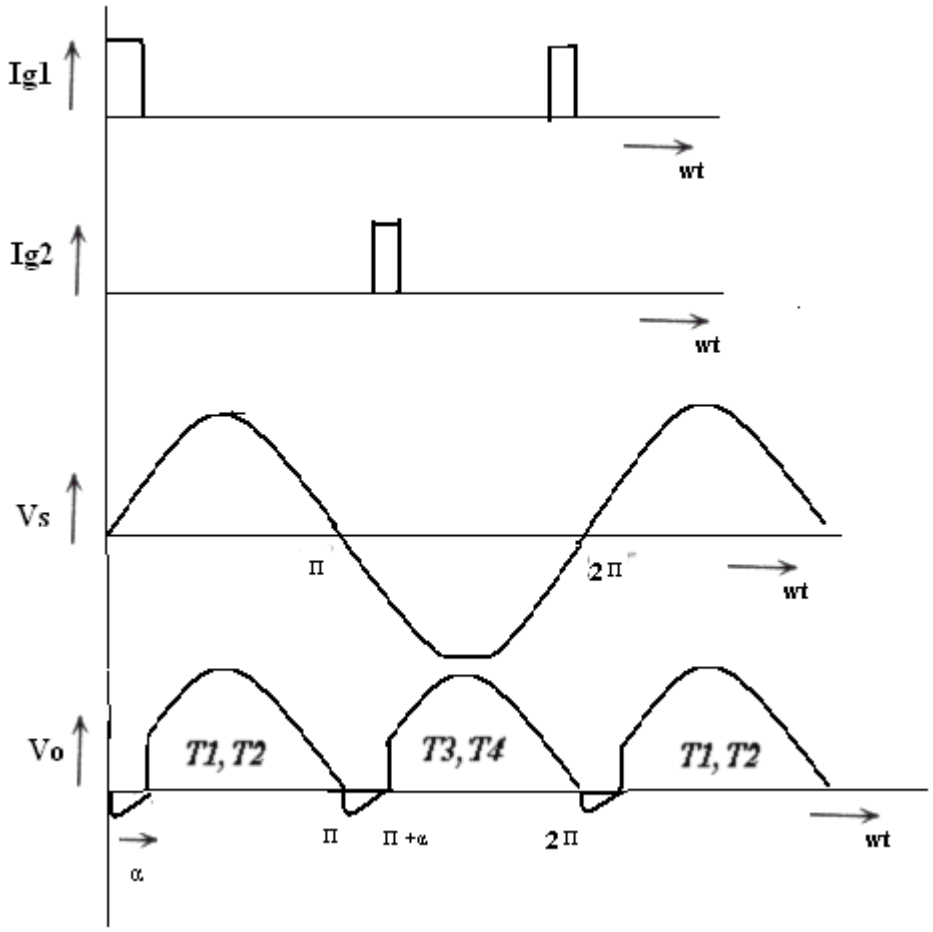


WAVE FORMS:

SINGLE PHASE FULLY CONTROLLED BRIDGE CONVERTER WITH R-LOAD



SINGLE PHASE FULLY CONTROLLED BRIDGE CONVERTER WITH RL-LOAD



TABULAR COLUMN:

V_m = _____

S.NO	FIRING ANGLE (Π)	V_{avg} (practical)	V_{avg} (theoreticall)
1	0		
2	30		
3	60		
4	90		
5	150		

THEORETICAL CALICULATIONS:

$$V_{d.c} = V_{avg} = \frac{1}{T}\int_{\alpha}^{\pi} V_m Sin\omega t.d\omega t \quad \text{for R-Load}$$

$$= \frac{V_m}{\pi}(1 + Cos\alpha)$$

$$V_{d.c} = V_{avg} = \frac{1}{T}\int_{\alpha}^{\pi+\alpha} V_m Sin\omega t.d\omega t \quad \text{for RL-Load}$$

$$= \frac{2V_m}{\pi} Cos\alpha$$

PRECAUTIONS:

1. Check the working condition of all the SCR's before connecting them in the circuit.
2. Check the firing circuit triggers outputs and its relative phase sequence.
3. Make fresh connections before you make a new experiment.
4. Preferably work at low voltages (30-40V) for every new connection after careful Verification raised to the max. ratings.
5. Keep all knobs at min. position before you switch ON the supply.
6. Show connections to the lab faculty before you start the experiment.

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the firing circuit.
3. The main supply is switched ON and triggering circuit is sitched ON
4. Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.
5. The out put wave forms are plotted on the graph sheet.
6. Similarly RL-load steps of the above are repeated.
7. Wave forms are observed in CRO

RESULT:

EXPERIMENT NO: **02** DATE:

1-PHASE AC VOLTAGE CONTROLLER

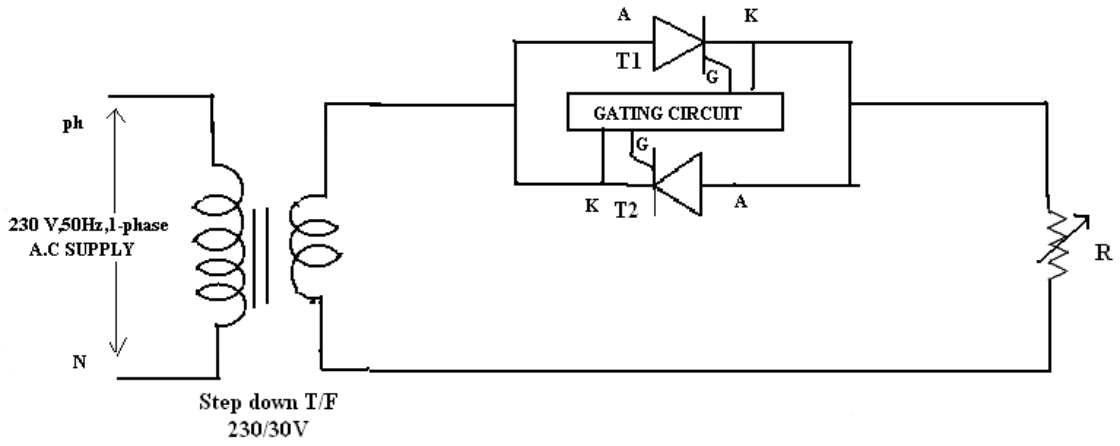
AIM : To study the performance of single phase A.C. Voltage controller.
To obtain the variable AC Voltage from the fixed AC Voltage by varying the firing angles of thyristors .
To observe the magnitude & wave forms of input and output in CRO
To draw the wave forms of input and output on graph sheet.

APPARATUS:

1. Single phase A.C. Voltage controller kit
2. Single phase A.C. Voltage controller firing kit
3. Rheostat-50 ohms
4. Loading inductor
5. CRO
6. Connecting wires

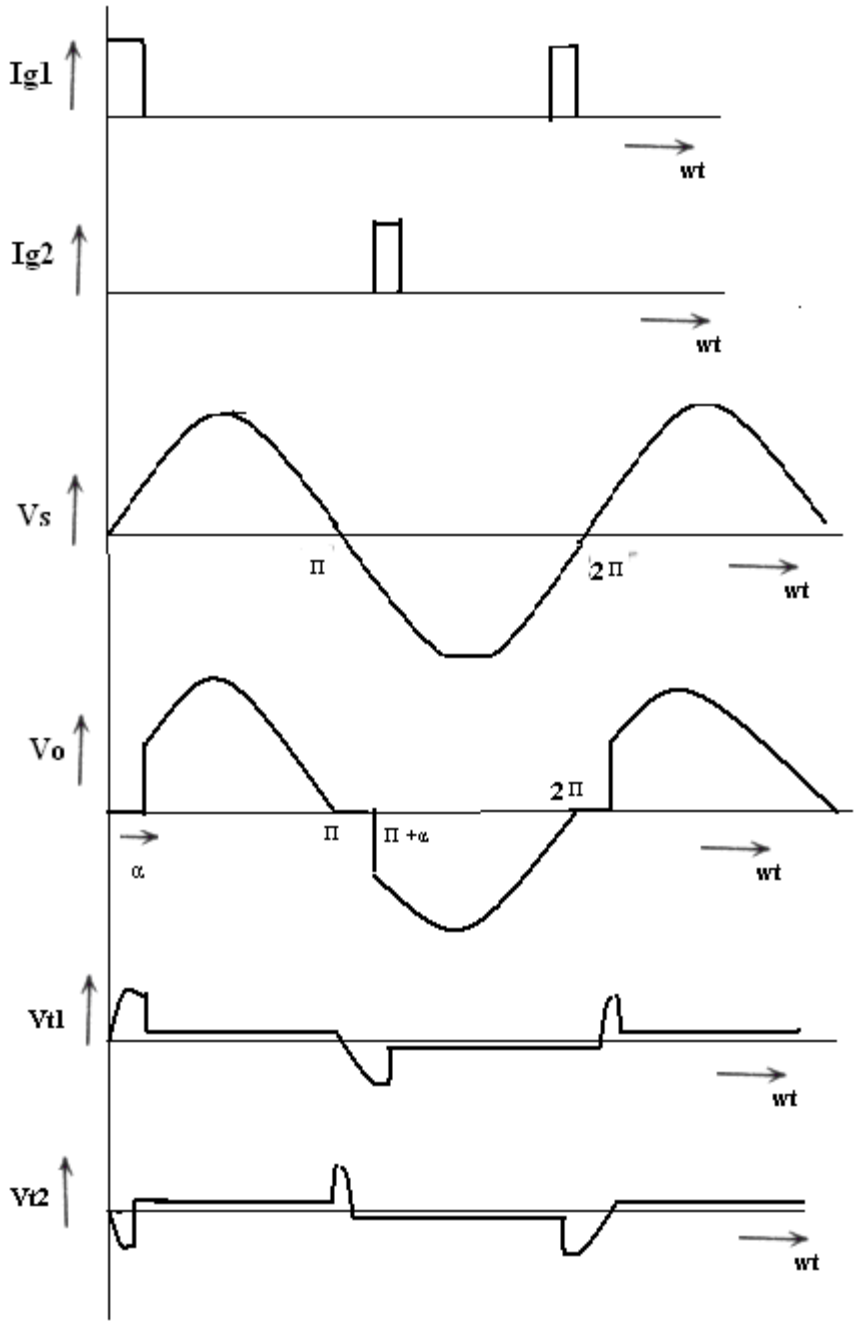
CIRCUIT DIAGRAM:

A.C VOLTAGE CONTROLLER WITH R-LOAD



WAVE FORMS:

A.C VOLTAGE CONTROLLER WITH R-LOAD



theoretical calculations :

$$V_{a.c} = V_{rms} = \sqrt{\frac{1}{T}\left[\int_{\alpha}^{\pi} V^2{}_m Sin^2\omega t.d\omega t + \int_{\pi+\alpha}^{2\pi} V^2{}_m Sin^2\omega t.d\omega t\right]}$$

$$= V_m\left[\frac{\pi-\alpha}{2\pi} + \frac{Sin2\alpha}{4\pi}\right]^{1/2}$$

TABULAR COLUMN:

V_m = _____

S.NO	FIRING ANGLE (α)	V_{rms} (practical)	V_{rms} (theoreticall)
1	0		
2	30		
3	60		
4	90		
5	150		

PRECAUTIONS:

1.Check all the SCR's for the performance before making connections
2. Check the firing circuit trigger outputs and its relative phase sequence.
3. Make fresh connections before you make a new experiment.
4. Preferably work at low voltages (30-40V) for every new connections after careful verification raised to the max. ratings.
5. Keep all knobs at min. position before you switch ON the supply.
6. Show connections to the lab faculty before you start the experiment.

PROCEDURE :

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the firing circuit.
3. The main supply is switched ON and triggering circuit is sitched ON
4. Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.

