

Roll. No:	Date:
Checked By:	Grade:

Power Electronics Laboratory-2

1 – Ø and 3 – Ø Uncontrolled Rectifiers

Objectives:

1. To analyze the working and performance of a 1 – Ø and 3 – Ø half wave uncontrolled rectifier.
2. To analyze the working and performance of a 1 – Ø and 3 – Ø full wave uncontrolled rectifier.
3. Observe the effect of inductive load on working of an uncontrolled rectifier.

Equipment:

AC supply, a diode, a diode bridge, resistors, inductor coil, oscilloscope, multimeter, hard wires.

Section-1: Analysis of a half-wave uncontrolled rectifier with Resistive Load

Arrange the circuits as shown in Figure-1.

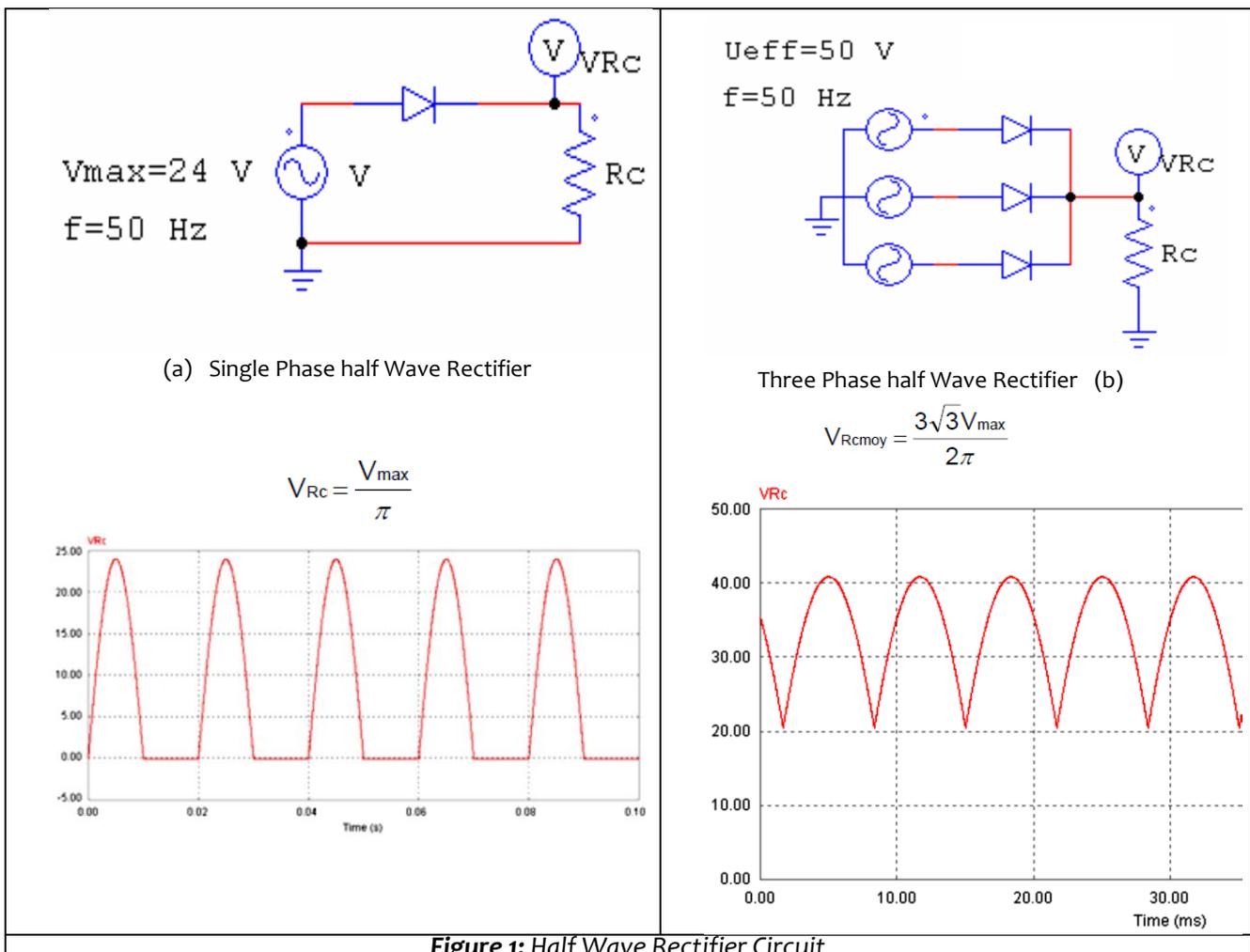


Figure 1: Half Wave Rectifier Circuit

Simulation Activity 1.1-1:

