Experiment No : 03
Experiment Name: i) Study of Controlled halfwave rectifier.
ii) Study of controlled fullwave rectifier.

Theory :
Controlled Halfwave rectifier : As shown in Figure 3.1 the single-phase half-wave rectifier uses a single thyristor to control the load voltage. The thyristor will conduct, ON state, when the voltage vT is positive and a firing current pulse iG is applied to the gate terminal. Delaying the firing pulse by an angle alpha does the control of the load voltage. The firing angle is measured from the position where a diode would naturally conduct. In Fig.(1), the angle a is measured from the zero crossing point of the supply voltage vs. The load in Fig. (1) is resistive and therefore current id has the same waveform as the load voltage. The thyristor goes to the non-conducting condition, OFF state, when the load voltage and, consequently, the current try to reach a negative value. The load average voltage is given by:

$$V_{dc} = \frac{1}{2\pi}\int_{\alpha}^{\pi} V_{max} \sin \omega t d(\omega t) = \frac{V_{max}}{2\pi}(1 + \cos\alpha)$$

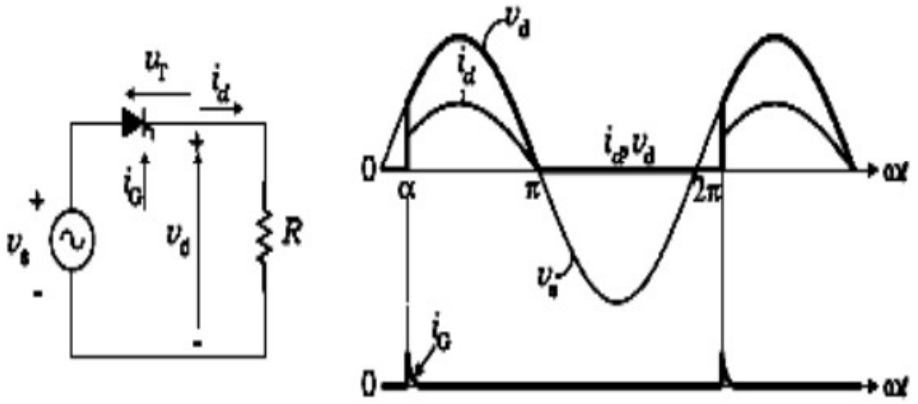


Figure 3.1 : Single thyristor rectifier with resistive load.

Controlled Full Wave Center tapped Rectifier:
Figure 3.2 shows the basic arrangement of a single-phase, center-tap controlled rectifier with a resistive load. Phase control of both the positive and the negative halves of the AC supply is now possible, thus increasing the DC voltage and reducing the ripple compared to those of half-wave rectifiers.

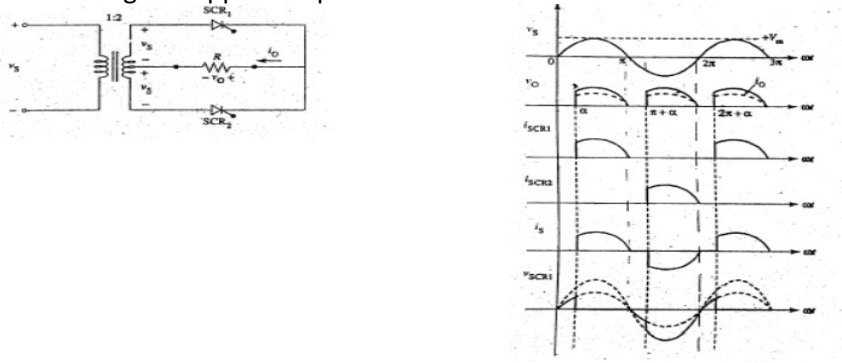


Figure 3.2 : Single phase center tapped full wave rectifier

Single phase fully-controlled bridge rectifier:

Single phase fully-controlled bridge rectifiers are known more commonly as AC-to-DC converters. Fully-controlled bridge converters are widely used in the speed control of DC machines and is easily obtained by replacing all four diodes of a bridge rectifier with thyristors as shown.

In the fully-controlled rectifier configuration, the average DC load voltage is controlled using two thyristors per half-cycle. Thyristors SCR1 and SCR4 are fired together as a pair during the positive half-cycle, while thyristors SCR3 and SCR4 are also fired together as a pair during the negative half-cycle. That is 180o after SCR1 and SCR4. Then during continuous conduction mode of operation the four thyristors are constantly being switched as alternate pairs to maintain the average or equivalent DC output voltage. As with the half-controlled rectifier, the output voltage can be fully controlled by varying the thyristors firing delay angle (α).

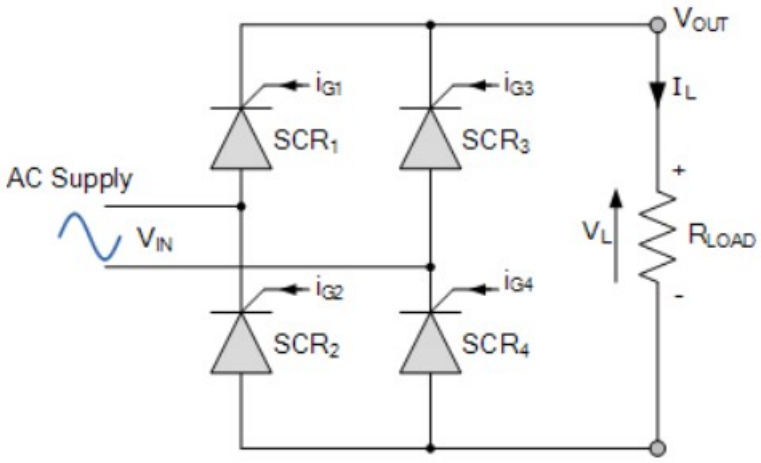


Figure 3.3 : Single phase fully-controlled bridge rectifier.

Required Apparatus:

SI No.	Name of the Equipment	Specification	Quantity
1	Diode	IN -4007X8	4
2	Resistor	10K ohm	1
3	AC supply	220V	1
4	Oscilloscope	TBS 1052,50Hz, 1GS/s	1
5	Connecting wire		

Simulated Diagram :

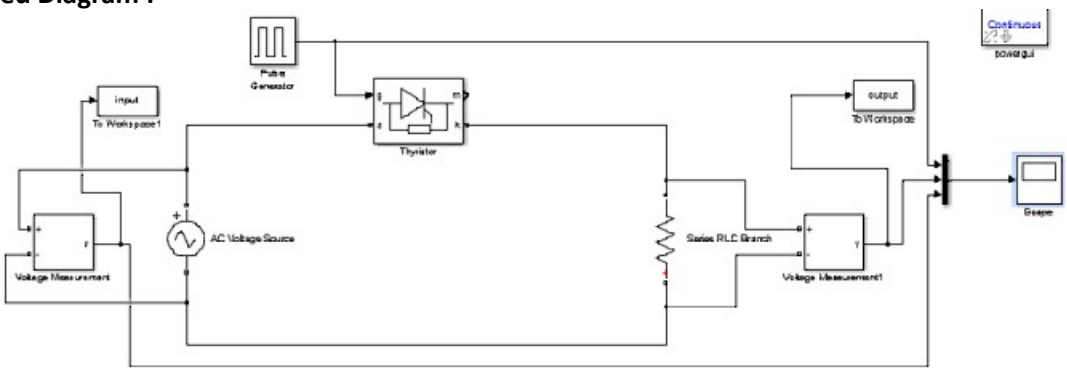


Figure 3.4 : Controlled halfwave rectifier.

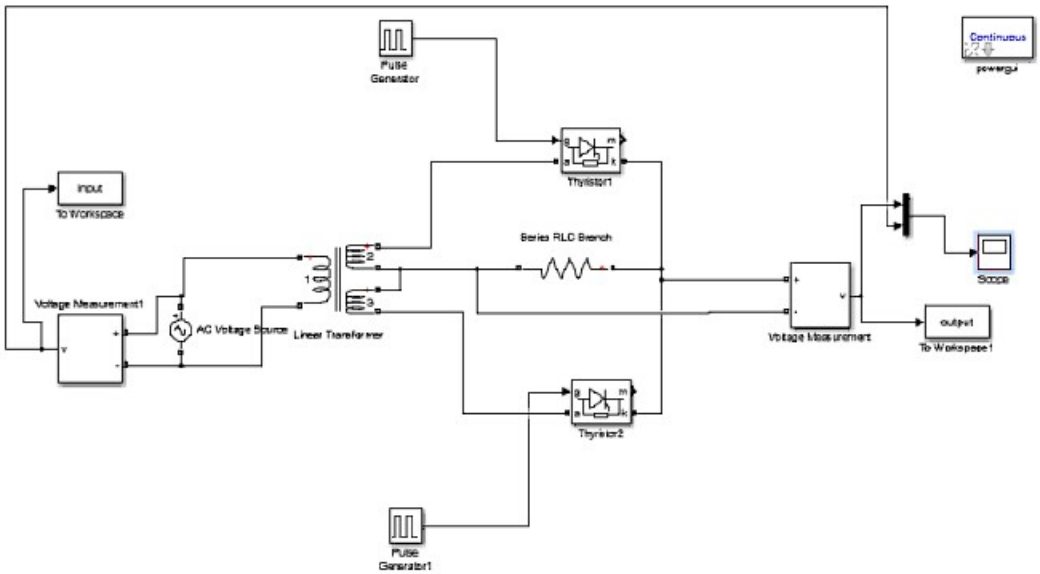


Figure 3.4 : Controlled center tapped Full wave rectifier.

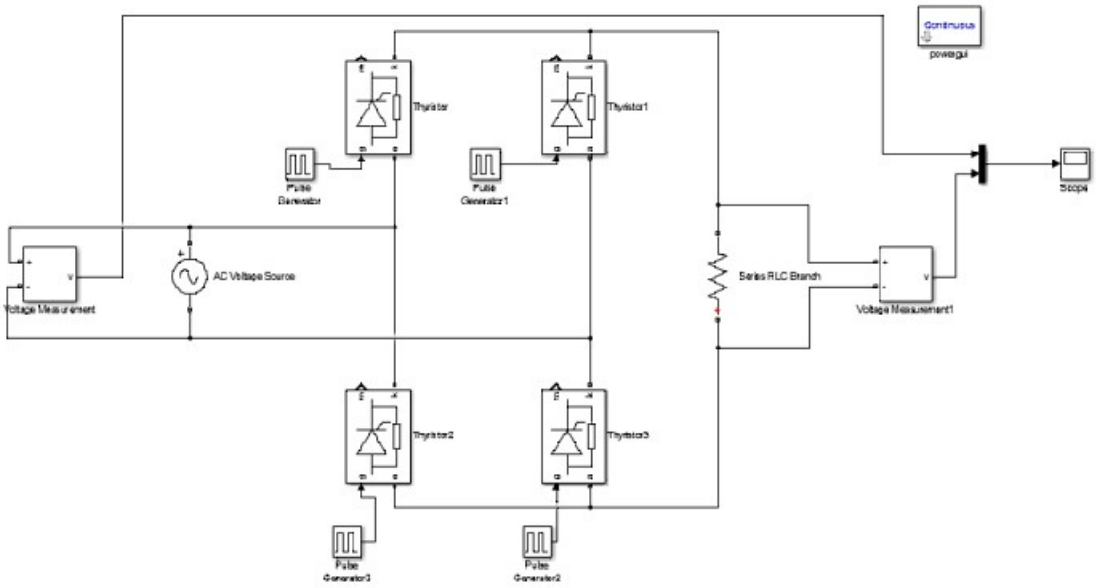


Figure 3.4 : Single phase full wave bridge rectifier

Input Output Wave shape :

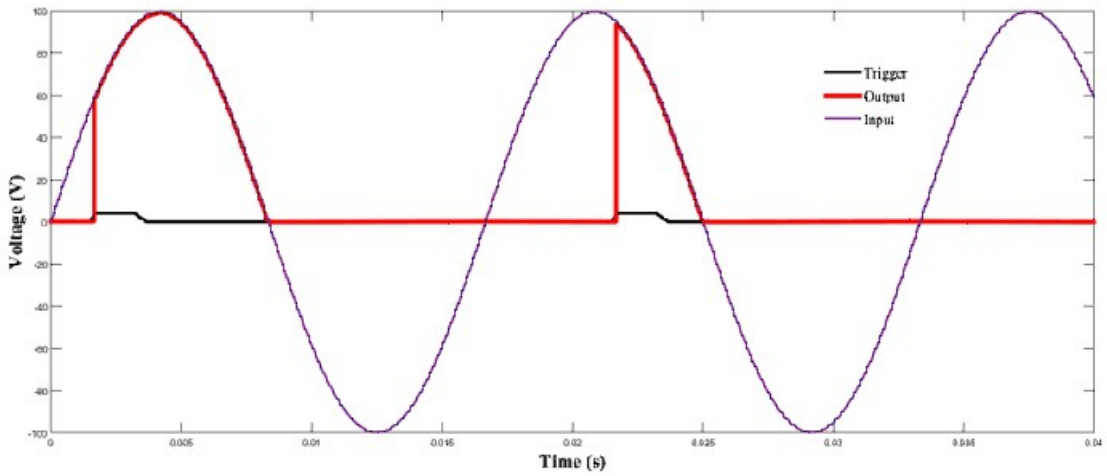


Figure 3.5 : Wave shape of single phase half wave controlled rectifier.

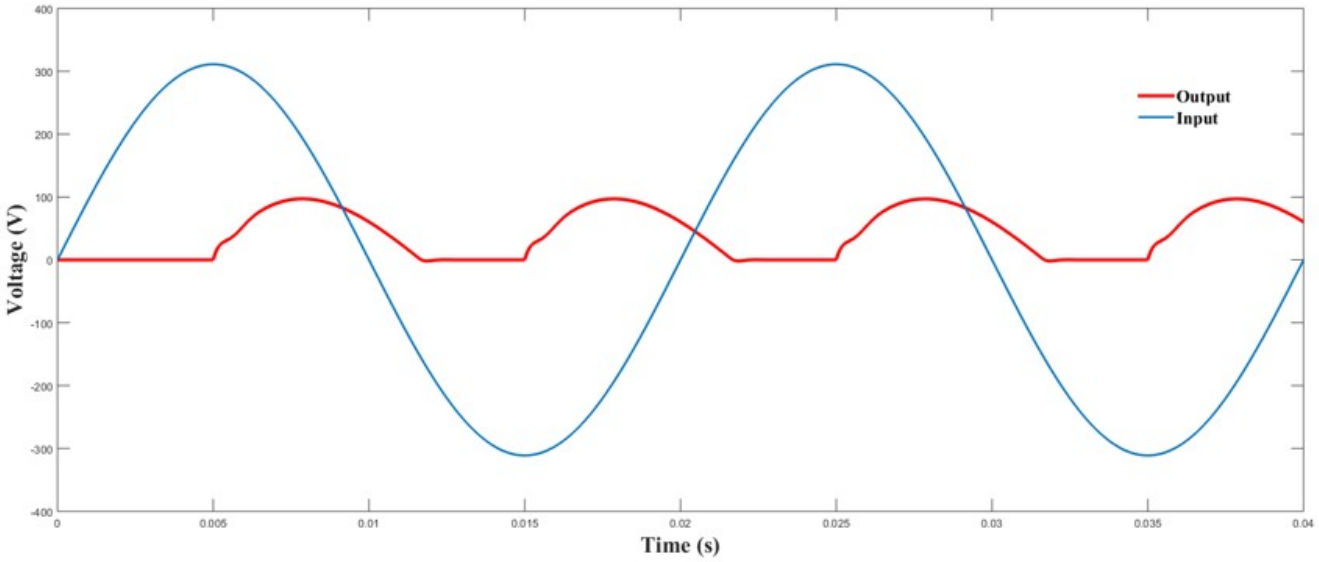


Figure 3.6 : Wave shape of single phase center tapped full wave rectifier.

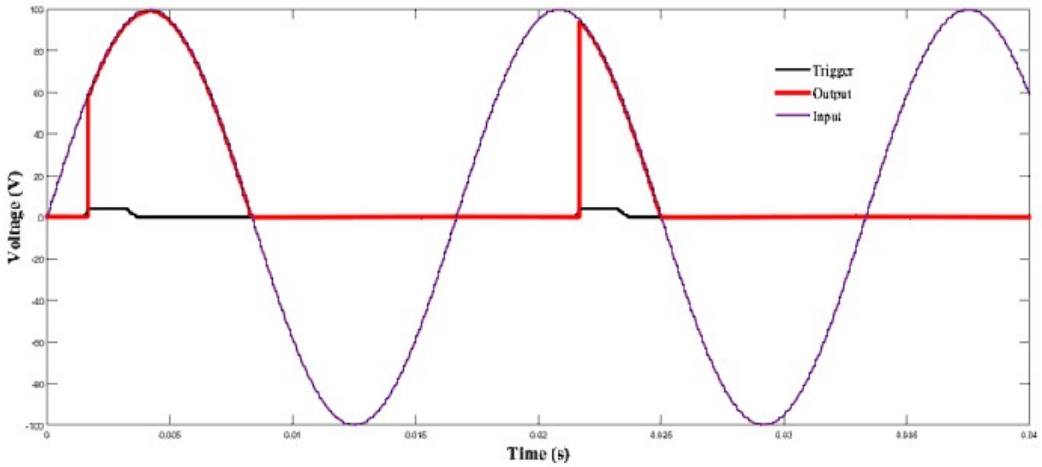
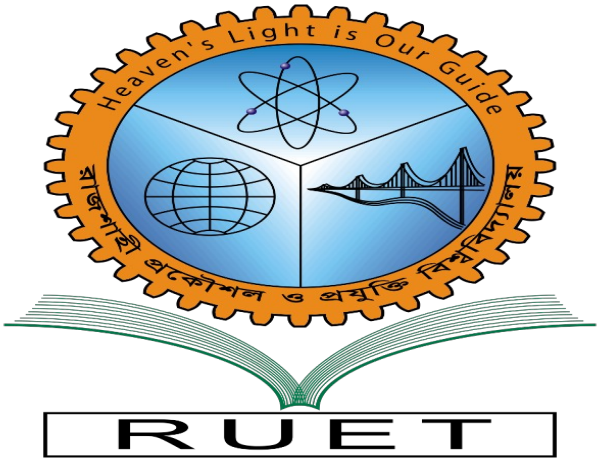


Figure 3.7 : Wave shape of single phase full wave bridge rectifier

Conclusion and Discussion :

In this experiment we connected all the elements of single phase controlled half wave rectifier and simulated it. We have also observed the output result in laborotory in oscilloscope. The output matched with the theory.



Department of Electrical and Computer Engineering

Course Code : ECE 3106
Course Title : Industrial Electronics
Submission Date: 7-12-’22

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