RESULT:

EXPERIMENT NO: **03** DATE:

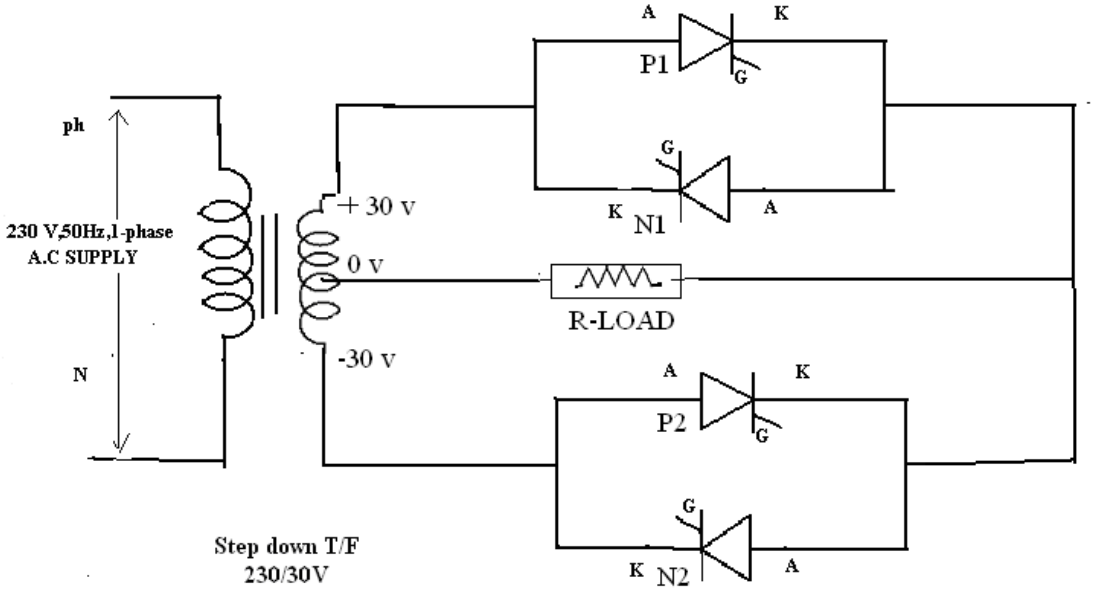
1-PHASE CYCLO CONVERTER

AIM : To study the performance of single phase Cyclo converter.
To change the 50Hz A.C input supply to 25Hz,16.66Hz without change in magnitude.

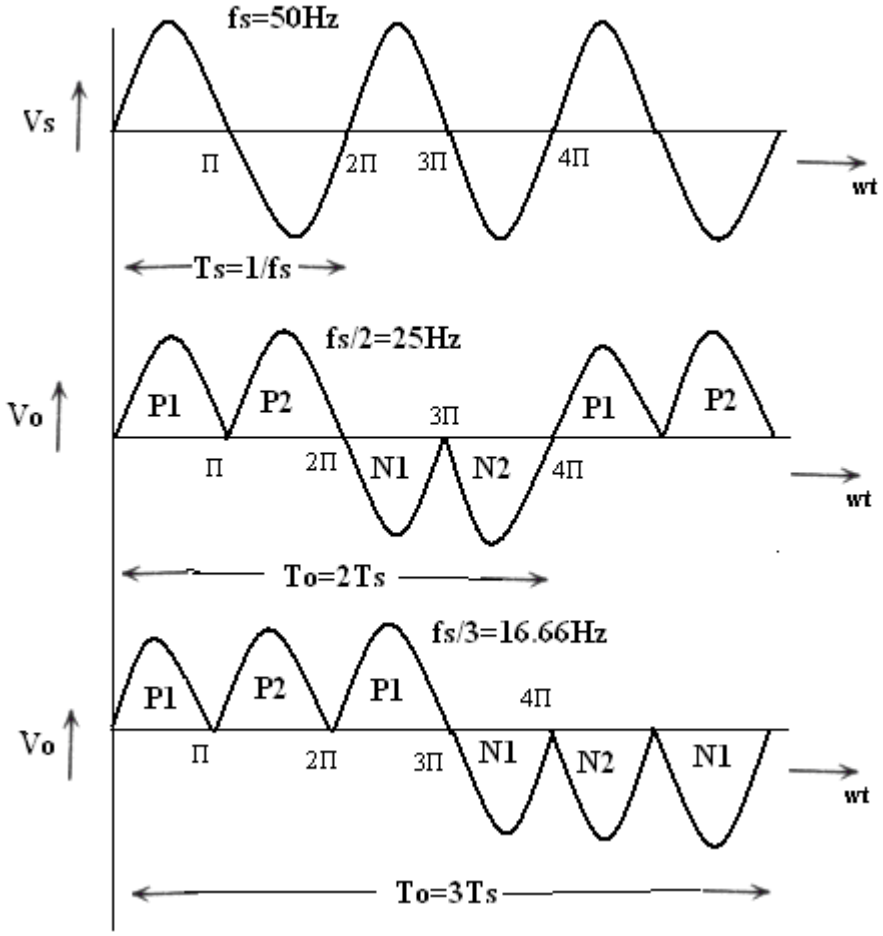
APPARATUS :

1. Single phase Cyclo Converter firing kit
2.Thyristors-TYN612-4 no
3.Rheostat-500 ohms
4. Loading inductor
5. CRO
6.Connecting wires

CIRCUIT DIAGRAM :



WAVE FORMS :



PRECAUTIONS:

1.Check all the SCR's for the performance before making connections
2.Check the firing circuit trigger outputs and its relative phase sequence.
3.Make fresh connections before you make a new experiment.
4.Preferably work at low voltages (30-40V) for every new connections after careful verification raised to the max. ratings.
5.Keep all knobs at min. position before you switch ON the supply.
6.Show connections to the lab faculty before you start the experiment.

PROCEDURE :

1.Connections are made as per the circuit diagram.
2.Firing pulses are applied for the respective SCR's from the firing circuit.
3.The main supply is switched ON and triggering circuit is sitched ON
4.Wave forms across the load are observed in CRO values are noted down and tabulated for different frequencies $f_s/2$, $f_s/3$, $f_s/4$,etc.,
5. The out put wave forms are plotted on the graph sheet.

THEORETICAL CALICULATIONS :

We know that source frequency (f_s)=50 Hz, i.e.,T_s= 20 mSec. ; [f =1/T]

$f_o = f_s/2 = 25$ Hz, i.e.$T_o = 2\ T_s = 40$ mS ;

$f_o = f_s/3 = 16.66$ Hz, i.e.$T_o = 3\ T_s = 60$ mS ;

RESULT:

EXPERIMENT NO: **04** DATE:

FORCED COMMUTATION CIRCUITS

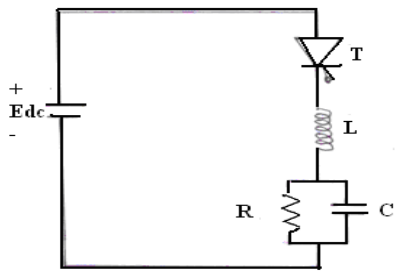
AIM : To study the Construction And Operation of 4- Forced Commutation Circuits.
To commutate thyrister using Class-A or Load commutation
To commutate thyrister using Class-B or current commutation
To commutate thyrister using Class-C or Complimentary commutation
To commutate thyrister using Class-D or Voltage commutation

APPARATUS :

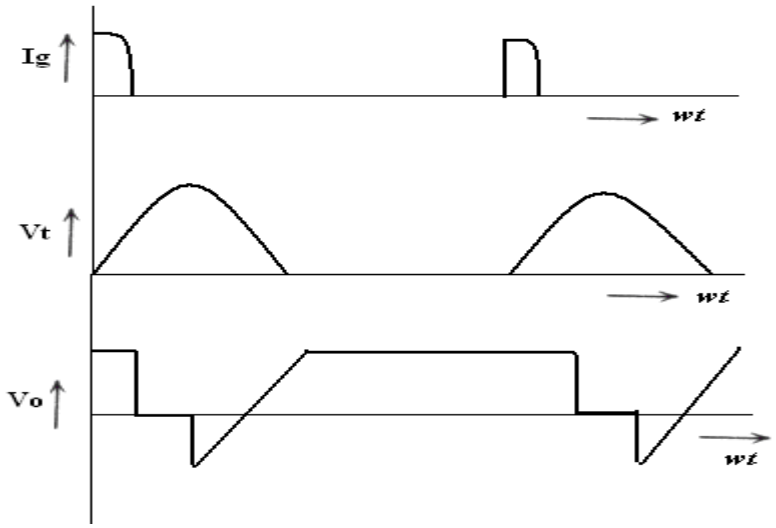
1. Forced Commutation Study Module
2.Rheostat-50 ohms
3.Loading Inductor
4. CRO
5.Connecting wires

CLASS-A COMMUTATION :

CIRCUIT DIAGRAM :



WAVE FORMS :

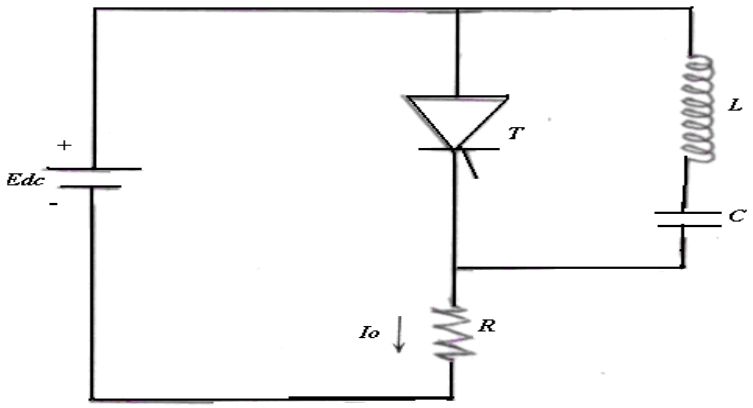


PROCEDURE:

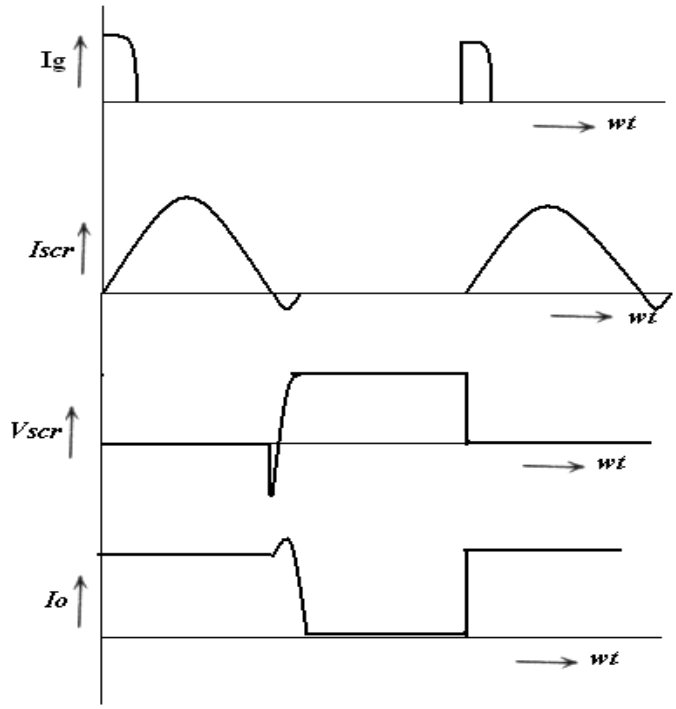
1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR from the Trigger Pulse Generator.
3. The main supply is switched ON and D.C supply switched ON.
4. Wave forms across the Thyristor, load and Capacitor are observed in CRO values are noted down.
5. The out put wave forms are plotted on the graph sheet.