Simulate the circuits shown in Figure 1 in PSIM and observe the waveforms of \dot{I} and V_O . Use parameter values: $R=1.5k\Omega$, Source voltage $V = 24v$, Frequency $f= 50Hz$, diode voltage drop = $0.7V$.

Lab Activity 1.1-1:

Practically verify the above waveforms with same parameter values.

Practically observing the waveform of current on Oscilloscope in the Lab:

Connect a 1Ω resistor within the path of which the current is to be observed. Now according to Ohm's law, the voltage waveform across the 1Ω resistor is also the waveform of the current flowing through it.

Performance Parameters:

Peak output voltage = $V_m =$ _____ (use oscilloscope waveform)

Average value of output voltage = $V_{dc} = 0.318 V_m =$ _____

$R =$ _____ ohms (use multi-meter)

Average value of output current = $I_{dc} = V_{dc} / R =$ _____

RMS value of output voltage = $V_{rms} = 0.5 V_m =$ _____

RMS value of output current = $I_{rms} = V_{rms} / R =$ _____

Output DC power = $P_{dc} = V_{dc} I_{dc} =$ _____

Output AC power = $P_{ac} = V_{rms} I_{rms} =$ _____

Secondary RMS Voltage of Transformer or the Source = $V_s =$ _____
(use multimeter)

Secondary RMS Current of Transformer or the Source = $I_{rms} =$ _____

Secondary AC Power supplied by Transformer or the Source = $P_s = V_s I_{rms} =$ _____

Peak Secondary Current of transformer or the Source = $I_m = V_m / R =$ _____

Evaluate the following parameters (also write down the required formulae) by consulting the suggested pre-lab reading:

Rectifier Efficiency = _____

Form Factor = _____

Ripple Factor = _____

Power Factor = _____

Section 2: Analysis of a half-wave rectifier with RL-load

Arrange the circuit as shown in Figure 2. An inductive load is added to the circuit.

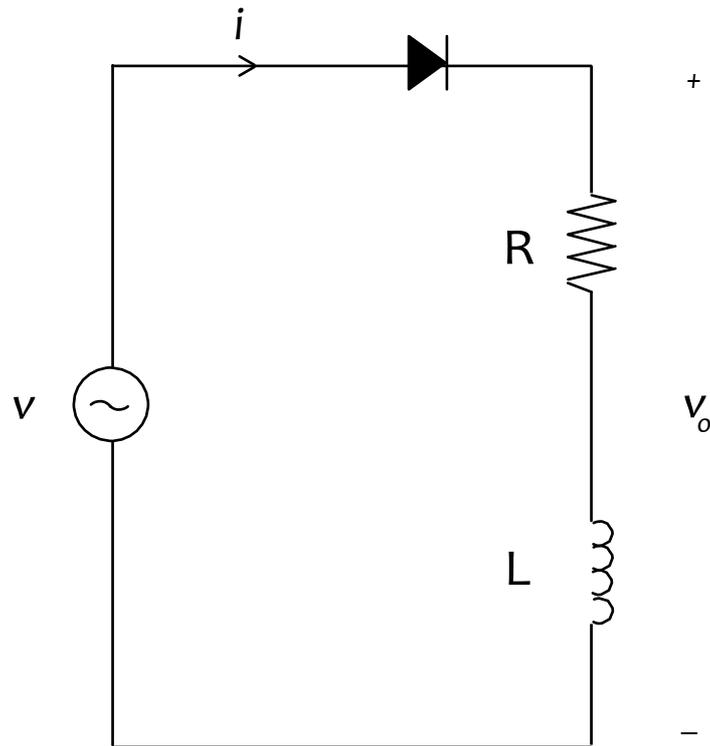


Figure 2: Half wave Rectifier with inductive Load

Simulation Activity 1.2-1:

Simulate the circuit shown in Figure 2 in PSIM and observe the waveforms of i , voltage across the diode, v_R , v_L and v_o . Use parameter values: $R=1.5\text{k}\Omega$, $L=3\text{H}$, Amplitude of $V = 24\text{v}$, Frequency $f = 50\text{Hz}$, diode voltage drop = 0.7V .

