



**Channabasaveshwara Institute of Technology**

(Affiliated to VTU, Belgaum & Approved by AICTE, New Delhi)  
(NAAC Accredited & ISO 9001:2015 Certified Institution)

NH 206 (B.H. Road), Gubbi, Tumkur – 572 216. Karnataka.

QMP 7.1 D/F



**Department of Electrical & Electronics Engineering**

**SIMULATION AND CONTROL OF POWER ELECTRONICS  
CIRCUITS LABORATORY**

**LAB MANUAL  
BEEL657B  
(2025-26)**

**Bachelor of Engineering  
VI Semester**

**NAME:** \_\_\_\_\_

**USN:** \_\_\_\_\_

**SECTION:** \_\_\_\_\_ **BATCH:** \_\_\_\_\_



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Department of Electrical & Electronics  
Engineering

# SIMULATION AND CONTROL OF POWER ELECTRONICS CIRCUITS LAB

Version 1.1

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**Dept. of EEE**



DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGG.

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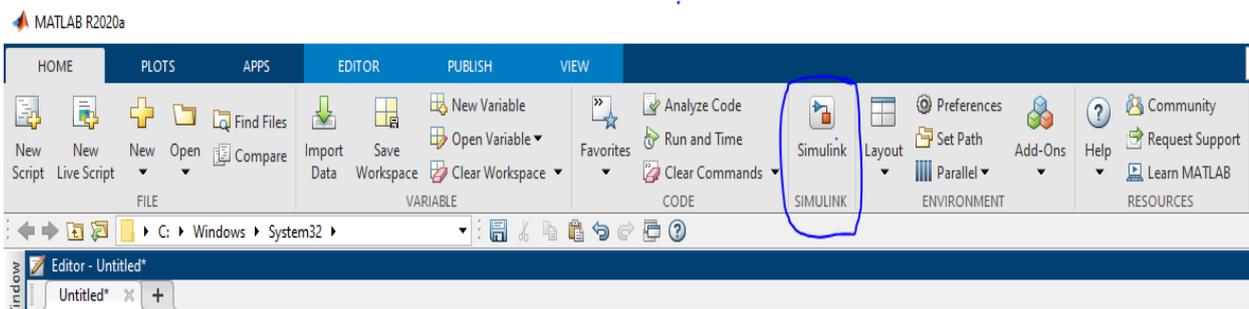
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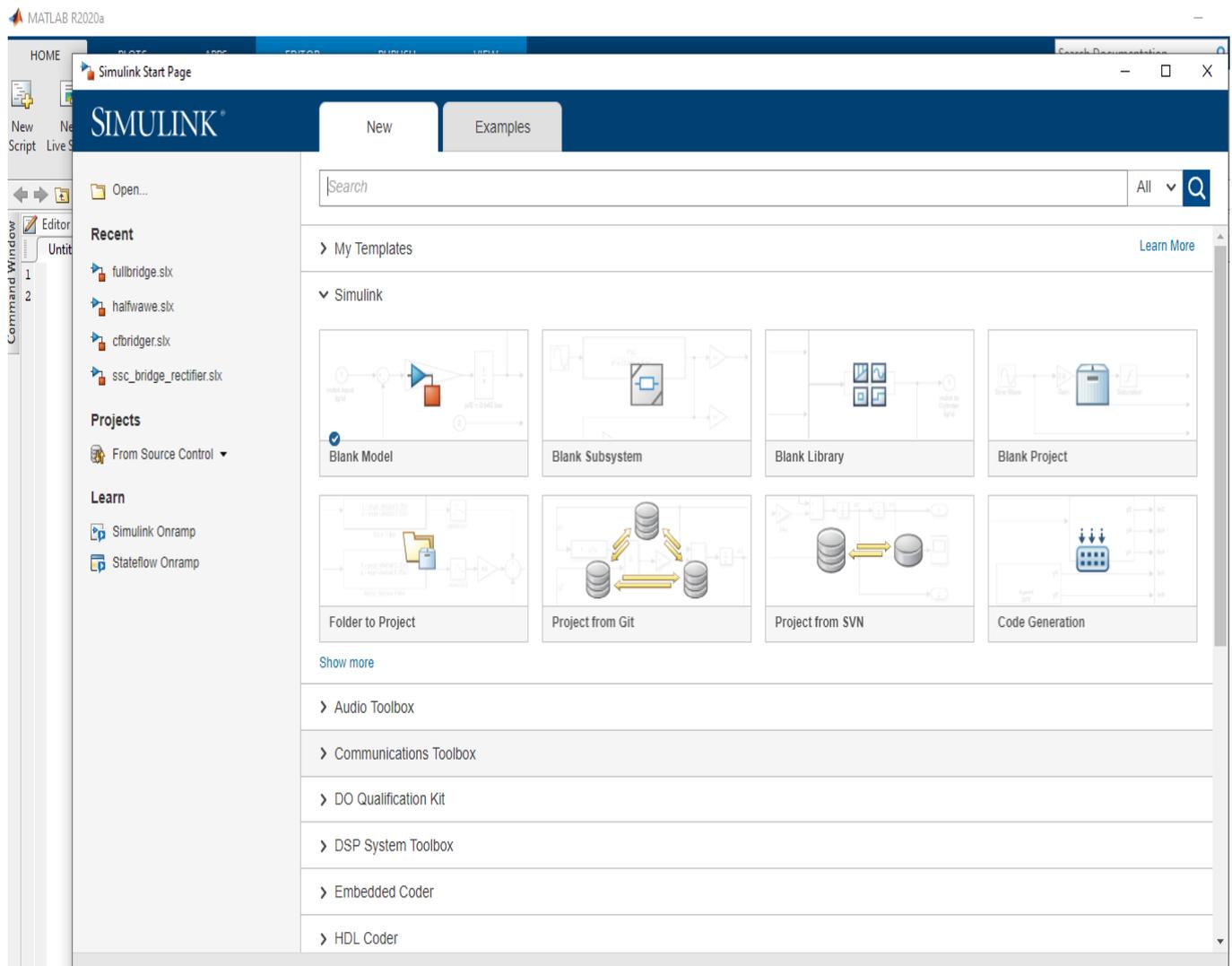
## Simulink Basics

### Starting Simulink

Simulink is started from the MATLAB command prompt by entering the following command: `simulink`



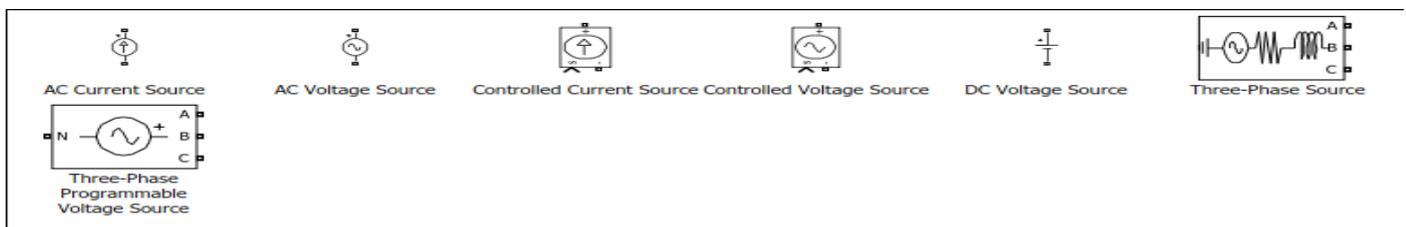
Alternatively, you can hit the New Simulink Model button at the top of the MATLAB command window as shown below:



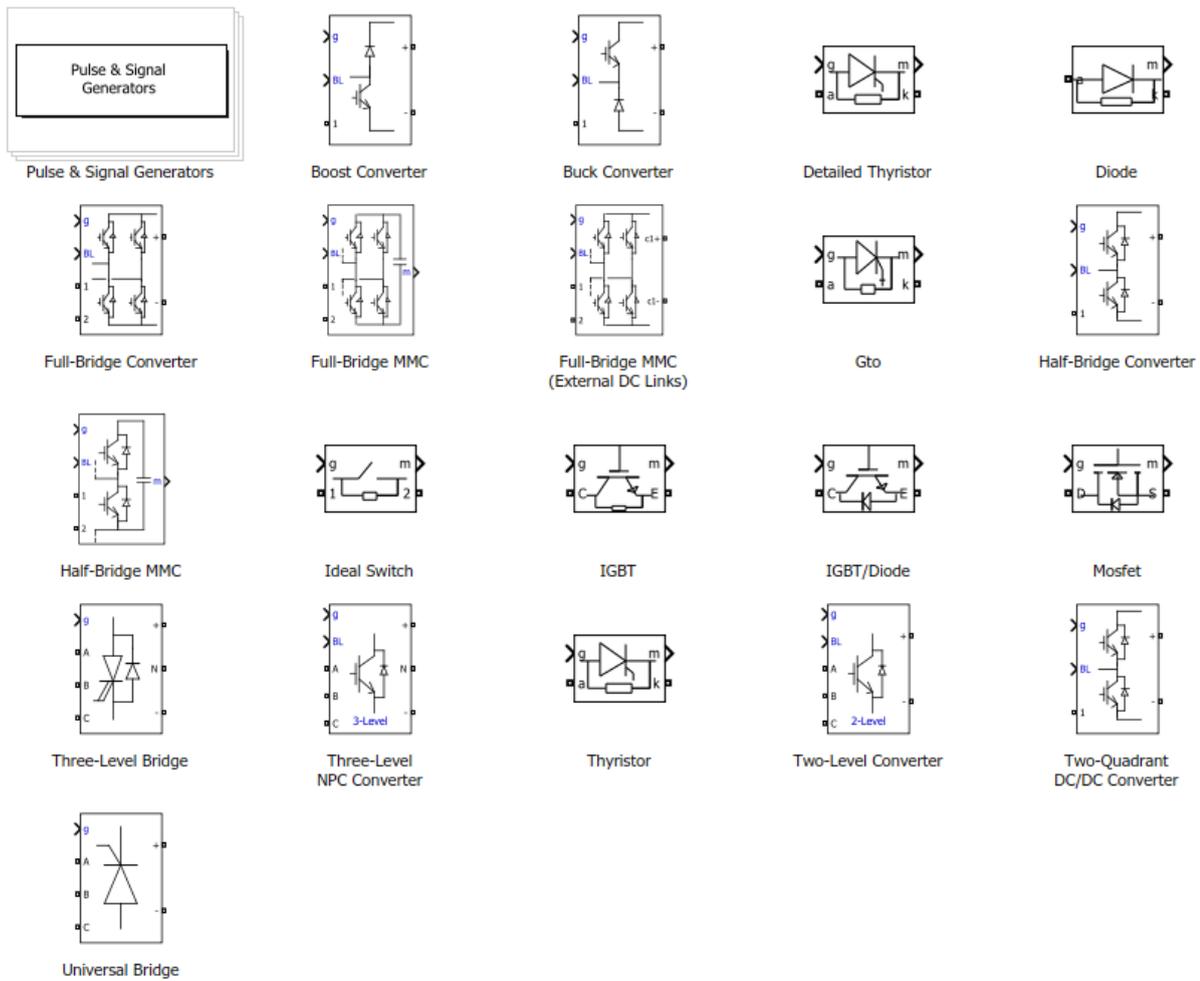
When it starts, Simulink brings up two windows. The first is the main Simulink window, which appears as shown or similar to this as different versions of the software are found: The second window is a blank, untitled, model window. This is the window into which a new model can be drawn. Model Files In Simulink, a model is a collection of blocks which, in general, represents a system. In addition, to drawing a model into a blank model window, previously saved model files can be loaded either from the File menu or from the MATLAB command prompt.

Basic Elements:

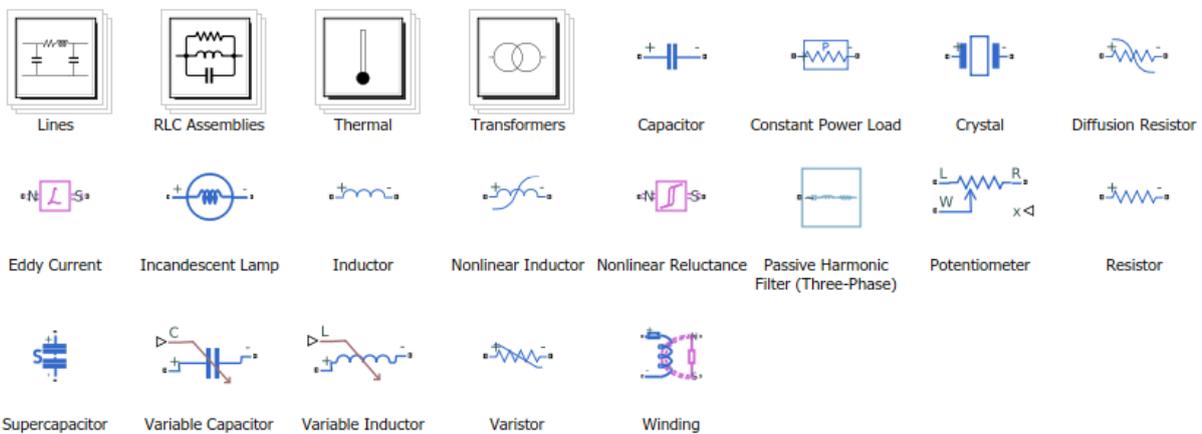
Electrical Sources



Power Electronics:



Passive:



Procedure:

1. **Launch Simulink:** Click the **Simulink** button on the MATLAB Home tab or type `simulink` in the Command Window. Select **Blank Model** to open the editor.

2. **Add Blocks:** Open the Simulink Library Browser to find components.

- **Sources:** Generate signals (e.g., Sine Wave, Constant, Step).
- **Math Operations:** Perform calculations (e.g., Gain, Sum, Product).
- **Continuous:** Add dynamic elements (e.g., Integrator, Transfer Function).
- **Sinks:** Display or save results (e.g., Scope, To Workspace).

**Connect Blocks:** Drag lines from the output port of one block to the input port of another. You can also hold **Ctrl** and click blocks to connect them automatically.

**Configure Parameters:** Double-click any block to open its Block Parameters dialog box and adjust values like gain or initial conditions.

**Run Simulation:** Set the **Stop Time** in the Simulation tab and click the **Run** (green play) button.

**Analyze Results:** Double-click a **Scope** block to view time-varying signals or use the Simulation Data Inspector to compare data across multiple runs.

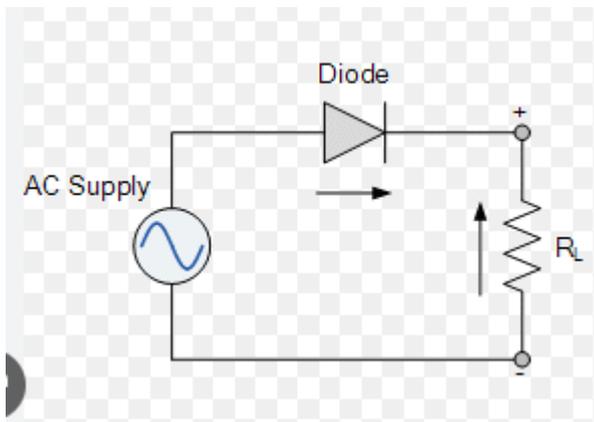
**Simulation and Control of Power Electronics Circuits**

## EXPRIMENT NO: 01

### AIM:

1. (a) Simulate a single phase half wave diode rectifier. Input 100V, 50 Hz. AC supply. At the output, resistance of 50 ohms.

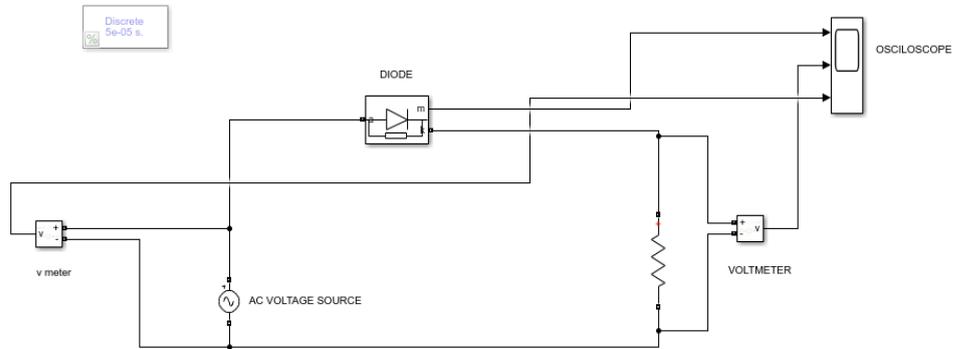
### CIRCIT DIAGRAM



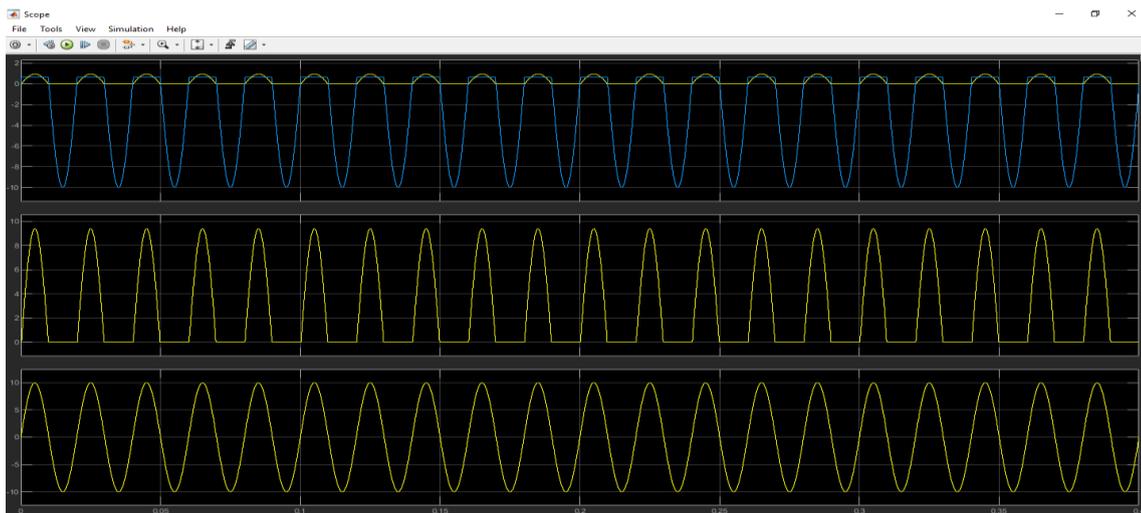
### BLOCKS ARE USED

1. DIODE
2. AC VOLTAGE SOURCE
3. VOLTMETER
4. OSCILLOSCOPE
5. POWERGUI

## Design of 1-Phase half wave rectifier



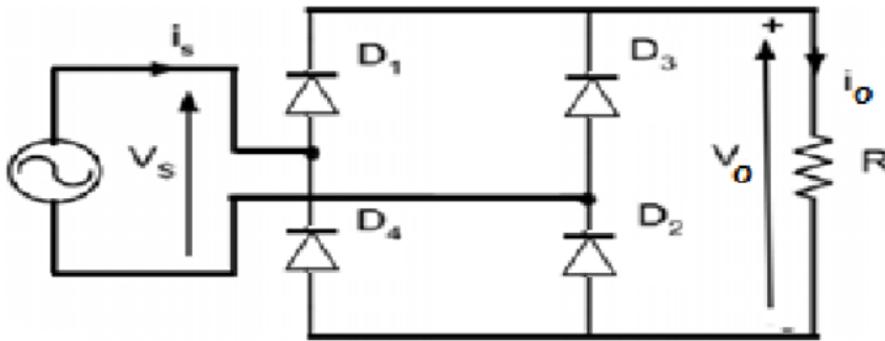
## Output Waveform:



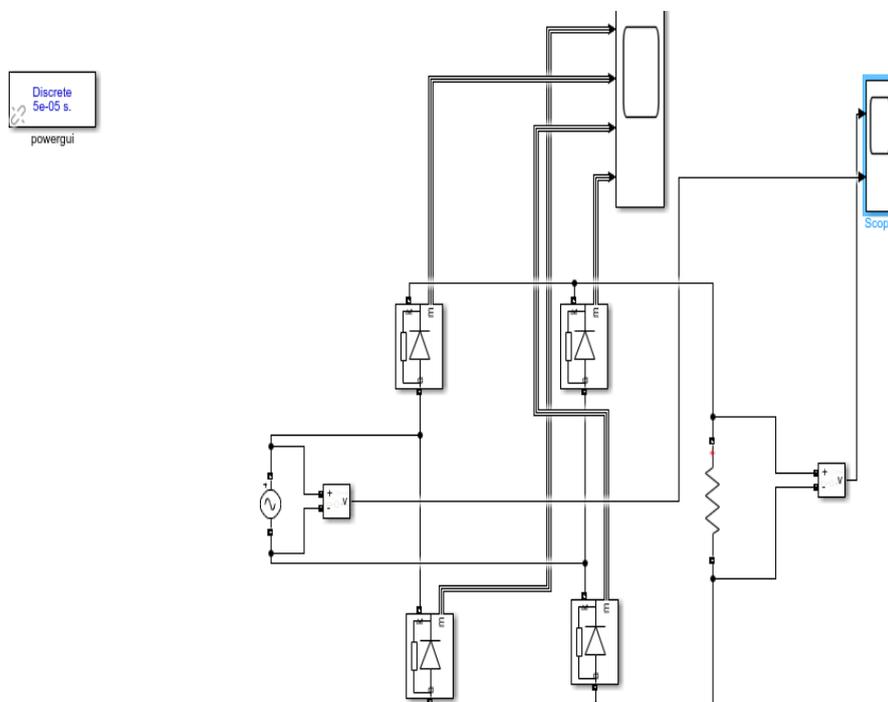
## CONCLUSION:

(b) Simulate a single phase full wave diode bridge rectifier. Input 100V, 50 Hz. AC supply. At the output, resistance of 50 ohms.

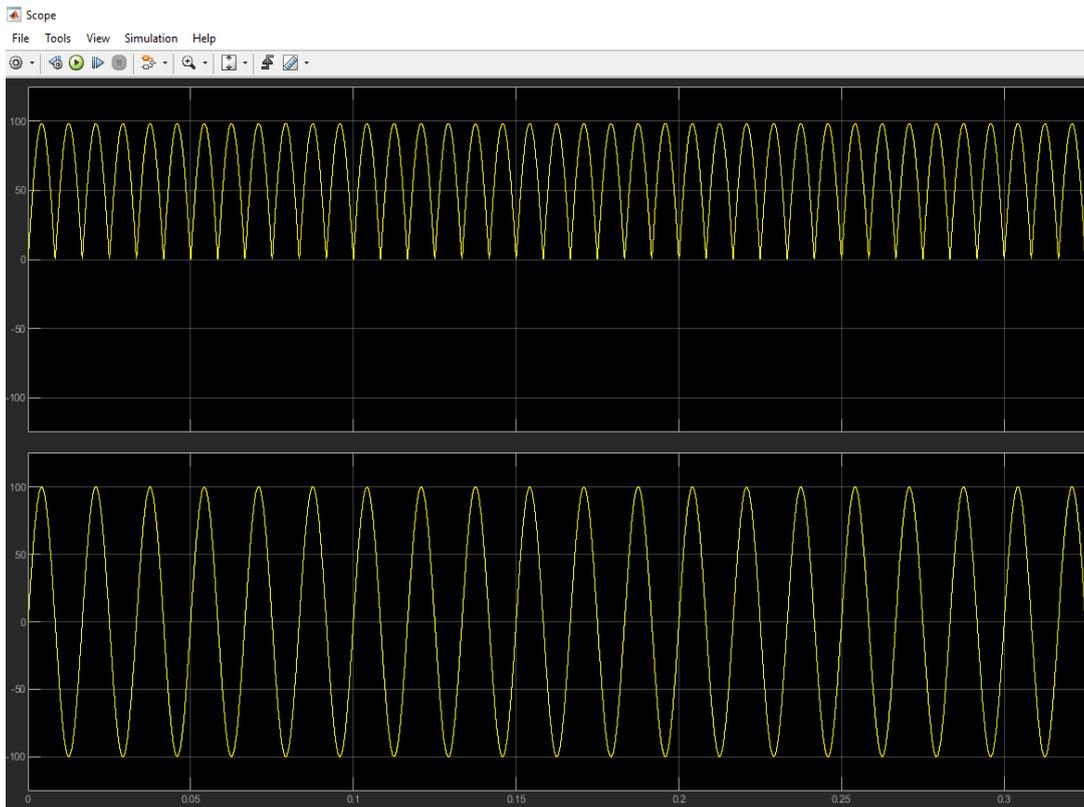
### Circuit Diagram



### Design of 1-Phase full wave uncontrolled rectifier



**Output Waveform:**

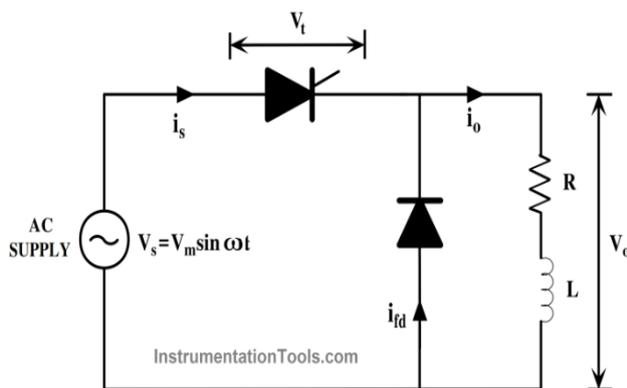


**CONCLUSION:**

## EXPERIMENT NO: 2

2(a) Simulate a single phase half controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the output, resistance of 50 ohms.

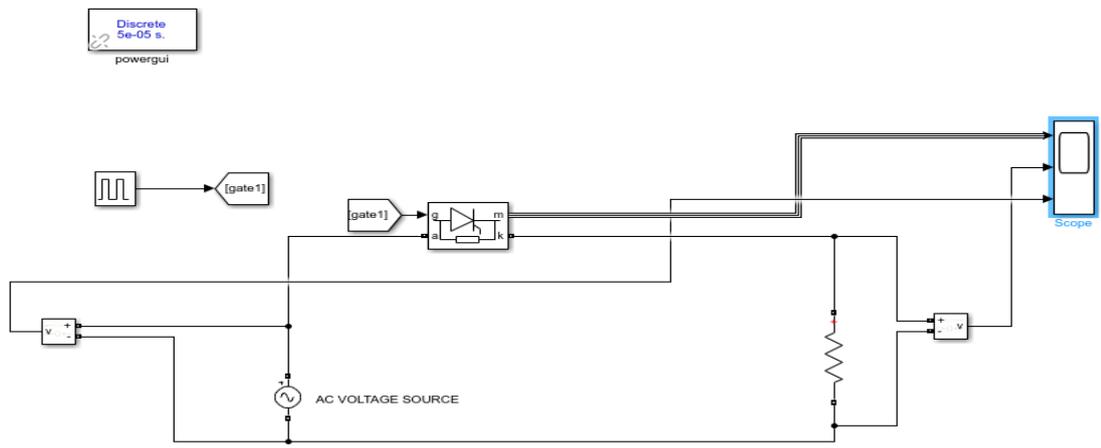
### Circuit Diagram:



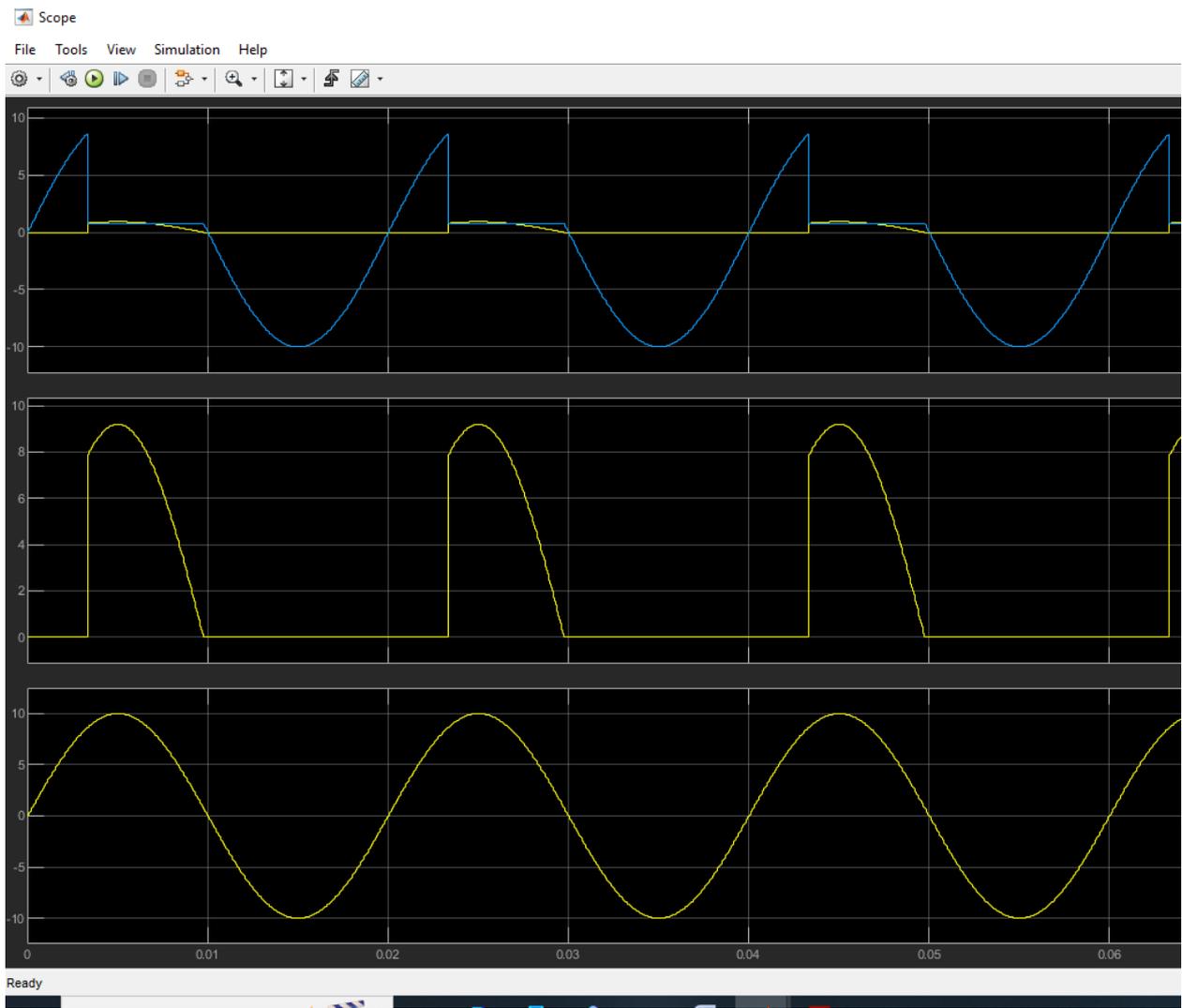
### BLOCKS ARE USED

1. THYRISTOR
2. AC VOLTAGE SOURCE
3. VOLTMETER
4. OSCILLOSCOPE
5. POWERGUI
6. PULSE GENERATOR
7. GOTO

### Design of single phase half controlled full wave rectifier



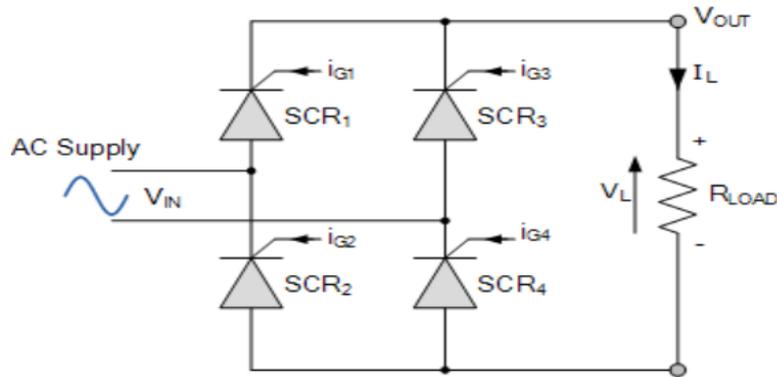
**Output Waveform:**



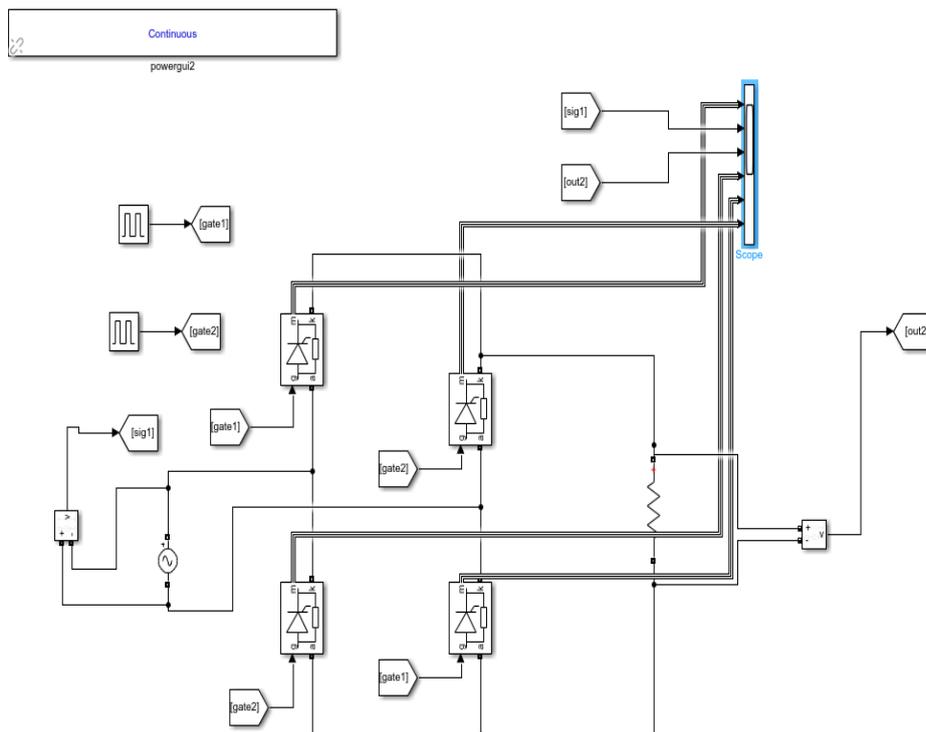
**CONCLUSION:**

2(b) Simulate a single phase fully controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the out put, resistance of 50 ohms.

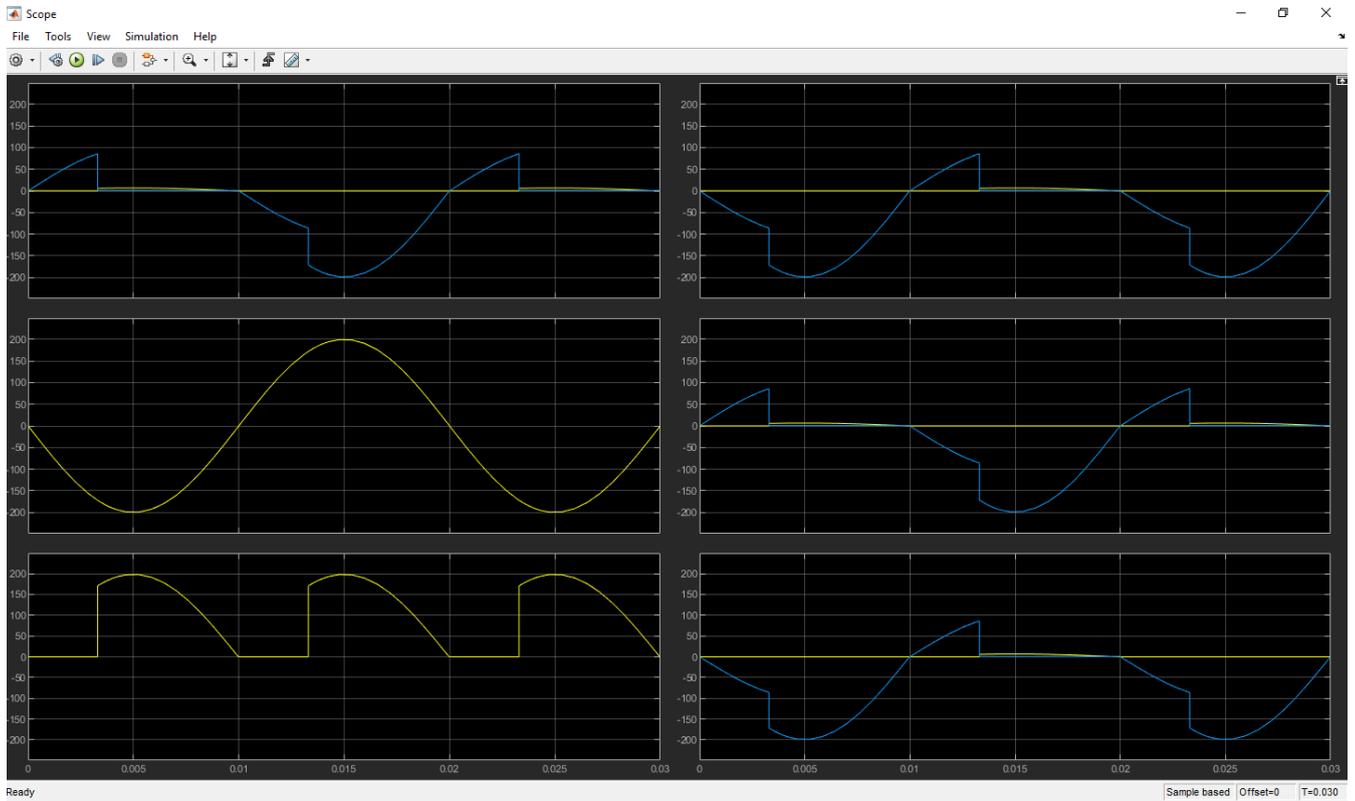
### Circuit Diagram:



### Design of single phase fully controlled full wave rectifier



**Output Waveform:**

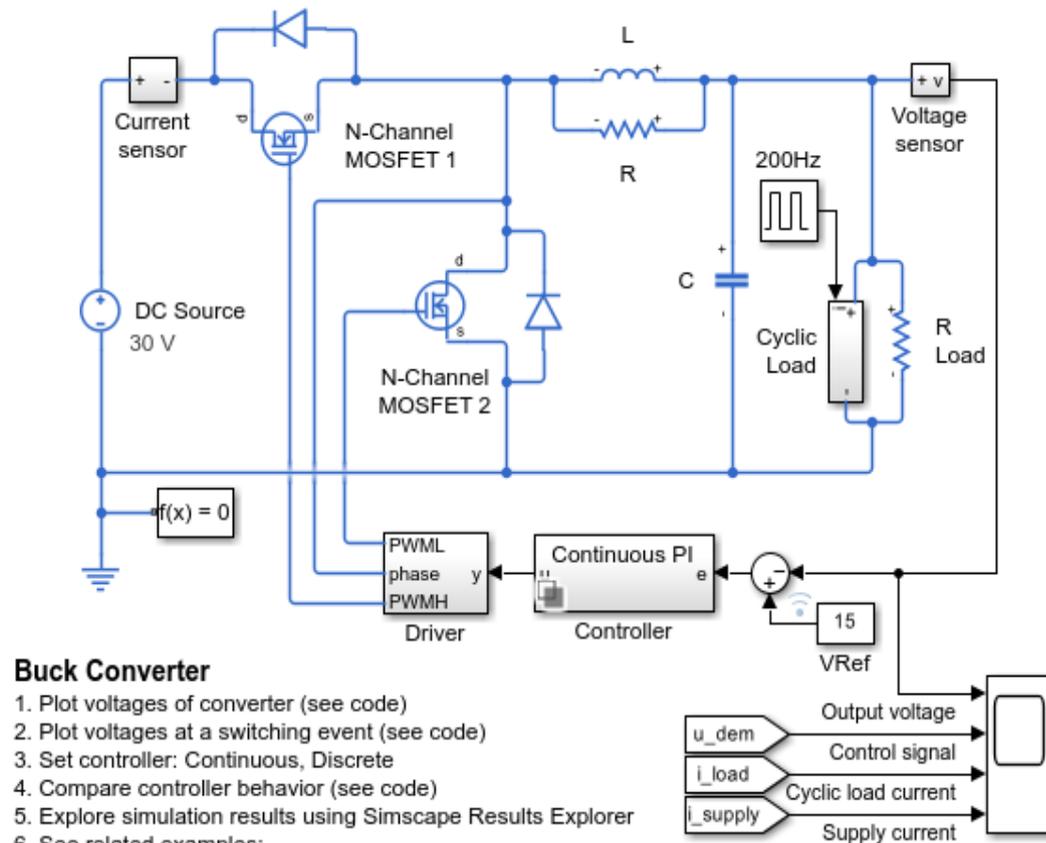


**CONCLUSION:**

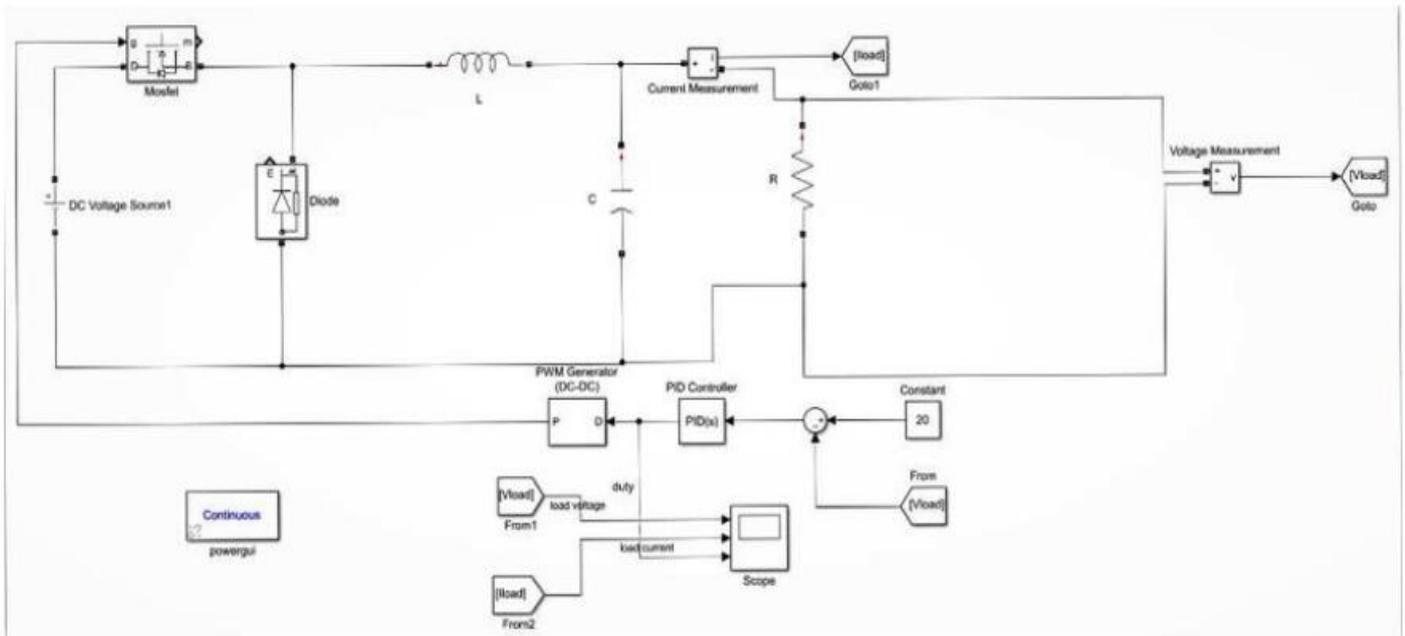
## EXPERIMENT NO: 3

3). Simulate a buck converter with 20 V DC input, and regulate the output at 10 V by implementing a PI controller for closed loop operation. The out put power to vary from 10 W to 20 W. Ensure that voltage ripple is limited to 1%.

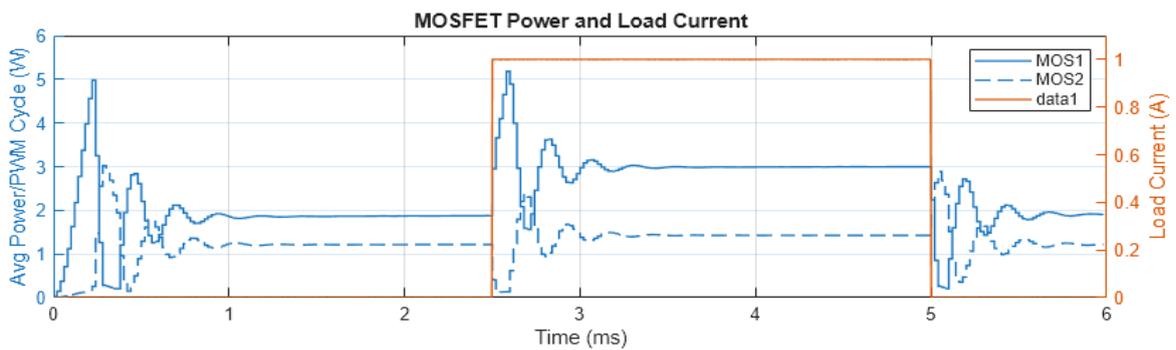
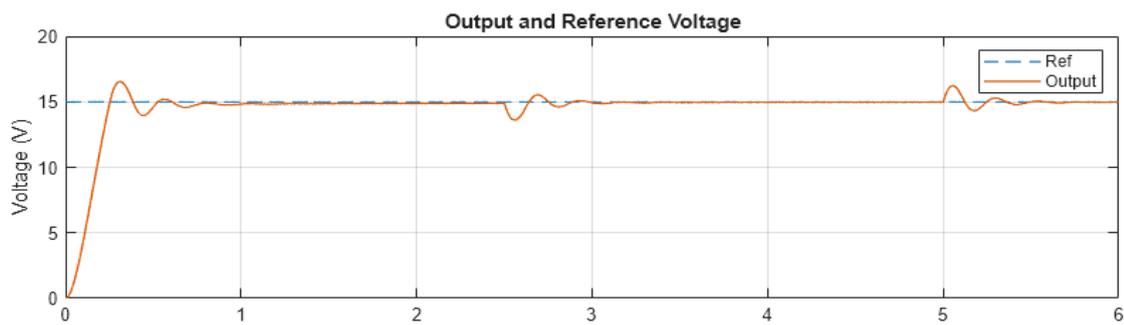
### Circuit Diagram:



### Design of Buck converter using PI controller:



**Output Waveform:**

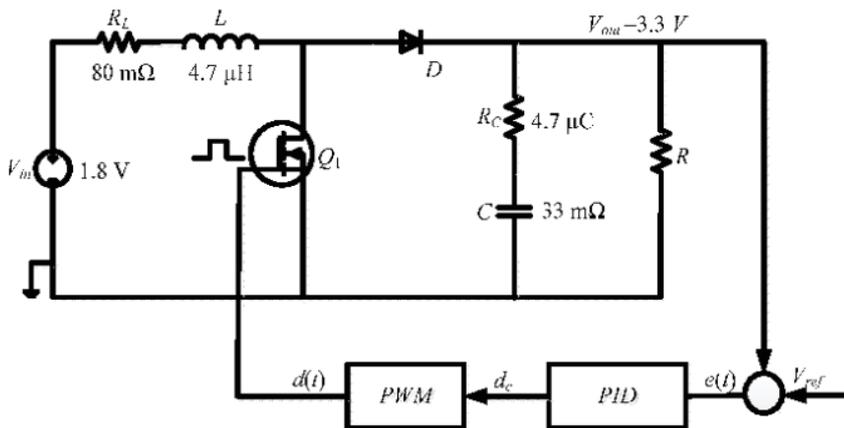


**CONCLUSION:**

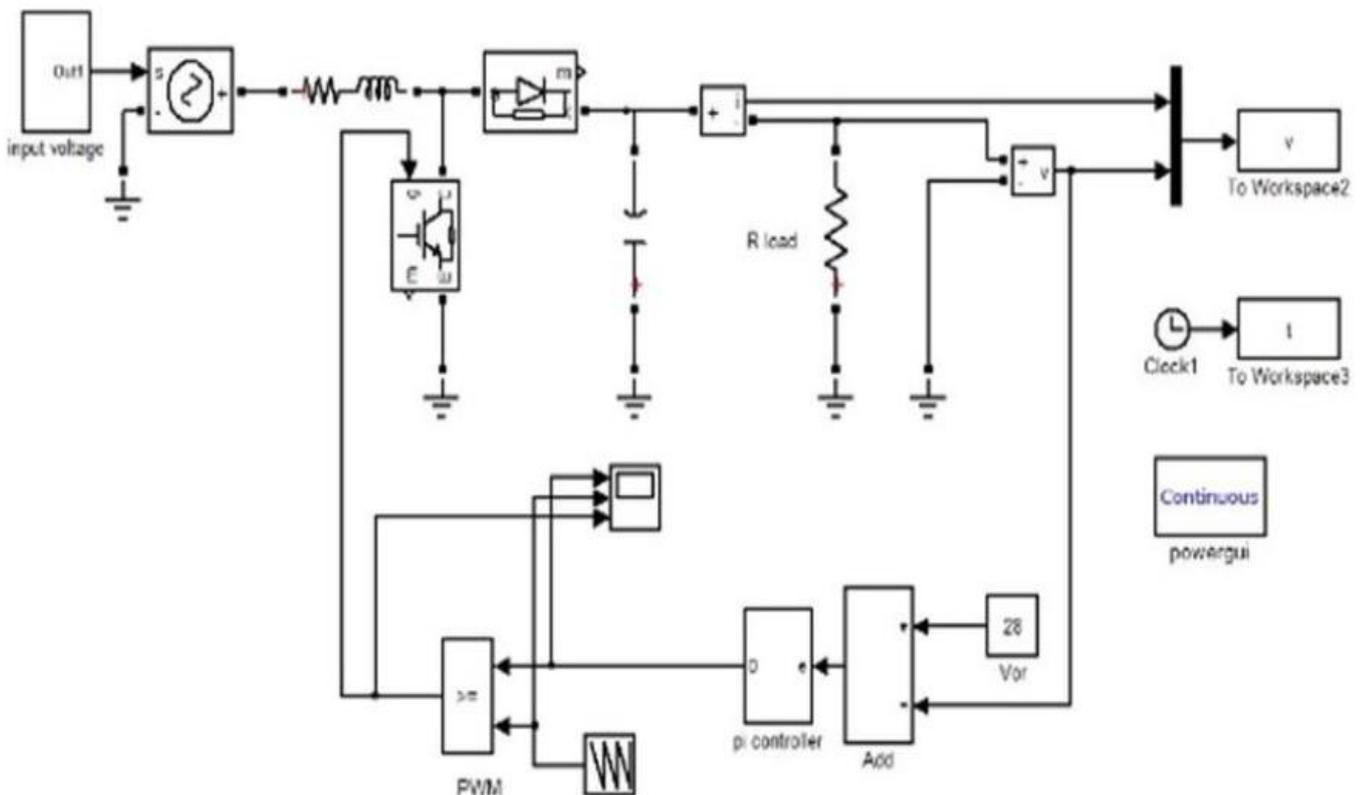
### EXPERIMENT 4

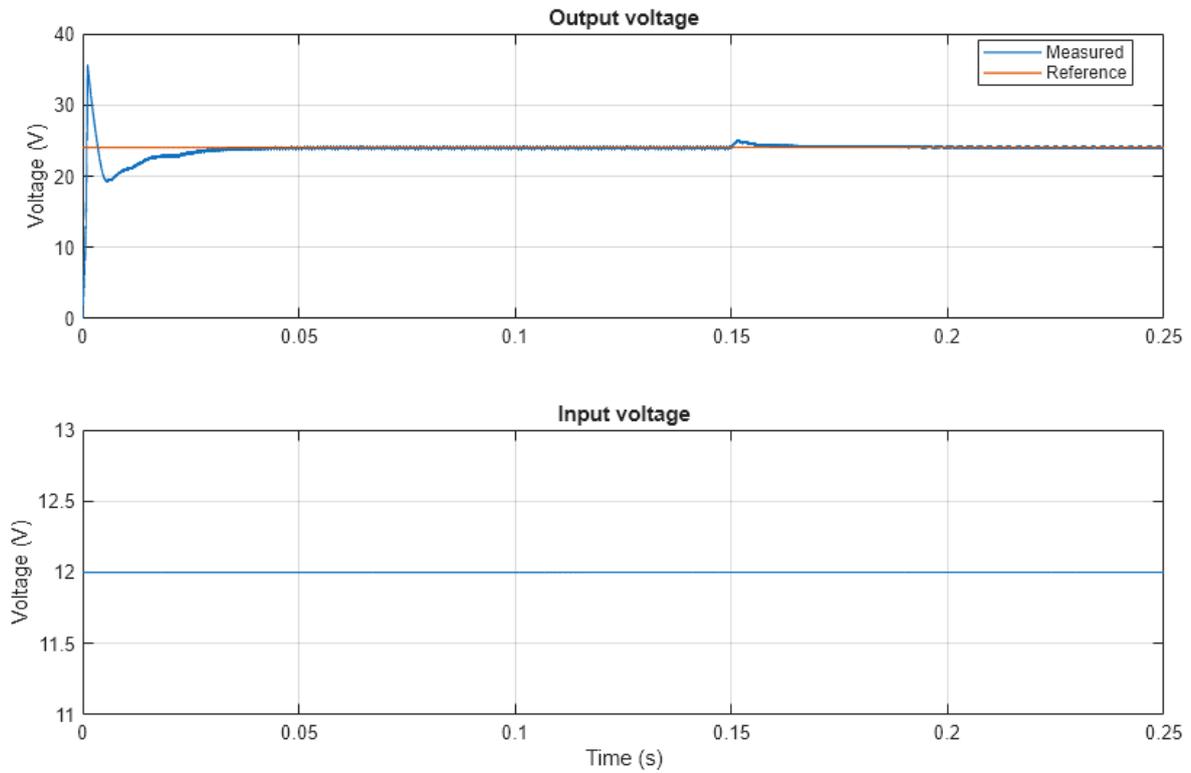
4). Simulate a boost converter with 20 V DC input, and regulate the output at 35 V by implementing a PI controller for closed loop operation. The out put power to vary from 30W to 60 W. Ensure that voltage ripple is limited to 1%

#### Circuit Diagram:



#### Design of Boost converter using PI controller:

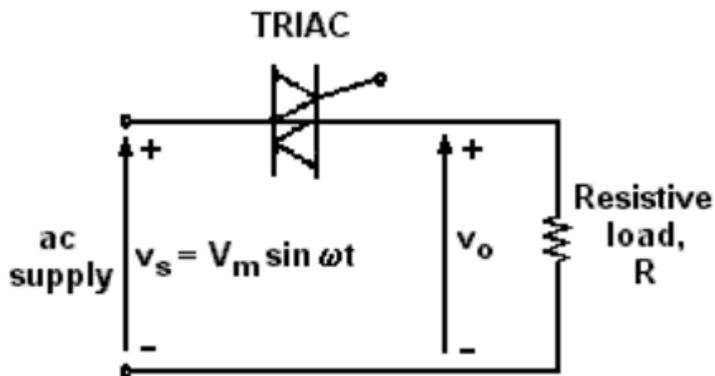


**Output Waveform:****CONCLUSION:**

## EXPERIMENT 5:

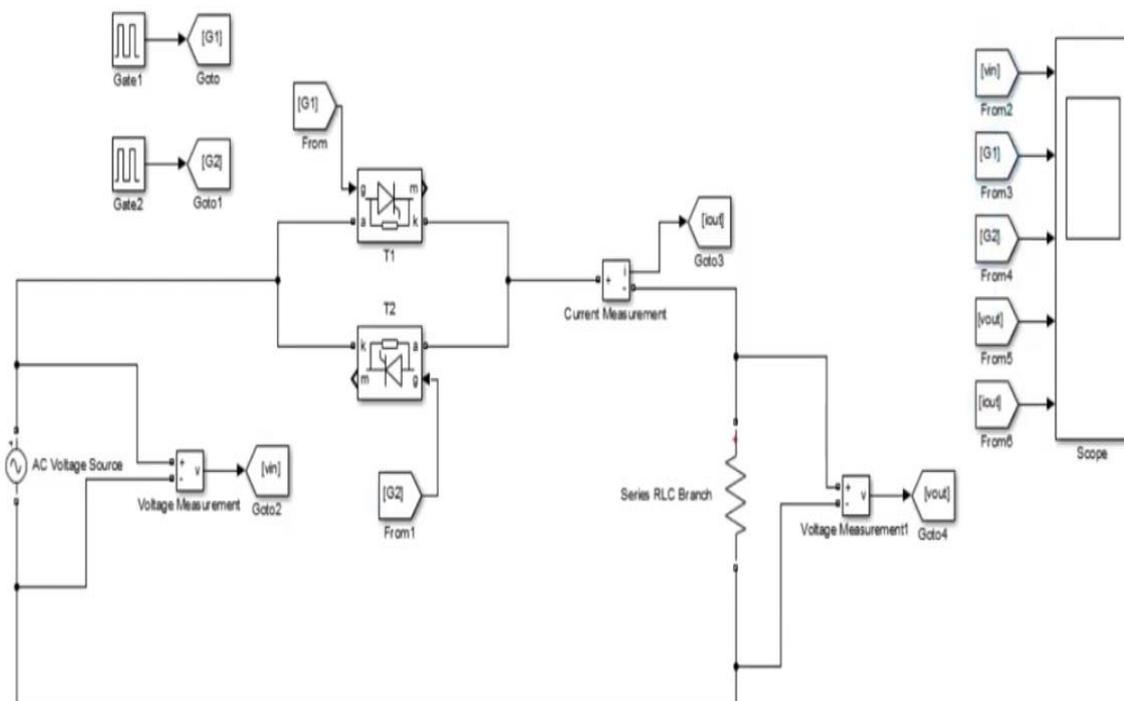
5. Simulate a single phase AC voltage controller using a triac with 100V ,50 Hz. AC supply for an RL load of 10 ohms and 2 mH.

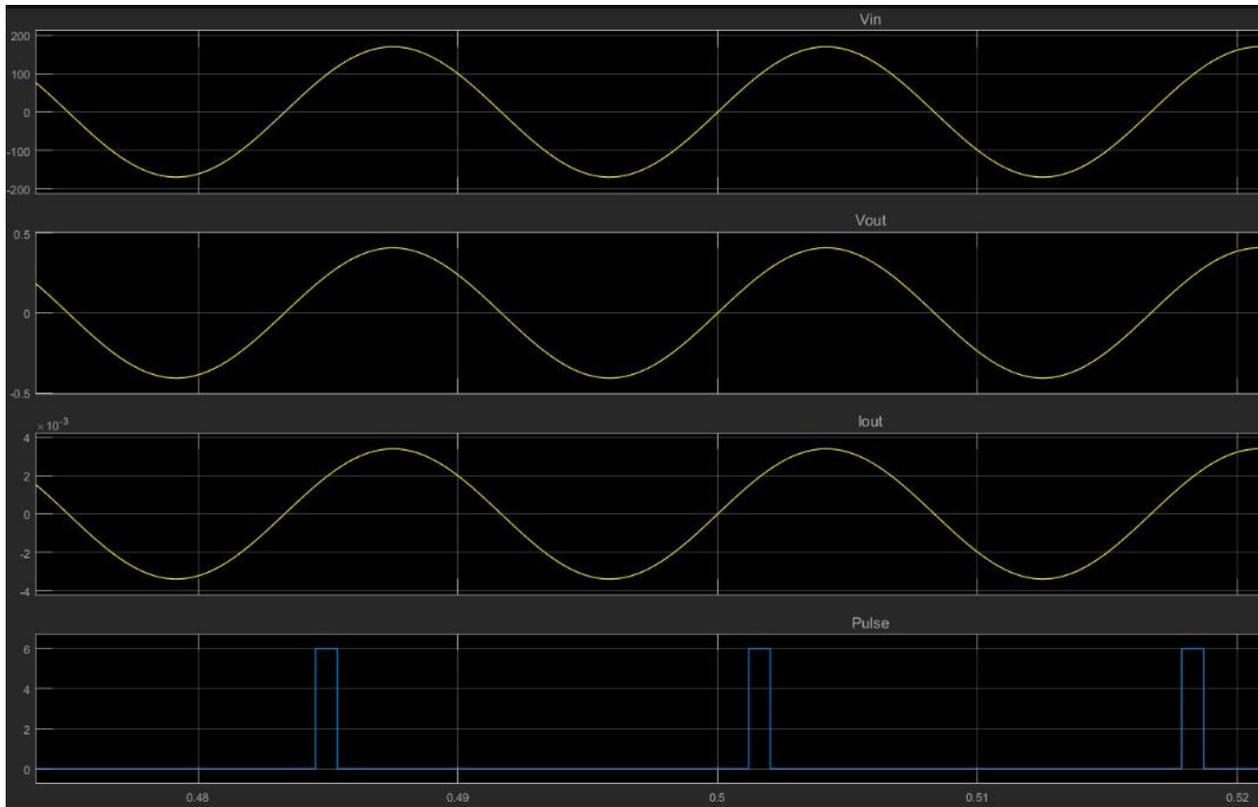
**Circuit Diagram:**



(a) Circuit diagram

**Design of single phase AC voltage controller using a triac**

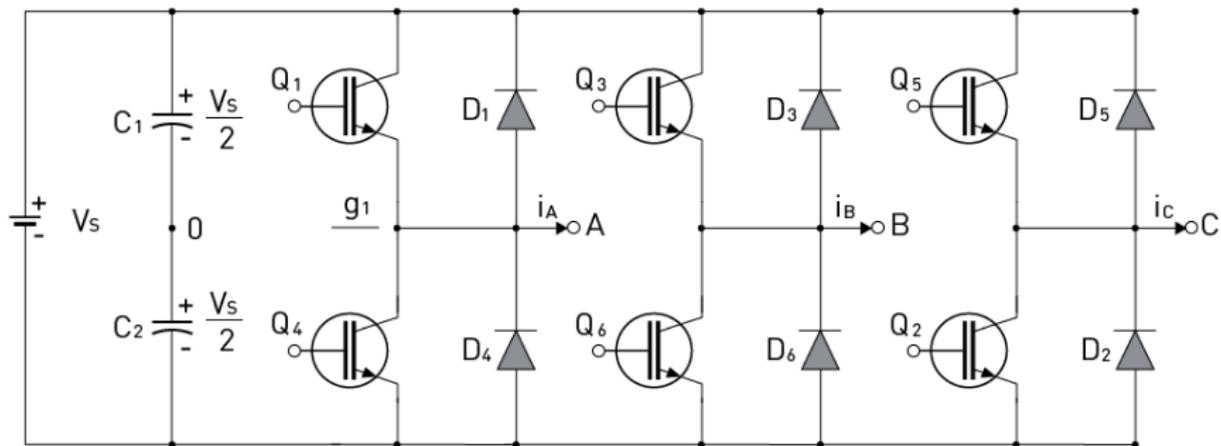


**Output Waveform:****CONCLUSION:**

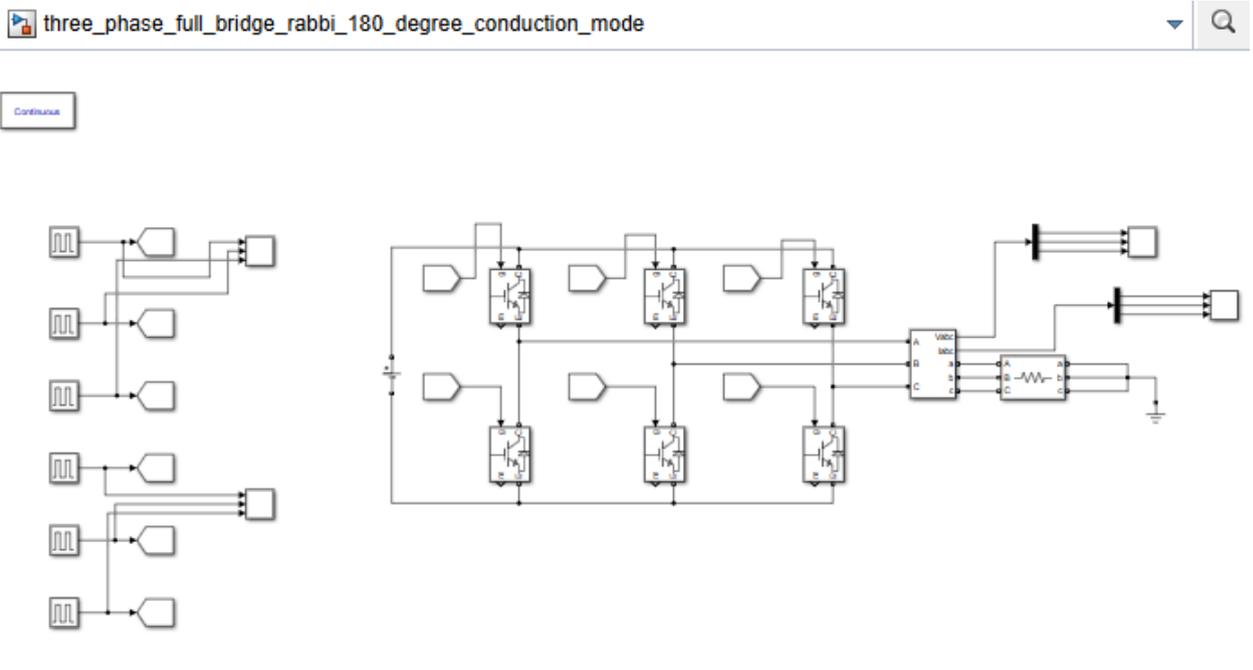
## EXPERIMENT NO: 6

6. Simulate a three phase inverter with 180 degree conduction mode with DC input of 100V and a star connected balanced resistive of 40 ohms each. Use IGBT for inverter

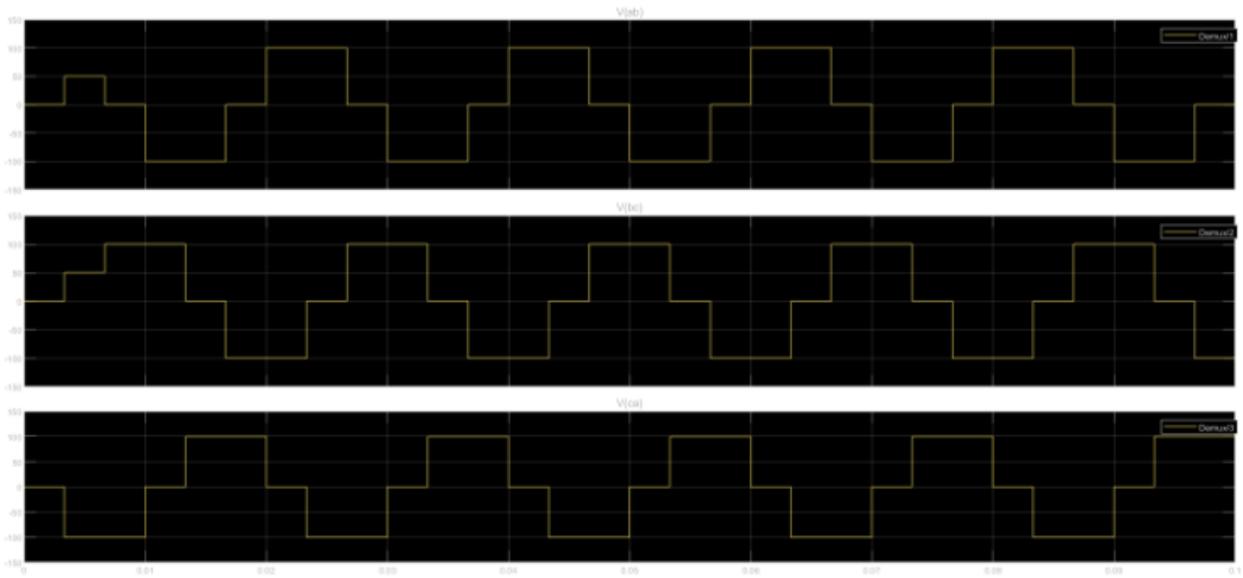
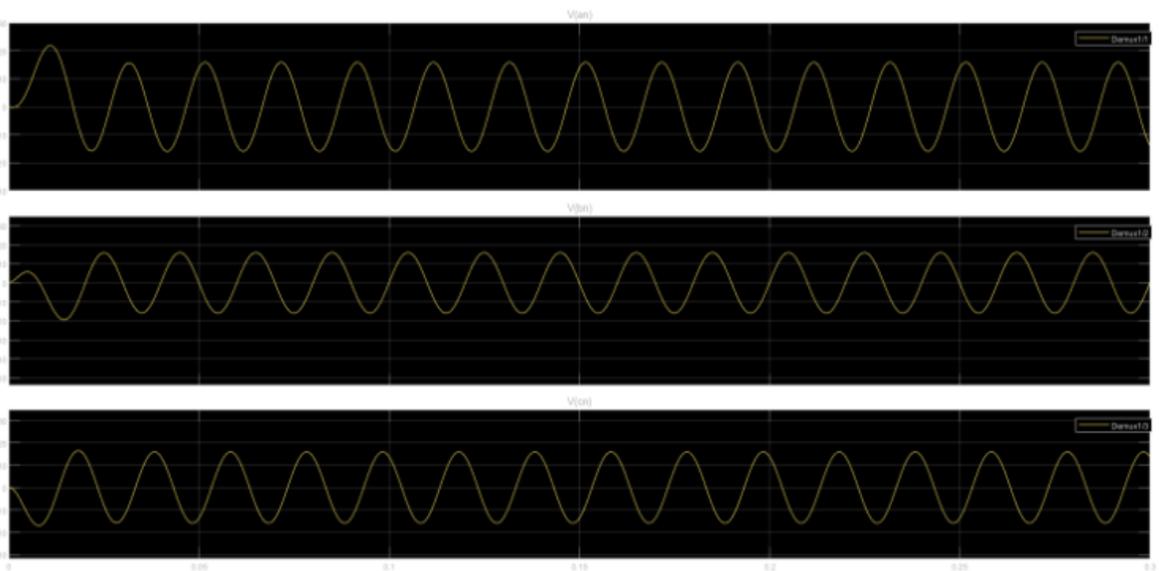
**Circuit Diagram:**



**Design of three phase inverter:**



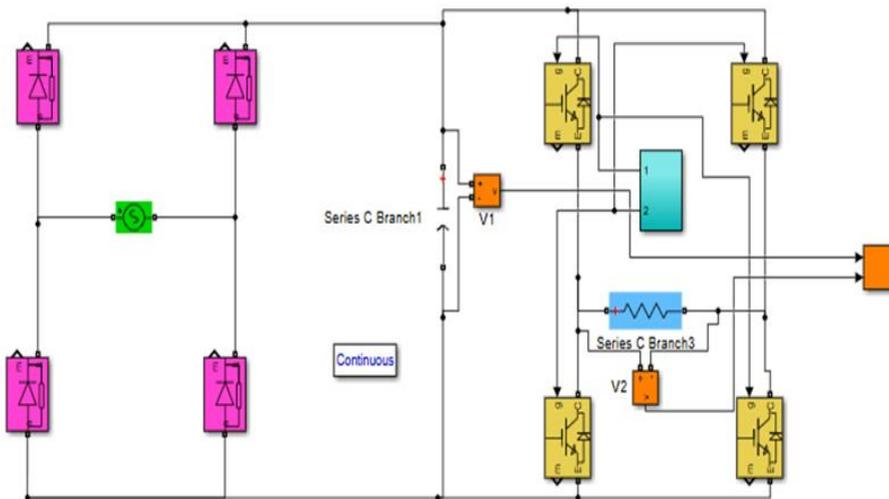
**Output Waveform:**

**▲ Line Voltages in 180° Mode****☑ Waveforms After LC Filter****CONCLUSION:**

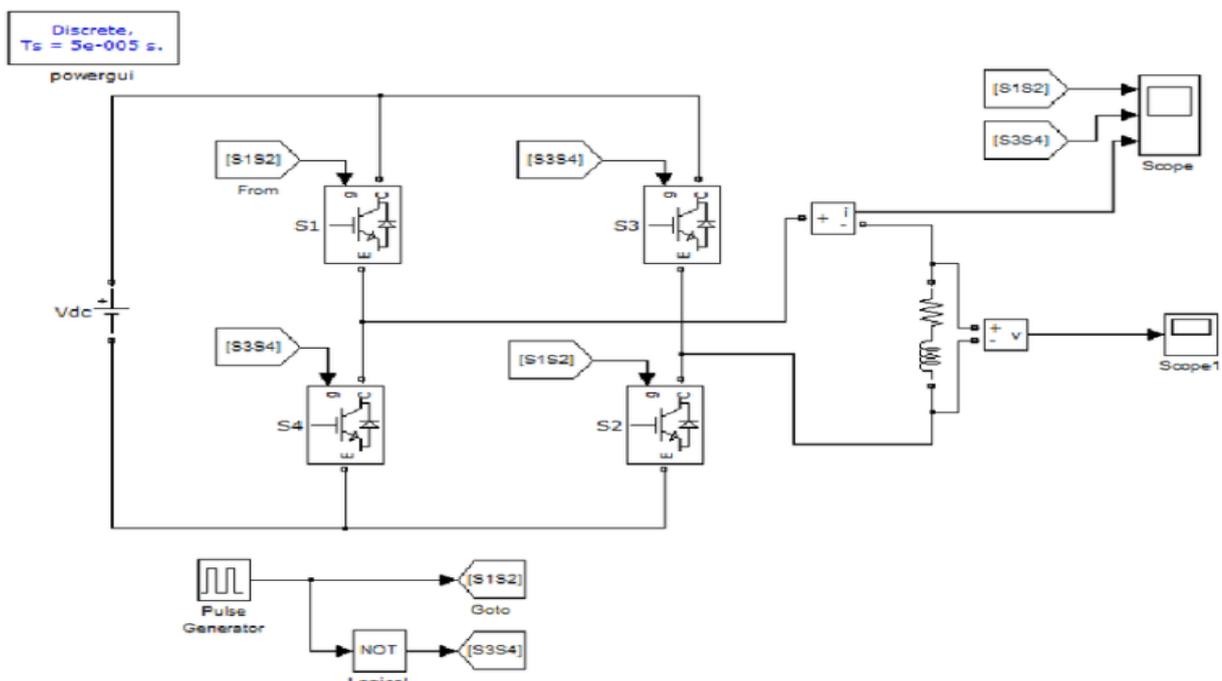
## EXPERIMENT- 7

7). Simulate a single phase SPWM inverter with 50V DC input with modulation indices of 0.5, 0.6 and 0.8. Connect a resistance of 25 ohms at the output of inverter. Use power MOSFET for inverter.

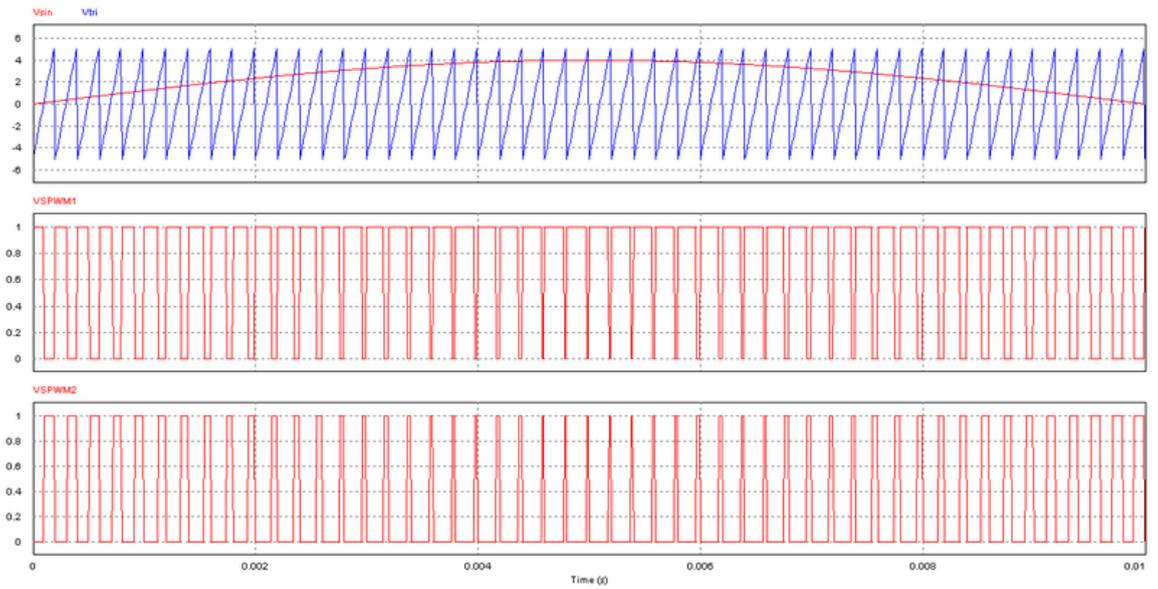
### Circuit Diagram:



### Design of single phase SPWM inverter using MOSFET for inverter:



**Output Waveform:**

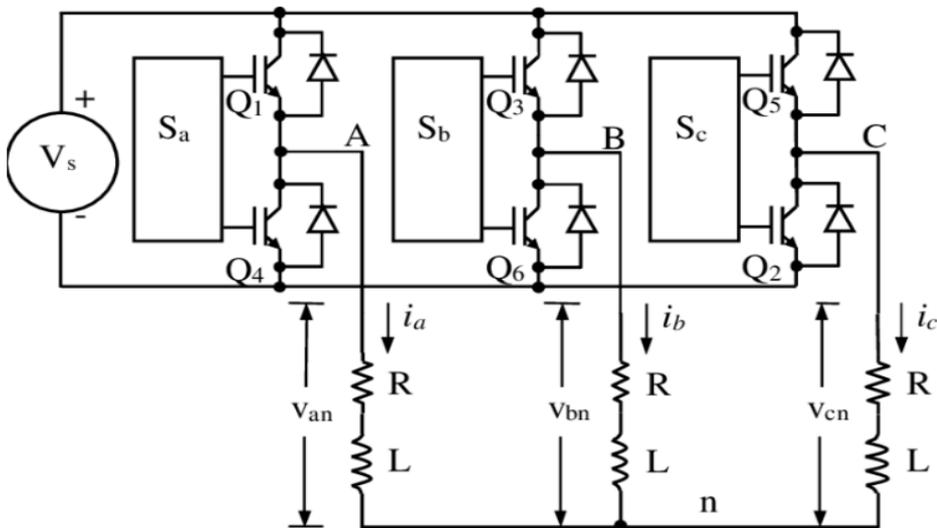


**CONCLUSION:**

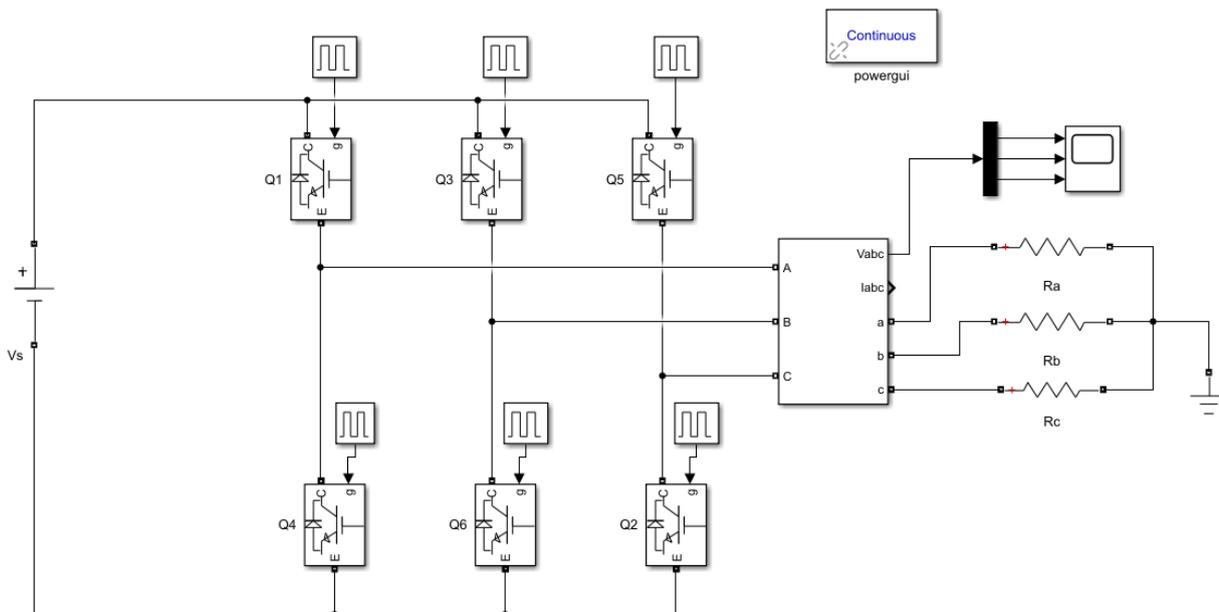
**EXPRIMENT NO:08**

8). Simulate a three phase inverter with 120 degree mode of conduction. Take input DC voltage of 100V and Three phase star connected balanced resistive load of 50 ohms each.

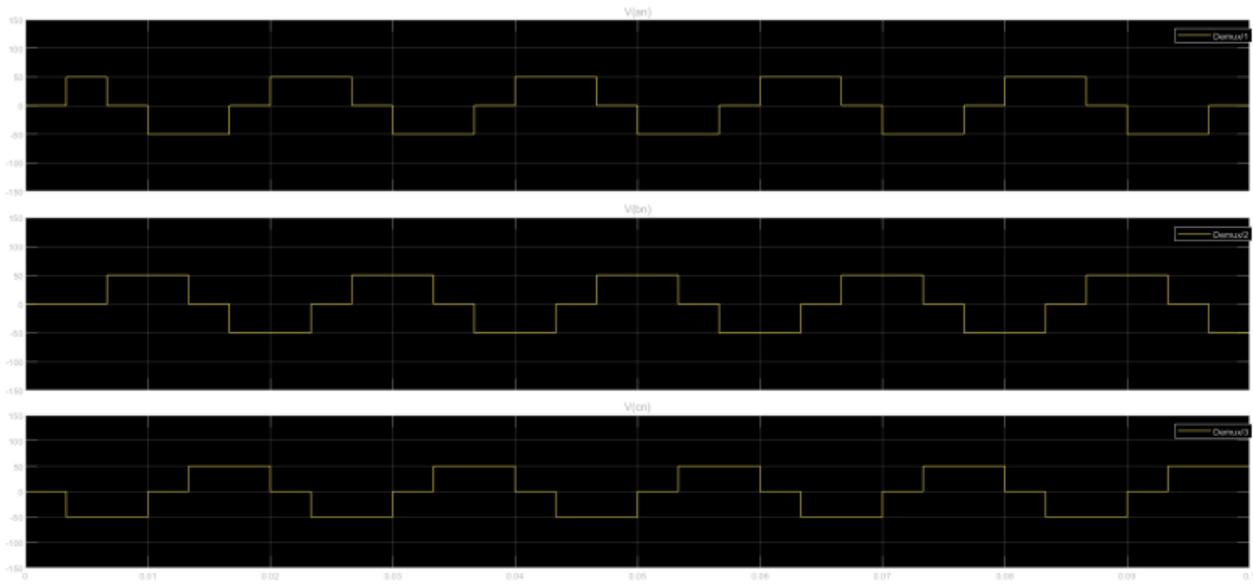
**Circuit Diagram:**



**Design of three phase converter:**



**Output Waveform:**

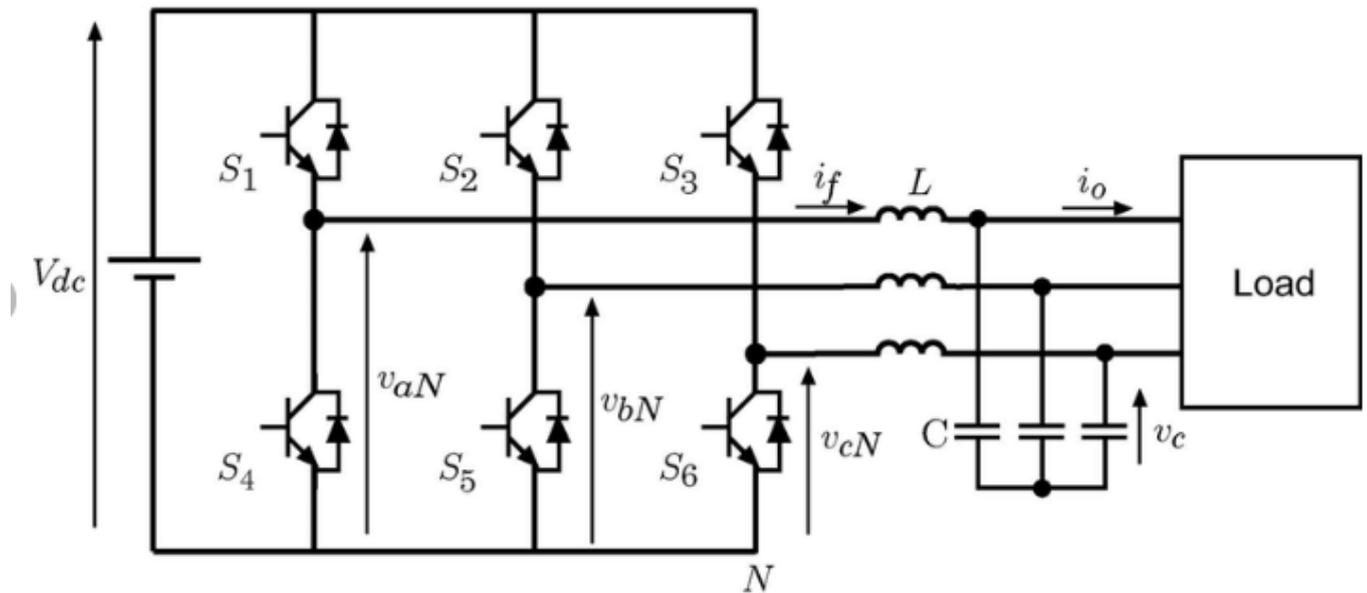


**CONCLUSION:**

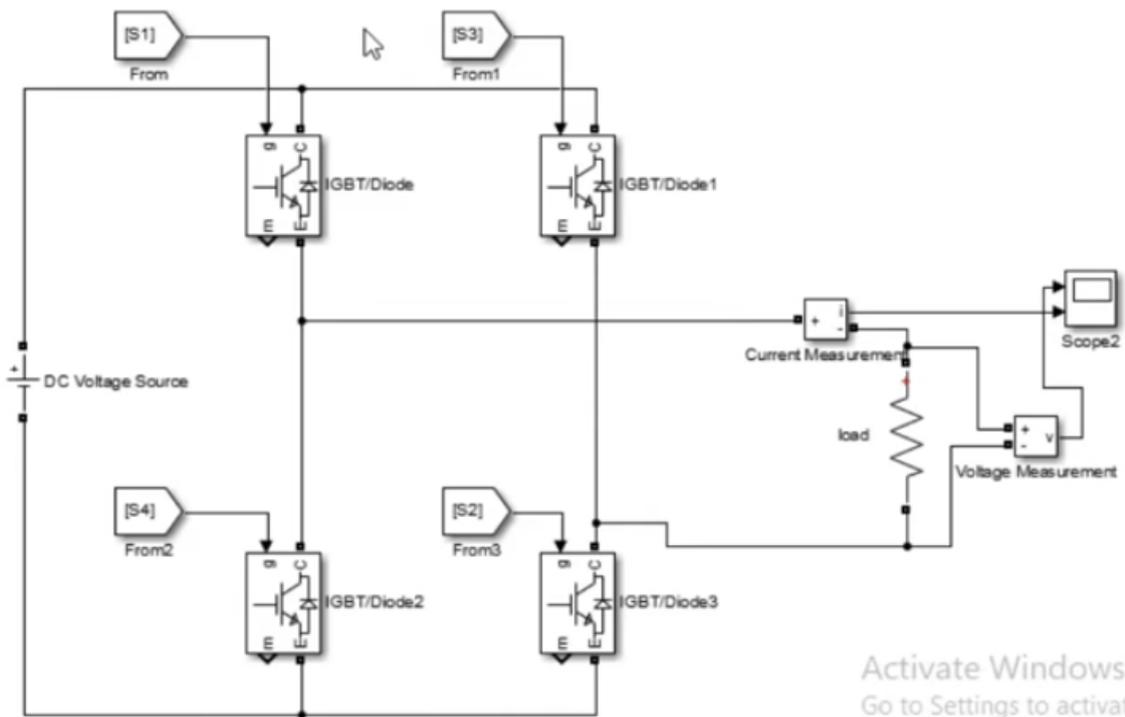
### EXPRIMENT NO:09

9). Connect suitable LC filter at the output to obtain a sinusoidal output with THD of less than 8 %.