CLASS-B COMMUTATION:

CIRCUIT DIAGRAM:



WAVE FORMS:

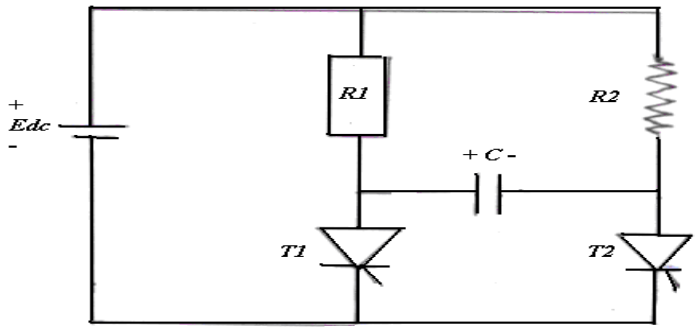


PROCEDURE:

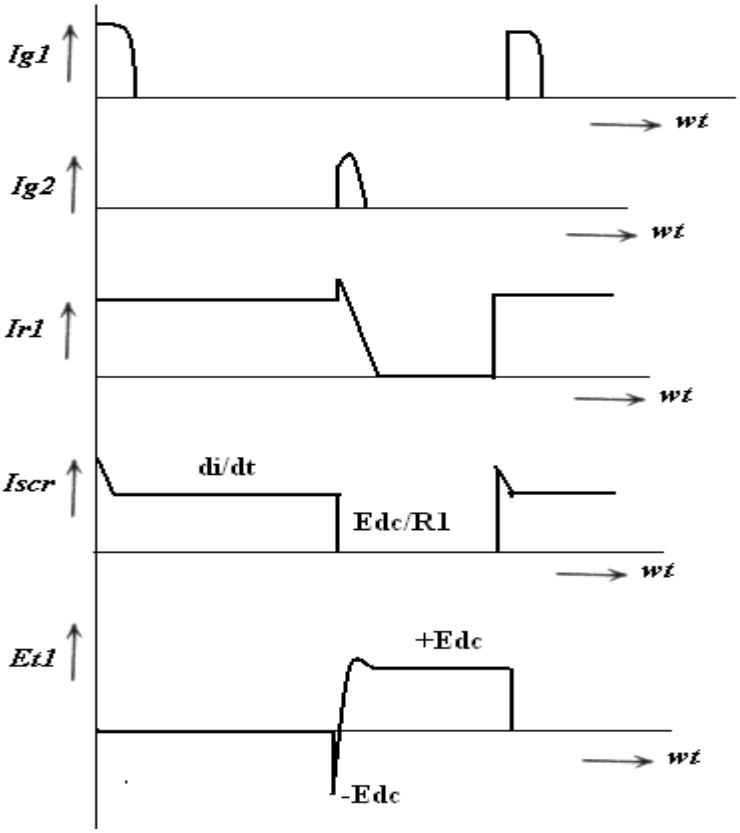
1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR from the Trigger Pulse Generator.
3. The main supply is switched ON and D.C supply switched ON.
4. Wave forms across the Thyristor, load and Capacitor are observed in CRO values are noted down.
5. The out put wave forms are plotted on the graph sheet.

CLASS-C COMMUTATION :

CIRCUIT DIAGRAM:



WAVE FORMS:

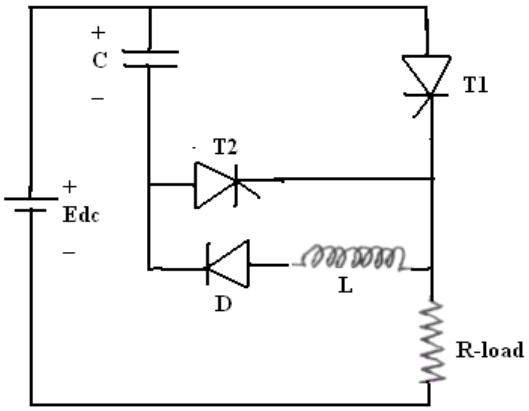


PROCEDURE:

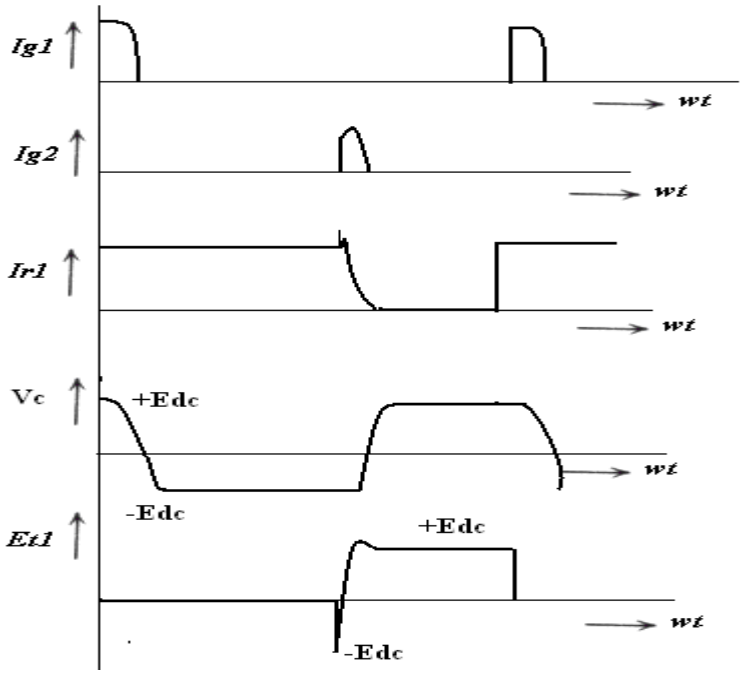
1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the Trigger Pulse Generator.
3. The main supply is switched ON and D.C supply switched ON.
4. Wave forms across the Thyristor, load and Capacitor are observed in CRO values are noted down.
5. The out put wave forms are plotted on the graph sheet

CLASS-D COMMUTATION :

CIRCUIT DIAGRAM :



WAVE FORMS:



PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the Trigger Pulse Generator.
3. The main supply is switched ON and D.C supply switched ON.

4. Wave forms across the Thyristor, load and Capacitor are observed in CRO values are noted down.
5. The out put wave forms are plotted on the graph sheet.

PRECAUTIONS:

1. Check all the SCR's for the performance before making connections.
2. Check the firing circuit trigger outputs and its relative phase sequence.
3. Make fresh connections before you make a new experiment.
4. Preferably work at low voltages (30-40V) for every new connections after careful verification raised to the max. ratings.
5. Keep all knobs at min. position before you switch ON the supply.
6. Show connections to the lab faculty before you start the experiment.

RESULT :

EXPERIMENT NO: **05** DATE:

1-PHASE HALF CONTROLLED CONVERTER

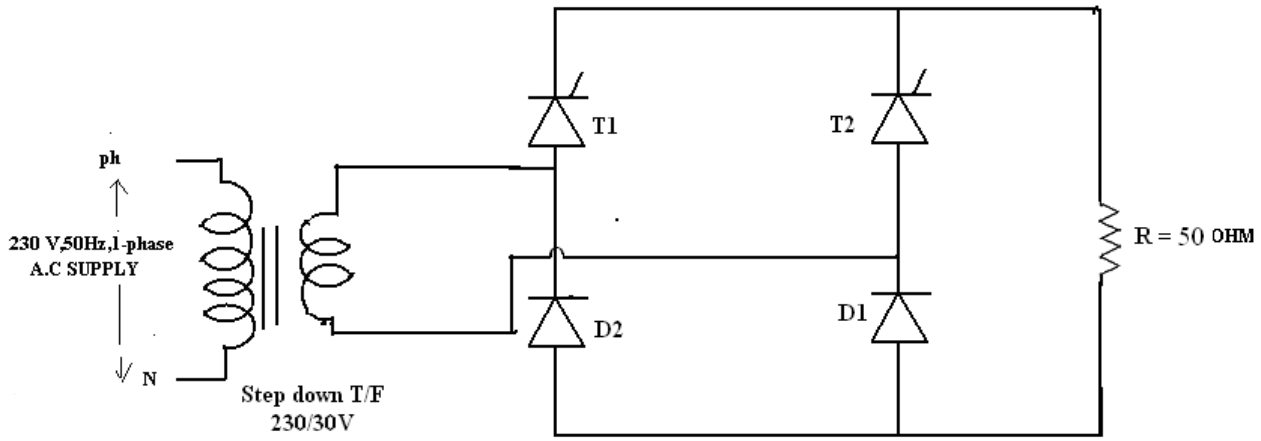
AIM : To study the performance of single phase Half controlled bridge converter.
To prove that the Half controlled converter works in only one quadrant.
To observe the magnitude & wave forms of input and output in CRO
To draw the wave forms of input and output drawn on graph sheet.

APPARATUS :

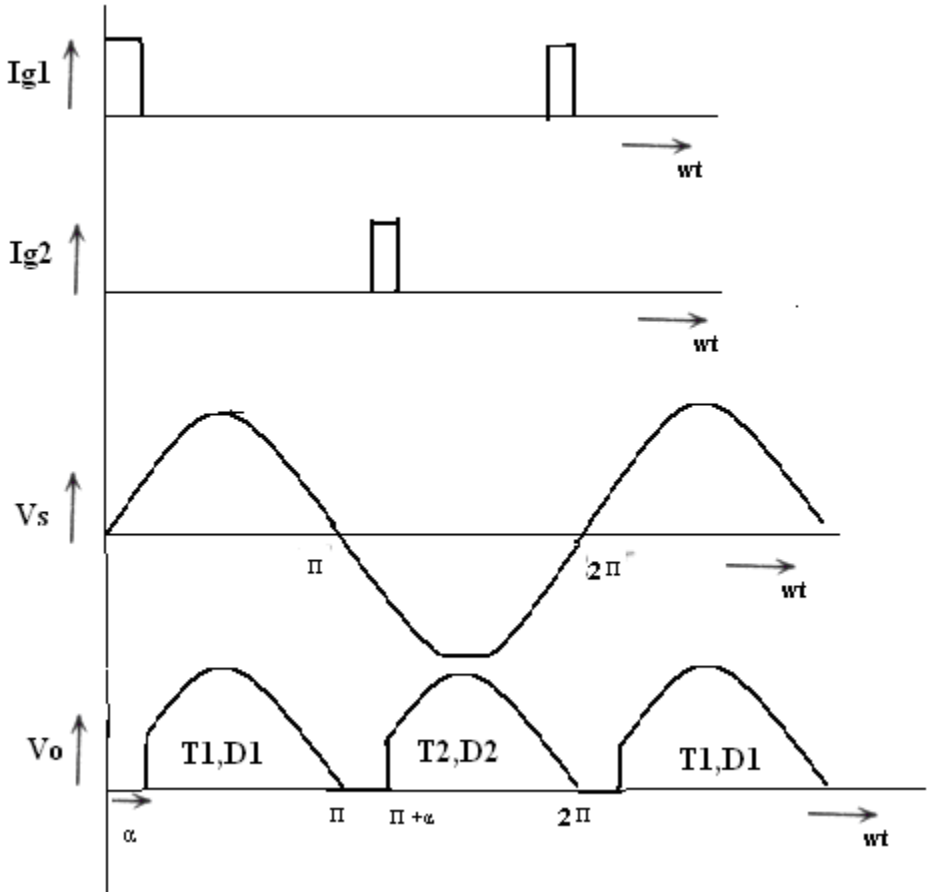
1.Single phase fully controlled bridge kit
2. Single phase fully controlled bridge firing kit
3.Thyristors-TYN612-2 no
4. Diodes –IN 4007-2 no
5.Rheostat-50 ohms
6. Loading inductor
7. CRO
8.Connecting wires

CIRCUIT DIAGRAM :

SINGLE PHASE HALF CONTROLLED BRIDGE CONVERTER WITH R-LOAD



WAVE FORMS :



TABULAR COLUMN :

V_m = _____

S.NO	FIRING ANGLE (α)	V_{avg} (practical)	V_{avg} (theoreticall)
1	0		
2	30		
3	60		
4	90		
5	150		

THEORETICAL CALICULATIONS :

$$V_{d.c} = V_{avg} = \frac{1}{T}\int_{\alpha}^{\pi} V_m Sin\omega t.d\omega t \quad \text{for R-Load}$$

$$= \frac{V_m}{\pi}(1 + Cos\alpha)$$

PRECAUTIONS:

1. Check all the SCR's for the performance before making connections
2. Check the firing circuit trigger outputs and its relative phase sequence.
3. Make fresh connections before you make a new experiment.
4. Preferably work at low voltages (30-40V) for every new connections after careful verification raised to the max. ratings.
5. Keep all knobs at min. position before you switch ON the supply.
6. Show connections to the lab faculty before you start the experiment.