Lab Activity 1.2-1:

Practically verify the above waveforms with same parameter values. Note the difference between waveforms of Section 1 & 2.

Section 3: The use of a free-wheeling diode

Arrange the circuit as shown in Figure 3. A free-wheeling diode D_m is added to the circuit.

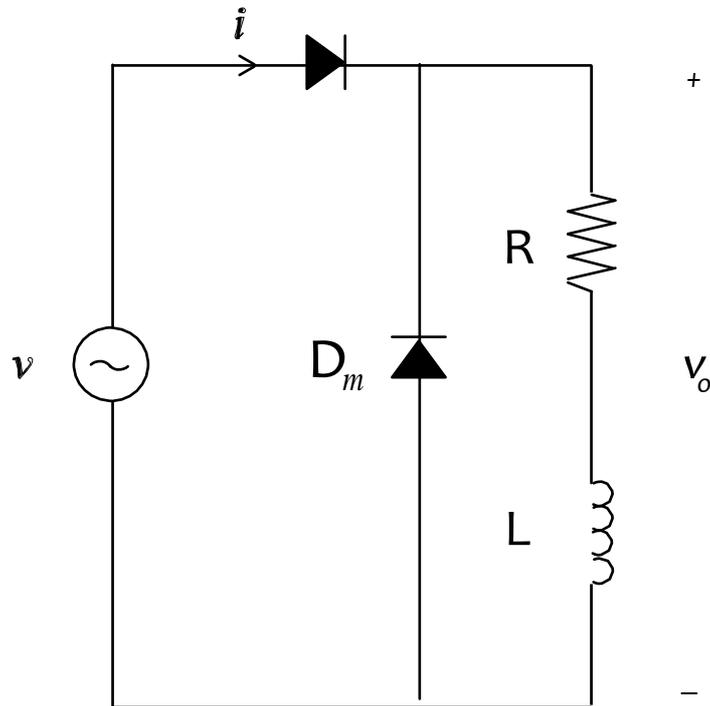


Figure 3: Half wave Rectifier with freewheeling diode

Simulation Activity 1.3-1:

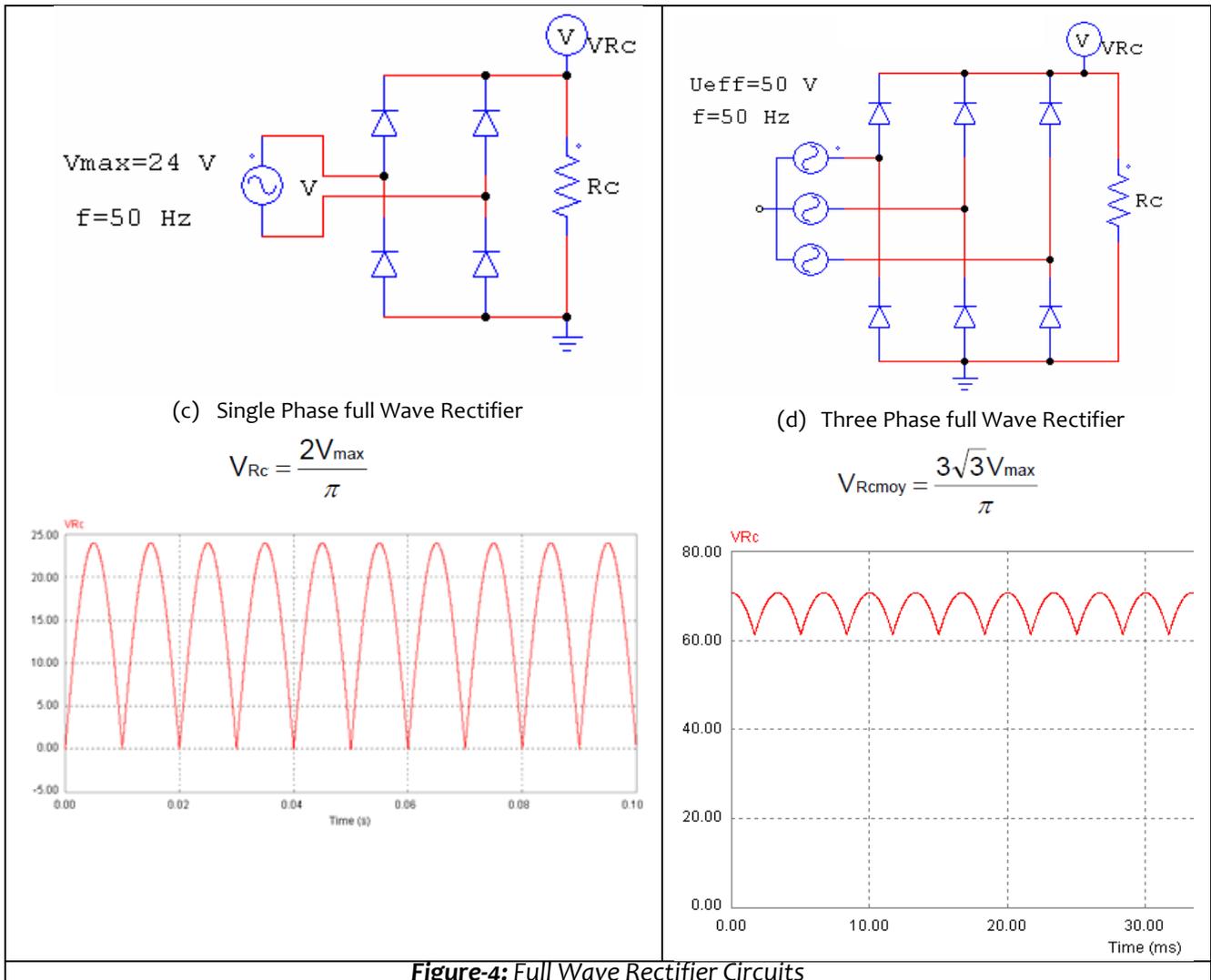
Simulate the circuit shown in Figure 3 in PSIM and observe the waveforms of i , voltage across the diode, v_R , v_L and v_o . Use parameter values: $R=1.5k\Omega$, $L=3H$, Amplitude of $V = 24V$, Frequency $f = 50Hz$, diode voltage drop = $0.7V$.

Lab Activity 1.3-1:

Practically verify the above waveforms with same parameter values. Note the difference between waveform of Sections 2 & 3.

Section 4: Analysis of a full-wave rectifiers.

Arrange the circuit as shown in Figure 4.



Simulation Activity 1.4-1:

Simulate the circuit shown in Figure 2 in PSIM and observe the waveforms of i_s , i_o and v_R . Use parameter values: $R=33k\Omega$, $V = 24v$, Frequency $f = 50Hz$ and diode threshold voltage set at 0.7 volts.

Lab Activity 1.4-1:

Practically verify the above waveforms with same parameter values.

Note: Follow the instructions given on the next page for submission of simulation assignments.

These instructions are mandatory to follow:

1. Always add a digital header in the reporting document having student's Roll. No. and Section.
2. Always add proper titles to the Assignment topics.
3. Plot waveforms on different charts.
4. Always number the figures properly and add suitable captions below the figures.
5. Also include the printouts of the circuit schematics in the report that are used for the simulation in PSIM.

Documentation Guidelines:

1. Copy figures to a word document and arrange two figures on one page.
2. To save pages, use double sided printouts.
3. **Do not use print screen command to copy graphs and schematics to MS-Word document. Rather, click the Edit button and select "Copy to Clipboard" option. Then, open an MS-Word document and simply paste the copied item.**

The End.