Power Electronics Lab

Department of Electrical Engineering

Course Name: Power Electronics and Drives Lab

Subject Code : EEC378

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Admission No: 20JE0212

Title: Electric Light Dimmer circuit using SCR or TRIAC

Objective: To study the performance and waveforms of Electric light dimmer with resistive load.

Apparatus Required: -

SI. No.	List of Equipment	Quantity	Specifications
1.	AC Power Supply 220 V	----------	----------
2.	Capacitor	1	339nf Polyester film capacitor
3.	DIAC	1	TYN604 – 600 V- 4A SCR Thyristor
4.	TRIAC	1	6A4 6A 400V Silicon Rec field Diode
5.	Potentiometer	1	10k to 100k, (0.5-6.0) Wa age
6.	Bulb/Load Resistance	1	10W,100 ohm
7.	Mul meter	1	Mastech MS8233C Digital Multimeter, AC-90 V
8.	Digital Storage Oscilloscope	1	Siglent Technologies SDS1052DL+ 50 MHz Digital Storage Oscilloscope
9.	Wires	----------	----------
10.	PCB	1	----------

Theory:

A light dimmer regulates power flow to a resistive load, such as an incandescent light bulb, in an efficient way by allowing only a poor one of the 60Hz current to pass through. Example current (and voltage) waveforms to a resistive load are shown in Figure 1 for firing angles α = 30º, 90º, and 150º. Firing angle is controlled by a potentiometer, RC circuit, and DIAC. The variation of load power with α is shown in Figure 2.

Two important characteristics of the light dimmer current are that -

1. it has zero average value (i.e., no DC, which minimizes corrosion of power grounds), and
2. it has half-wave symmetry (i.e., has no even-ordered harmonics).

The light dimmer circuit is designed for use at 120Vrms. However, the experiment is performed using an isolation transformer and variac set at 90 Vrms.

Light dimmer circuit and operation

The light dimmer circuit is shown in Figure 3. During each half-cycle, when the voltage across the capacitor (either positive or negative) exceeds the breakover voltage of the DIAC and "fires" the TRIAC, current then flows through the load. Once firing occurs, the voltage across the TRIAC collapses, the capacitor voltage goes to nearly zero, and the entire process resets at the beginning of the next half cycle. For the circuit to work properly, a small current must flow through the load before firing occurs, but this current is miniscule with respect to full load current.

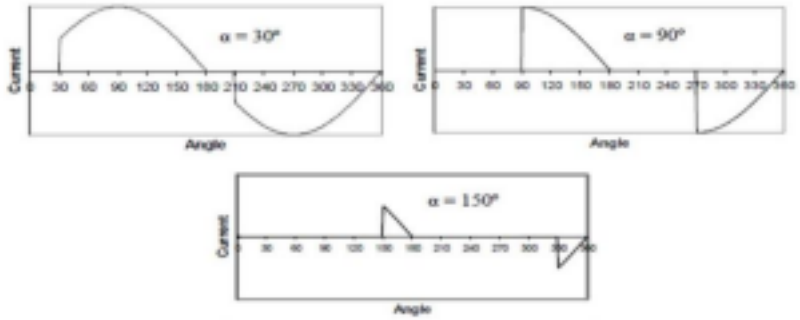


Figure 1. Resistive load current (and voltage) waveforms for firing angles $\alpha = 30°$, $90°$, and $150°$.

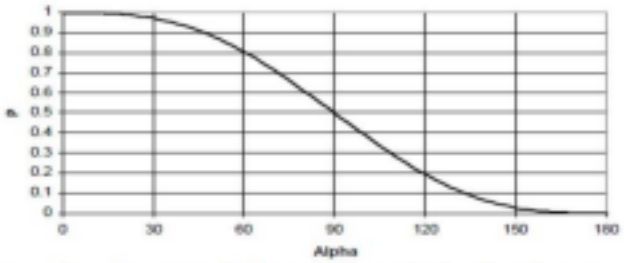


Figure 2. Normalized power delivered to resistive load versus firing angle.