PROCEDURE :

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the firing circuit.
3. The main supply is switched ON and triggering circuit is sitched ON
4. Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.
5. The out put wave forms are plotted on the graph sheet.
6. Similarly RL-load steps of the above are repeated.
7. Wave forms are observed in CRO

RESULT:

EXPERIMENT NO: **06** DATE:

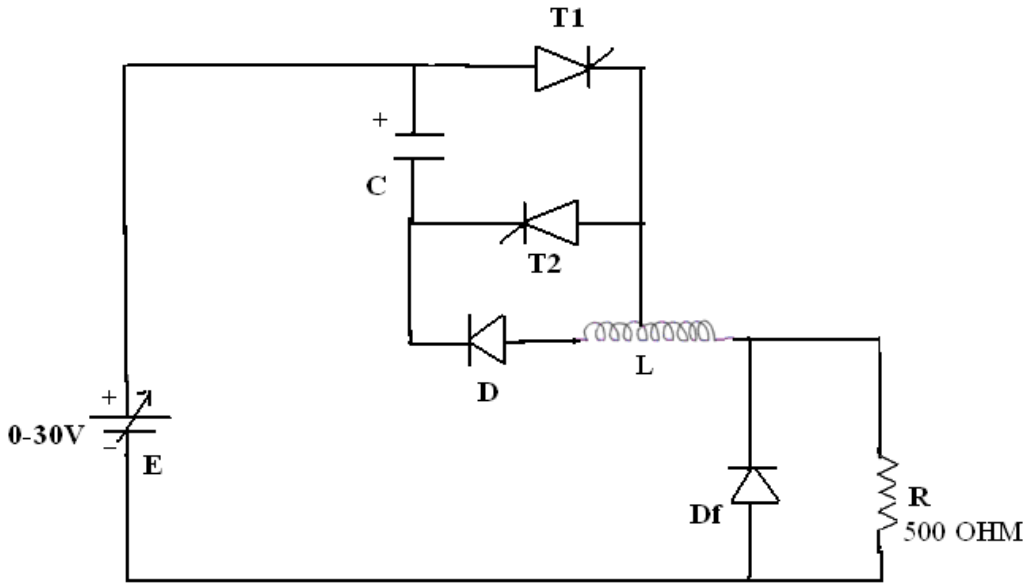
DC JONES CHOPPER

AIM : To study the performance of Jones Chopper and observe the wave forms at different duty cycles.
To observe the Chopped output across the load and it's variation as duty ratio varies.
To study Voltage commutation.
To observe the magnitude & wave forms of input and output in CRO
To draw the wave forms of input and output drawn on graph sheet.

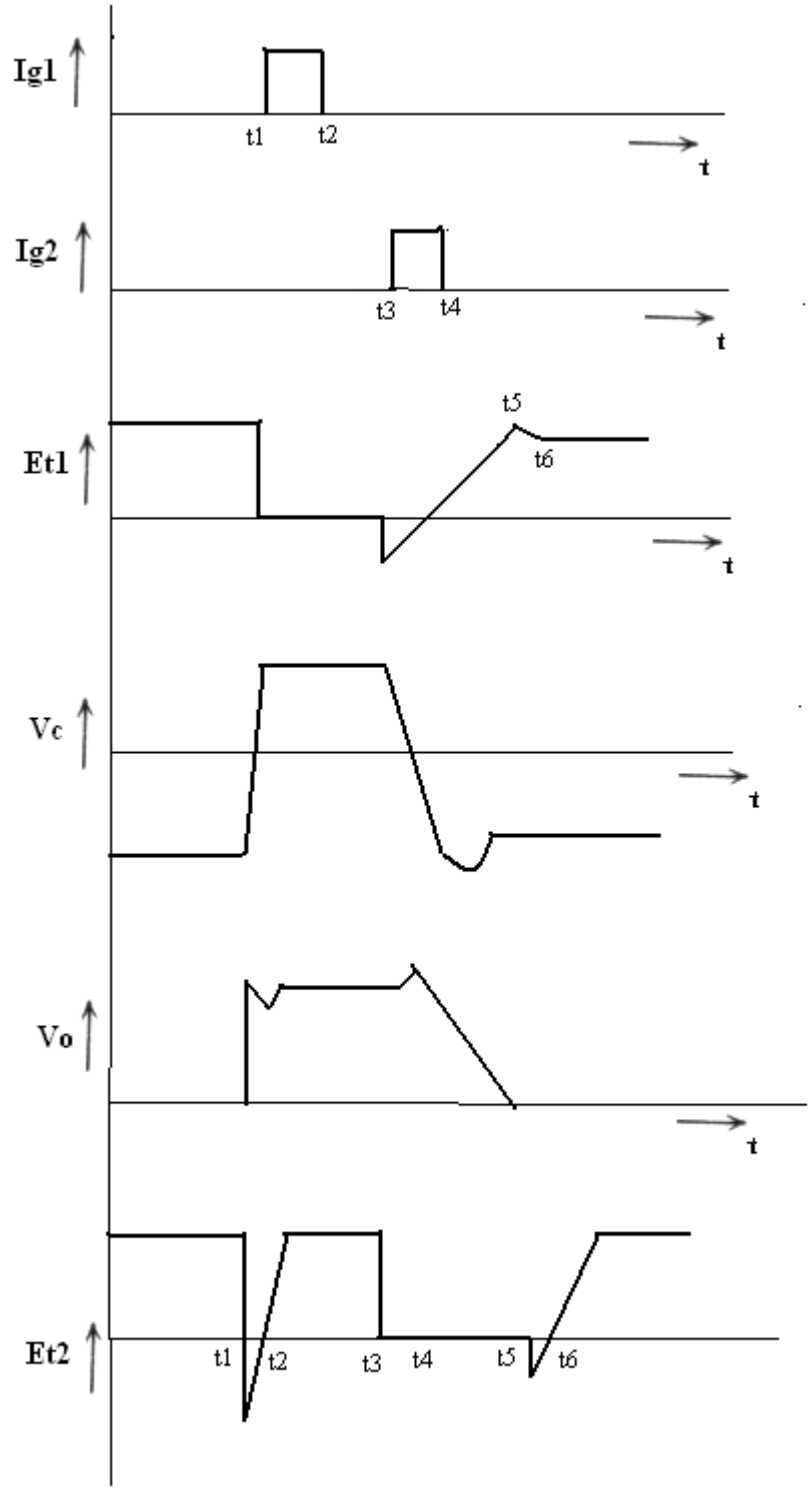
APPARATUS :

1. Jones Chopper study unit.
2. Jones Chopper Firing unit
3. Rheostat-500 ohms
4. CRO
5. Connecting wires

CIRCUIT DIAGRAM :



WAVE FORMS :


Ig1
t1
t2
t
Ig2
t3
t4
t
Et1
t5
t6
t
Vc
t
Vo
t
Et2
t1
t2
t3
t4
t5
t6

PROCEDURE :

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the firing circuit.
3. The main supply is switched ON and triggering circuit is switched ON
4. Wave forms across the Main Thyristor, Auxiliary Thyristor, Capacitor and load are observed in CRO values are noted down and tabulated for different firing angles.
5. The out put wave forms are plotted on the graph sheet.

PRECAUTIONS:

1. Check all the SCR's for the performance before making connections
2. Check the firing circuit trigger outputs and its relative phase sequence.
3. Make fresh connections before you make a new experiment.
4. Keep all knobs at min. position before you switch ON the supply.
5. Show connections to the lab faculty before you start the experiment

RESULT :

EXPERIMENT NO: **07** DATE:

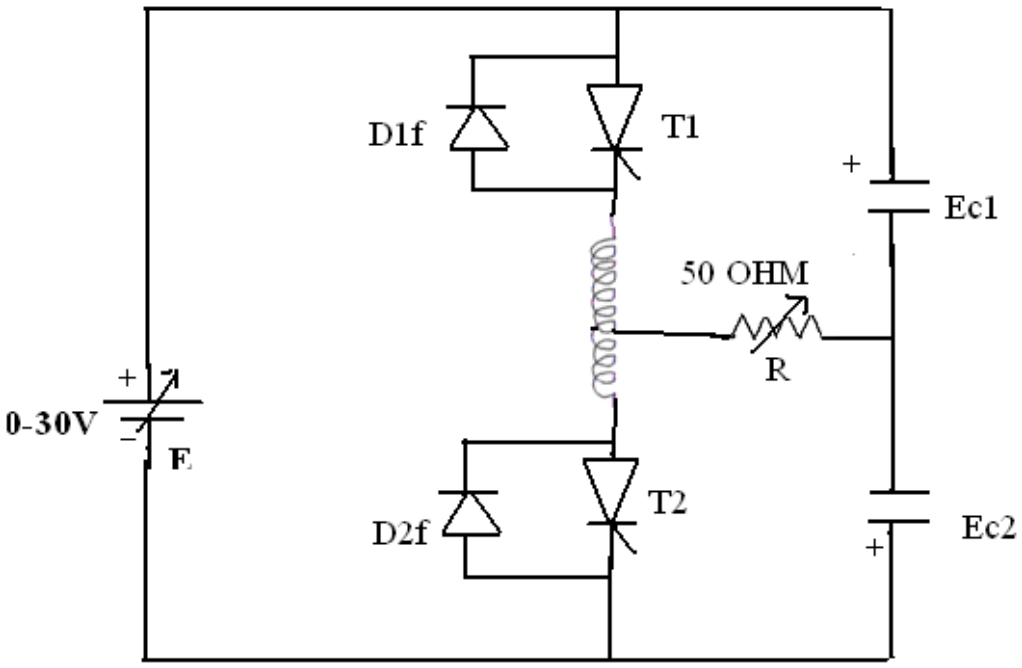
SERIES INVERTER

AIM : To study the performance of Series Inverter.
To obtain AC output across load by using load commutation from DC input.
To observe the magnitude & wave forms of input and output in CRO
To draw the wave forms of input and output drawn on graph sheet.

APPARATUS :

1. Series Inverter kit
2. Rheostat-50 ohms
3. CRO
4. Connecting wires

CIRCUIT DIAGRAM :

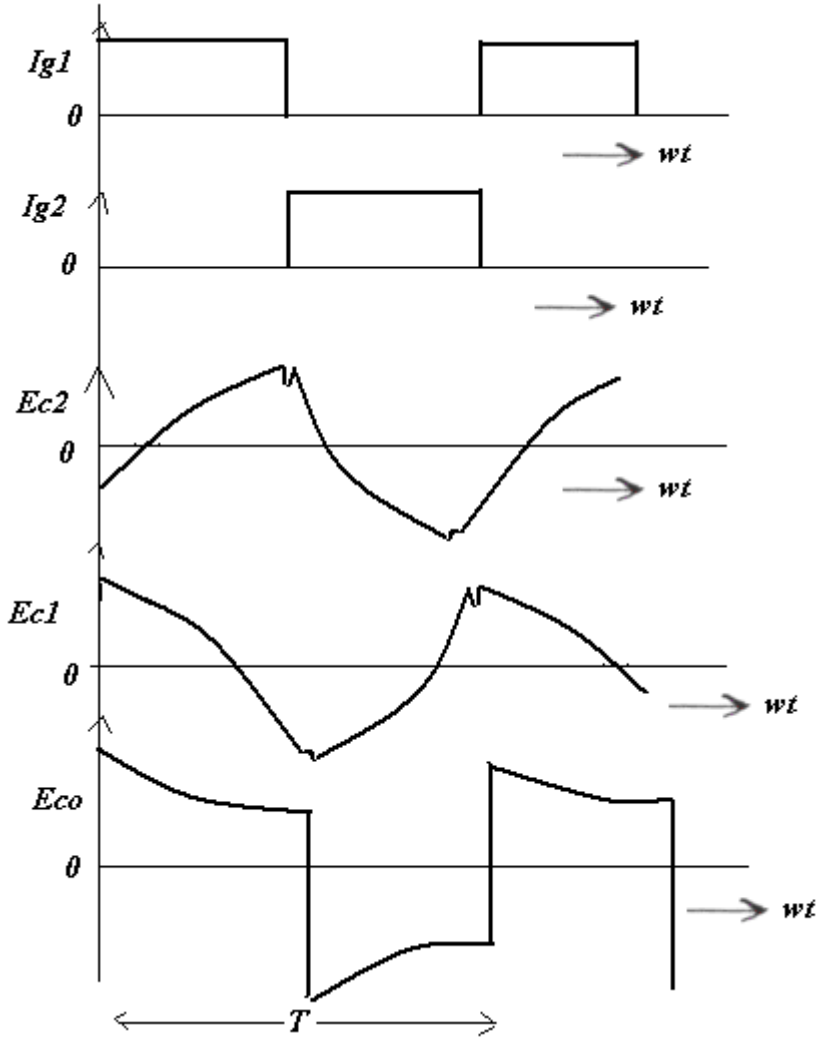


PRECAUTIONS:

1. Check all the SCR's for the performance before making connections
2. Check the firing circuit trigger outputs and its relative phase sequence.

