Experiment 2: Single Phase Uncontrolled (Diode) Rectifier

Introduction to the experiment

This experiment is aimed at converting AC (single phase) to DC using a diode (uncontrolled) rectifier. The circuit is implemented in simulation as well as hardware and the performance is studied.

Learning Outcomes:

Operation and analysis of a single phase rectifier for various loads

Introduction to diode rectifier

A rectifier is a circuit used to convert AC voltage to DC voltage. There are two types of rectifier circuits: uncontrolled and controlled. An uncontrolled rectifier does not have control on the output voltage. The switch used in this case will be a diode.

There are two types of uncontrolled rectifiers: This section emphasizes the single phase full wave bridge diode rectifier. The rectifier is as depicted in Fig. 1. Fig. 2 represents the Full wave rectifier waveform.

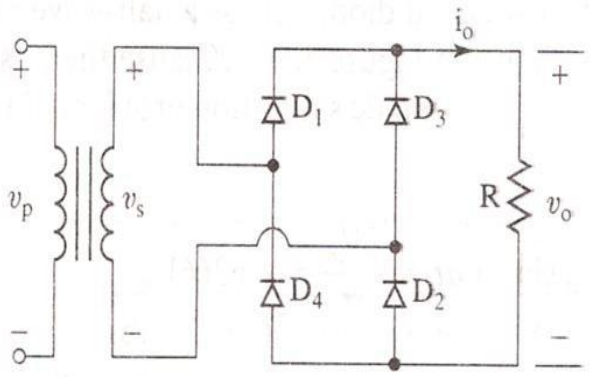


Fig. 1

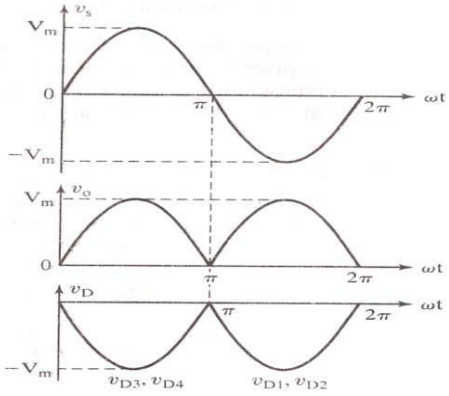
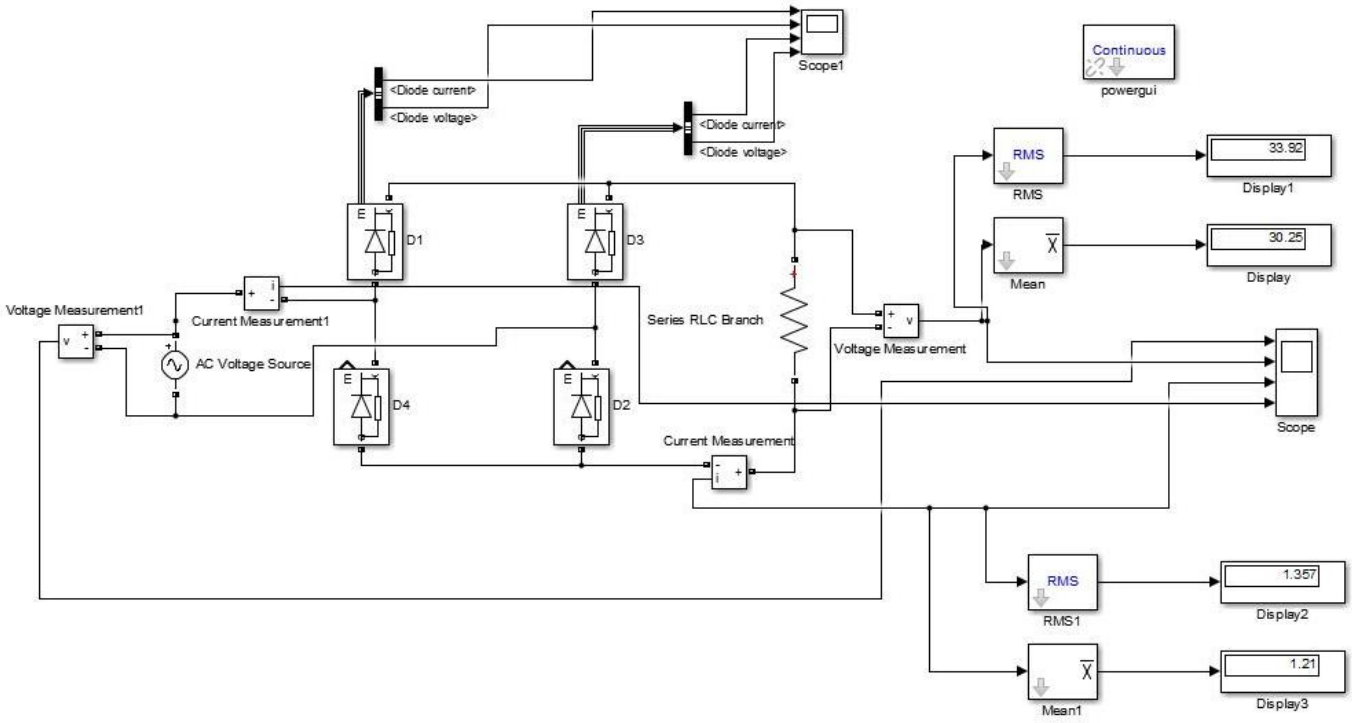