Circuit Diagram:

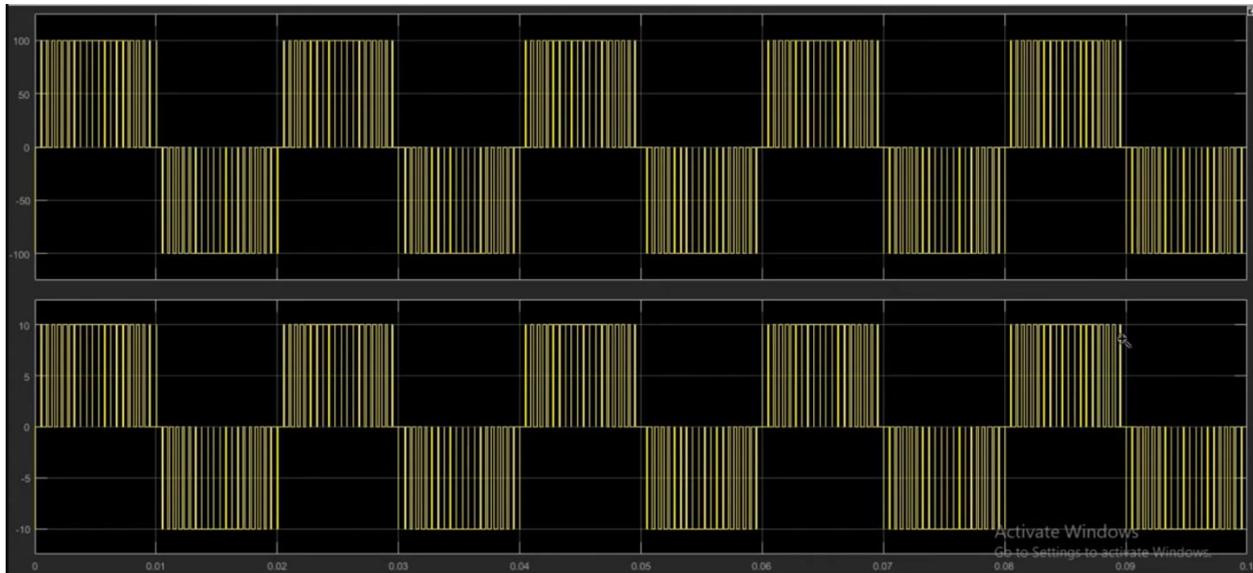


Design of LC filter with inverter at the output to obtain a sinusoidal output:



Activate Windows  
Go to Settings to activate Win

**Output Waveform:**

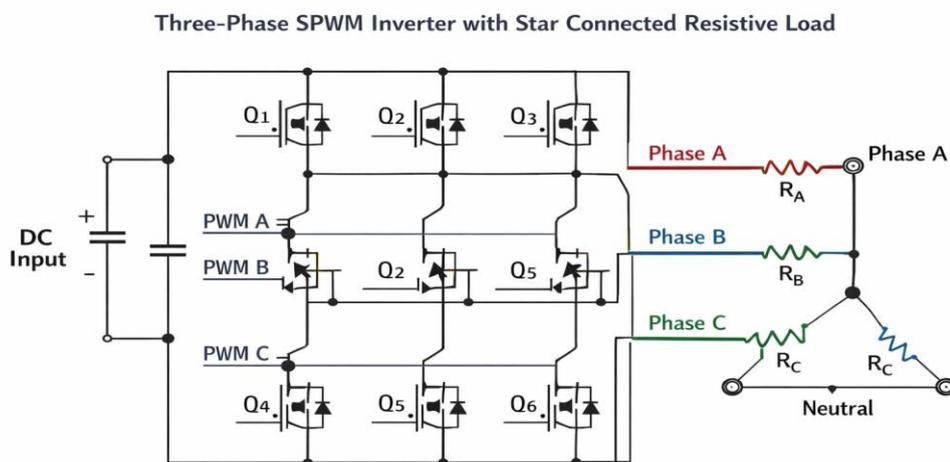


**CONCLUSION:**

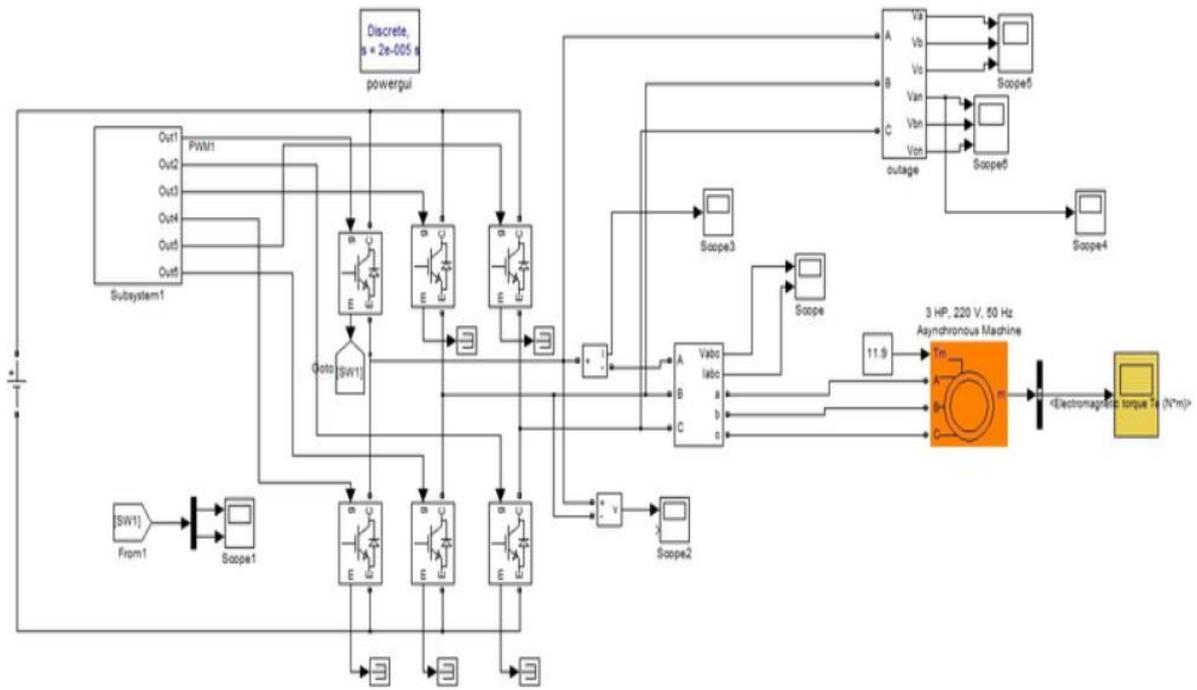
## EXPRIMENT NO:10

10). Simulate a three phase SPWM inverter with 50V DC input with modulation indices of 0.5, 0.6 and 0.8 connect a star connected resistances of 25 ohms each at the output of the inverter. Use power MOSFET for inverter.

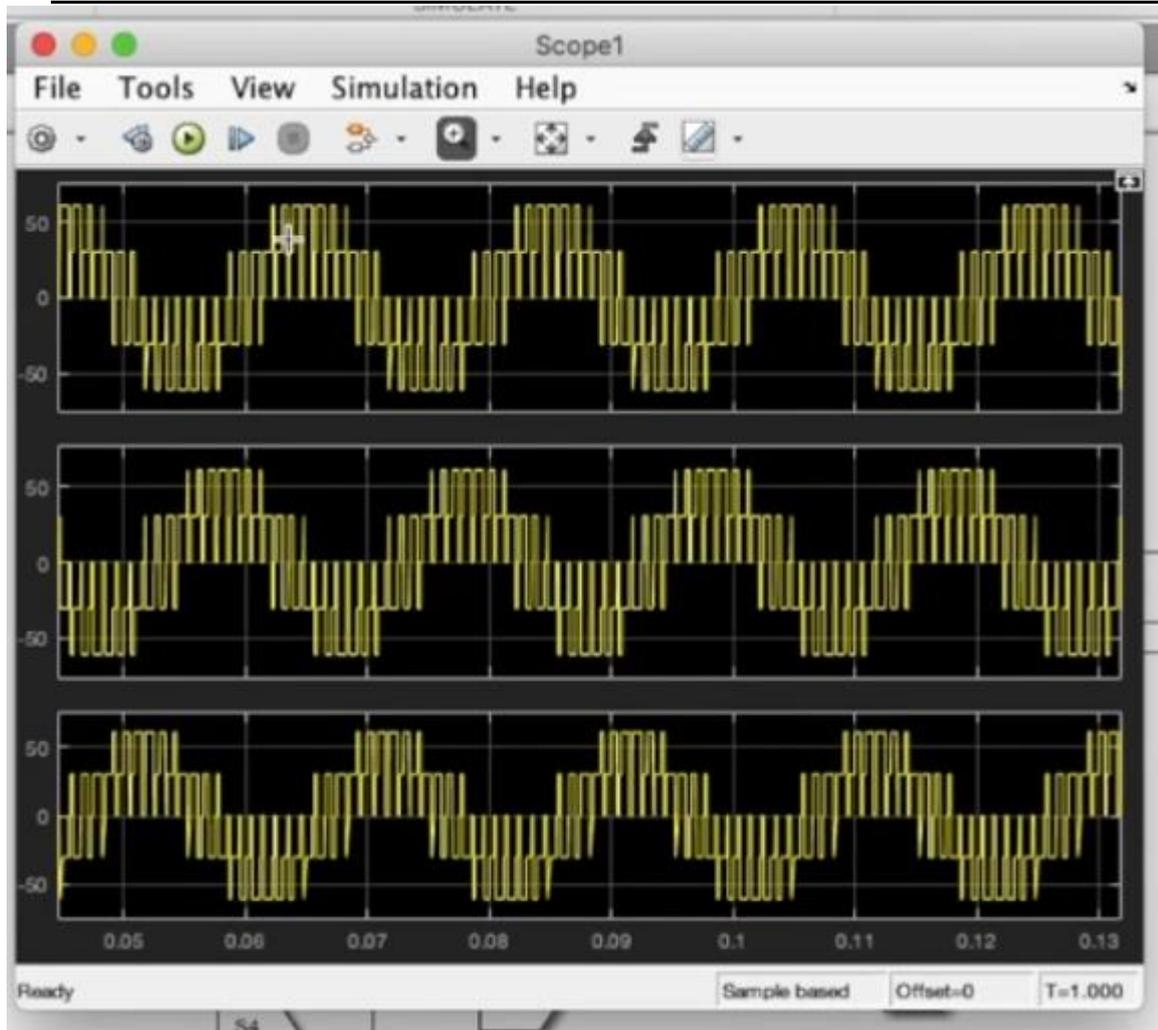
### Circuit Diagram:



### Design of 3 phase inverter :



Output Waveform:

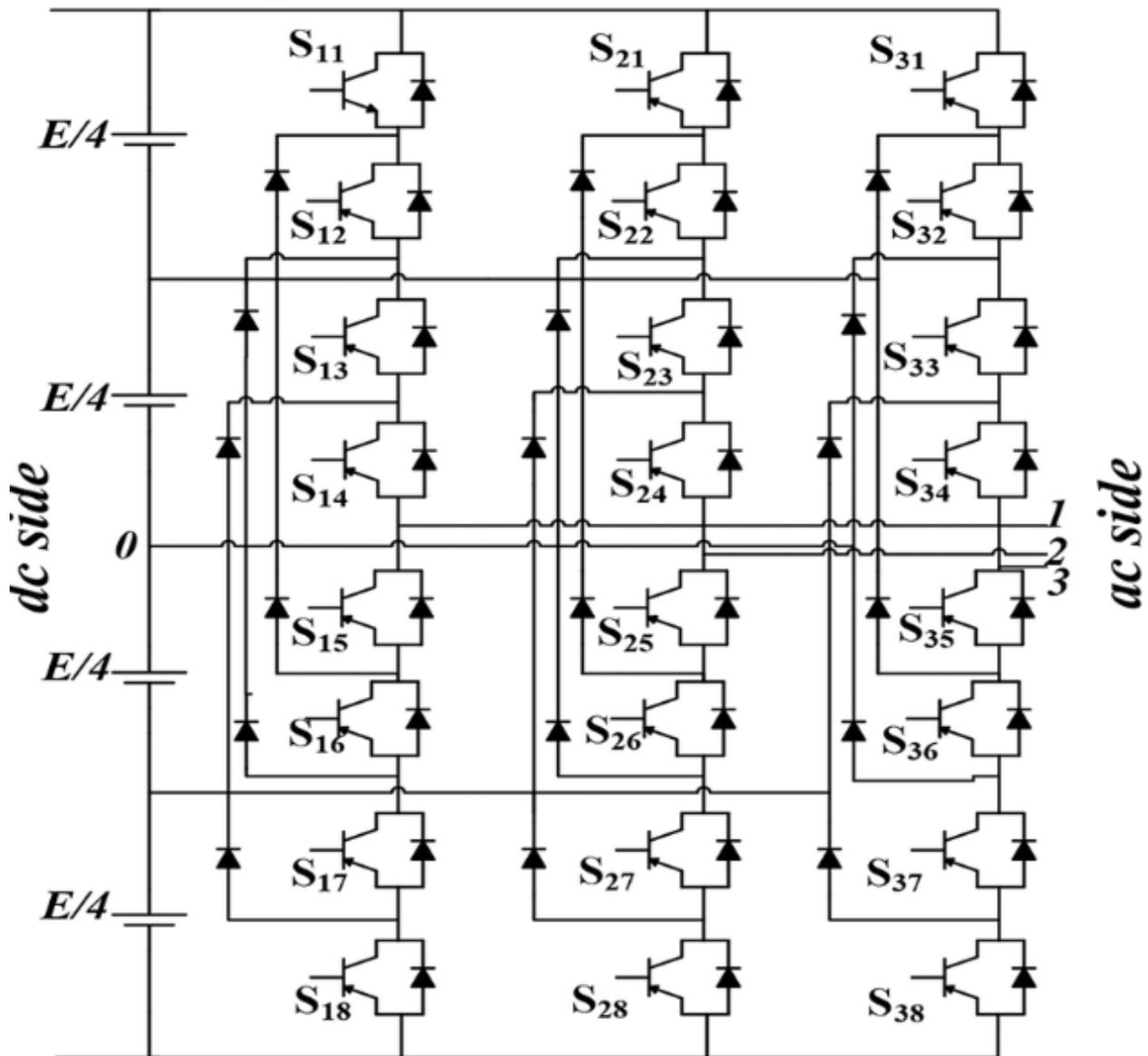


**CONCLUSION:**

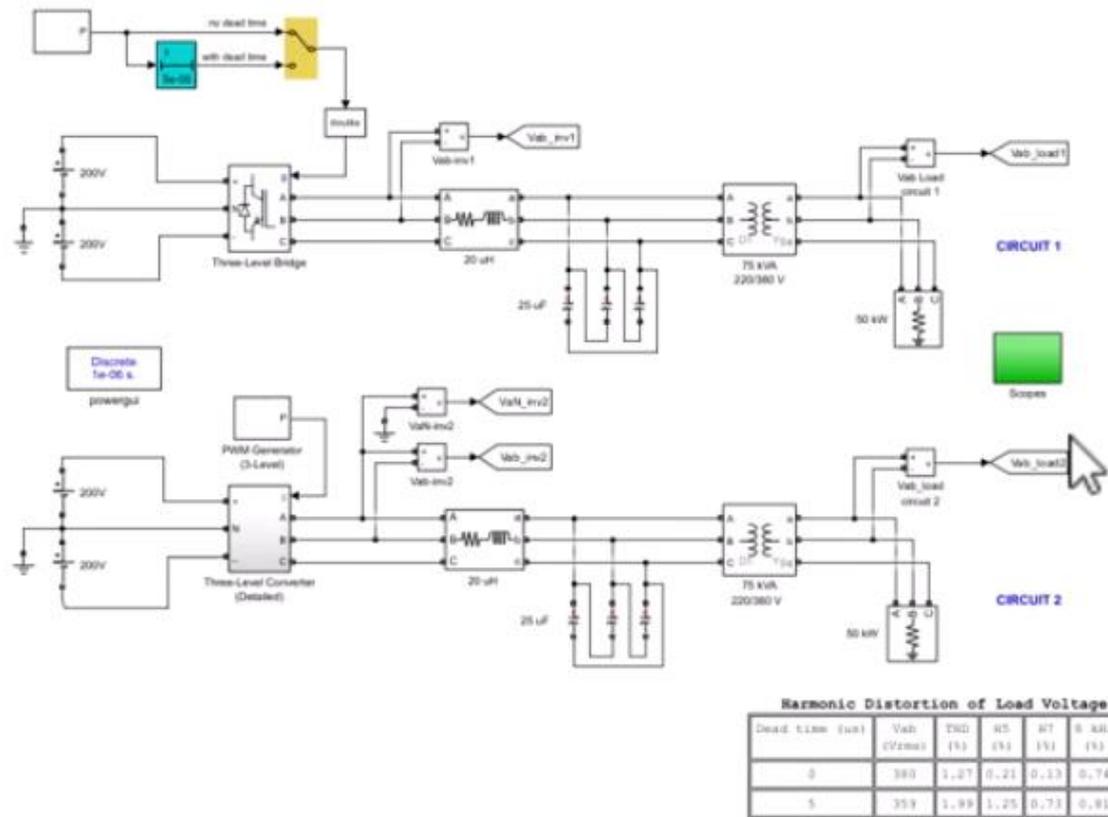
## **EXPRIMENT NO:11**

11). Simulate a three phase, 5 level, neutral point clamped (NPC) inverter. Input DC voltage is 100V. The inverter output is connected to a balanced 3 phase resistive load of 40 Ohms each.

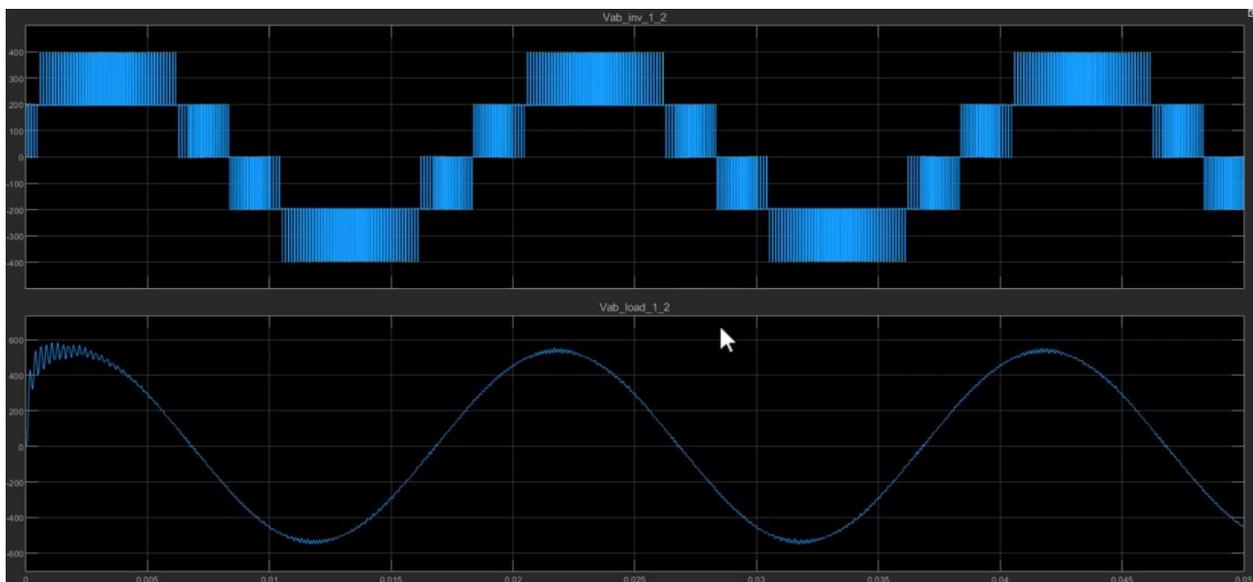
Circuit Diagram:

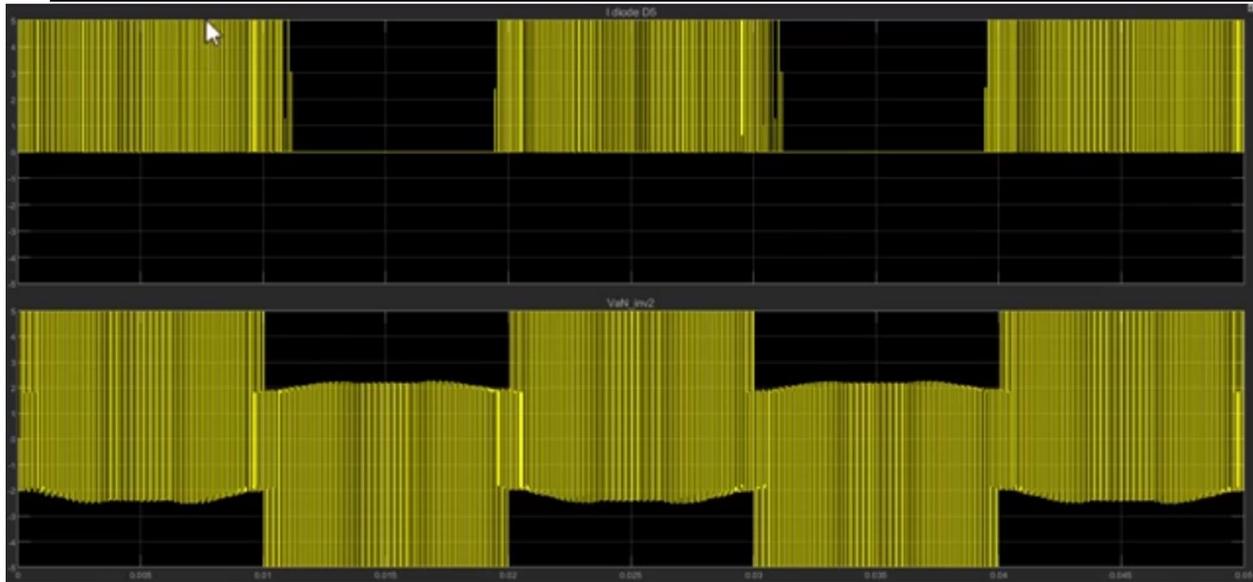


Design of a three phase, 5 level, neutral point clamped (NPC) inverter:



Output Waveform:

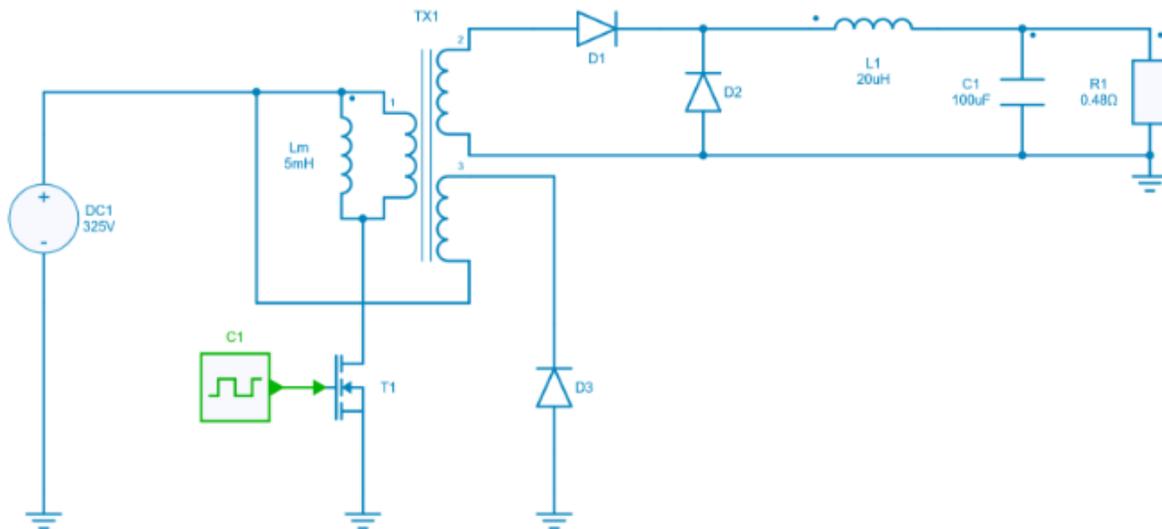
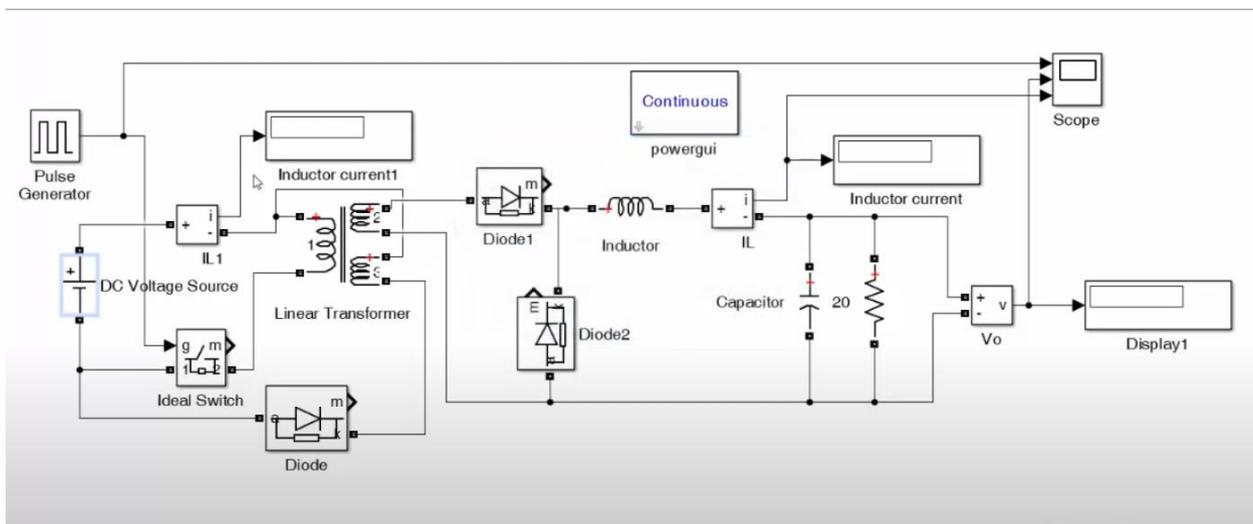


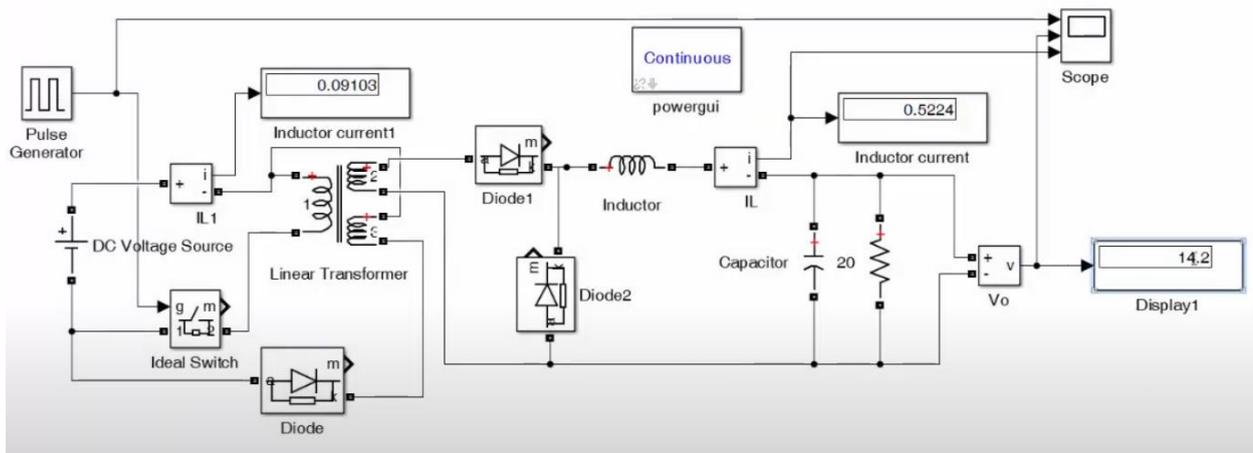


**CONCLUSION:**

**EXPRIMENT NO:12**

12). Simulate a forward converter with input DC voltage of 30 V. Take transformer ratio of 1.5:1. Observe the output voltages for duty cycles of 0.4, 0.6 and 0.8. Ensure that the output voltage ripple is less than 0.5 V. The load resistance is 10 Ohms.

**Circuit Diagram:****Design of a forward converter with input DC voltage:**

**Output Waveform:****CONCLUSION**