3. Make fresh connections before you make a new experiment.
4. Keep all knobs at min. position before you switch ON the supply.
5. Show connections to the lab faculty before you start the experiment

WAVE FORMS :



PROCEDURE :

1. Connections are made as per the circuit diagram.
2. Firing pulses are applied for the respective SCR's from the firing circuit.
3. The main supply is switched ON and triggering circuit is sitched ON
4. Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.

5. The out put wave forms are plotted on the graph sheet.

RESULT:

EXPERIMENT NO: **08** DATE:

CHARACTERISTICS OF SCR, MOSFET AND IGBT

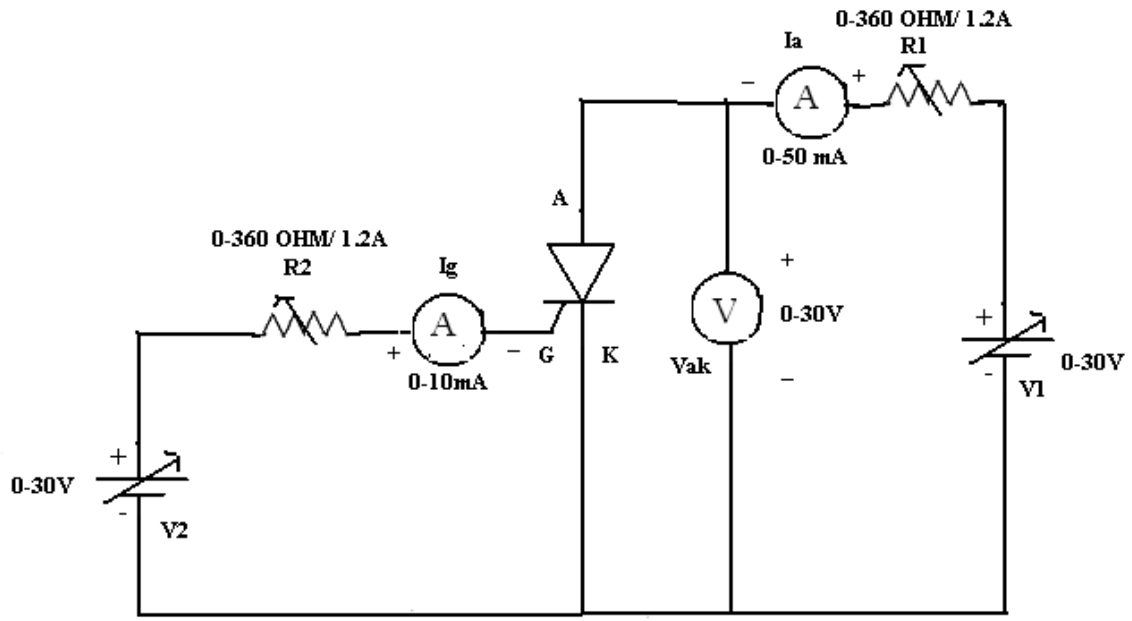
AIM : To study the characteristics of SCR,MOSFET and IGBT.
To draw the V-I characteristics of SCR and Break down voltage
To draw the input and output characteristics 0f MOSFET & IGBT

APPARATUS :

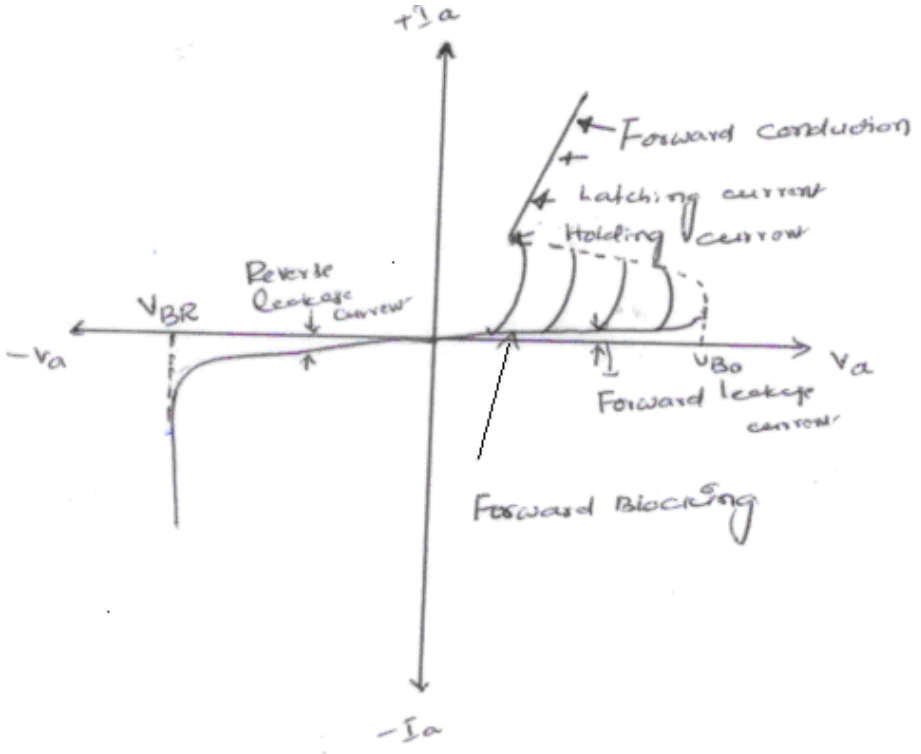
1. Characteristics of SCR,MOSFET and IGBT study unit.
2. Ammeters 0-500mA-1 no
   Ammeters 0-50mA-2 no
   Ammeter 0-10mA-2 no
3. Voltmeter 0-50V-2no
4. CRO
5. Connecting wires

V-I CHARACTERISTICS OF SCR

CIRCUIT DIAGRAM :


0-360 OHM/ 1.2A
Ia
R1
A
0-50 mA
A
0-360 OHM/ 1.2A
R2
Ig
A
0-10mA
G
K
V
0-30V
Vak
0-30V
V1
0-30V
V2

WAVE FORMS:



TABULAR COLUMN :

I_G =__4___mA

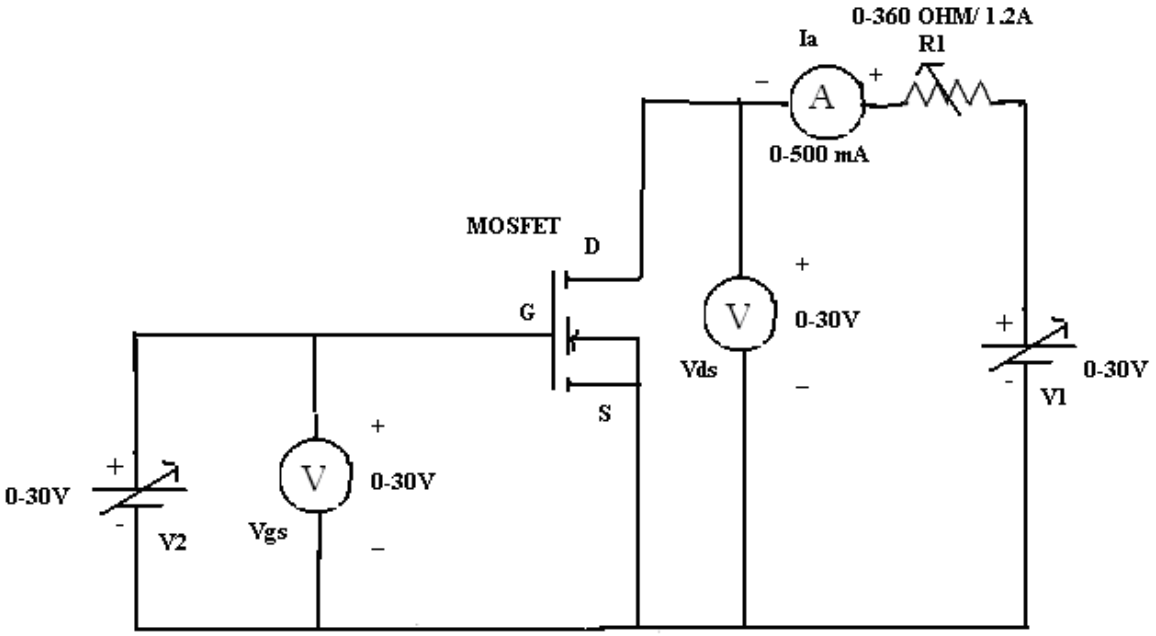
S.NO	V_{AK}	I_A

PROCEDURE :

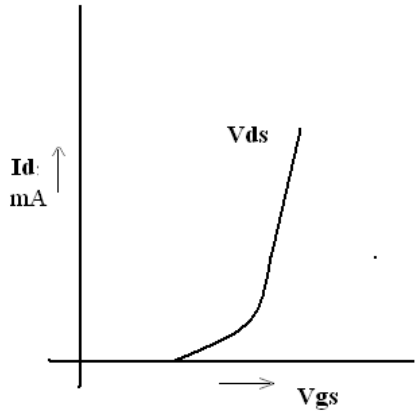
1. Connections are made as per the circuit diagram.
2. Gate current is kept at constant fixed value by varying the Gate source, potentiometer.
3. Anode Cathode source is varied from its min. value in steps and readings of V_{AK} & I_A are noted down at each step by observing the gate current I_G , At Break down voltage the gate current raises rapidly(to be observed in Ammeter I_G) and Anode Cathode Voltage is falls down suddenly (to be observed in Volt meter V_{AK}).
4. The Break down voltage,Anode current at which sudden rising starts will be noted .
5. Repeat the steps 2-4 for other constant gate current.
6. Graph is drawn between V_{AK} & I_A for different values of gate currents . I_{G1} & I_{G2} .

