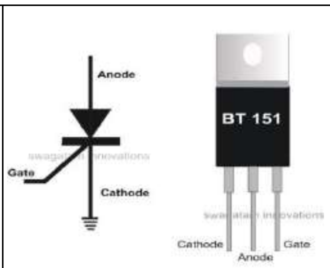
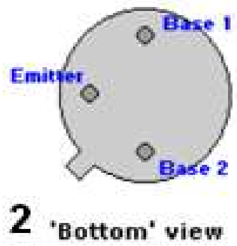
Islamic University of Technology (IUT)
Organisation of Islamic Cooperation (OIC)
Department of Electrical and Electronic Engineering
Electronics Laboratory

Name: ………………………………. Student No …………………...…… Section and Group……

Course: EEE 4384
Experiment no.: 04

Name of the experiment: Study of Half wave and Full wave control Bridge Rectifier Using UJT and SCR.

Equipment:

1. Resistors:120Ω, 1KΩ(2),330 Ω, 4.7K Ω 2. One LED 3. One SCR (BTA 151), TRIAC (BTAl2) DIAC (DB3) 4. One 0.1 pF Capacitor 5. One 100KQ potentiometer 6. One UJT (2N2646) 7. Project Board Wire		

Task-1: Study of Half Wave Control Rectifier and its Corresponding Wave Shapes.

THEORY:

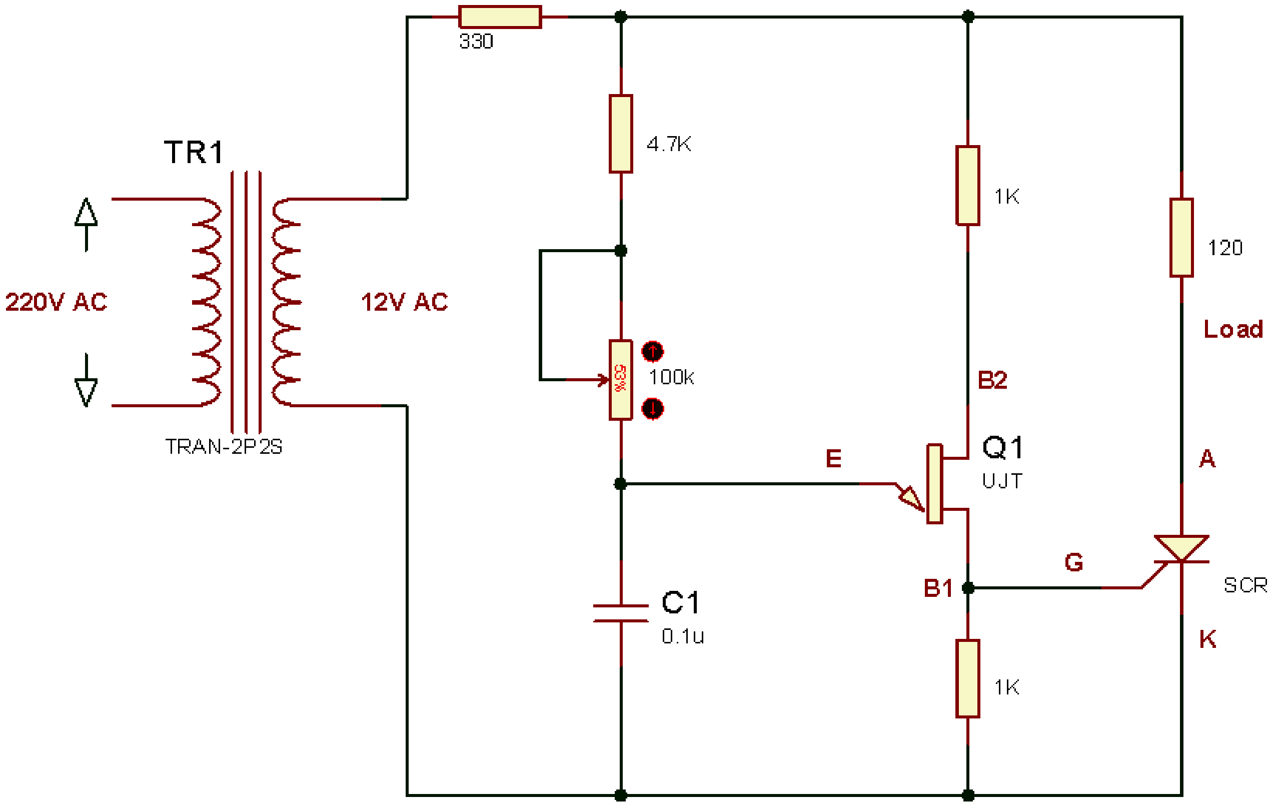
The circuit presented in this experiment implements a controlled rectifier using SCR where natural commutation or line commutation is used. This circuit uses half wave rectification. The time after the input voltage starts to go positive until the SCR is fired corresponds to an angle called delay or firing angle. For V_m as the peak input voltage and α as the firing angle, the output voltage, V_{dc} can be calculate by,

$$V_{dc} = V_m (1+\cos\alpha)/2\pi.$$

Procedure:

1. Connect the first circuit as shown in the figure to implement the controlled rectifier.
2. Observe wave shapes across both load and SCR together in chop mode of oscilloscope.
3. Vary the 100 KΩ pot and note the changes among the wave shapes.
4. Observe also wave shapes of both input voltage and voltage across capacitor together in chop mode of oscilloscope and note their change with variation of the pot.

Circuit Diagram:



<u>**Fig: 1 Single phase SCR Controlled Converter (Half Wave)**</u>

Observed Wave shapes and Calculation:

Task-2: Study of Full Wave Control Rectifier and its Corresponding Wave Shapes using SCR

UJT and Diode.

Theory:
Single phase full controlled bridge rectifier for resistive load will be studied here using SCR and UJT. For V_m as the peak input voltage and α as the firing angle, the output voltage, V_{dc} can be calculate by,

$$Vdc = (Vm/\pi) * (1 + \cos\alpha)$$
$$= (Vm(1 + \cos\alpha)) / \pi$$

$$Idc = (Vm/ \pi R) * (1 + \cos\alpha)$$

$$Vm = (Vdc* \pi) /(1 + \cos\alpha)$$

Circuit Diagram:

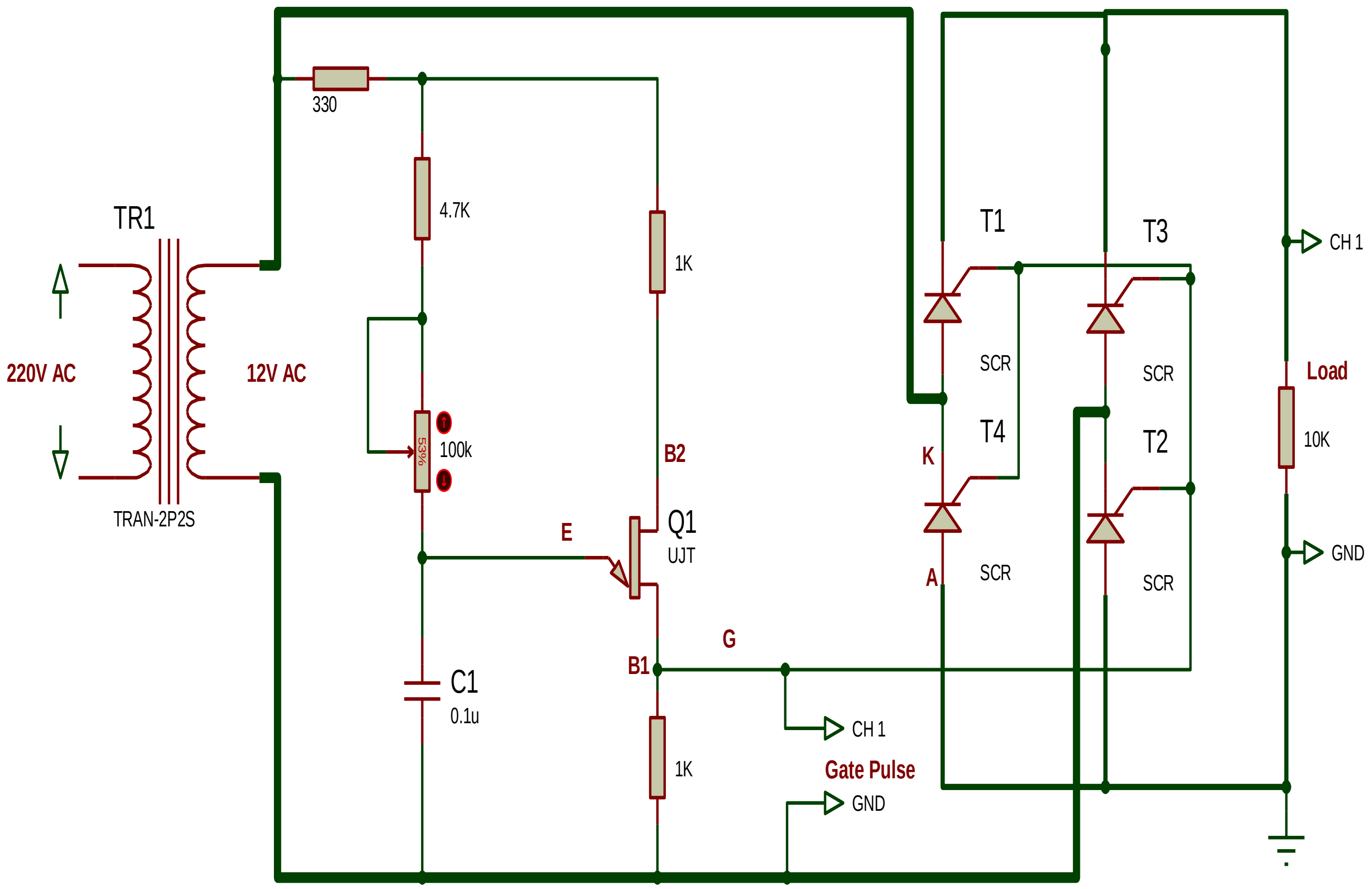


Fig: 2 Single phase SCR Controlled Converter (Full Wave)

Procedure:

1. Connect the second circuit as shown in the figure to implement the controlled rectifier.
2. Observe wave shapes across 12V AC and load using oscilloscope separately.
3. Vary the 100 KΩ pot and note the changes among the wave shapes.
4. Replace T2 and T4 with diode D1 and D2 and observe the wave shapes.
5. Comments on the results.

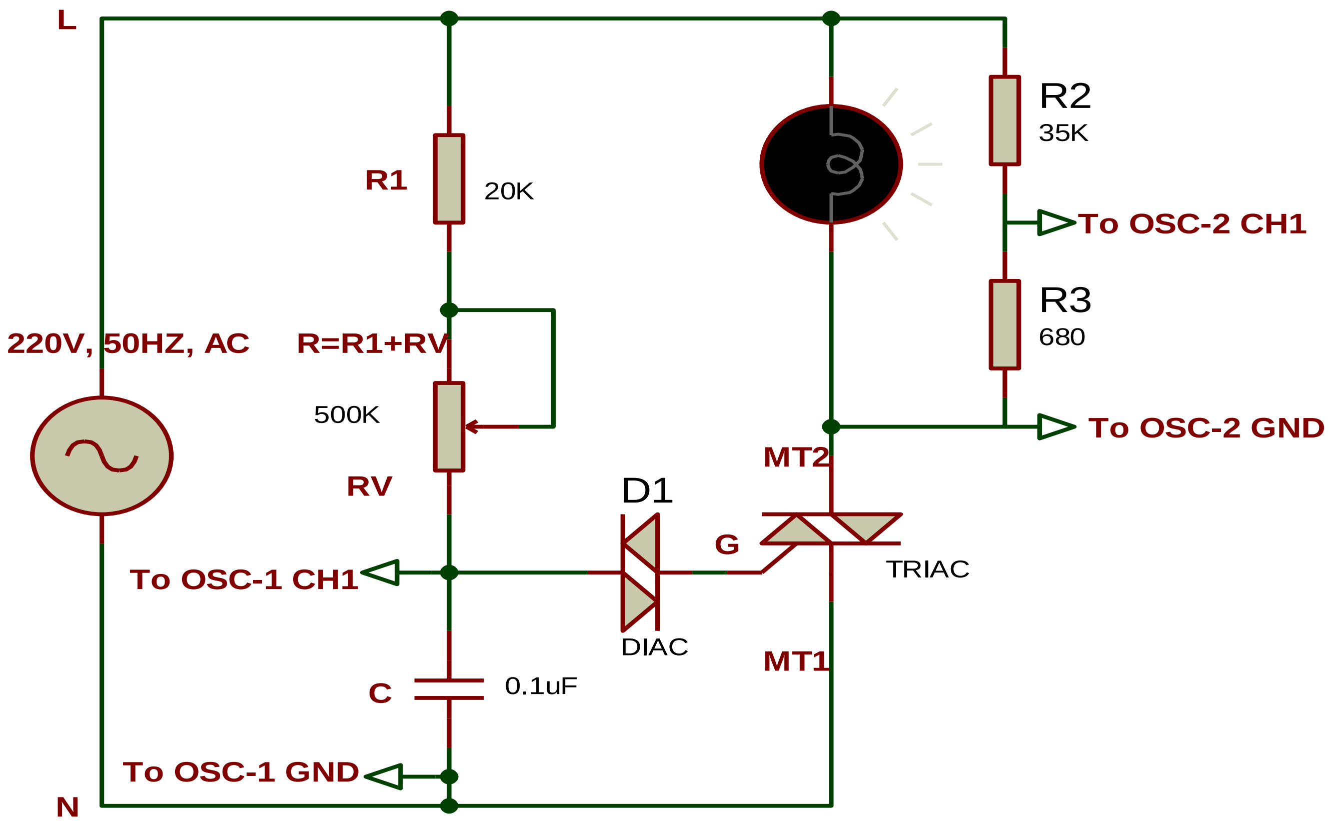
Observed Wave shapes and Calculation:

Task-3: Study of Full Wave Control Rectifier and its Corresponding Wave Shapes using TRIAC and DIAC.

THEORY:

The circuit presented here uses a TRIAC connected in series with the load and it is triggered at proper firing angle to adjust the load power. RC circuit with variable resistance, R is used to control the triggering signal and a DIAC will be used along with the RC circuit to improve the triggering. In practice, this simple circuit is not feasible for sophisticated applications since the resistance, R cannot be calibrated enough to give accurate firing angle.

Circuit Diagram:



CAUTION:

This experiment needs care because 220V AC power supply is involved. Don't connect the power supply first. First make all the connections shown except the power supply. Then ask your course teacher or lab-attendant to check the circuit and connect the power supply. The resistors get hot if the experiment is conducted for a long time and may get damaged. So make all the observations within 2 minutes after energizing the circuit. If it is not possible to do that, perform the experiment in steps with 2-3 minutes between successive two steps to allow the resistors to cool down by de-energizing the circuit.

PROCEDURES:

1. Connect the circuit as shown in the figure except the power supply connection. Ask your course teacher or lab-attendant to check the circuit and connect the power supply. After energizing the circuit the bulb should glow.
2. Vary the resistance of the variable resistor and see the effect of the variation on the brightness of the bulb.
3. Observe the wave shape on the oscilloscope. Record the change in the wave shape qualitatively with the variation of the resistance.

Questions (UJT):

1.What is an UJT and draw its equivalent circuit?

2.Why is an UJT used in SCR firing circuit?

3.Why is the isolation needed between Thyristor and firing circuit?

4.How is a pulse transformer different from other transformer?

5.What are the features of pulse transformer?

6.What are the advantages of using pulse transformer?

7. What is a firing circuit?

8. What is the load used?

9.What is meant by ramp control, open loop control or manual control with respect to UJT firing circuit?

10. What is time constant of a circuit?

12. What are the merits of UJT firing circuit over RC triggering circuit?

13. What are the advantages of UJT pulse trigger circuit?

14. What is relaxation oscillator? Why is UJT used as relaxation oscillator?

15. What are the applications of UJT trigger circuits?

16. What is valley voltage?

17. What is the discharging path if the capacitor?

18. Draw the static characteristics of UJT.

19. What is negative resistance?

20. What is interring base resistance?

21.What is intrinsic standoff ratio?

22.What is the width of the triggering pulse?

Questions (Controlled Rectifier):

1.What is a full controlled rectifier?

2.What is a semi converter?

3.What is a dual converter?

4.How can we control the output voltage of a single-phase full converter?

5.How many lines are there in single-phase system?

6.What is the type of commutation used?

7.What is rectification mode and inversion mode?

8.Where is full bridge converter used?

9.What is the effect of adding freewheeling diode?

10. Why the brightness of the bulb varies with the variation of the resistance?