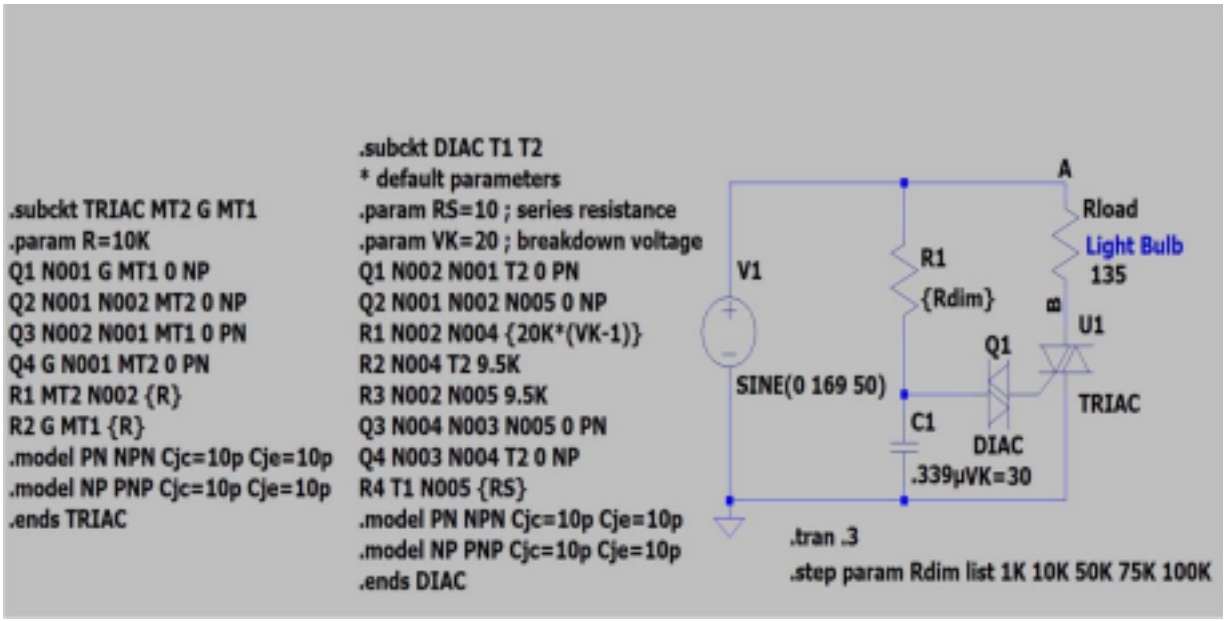


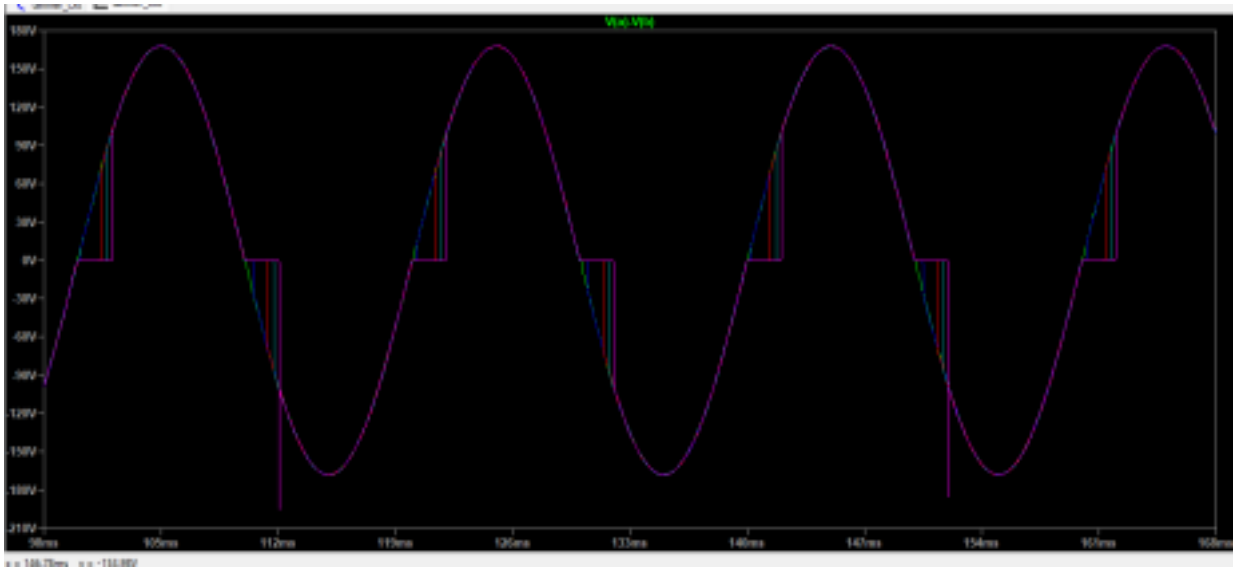
Figure-3 (Simula on Diagram)

Procedure: -

1. Connect the circuit diagram of the TRIAC light dimmer.
2. Switch on the supply and set the Variac voltage to 90V.
3. Connect the oscilloscope channel across the load terminals.
4. Vary a variable resistor pot(R) in steps gradually from
   Minimum maximum and observe the light bulb.
5. For each step measure the load R.M.S voltage.

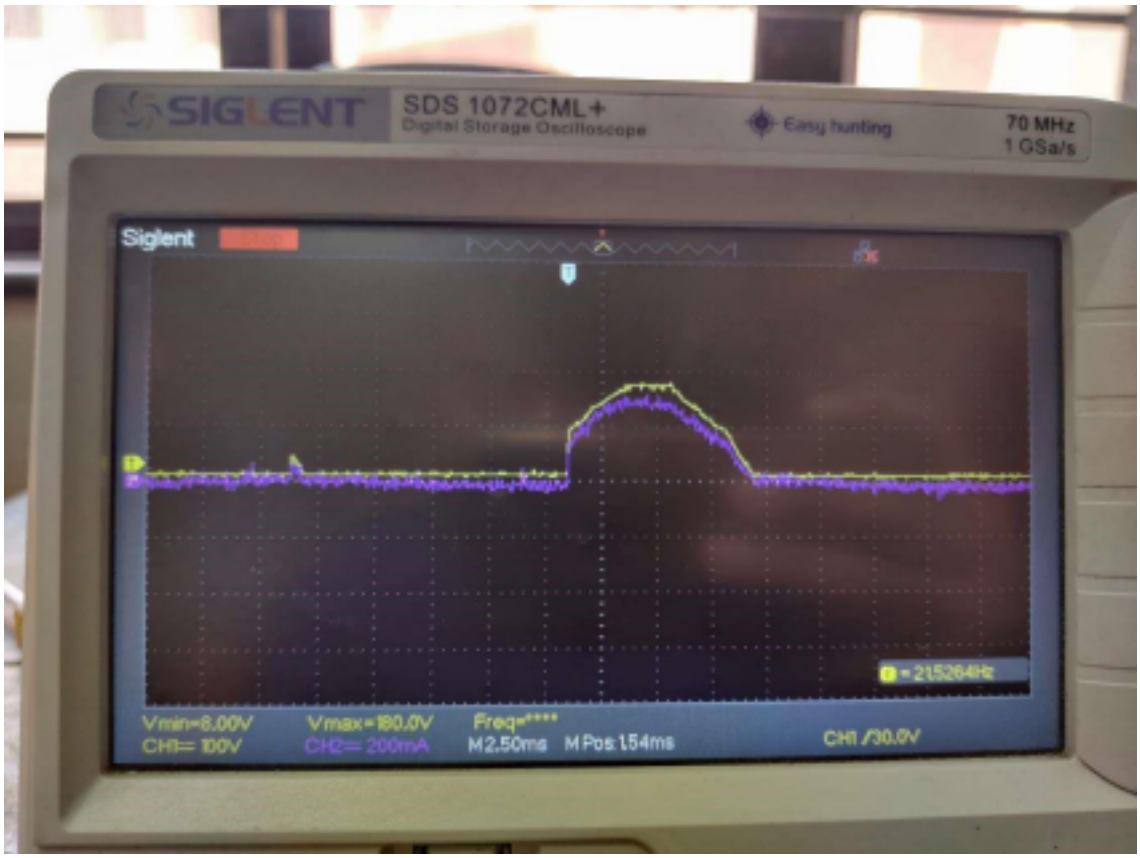
Observa on Table:-

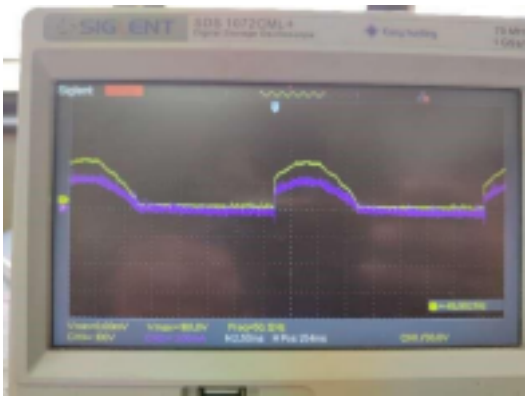
	Input Supply Voltage(V)	Firing Angle(in deg)		Irms(A)	Power(in W)
1.	120.2	20	119.669	0.886	106.027
2.	120.2	27	118.916	0.881	104.765
3.	120.2	40.5	116.053	0.859	99.69
4.	120.2	54	110.907	0.821	91.05
5.	120.2	50	112.69	0.8347	94.06

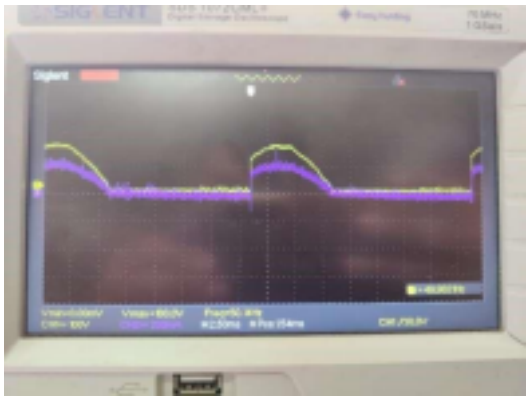


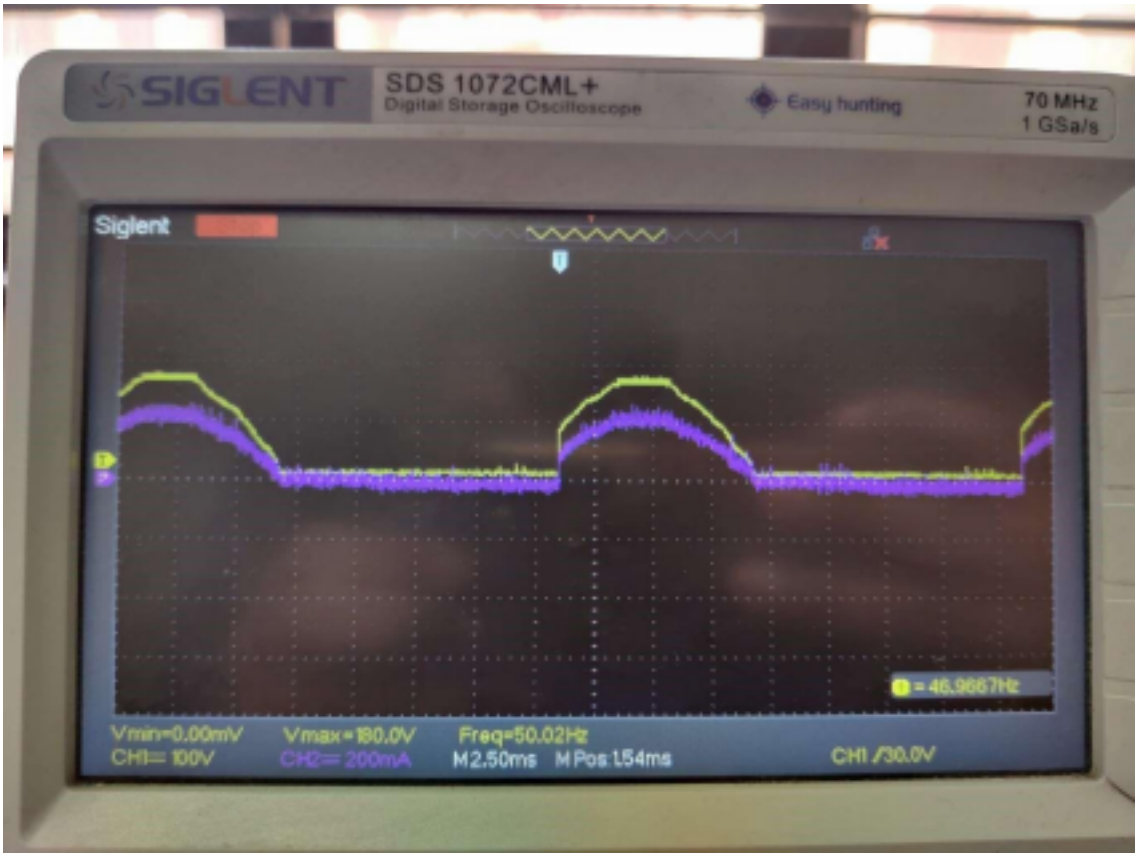
Discussion:-

By varying the potentiometer knob, the firing angle varies ,hence the intensity of the bulb changes.


SIGLENT
SDS 1072CML+
Digital Storage Oscilloscope
Easy hunting
70 MHz
1 GSa/s
Siglent
Vmin=8.00V
Vmax=180.0V
Freq=****
CH1= 100V
CH2= 200mA
M2.50ms
M Pos:1.54ms
CH1 /30.0V



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1 = 46.9667Hz
Vmin=0.00mV
Vmax=180.0V
Freq=50.02Hz
CH1= 100V
CH2= 200mA
M2.50ms
M Pos:1.54ms
CH1 /30.0V