CHARACTERISTICS OF MOSFET

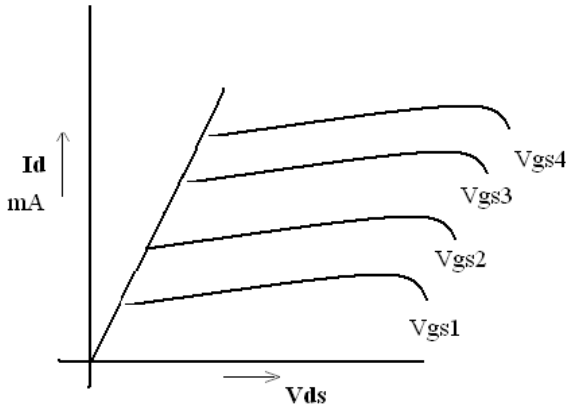
CIRCUIT DIAGRAM :



WAVE FORMS :



TRANSFER CHARACTERISTICS



DRAIN CHARACTERISTICS

TABULAR COLUMN :

V_{DS} =__4___V

S.NO	V_{GS}	I_D

V_{GS} =__4___V

S.NO	V_{DS}	I_D

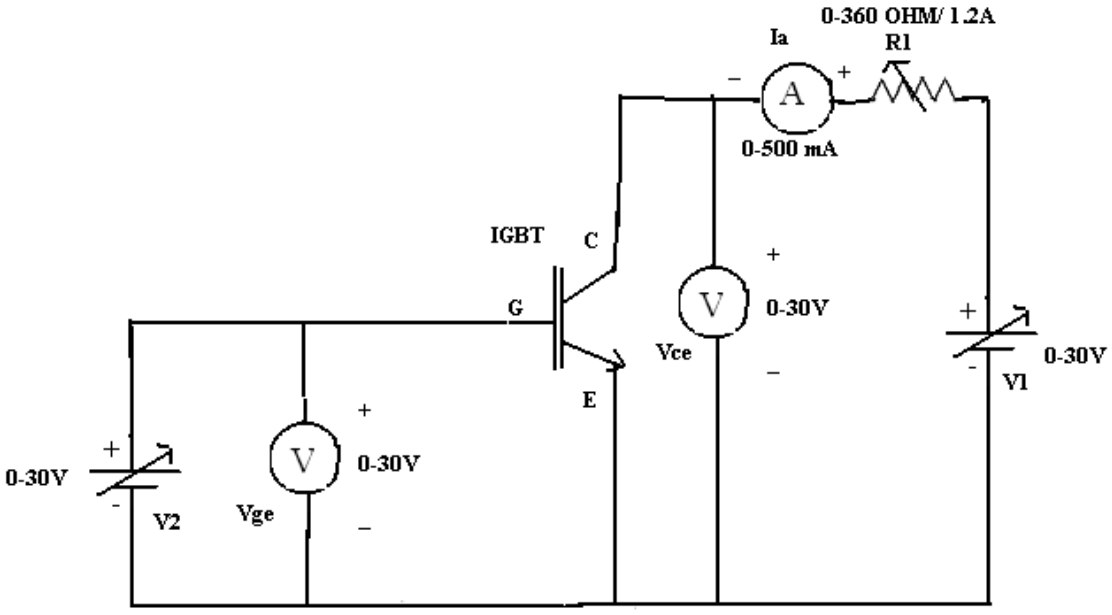
PROCEDURE :

1. Connections are made as per the circuit diagram.
2. V_{GS} is kept at constant fixed value by varying the Gate supply.
3. Drain Source supply is varied from its min. value in steps and readings of V_{DS} & I_D are noted down at each step by observing the V_{GS} constant.
4. Graph is drawn between V_{DS} & I_D for different values of Gate Source Voltages V_{GS1} & V_{GS2}.
5. V_{DS} is kept at constant fixed value by varying the Drain resistance using potentio meter.
6. Gate Source supply is varied from its min. value in steps and readings of V_{GS} & I_D are noted down at each step by observing the V_{DS} constant.

7.Graph is drawn between V_{GS} & I_D for different values of Drain Source Voltages V_{DS1} & V_{DS2}.

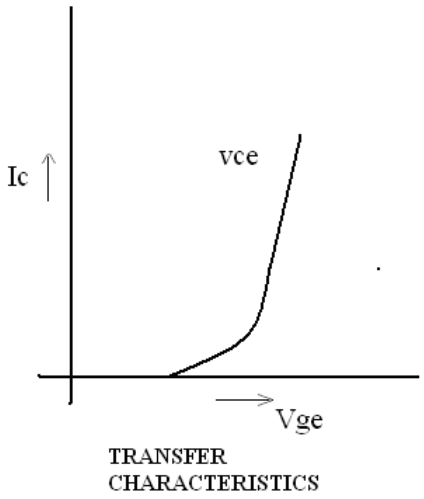
CHARACTERISTICS OF IGBT

CIRCUIT DIAGRAM

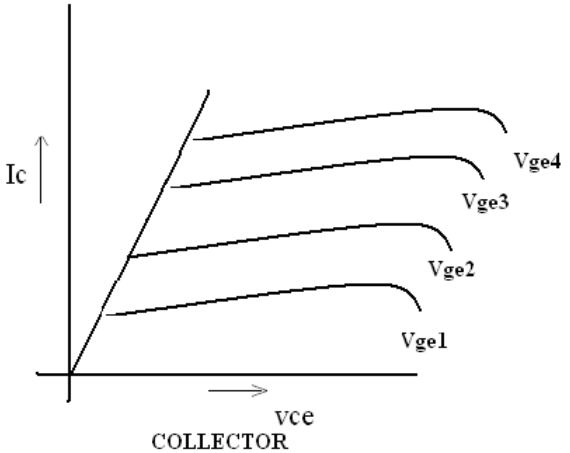


:

WAVE FORMS :



TRANSFER CHARACTERISTICS



COLLECTOR CHARACTERISTICS

TABULAR COLUMN :

V_{CE} =__4___V

S.NO	V_{GE}	I_C

V_{GE} =__4___V

S.NO	V_{CE}	I_C

PROCEDURE :

1. Connections are made as per the circuit diagram.

2. V_{GE} is kept at constant fixed value by varying the Gate supply.
3. Drain Source supply is varied from its min. value in steps and readings of V_{CE} & I_C are noted down at each step by observing the V_{GE} constant.
4. Graph is drawn between V_{CE} & I_C for different values of Gate Emitter Voltages V_{GE1} & V_{GE2}.
5. V_{CE} is kept at constant fixed value by varying the Drain resistance using potentio meter.
6. Gate Source supply is varied from its min. value in steps and readings of V_{GE} & I_C are noted down at each step by observing the V_{CE} constant.

7.Graph is drawn between V_{GE} & I_C for different values of Collector Emitter Voltages V_{CE1} & V_{CE2}.

PRECAUTIONS:

1. Check the SCR.MOSFET & IGBT for the performance before making connections

2. Check the Battery supplies V1 & V2,R1 & R2.
3. Make fresh connections before you make a new experiment.
4. Keep all knobs at min. position before you switch ON the supply.
5. Show connections to the lab faculty before you start the experiment.

RESULT :

\

EXPERIMENT NO: **09** DATE:

GATE FIRING CIRCUITS (R, RC & UJT)

AIM : To study the performance of various turn-on methods of thyristers by it's gate terminal.
To prove that the firing angle range for R-triggering is 0 to 90^0
To prove that the firing angle range for RC-triggering is 0 to 180^0
To prove that the firing angle range for UJT-triggering ramp triggering.
To observe the magnitude & wave forms of input and output in CRO
To draw the wave forms of input and output drawn on graph sheet.

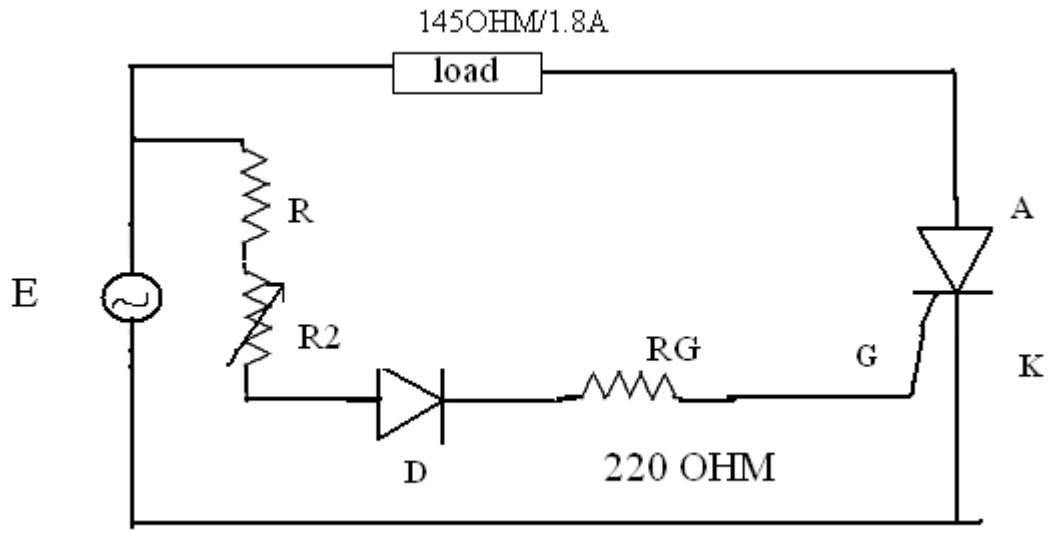
APPARATUS :

1.RC-Firing circuit study unit.
2.UJT-Firing circuit study unit
3.Thyristor-TYN612-1 no

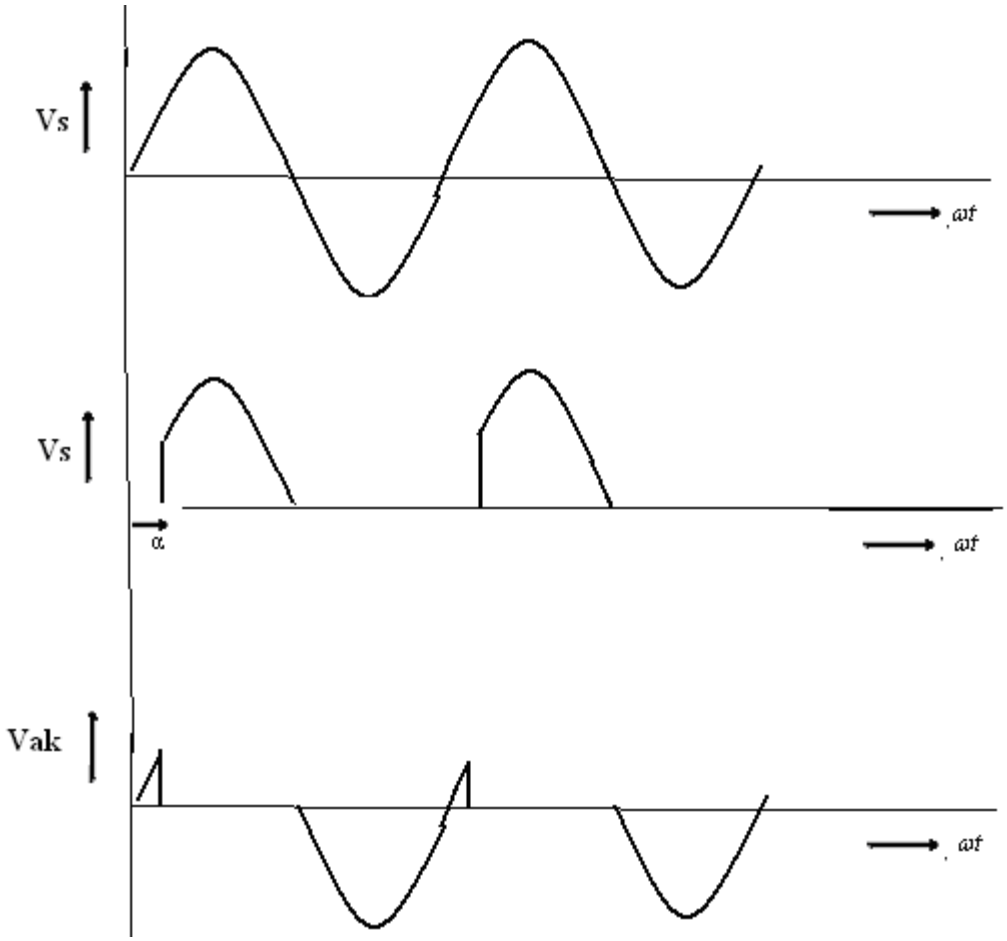
4.Rheostat-50 ohms
5. CRO
6.Connecting wires

R-FIRING CIRCUIT

CIRCUIT DIAGRAM :



WAVE FORMS :



PROCEDURE :

1.Connections are made as per the circuit diagram.
2.The main supply is switched ON and triggering circuit is switched ON
3.Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.
4. The out put wave forms are plotted on the graph sheet.