Fig. 2

During the positive half cycle of the input supply, the diodes D_1 and D_2 are conducting, and the output voltage is as depicted in Fig. 2. During the negative half cycle diodes D_3 and D_4 conduct. Since the load is resistive, the output voltage follows the input.

1 a). Simulation of full wave DIODE Rectifier in MATLAB Simulink

Aim: To simulate the Diode Rectifier in MATLAB Simulink



PROBLEM 1:

a. Implement the 1-phase *uncontrolled* full wave rectifier with an R load of 25 Ω. (Input voltage: V_{peak} = 50V=35.35 rms, 50Hz)

b. To the above circuit add an L load of 6mH along with the R load of 25 Ω and observe the changes in the output voltage waveform and FFT analysis.

CALCULATION

Form Factor = V_{rms}/ V_{dc} =

Ripple Factor = $\sqrt{FF^2 - 1}$ =

1. b) Hardware Implementation of 1-Phase (R Load)

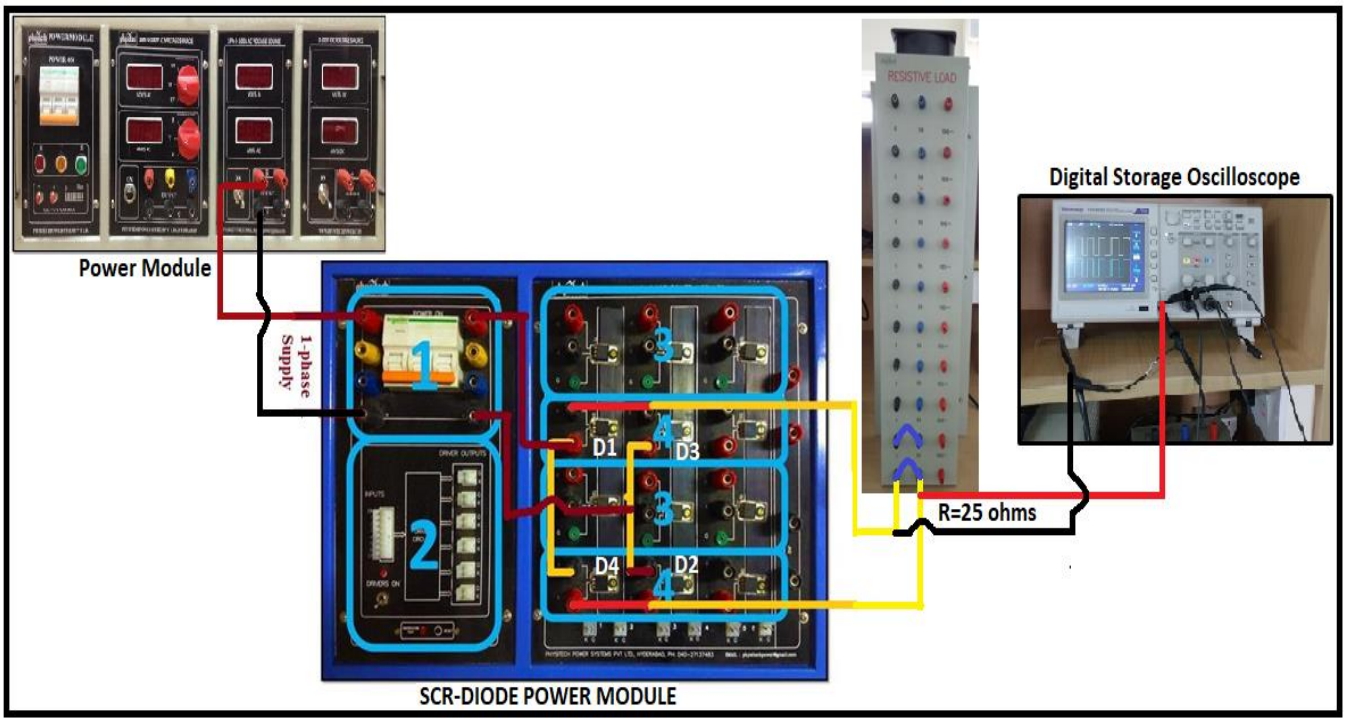


Fig. 3 Hardware implementation of 1-phase diode bridge rectifier with R Load

Procedure for R Load:

1. Connect the circuit as shown in Fig. 3 (R=25ohms)
2. Switch ON the MCB of 3Ø supply on the Left hand side of your Experimental Table.
3. Switch ON the MCB on the POWER MODULE kit.
4. Switch ON the MCB on the SCR-Diode Power module and slowly increase the Voltage to reach up to 35.35 V in RMS using + symbol Push Button in the Power Module kit.

   Note: The Voltage Adjustment Controls are a pair of push buttons to finely adjust the voltage to required value.

5. Connect CRO probes across the R load to measure the output voltage.
6. Observe the Output voltage waveforms and the FFT plot in the CRO.

1.c) Hardware Implementation of 1-Phase (RL Load)

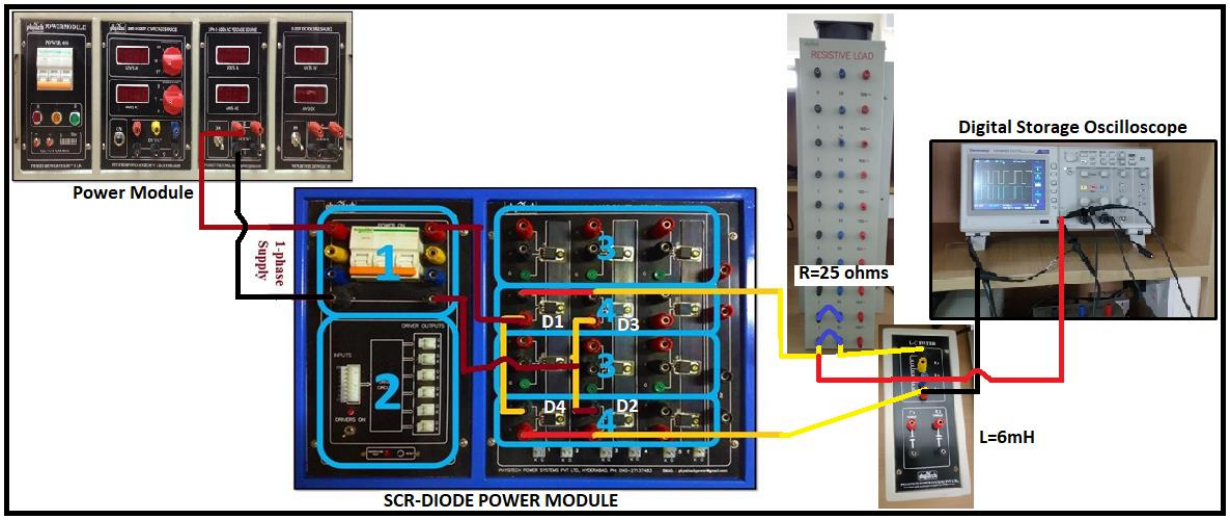


Fig. 4 Hardware implementation of 1-phase diode bridge rectifier with RL Load

Procedure for RL Load:

1. Connect the circuit as shown in Fig.4 (R=25ohms, L=6mH))
2. Switch ON the MCB of 3Ø supply on the Left hand side of your Experimental Table.
3. Switch ON the MCB on the POWER MODULE kit.
4. Switch ON the MCB on the SCR-Diode Power module and slowly increase the Voltage to reach up to 35.35 V in RMS using + symbol Push Button in the Power Module kit.

   Note: The Voltage Adjustment Controls are a pair of push buttons to finely adjust the voltage to required value.

5. Connect CRO probes across the RL load to measure the output voltage.
6. Observe the Output voltage waveforms and the FFT plot in the CRO.

Conclusion: Obtain the results as per "Exp2_Part B.doc" file.