

Jawaharlal Nehru Engineering College

Laboratory Manual

POWER ELECTRONICS II

For
B.E. (EEP) Students

PREFACE

It is my great pleasure to present this laboratory manual to final year engineering students for the subject Power Electronics II, to understand and visualize the advance concepts of power electronics. The study of power electronics is essential for the students pursuing degrees in electronics, electrical, mechanical, aerospace and chemical engineering.

Good Luck for your enjoyable laboratory sessions.

Prof. J.R.Rana
Author

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DOs and DON'Ts in the Laboratory:

1. Do not handle any equipment before reading the instructions/Instruction manuals
2. Read carefully the power ratings of the equipment before it is switched on whether ratings 230 V/50Hz or 115V/60 Hz. For Indian equipments, the power ratings are normally 230V/50Hz. If you have equipments with 115/60 Hz ratings, do not insert power plug, as our normal supply is 230V/50 Hz, which will damage the equipment.
3. Observe the type of sockets of equipment power to avoid mechanical damage.
4. Do not forcefully place connectors.
5. Strictly observe the instructions given by the Teacher/Lab Instructor.

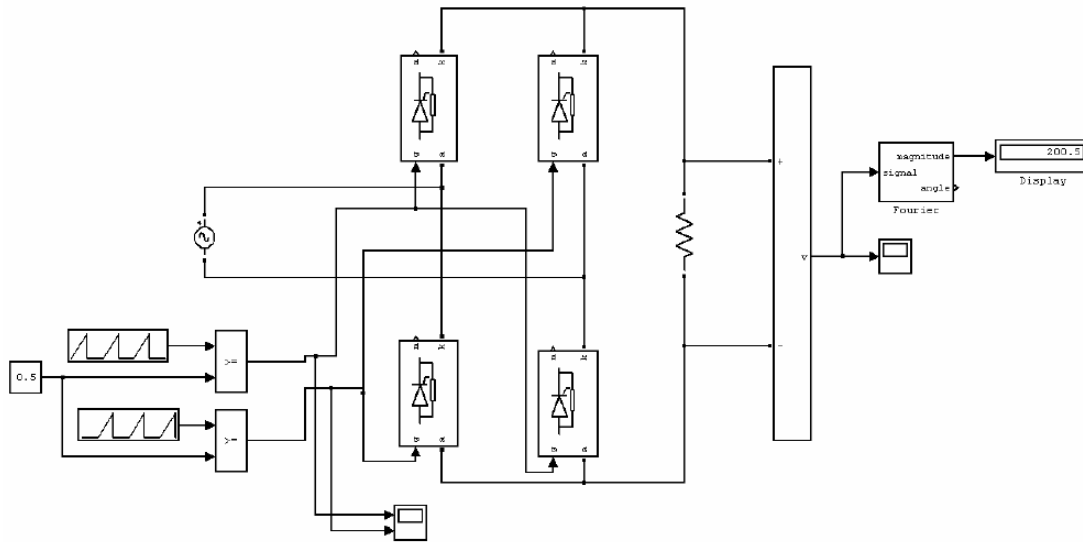
Instructions for Laboratory Teachers:

1. Submission related to whatever lab work has been completed should be done during the next lab session.
2. Students should be instructed to switch on the power supply after getting the connections checked by the lab assistant/teacher. After the experiment is over the students must hand over the circuit board, wires, CRO probe to the lab assistant/teacher.
3. The promptness of submission should be encouraged by way of marking and evaluation patterns that will benefit the sincere students.

Exercise Number :01

Aim: Simulation of Single Phase Controlled Rectifier.

Simulation Circuit Diagram:



Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

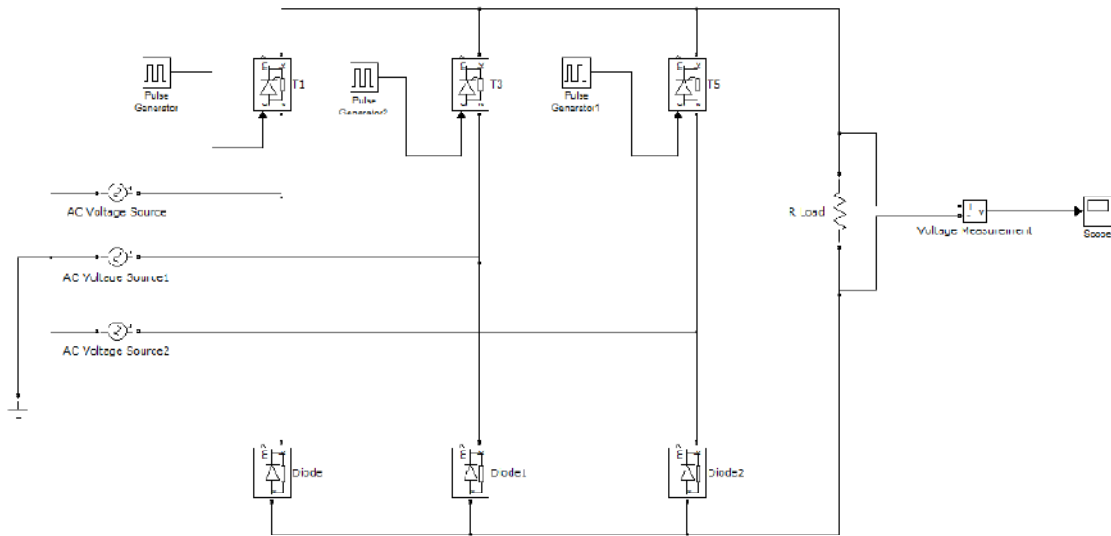
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No.: 02

AIM: Simulation of Three-Phase Thyristor Controlled Converter.

Simulation Circuit Diagram:



Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

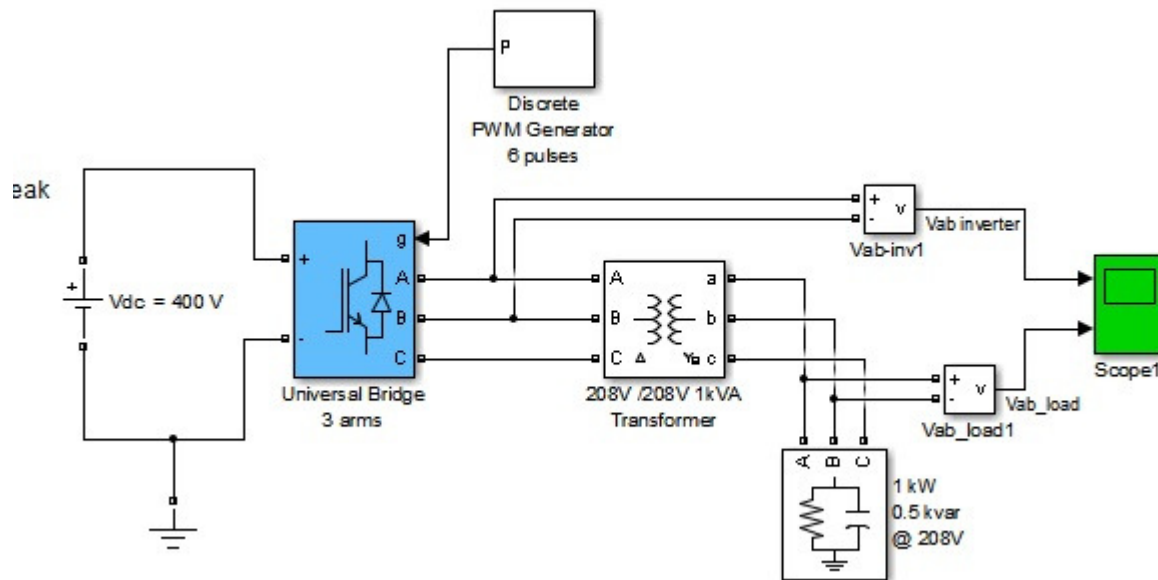
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No.:03

AIM: Simulation of Three-Phase Two-Level PWM Converters.

Simulation Circuit Diagram:



Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

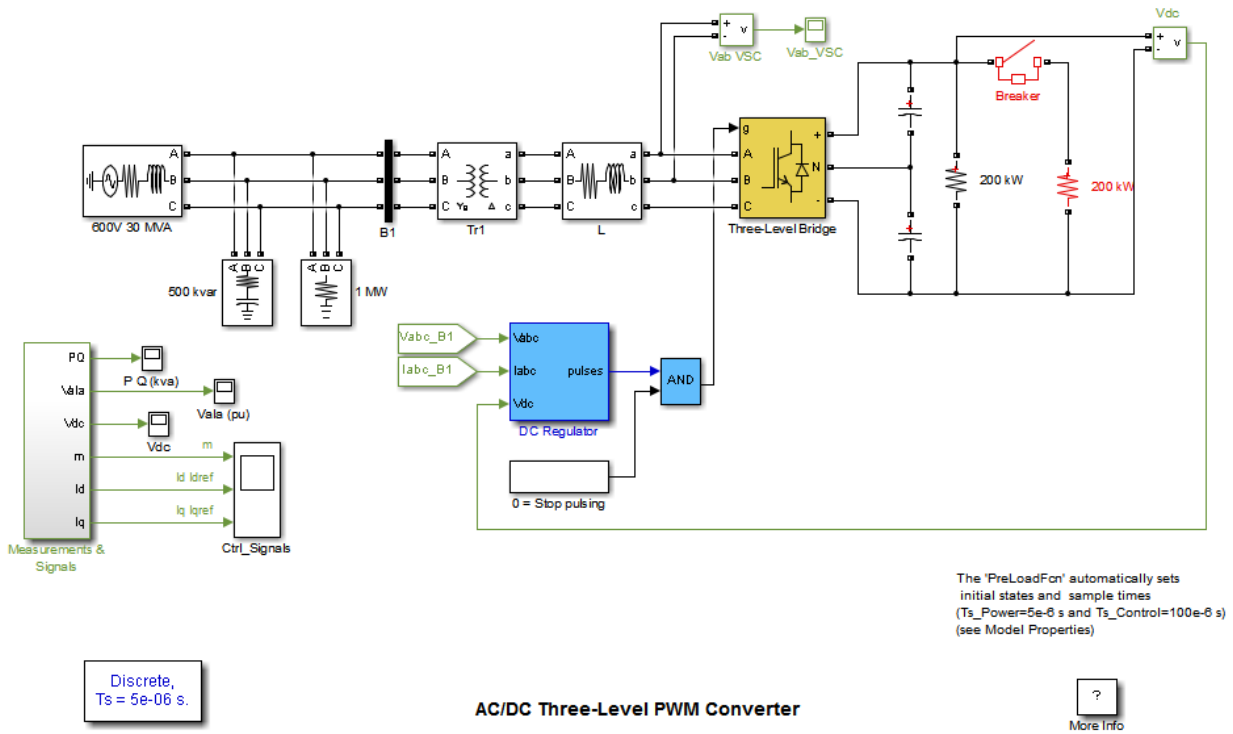
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No.: 04

Aim : Simulation of AC/DC Three Level PWM Converters.

Simulation Circuit Diagram:



Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

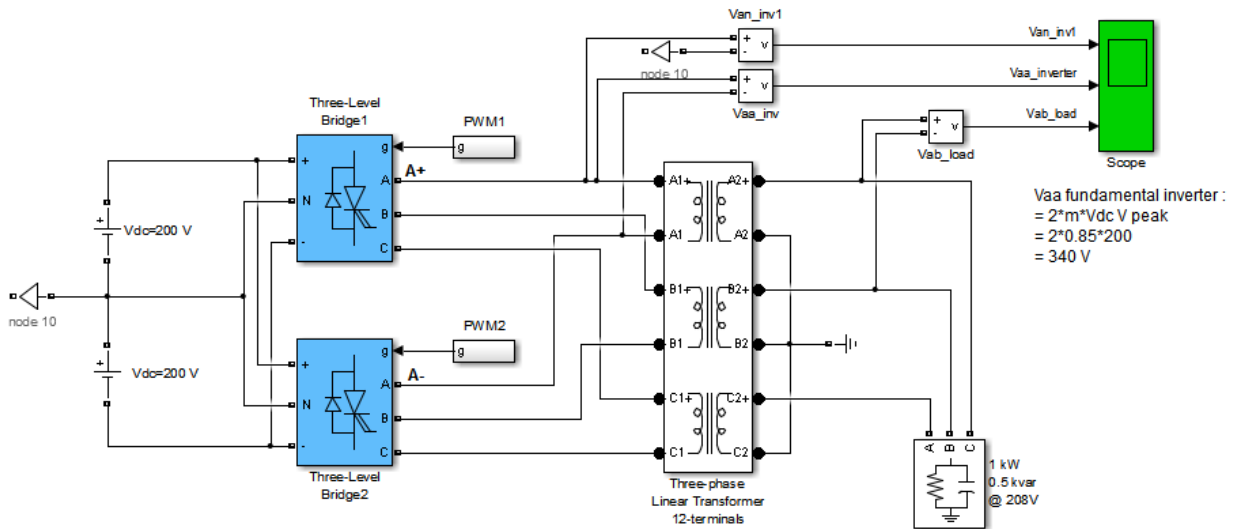
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No: 05

AIM: Simulation of Three-Phase Three Level PWM Converters.

Simulation Circuit Diagram:



Use the Powergui FFT tool to display the spectrum of Scope2 signals stored in 'psb3phPWM3level_str' structure.

Discrete,
 $T_s = 5.144e-06$ s.

Three-Phase Three-Level PWM Converter

More info

Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

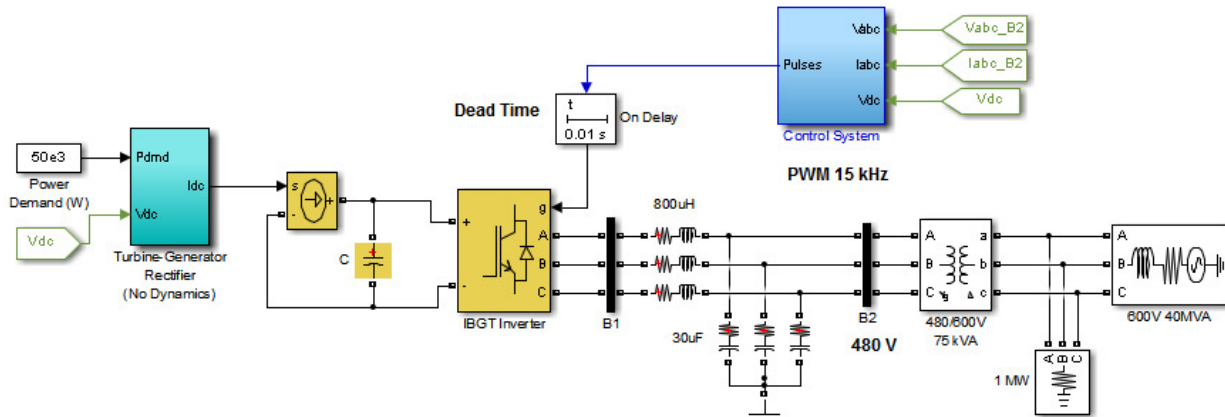
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No.:06

AIM: Simulation of Two-Level PWM Converter and effect of dead-time.

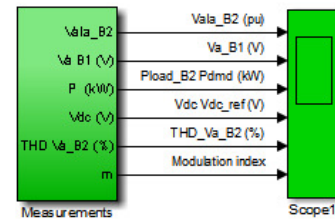
Simulation Circuit Diagram:



Harmonic distortion of B2 voltage as function of dead time at nominal output power 50kW PF=1.0; Vdc=900 V

Dead Time (us)	THD (%)	H5 (% of fund.)	H7 (% of fund.)	H11 (% of fund.)	15kHz+/-k*60Hz (% of fund.)	Modulation index
0	0.74	0.02	0.03	0.02	0.42	0.87
1	0.85	0.29	0.22	0.09	0.44	0.91
2	1.27	0.72	0.50	0.34	0.45	0.97
3	1.75	0.71	0.97	0.70	0.47	0.99

The 'Model initialization function' automatically sets initial states and sample times Ts_Power = 0.5e-6 s and Ts_Control=50e-6 s)



Discrete,
Ts = 5e-07 s.

Two-Level PWM Converter and Dead Time

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More Info

Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

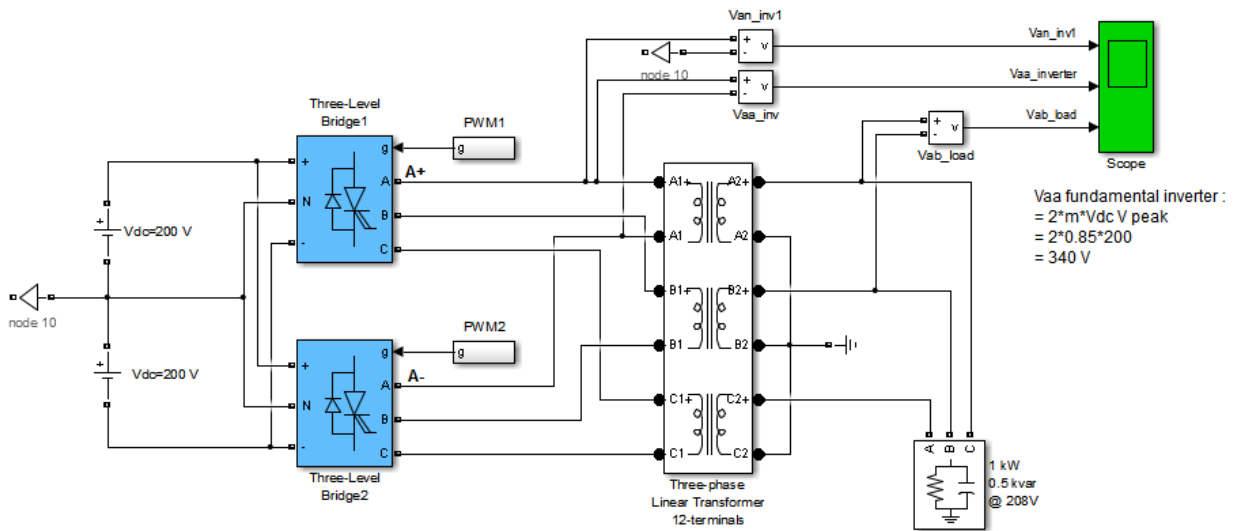
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No: 07

AIM: Simulation of Three-Level PWM Converter and effect of dead-time.

Simulation Circuit Diagram:



Use the Powergui FFT tool to display the spectrum of Scope2 signals stored in 'psb3phPWM3level_str' structure.

Discrete,
 $T_s = 5.144 \times 10^{-6}$ s.

Three-Phase Three-Level PWM Converter

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More info

Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

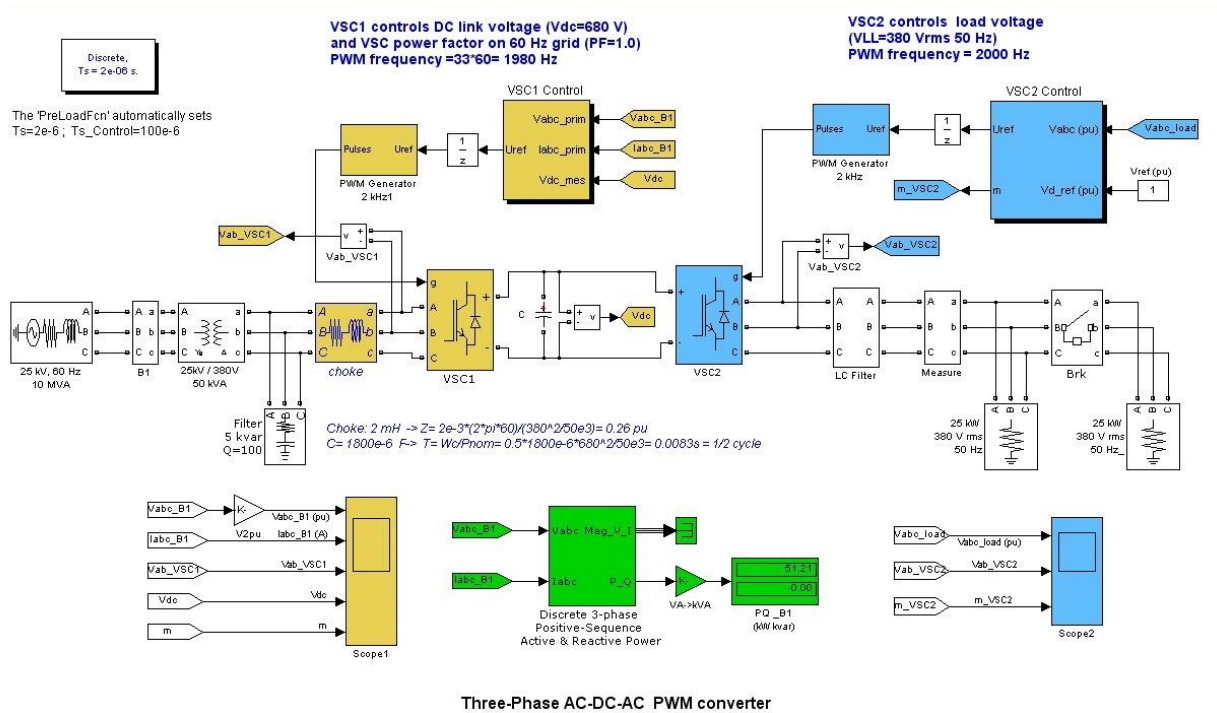
Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.

Exercise No.:08

AIM: Simulation of AC-DC-AC PWM Converters.

Simulation Circuit Diagram:



Outputs:

1. Observe the waveforms for output signals.
2. Note the remarks on observed signals.

Concluding Remarks:

Write a brief concluding remarks on the circuit studied and observed waveforms.