TABULAR COLUMN :

V_m = _____

s.no	Firing angle (α)	V_{dc} (theoretical)	V_{dc} (Practical)	V_{rms} (theoretical)	V_{rms} (Practical)

THEORETICAL CALICULATIONS :

$$V_{d.c} = V_{avg} = \frac{1}{T}\int_{\alpha}^{\pi} V_m Sin\omega t.d\omega t$$

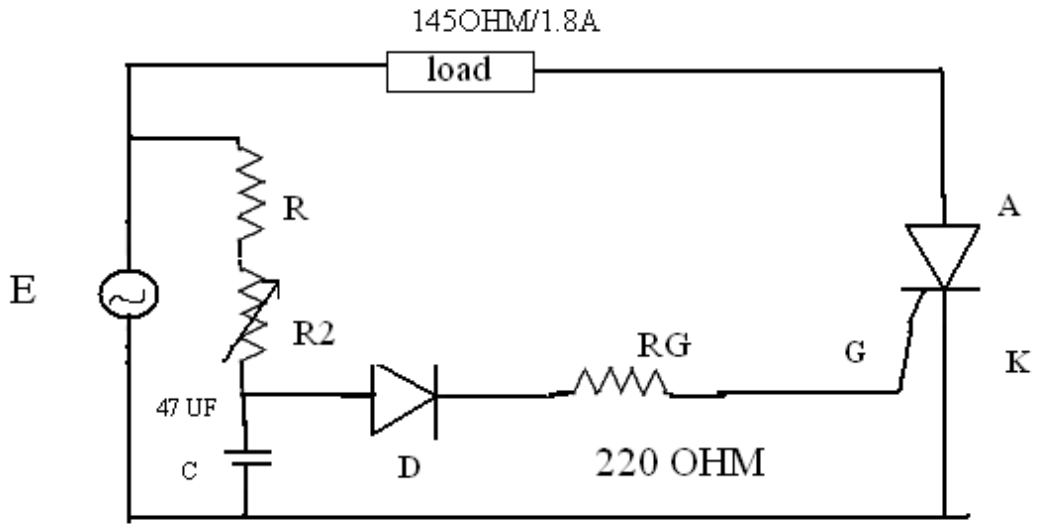
$$= \frac{V_m}{2\pi}(1 + Cos\alpha)$$

$$V_{a.c} = V_{rms} = \sqrt{\frac{1}{T}\int_{\alpha}^{\pi} V^2{}_m Sin^2\omega t.d\omega t}$$

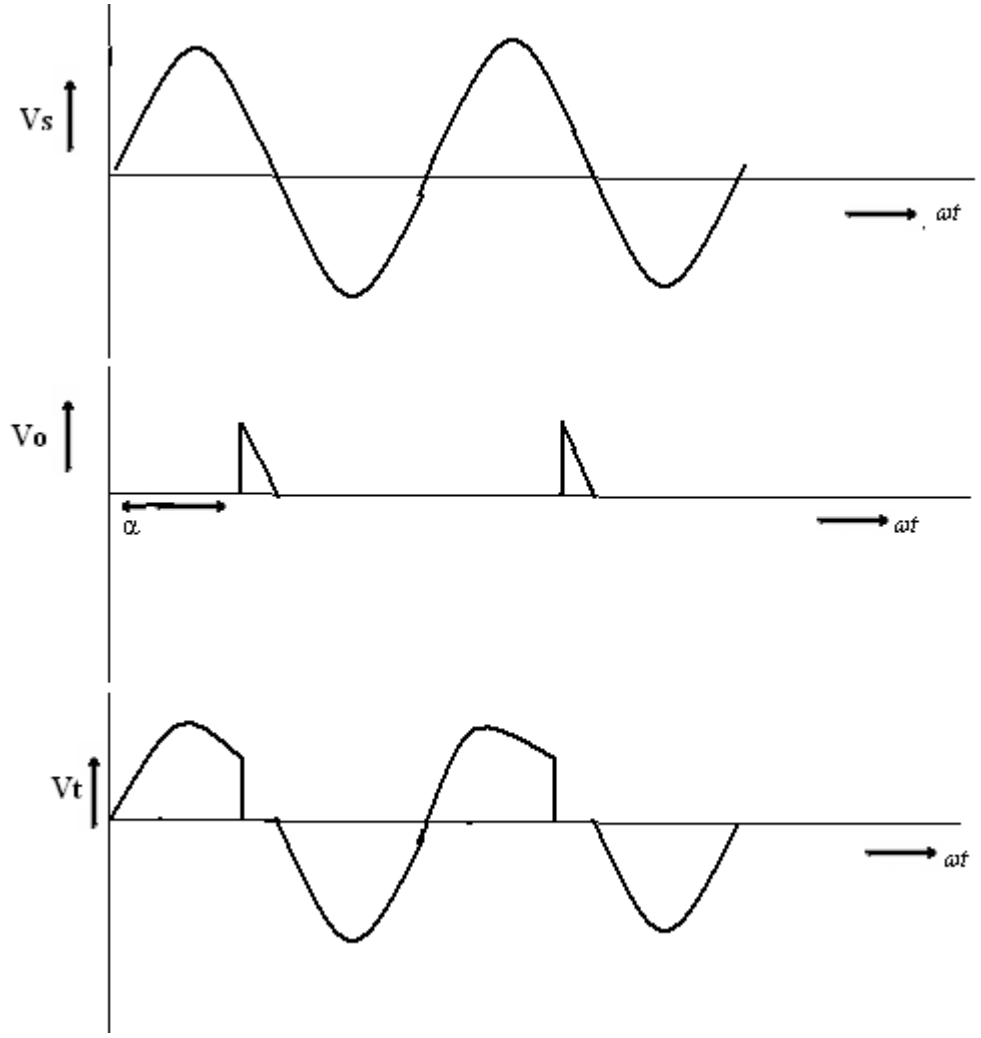
$$= \frac{V_m}{2\sqrt{\pi}}\left[(\pi - \alpha) + \frac{Sin2\alpha}{2}\right]^{1/2}$$

RC-FIRING CIRCUIT

CIRCUIT DIAGRAM:



WAVE FORMS :



TABULAR COLUMN :

V_m = _____

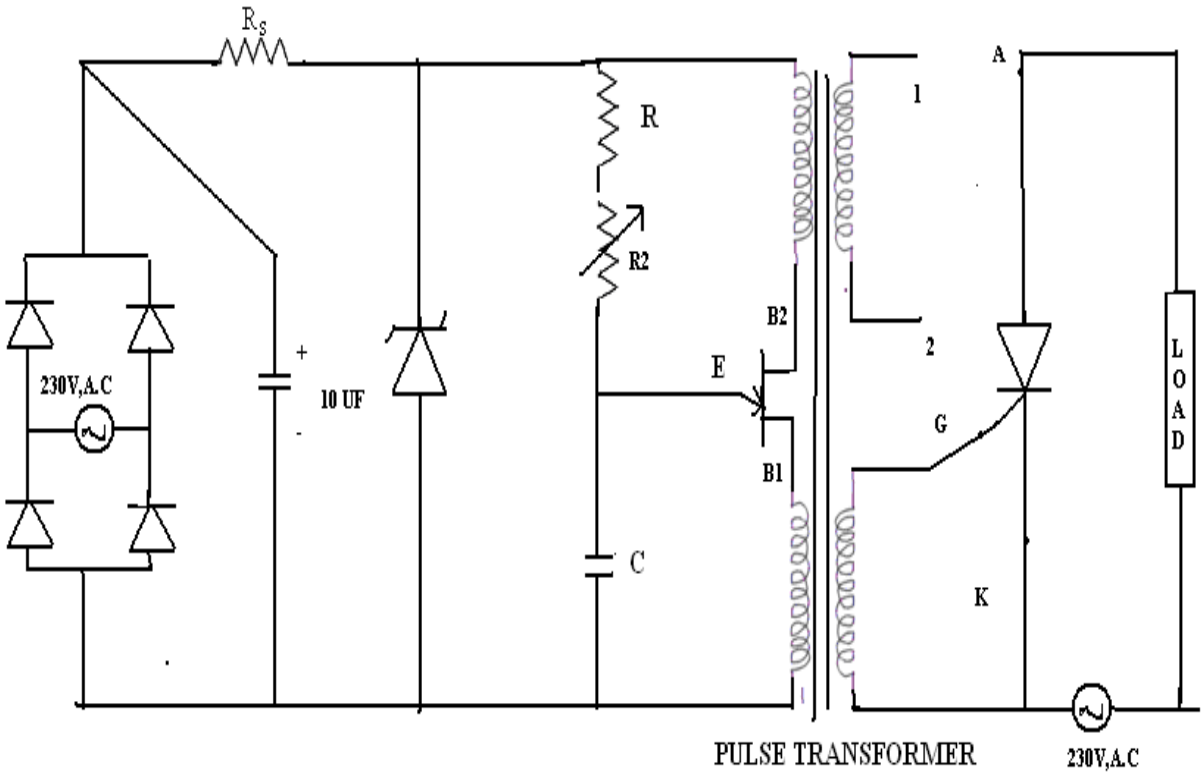
s.no	Firing angle (α)	V_{dc} (theoretical)	V_{dc} (Practical)	V_{rms} (theoretical)	V_{rms} (Practical)

PROCEDURE :

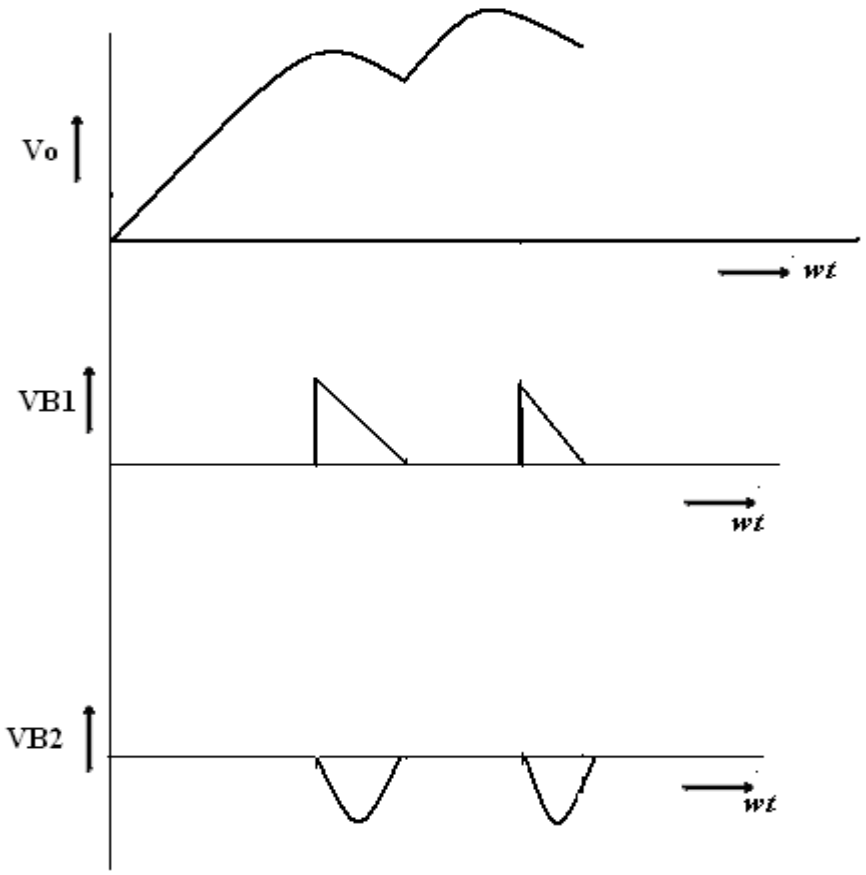
1. Connections are made as per the circuit diagram.
2. The main supply is switched ON and triggering circuit is switched ON
3. Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.
4. The out put wave forms are plotted on the graph sheet.

UJT-FIRING CIRCUIT

CIRCUIT DIAGRAM :



WAVE FORMS:



PROCEDURE:

1.Connections are made as per the circuit diagram.
2.The main supply is switched ON and triggering circuit is switched ON
3.Wave forms across the load are observed in CRO values are noted down and tabulated for different firing angles.
4. The out put wave forms are plotted on the graph sheet.

PRECAUTIONS:

1.Check all the SCR's for the performance before making connections
2.Check the firing circuit trigger outputs and its relative phase sequence.
3.Make fresh connections before you make a new experiment.
4.Preferably work at low voltages (30-40V) for every new connections after careful

verification raised to the max. ratings.
5.Keep all knobs at min. position before you switch ON the supply.
6.Show connections to the lab faculty before you start the experiment.

RESULT :

EXPERIMENT NO: **10** DATE:

SINGLE PHASE DUAL CONVERTER WITH R & RL LOADS

AIM: To study Single Phase Dual Converter.

APPARATUS:

S.No	Apparatus	Range	Quantity
1	Single Phase Dual Converter Firing Unit (Microcontroller Based)	---	1
2	Single Phase Dual Converter Kit	---	1
3	Single Phase Isolation Transformer	Primary: 230V, Secondary: (0-30-60-115-230)V	1
4	Rheostat	150Ω/5A(WW)	1
5	CRO	(0-30)MHz	1
6	BNC Adaptors	---	1
7	Patch Cords	---	Some

PRECAUTIONS:

1) Make fresh connections before you make a new experiment.
2) Preferably work at low voltages (20-30V) for every new connection after careful verification it can be raisedto the maximum ratings. (This is to reduce damages due to wrong connections and high starting current problems)

PROCEDURE:

1) Switch ON the single phase dual converter firing converter circuit. Observe the test points.
2) Observe trigger outputs both in P and N-converter by varying firing angle in non-circulatory mode.
3) Make sure that all the pulses are proper before connecting to power circuit to conduct the experiment.
4) Check all the SCRs in the power circuit. This can be done by checking the resistance

between gate and cathode and also between anode and cathode using a multi meter putting it in the diode range.

5) If the SCRs are good, it shows some resistance value of the order of 20Ω to 200Ω between gate and cathode. And very high resistance value of the few mega ohms between anode and cathode. If the resistance between gate / cathode is zero or very high means the device is faulty. If the resistance between anode / cathode is zero means the device is faulty.
6) Make sure that all the SCRs are good before connecting the firing pulses from the firing circuit.
7) Make the connections in the power circuit as shown in the circuit diagram for non circulatory current mode.
8) Connect firing pulses from the firing circuit to the respective SCR's gate / cathode terminals in the power circuit.
9) Connect input AC supply to the power circuit through an isolation transformer for safety for measurement.Initially adjust the input voltage for 30V.
10) Connect a rheostat of suitable value (150Ω/5A) between output terminals. Connect the ammeter andvoltmeter as shown.
11) Switch ON the firing circuit. Select NCC mode. Switch ON the MCB.
12) Vary the firing angle by dec key and press ON / OFF key to ON and observe the voltage waveforms acrossload and the devices.
13) Note down the voltmeter and ammeter readings for different values of firing angle. Note down the reading inthe tabular column.

TABULAR COLUMNS:

S.No.	Input Voltage V_{in}	FiringAngle	OutputVoltage V_o	Output Current I_o
1				
2				
3				
4				

RESULT:

EXPERIMENT NO: **11** DATE:

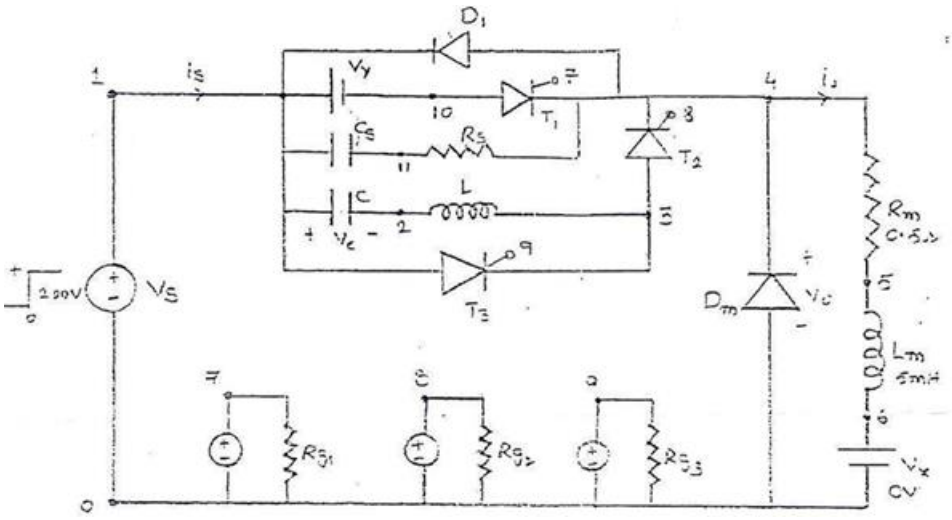
P-SPICE SIMULATION OF RESONANT PULSE COMMUTATION CIRCUIT

AIM: To obtain the performance characteristics of a Resonant Pulse Commutation Circuit

APPARATUS:

S.No	Apparatus
1	PC With Desktop
2	MATLAB / Simulink

CIRCUIT DIAGRAM:



PROCEDURE:

1. Represent the nodes for a given circuit.
2. Write spice program by initializing all the circuit parameter as per given flowchart.
3. From desktop of your computer click on "START" menu followed by "programs" and then clicking appropriate program group as "DESIGN LAB EVAL8 followed by "DESIGN MANAGER."

4. Open the run text editor from micro sim window & start writing p-spice program.
5. Save the program with a circuit extension.
6. Open the run spice A / D window from micro sim window.
7. Open file menu from run spice A / D window then open saved circuit file.
8. If there are any errors, simulates will be displayed with statement as "simulation error occurred".
9. To see the errors click on o/p file icon and open examine o / p.
10. To make changes in the program open the circuit file, modify, save & Run the program.
11. If there are no errors, simulation will be completed & it will bed is played with a statement as "simulation completed".
12. To see the o / p click on o / p file icon & open examine o / p then note down the values.
13. If .probe command is used in the program, click on o / p file icon &open run probe. Select variables to plot on graphical window and observe the o / p plots then take print outs of that.

PROGRAM CODE:

```
CLC
VS 1 0 DC 200V
VG1 7 0 PULSE (0V 100V 0 1US 1 US 0.4MS 1MS) VG2 8 0 PULSE (0V 100V
0.4MS 1US 1 US 0.6MS 1MS) VG3 9 0 PULSE (0V 100V 0.1US 1US 1 US 0.2MS 1MS) RG1 7 0
10MEG
RG2 8 0 10MEG
RG3 9 0 10MEG
CS 10 11 0.1UF
RS 11 4 750
C 1 2 31.2UF IC=200V
L 2 3 6.4UH
D1 4 1 DMOD
DM 0 4 DMOD
.MODEL DMOD
D(IS=1E-25 BV=1000V)
RM 4 5 0.5
LM 5 6 5MH
VX 6 0 DC 0V
VY 1 10 DC 0V
XT1 10 4 7 0 DCSCR
XT2 3 4 8 0 DCSCR
XT3 1 3 9 0 DCSCR
.SUBCKT DCSCR 1 2 3 4
DT 5 2 DMOD
```

```
ST 1 5 3 4 SMOD
.MODEL DMOD D (IS=1E-25 BV=1000V)
.MODEL SMOD VSWITCH (RON=0.1 ROFF=10E+6 VON=10 VOFF=5V)
.ENDS DCSCR
.TRAN 0.5US 3MS 1.5MS 0.5US
.PROBE
.END
```

PLOT I (C) AND V(2)

RESULT:

EXPERIMENT NO: **12** DATE:

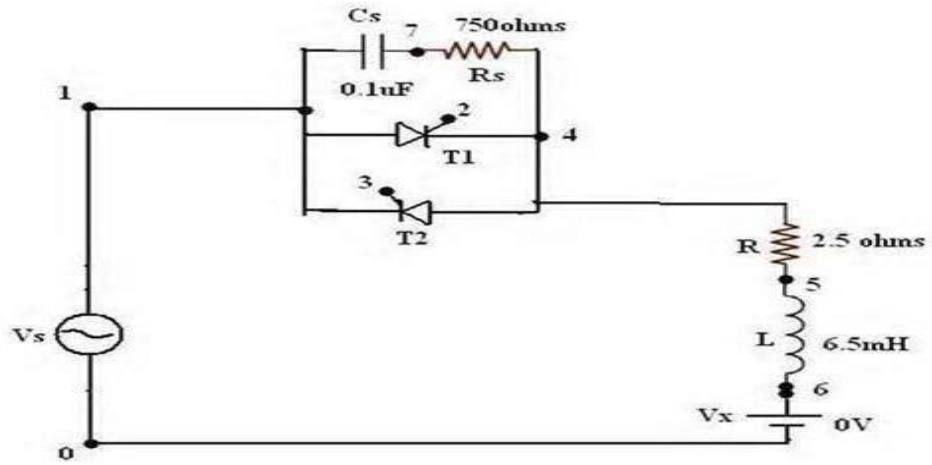
P-SPICE SIMULATION OF SINGLE-PHASE AC VOLTAGE CONTROLLER USING RLE LOADS

AIM: To obtain the performance characteristics of Single Phase for R, RL, RLE Loads Using P-Spice

APPARATUS:

S.No	Apparatus
1	PC With Desktop
2	P-Spice / Simulink

CIRCUIT DIAGRAM:



PROCEDURE:

1. Represent the nodes for again circuit.

2. Write PSPICE program by initializing all the circuit parameters as per given flow chart From desktop of your computer click "start" menu followed "PROGRAMS" & then clicking appropriate program group as "DESIGN LAB tv 218" followed by design manager.

3. Open the Run text editor from micro sim window & start writing PSPICE program.

4. Save the program with .circuit extension. (Ex: DA .circuit).

5. Open the RUN SPICE A / D window from micro sim window.

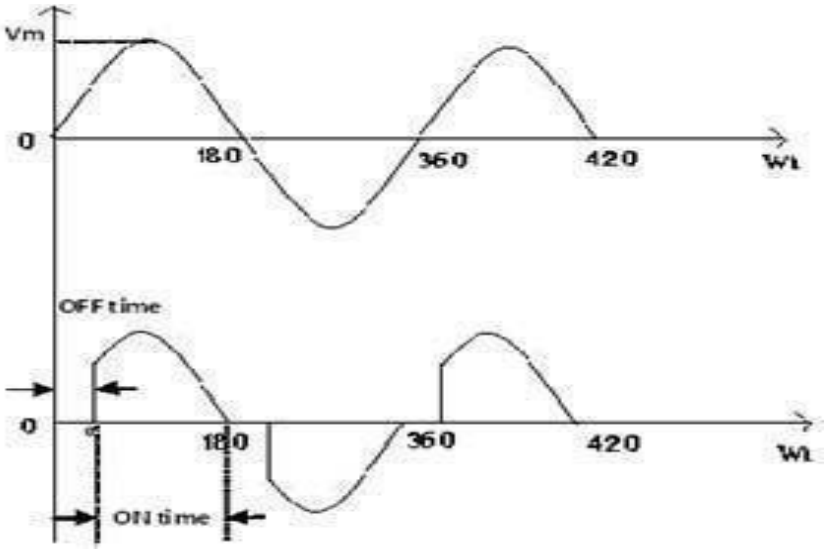
6. Open file menu from RUN SPICE A / D window then open saved circuit file.

7. If there are any errors, simulation will be displayed with statement as “simulation error occurred.
8. To see the errors click on output file icon & open examine output.
9. To make changes in the program open the circuit file modifies & run the program.
10. If there are no errors simulation modifies be displayed with a statement as “simulation completed”. To see the output click on the output file icon & open examine output then note down the values.
11. If probe command is used in the program click on output file icon & open Run probe select variable to plot on graphical window &observe the plots then the printouts of that.

PROGRAM CODE:

```
CLC
VS 1 0 SIN (0 325V 50HZ)
VG1 2 4 PULSE (0V 10V 2500US 1NS 1NS 100US 20000US)
VG2 3 1 PULSE (0V 10V 2500US 1NS 1NS 100US 20000US)R 4 5 2.5
L 5 6 6.5MH
VX 6 0 DC 10V
XT1 1 4 2 4 SCR
XT2 4 1 3 1 SCR
.SUBCKT SCR 1 2 3 2
S1 1 5 6 2 SMOD
RG 3 4 50
VX 4 2 DC 0V
VY 5 7 DC 0V
DT 7 2 DMOD
RT 6 2 1
CT 6 2 100F
F1 2 6 POLY (2) VX VY 0 50 11
.MODEL SMOD VSWITCH (RON=0.0105 ROFF=10E+5 VON=0.5V VOFF=0V)
.MODEL DMOD D (IS=2.2E-15 BV=1200V TT=0 CJO=0)
.ENDS SCR
.TRAN 50US 100MS 50MS 50US
.PROBE
.FOUR 50HZ I(VX)
.END PLOT V (2)
```

MODEL WAVEFORMS:



RESULT: