VASAVI COLLEGE OF ENGINEERING

(AUTONOMOUS)

IBRAHIMBAGH, HYDERABAD-31

Department of Electrical and Electronics Engineering

Simulation of Power Electronics using PSIM

AC-DC CONVERTERS

Uncontrolled rectifier

- Half wave with R load
- Centre tapped full wave rectifier
- Bridge rectifier with R load
- Bridge rectifier with RL load
- Bridge rectifier with RE load
- Bridge rectifier with RLE load with discontinuous conduction
- Bridge rectifier with RLE load with continuous conduction
- Bridge rectifier with RL load with free wheeling diode
- Bridge rectifier with RLE load with free wheeling diode

Controlled rectifier

- Controlled rectifier with RL load
- Controlled rectifier with RL load with free wheeling diode

Three pulse rectifier

Six pulse rectifier

12 pulse rectifier

DC-DC CONVERTERS

- Boost converter
- Buck converter
- Buck-Boost converter

DC-AC CONVERTERS

- Single phase converter
- Three phase converter

AC-AC CONVERTERS

- Cycloconverter

Electronic circuits

Clippers

- Above reference
- Below reference

- Above and below reference

Clampers

- Negative clampers
- Positive clampers

Multiplier circuit

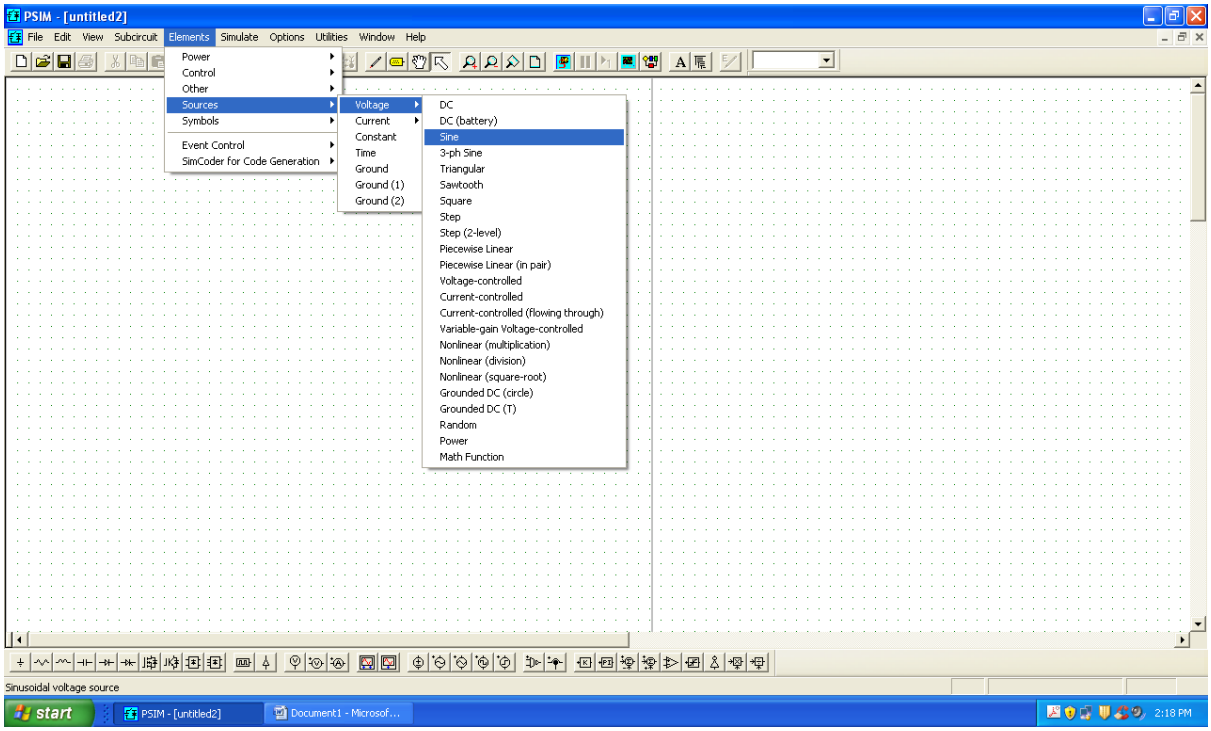
Integrator

differentiator

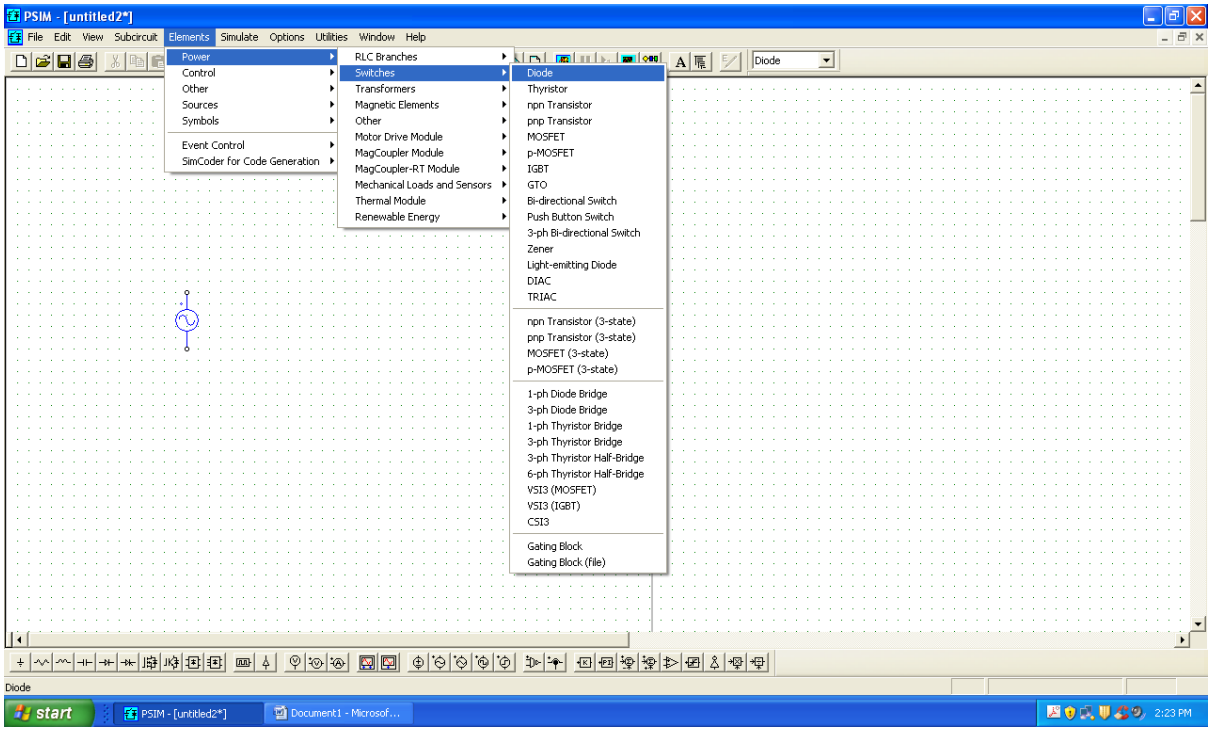
HALF WAVE RECTIFIER

Selecting the elements:

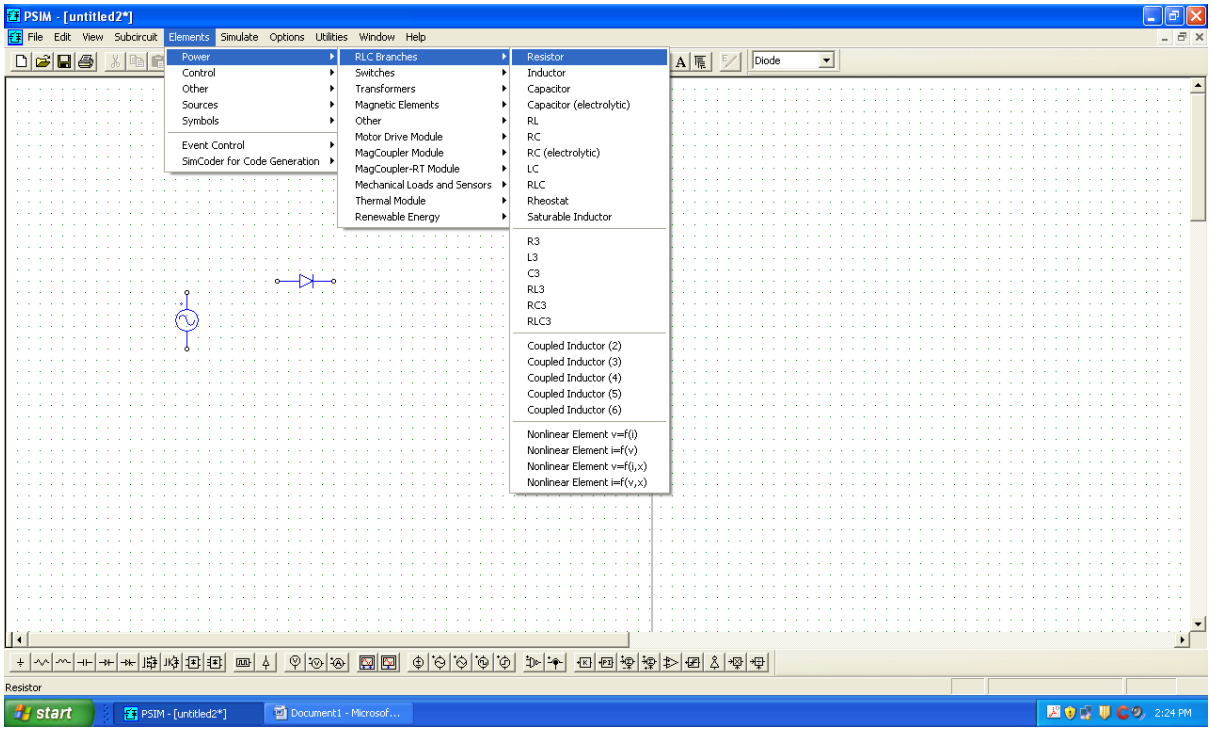
1) How to select AC Source:



2) Diode:

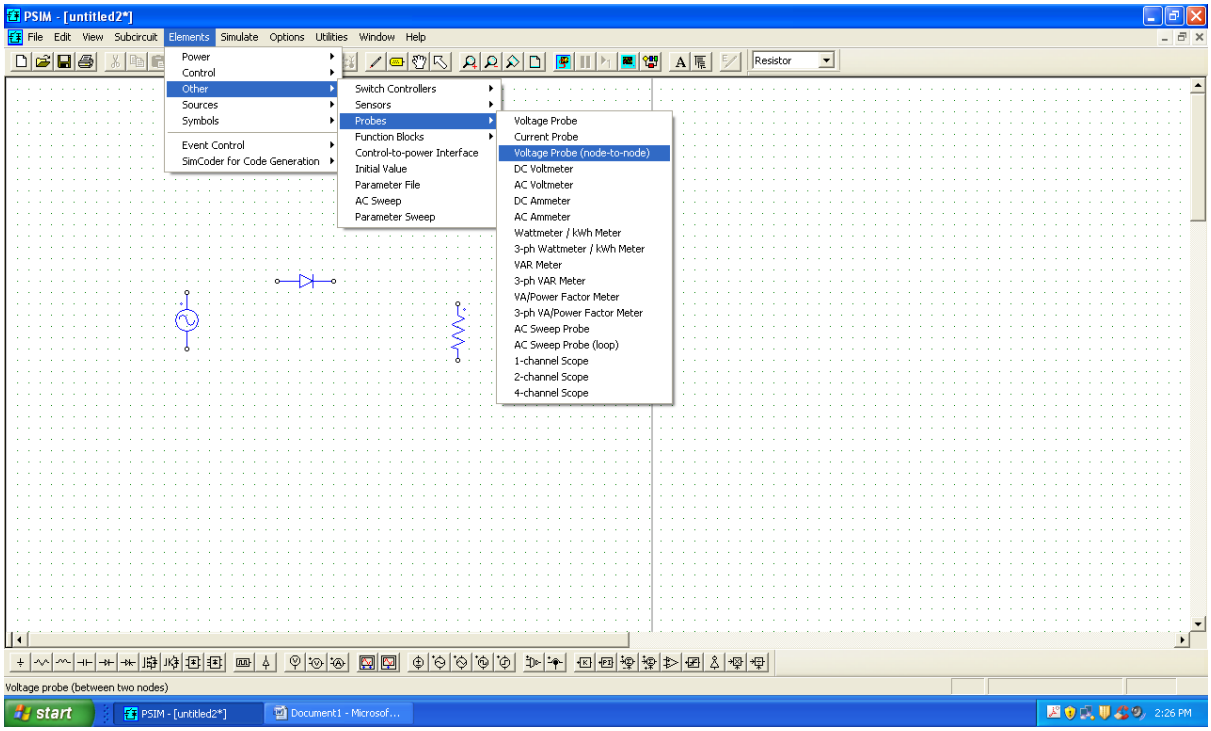


3) Resistor:

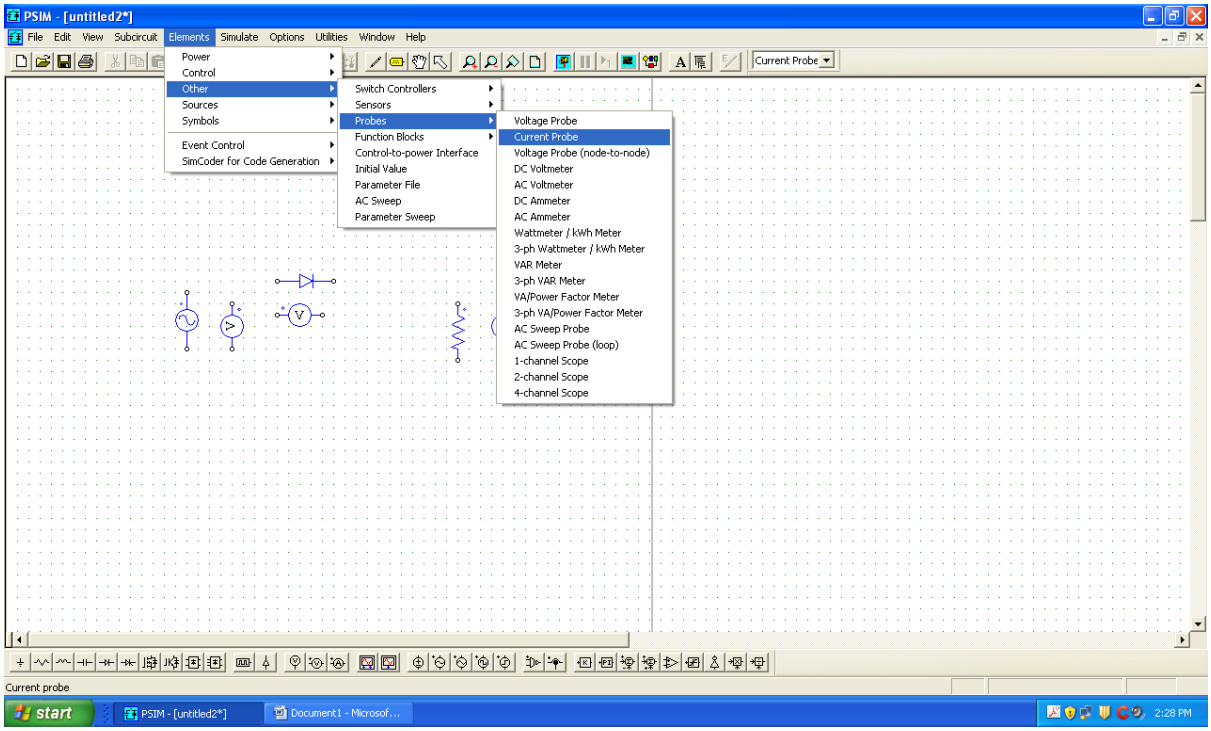


Hint: To rotate the element click right button of the mouse after selecting the element.

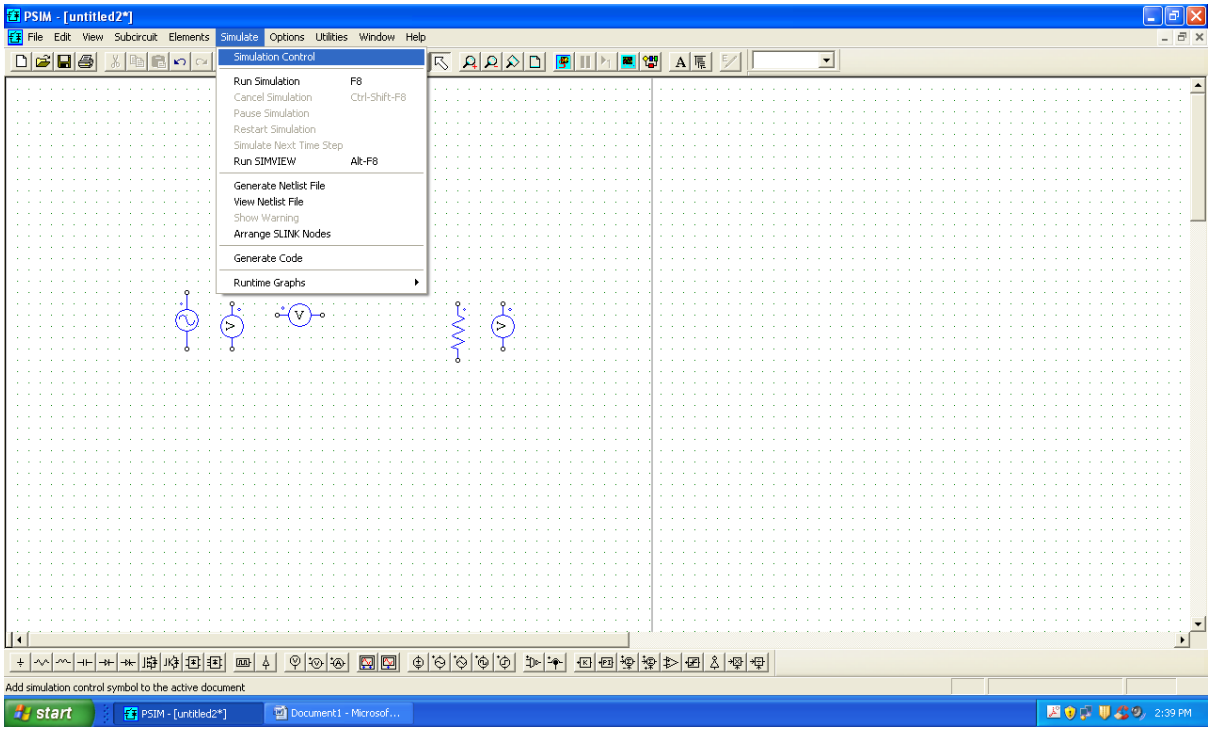
4) Voltmeter:



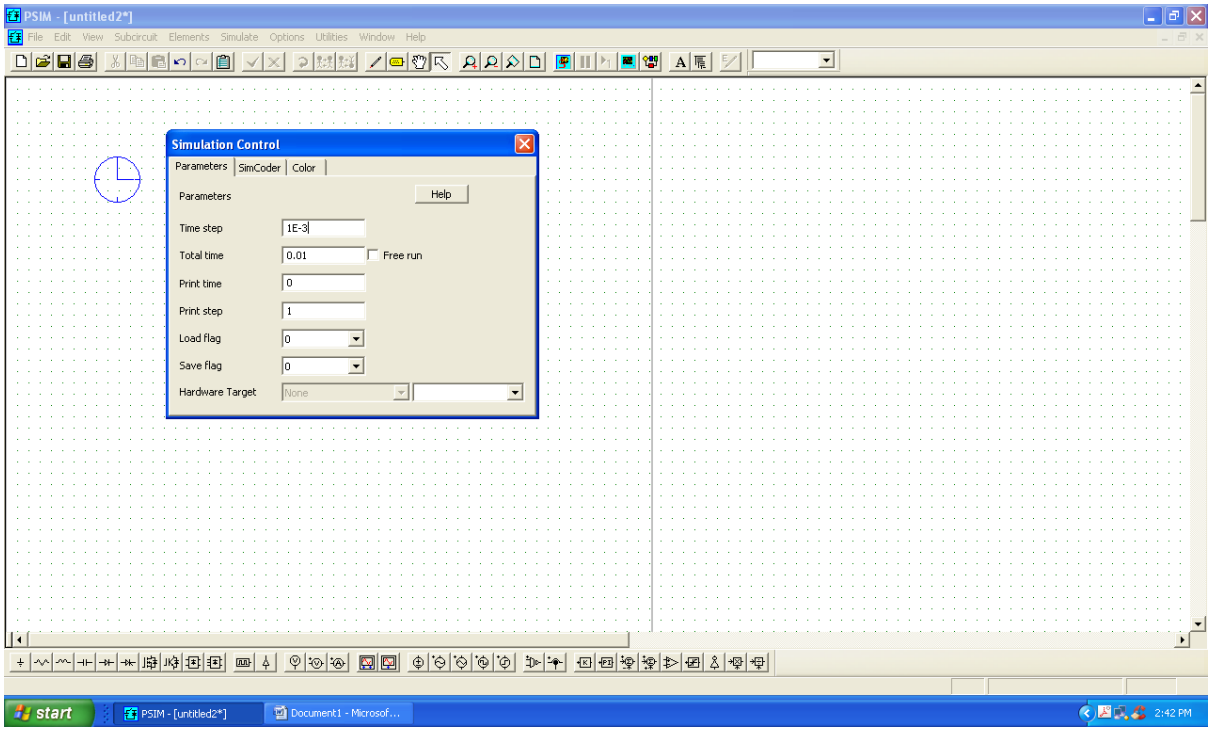
5) Ammeter:



6) Simulation Control:

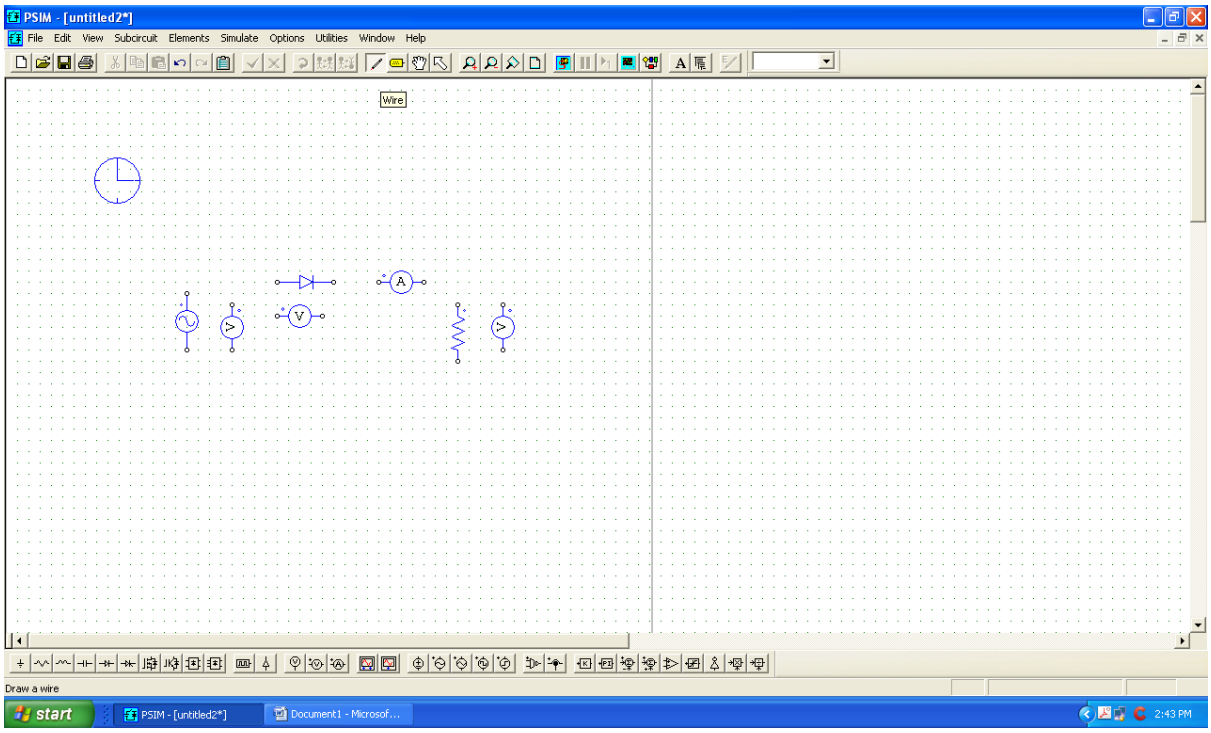


Simulation Controller Settings:

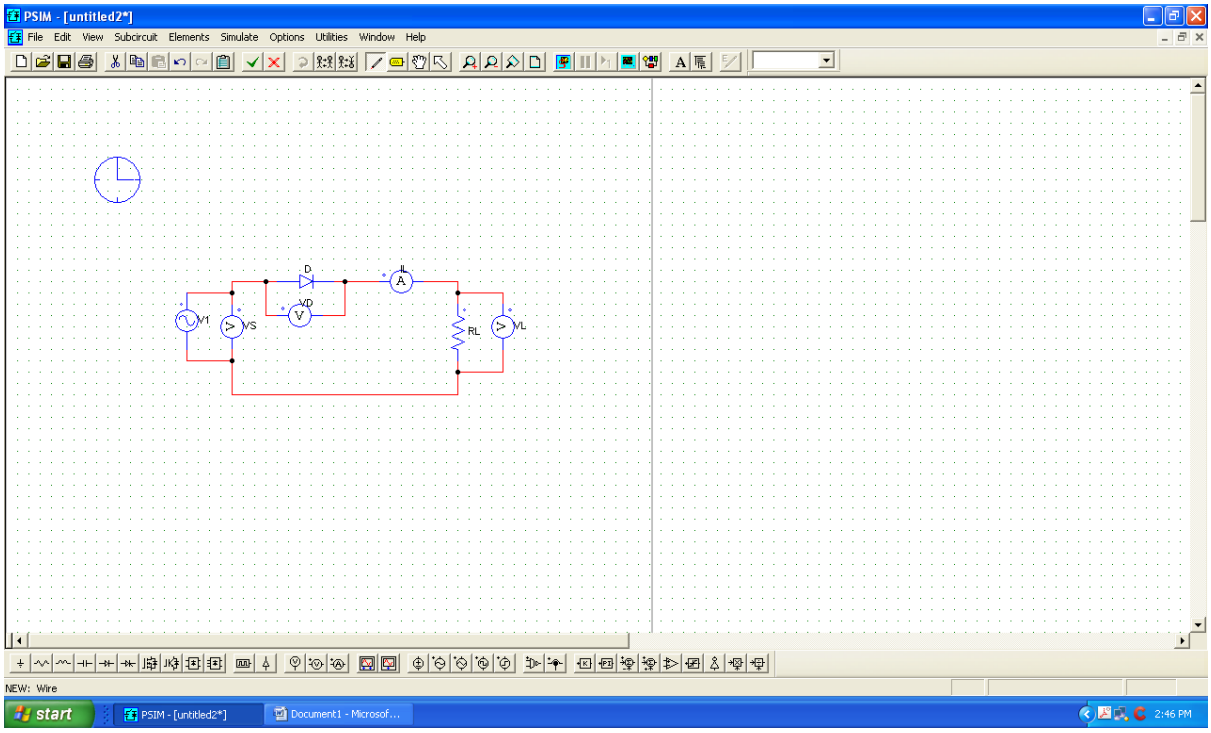


Connecting the elements:

Select the wire tool from the tool bar as shown:

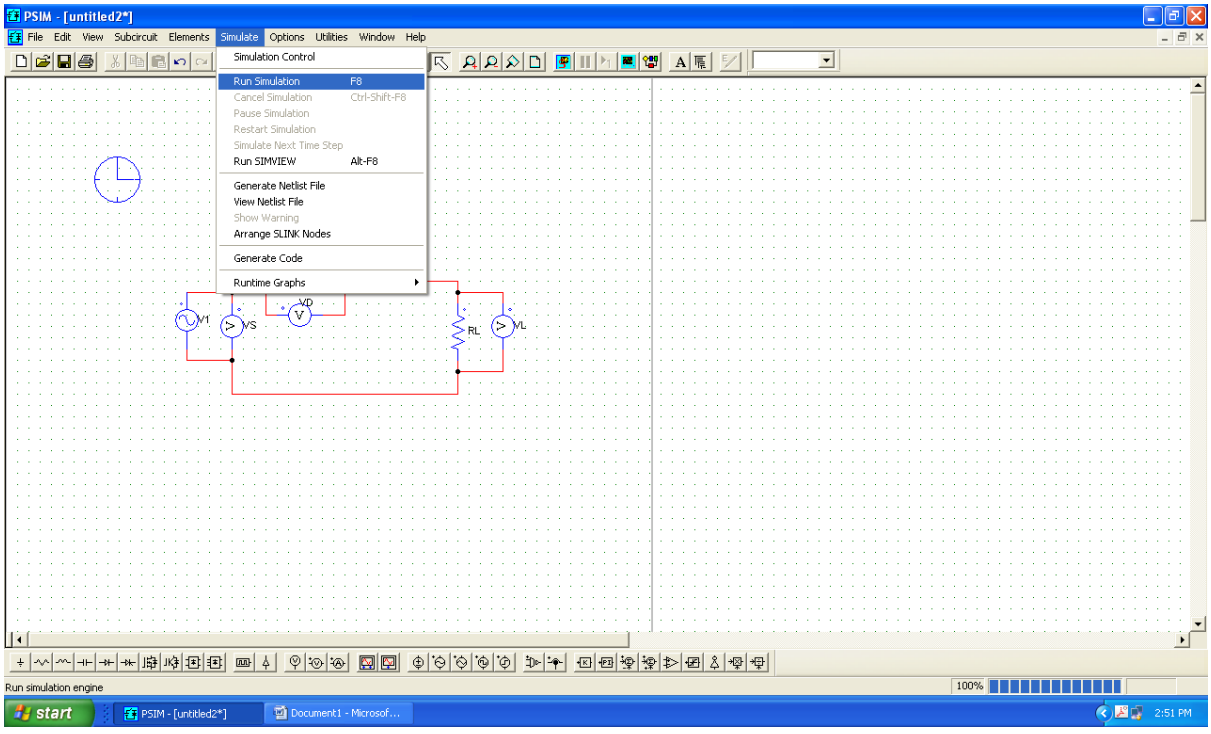


Connect the elements using the wire tool selected from the tool bar.

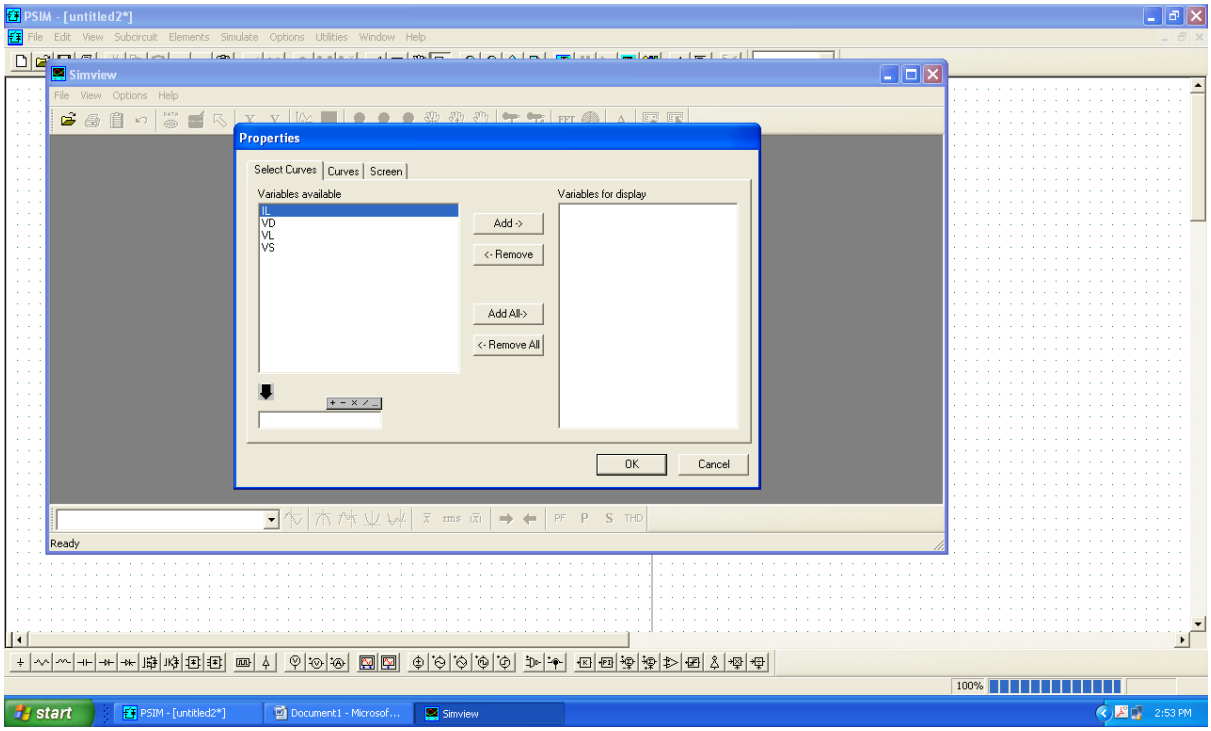


How to run simulation:

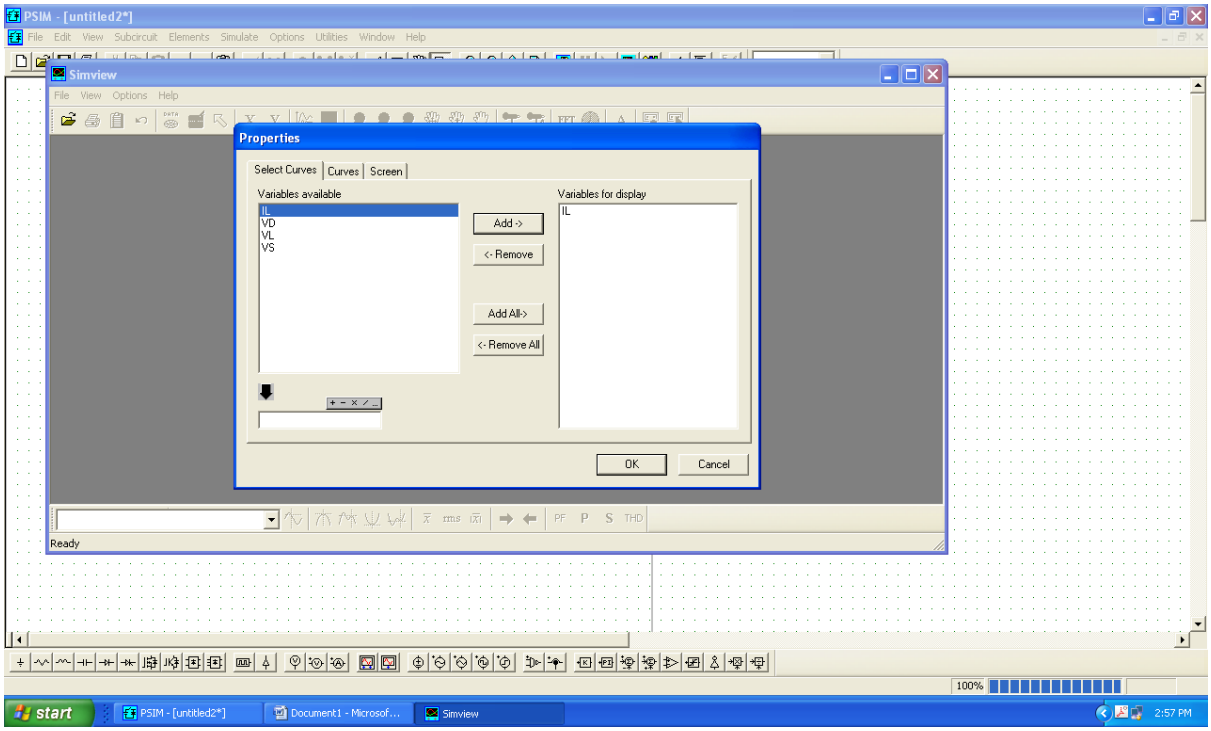
Select the Run Simulation:



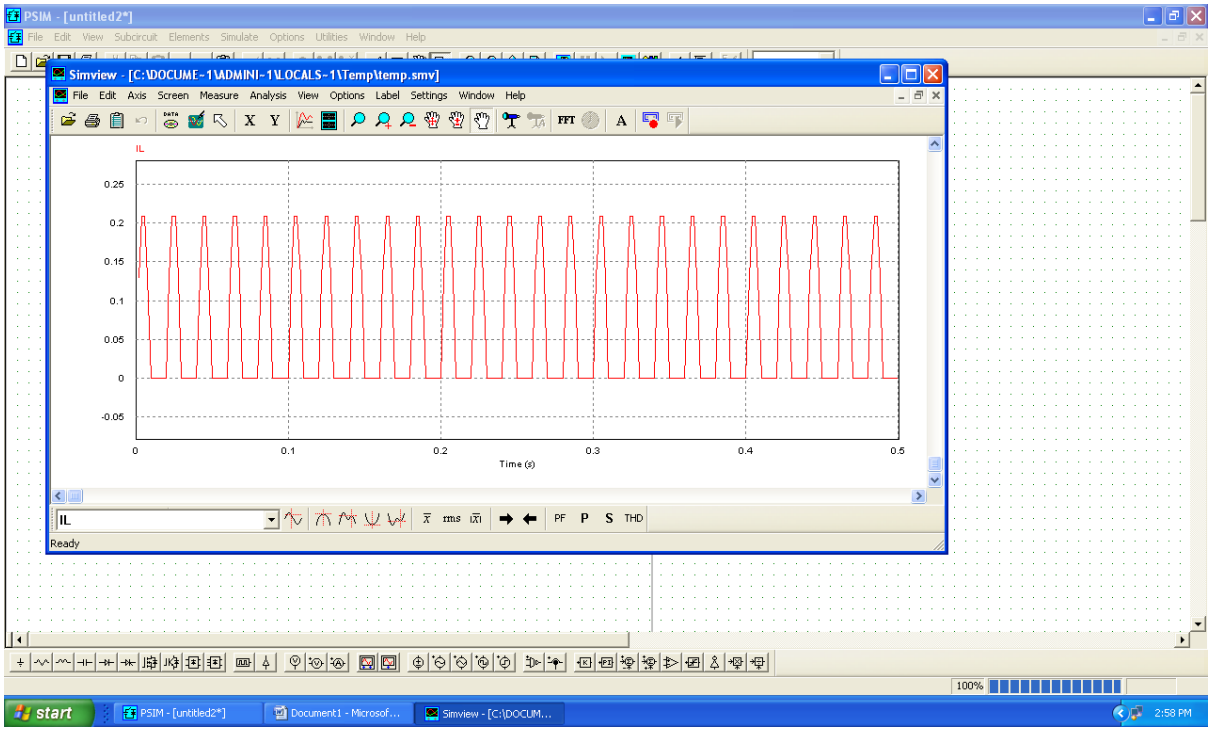
Adding the Variables to SimView for analyzing the waveforms:



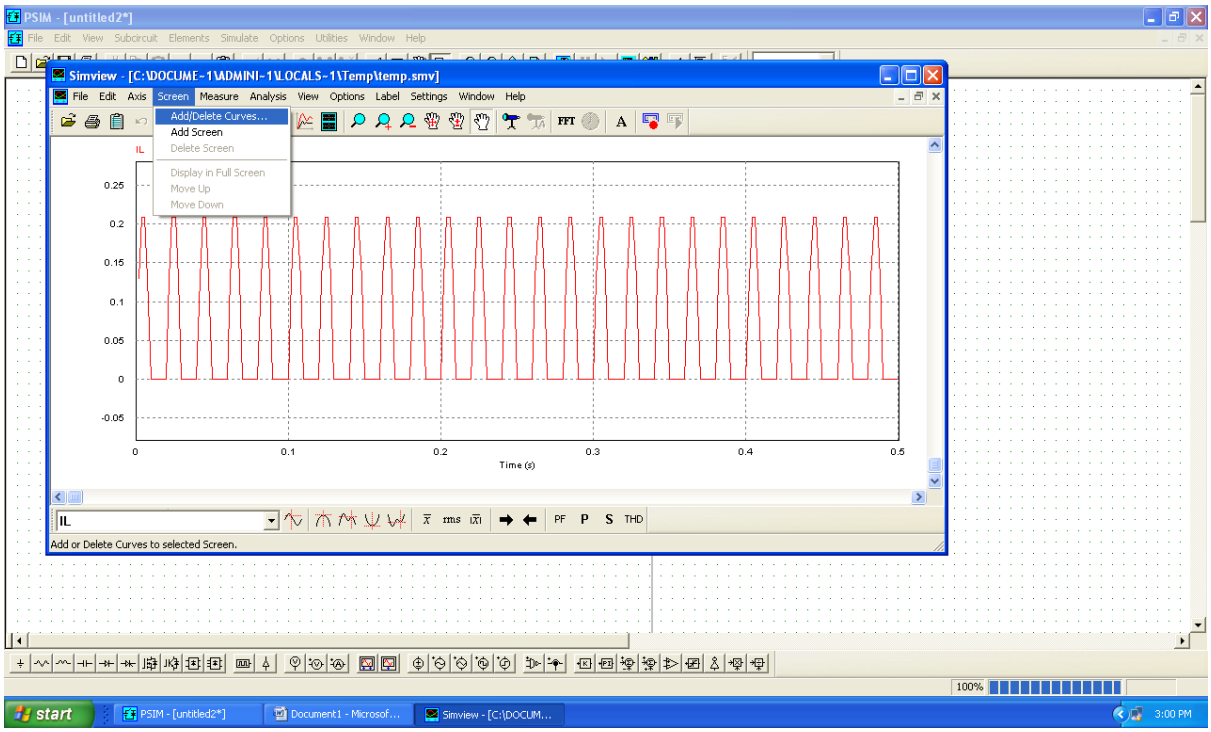
Select the variables and click on “Add” to add the variables.

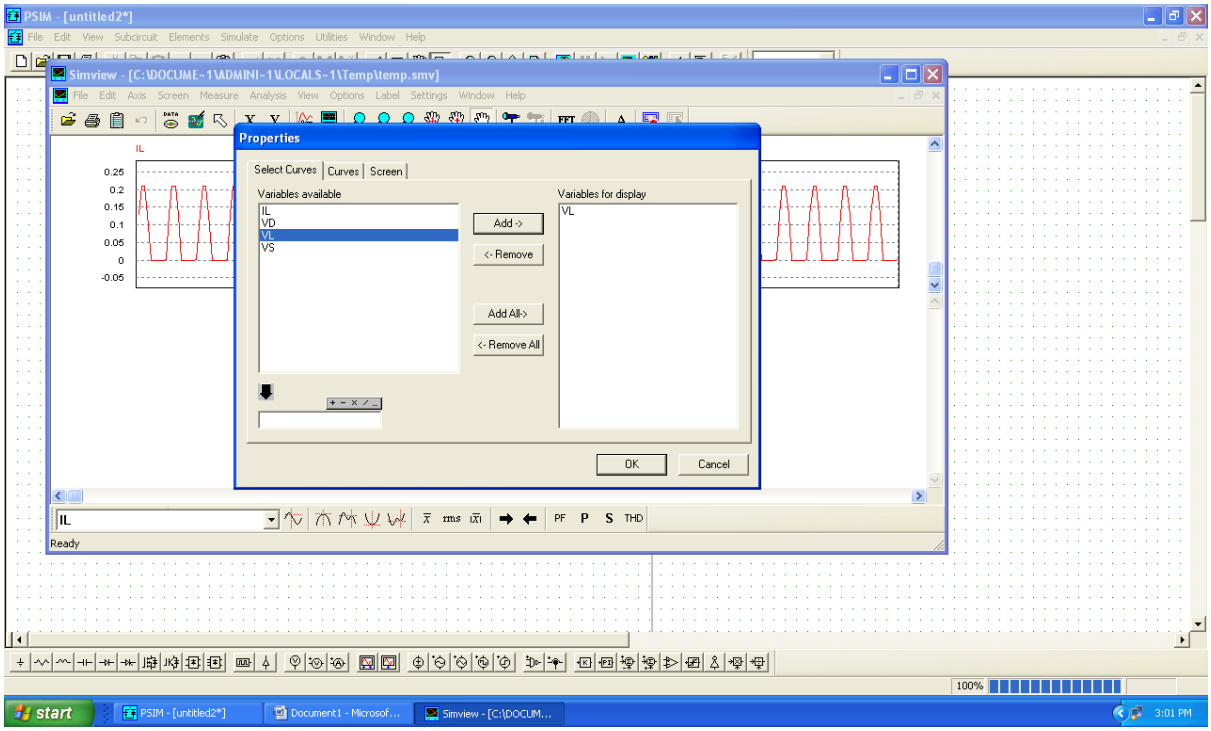


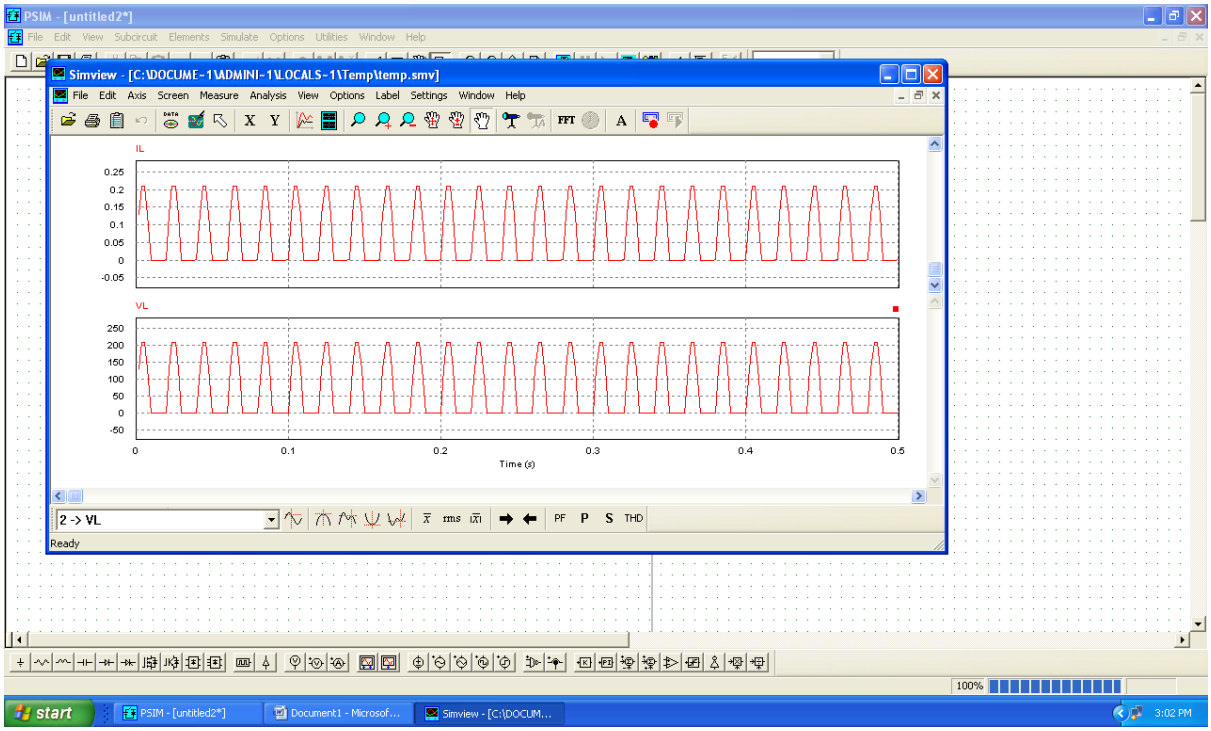
After selecting the variables click on “OK” to get waveforms.



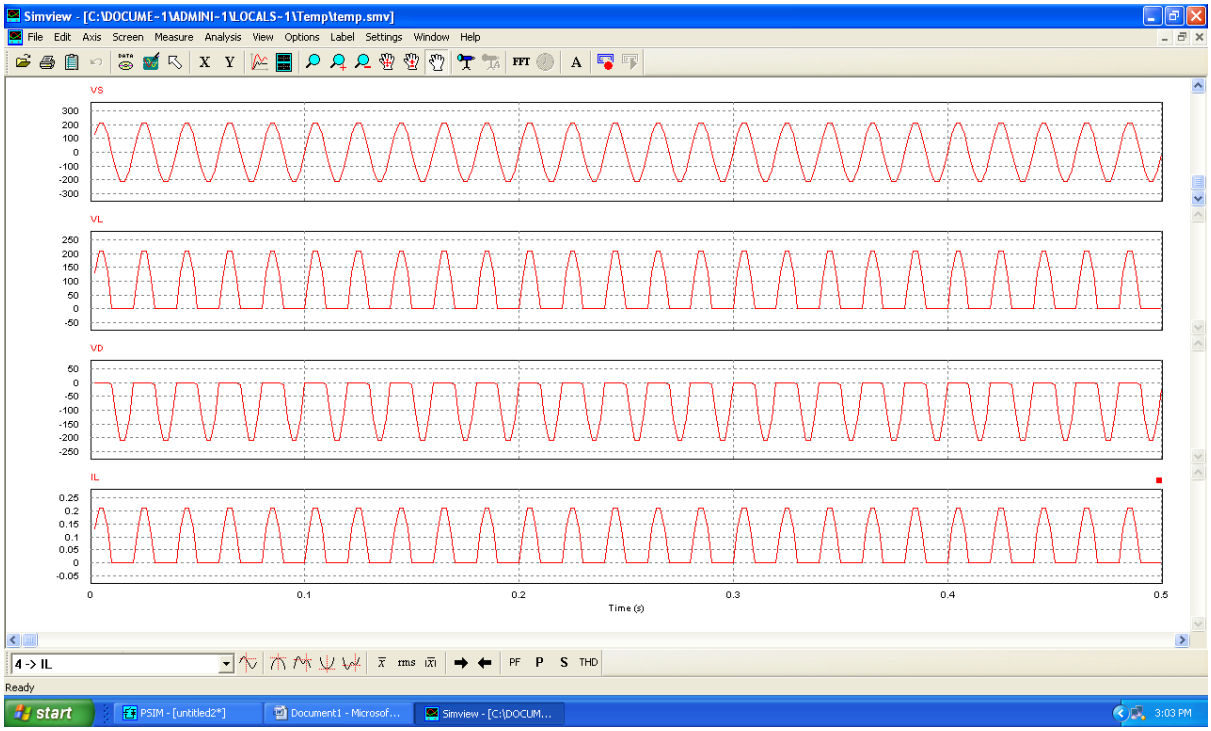
To add another variable to SimView:




PSIM - [untitled2*]
Simview - [C:\DOCUME~1\ADMINI~1\LOCALS~1\Temp\temp.smv]
Properties
Select Curves
Curves
Screen
Variables available
IL
VD
VL
VS
Add ->
<- Remove
Add All->
<- Remove All
Variables for display
VL
OK
Cancel
Ready


PSIM - [untitled2*]
Simview - [C:\DOCUME~1\ADMINI~1\LOCALS~1\Temp\temp.smv]
IL
VL
Time (s)
2 -> VL
Ready

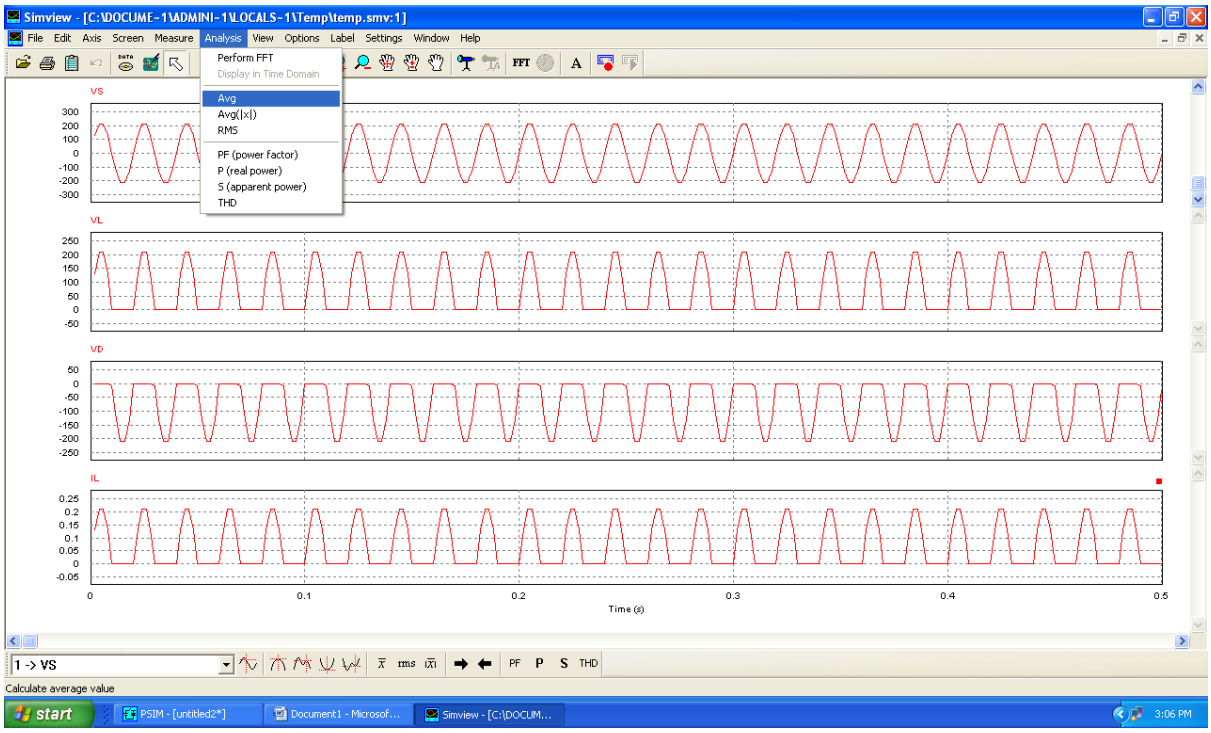
Similarly add all the required variables to analyze the waveforms.



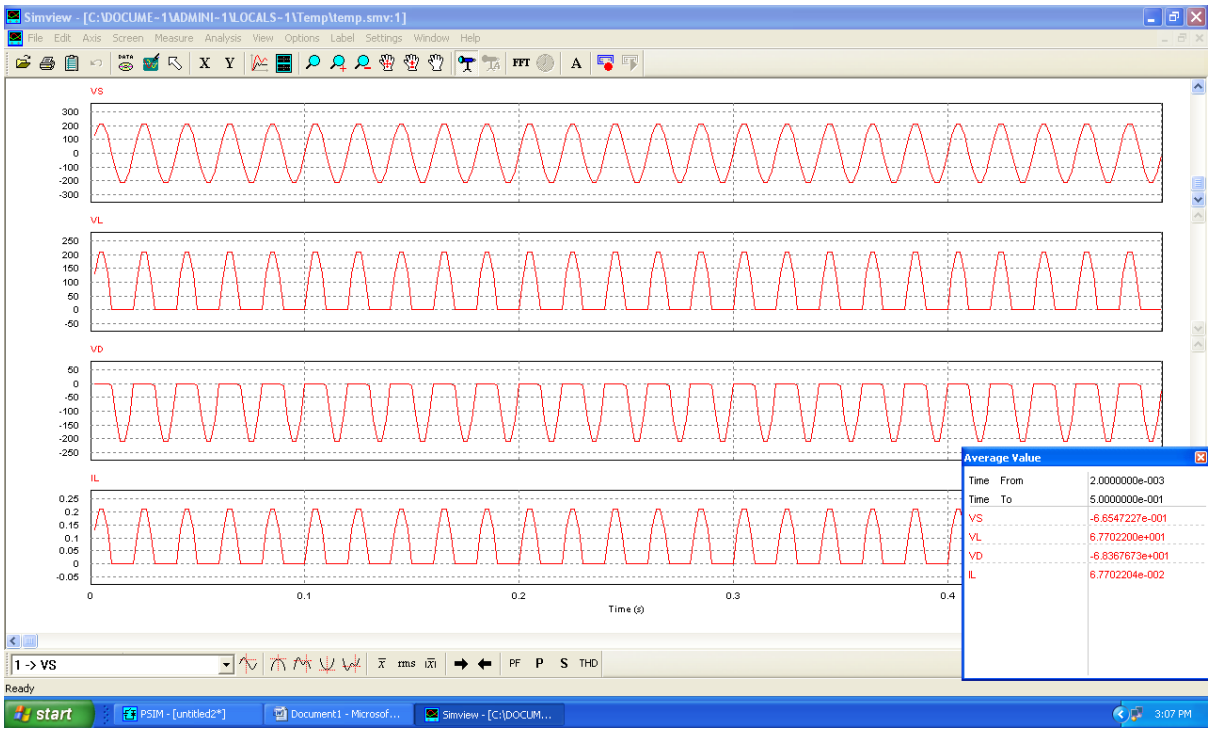
Analysis of waveform by using SimView:

Calculation of Average value:

Select “Avg” from “Analysis” icon on task bar.

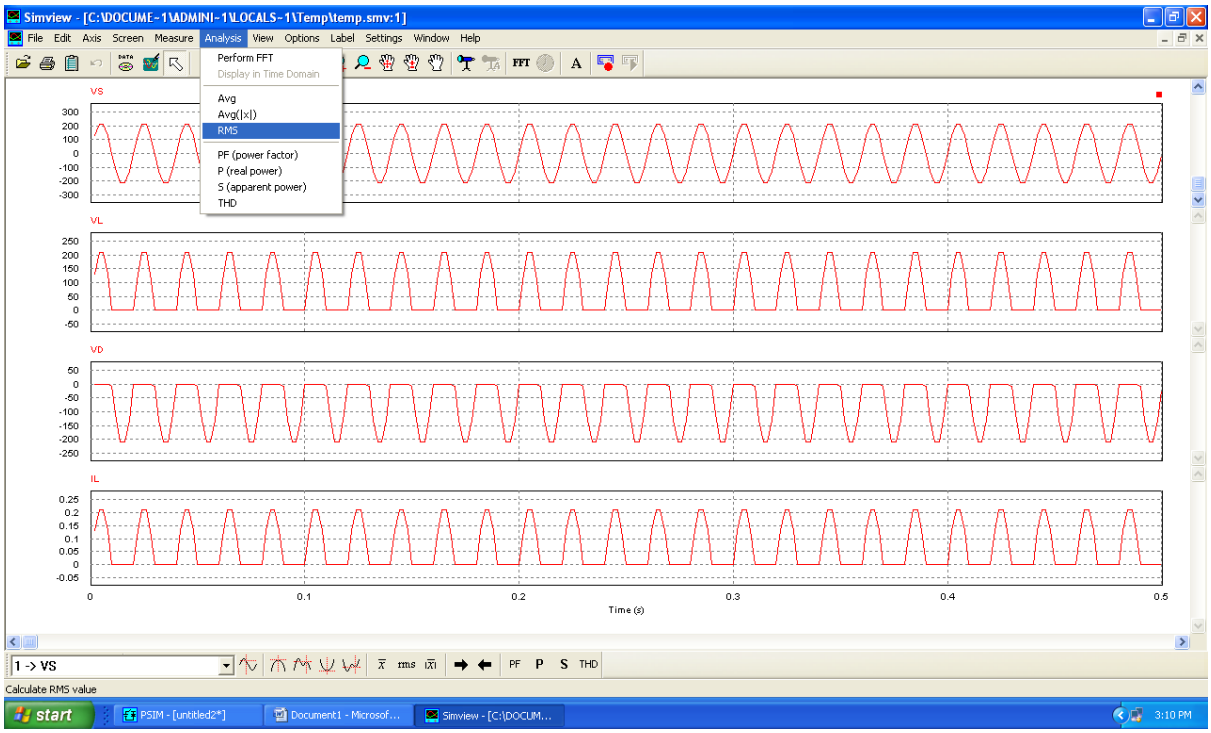


On the right bottom of the screen we can observe the average values of according to their lables.

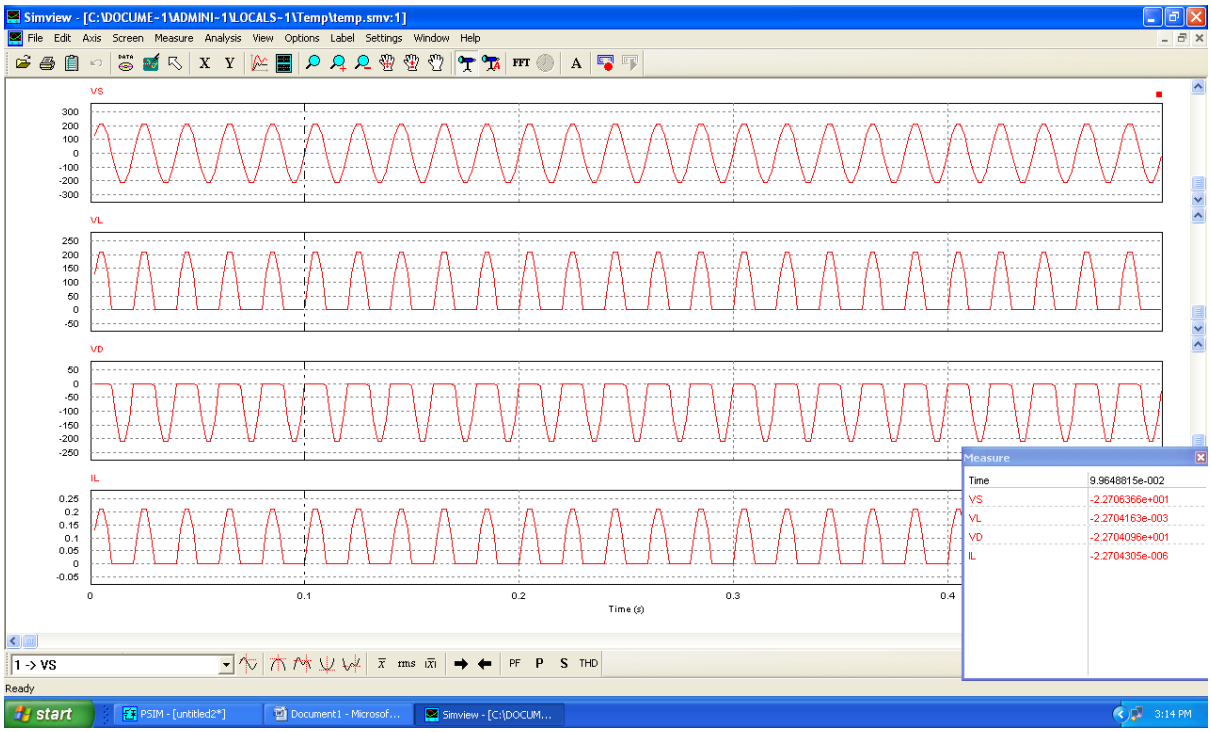


Calculation of RMS value:

Select “RMS” from “Analysis” icon on task bar.

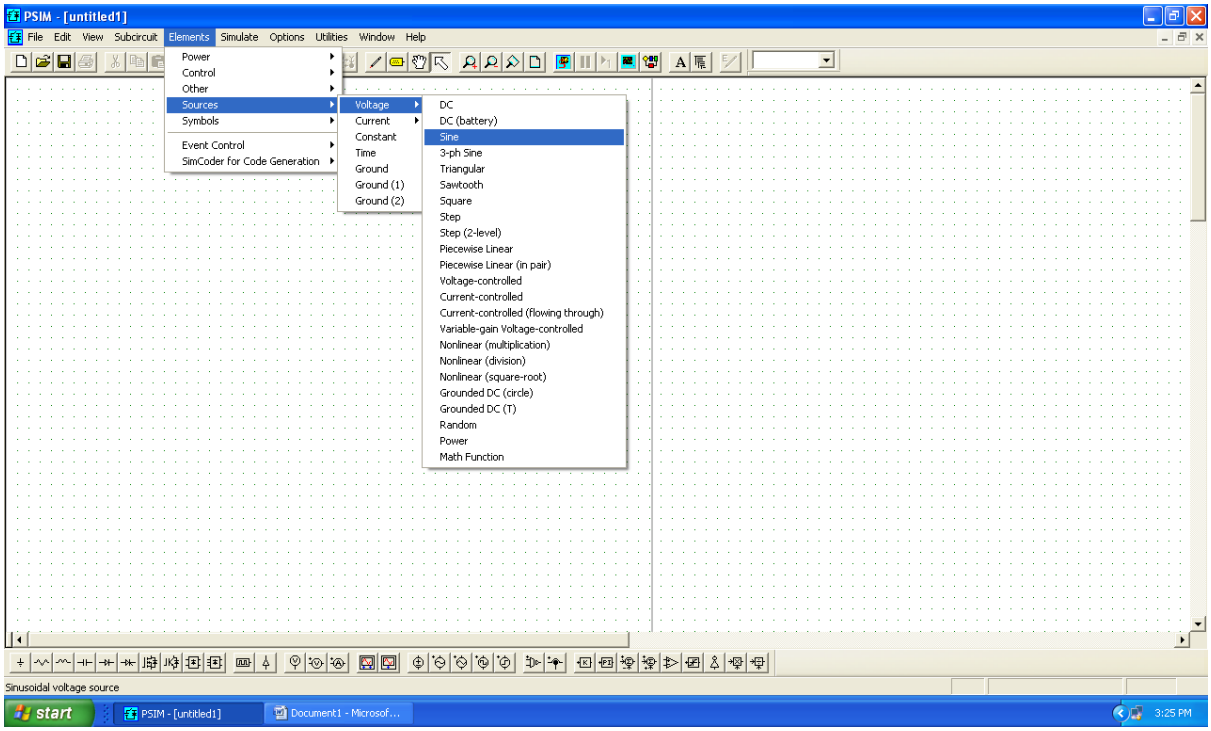


On the right bottom of the screen we can observe the average values of according to their lables.

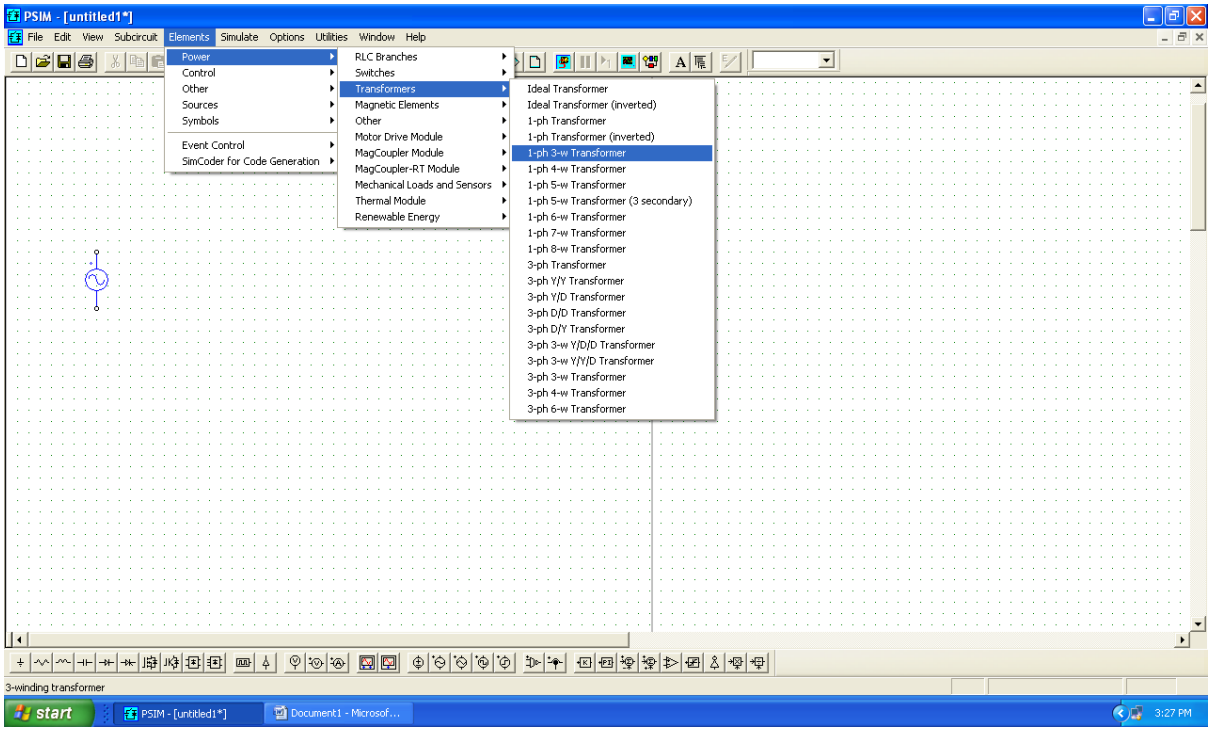


CENTER TAPPED FULL WAVE RECTIFIER

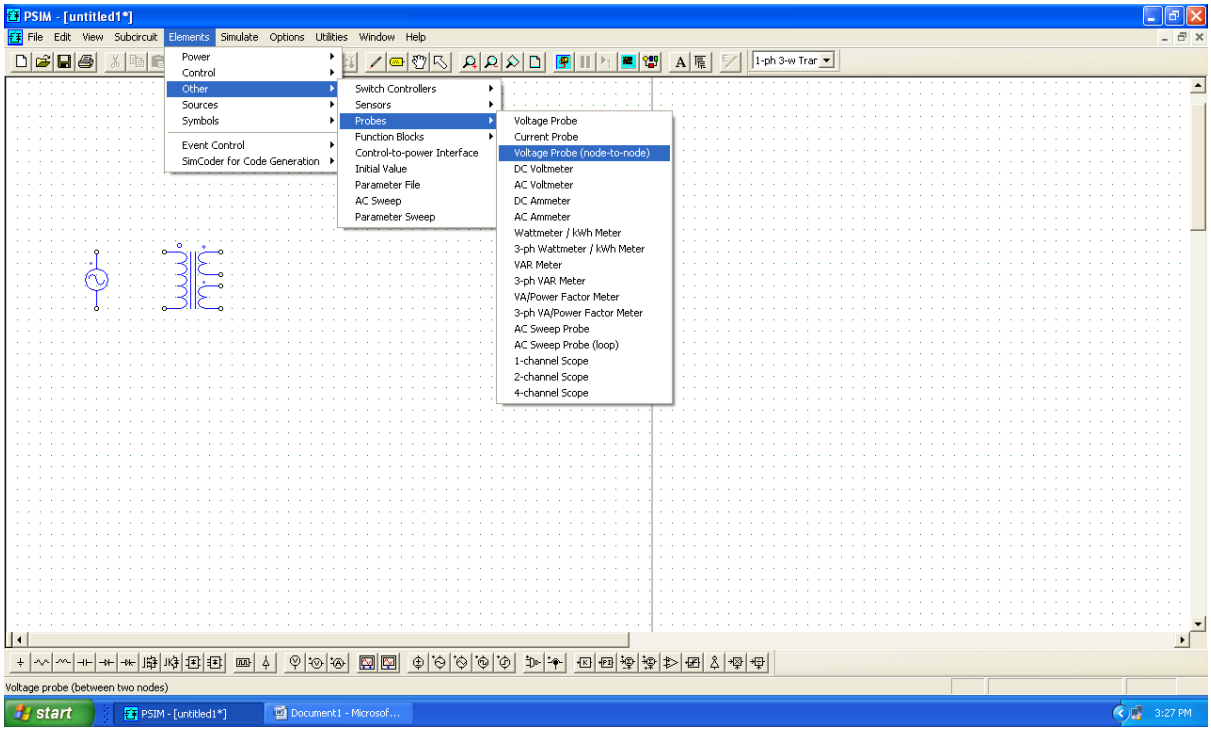
1) Selection of source



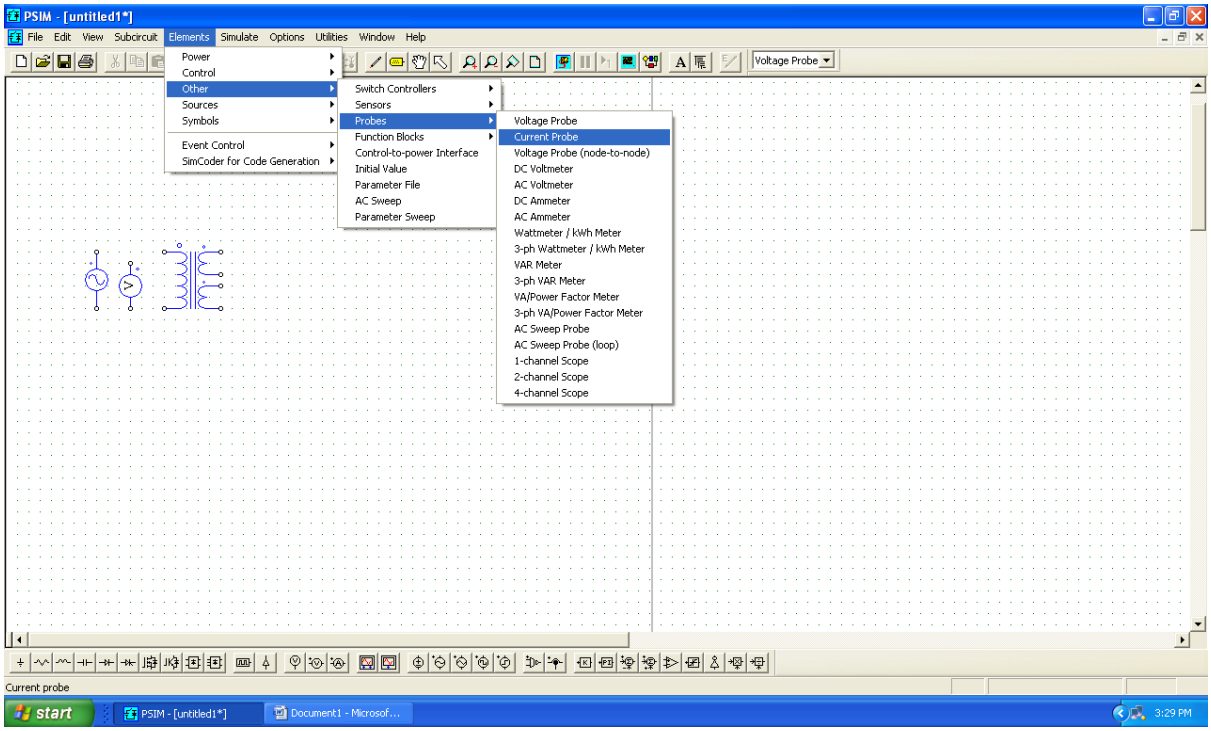
2) Selection of transformer



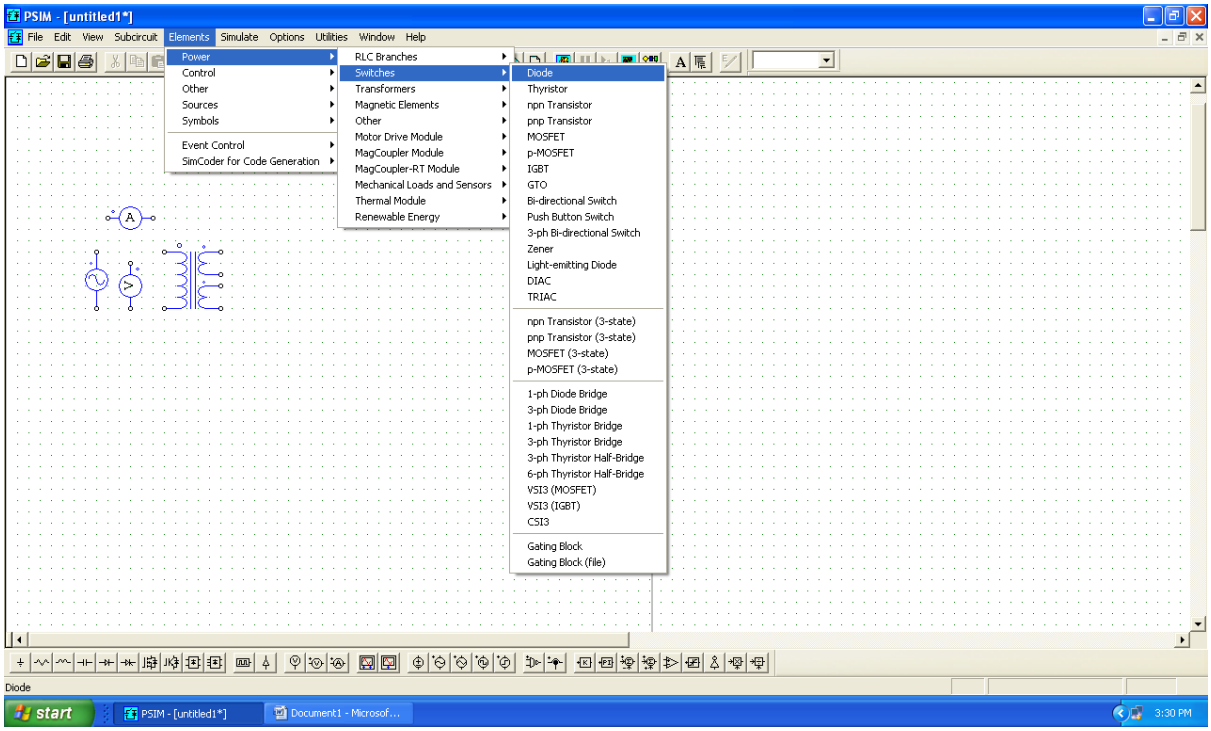
3) Selection of volt meter



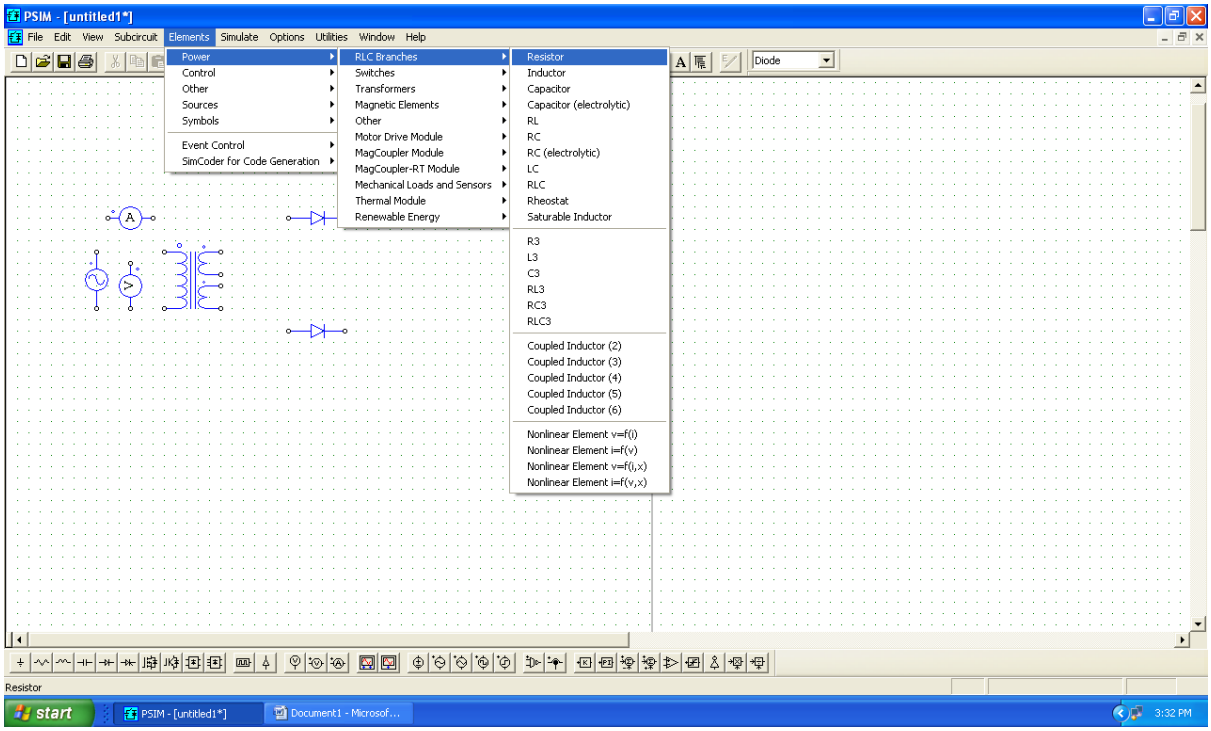
4) Selection of ammeter



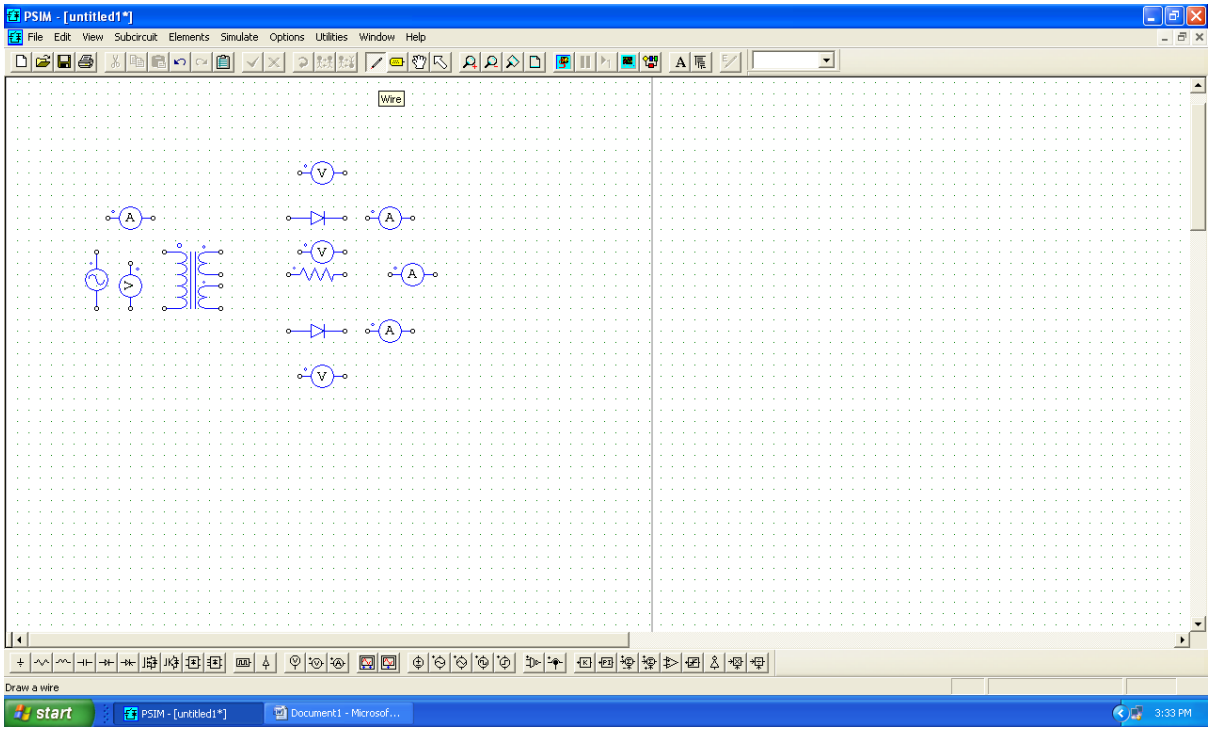
5) Selection of diode



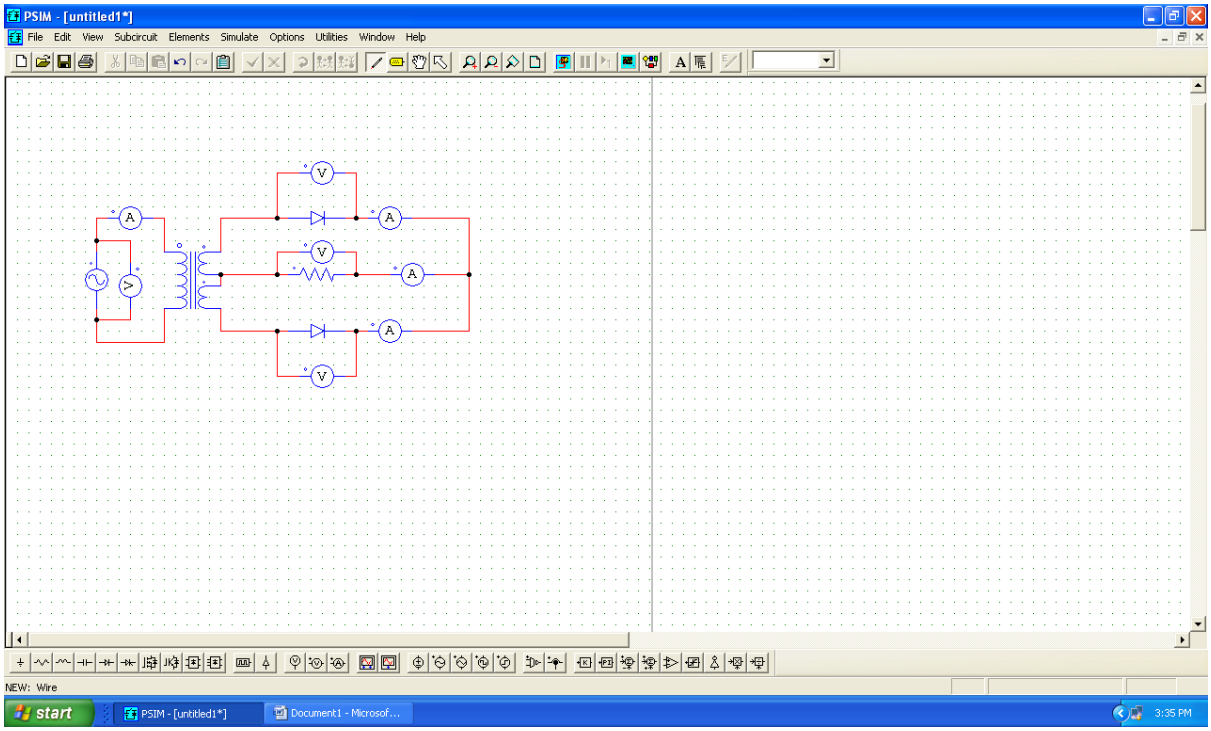
6) Selection of resistor



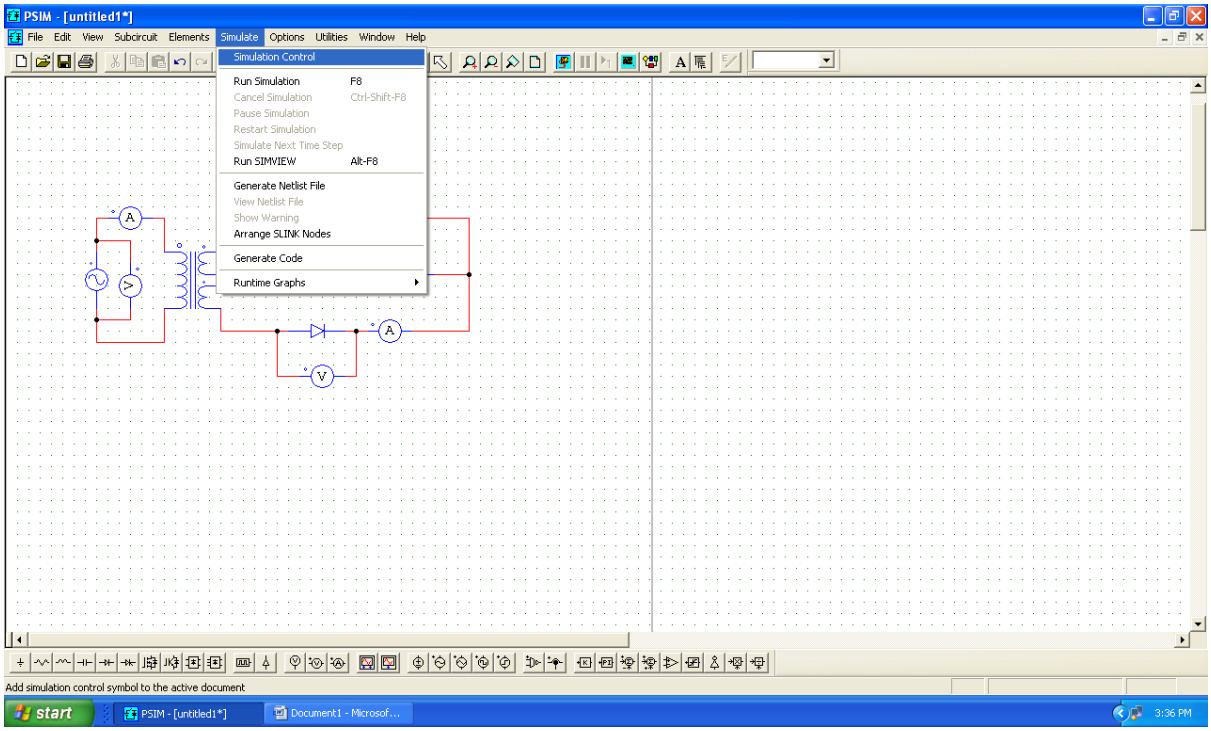
7) Select number of elements as shown in below fig



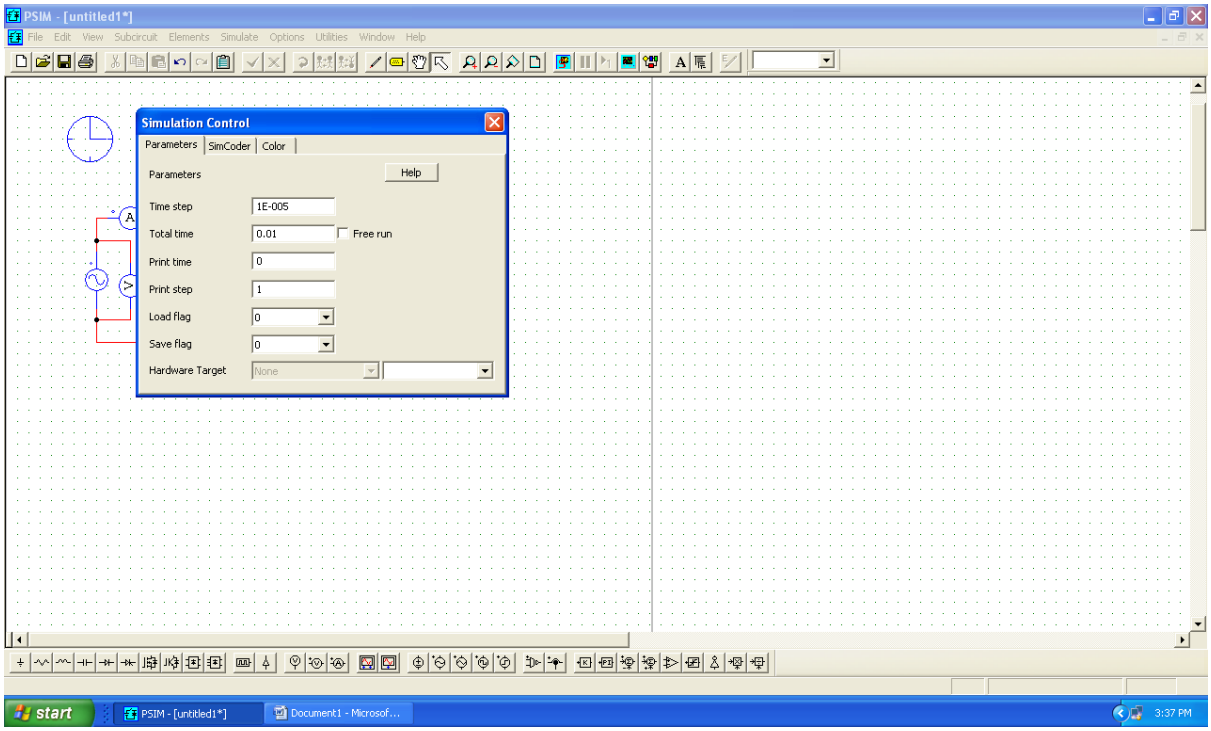
8) Connect the elements as shown below using pencil tool



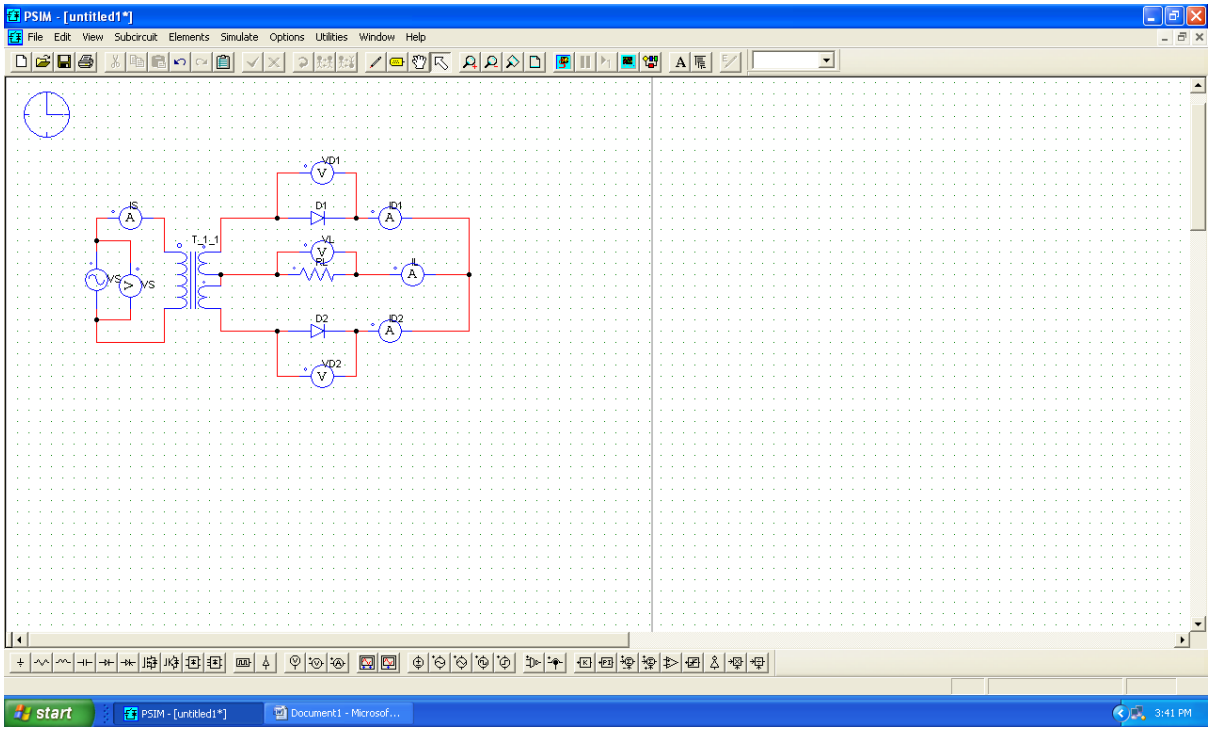
9) Add simulation controller



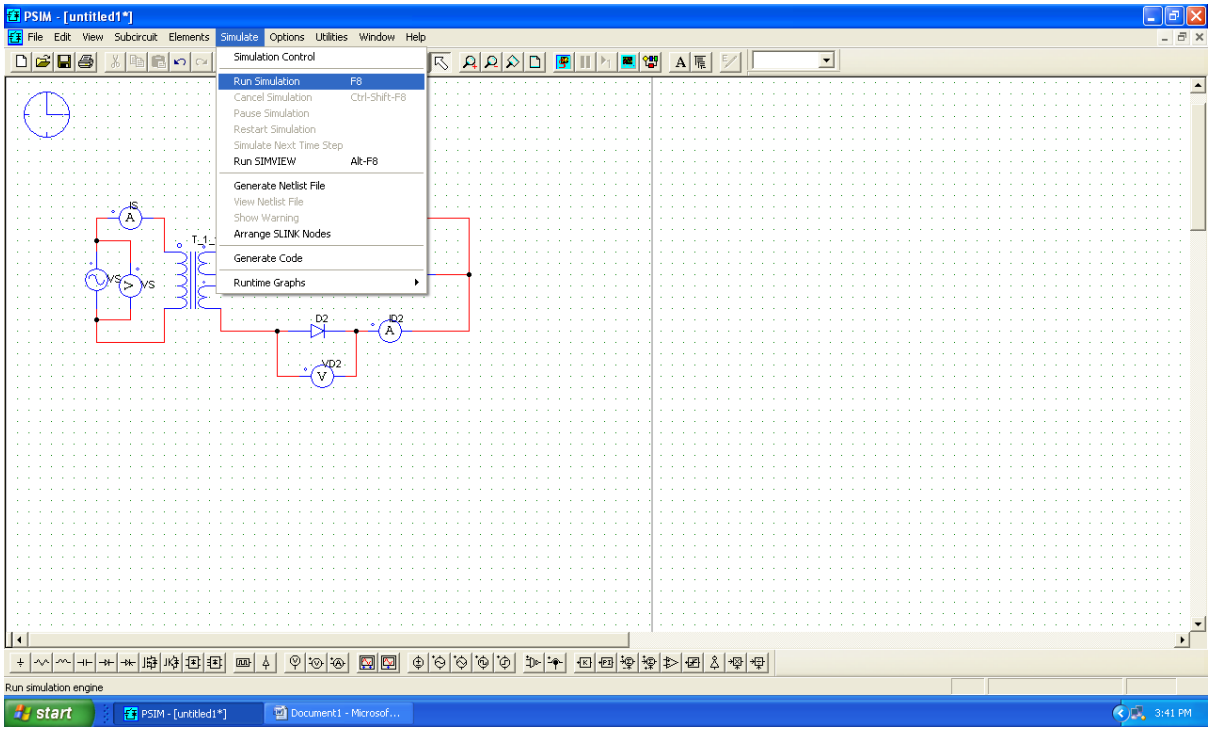
10) Put the values as shown below



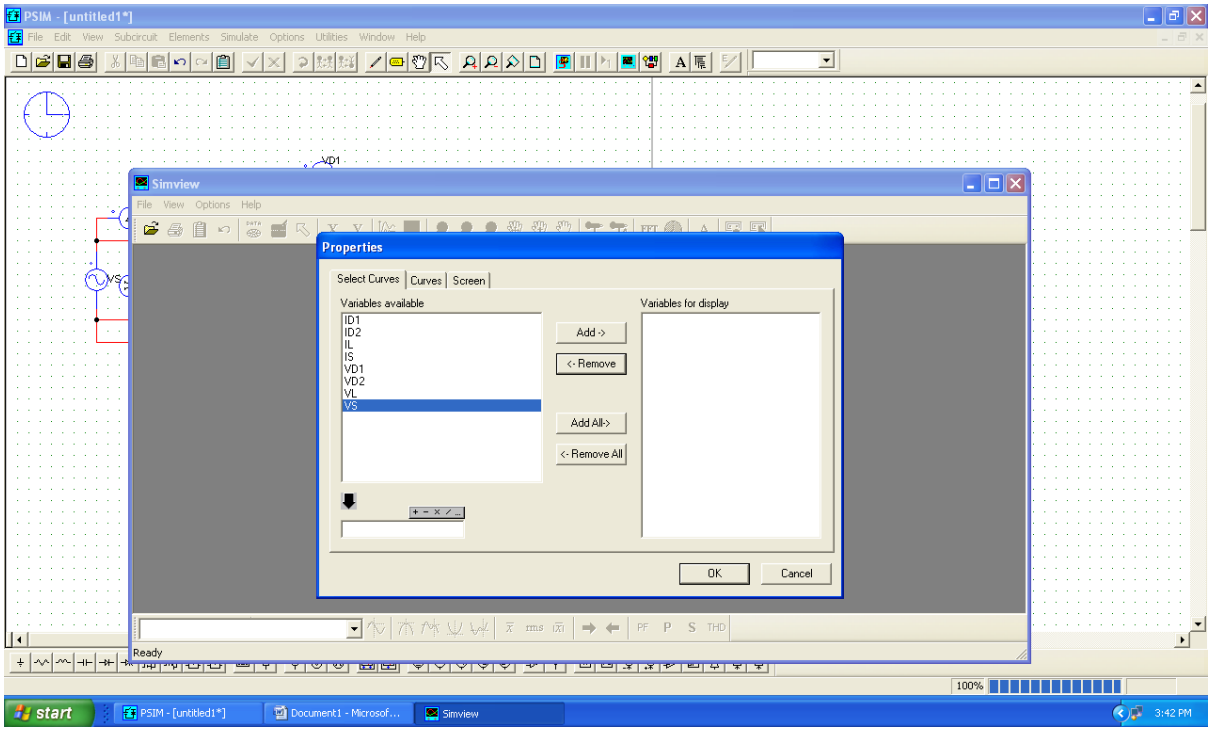
11) Give the appropriate name to the every element



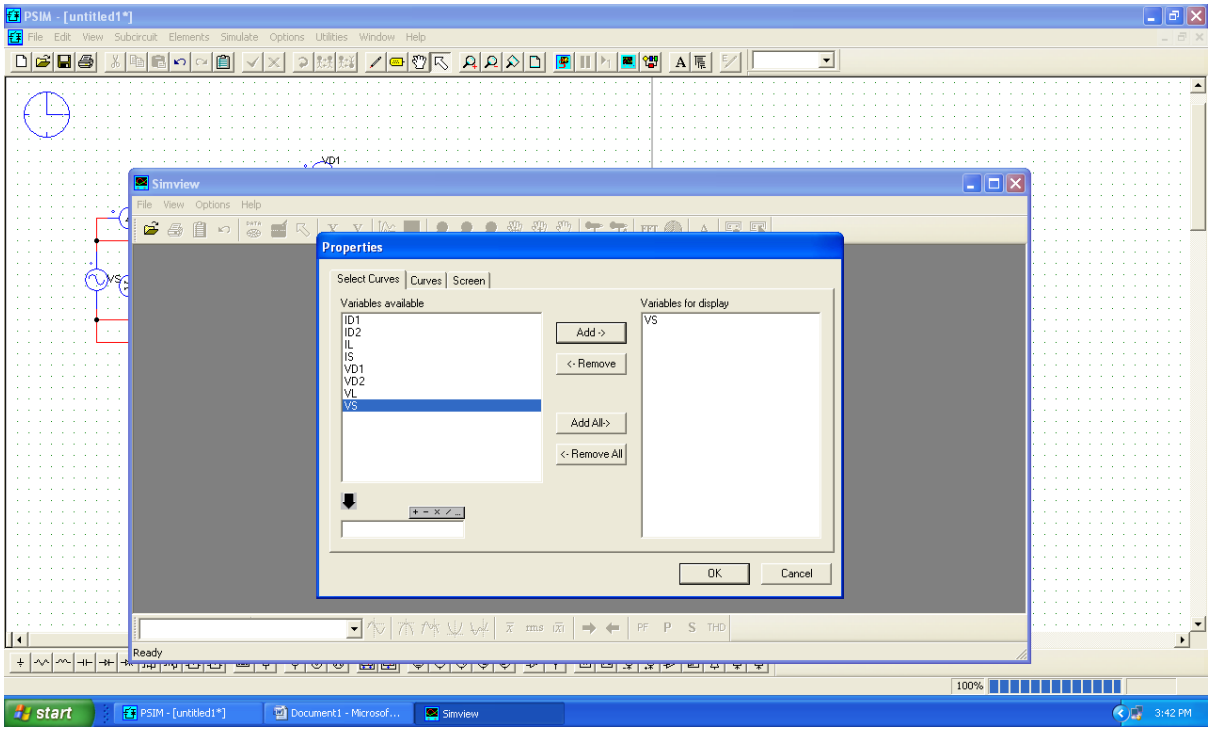
12) Run the simulation



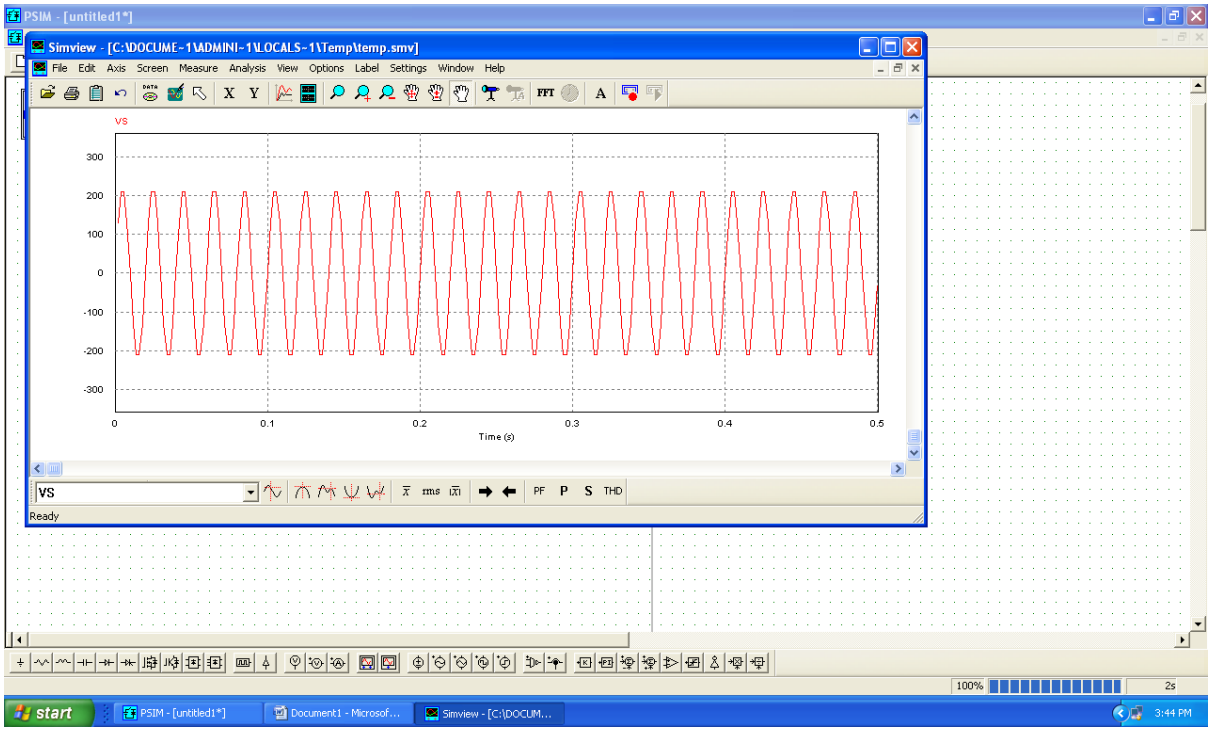
13) Select the required



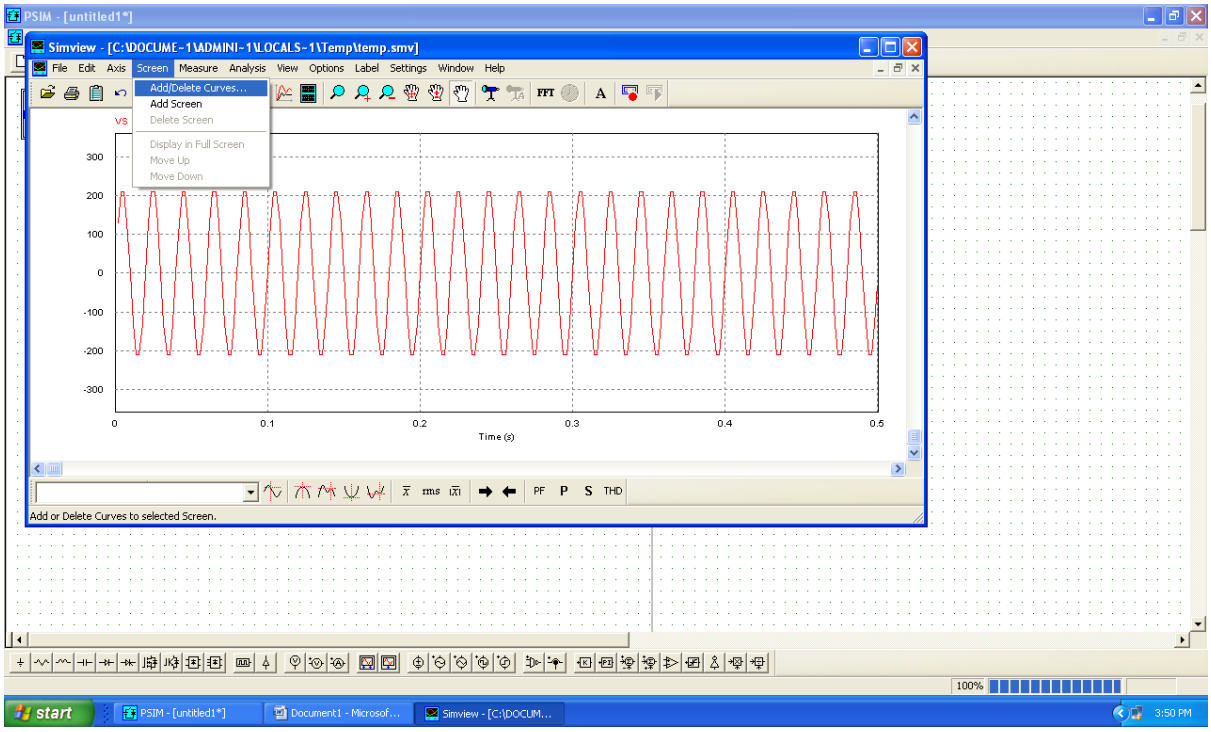
14) Select the required element to be measured from the dialogue box

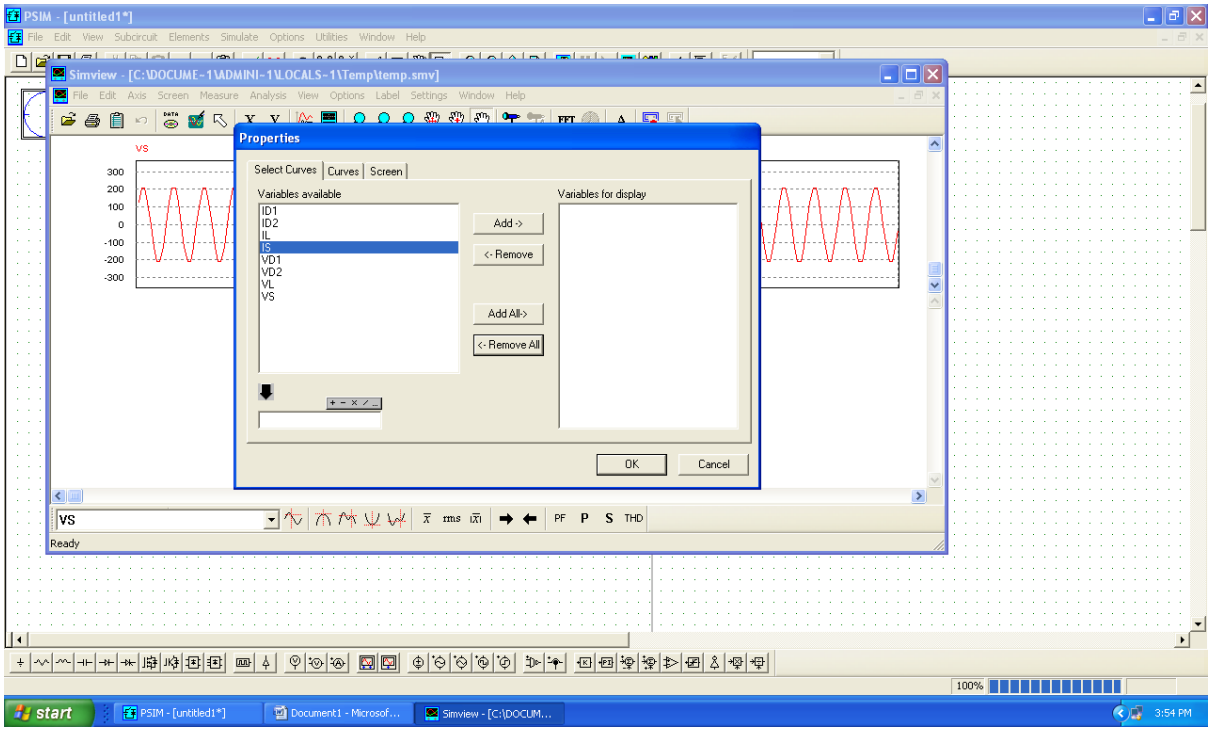


15) Source voltage is selected

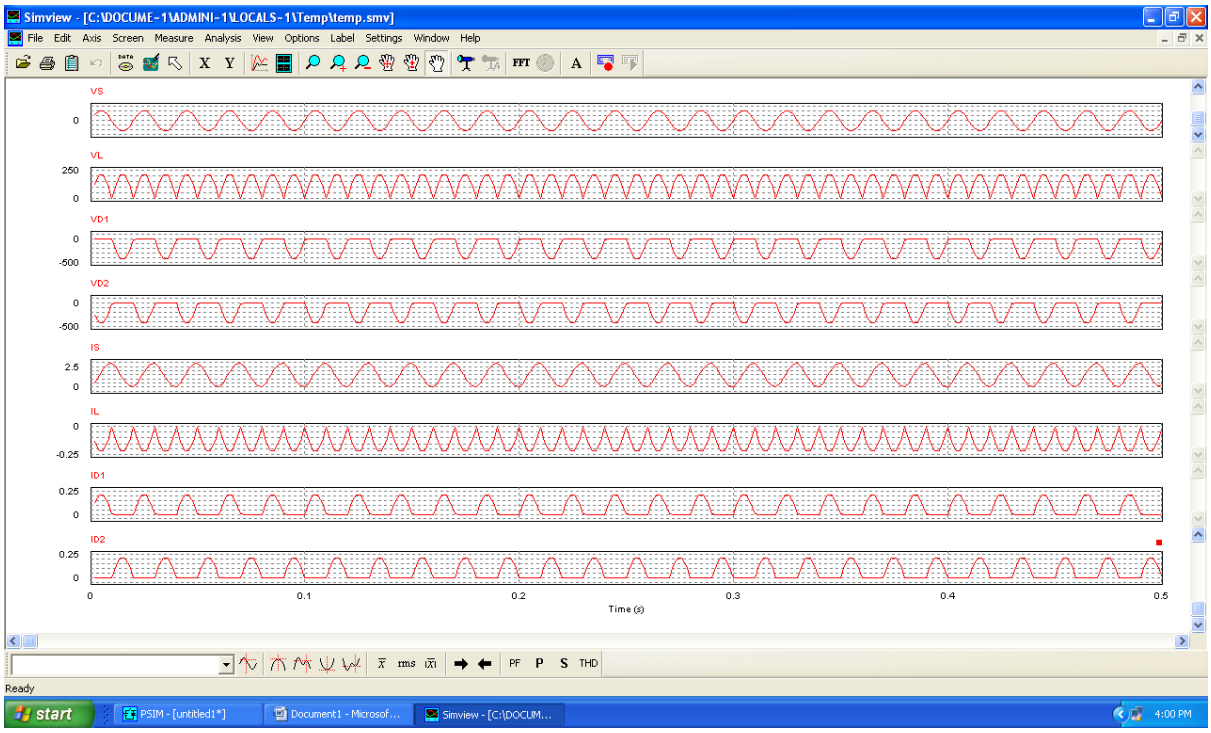


16) Addition of other curve





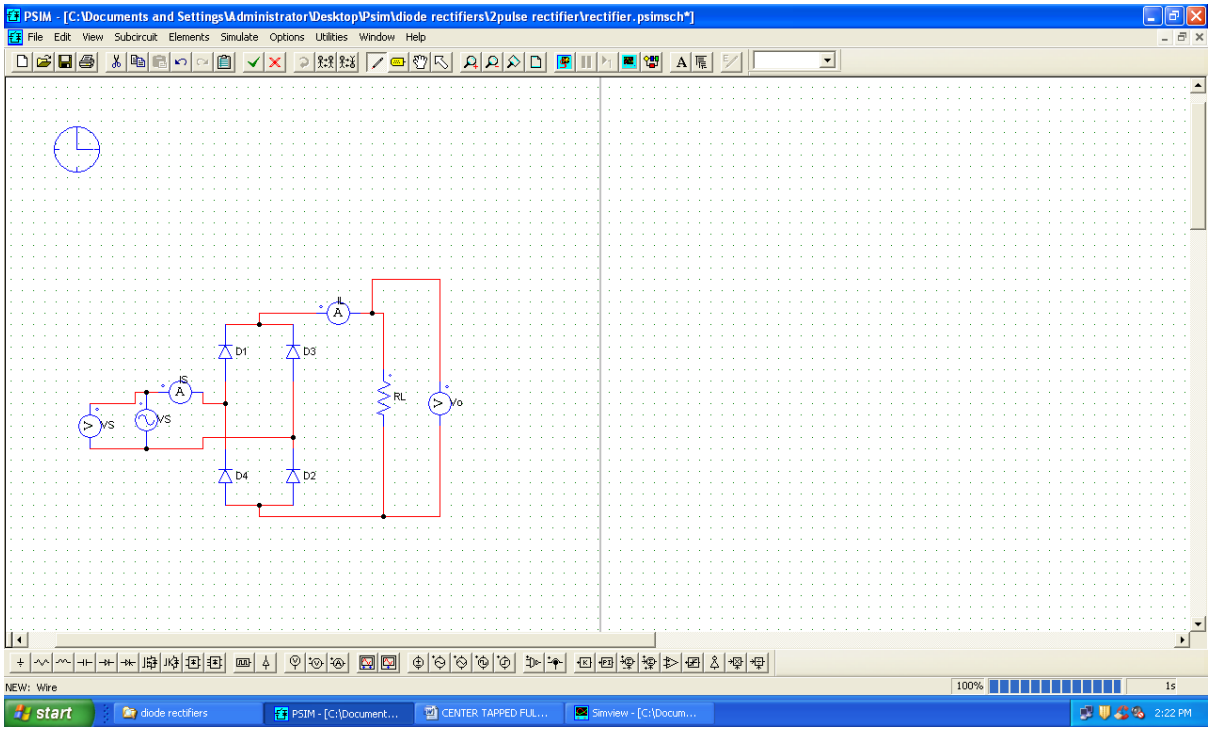
17) Voltage and current waveforms



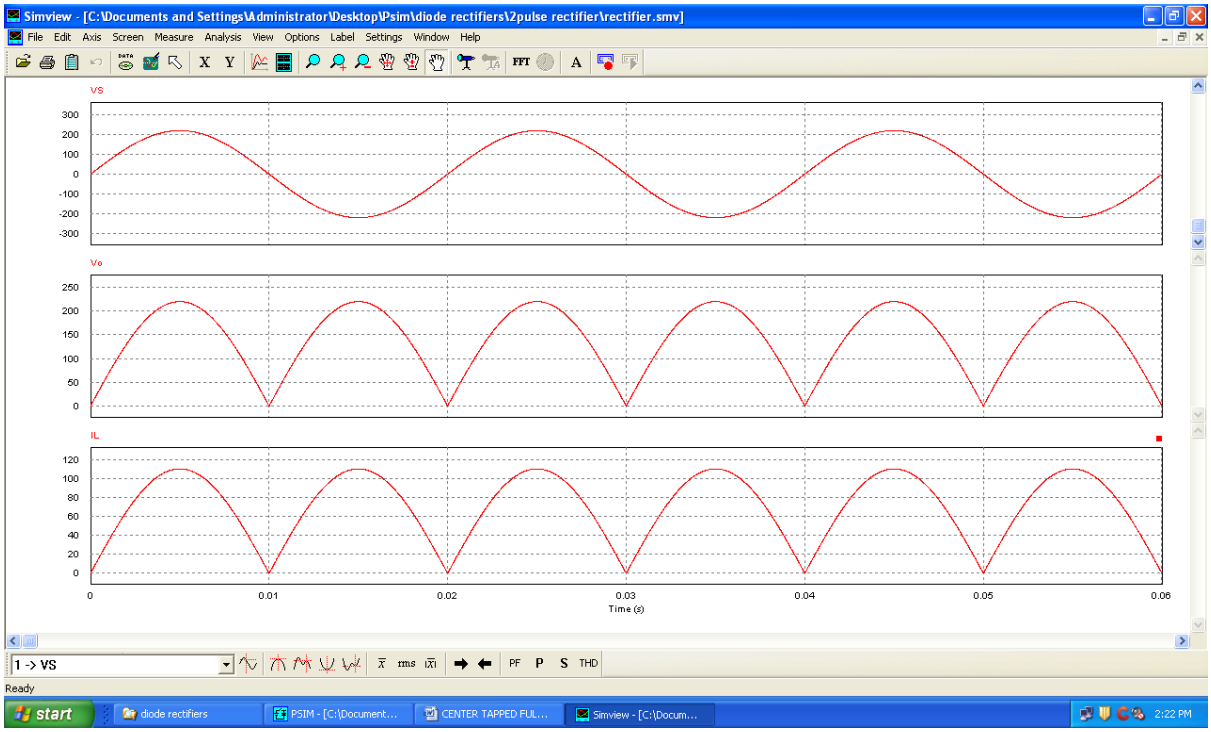
2PULSE BRIDGE RECTIFIER WITH R-LOAD

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



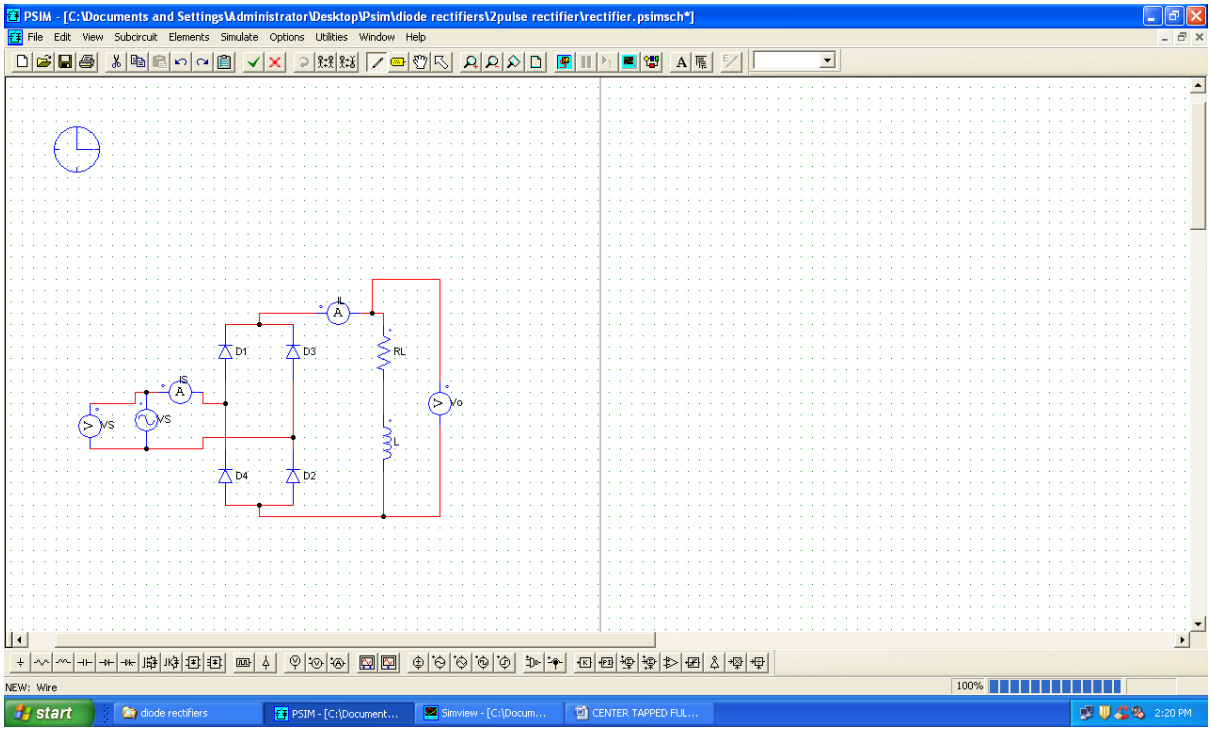
Voltage and current waveforms



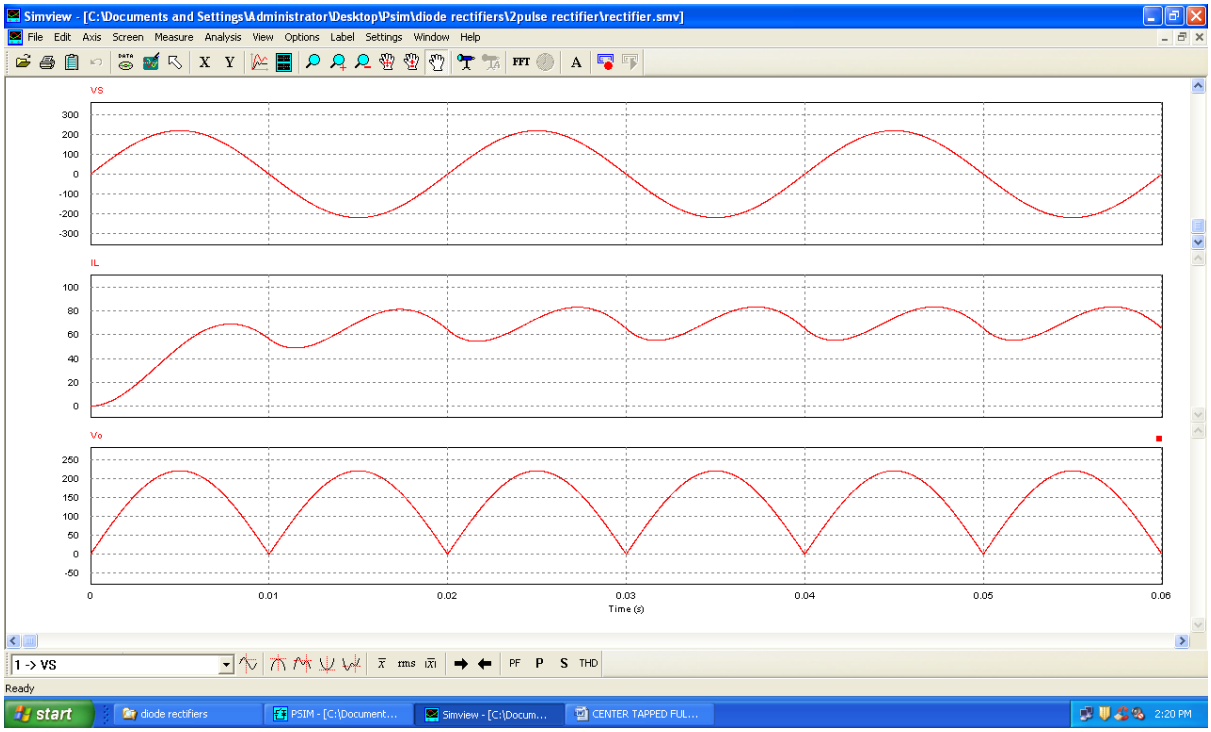
2PULSE BRIDGE RECTIFIER WITH RL-LOAD

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



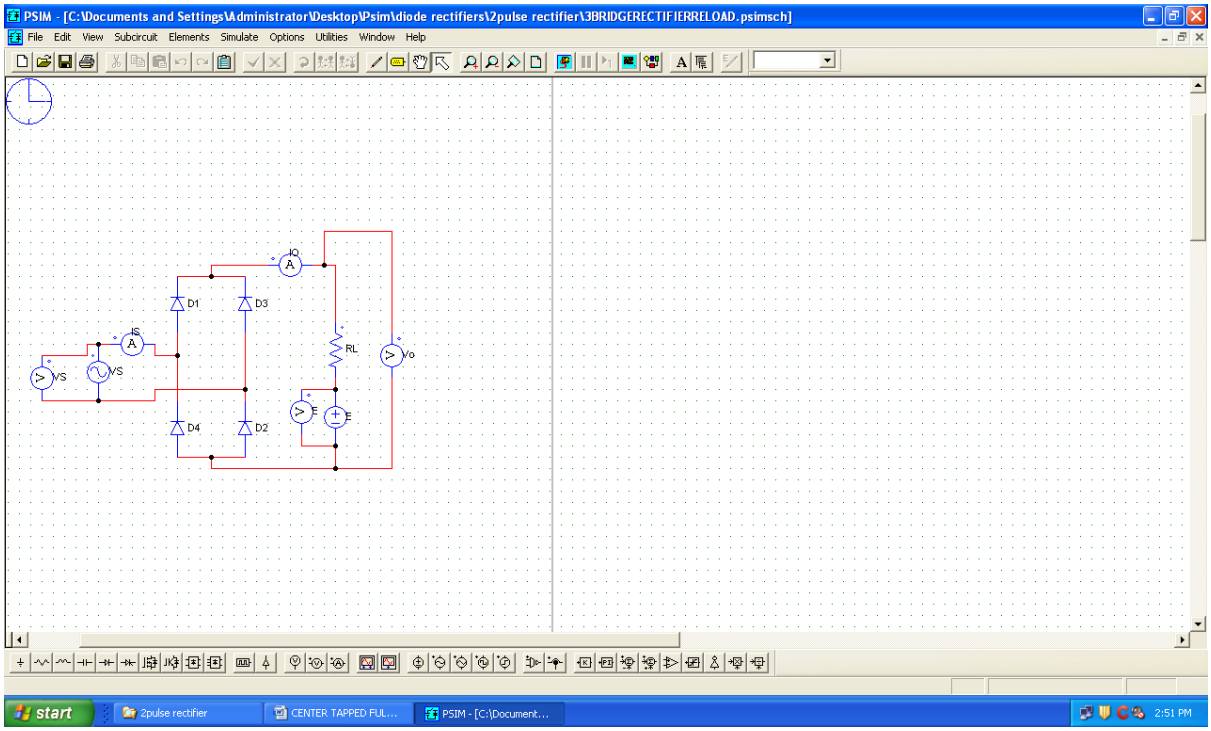
Voltage and current waveforms



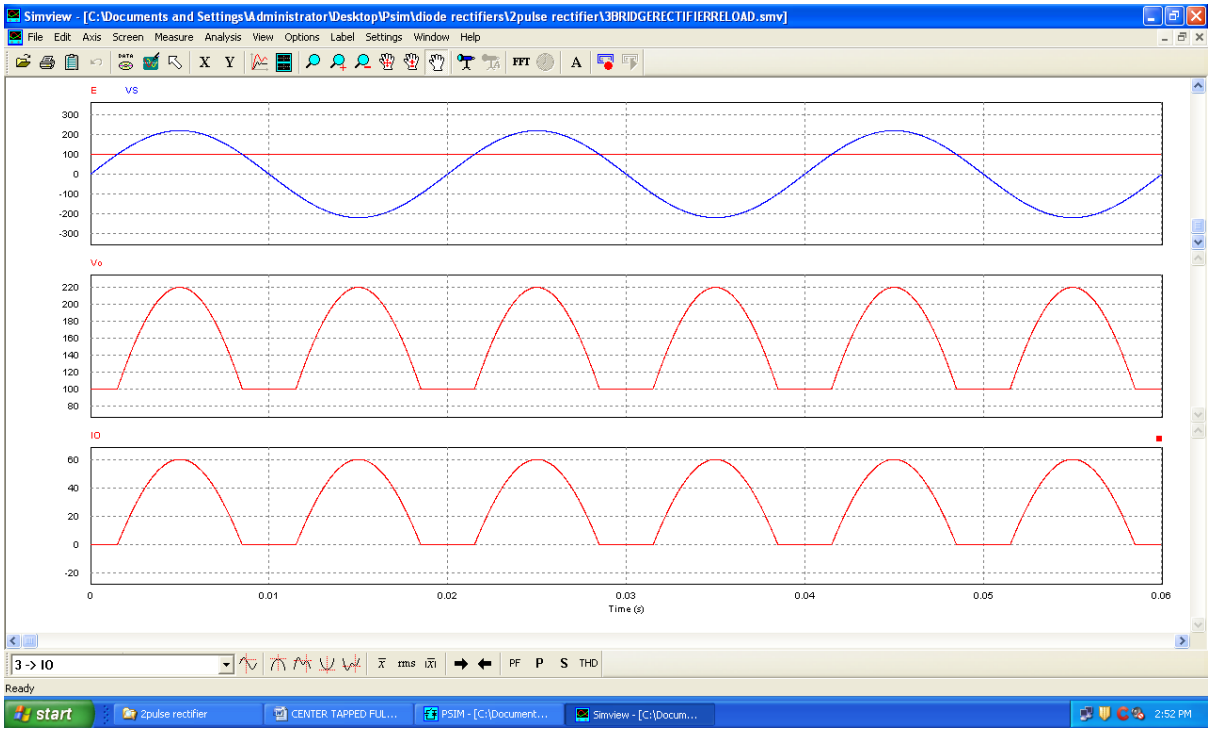
2PULSE BRIDGE RECTIFIER WITH RE-LOAD

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



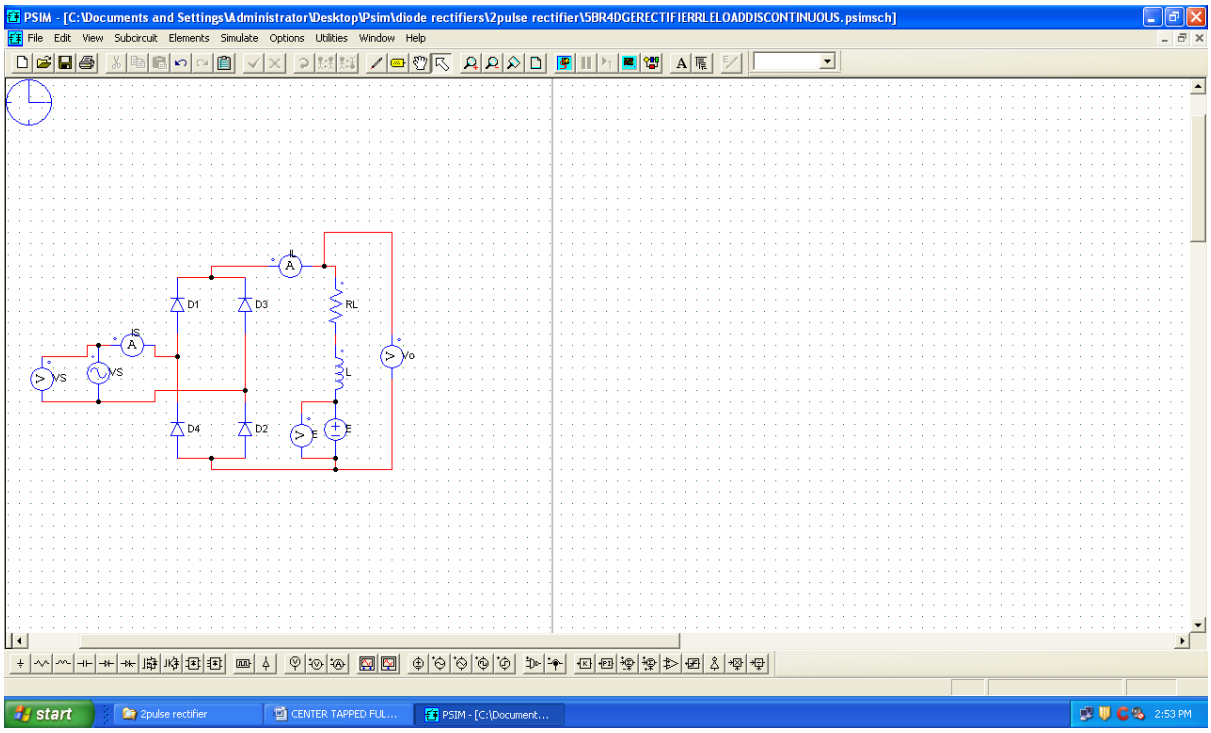
Voltage and current waveform



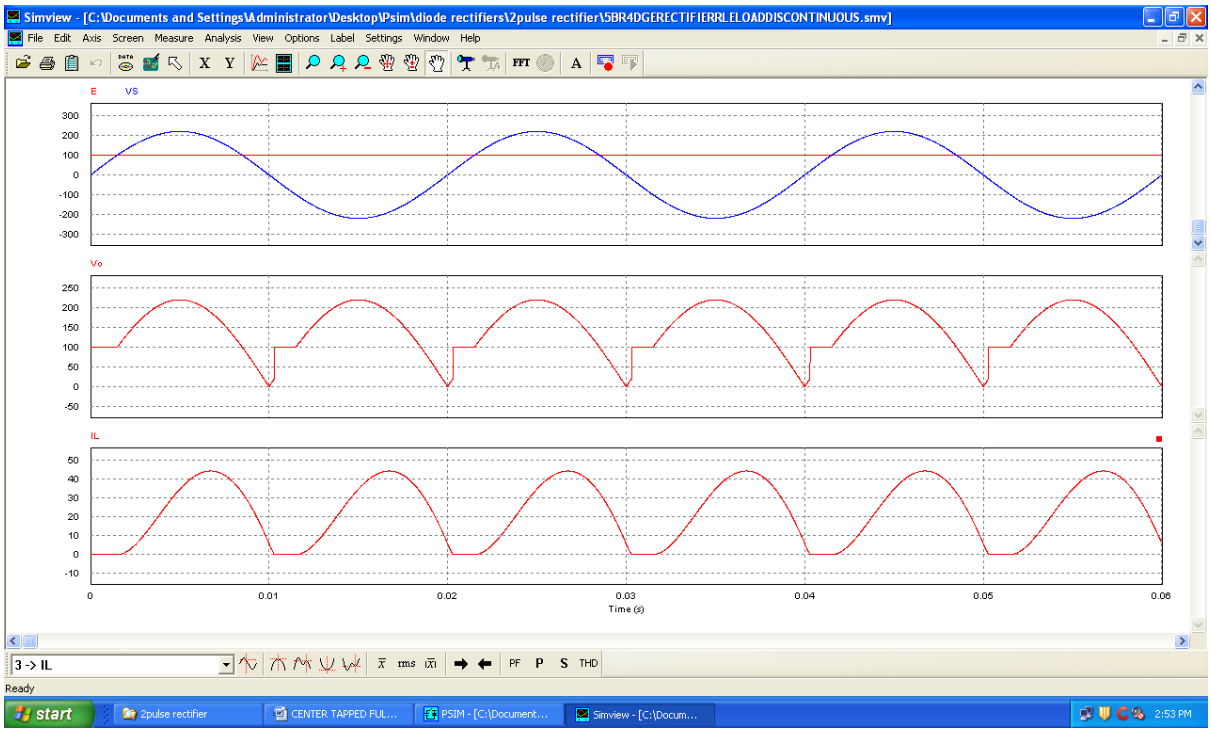
2PULSE BRIDGE RECTIFIER WITH RLE-LOAD DISCONTINUOUS CONDUCTION

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



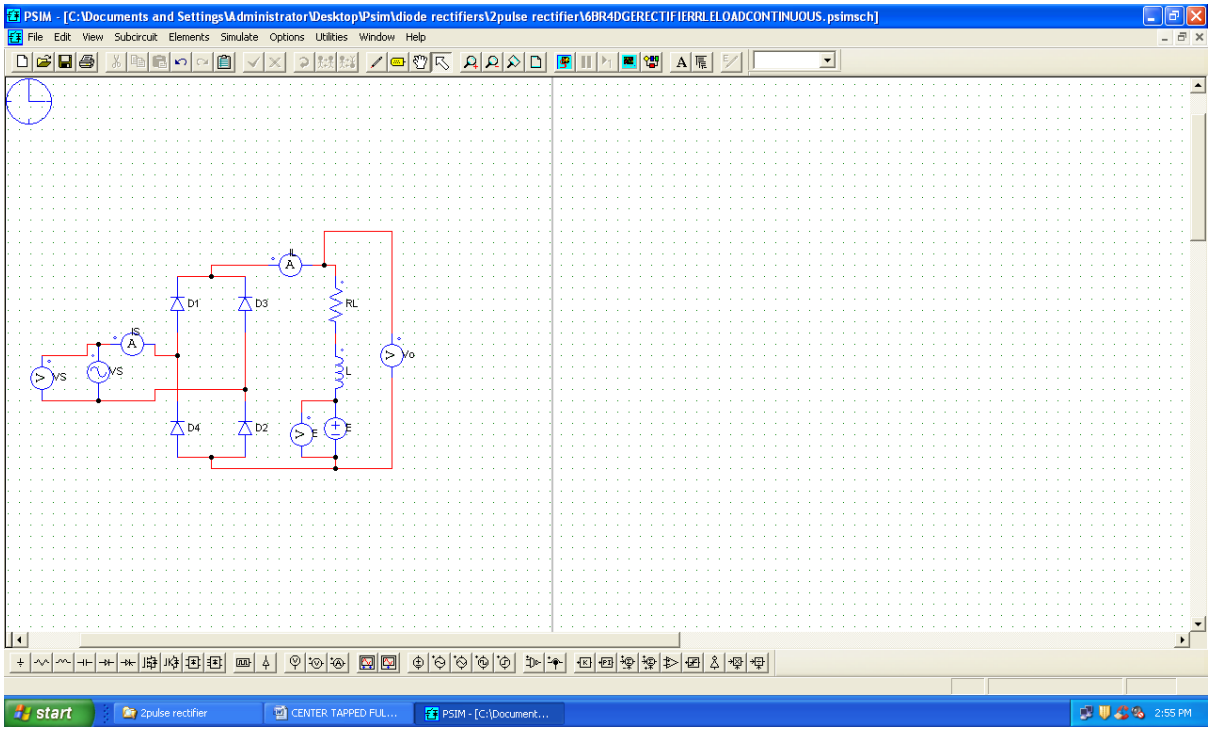
Voltage and current waveforms



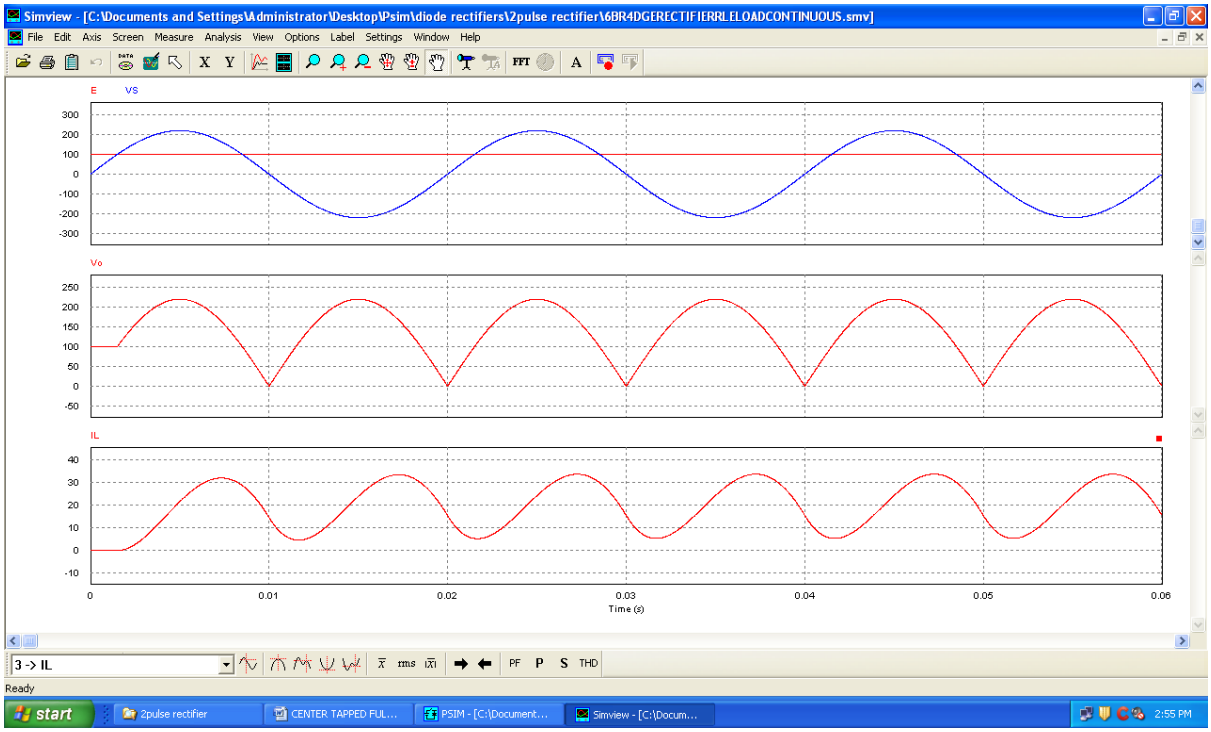
2PULSE BRIDGE RECTIFIER WITH RLE-LOAD CONTINUOUS CONDUCTION

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



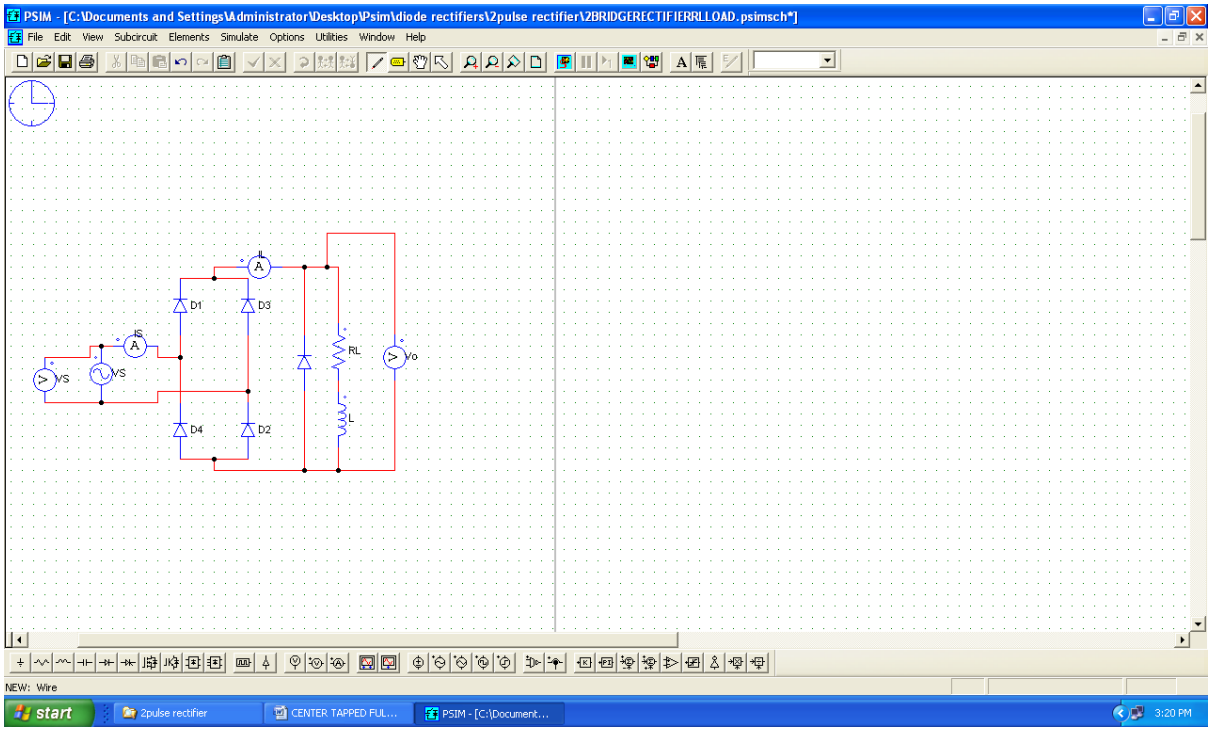
Voltage and current waveforms



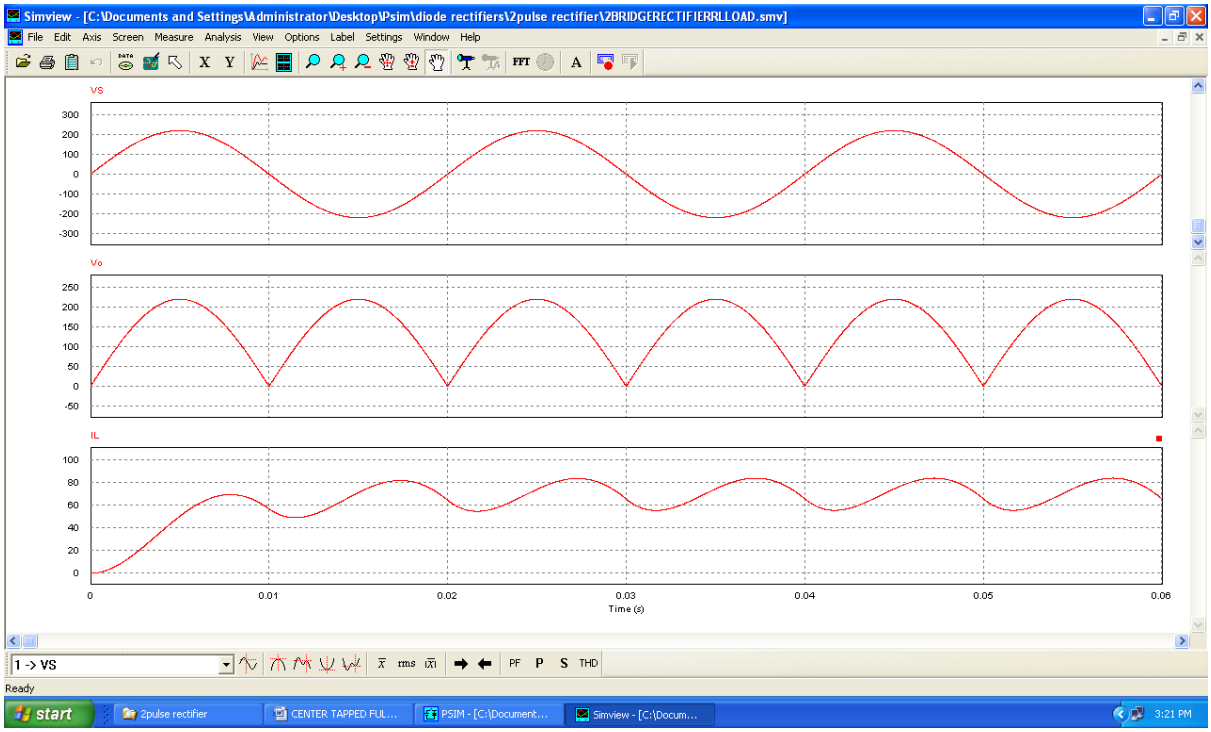
2PULSE BRIDGE RECTIFIER WITH RL-LOAD WITH FREE WHEELING DIODE

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



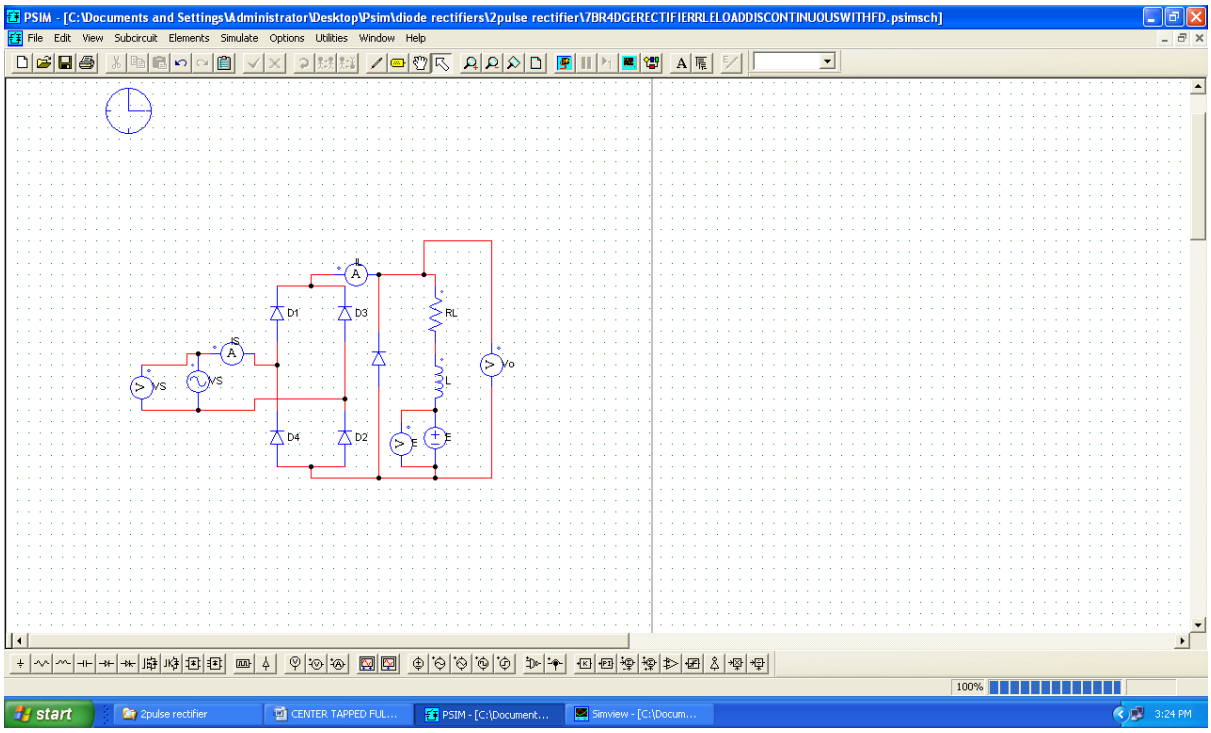
Voltage and current waveforms



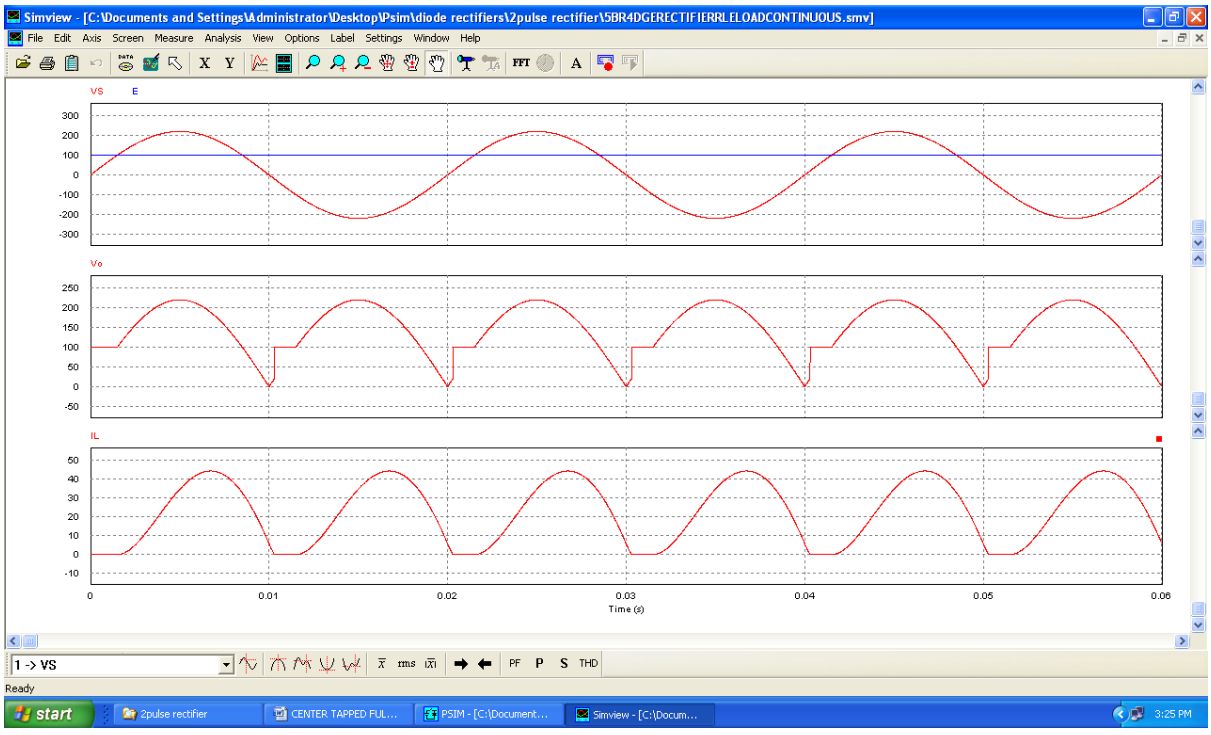
2PULSE BRIDGE RECTIFIER WITH RLE-LOAD WITH FREE WHEELING DIODE

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram

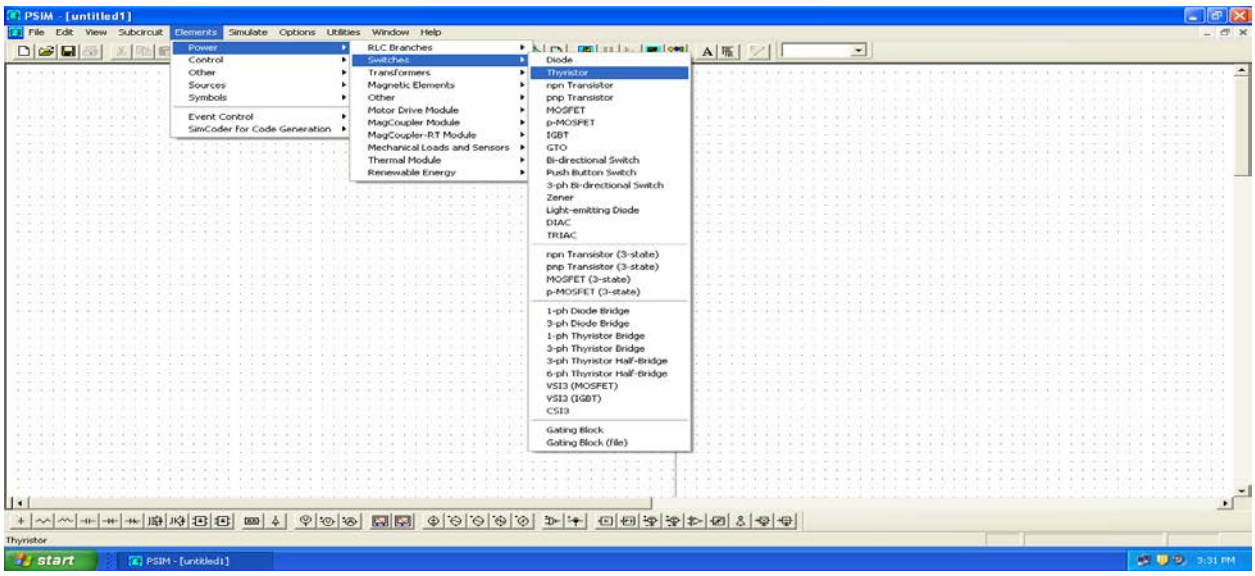


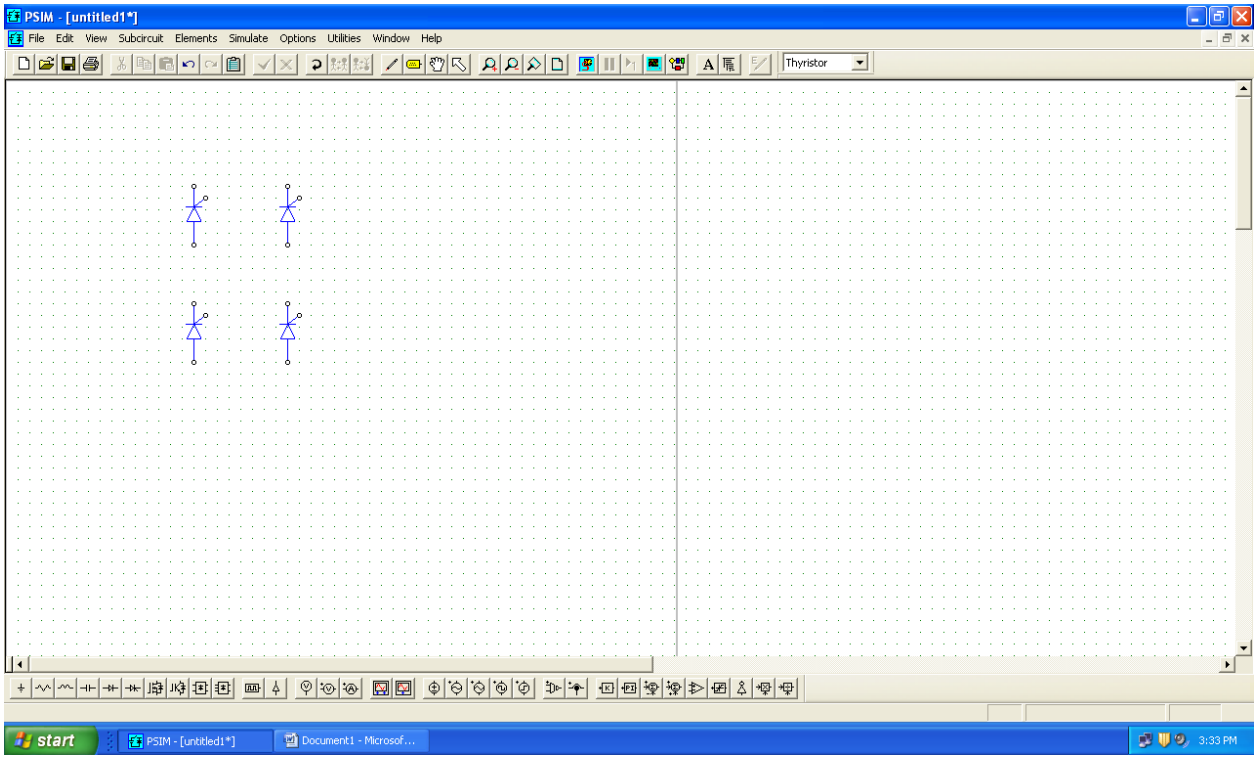
Voltage and current waveforms



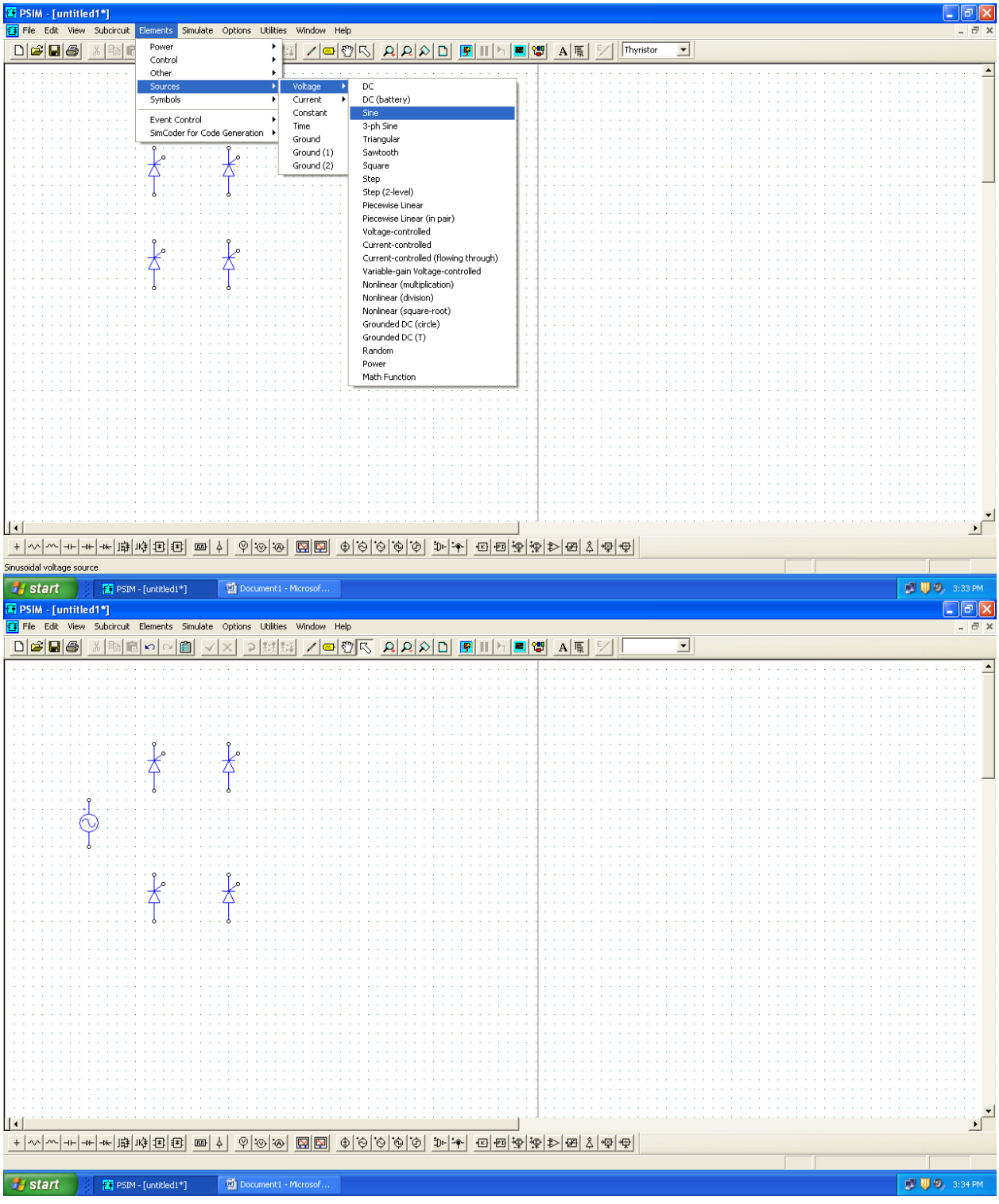
Controlled rectifier

Select the thyristor

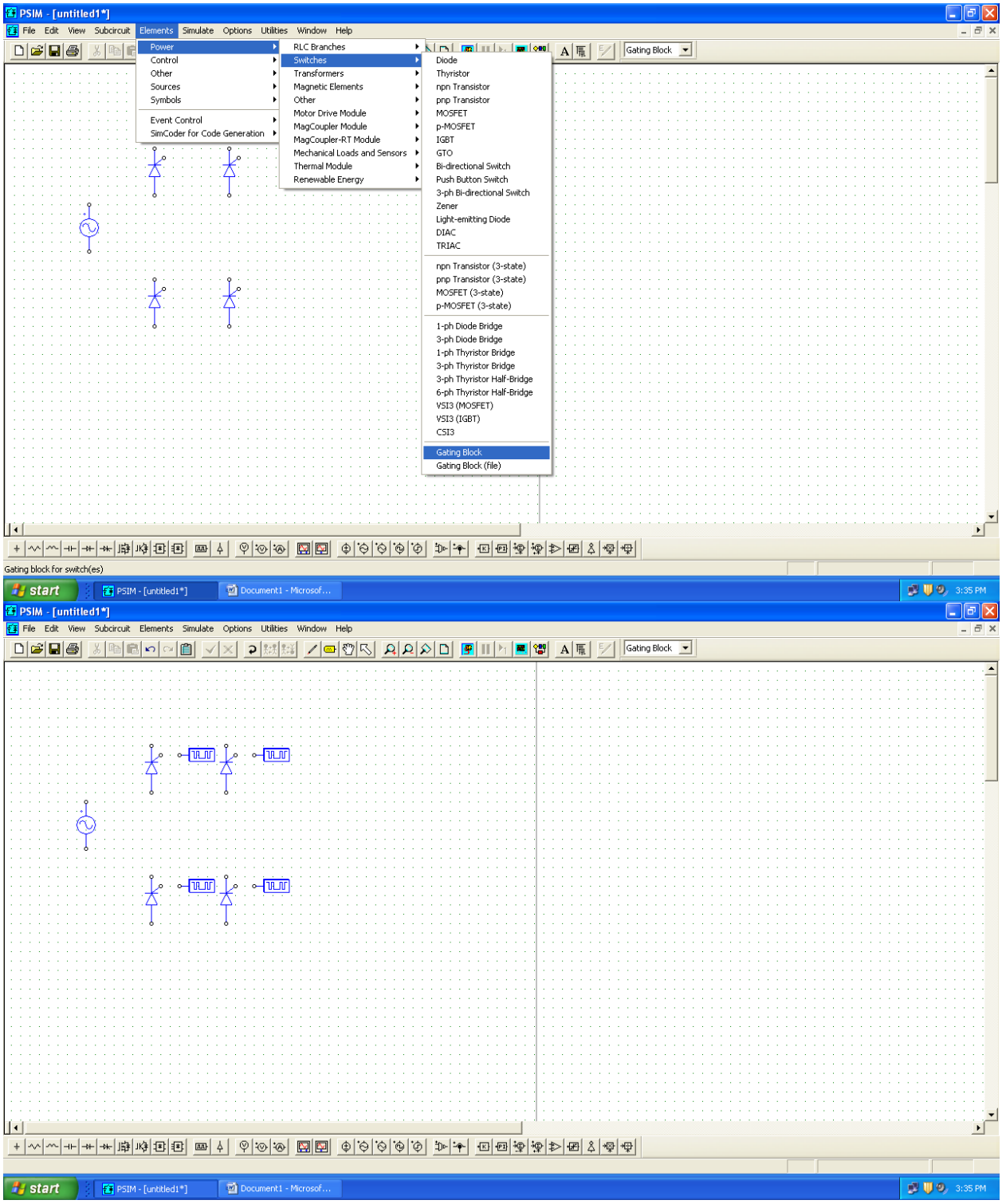




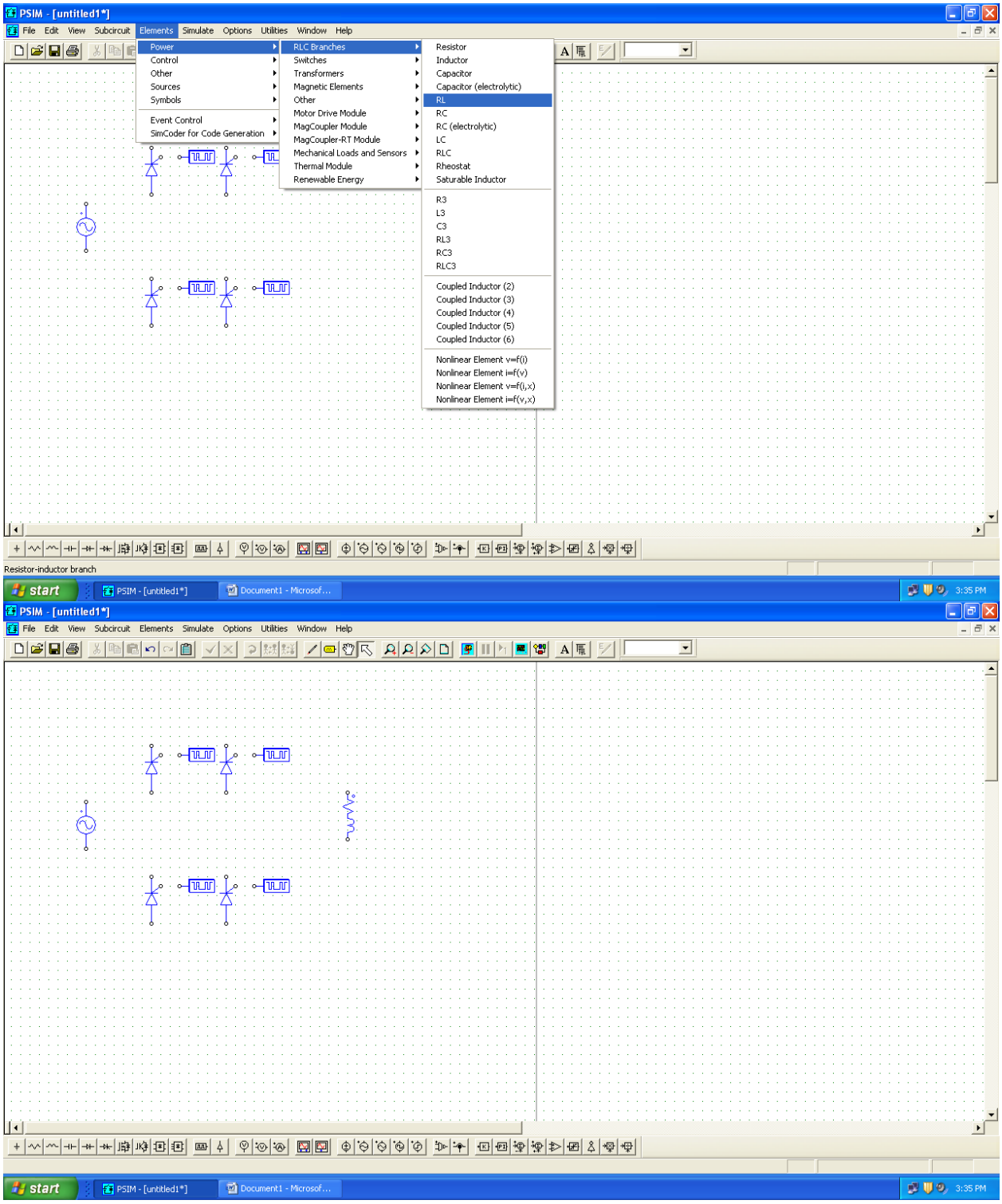
Select the source



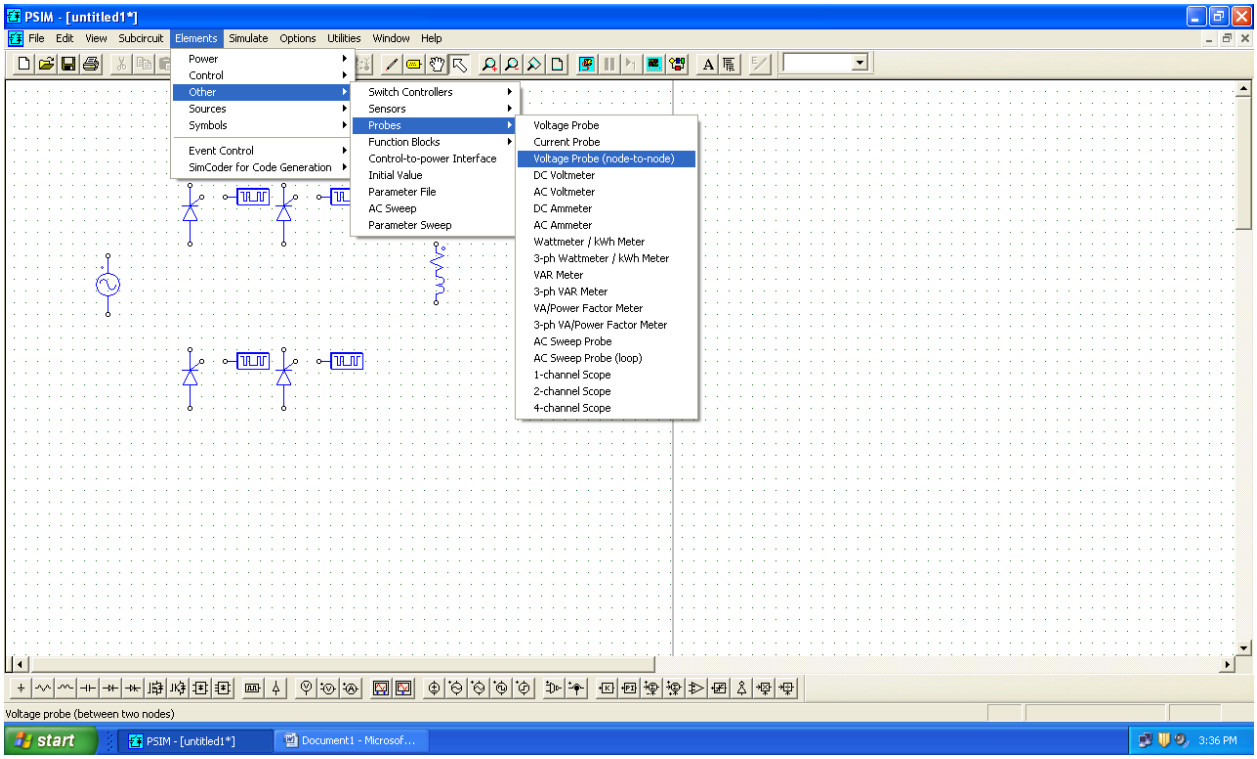
Select the gating block



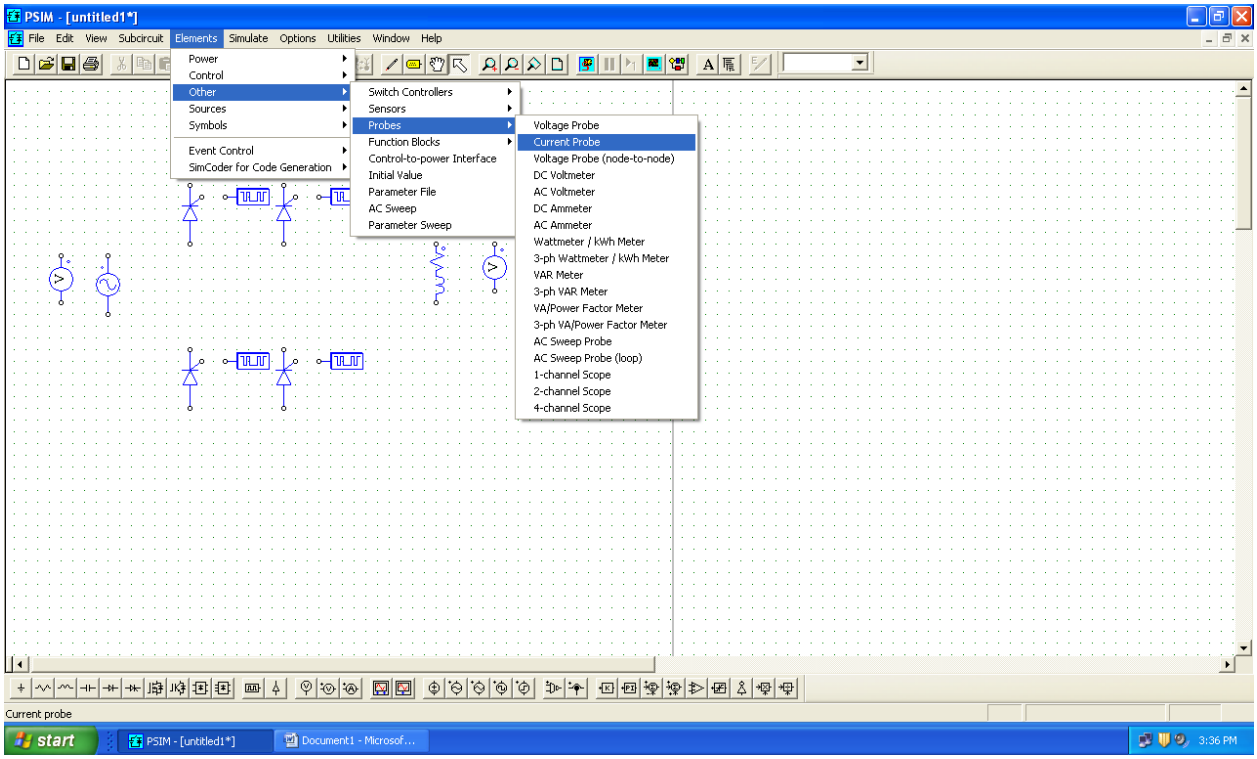
Select the RL load



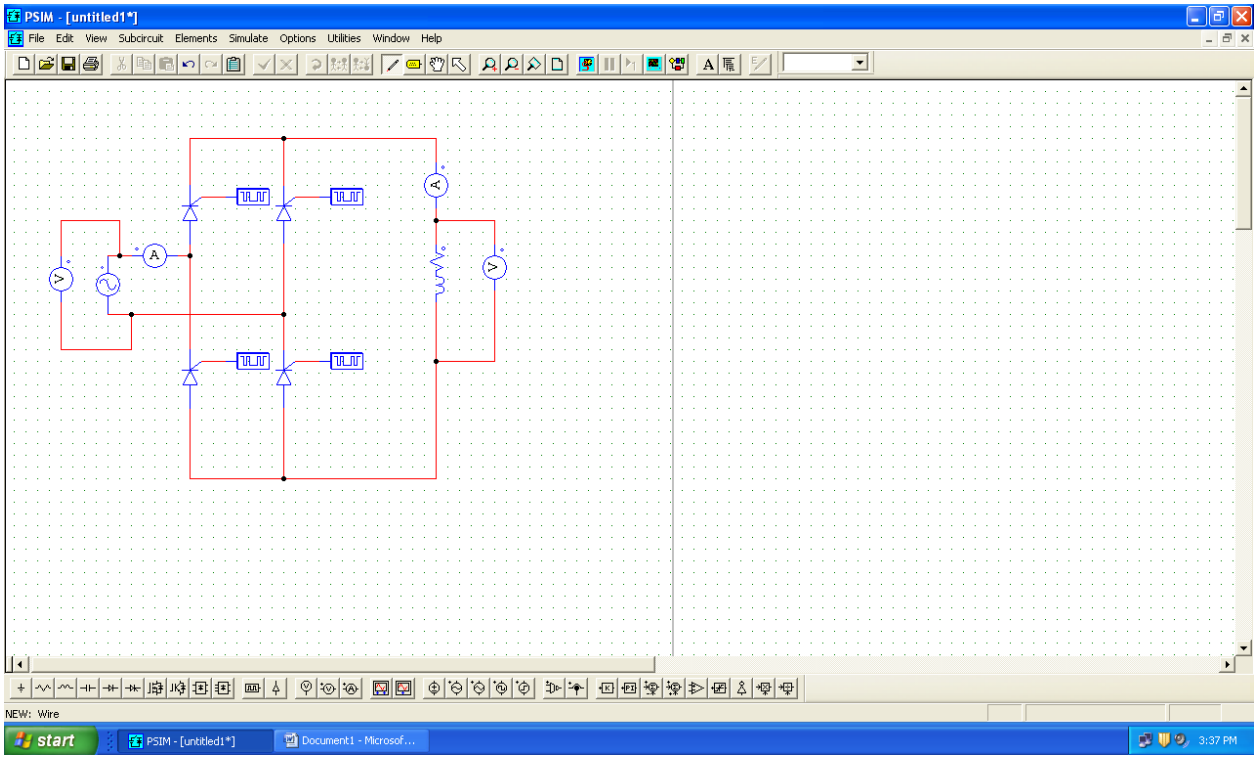
Select the volt meter



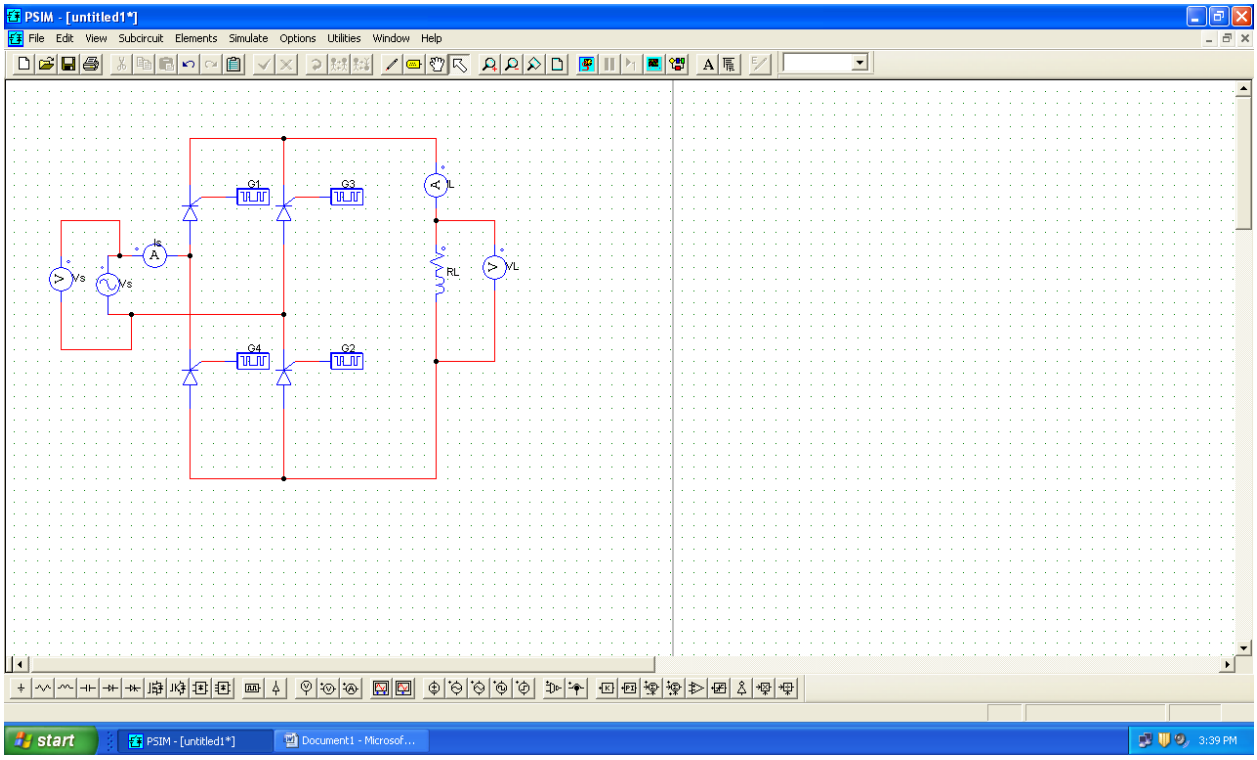
Select the ammeter



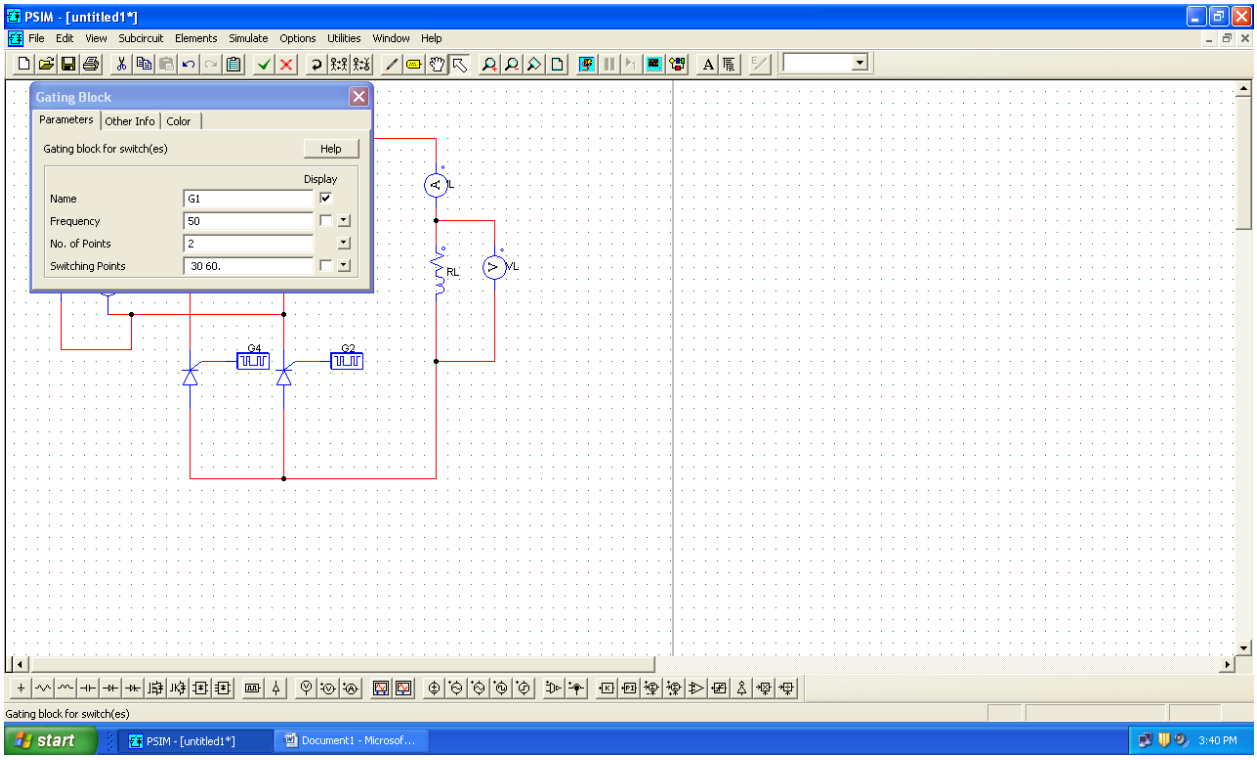
Connect the circuit using wiring tool

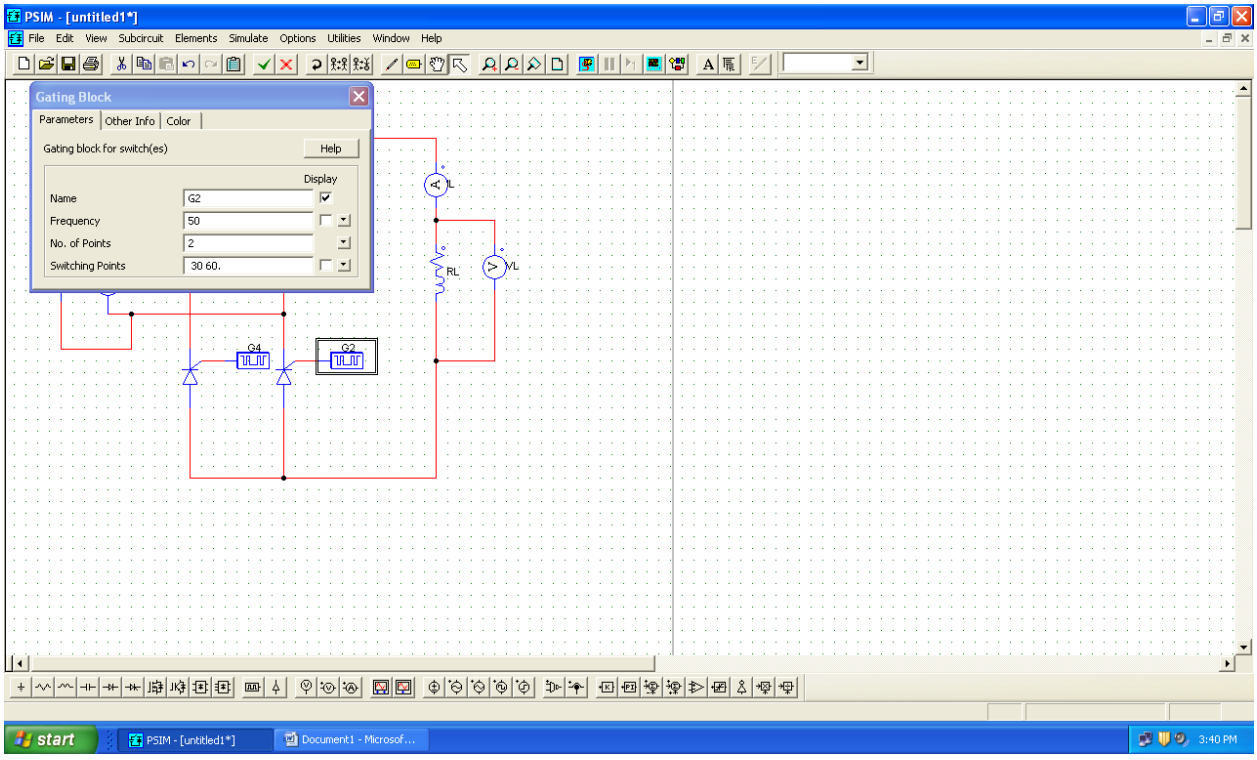


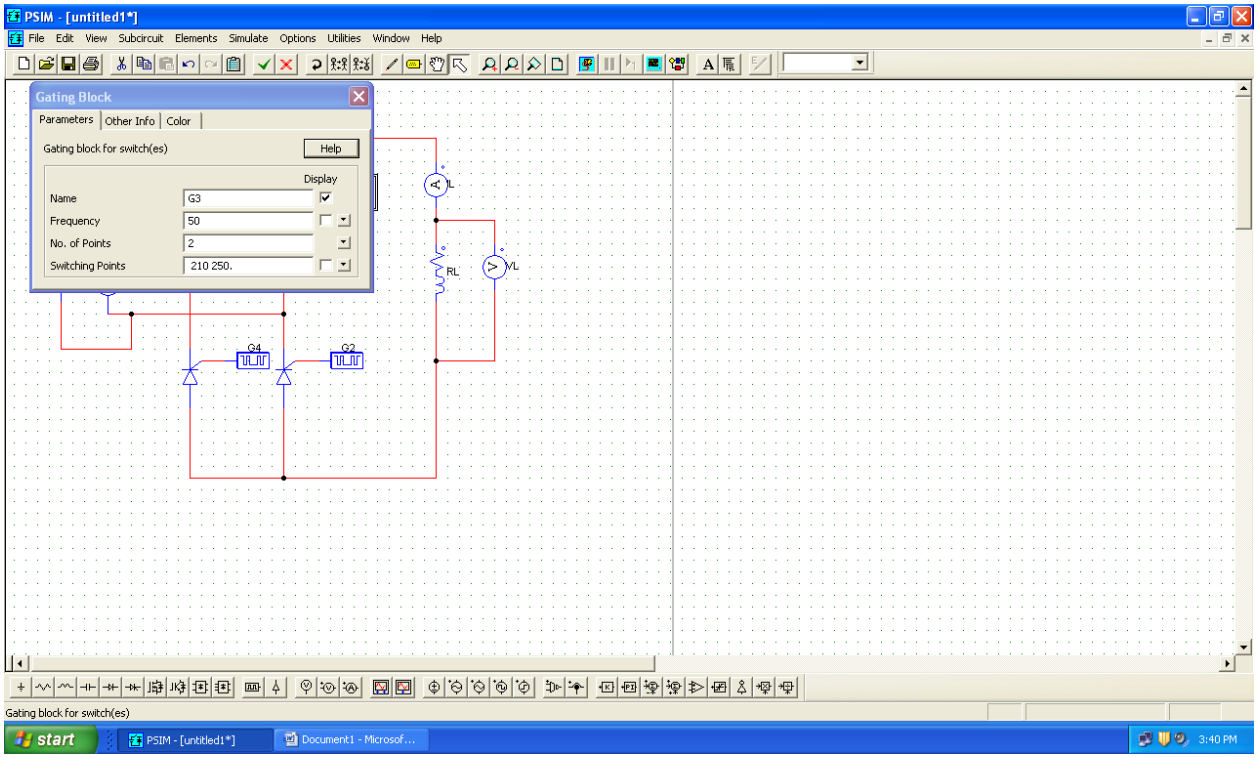
Give the proper label

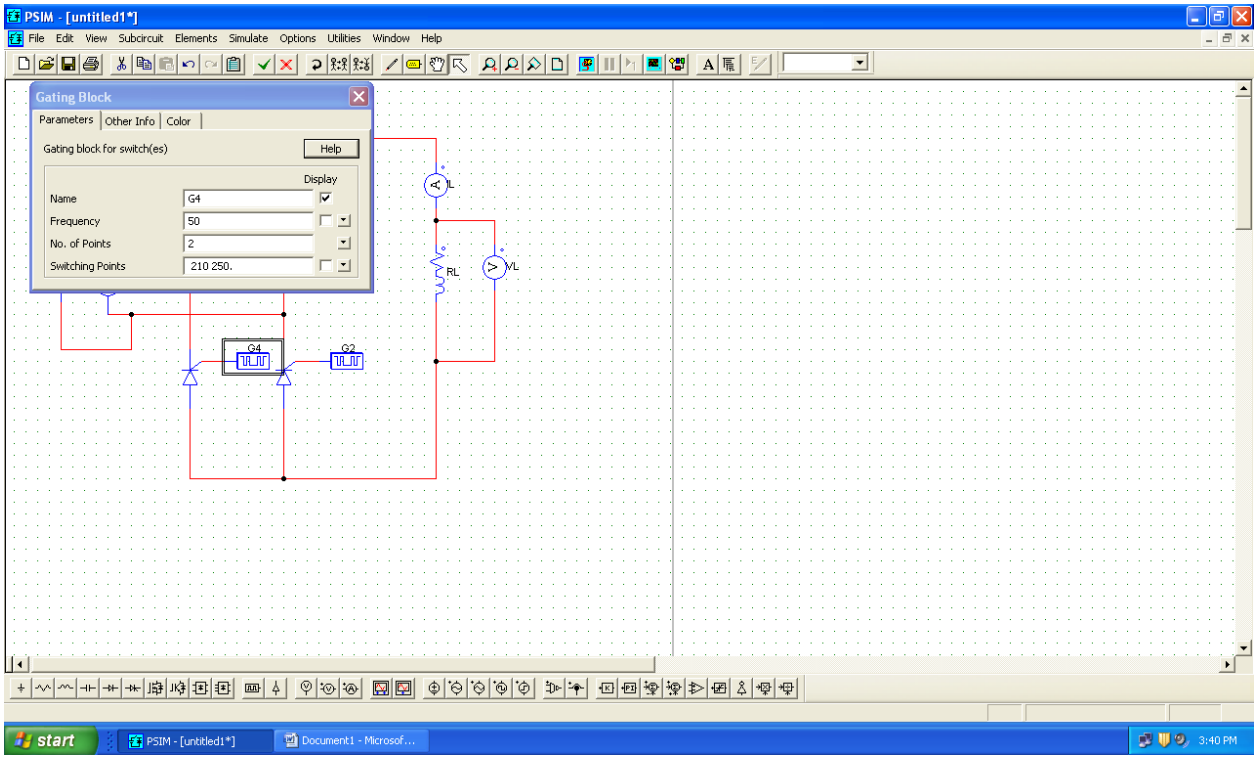


Give the gating block parameters as shown below

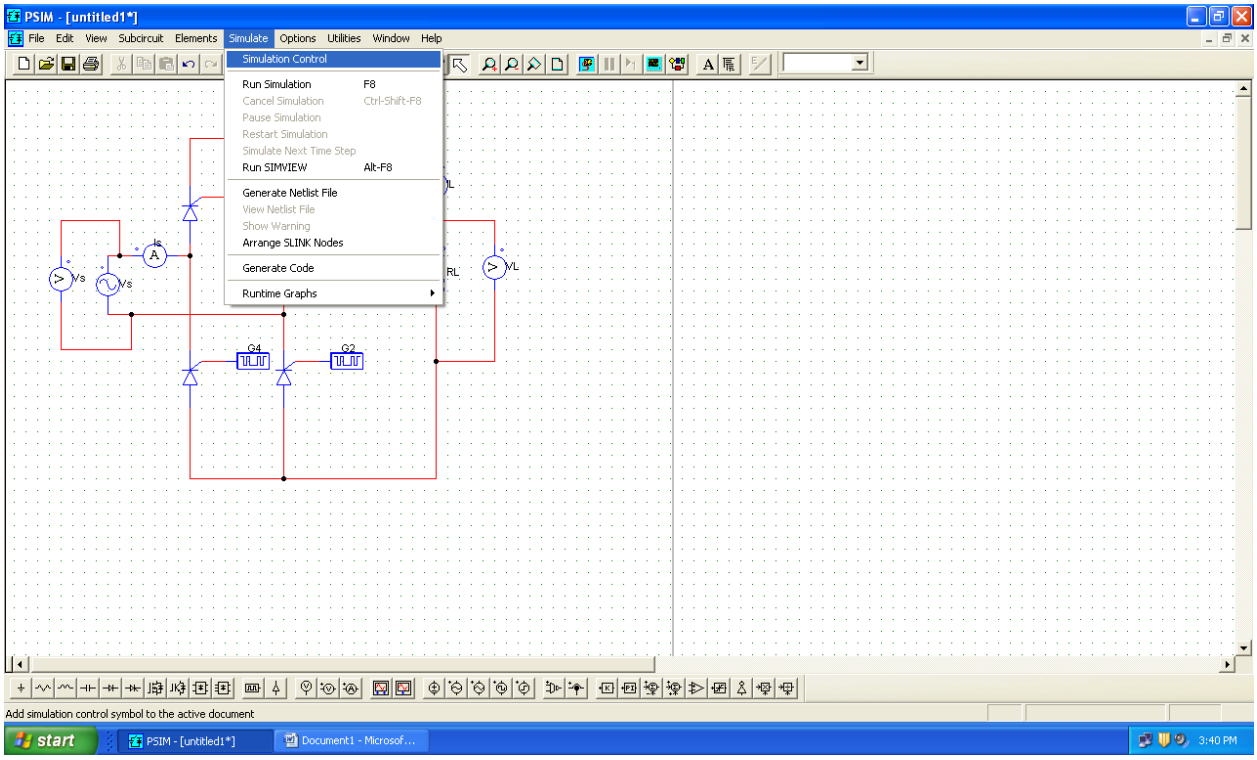


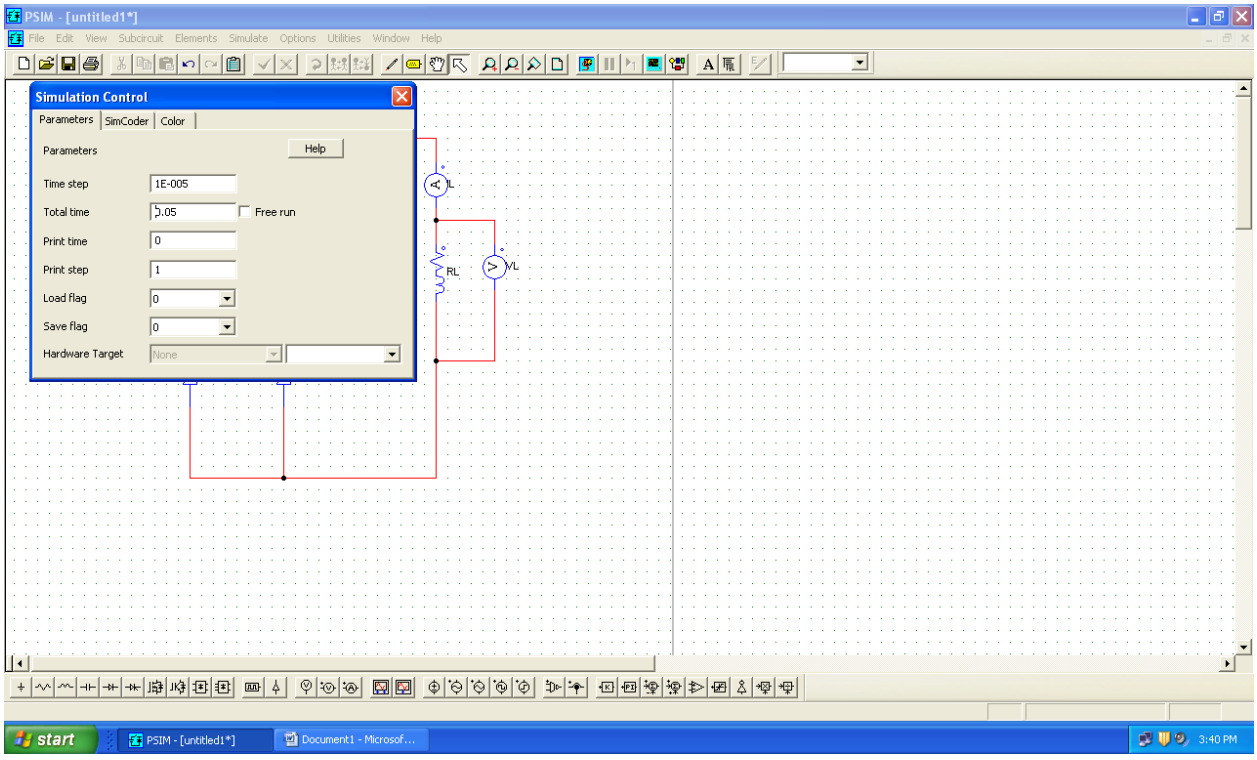



PSIM - [untitled1*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name G3
Frequency 50
No. of Points 2
Switching Points 210 250.
G4
G2
IL
RL
VL
Gating block for switch(es)
start
PSIM - [untitled1*]
Document1 - Microsof...
3:40 PM

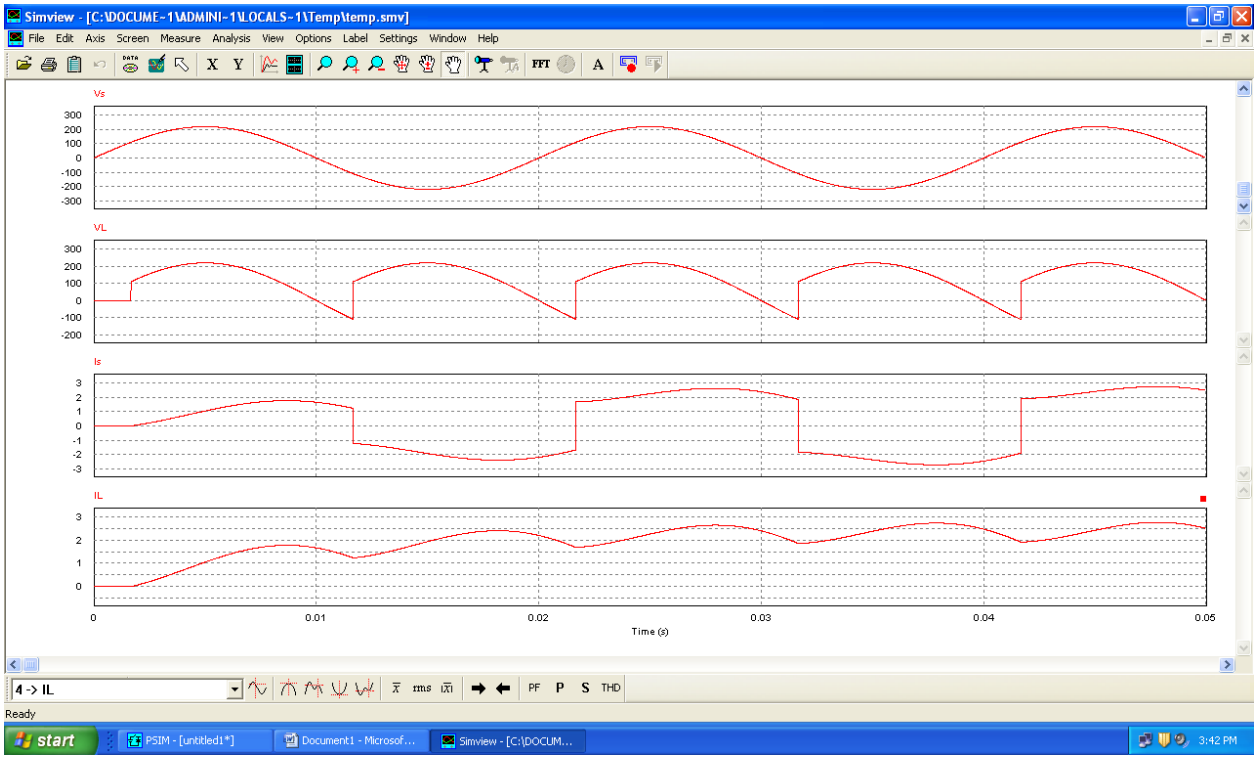

PSIM - [untitled1*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name G4
Frequency 50
No. of Points 2
Switching Points 210 250.
G4
G2
IL
RL
VL
start
PSIM - [untitled1*]
Document1 - Microsof...
3:40 PM

Select the simulation control



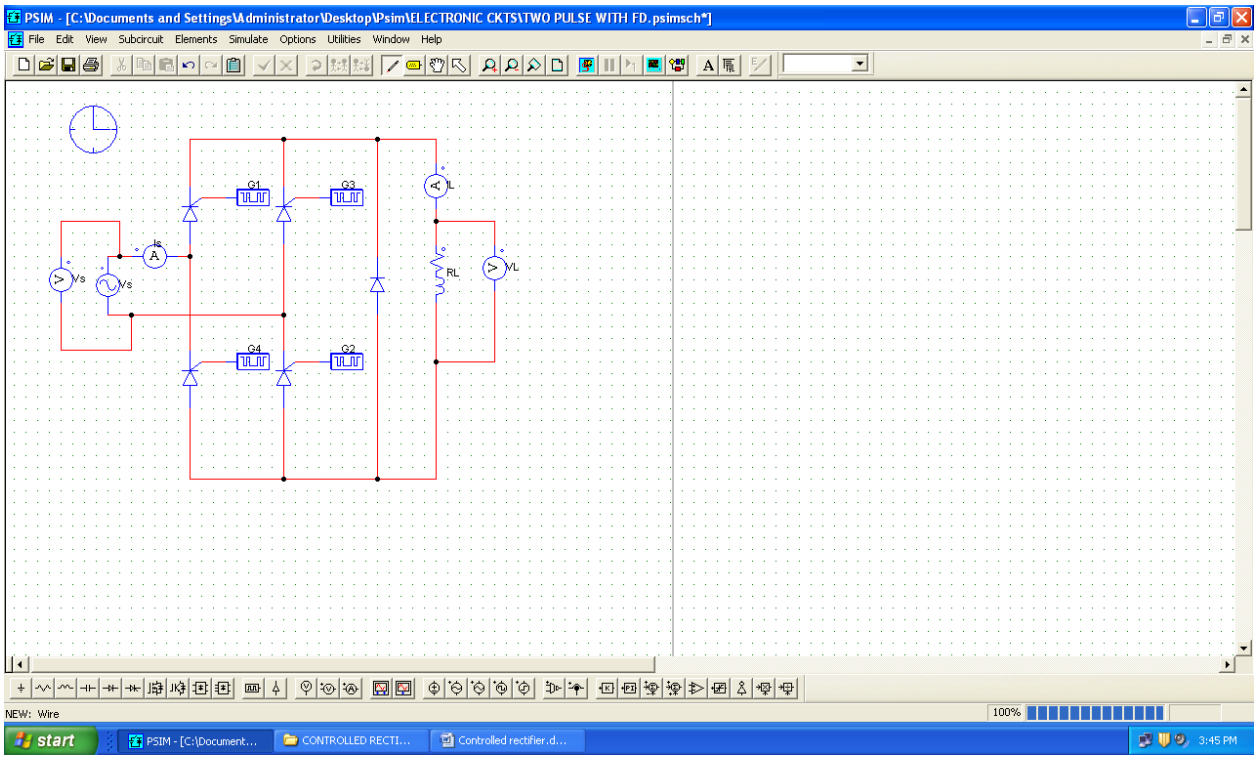


Output waveforms

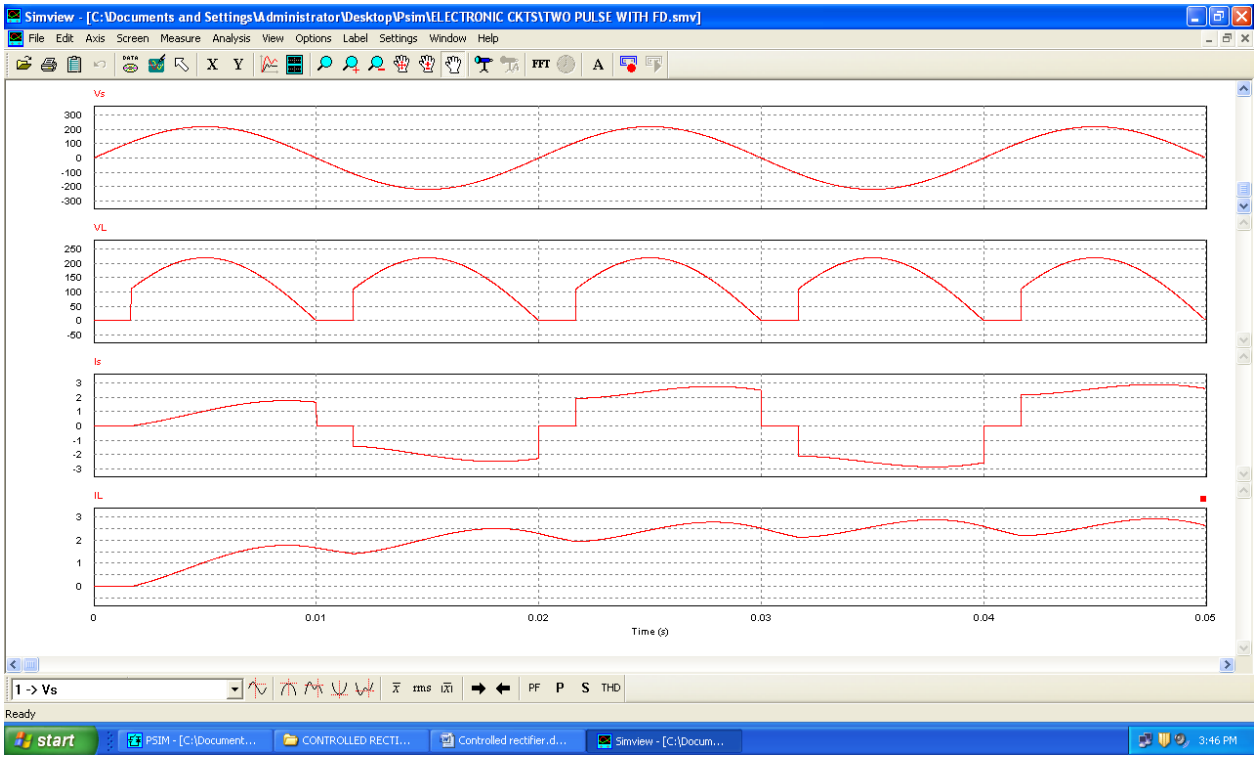


RECTIFIER WITH FREE WHELLING DIODE

Circuit diagram

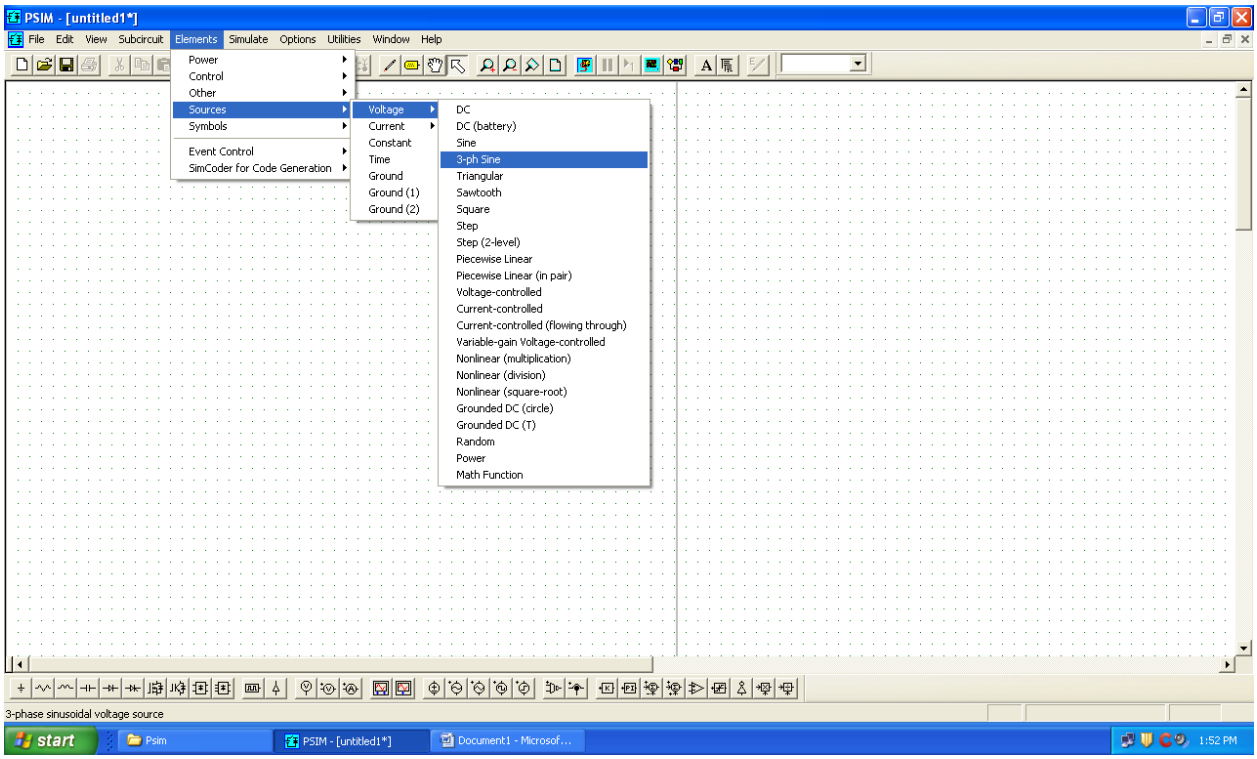


Output waveforms

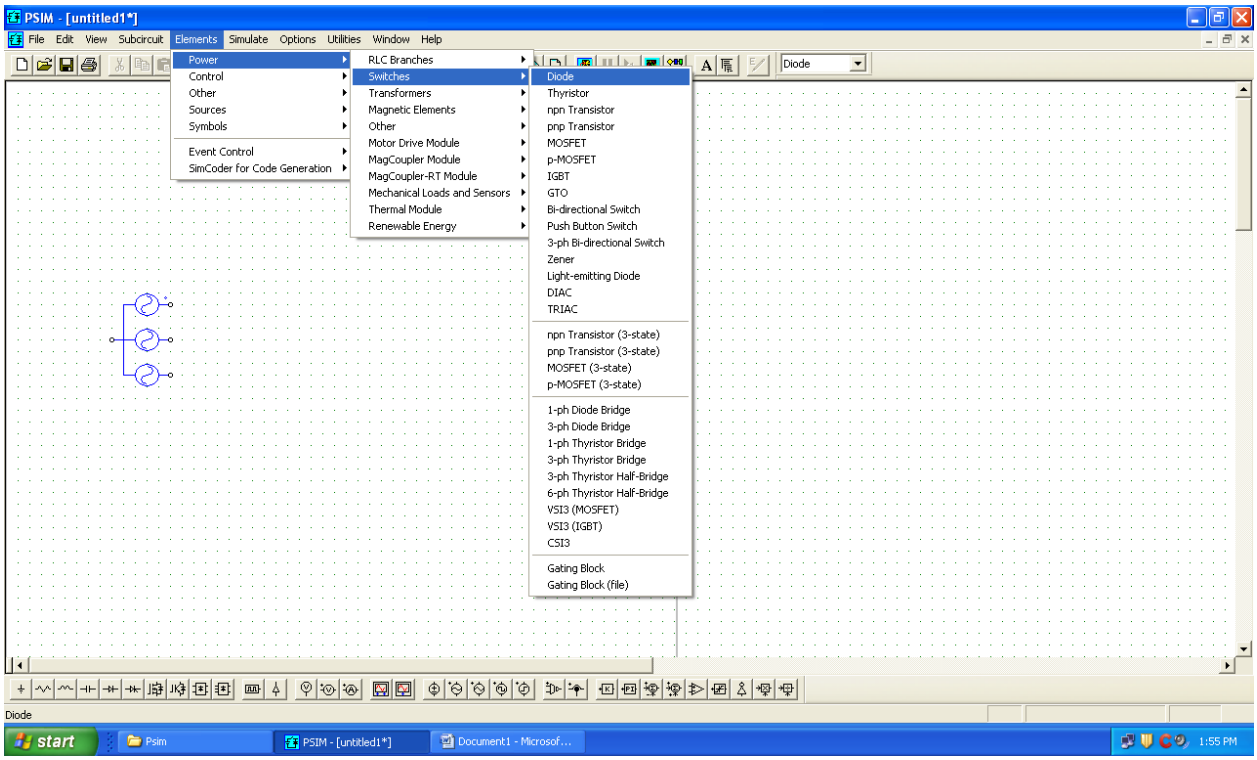


THREE PULSE RECTIFIER

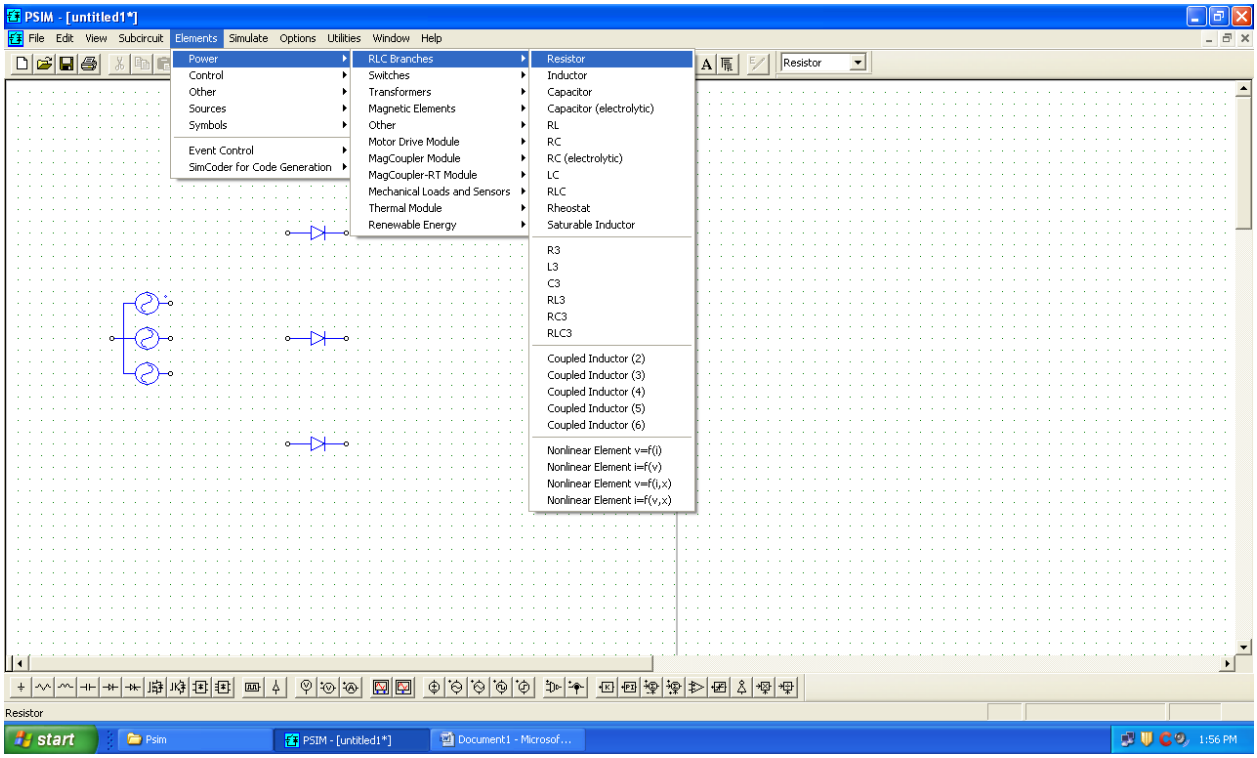
SELECTION OF 3-PHASE AC VOLTAGE SOURCE:



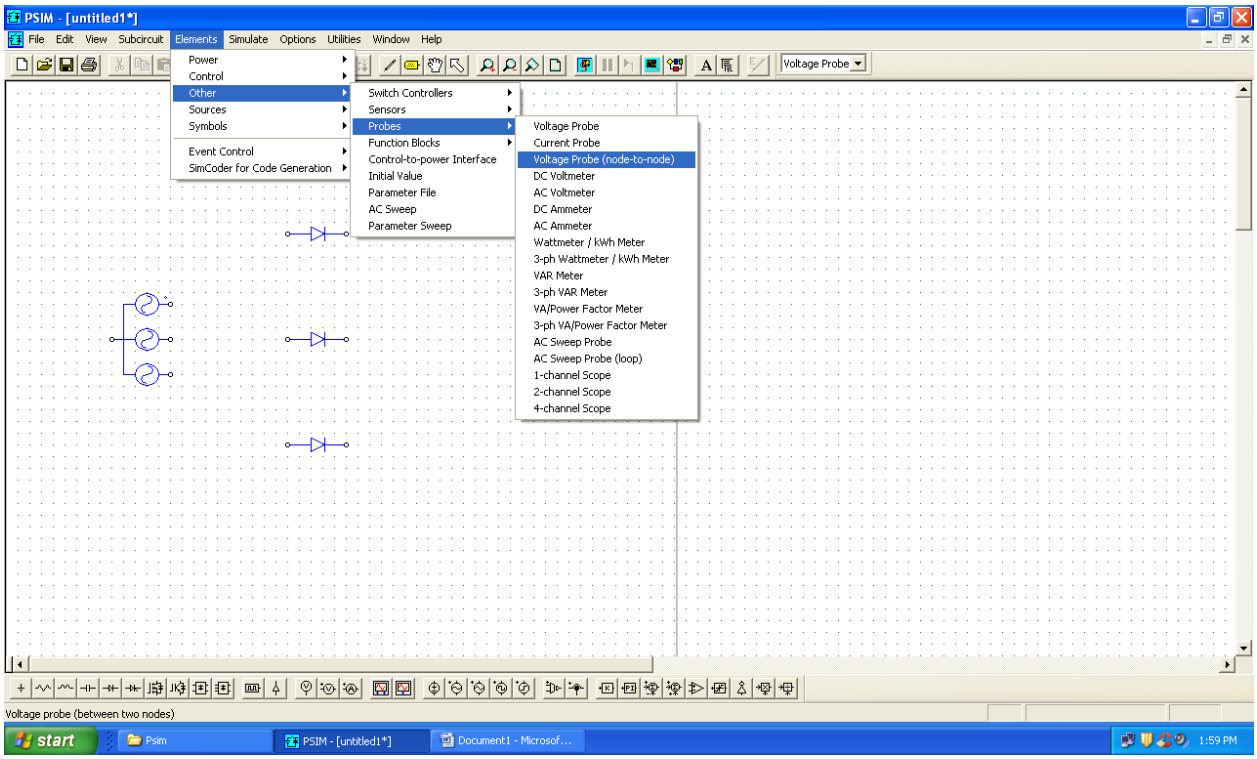
SELECTION OF DIODE:



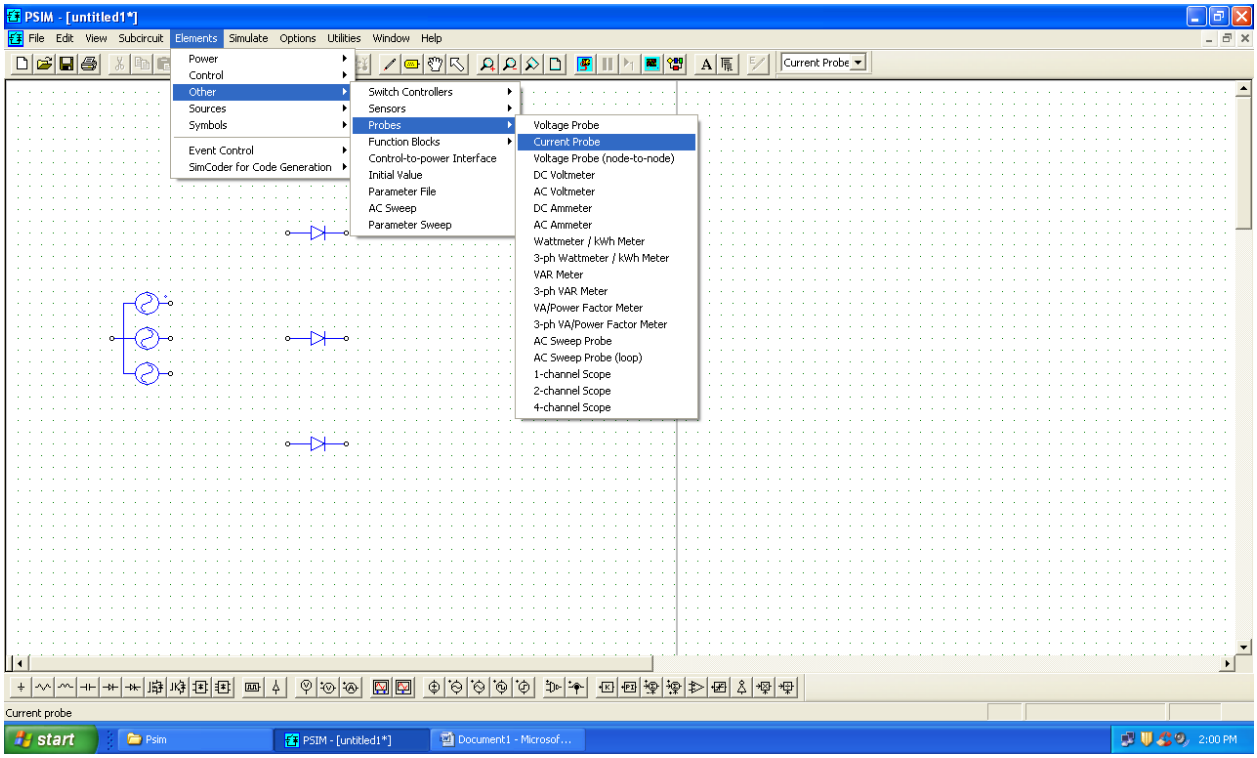
SELECTION OF THE LOAD RESISTANCE:



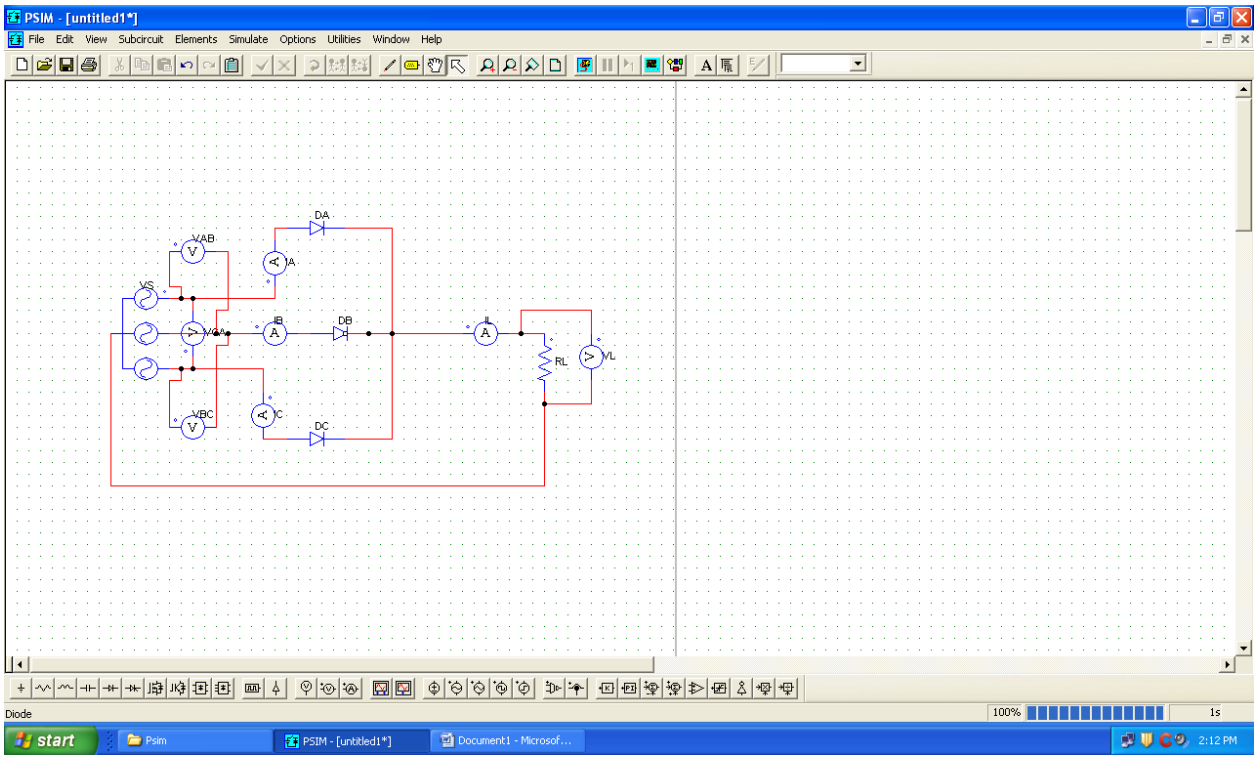
SELECTION OF VOLTMETERS:



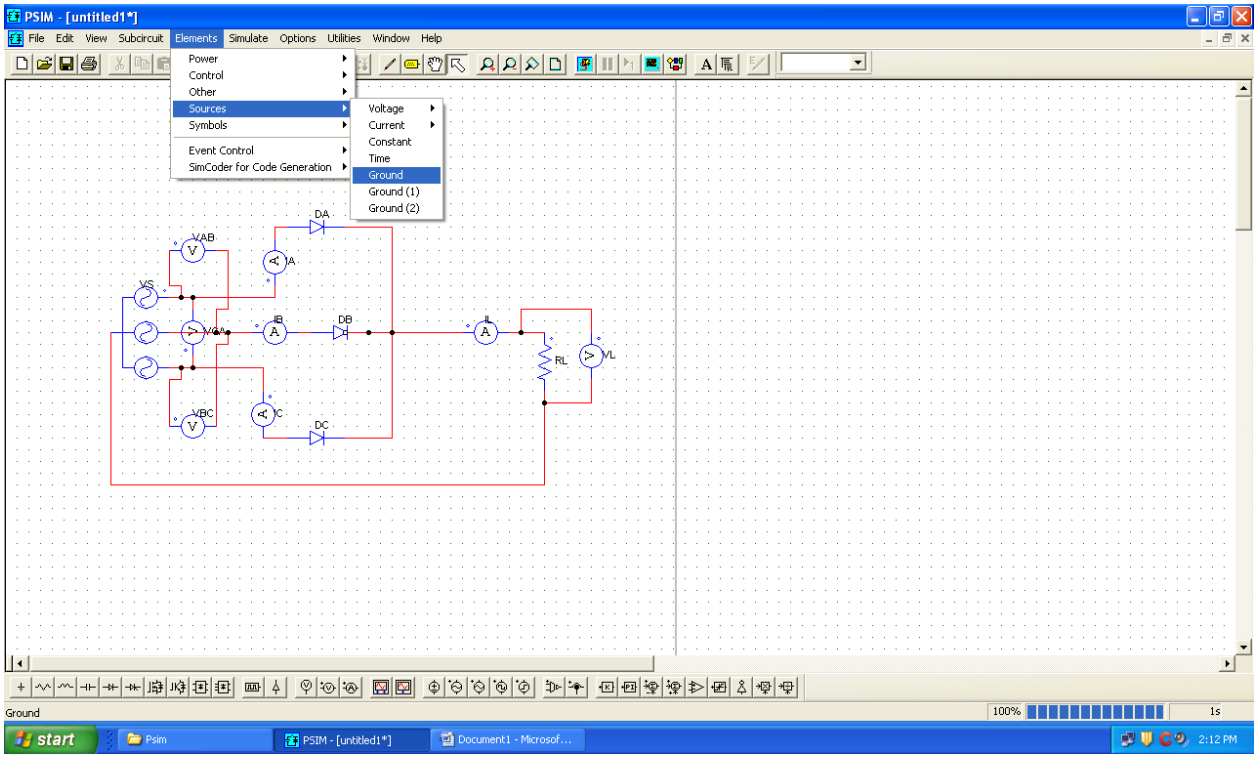
SELECTION OF AMMETERS:



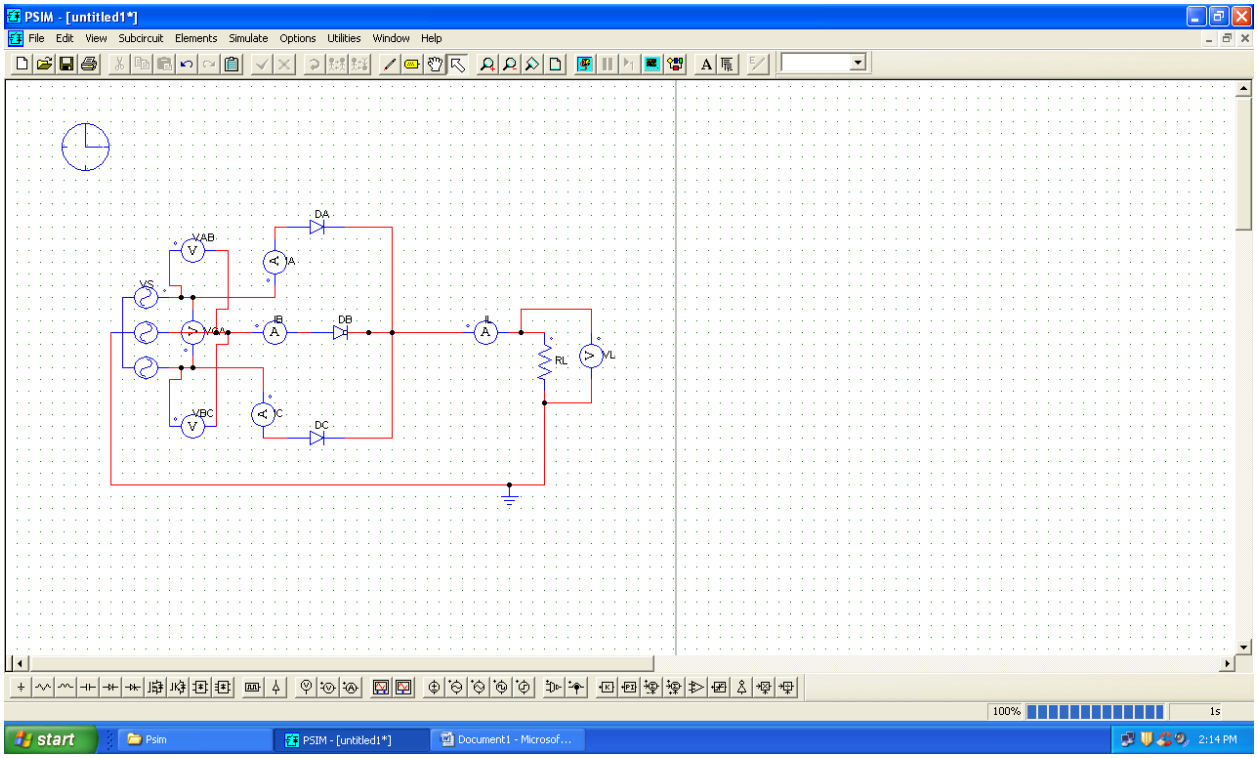
CONNECTING THE ELEMENTS:



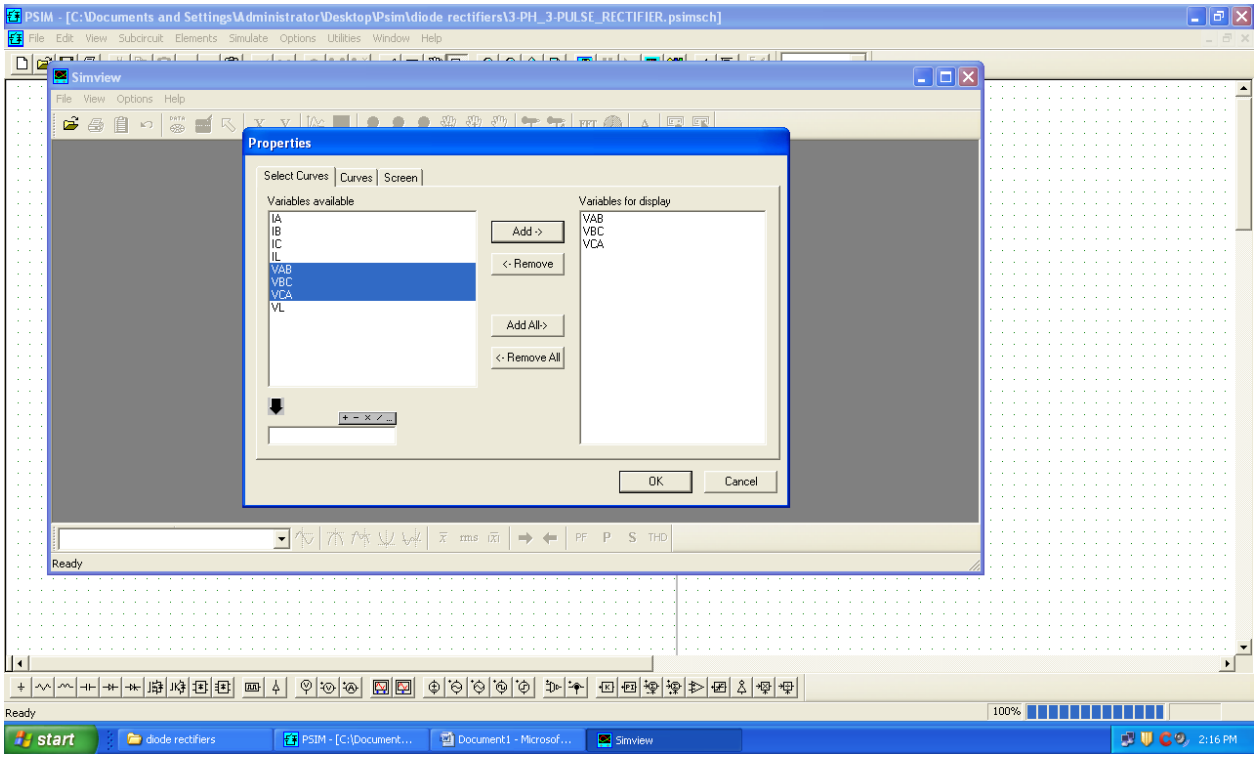
SELECTION OF THE GROUND:



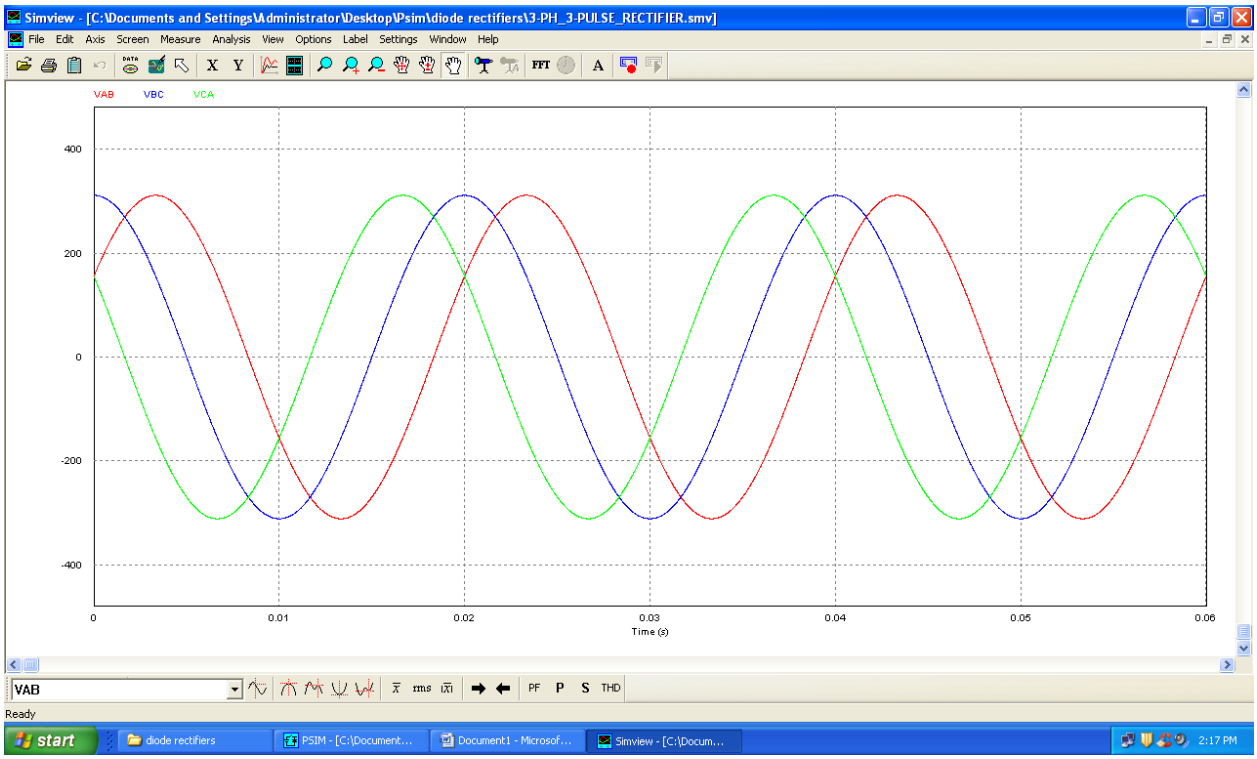
FINAL CIRCUIT:



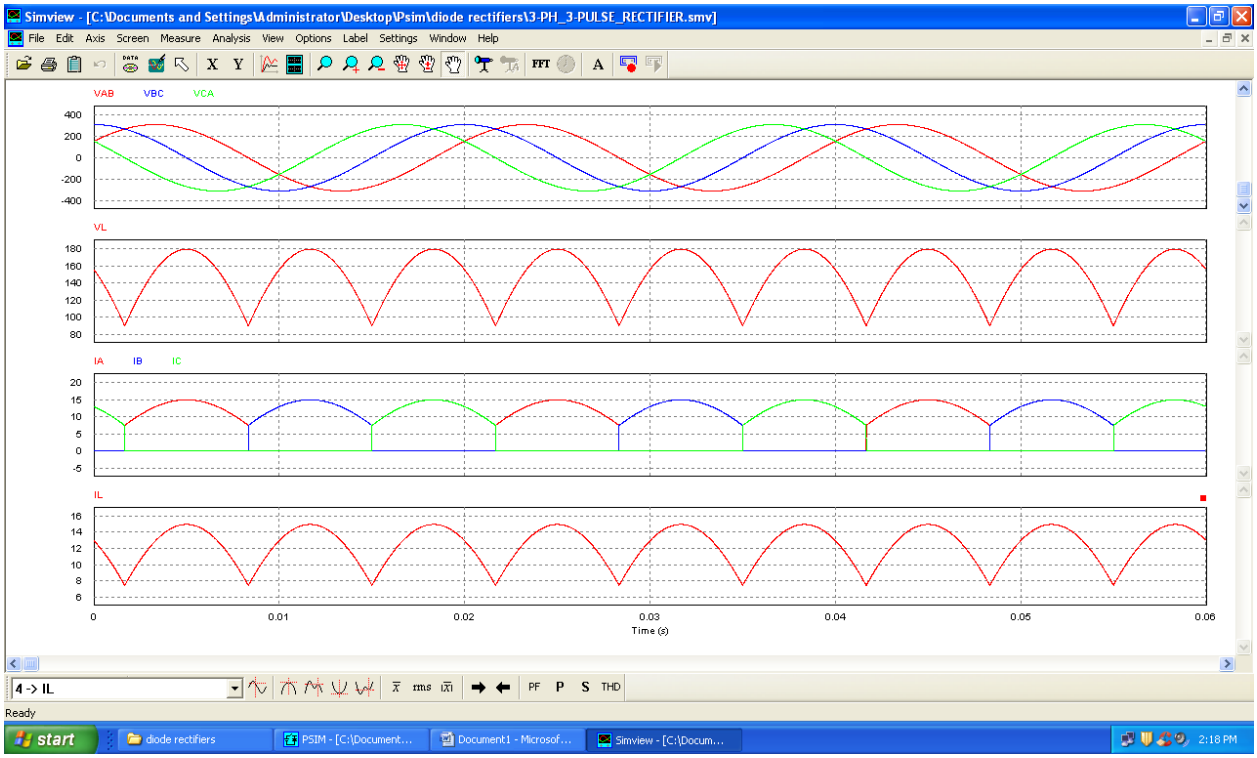
SELECTING THE VARIABLES FOR OUTPUT WAVEFORMS:



3-PH SOURCE VOLTAGE WAVEFORMS:



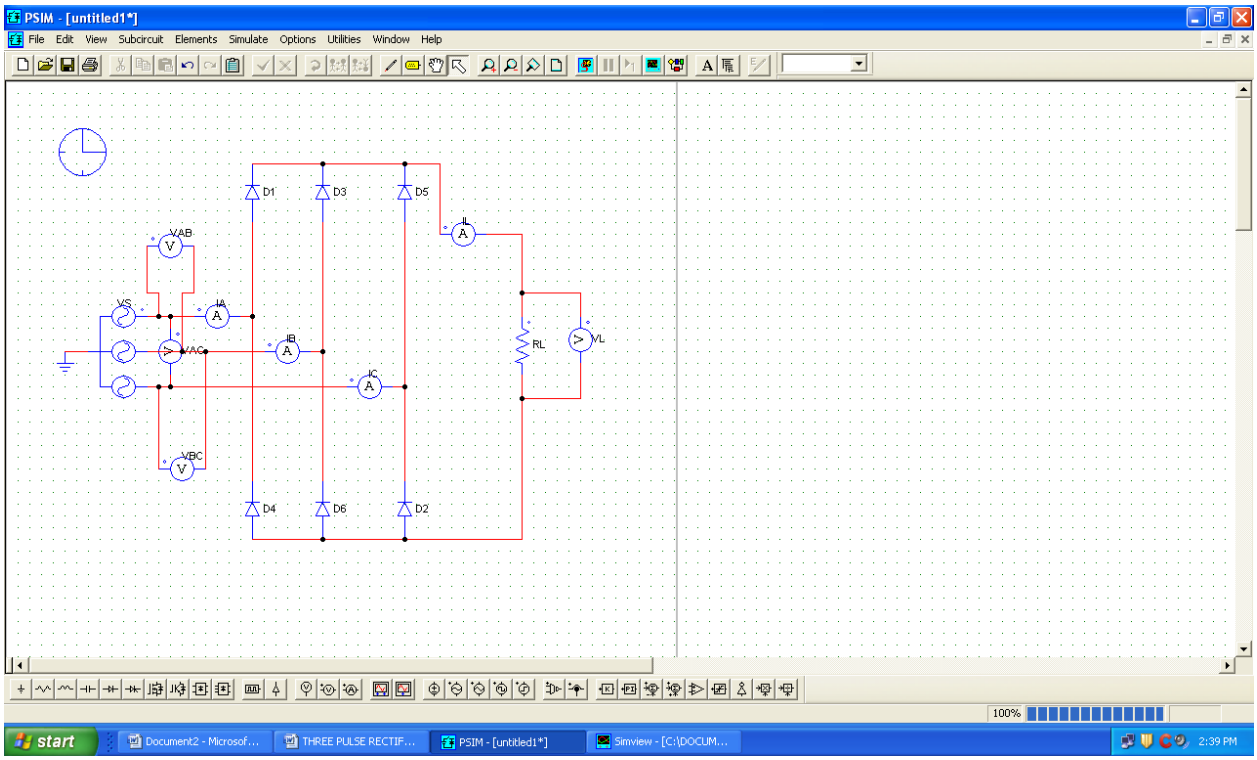
OUTPUT WAVEFORMS OF ALL VARIABLES:



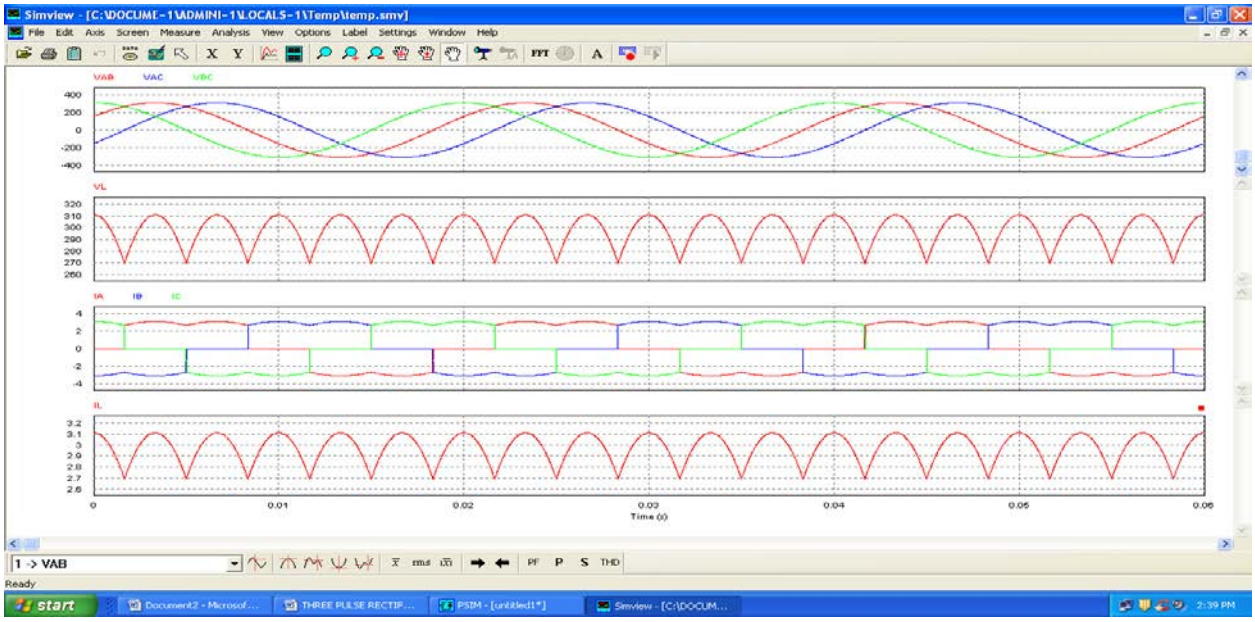
SIX PULSE RECTIFIER

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram

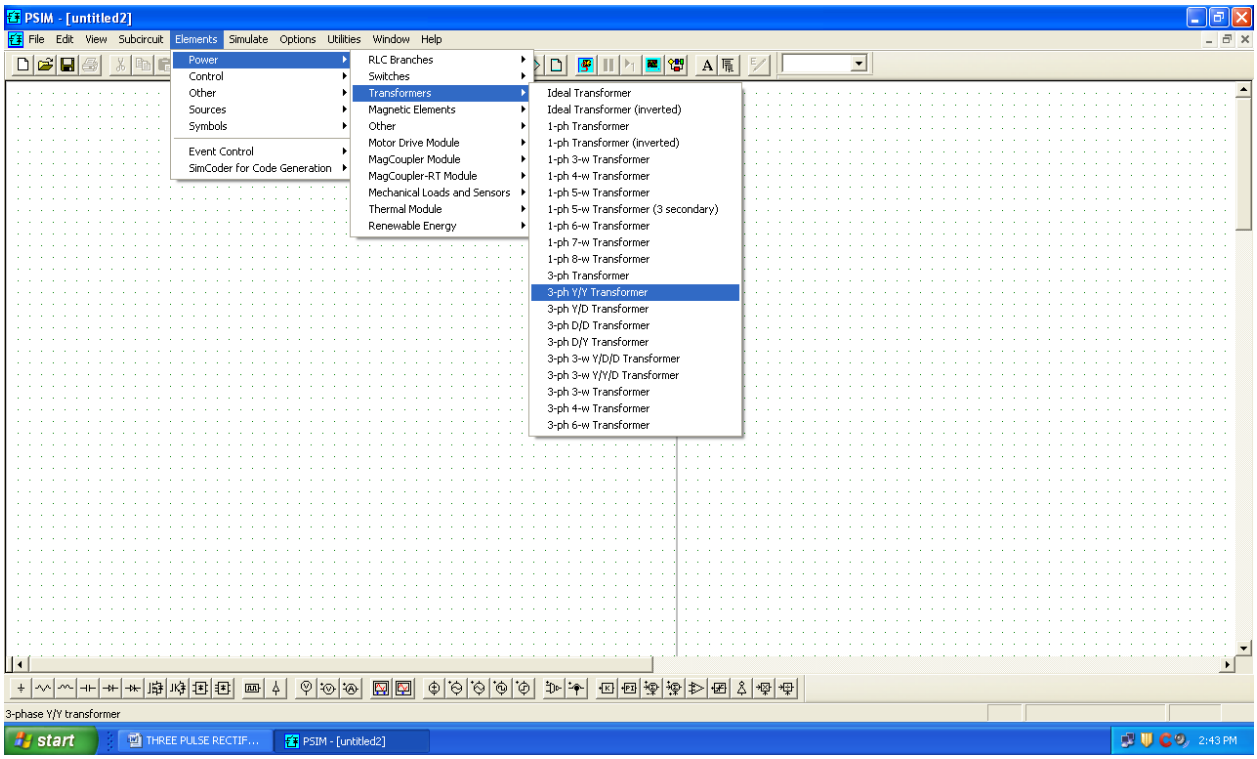


OUTPUT WAVEFORMS:

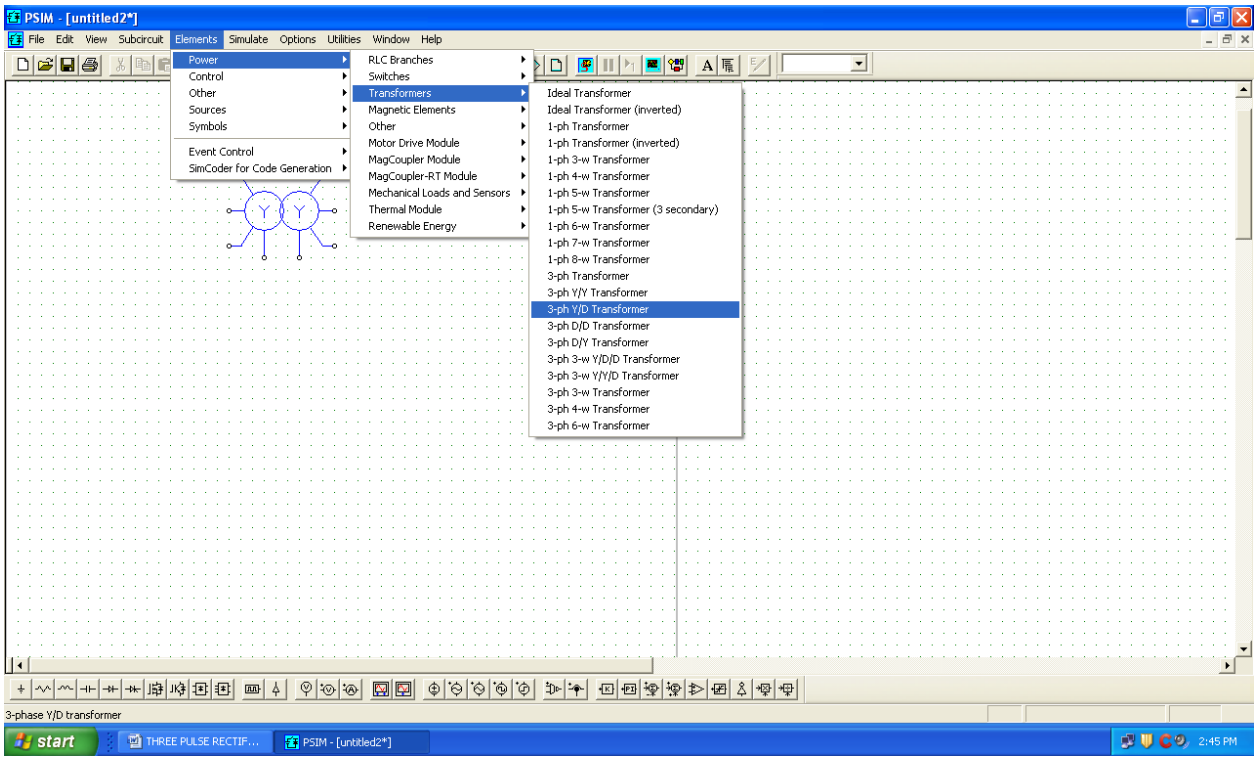


TWELVE PULSE RECTIFIER

SELECTING THE 3-PHASE Y-Y TRANSFORMER:

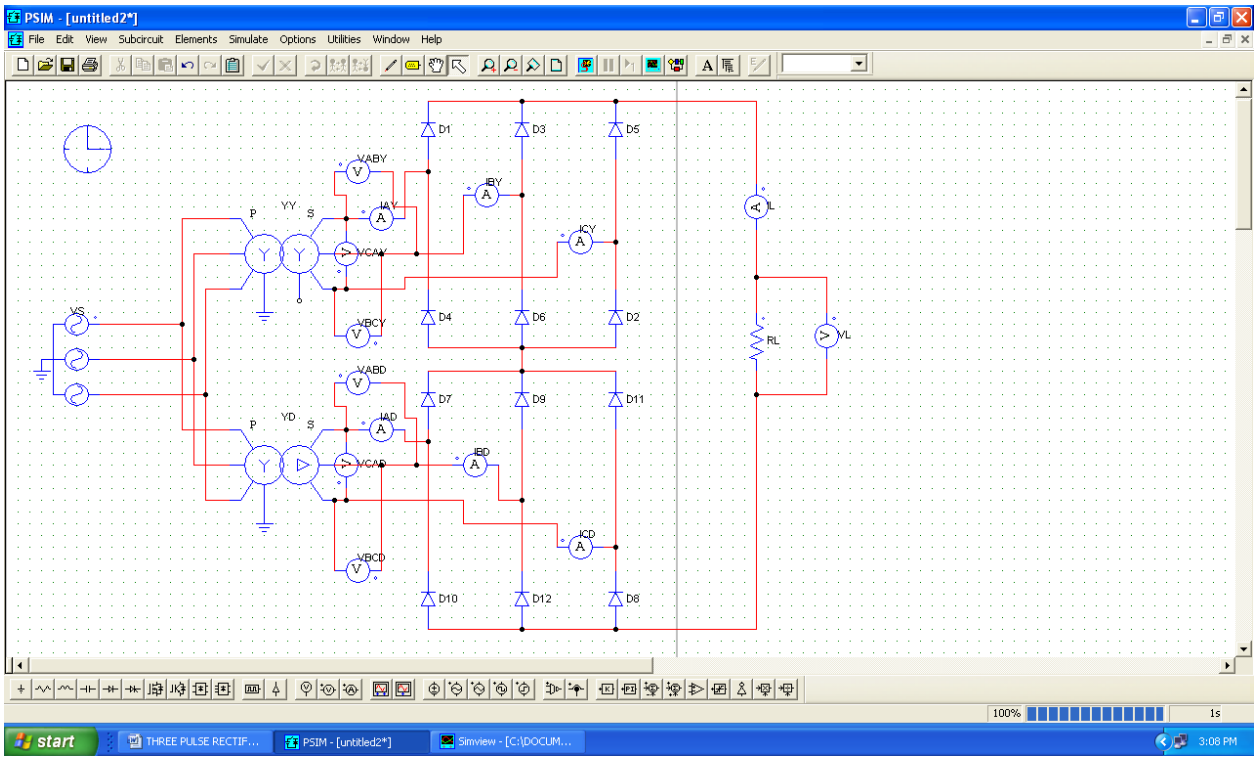


SELECTING THE 3-PHASE Y-Δ TRANSFORMER:

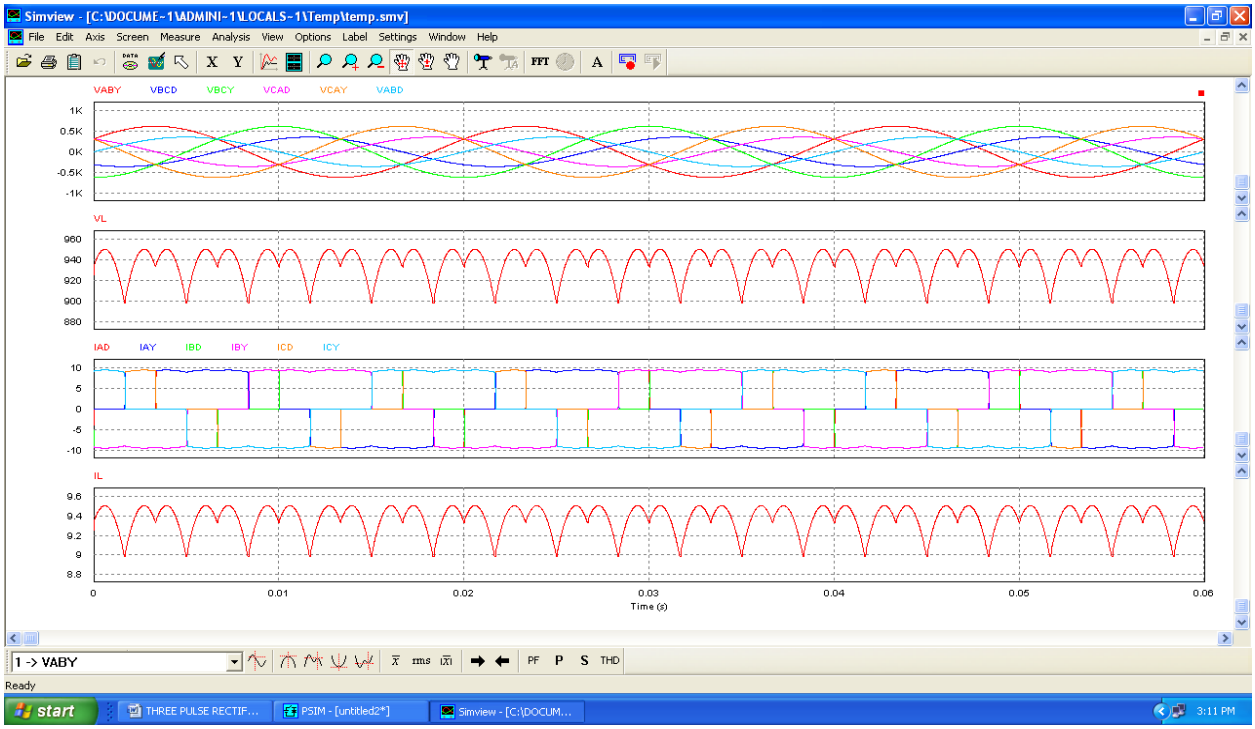


Select the remaining elements as shown above and connect them as shown in below figure with proper labeling

CIRCUIT DIAGRAM:



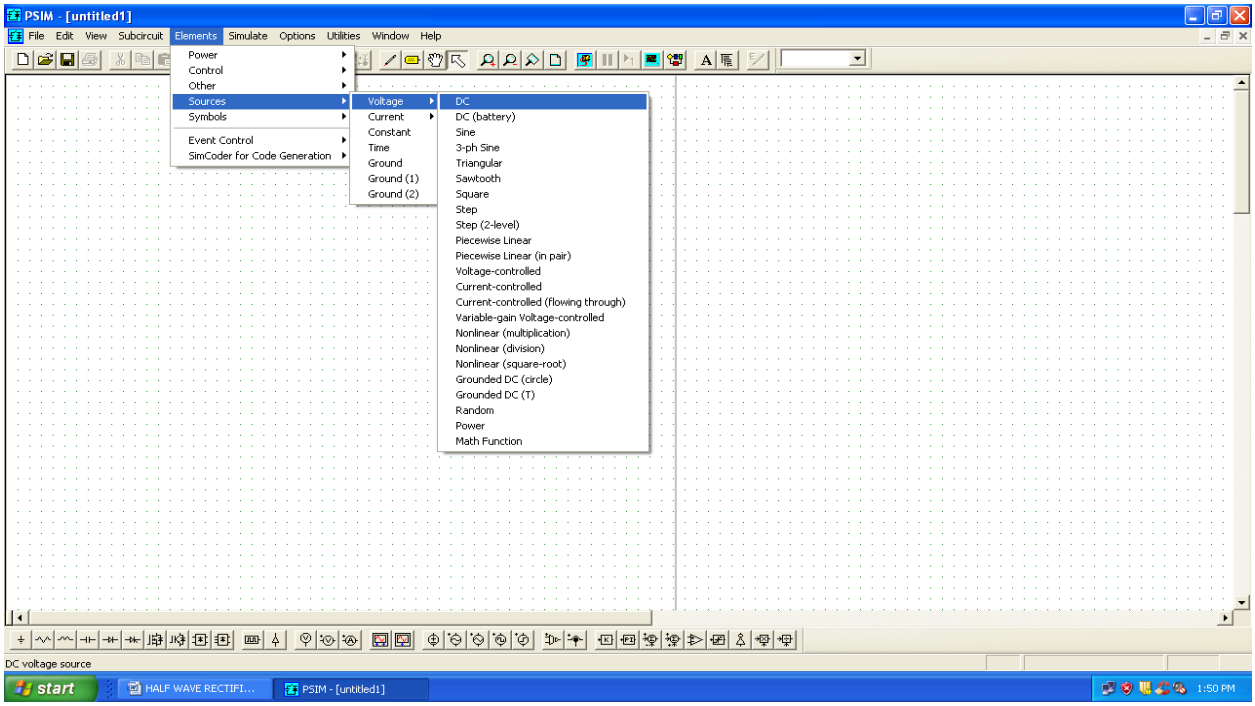
OUTPUT WAVEFORMS:


Simview - [C:\DOCUME~1\ADMINI~1\LOCALS~1\Temp\temp.smv]
File Edit Axis Screen Measure Analysis View Options Label Settings Window Help
VABY VBCD VBCY VCAD VCAY VABD
1K
0.5K
0K
-0.5K
-1K
VL
960
940
920
900
880
IAD IAY IBD IBY ICD ICY
10
5
0
-5
-10
IL
9.6
9.4
9.2
9
8.8
0
0.01
0.02
0.03
0.04
0.05
0.06
Time (s)
1 -> VABY
PF P S THD
Ready
start
THREE PULSE RECTIF...
PSIM - [untitled2*]
Simview - [C:\DOCUM...
3:11 PM

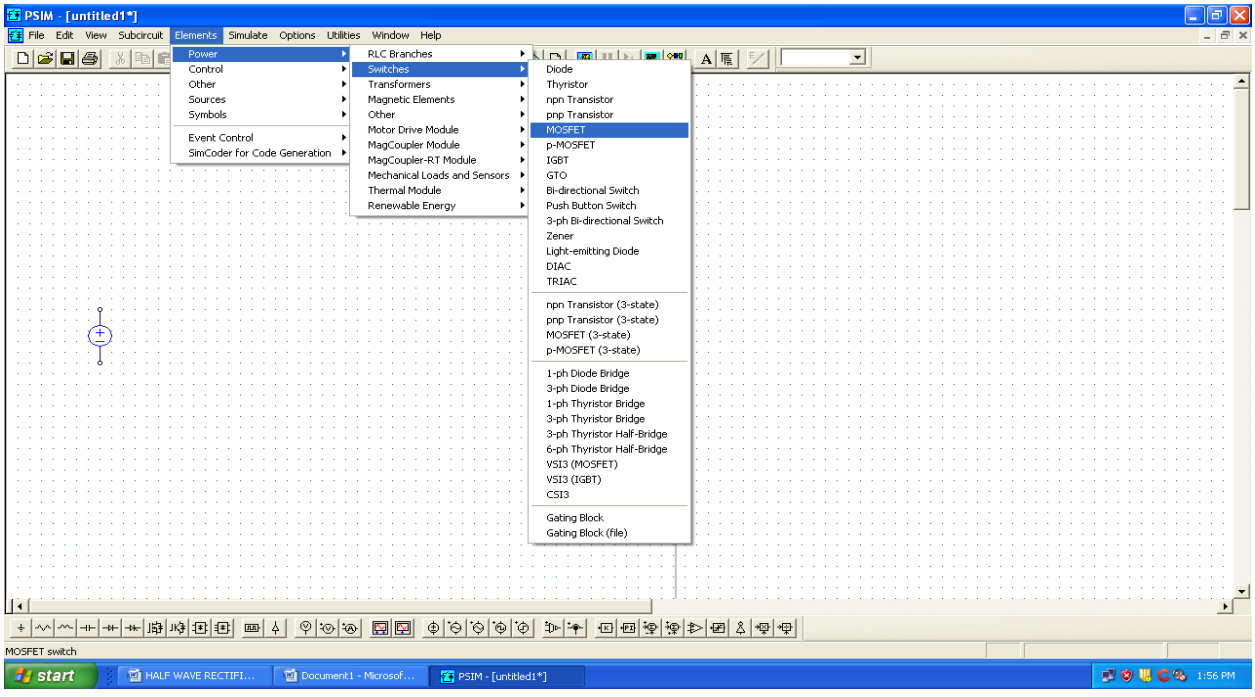
Dc to Dc converters

Buck converter

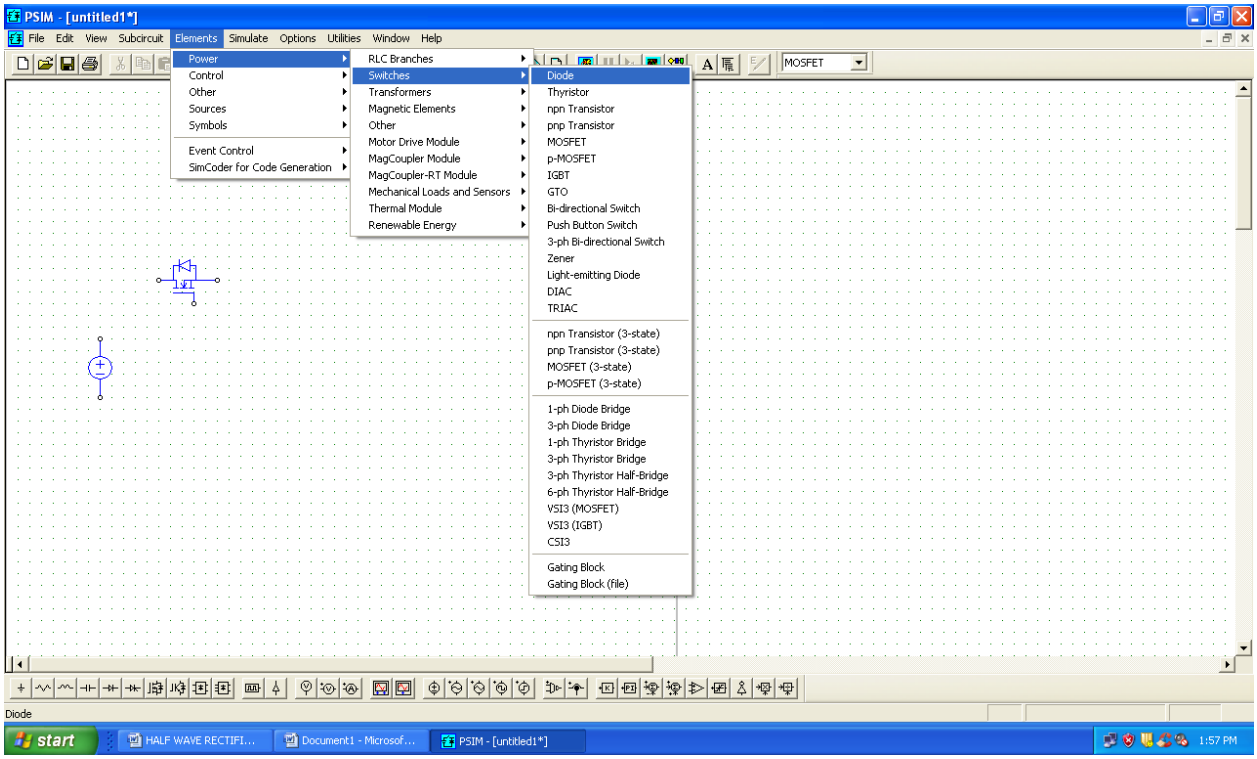
Selection of DC source



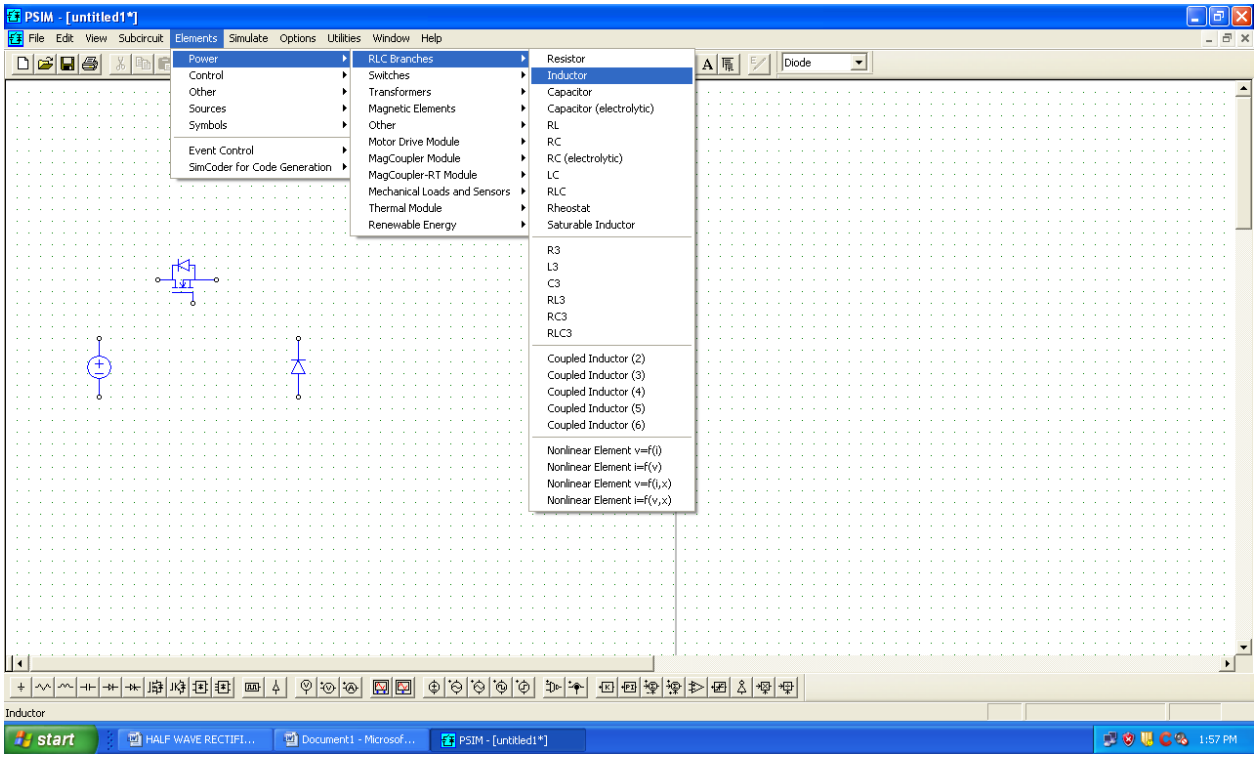
Selection of mosfet



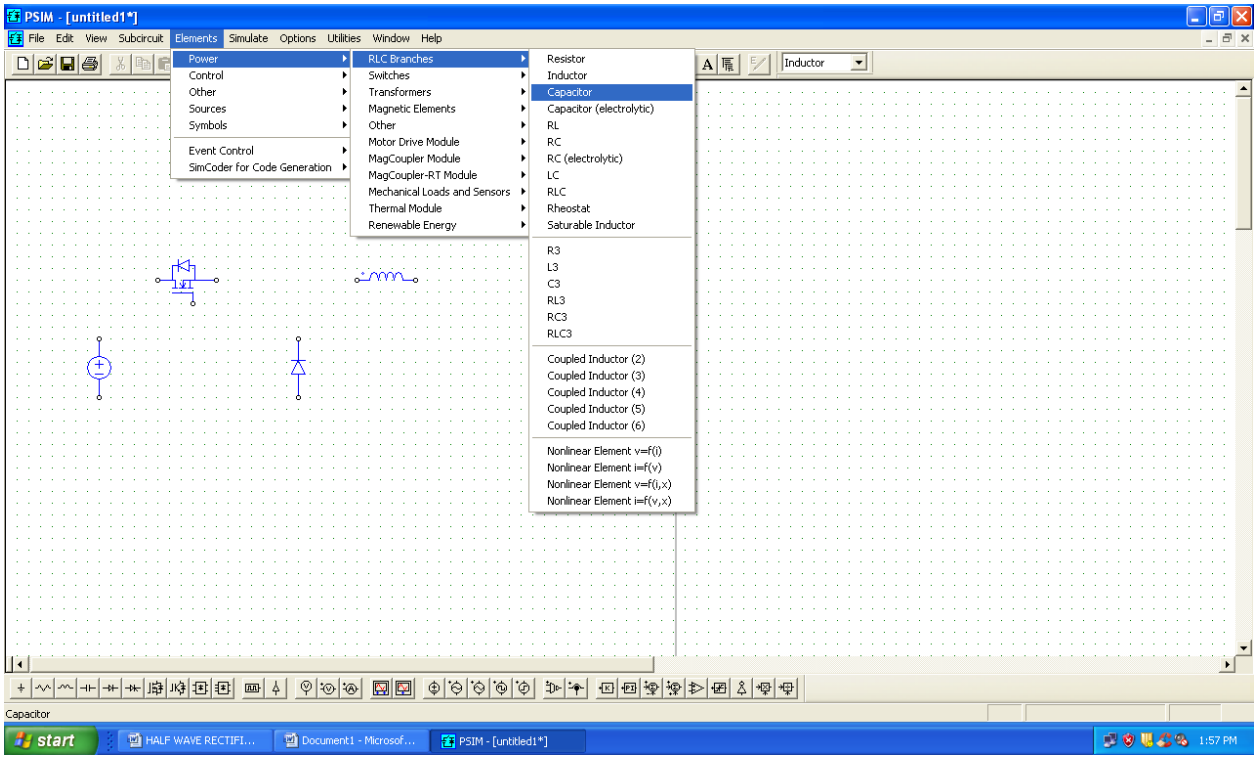
Selection of diode



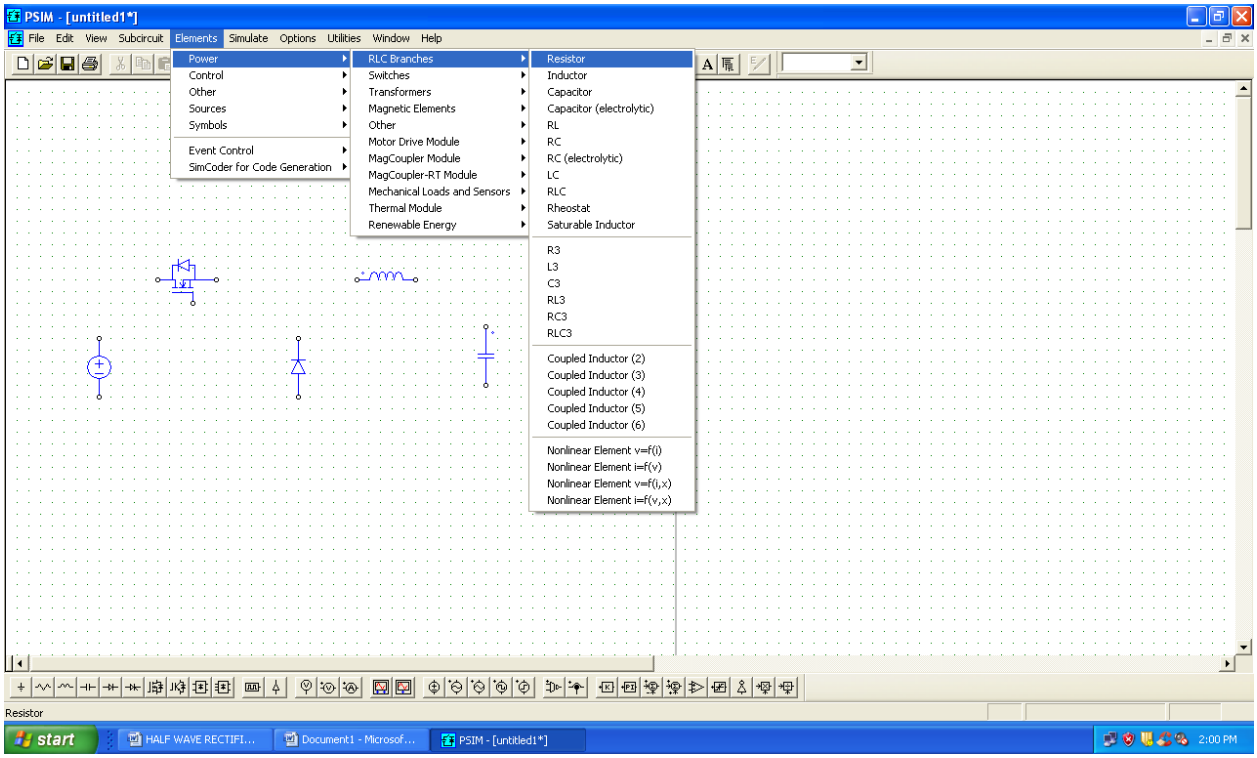
Selection of Inductor



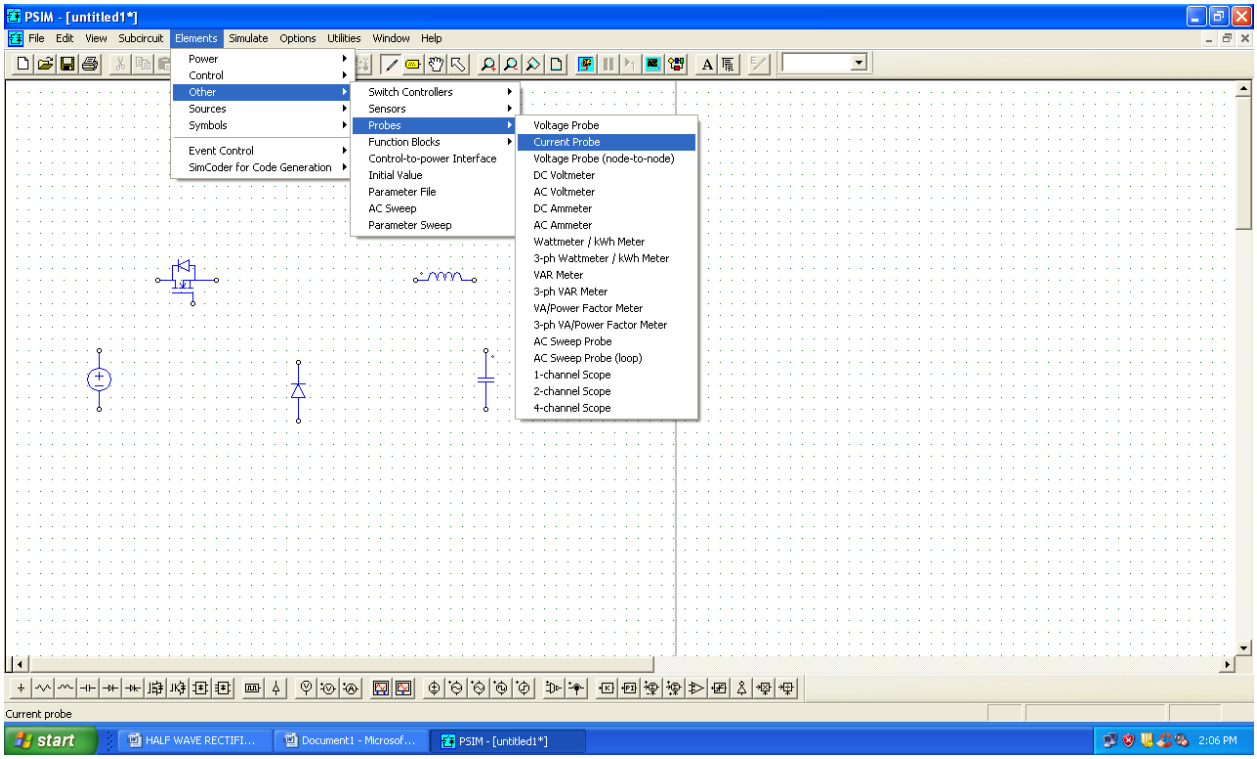
Selection of Capacitor



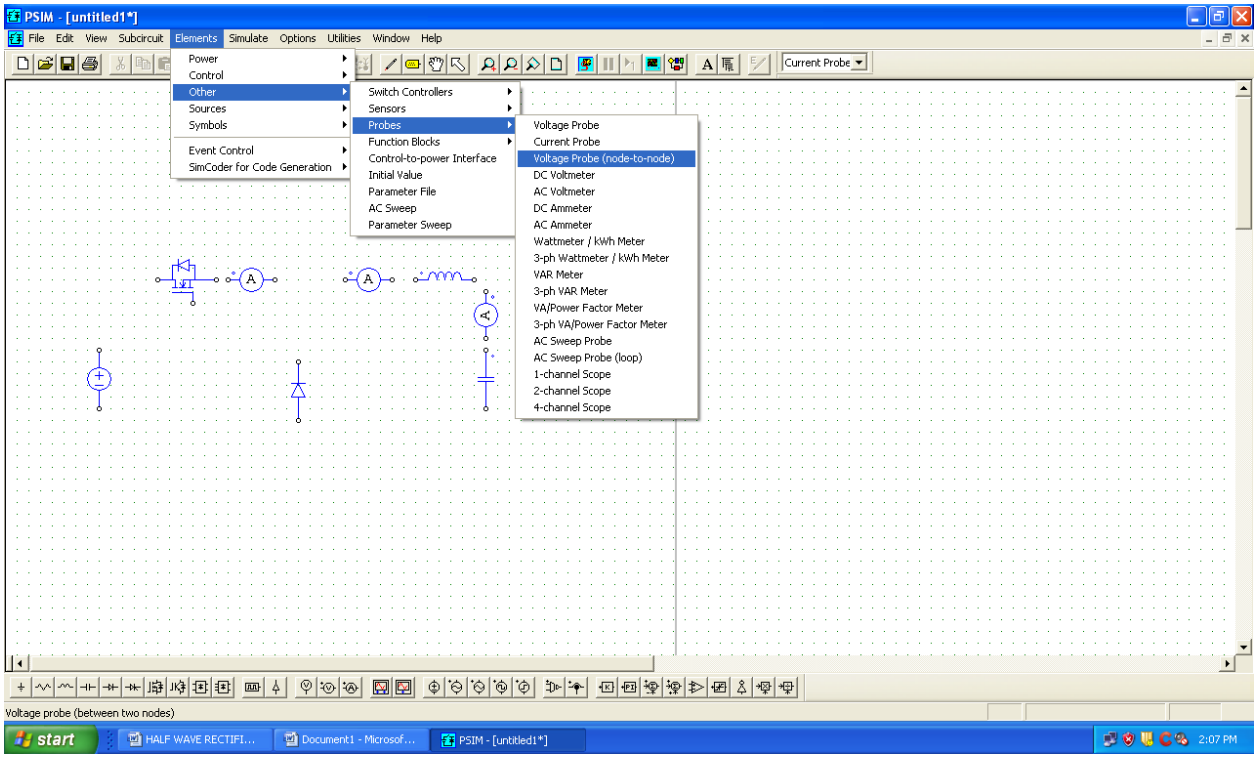
Selection of Resistor



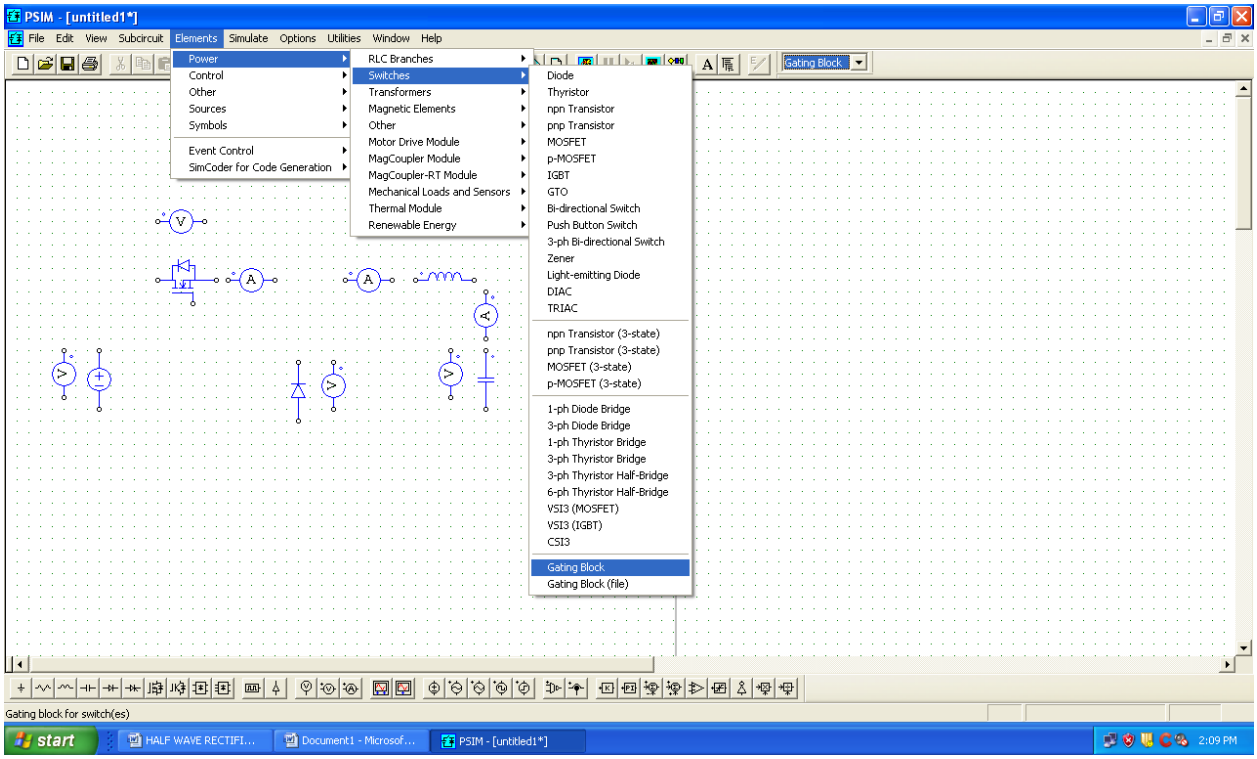
Selection of ammeter



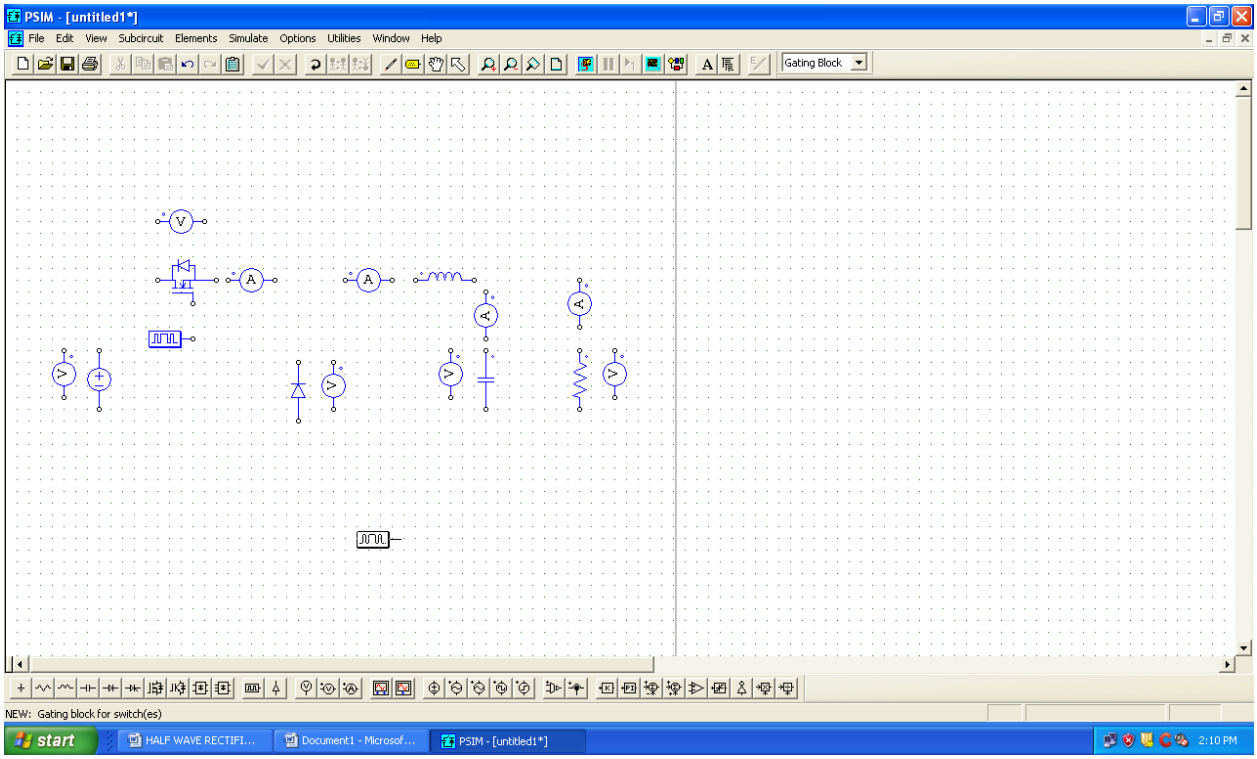
Selection of volt meter



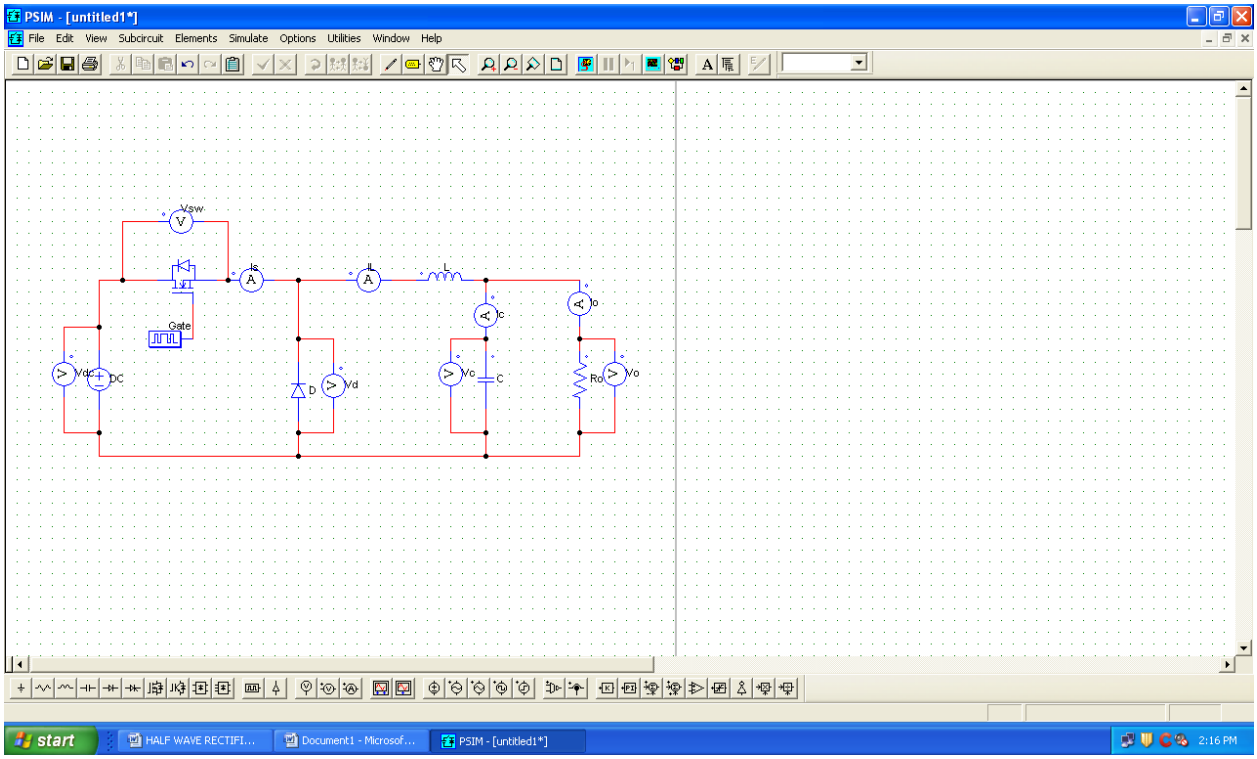
Selection of gating block



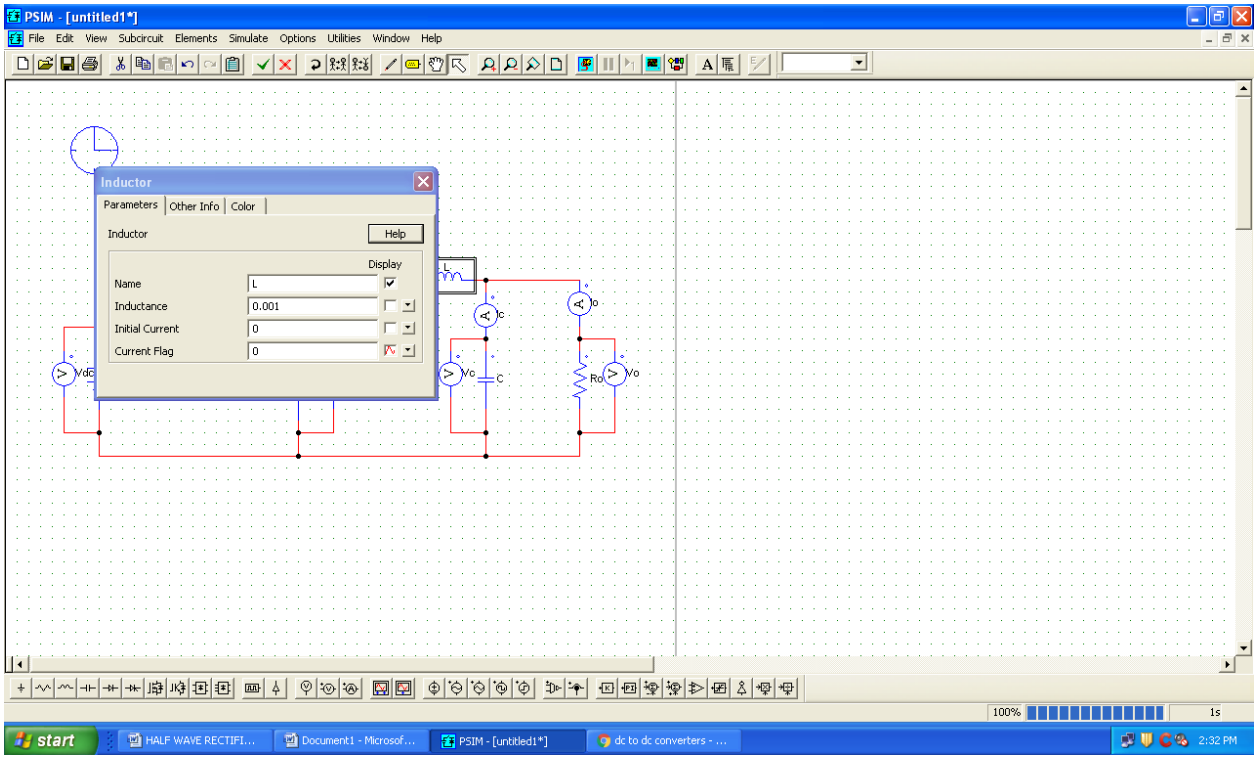
Select as many elements as shown below



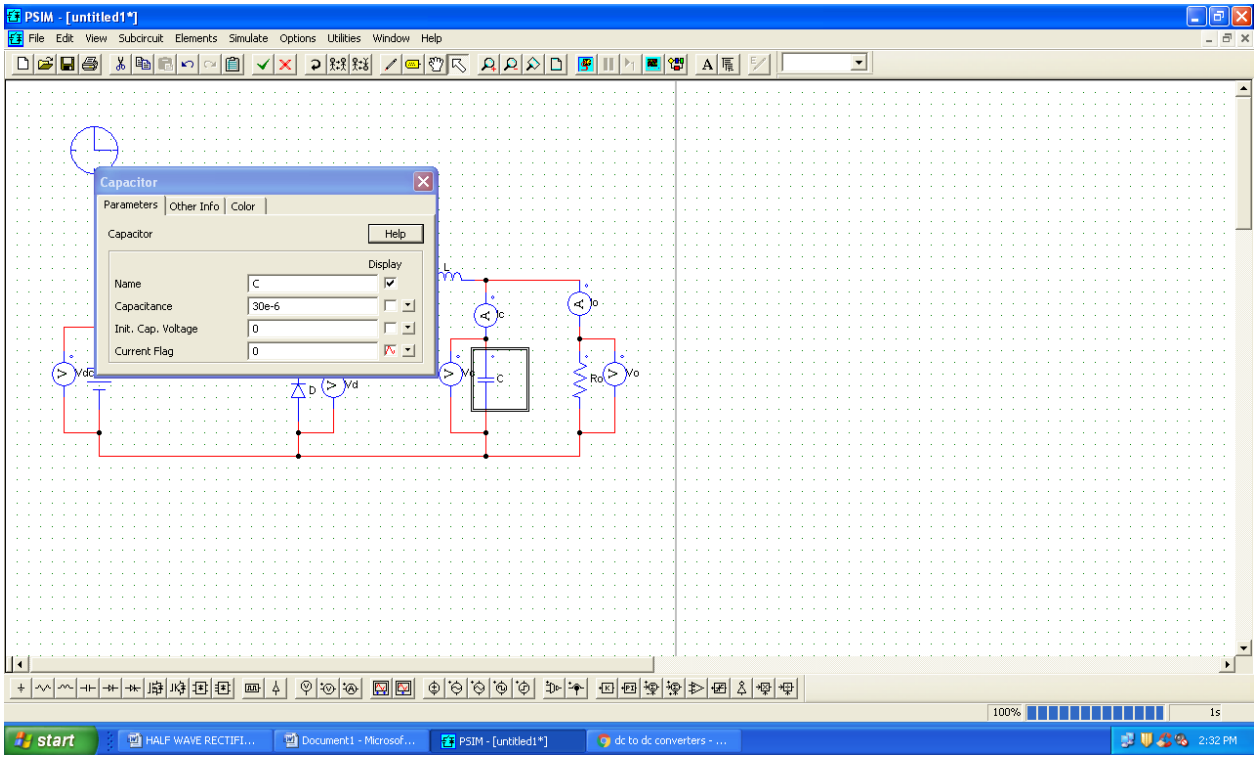
Connect the circuit as shown below using wiring tool



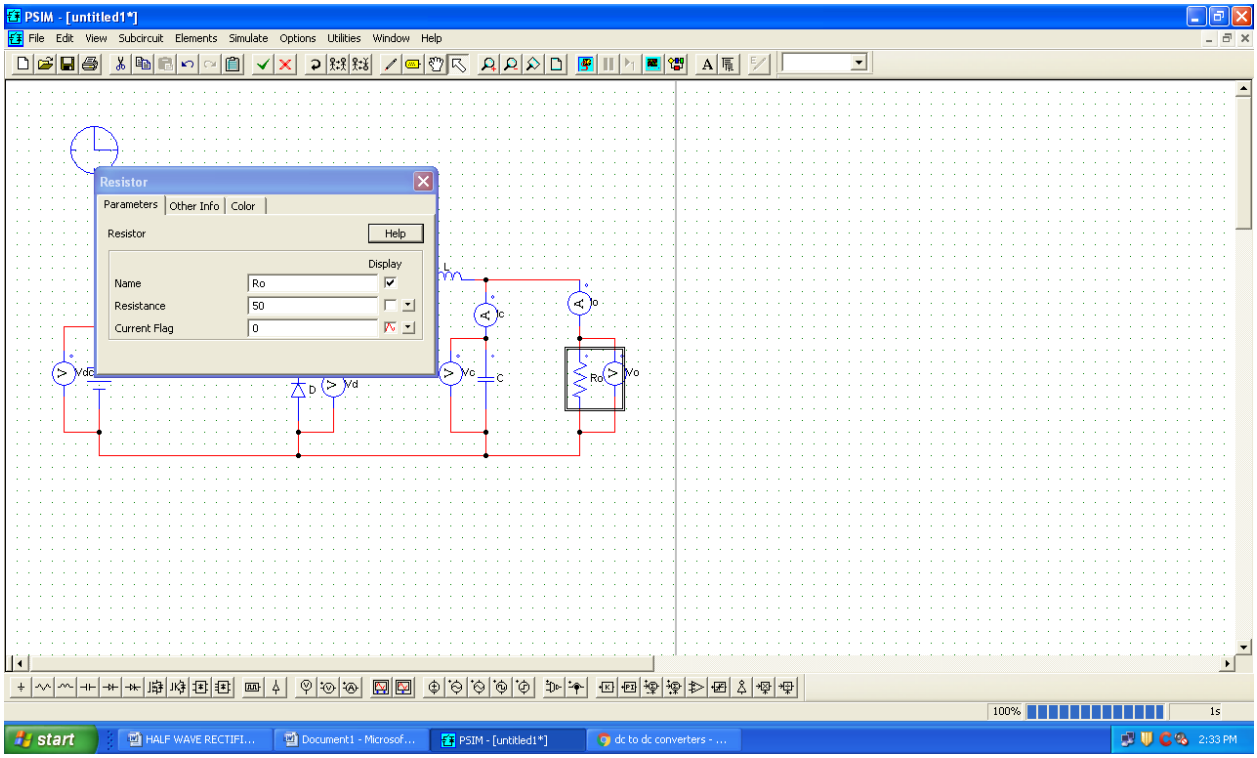
Give the inductor value=1mh



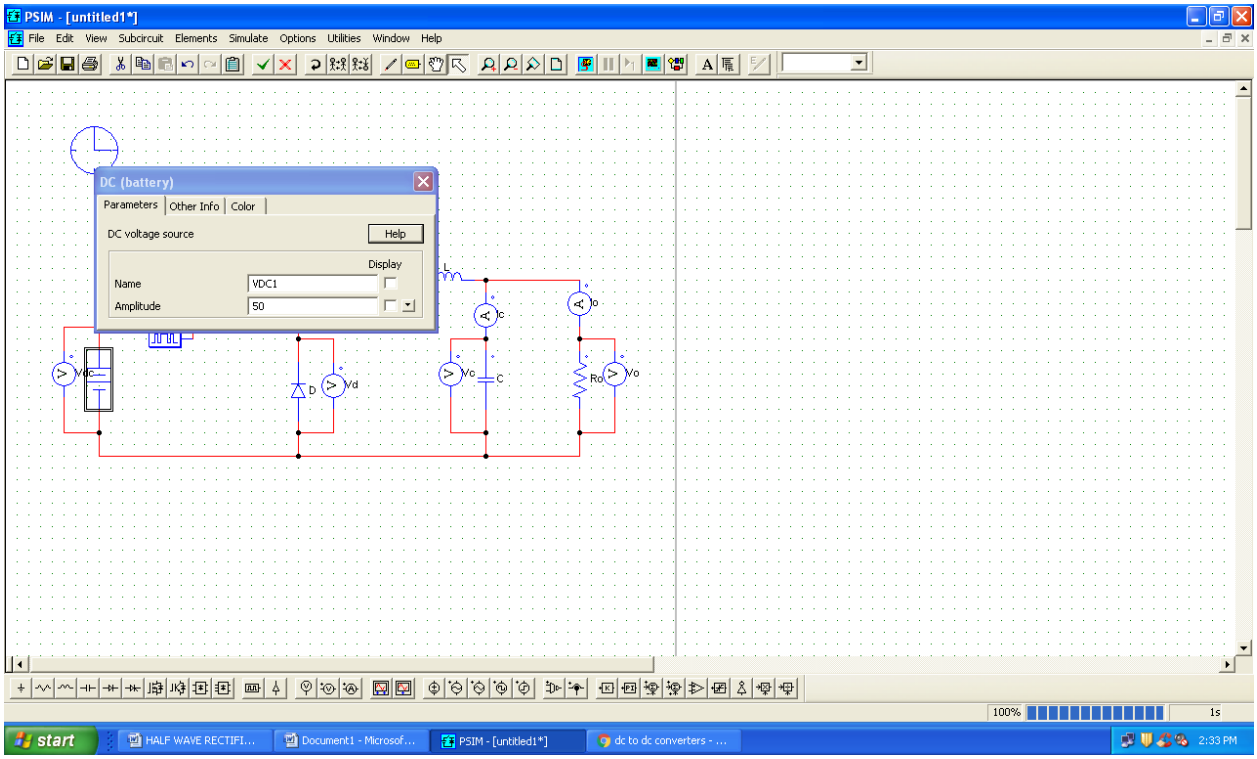
Give the capacitor value=30micro F



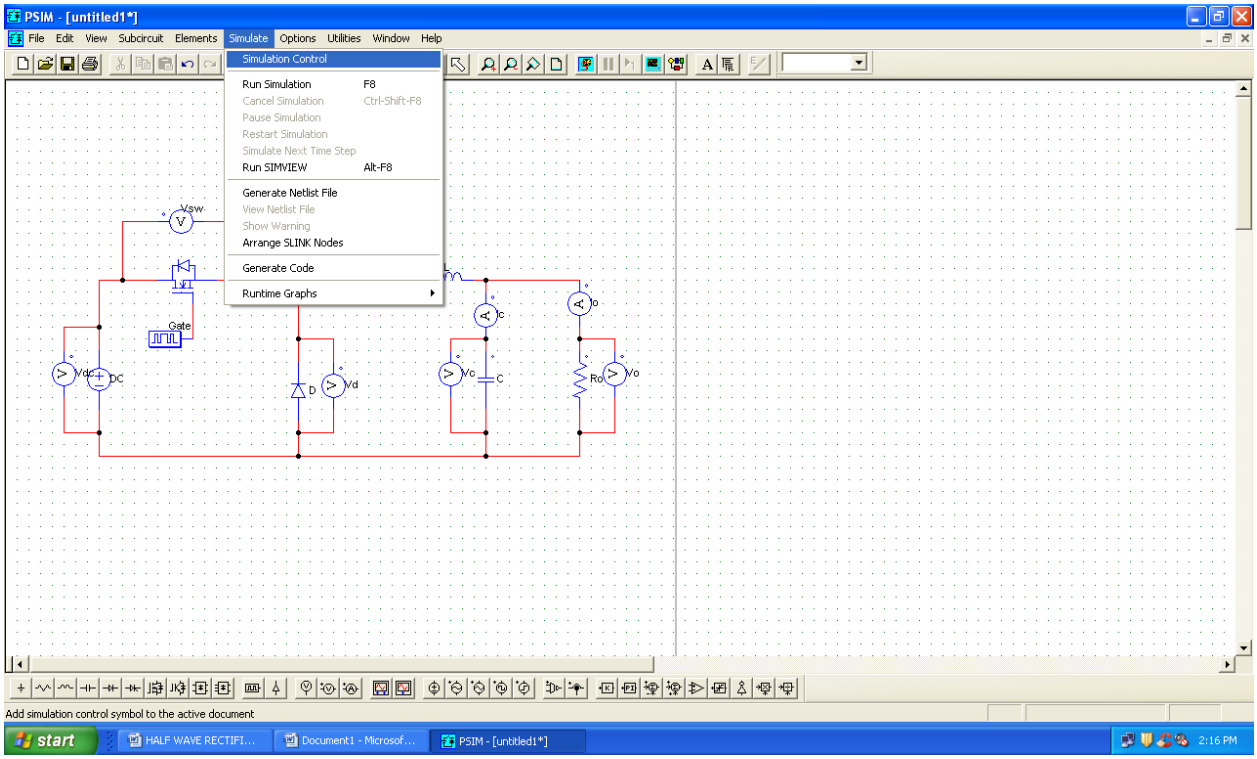
Give the resistor value=50ohm



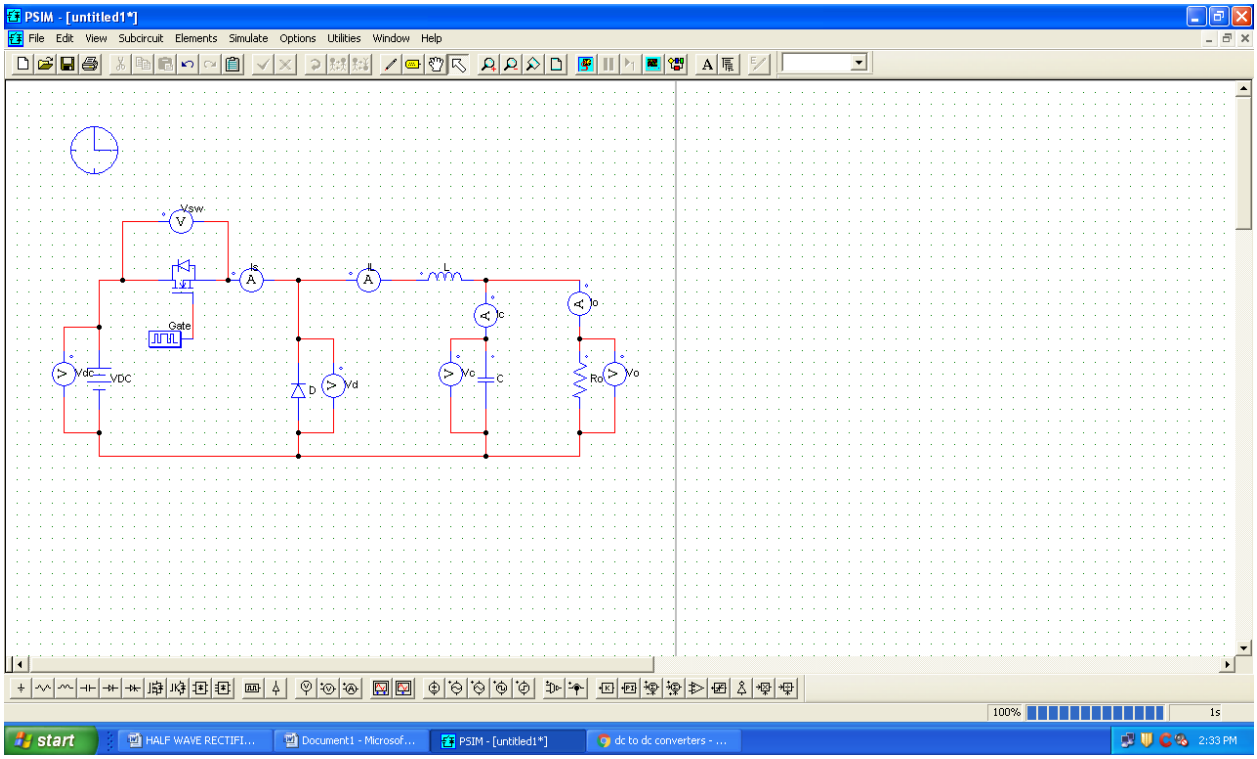
Give the dc source value=50V



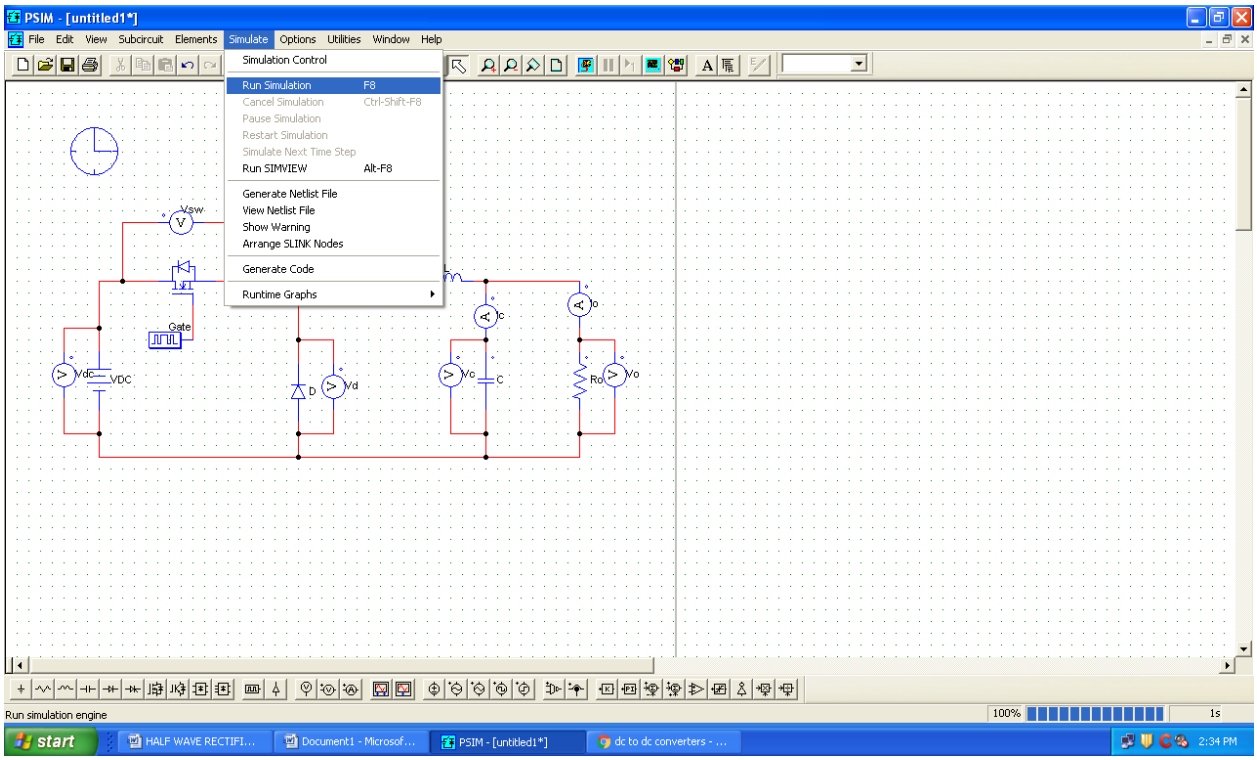
Select simulation control



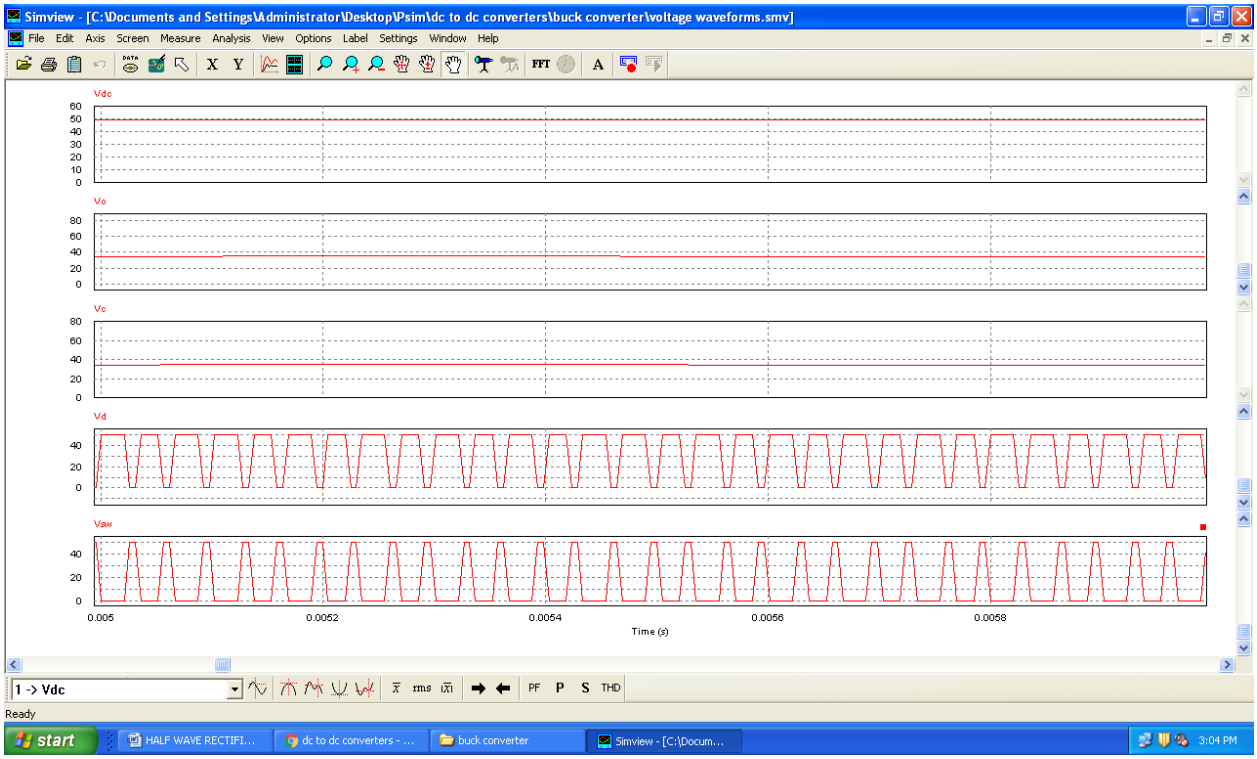
Give the proper label to the every element



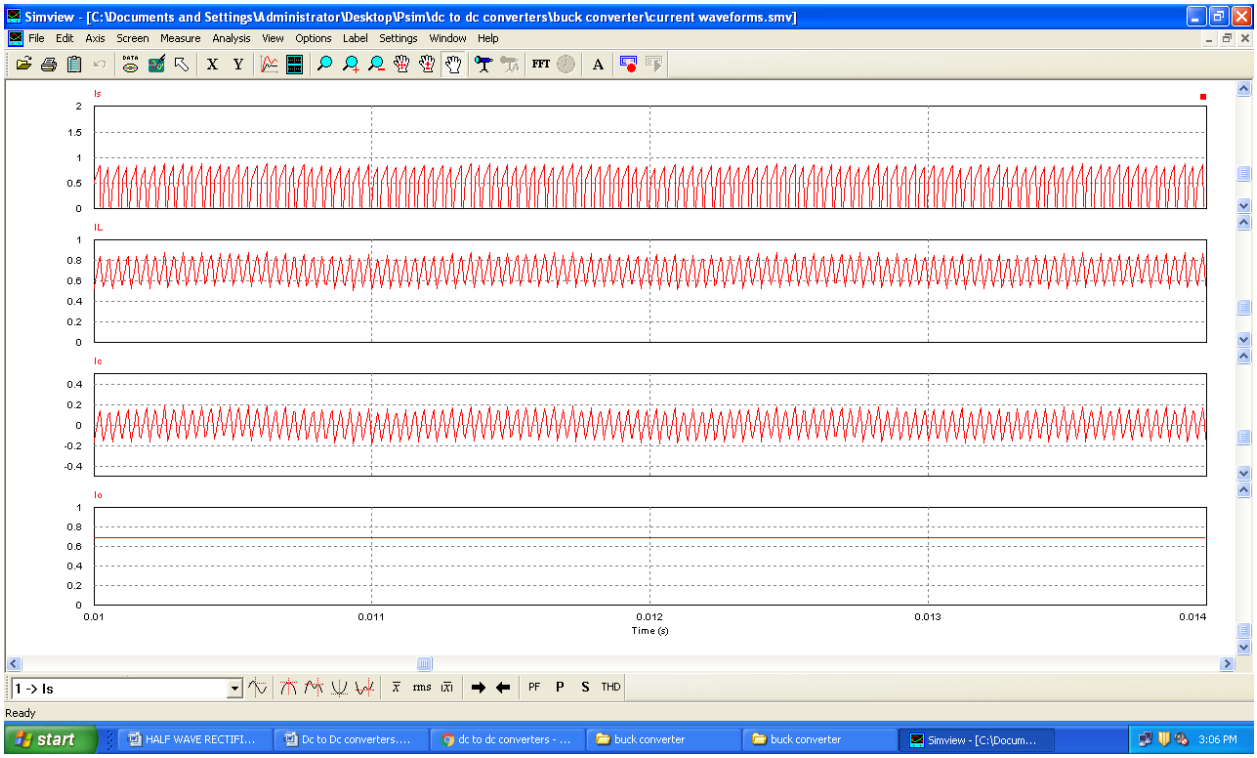
Run the circuit by selecting run simulation



Voltage waveforms



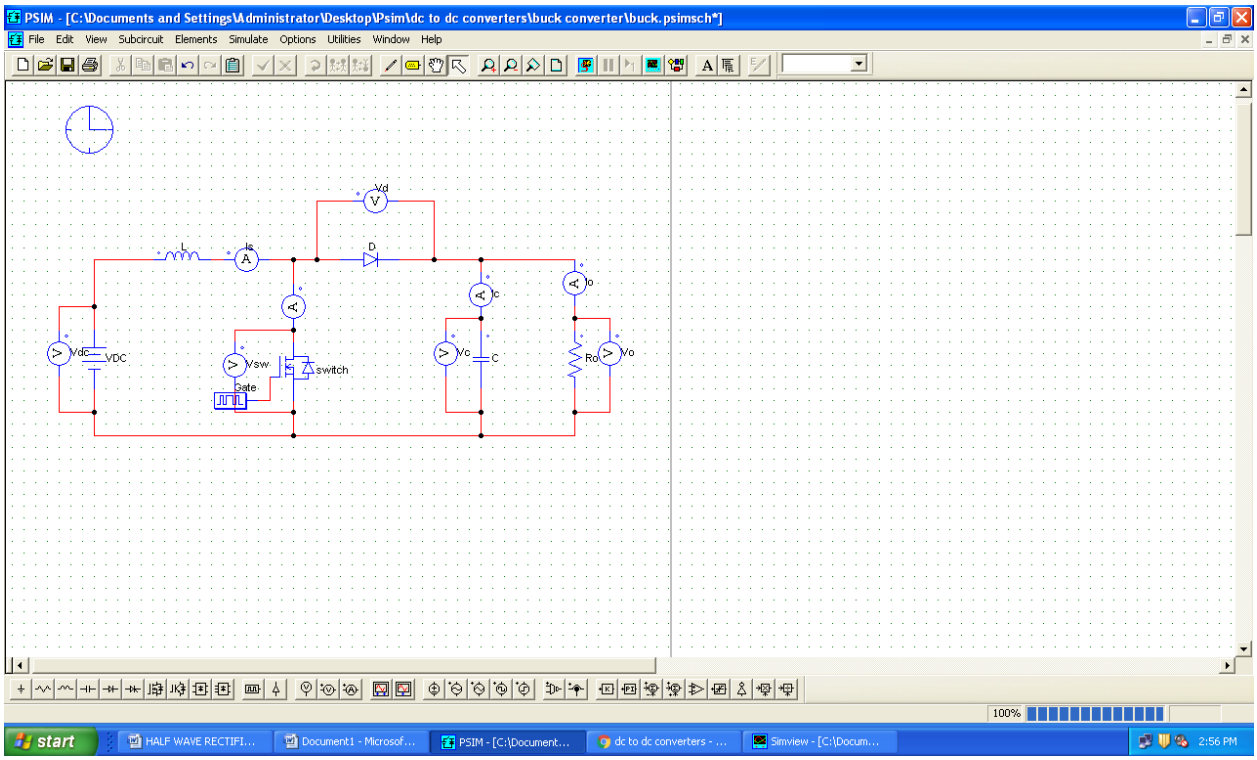
Current waveforms



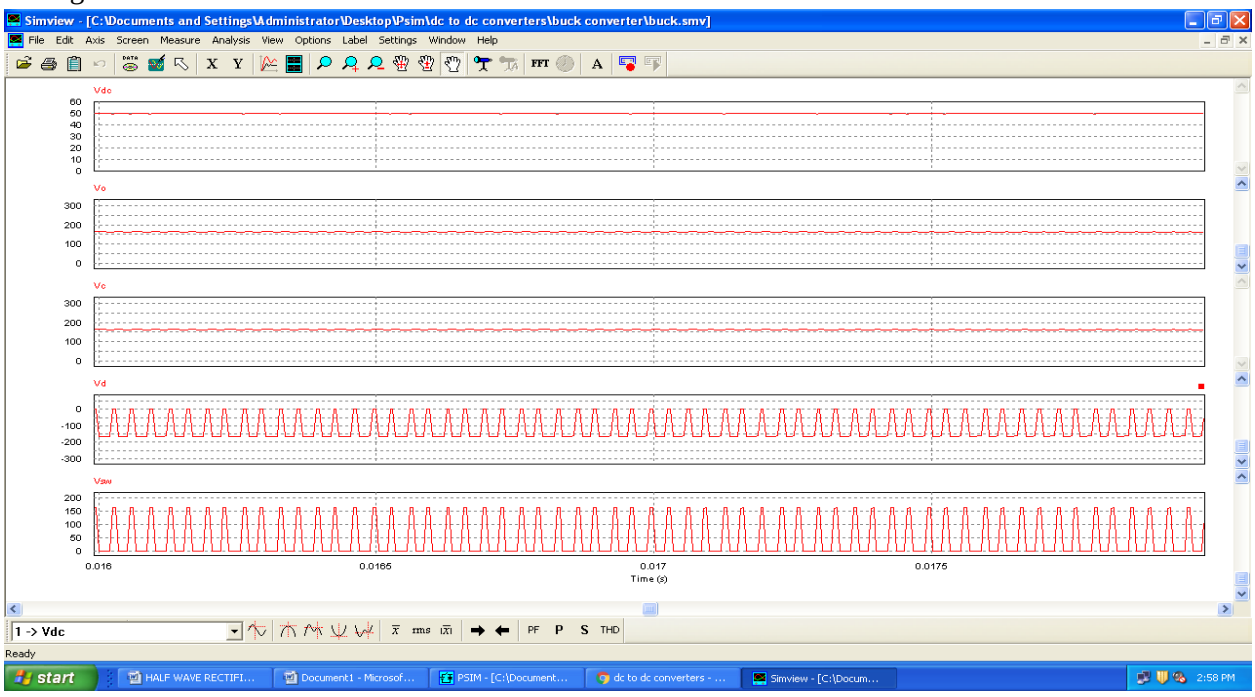
Boost converter

Select the elements as shown above and connect them as shown in below figure with proper labeling

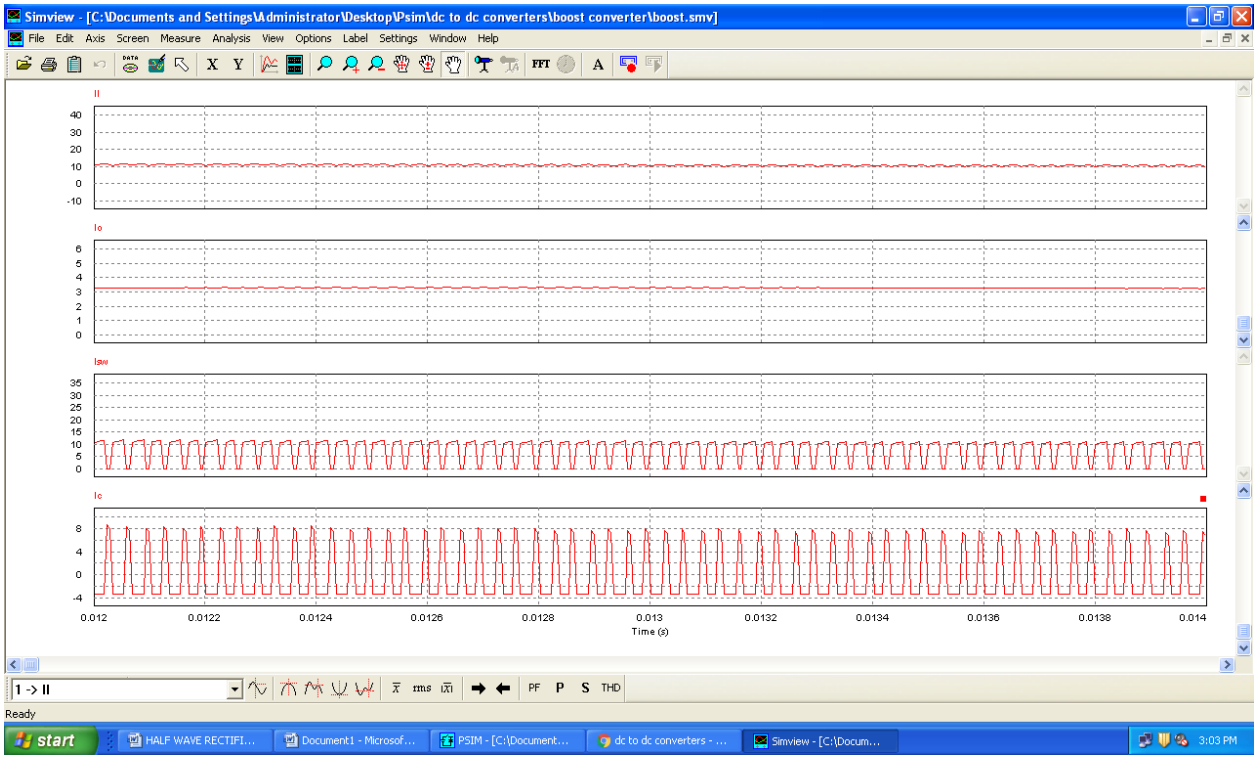
Circuit diagram



Voltage waveforms



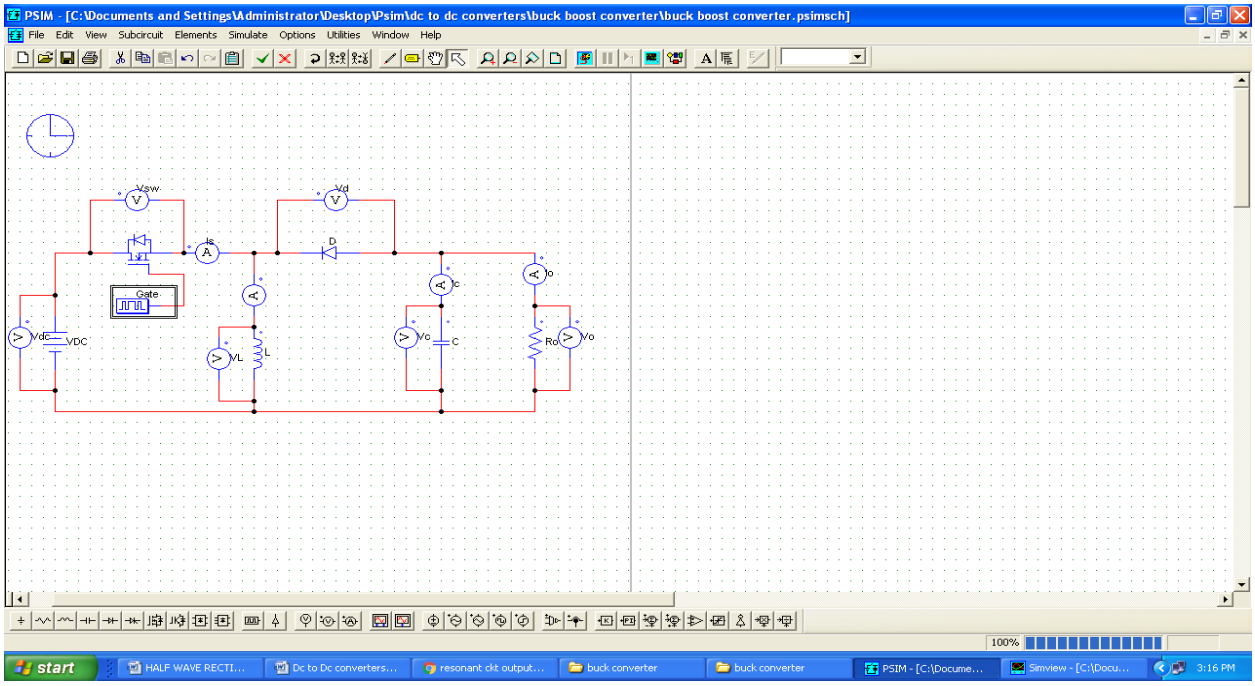
Current waveforms



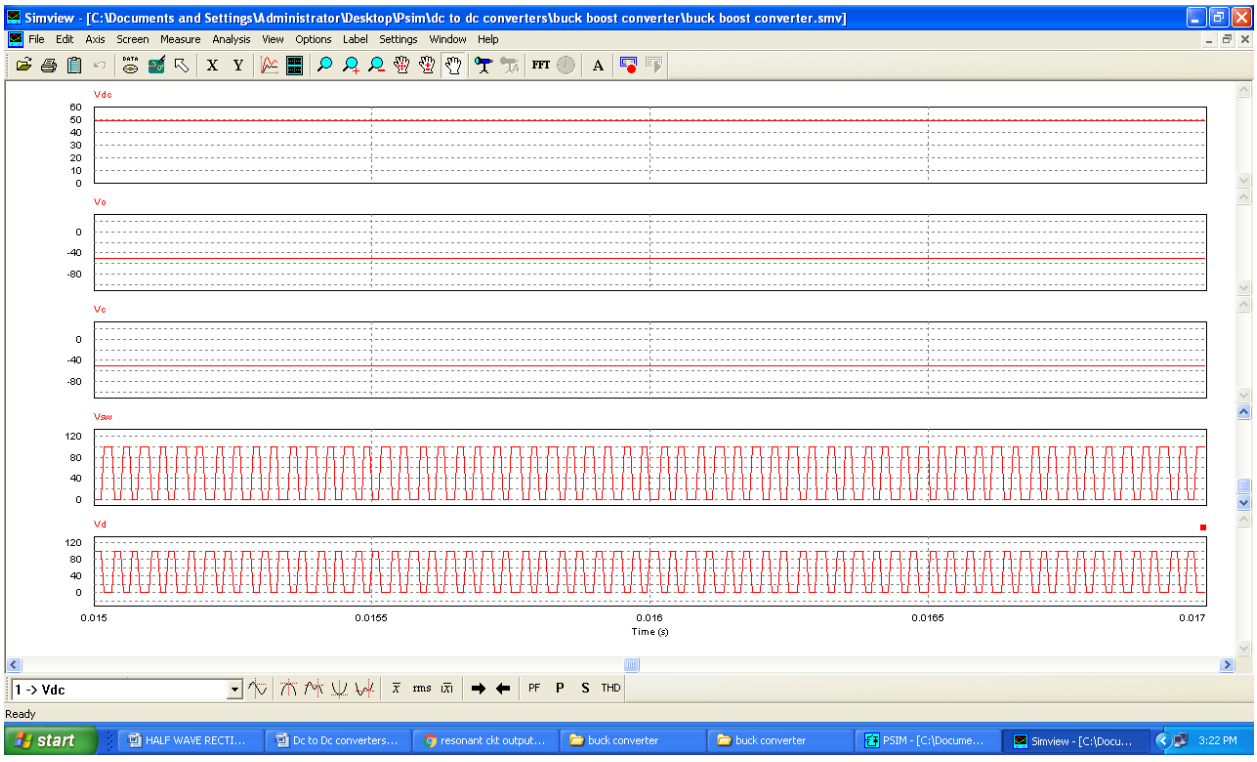
Buck-Boost converter

Select the elements as shown above and connect them as shown in below figure with proper labeling

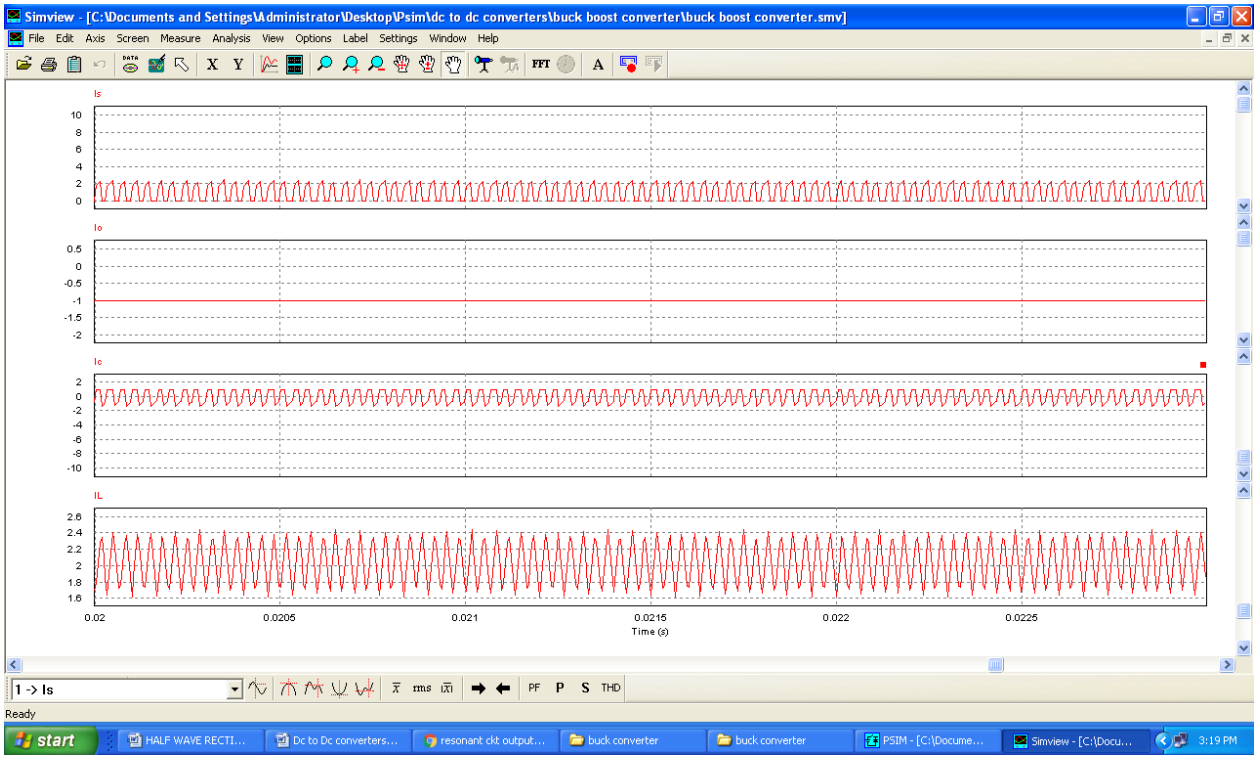
Circuit diagram



Voltage waveforms



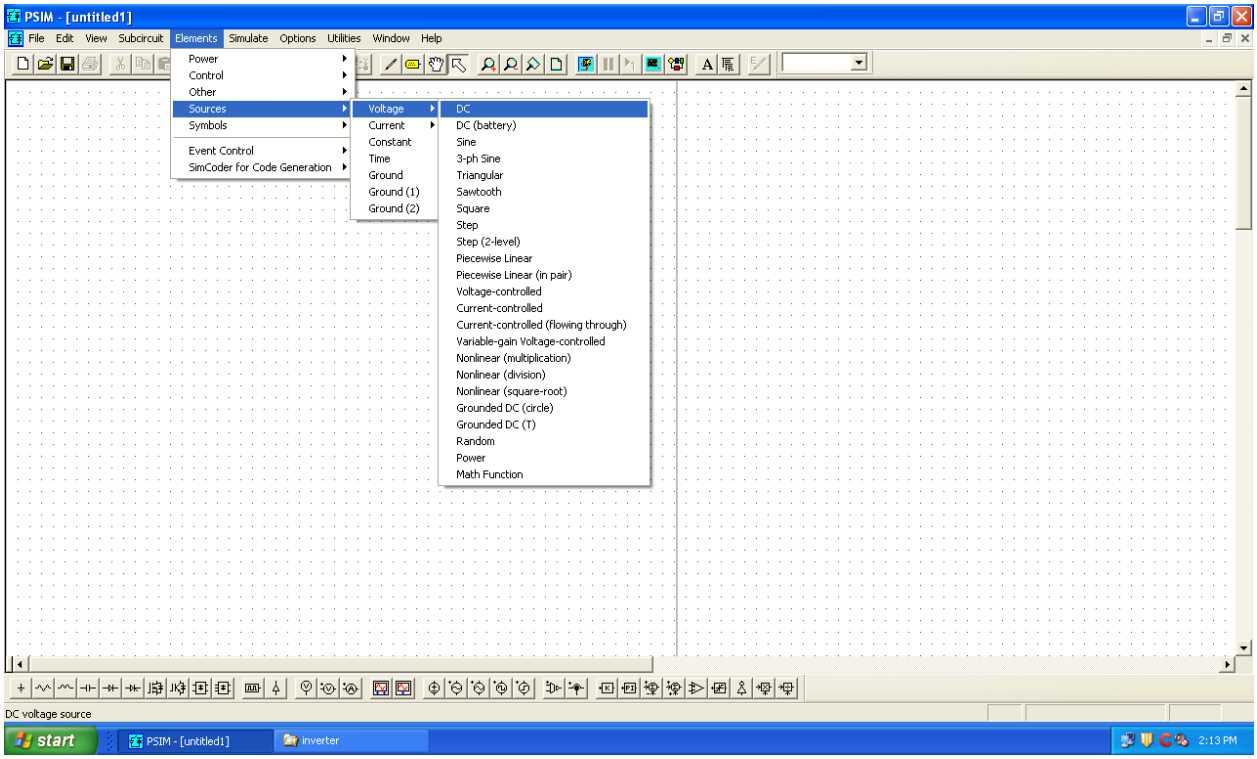
Current waveforms



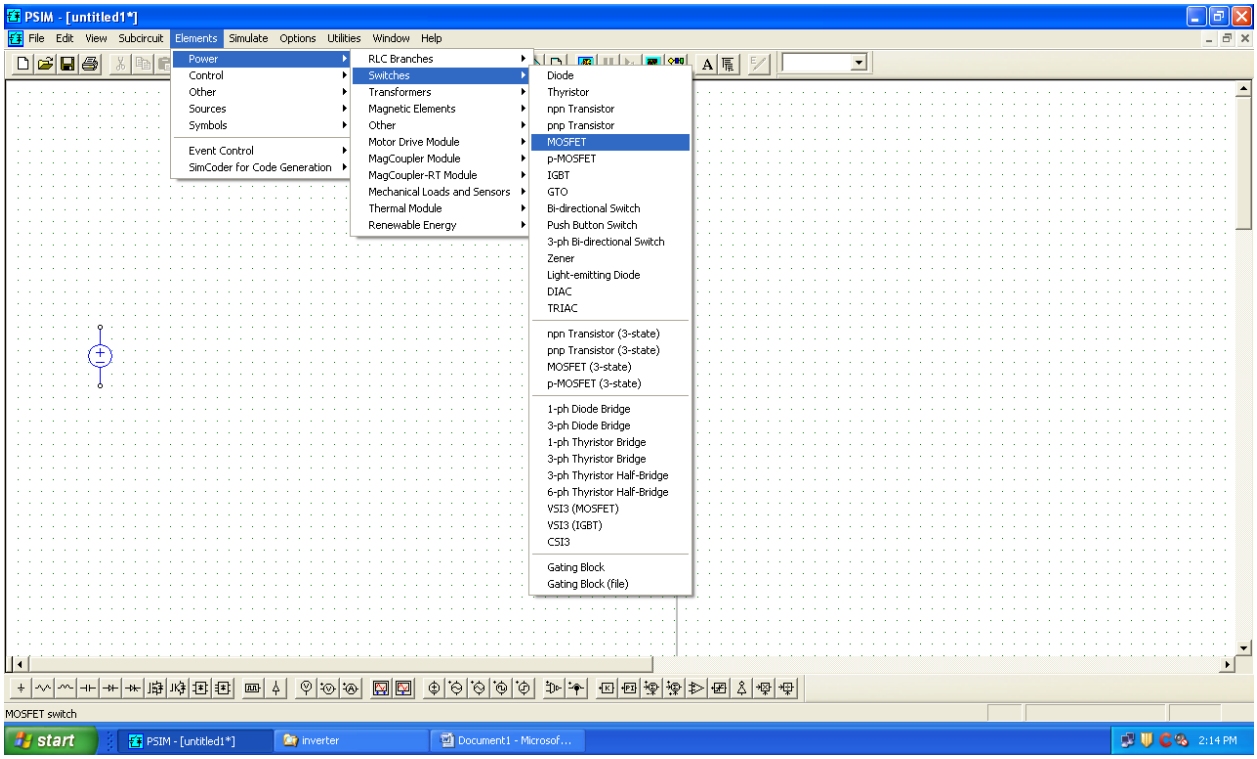
Inverters

Single phase inverter

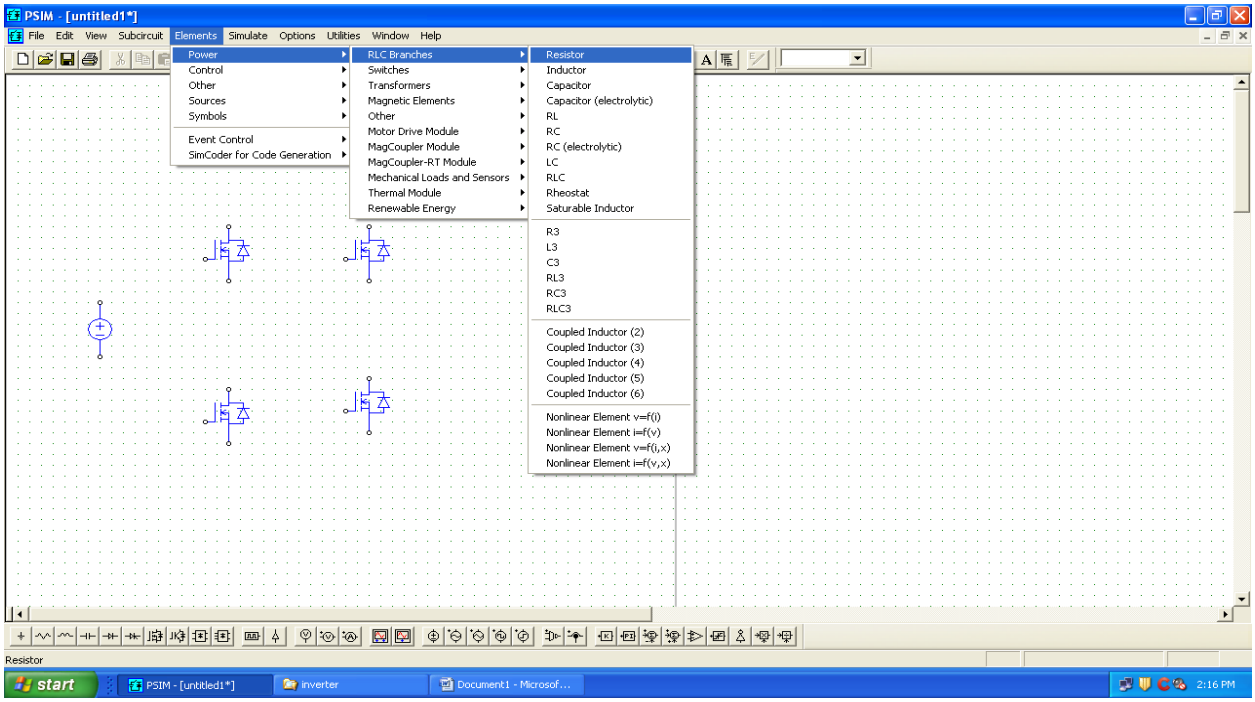
Select the source



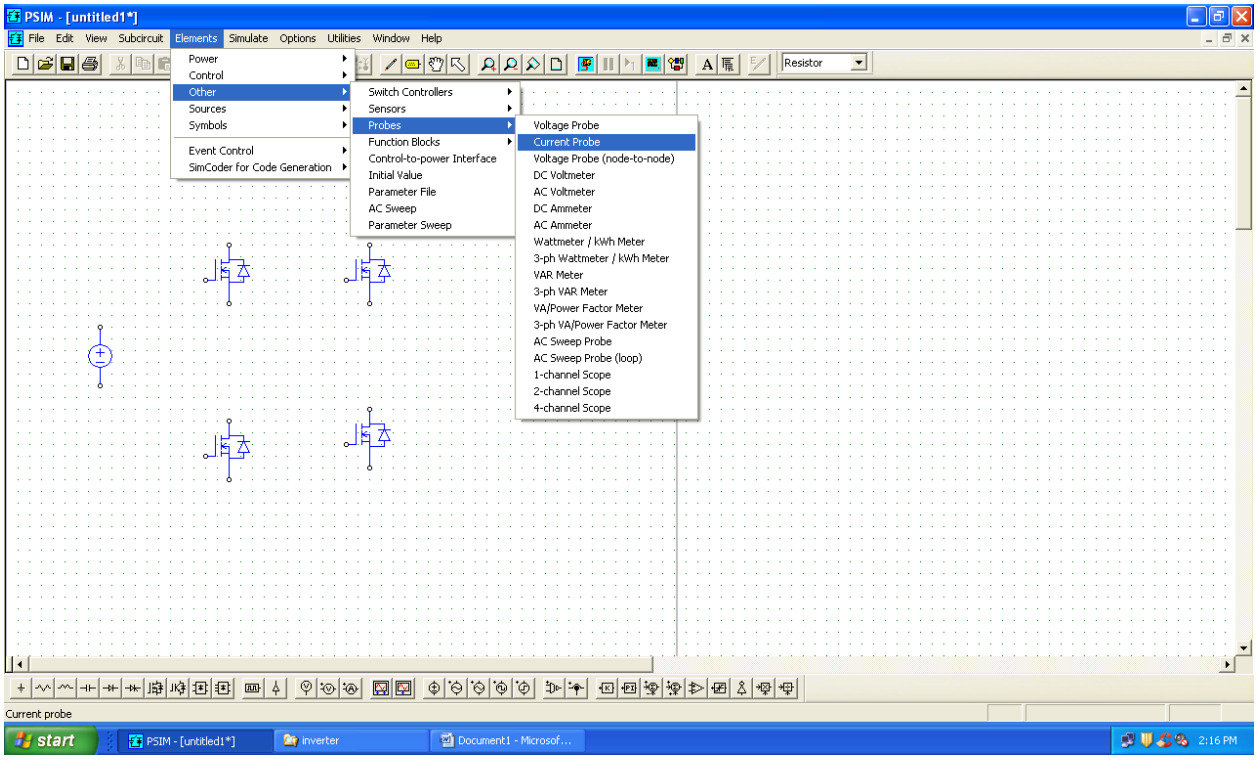
Select the mosfet



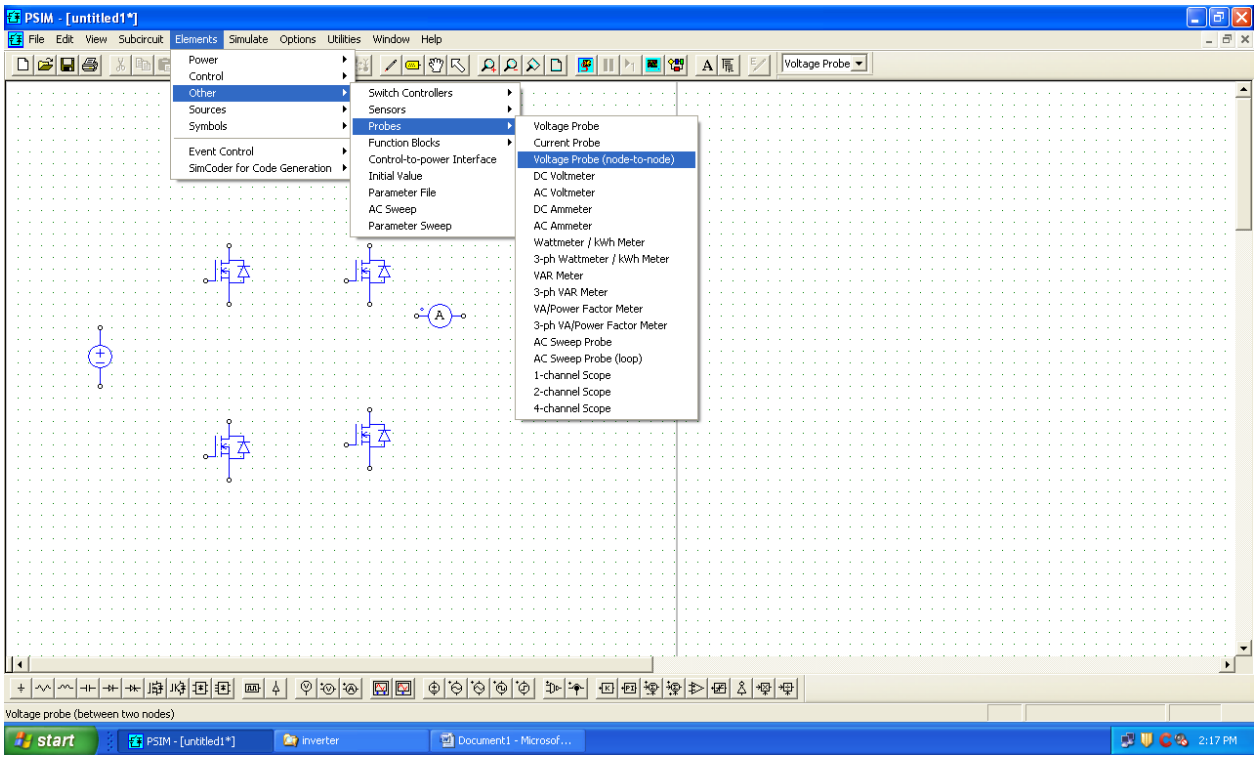
Select the resistor



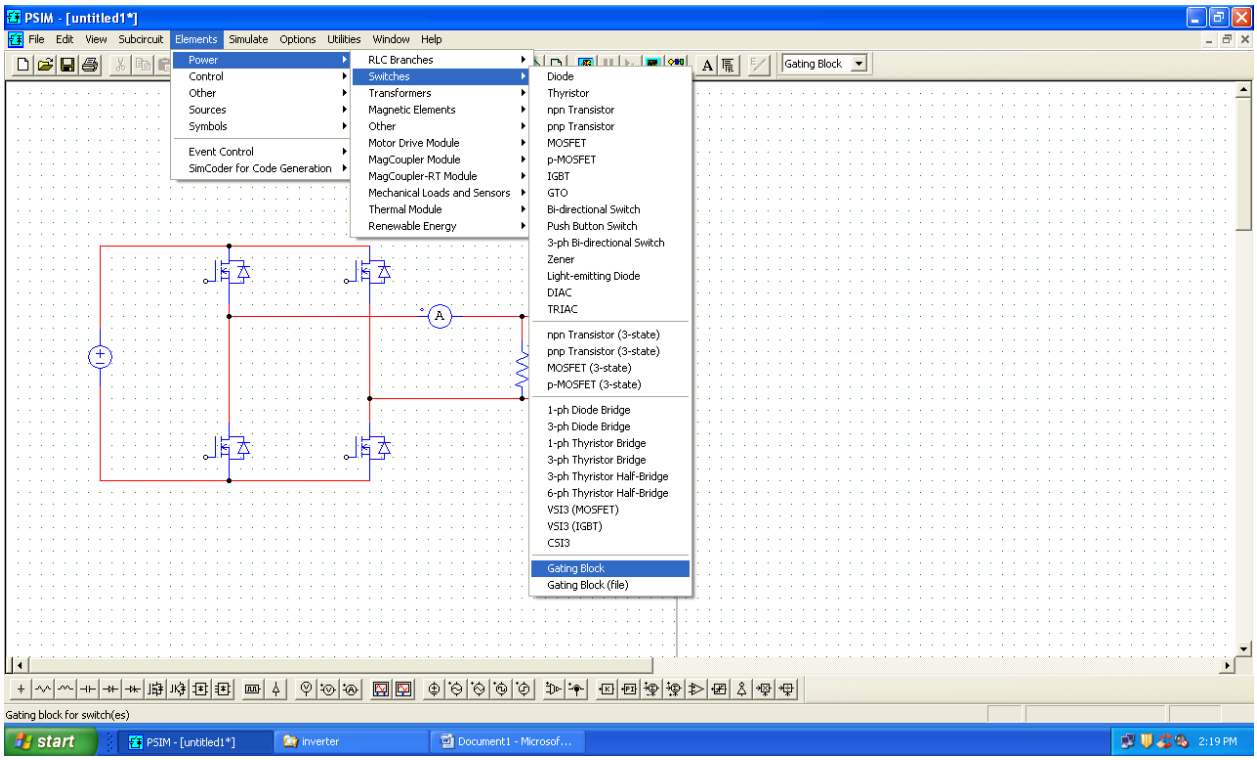
Select the ammeter



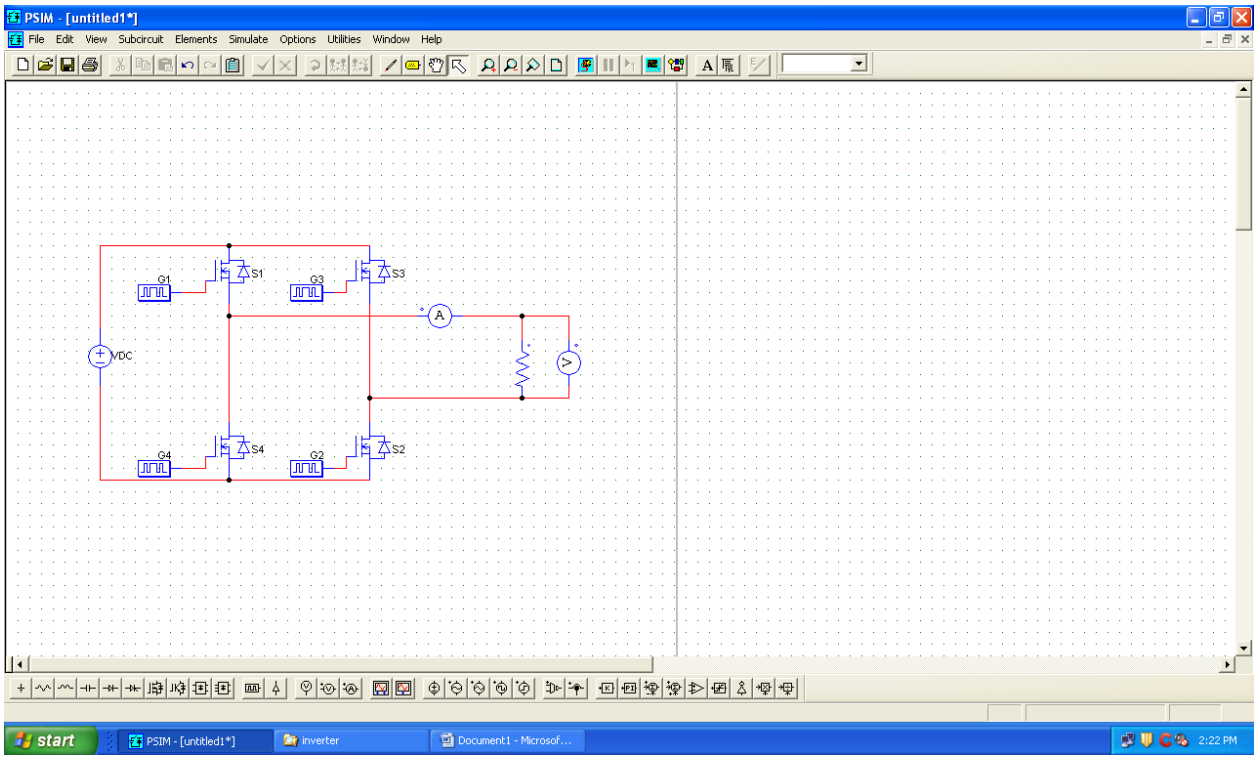
Select the volt meter



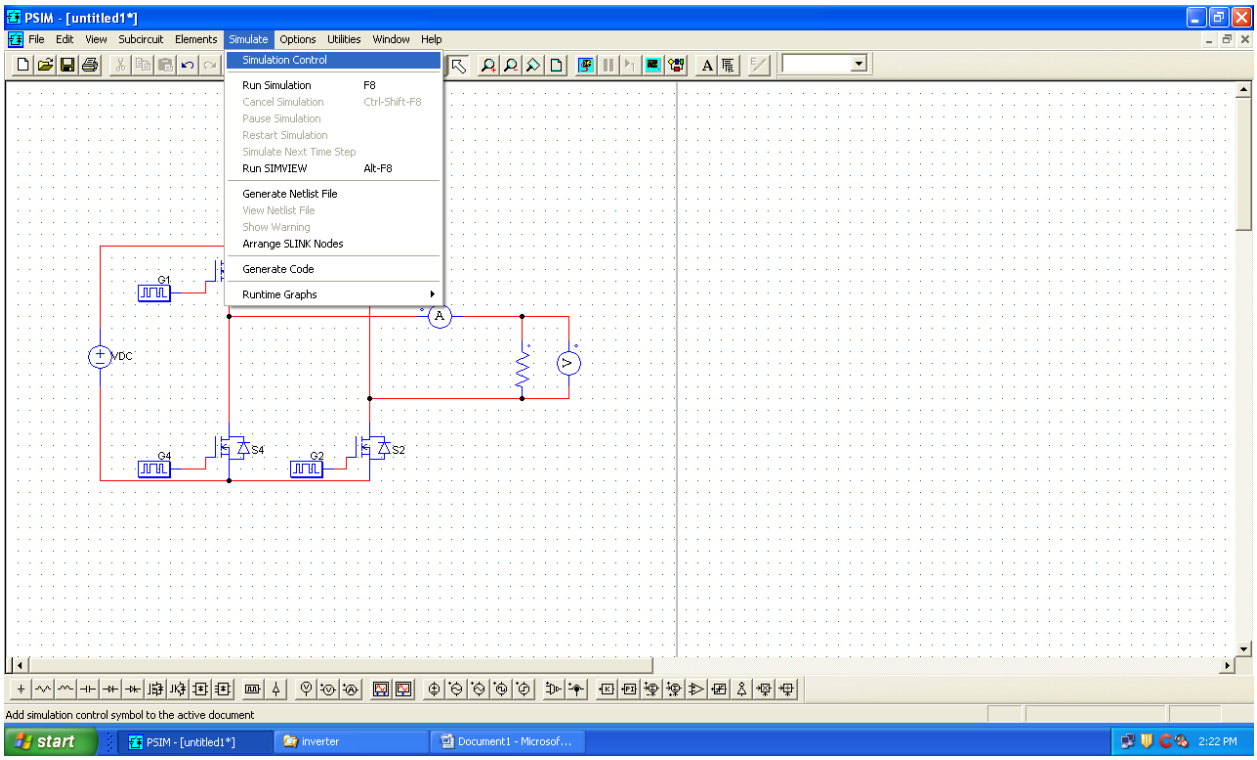
Select the gating block

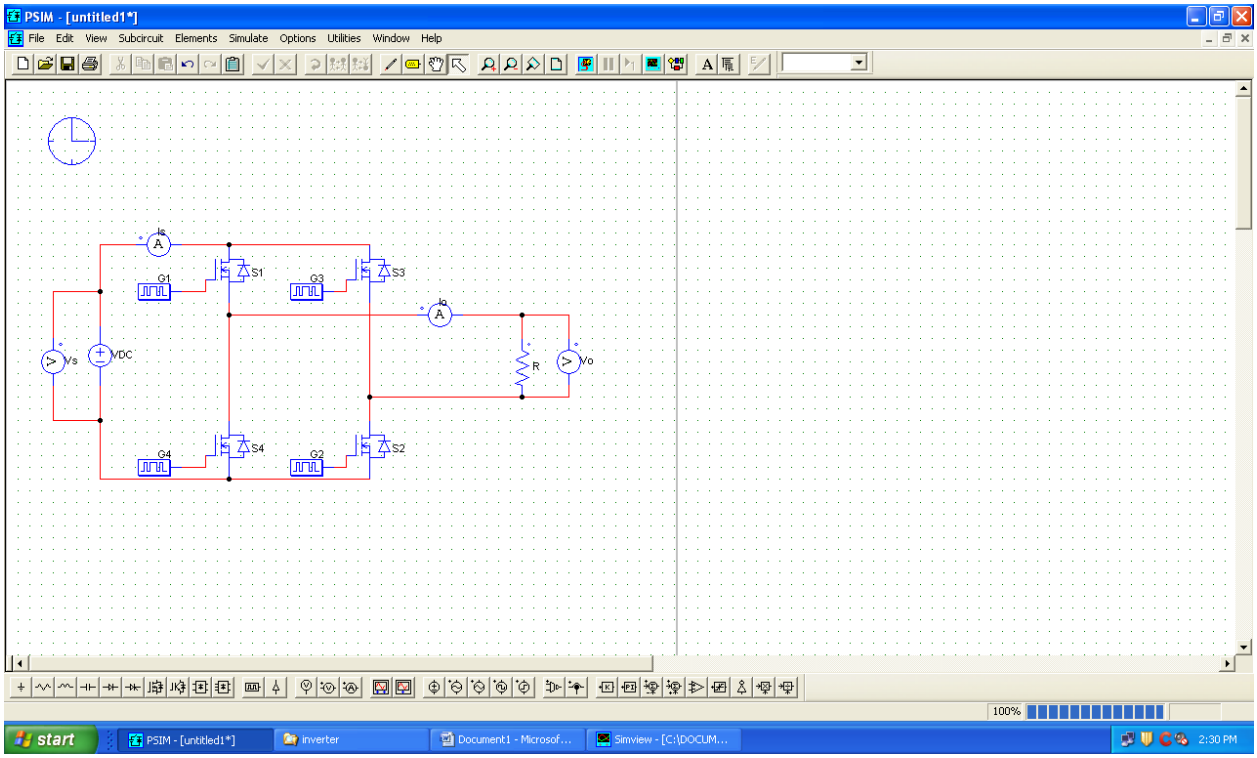


Connect the circuit by using wiring tool

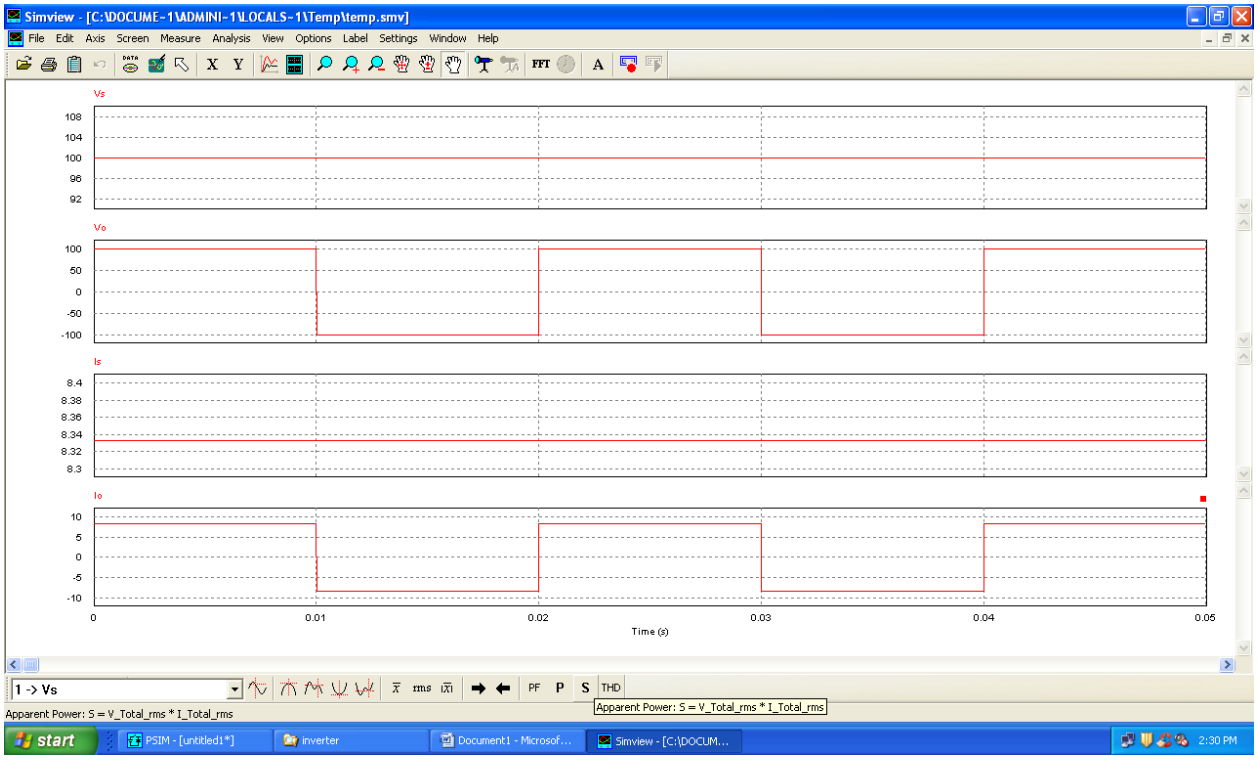


Select simulation control



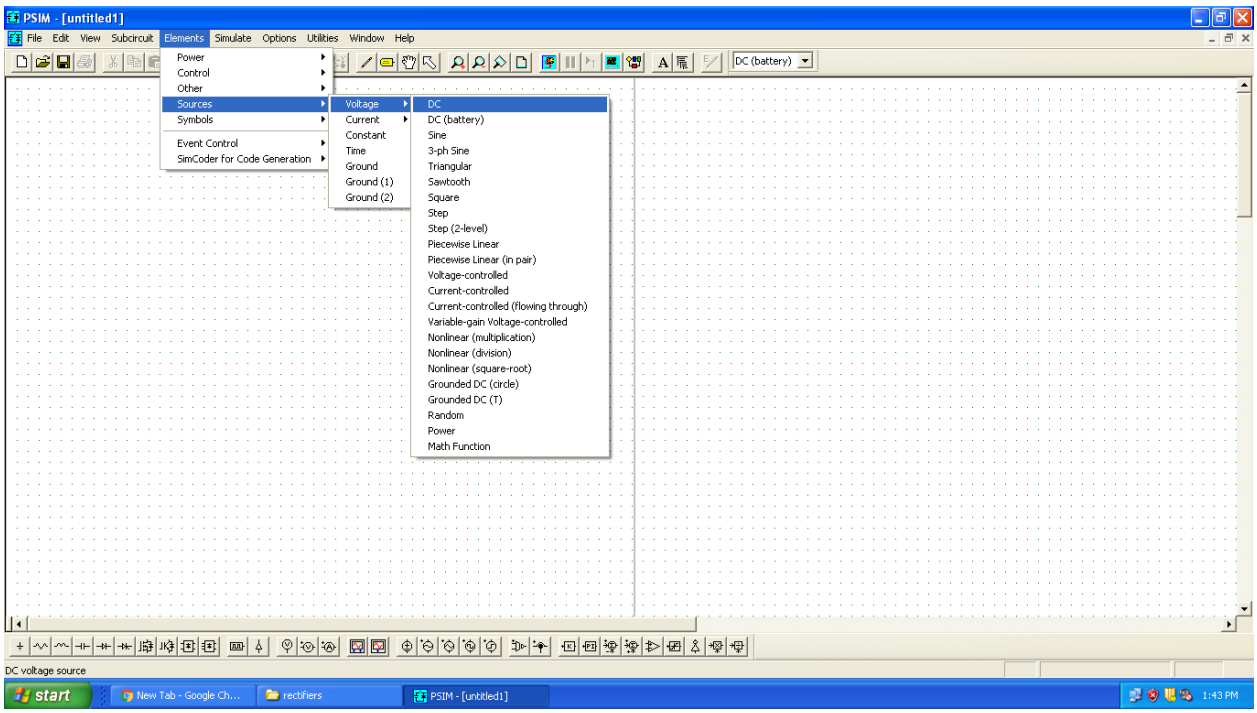


Output waveforms

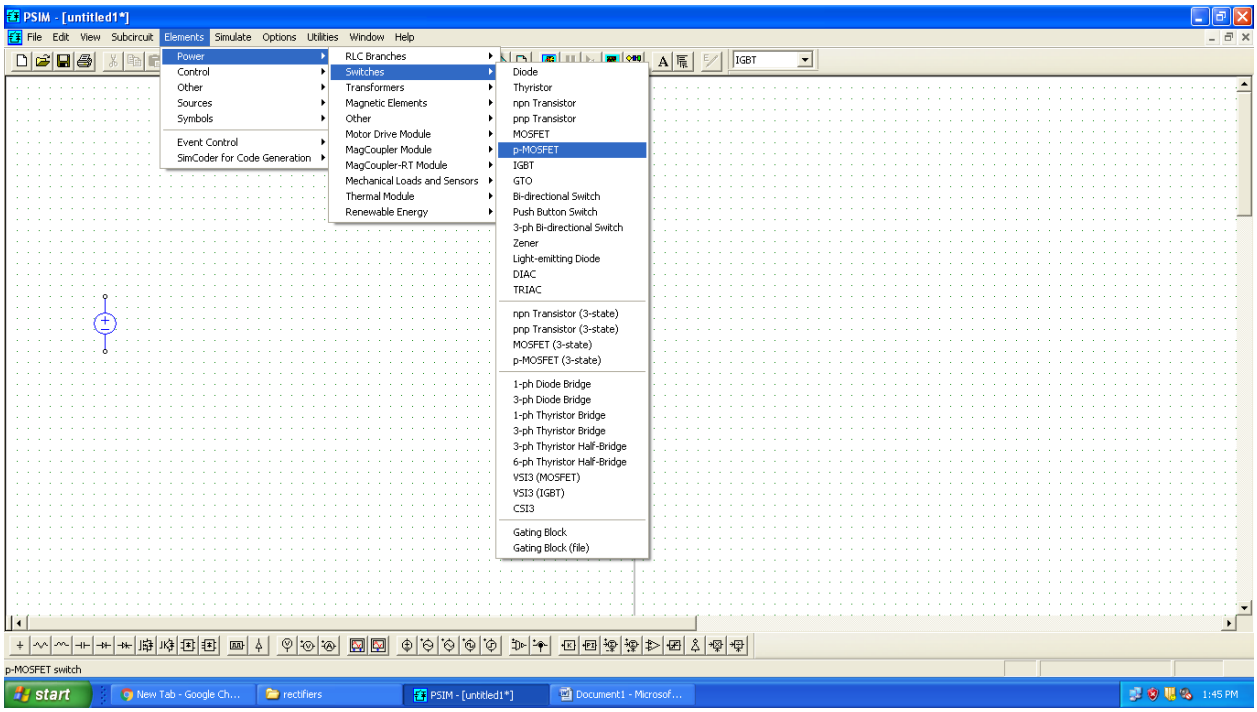


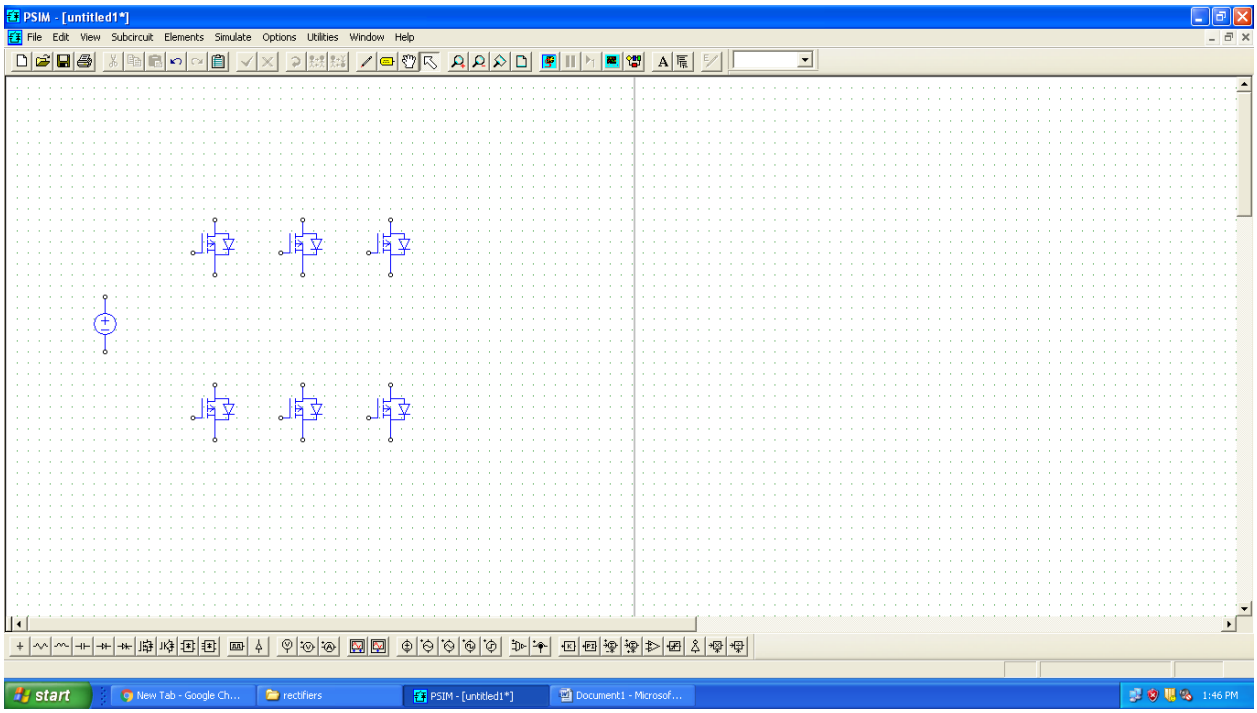
3-phase inverter

Select the dc source

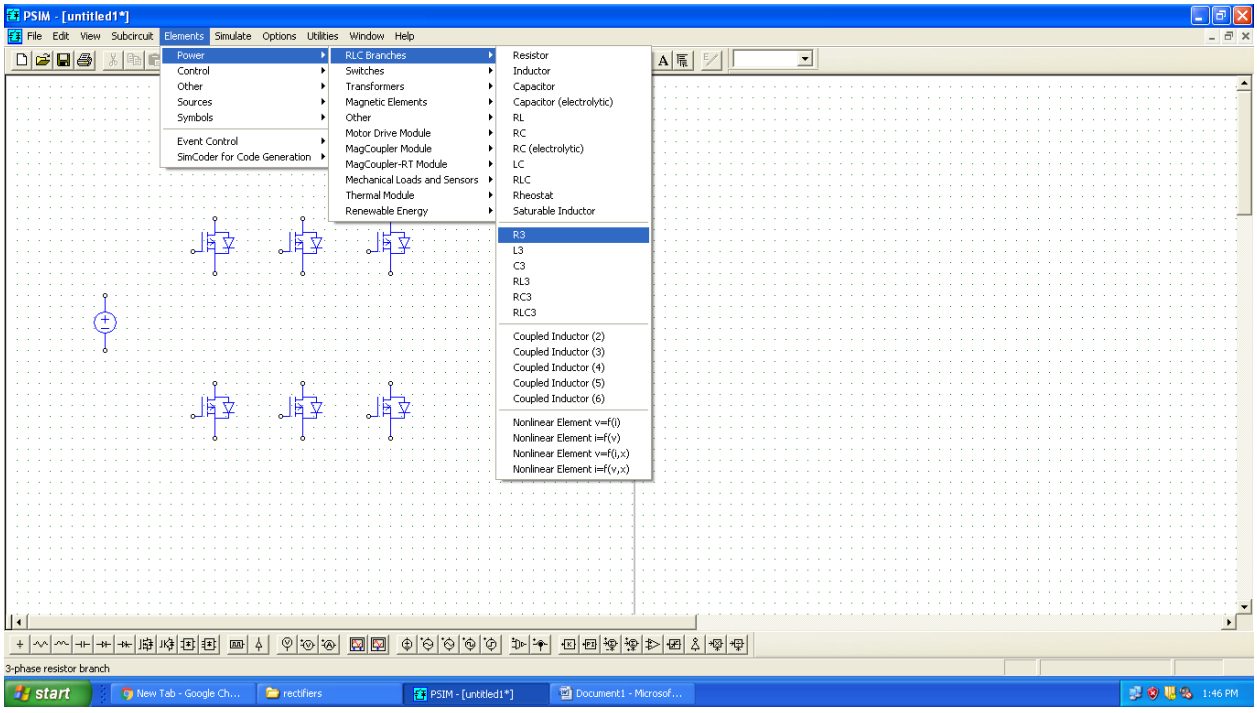


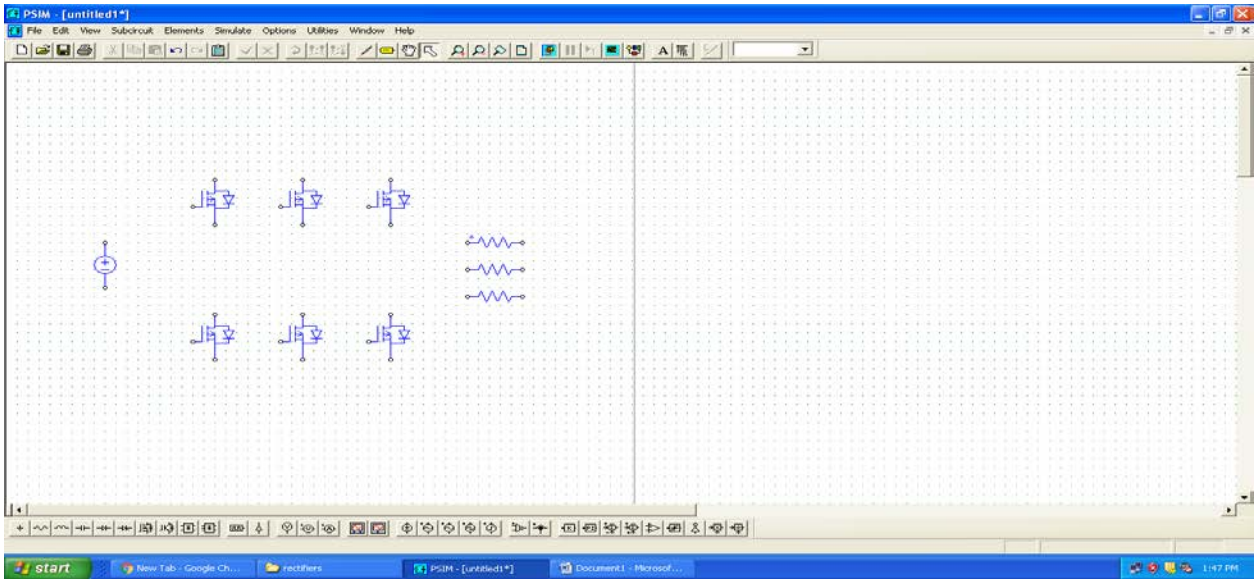
Select the Mosfet



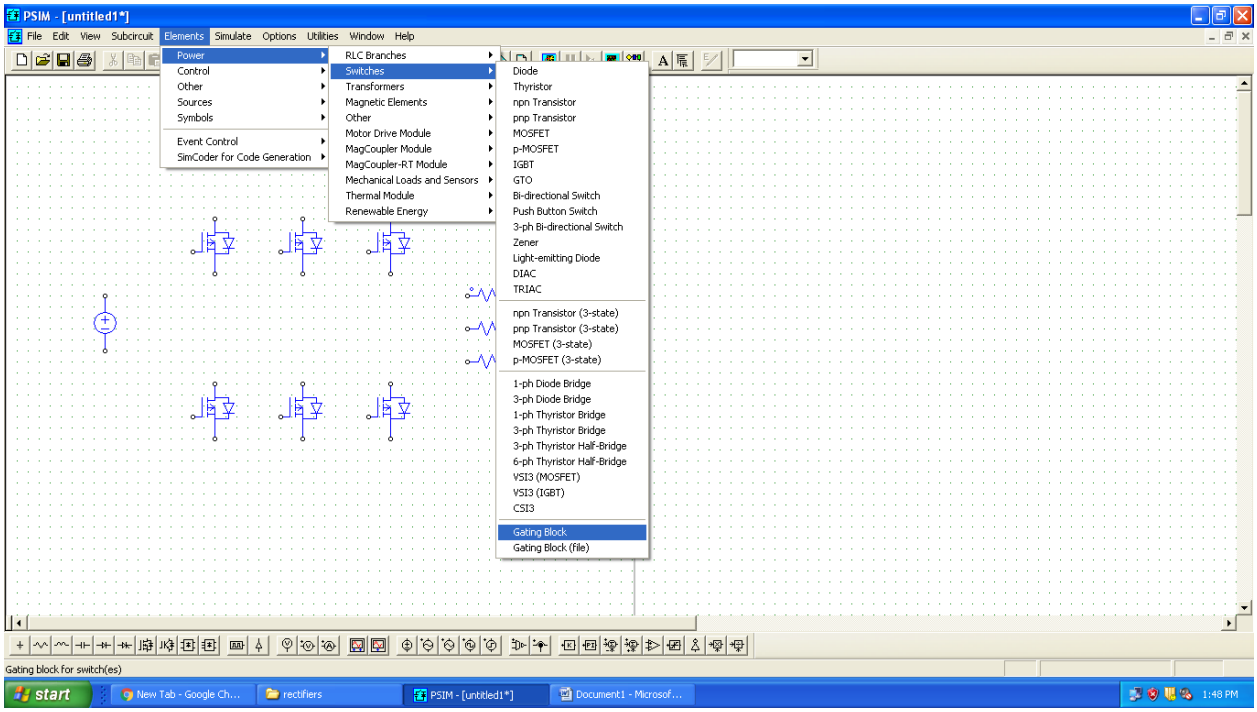


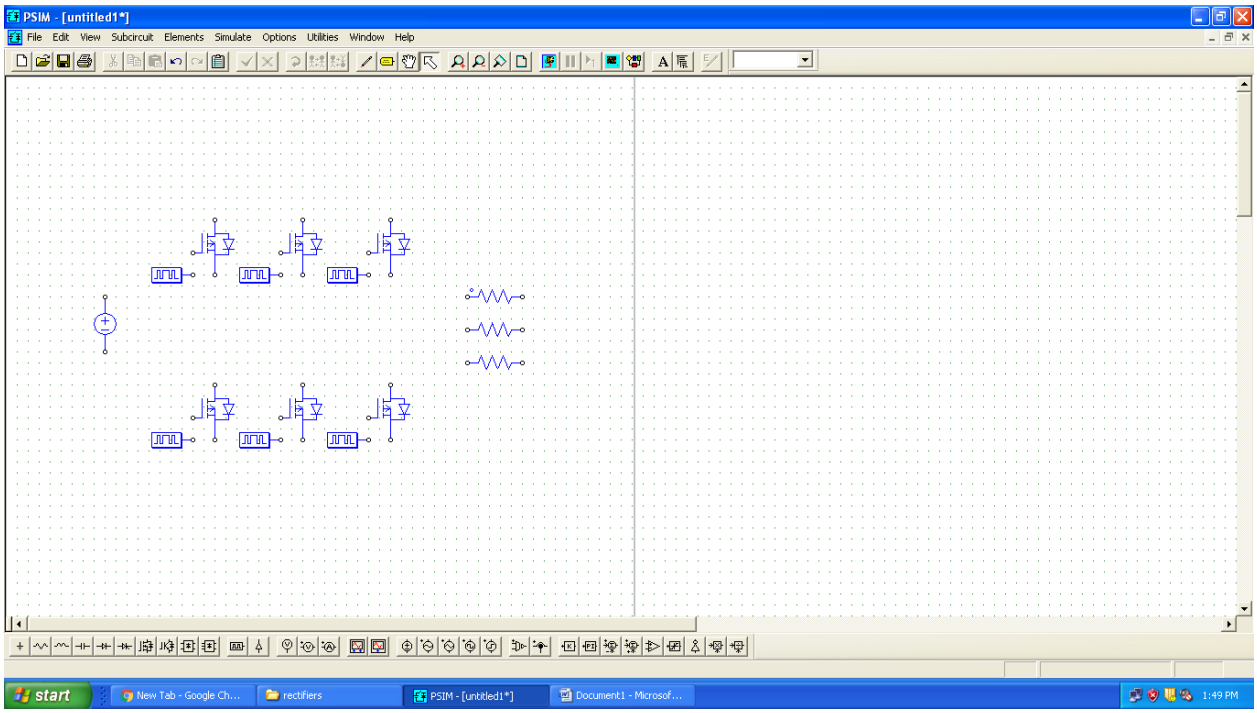
Select 3-phase R-load



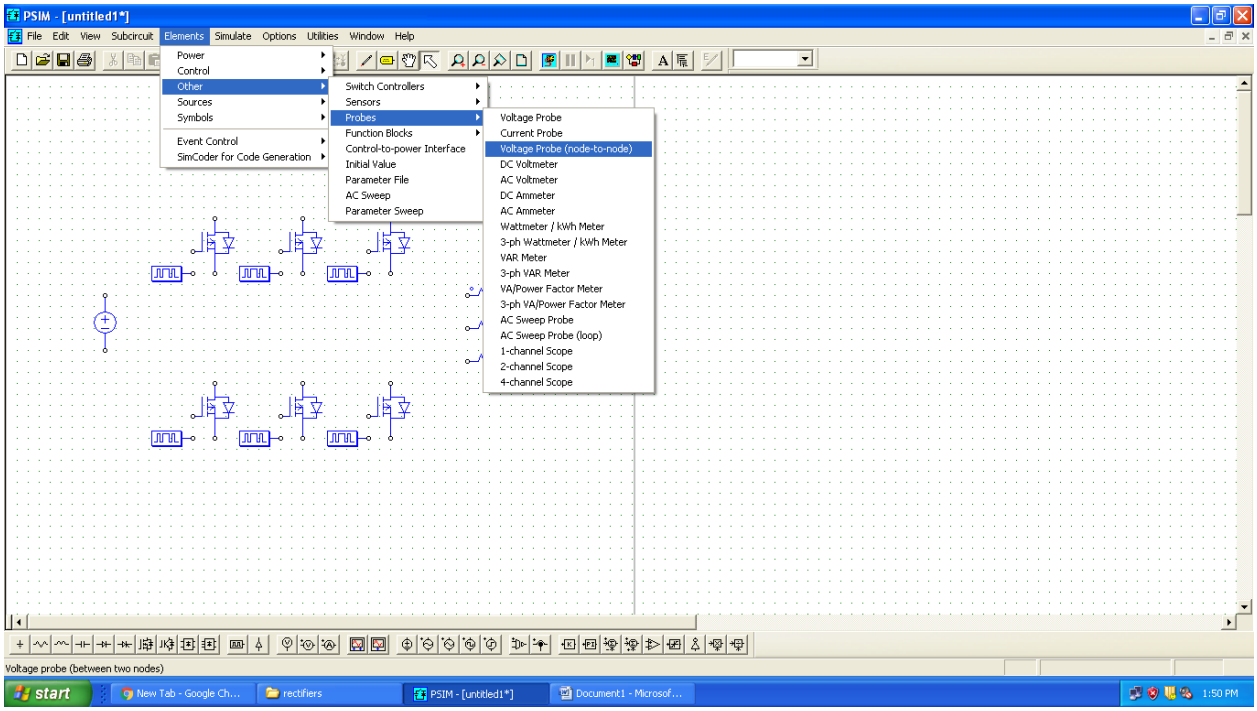


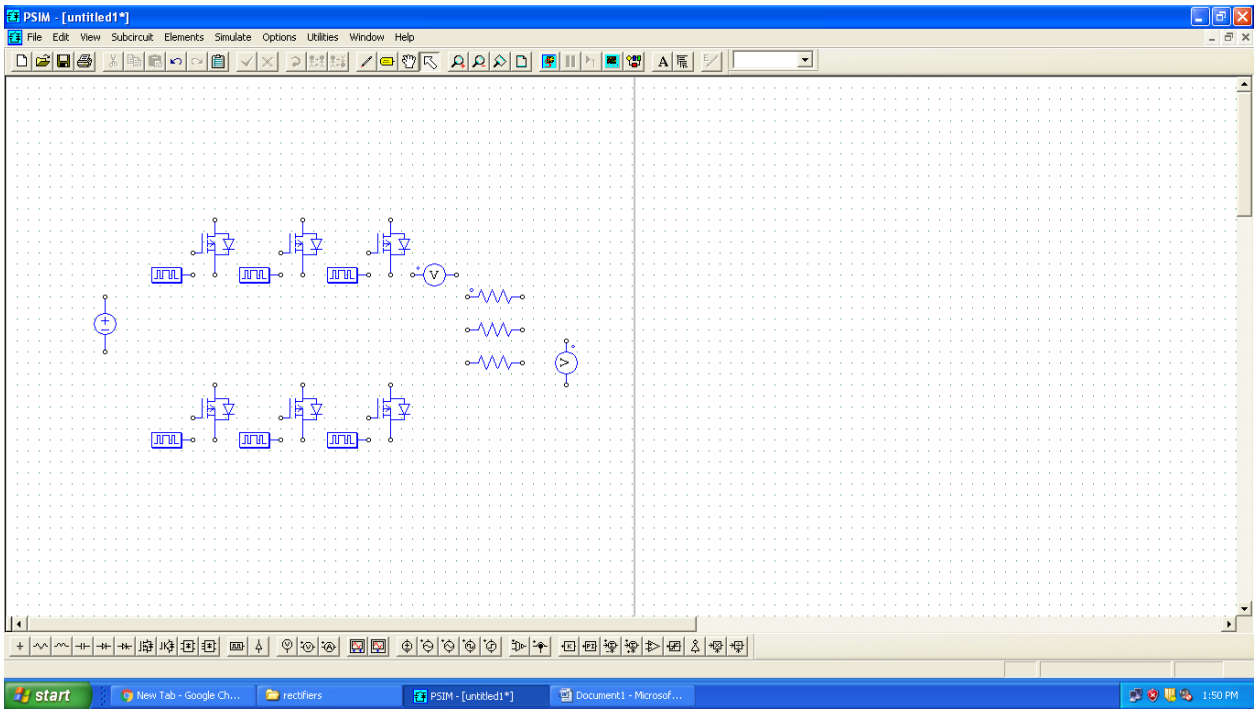
Select gating block



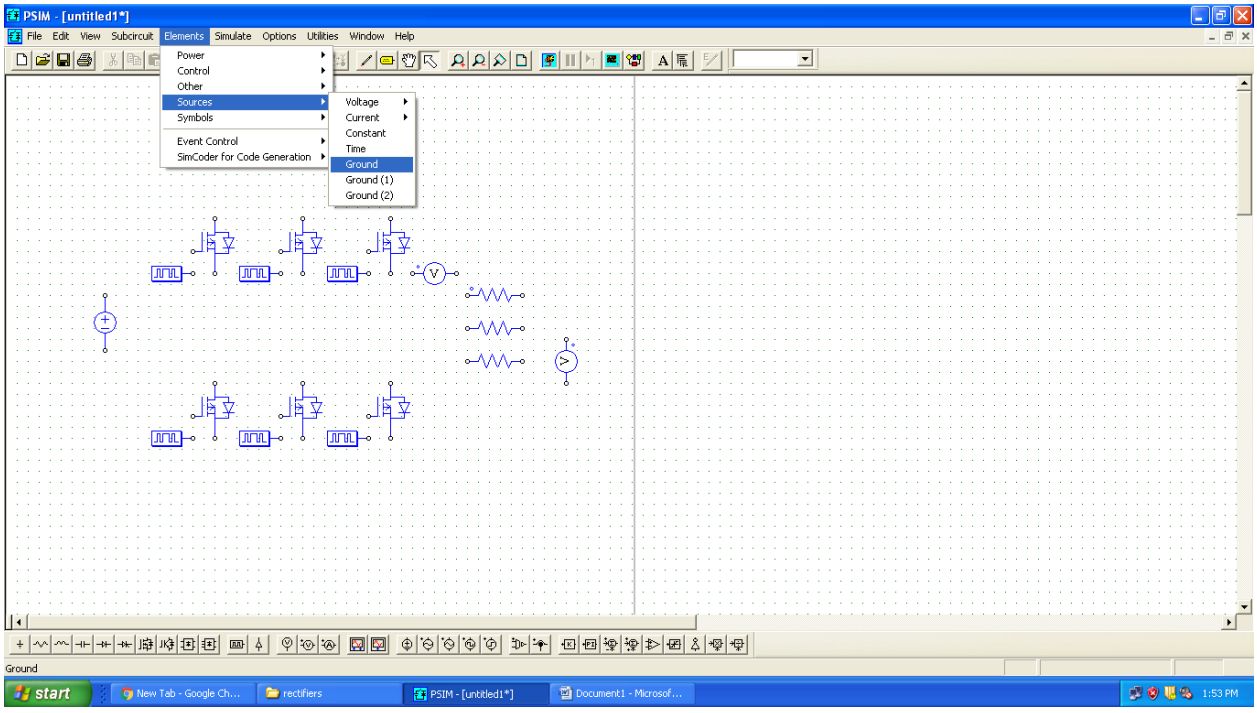


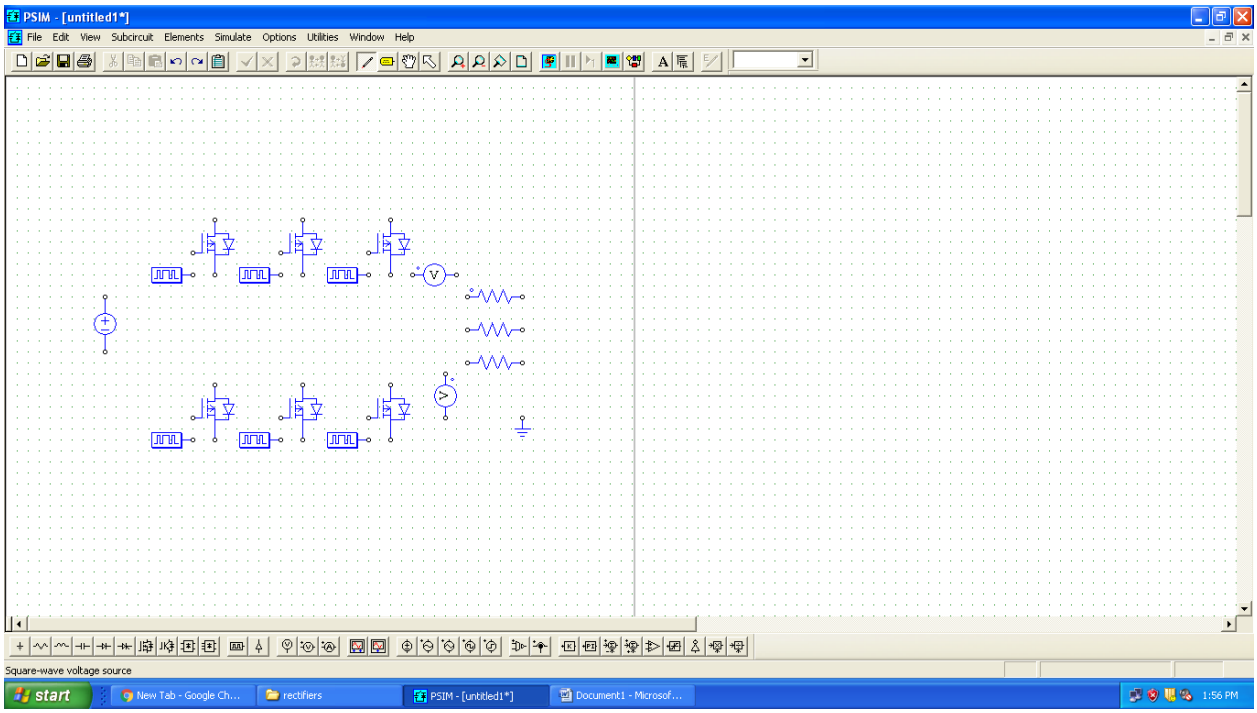
Select volt meter



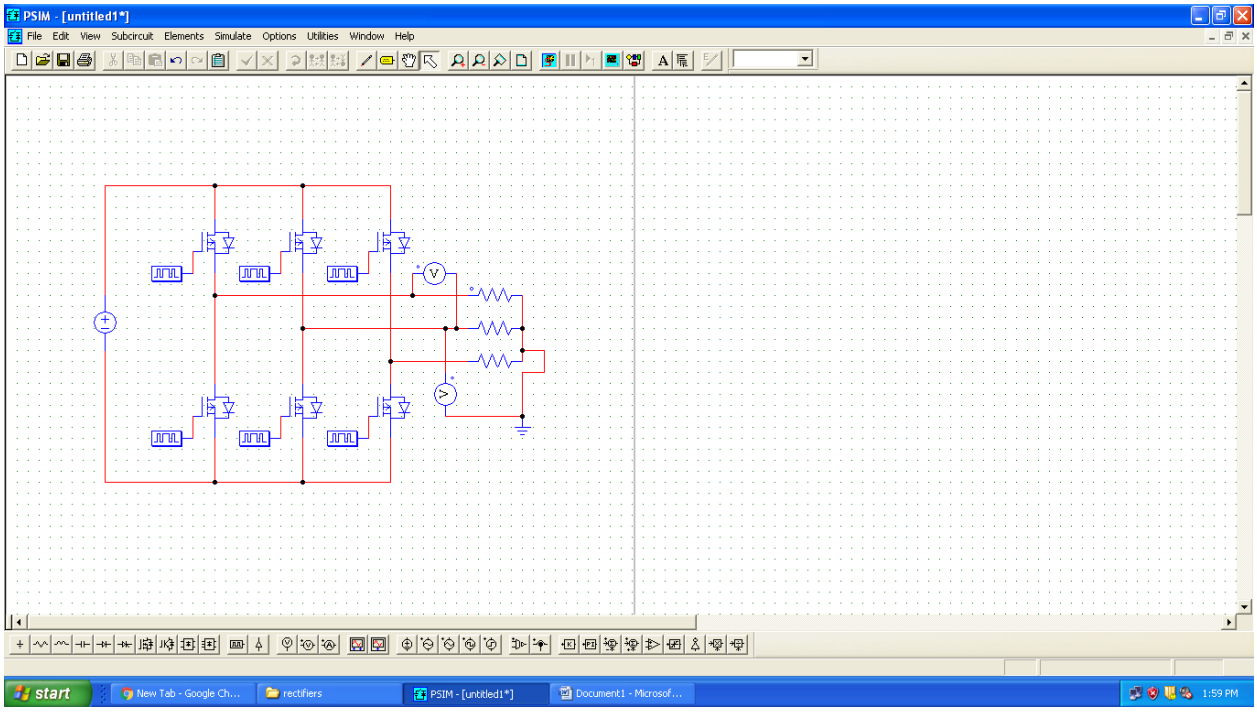


Select ground

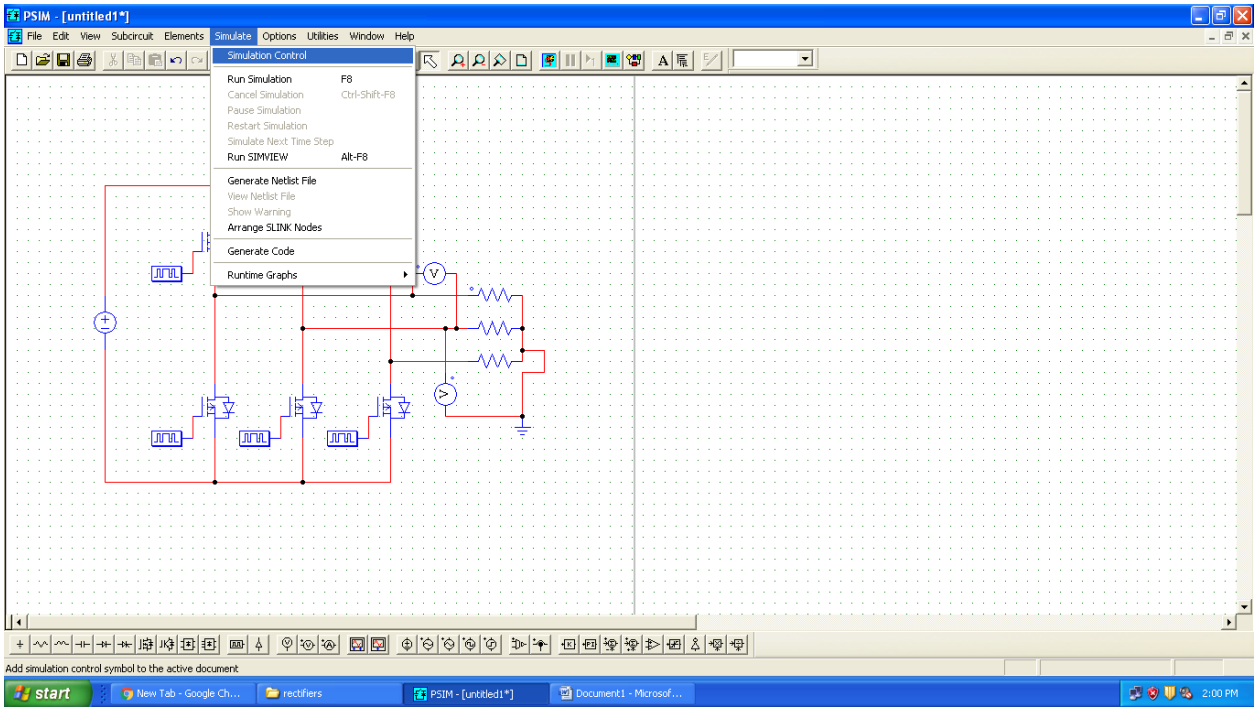


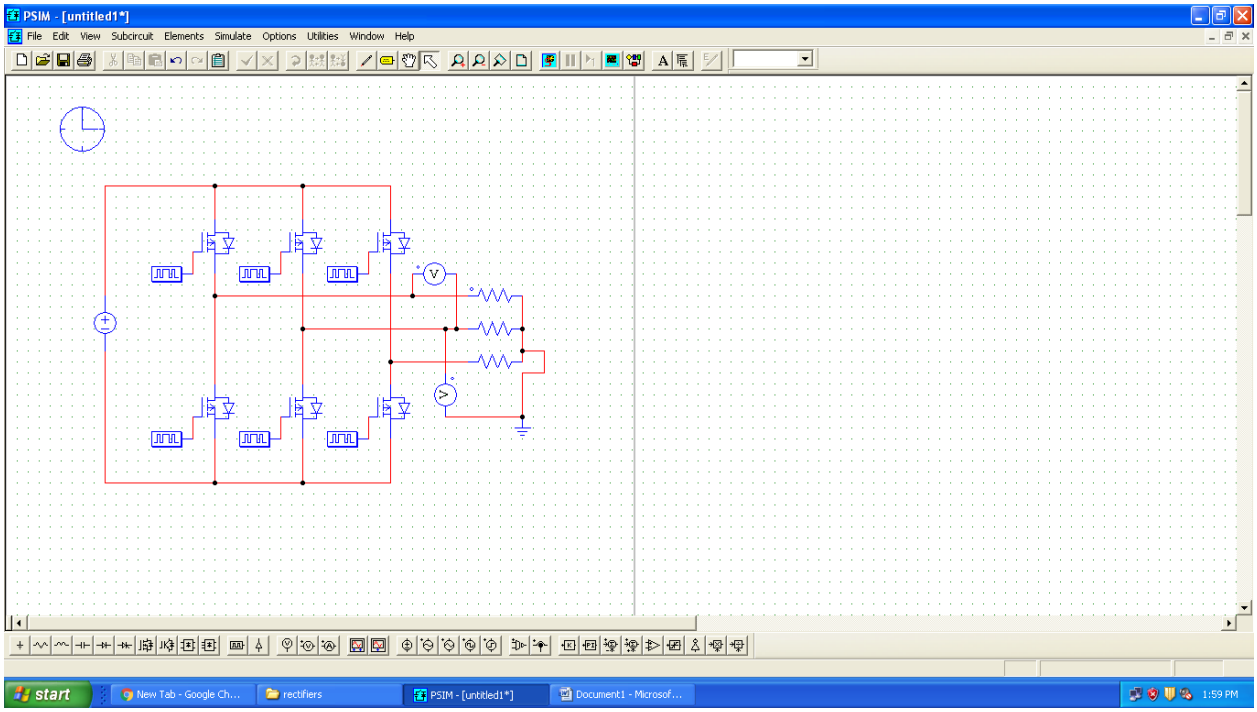


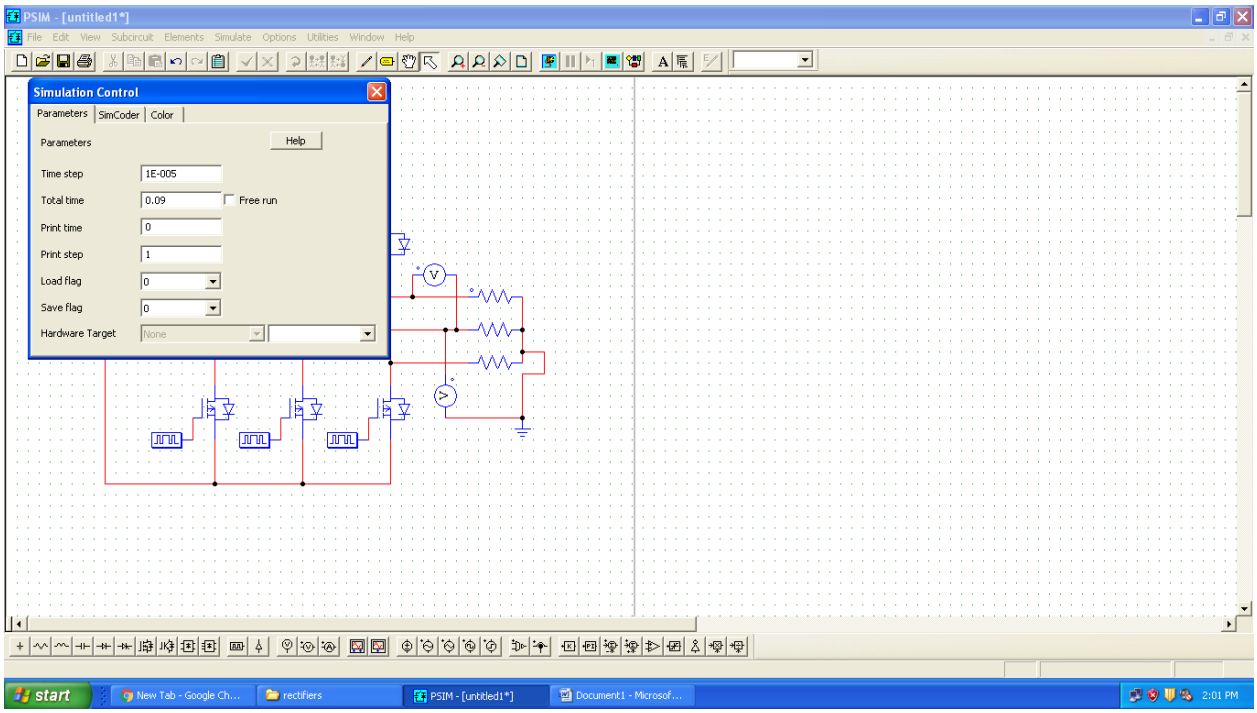
Connect the circuit by using wiring tool



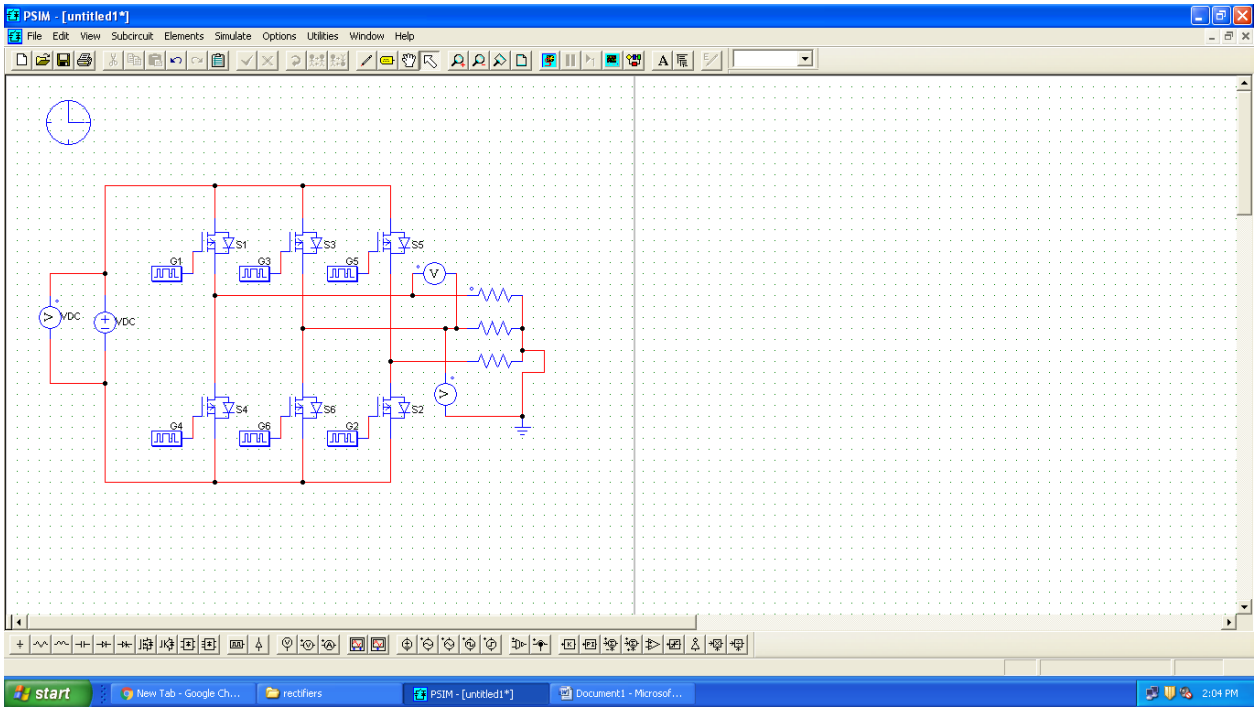
Select the simulation control



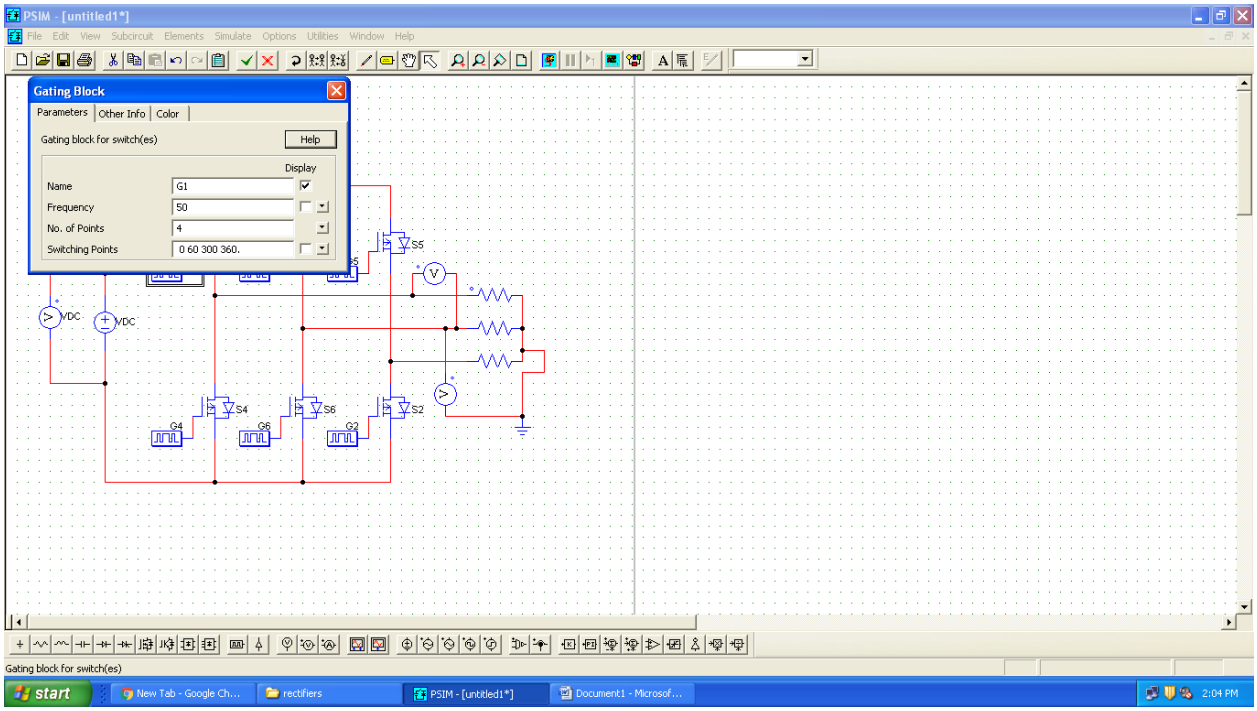


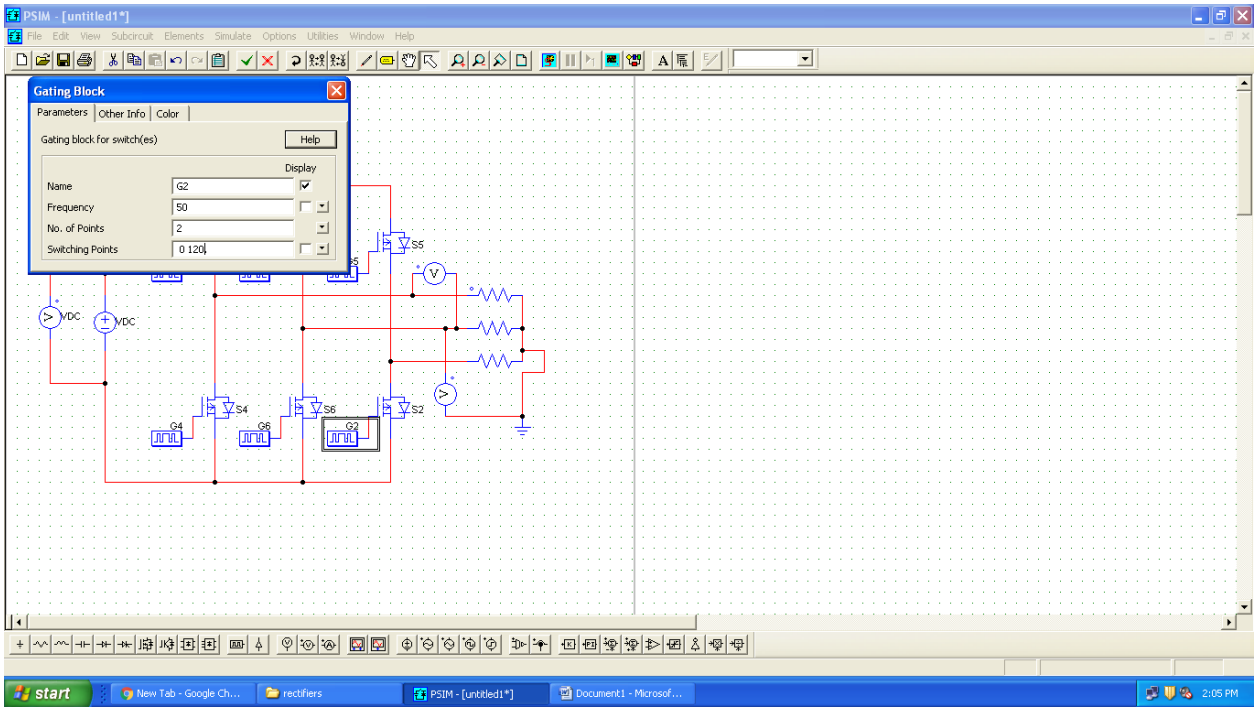


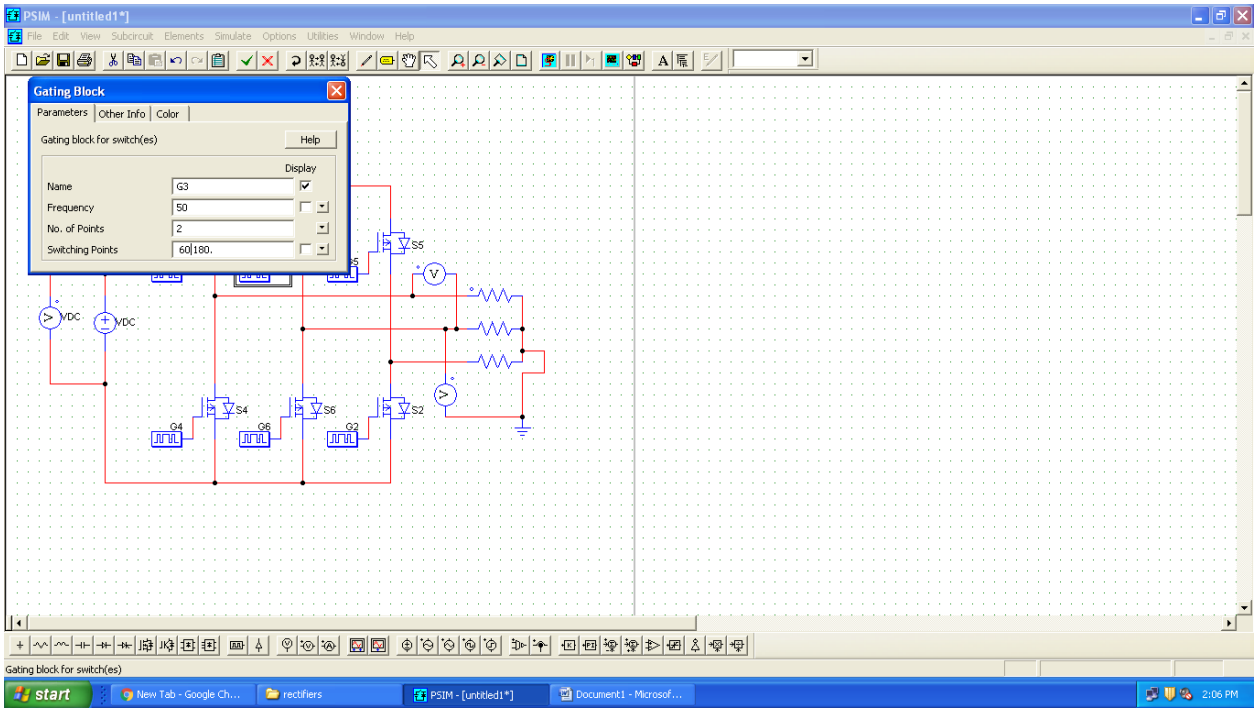
Give the proper labling

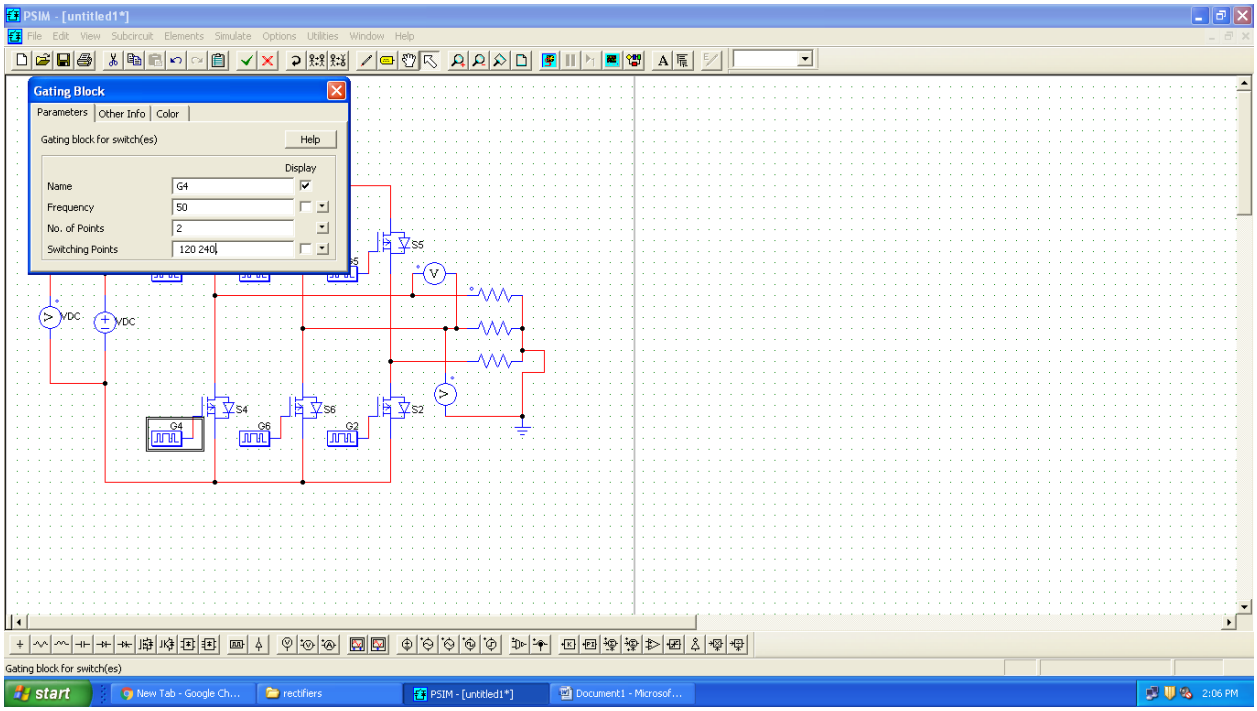


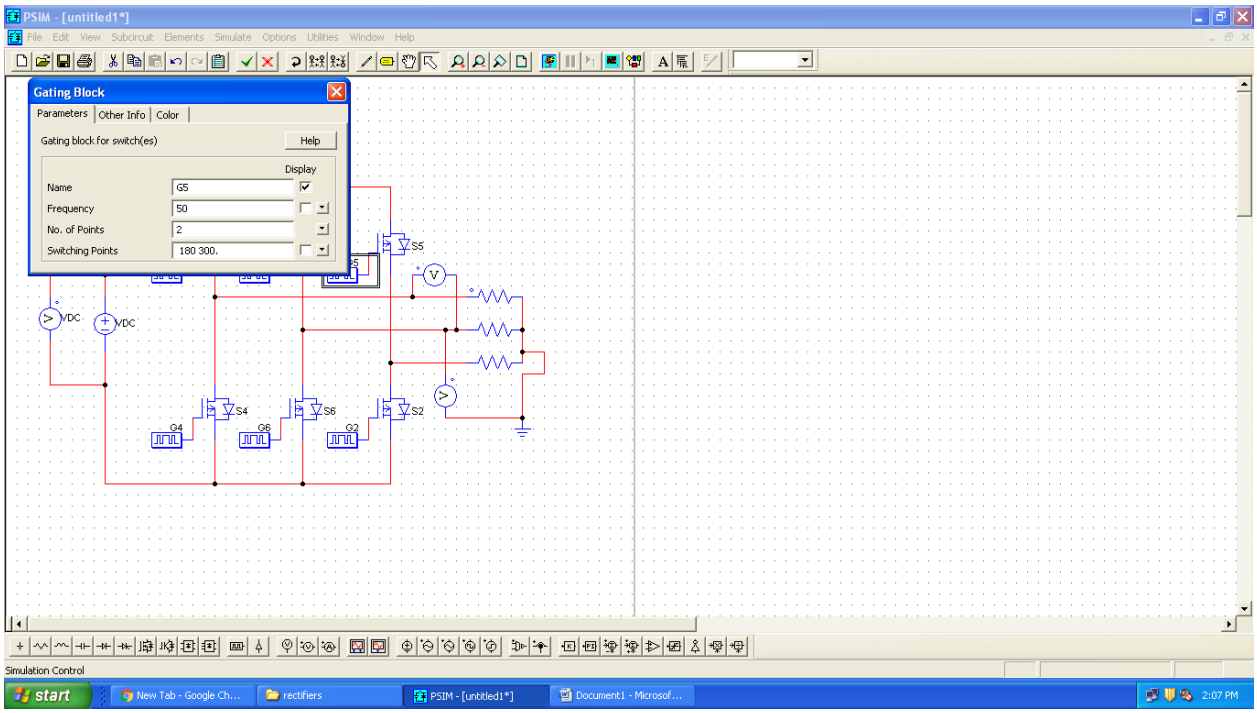
Give all the gating parameters as shown below

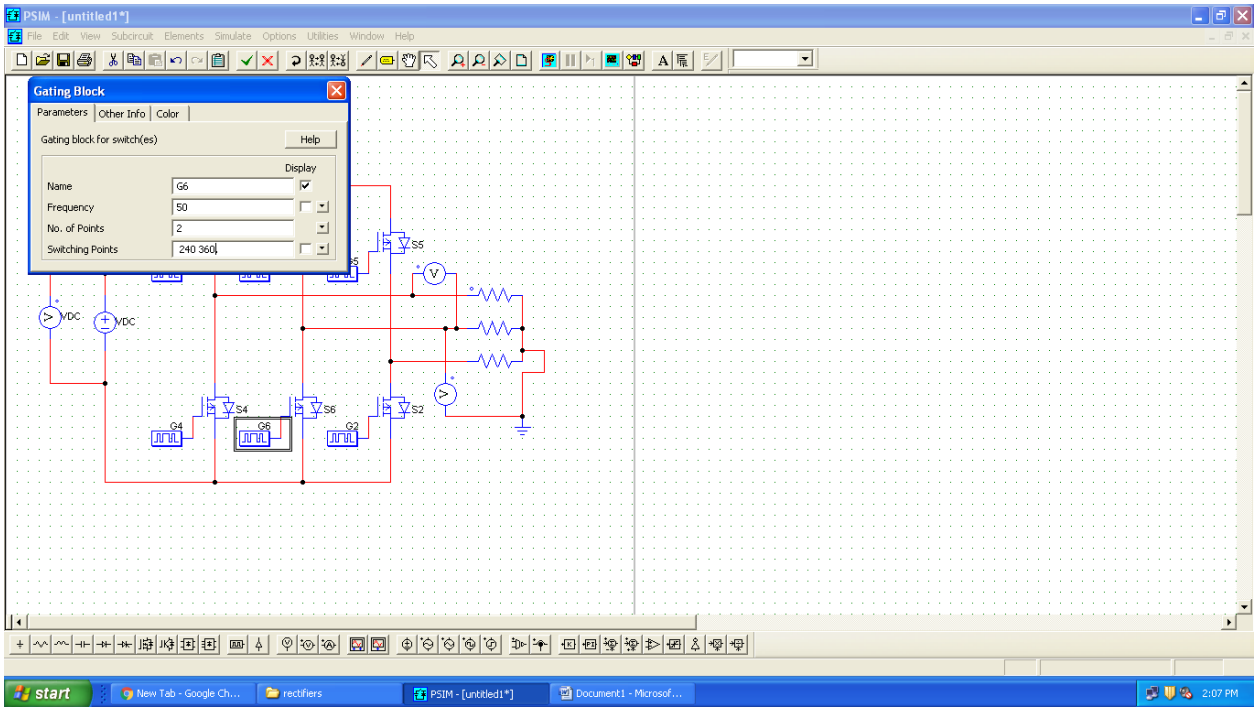




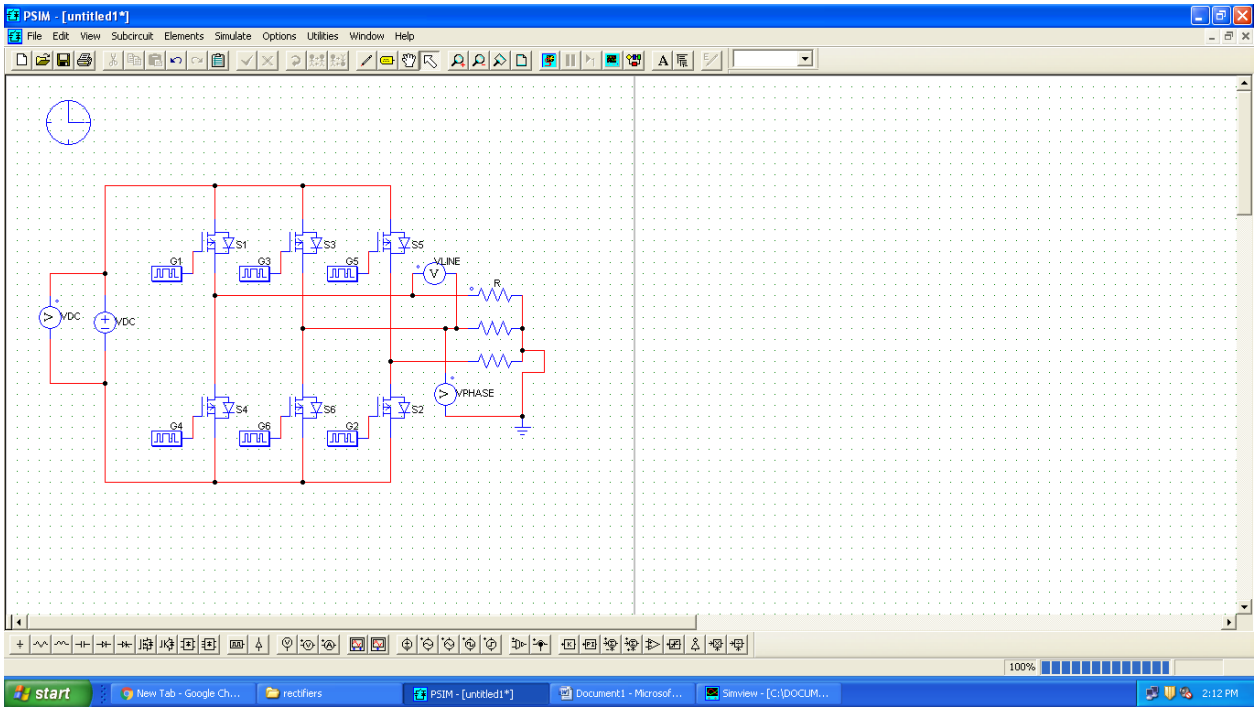

PSIM - [untitled1*]
Gating Block
Parameters
Other Info
Color
Gating block for switch(es)
Help
Display
Name
G3
Frequency
50
No. of Points
2
Switching Points
60 180.
S5
S4
S6
S2
G4
G6
G2
VDC
Gating block for switch(es)
start
2:06 PM


PSIM - [untitled1*]
Gating Block
Parameters
Other Info
Color
Gating block for switch(es)
Help
Display
Name
G4
Frequency
50
No. of Points
2
Switching Points
120 240
S5
S4
S6
S2
G4
G6
G2
VDC
Gating block for switch(es)
start
2:06 PM

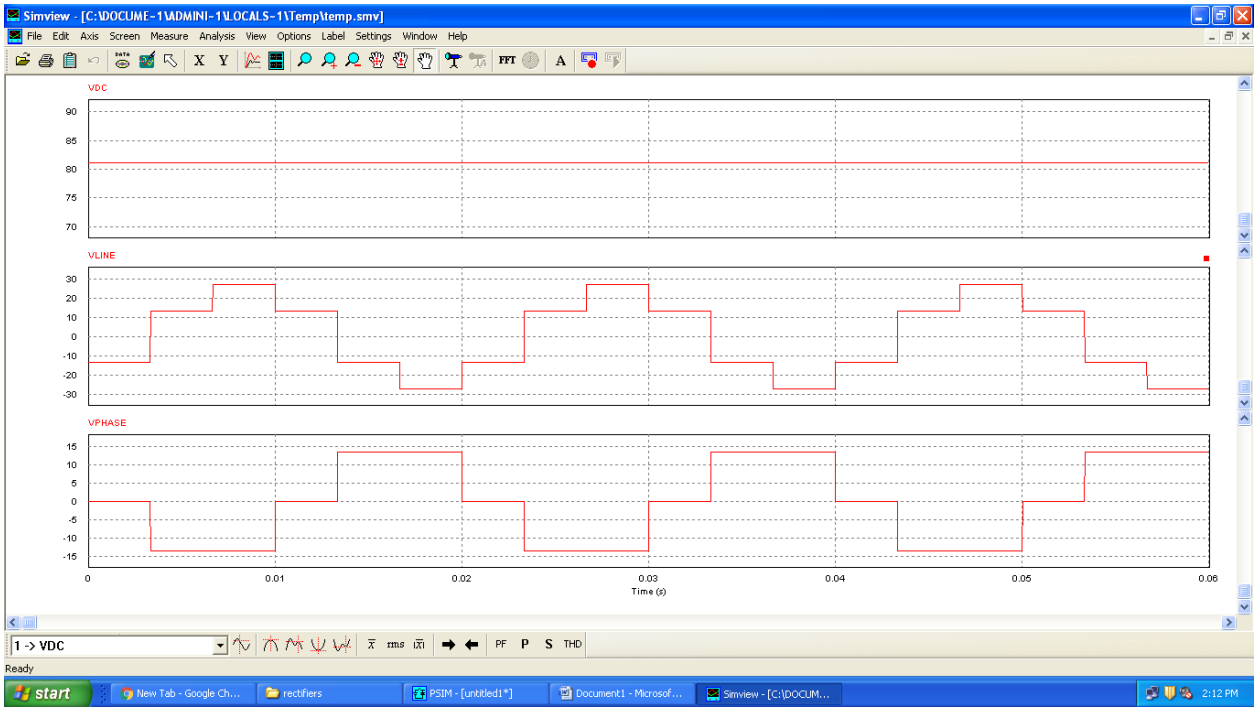

PSIM - [untitled1*]
Gating Block
Parameters
Other Info
Color
Gating block for switch(es)
Help
Display
Name
G5
Frequency
50
No. of Points
2
Switching Points
180 300.
S5
S4
S6
S2
G4
G6
G2
VDC
Simulation Control
start
2:07 PM


PSIM - [untitled1*]
Gating Block
Parameters
Other Info
Color
Gating block for switch(es)
Help
Display
Name
G6
Frequency
50
No. of Points
2
Switching Points
240 360
S5
S4
S6
S2
G4
G6
G2
VDC
start
2:07 PM

Circuit diagram

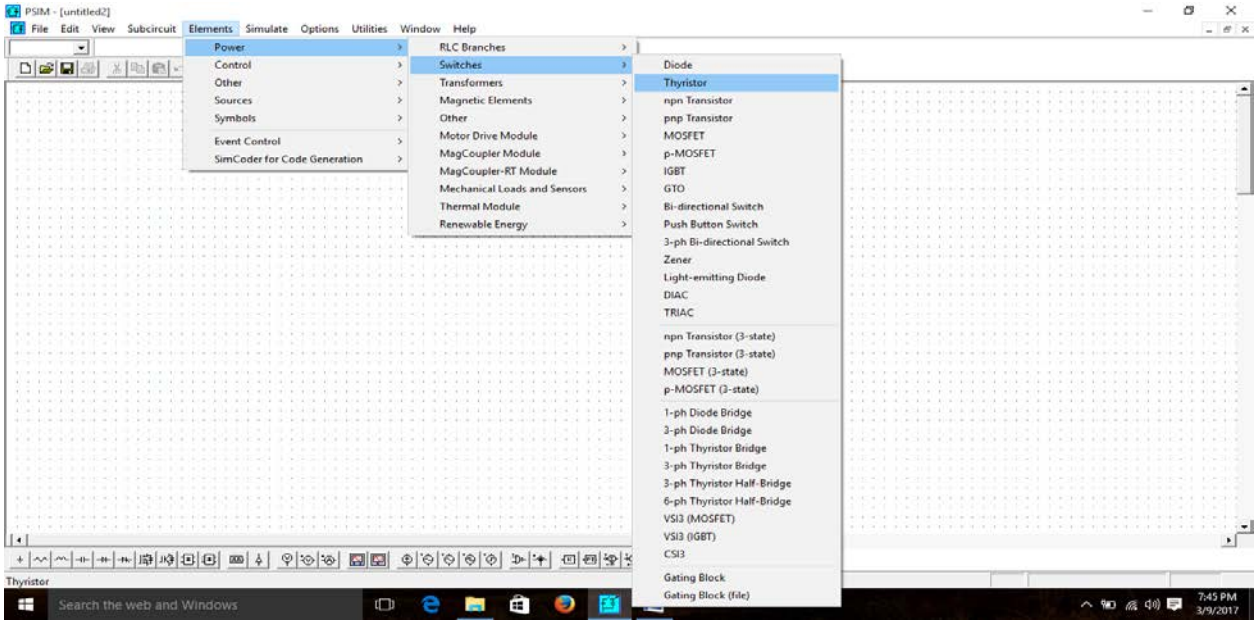


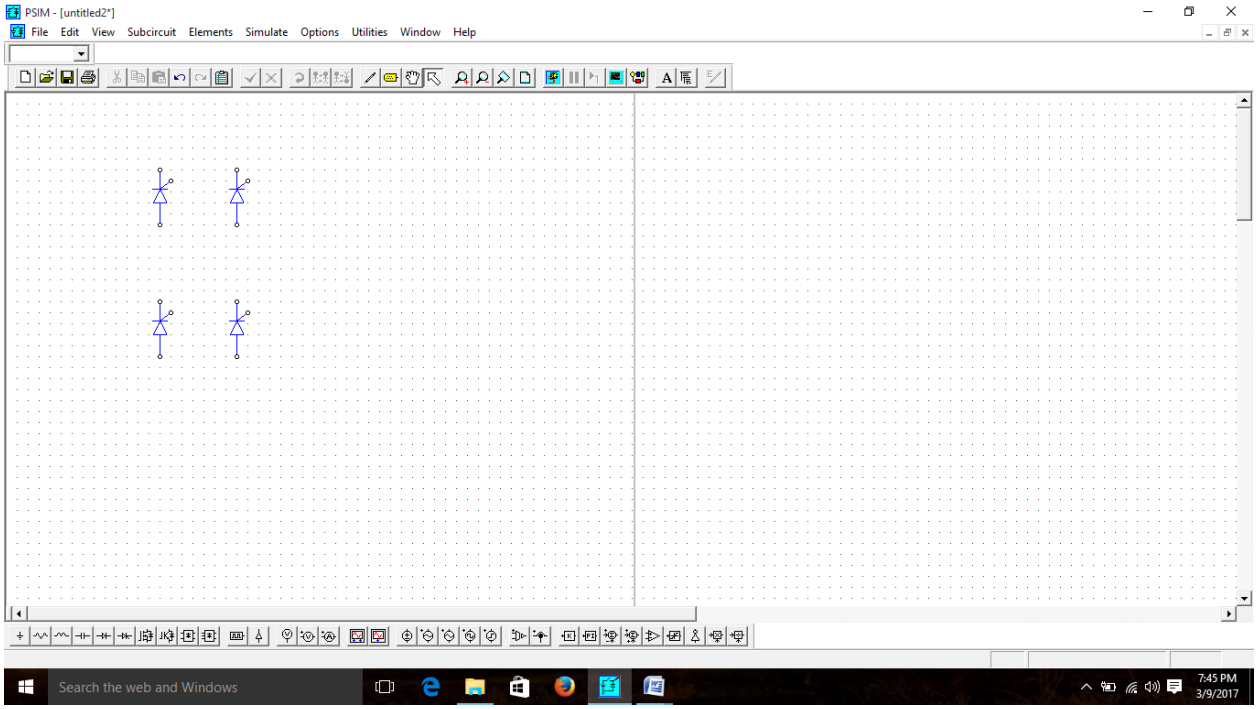
Output waveforms

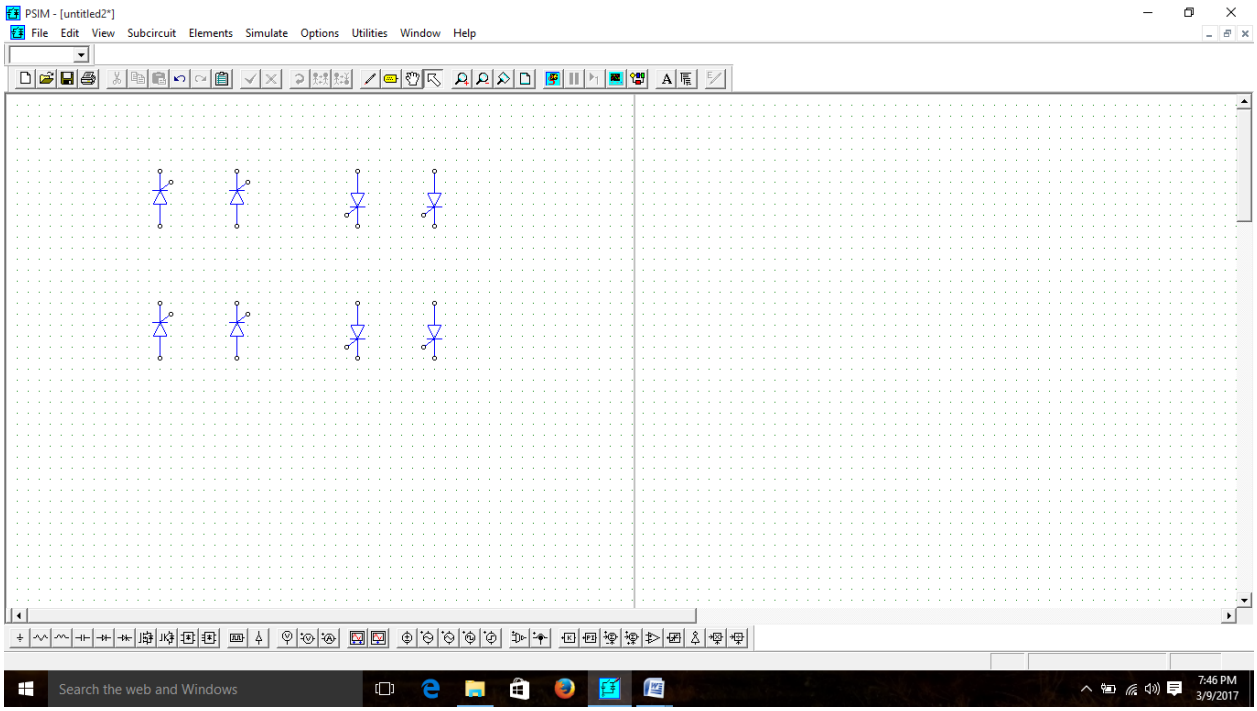


Cycloconverter

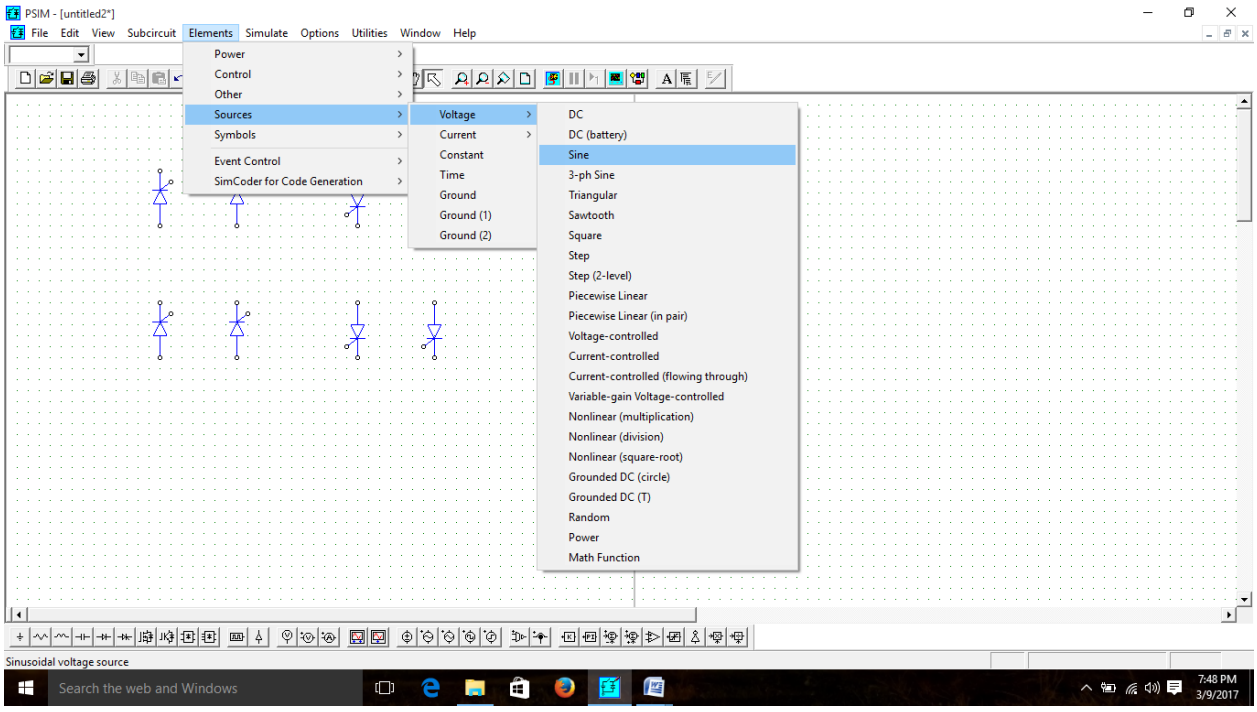
select the thyristor

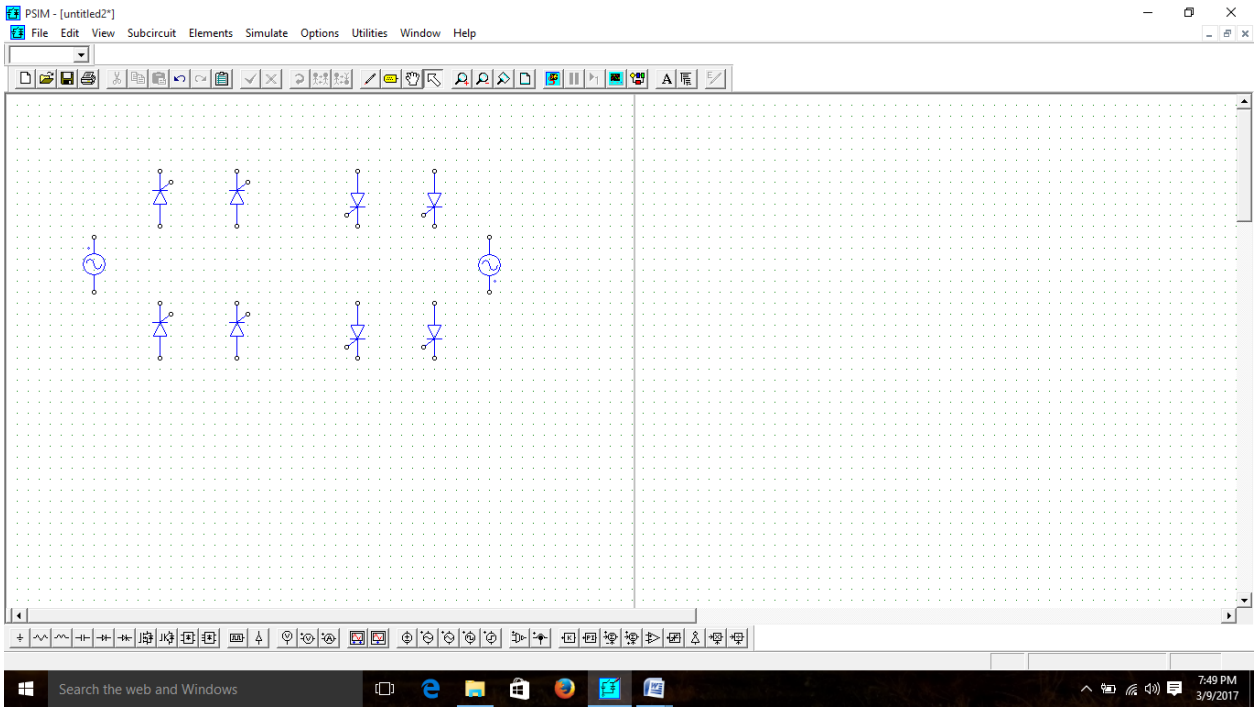




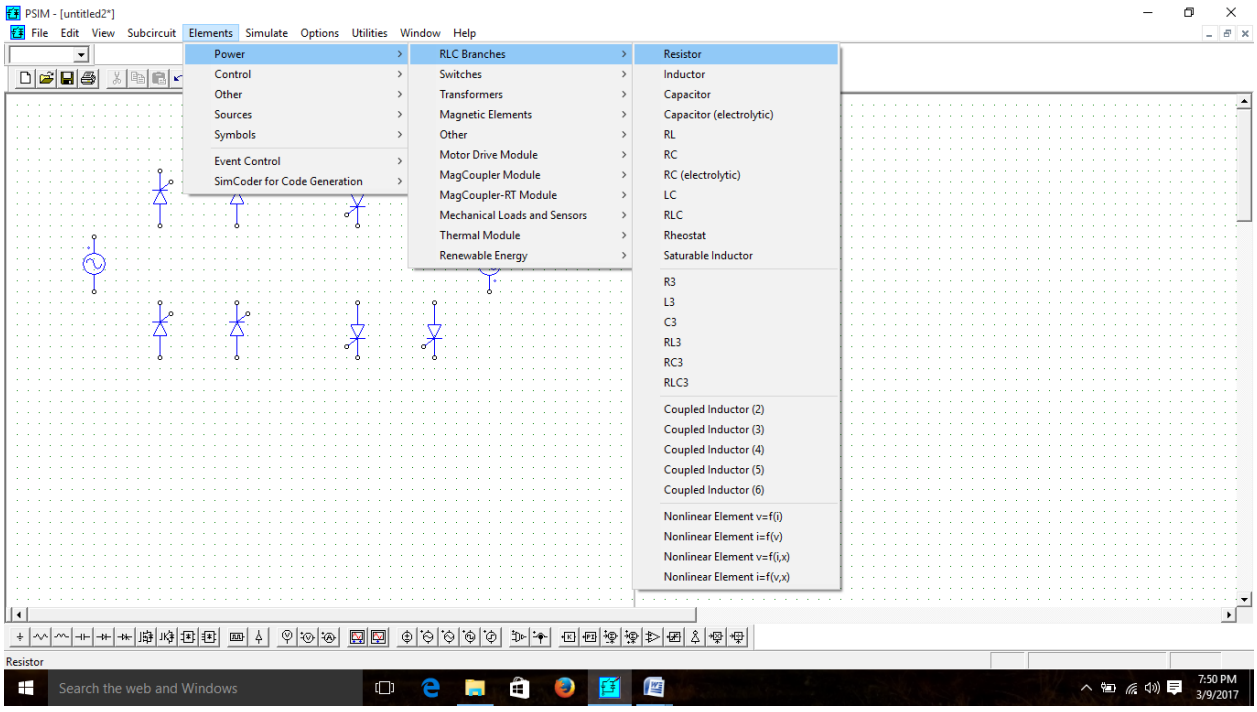


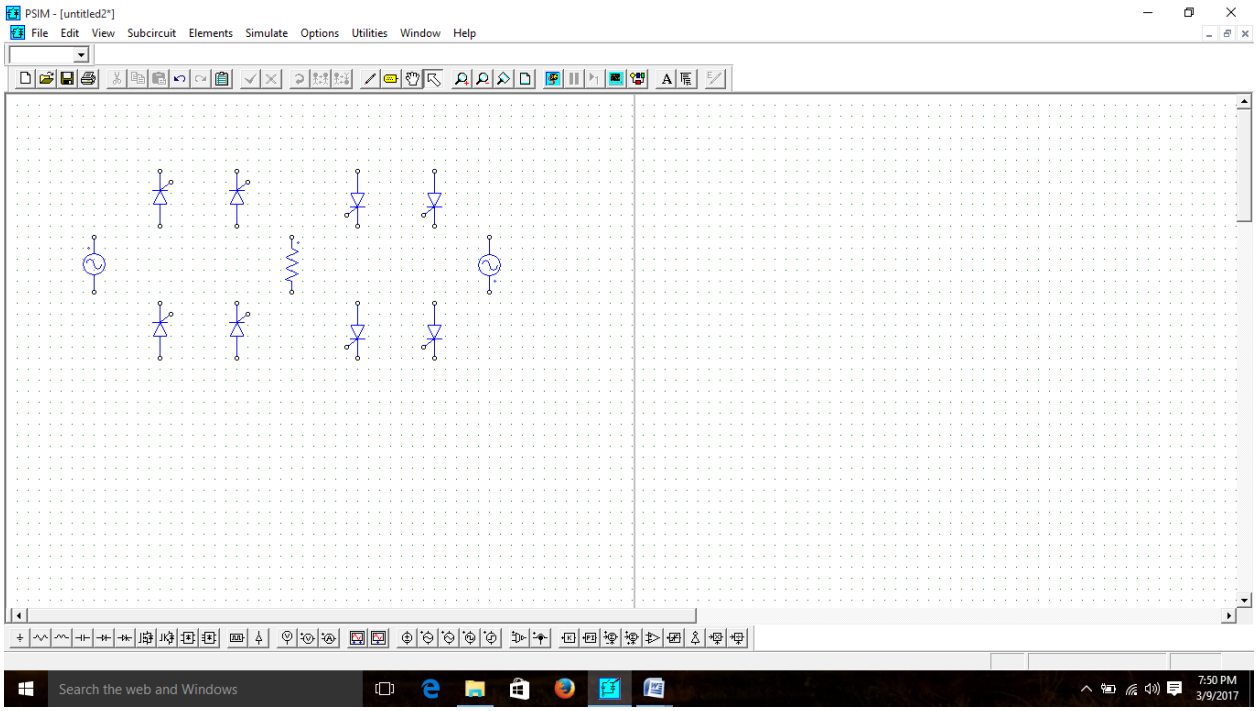
Select voltage source



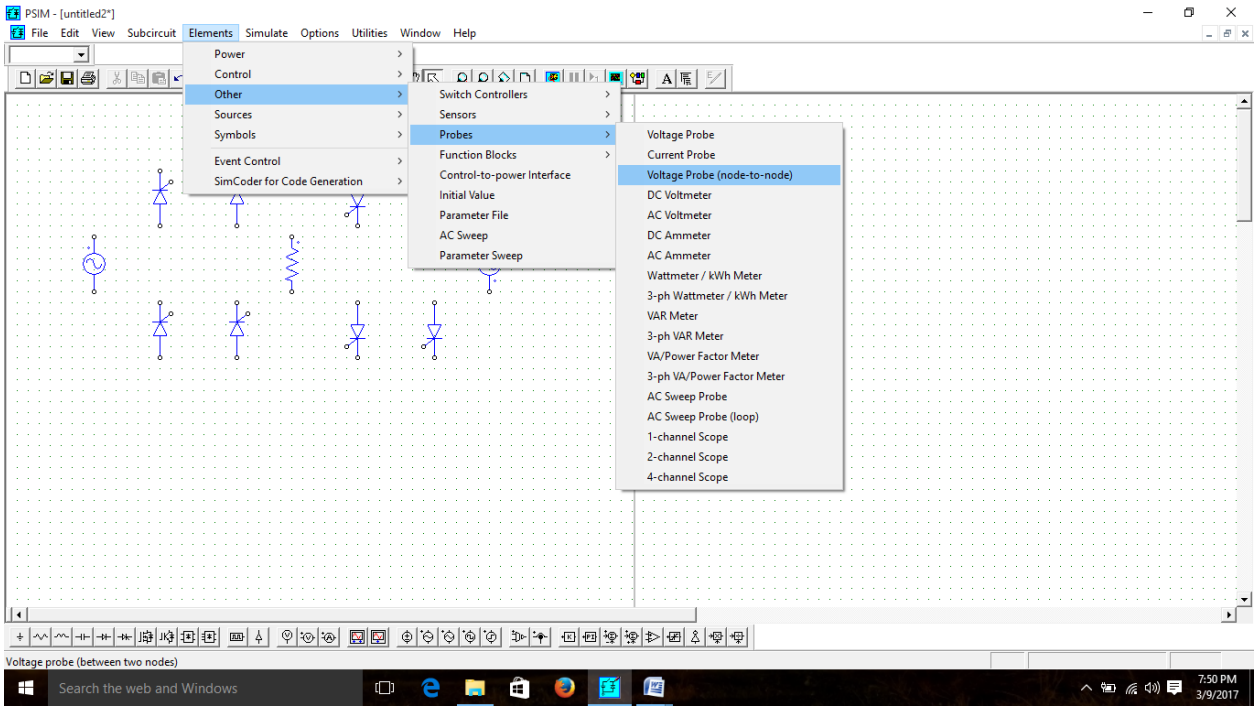


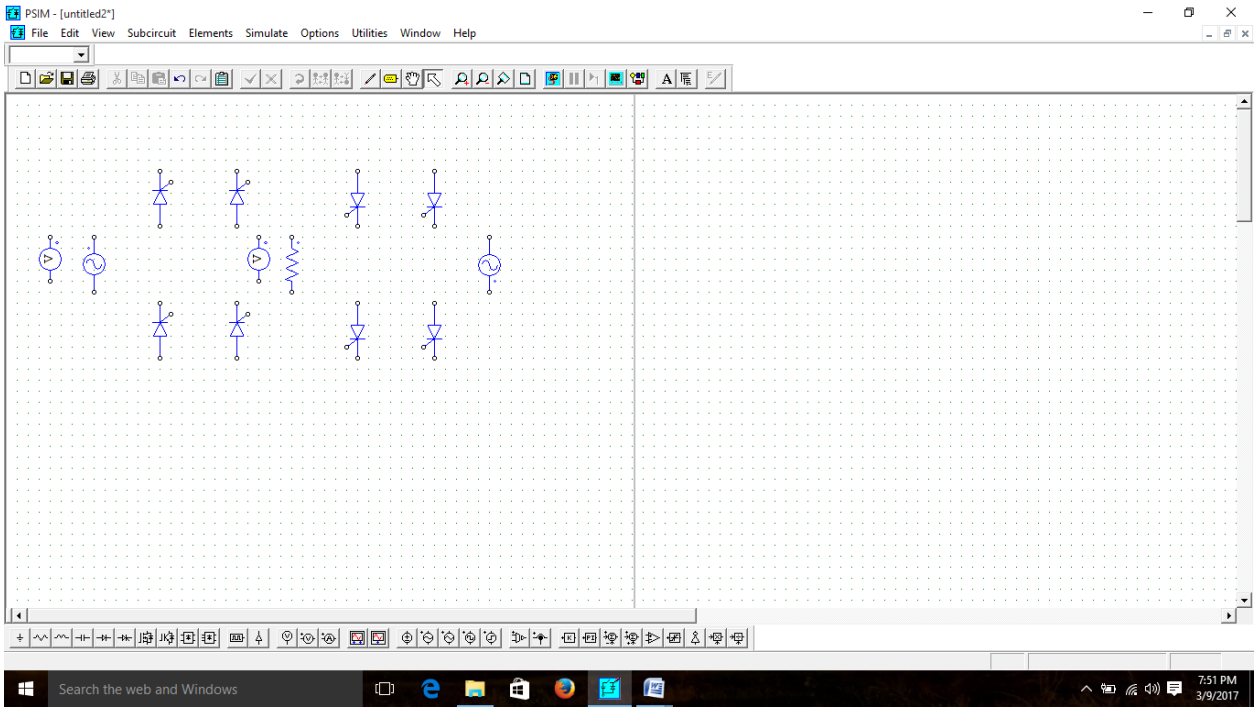
Select the resistor



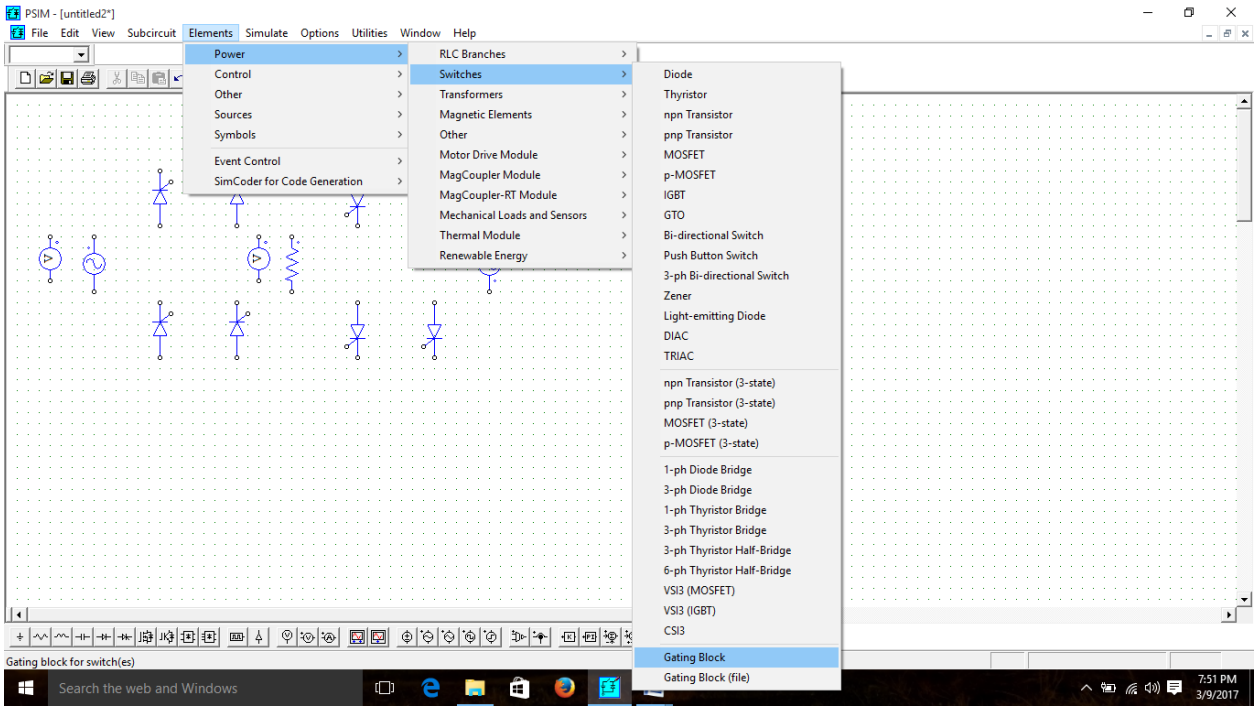


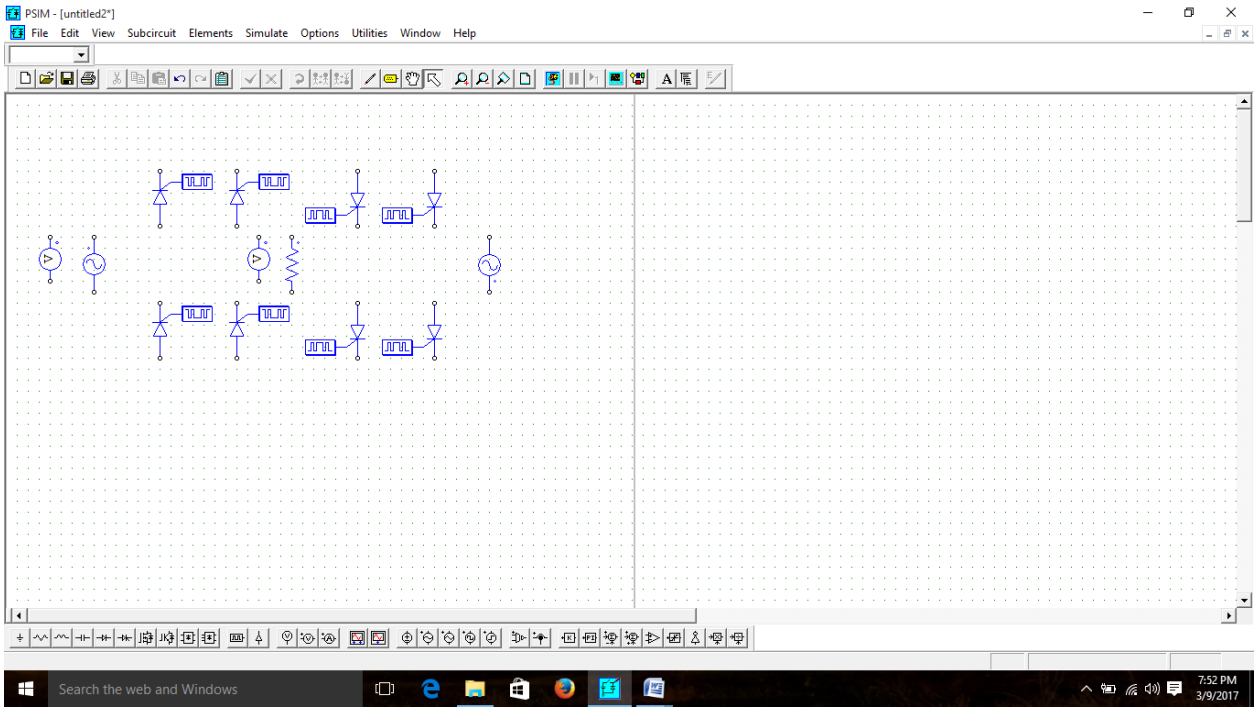
Select the volt meter



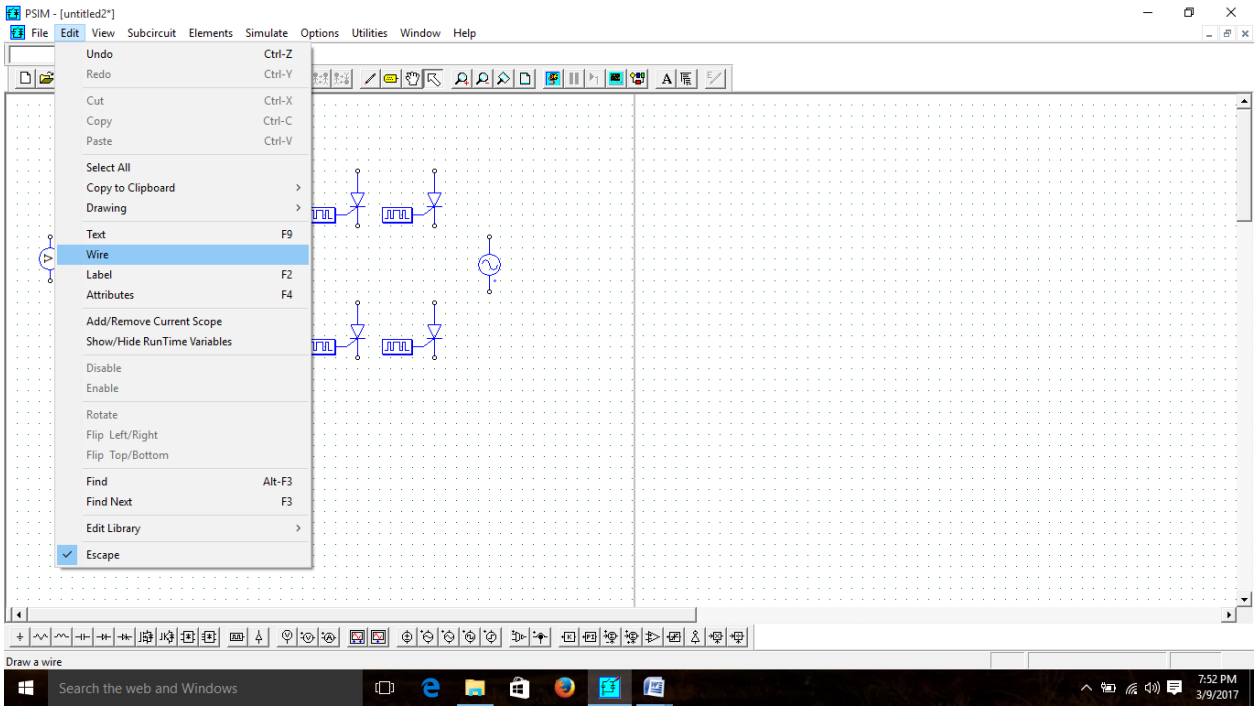


Select the gating block

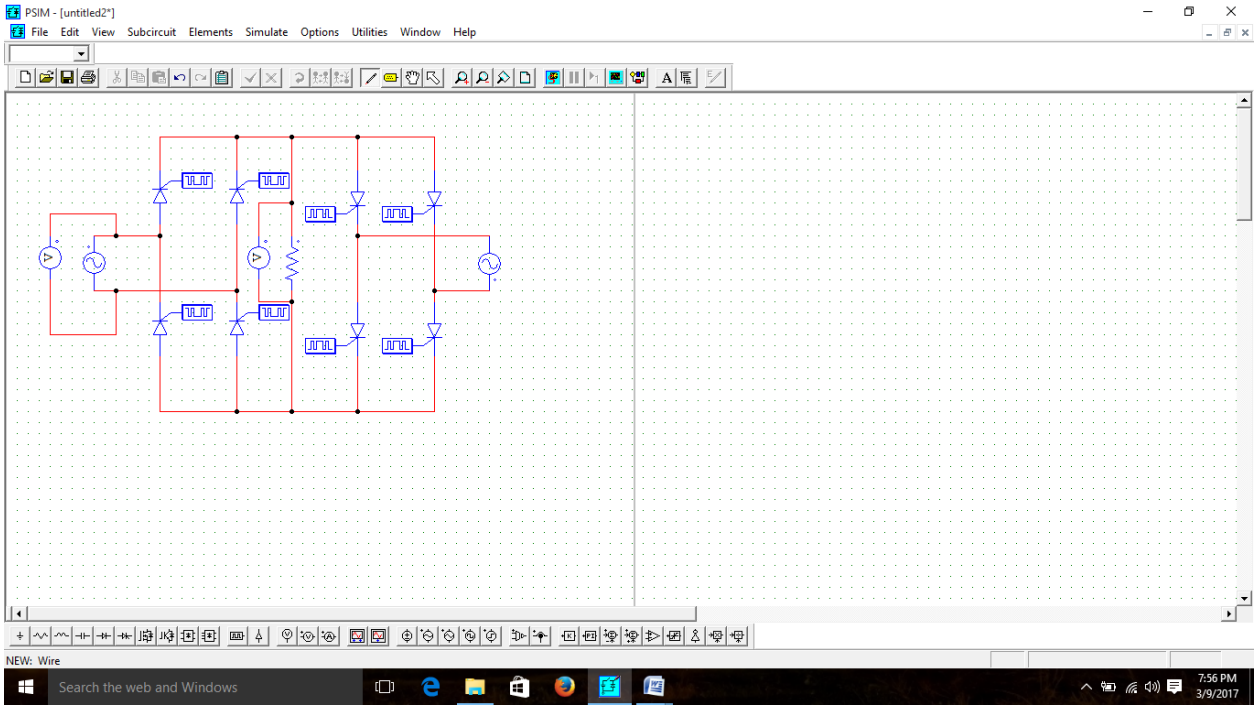




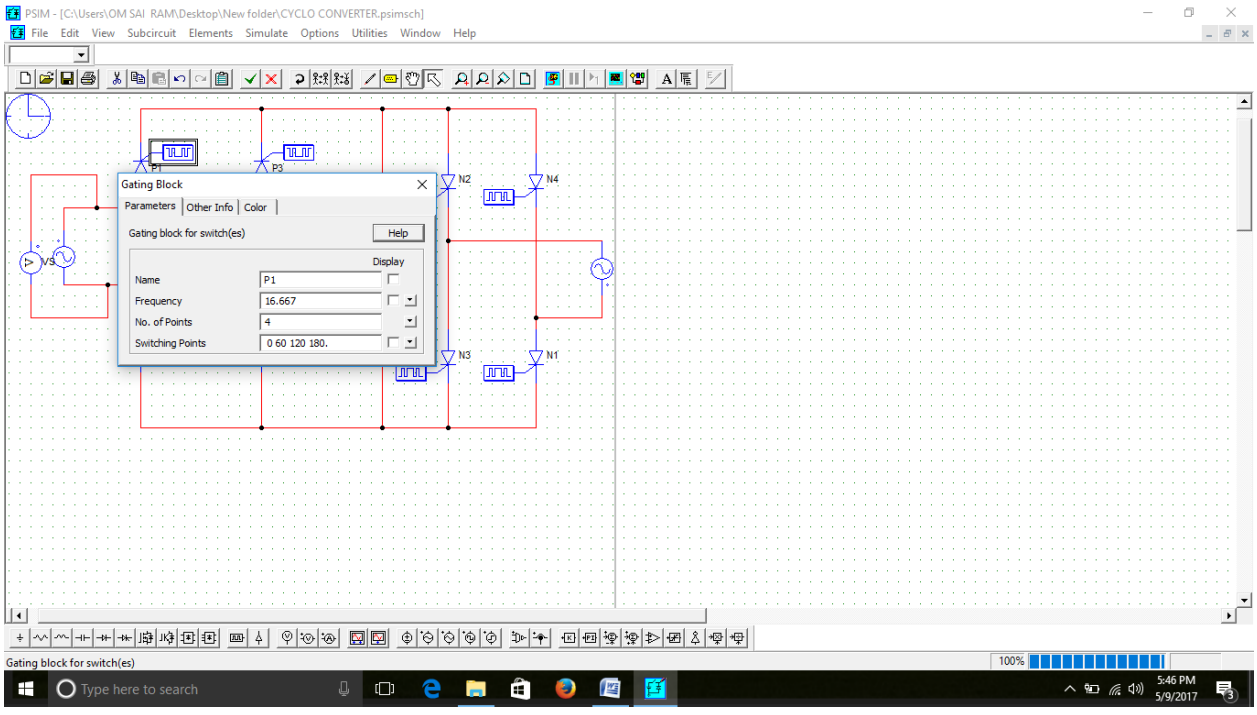
Select the wire for conning elements

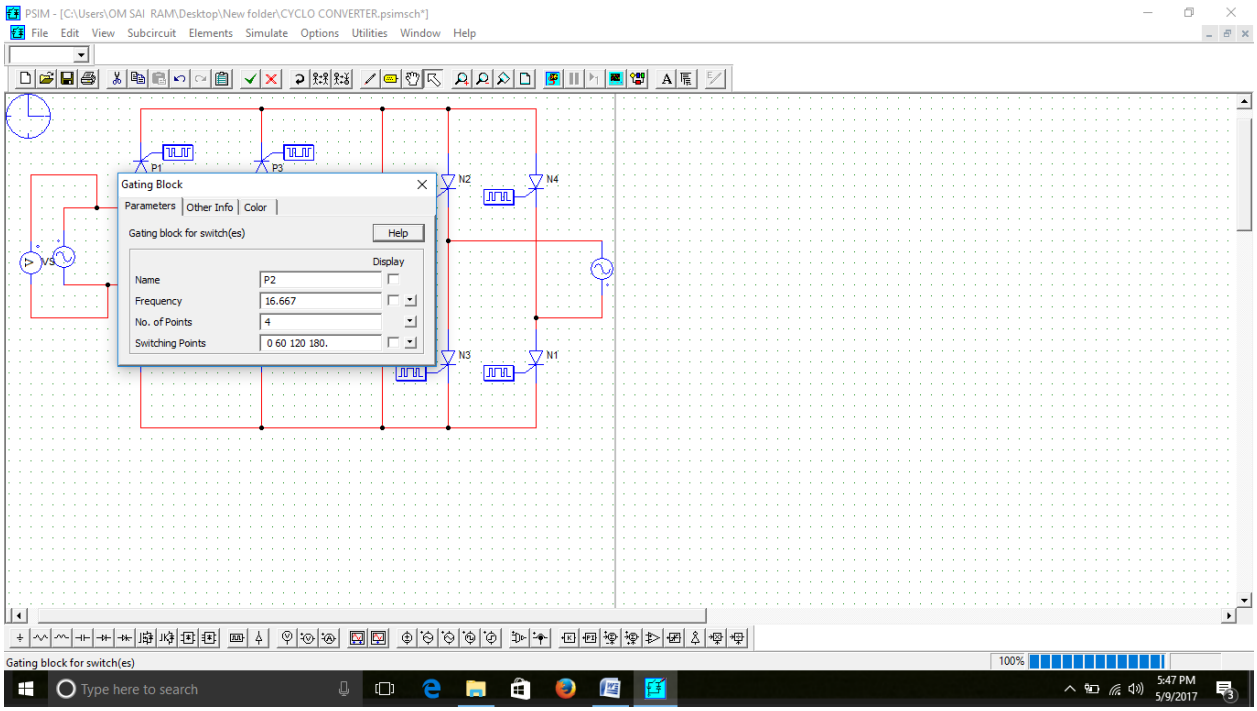


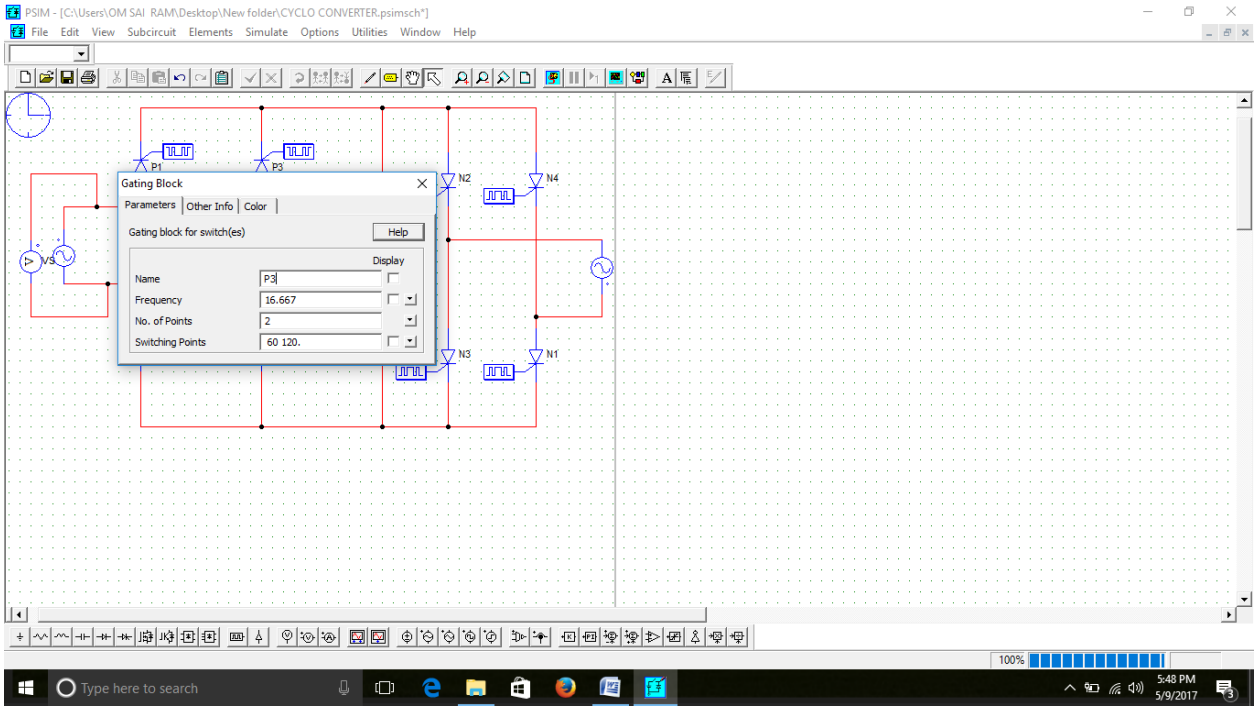
Connect all the elements using wiring tool

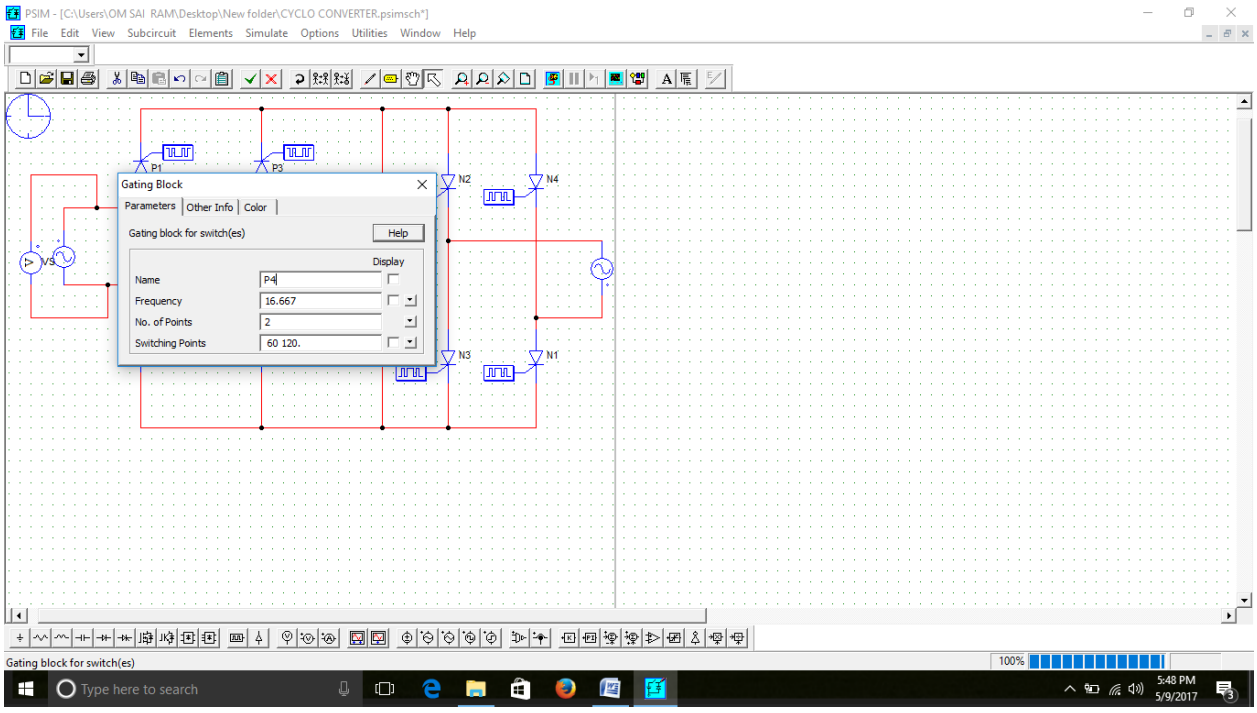


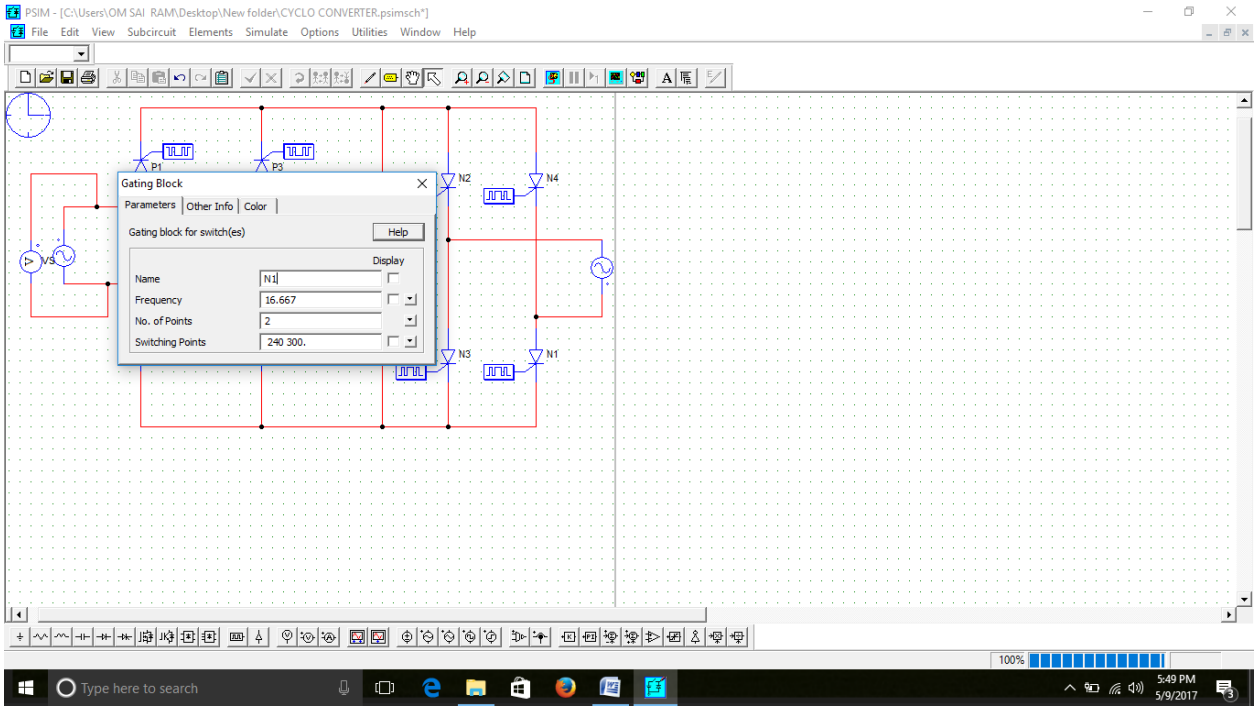
Give the gating block parameters for all 8 gating blocks

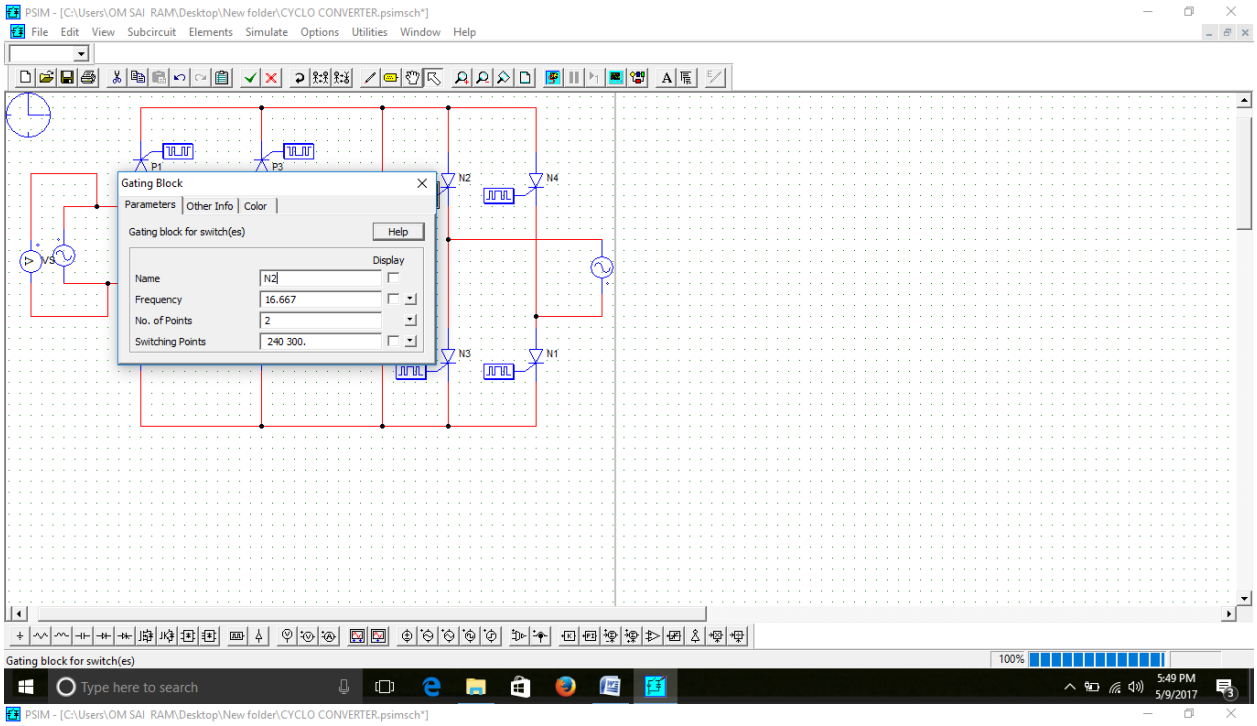


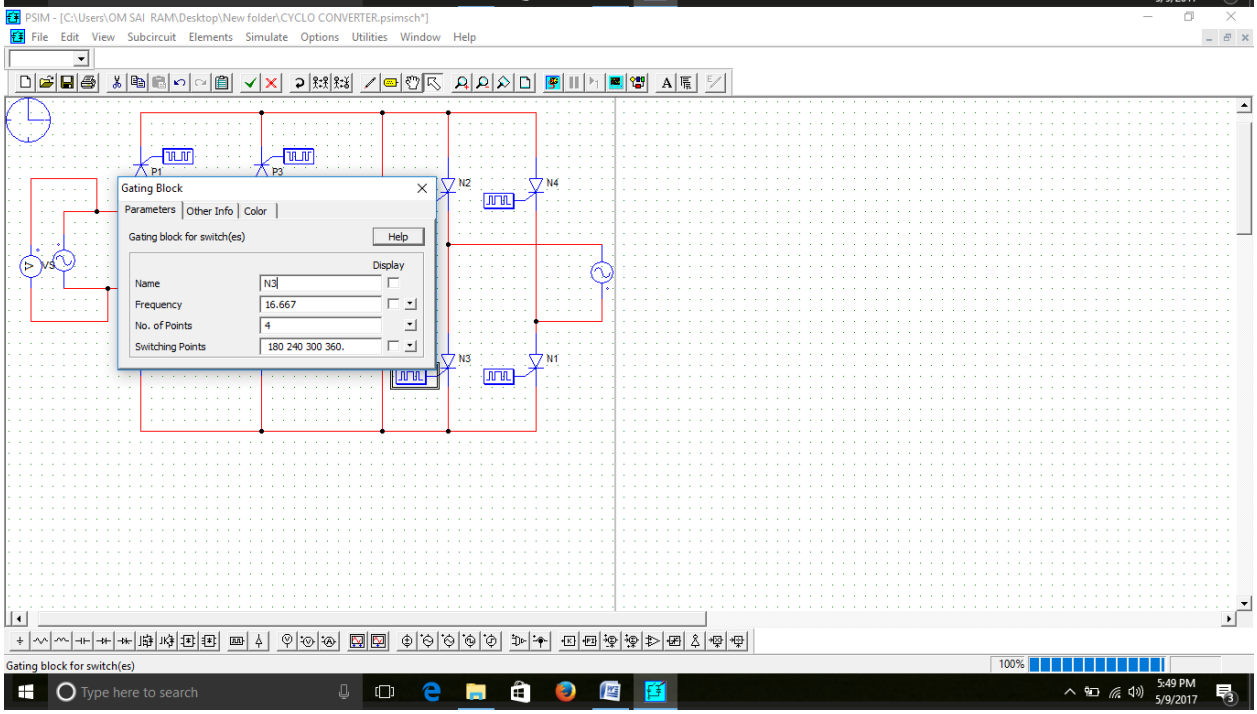

PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name P2
Frequency 16.667
No. of Points 4
Switching Points 0 60 120 180.
P1
P3
N2
N4
N3
N1
V3
Gating block for switch(es)
100%
Type here to search
5:47 PM
5/9/2017

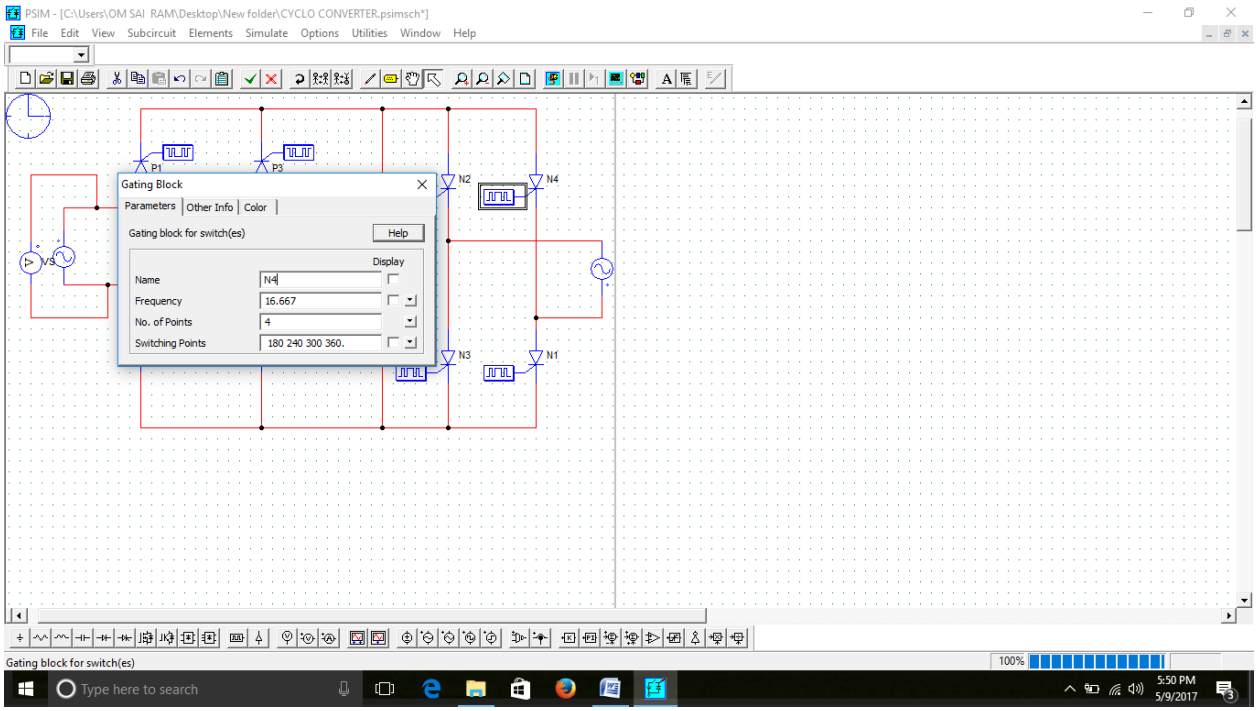

PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name P3
Frequency 16.667
No. of Points 2
Switching Points 60 120.
P1
P3
N2
N4
N3
N1
V3
100%
Type here to search
5:48 PM
5/9/2017


PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name P4
Frequency 16.667
No. of Points 2
Switching Points 60 120.
P1
P3
N2
N4
N3
N1
V3
Gating block for switch(es)
100%
Type here to search
5:48 PM
5/9/2017

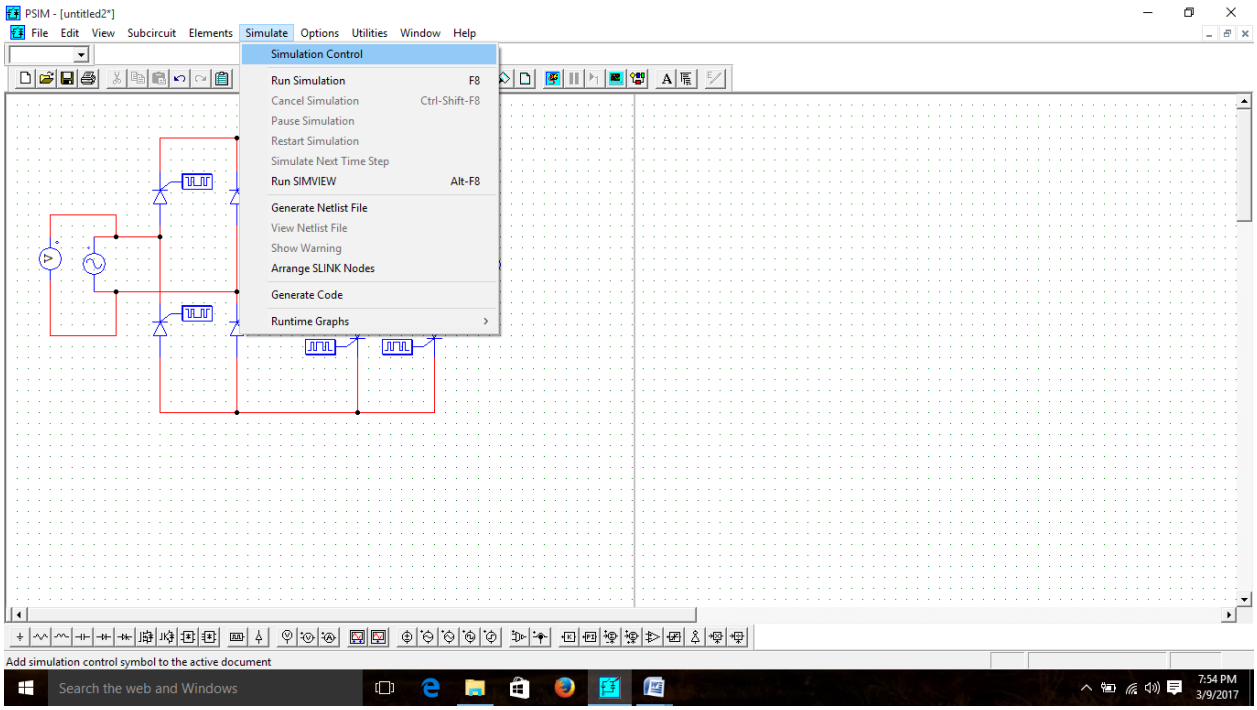

PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name N1
Frequency 16.667
No. of Points 2
Switching Points 240 300.
P1
P3
N2
N4
N3
N1
V3
100%
Type here to search
5:49 PM
5/9/2017

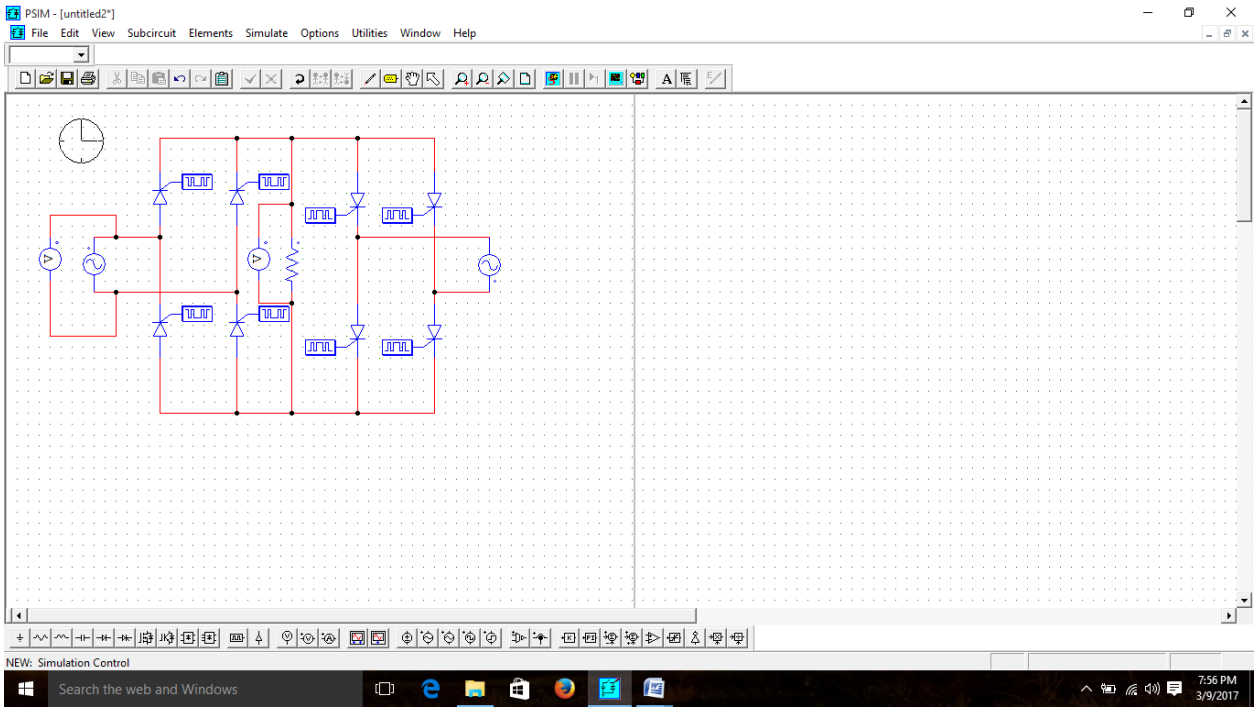

PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name N2
Frequency 16.667
No. of Points 2
Switching Points 240 300.
P1
P3
N2
N4
N3
N1
VS
Gating block for switch(es)
100%
Type here to search
5:49 PM
5/9/2017

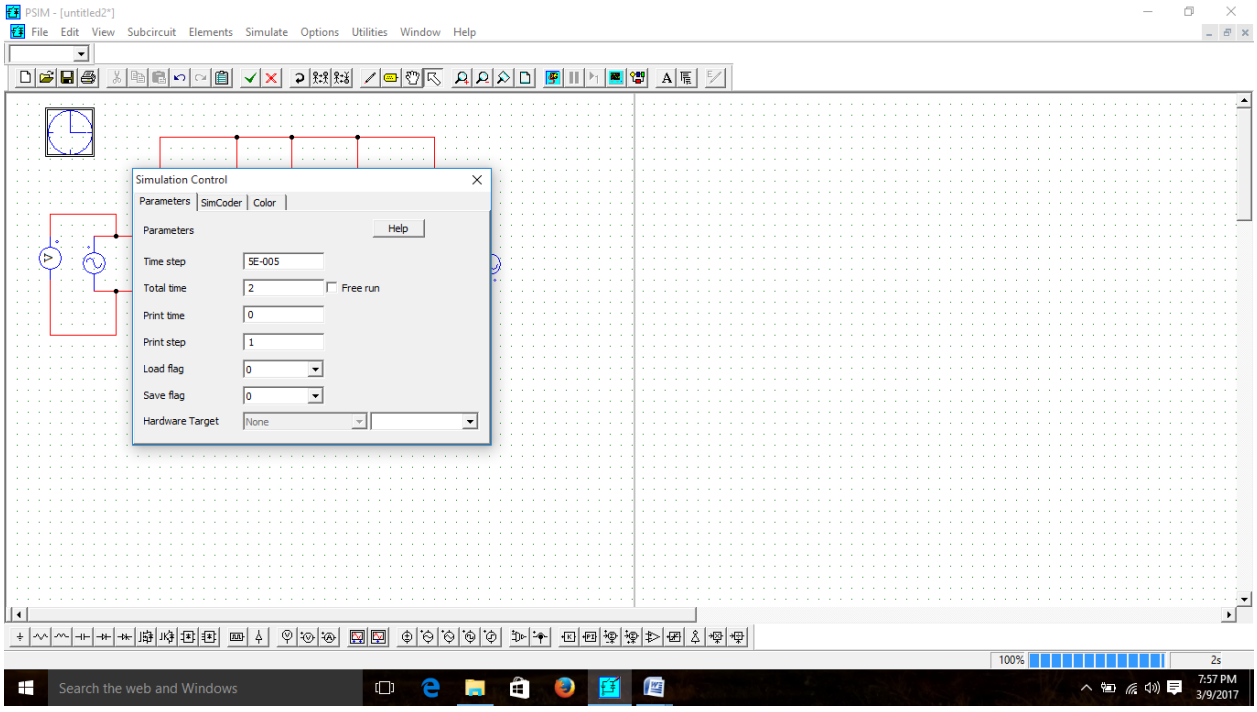

PSIM - [C:\Users\OM SAI RAM\Desktop\New folder\CYCLO CONVERTER.psimsch*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Gating Block
Parameters Other Info Color
Gating block for switch(es)
Help
Display
Name N3
Frequency 16.667
No. of Points 4
Switching Points 180 240 300 360.
P1
P3
N2
N4
N3
N1
VS
Gating block for switch(es)
100%
Type here to search
5:49 PM
5/9/2017

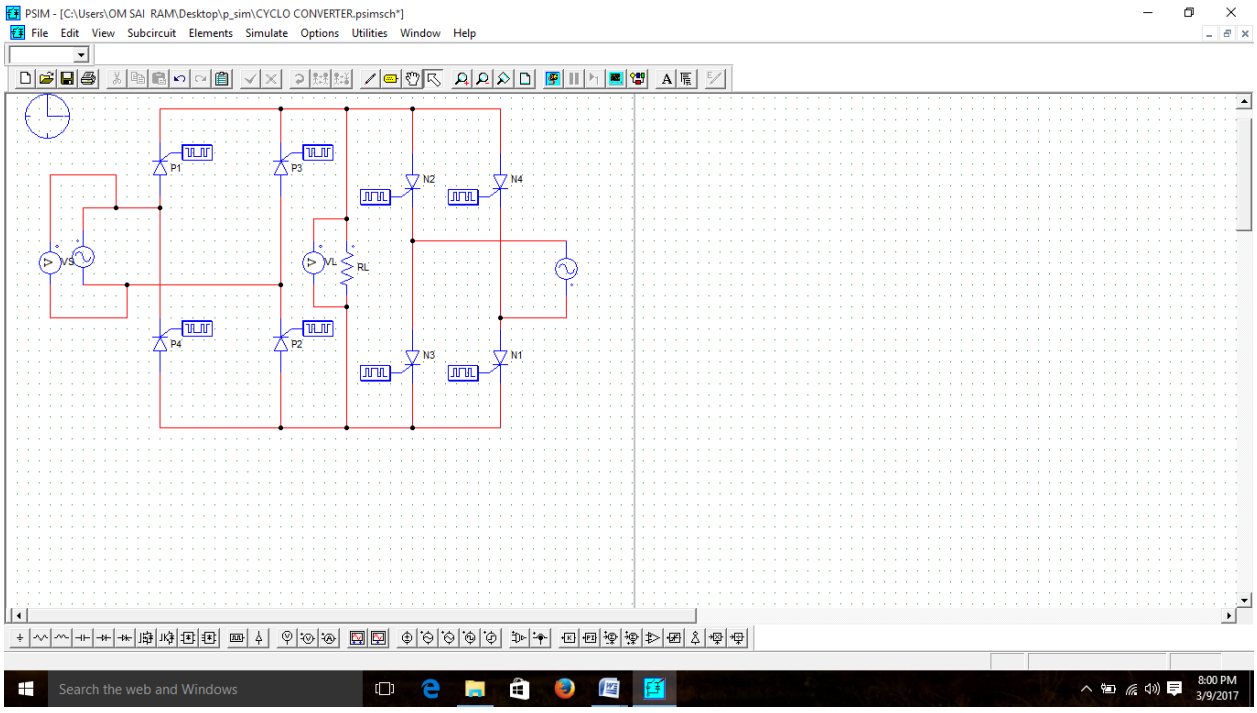


Select the simulation control

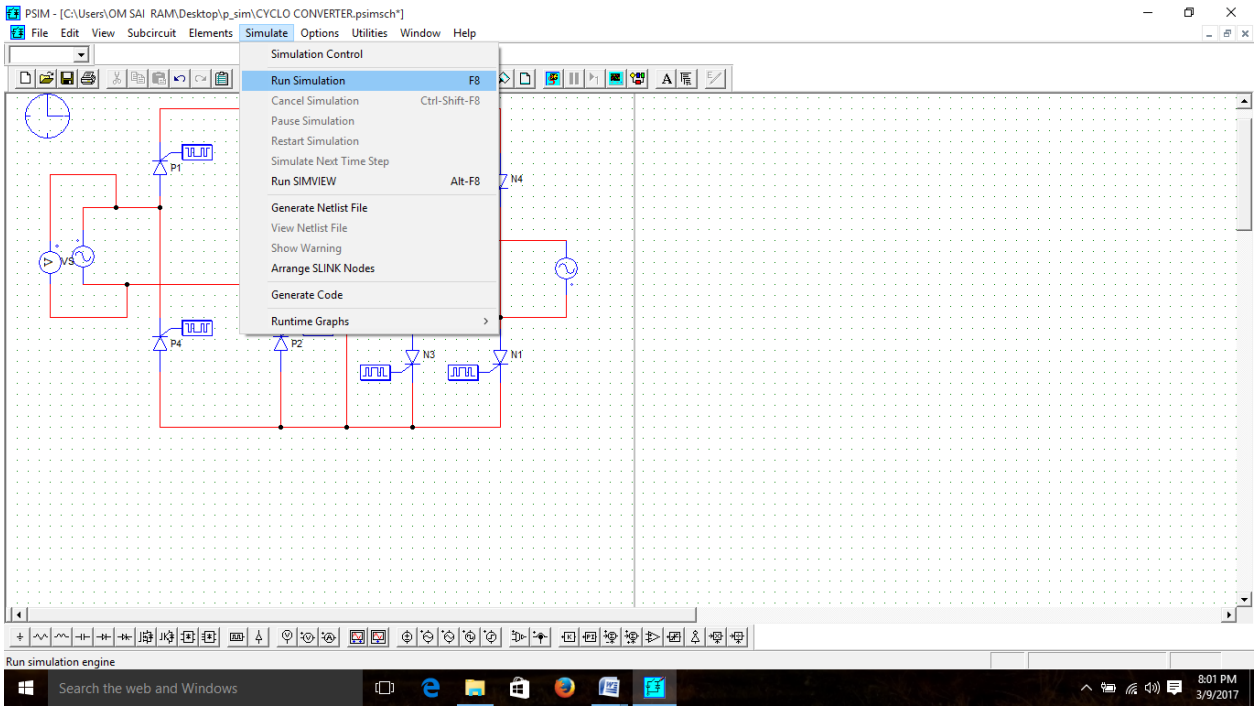



PSIM - [untitled2*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
NEW: Simulation Control
Search the web and Windows
7:56 PM
3/9/2017

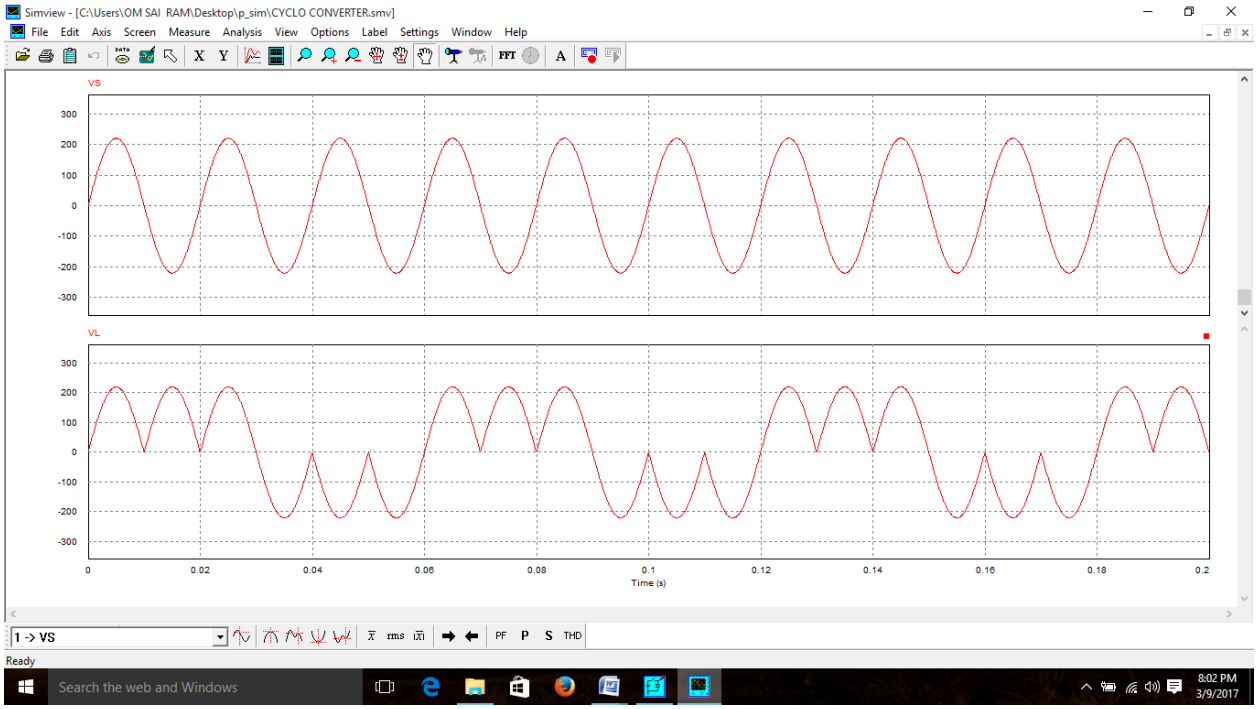

PSIM - [untitled2*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Simulation Control
Parameters SimCoder Color
Parameters
Help
Time step 5E-005
Total time 2
Free run
Print time 0
Print step 1
Load flag 0
Save flag 0
Hardware Target None
100%
2s
Search the web and Windows
7:57 PM
3/9/2017



Run the circuit by selecting run simulation



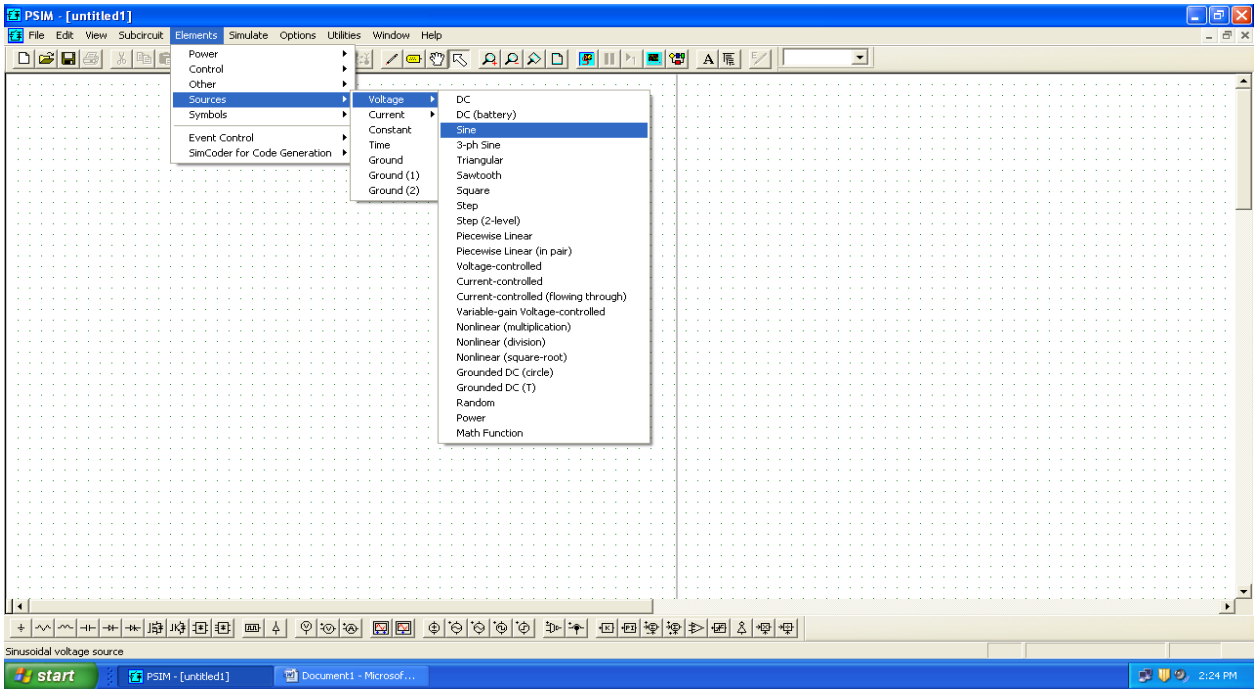
Output waveform



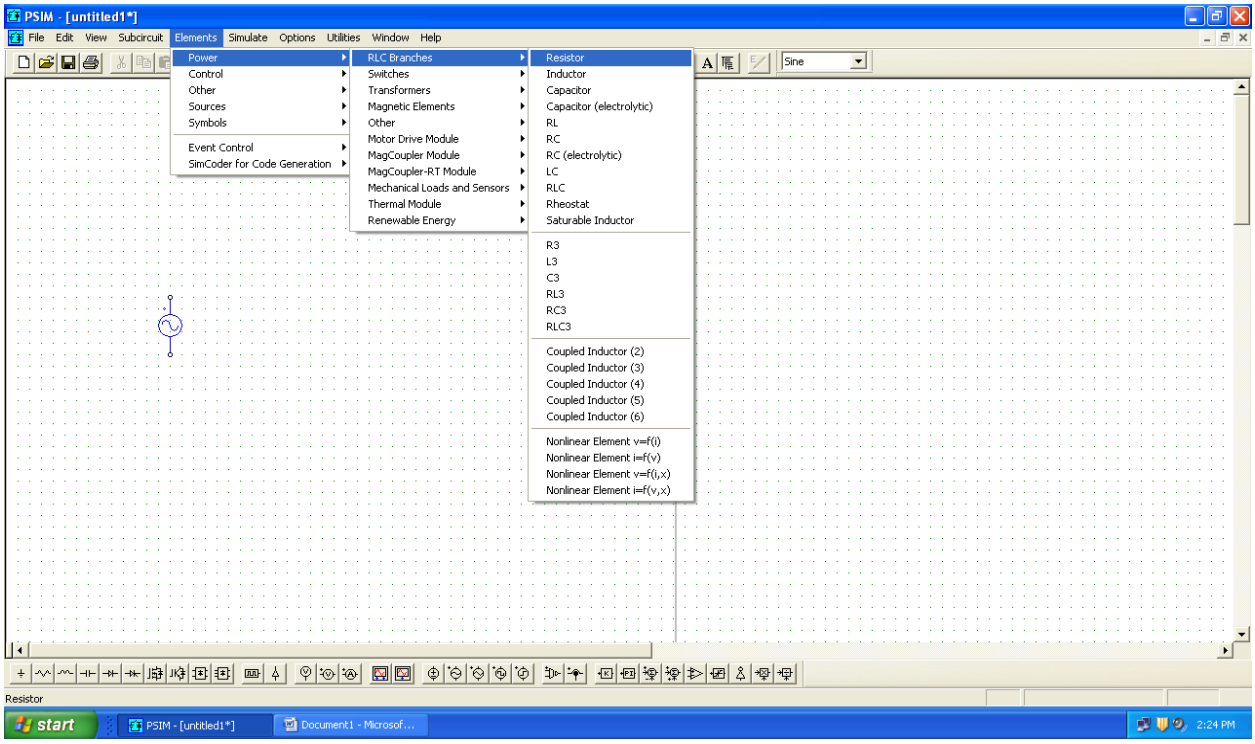
CLIPPERS

Above reference:

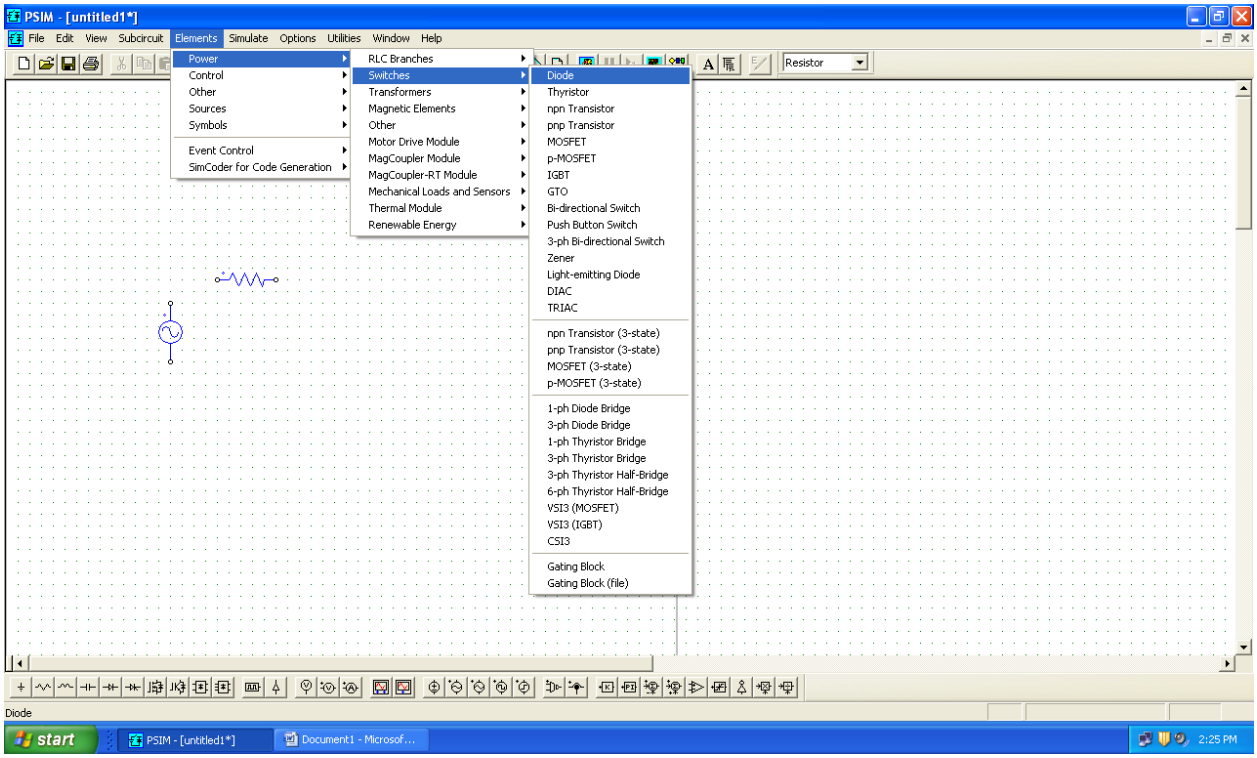
Select source



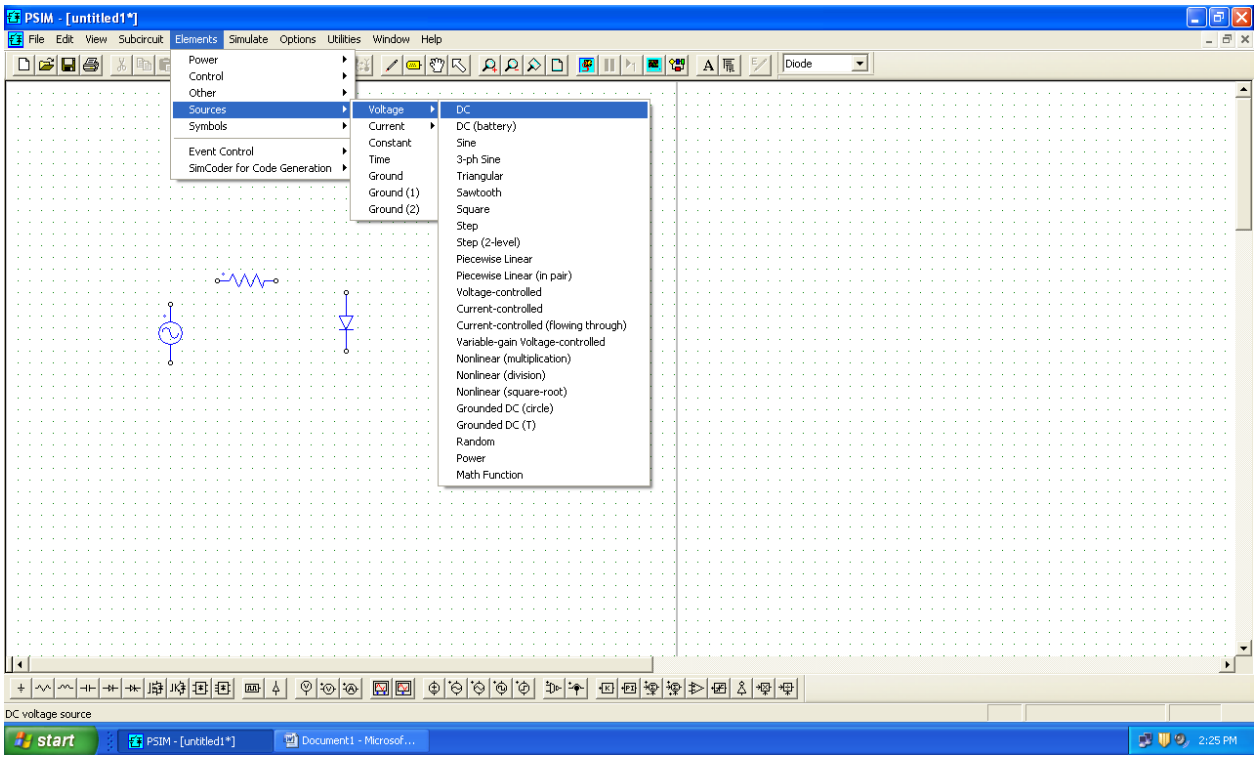
Select the resistor



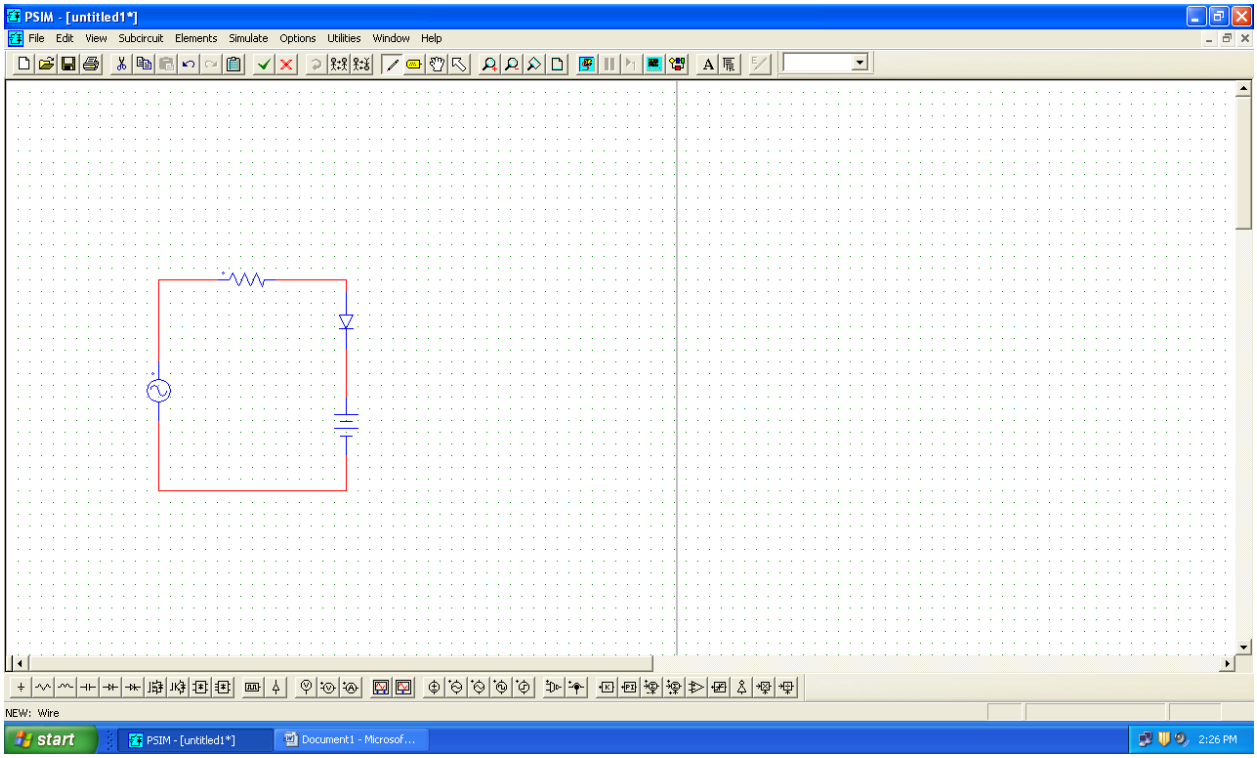
Select the diode



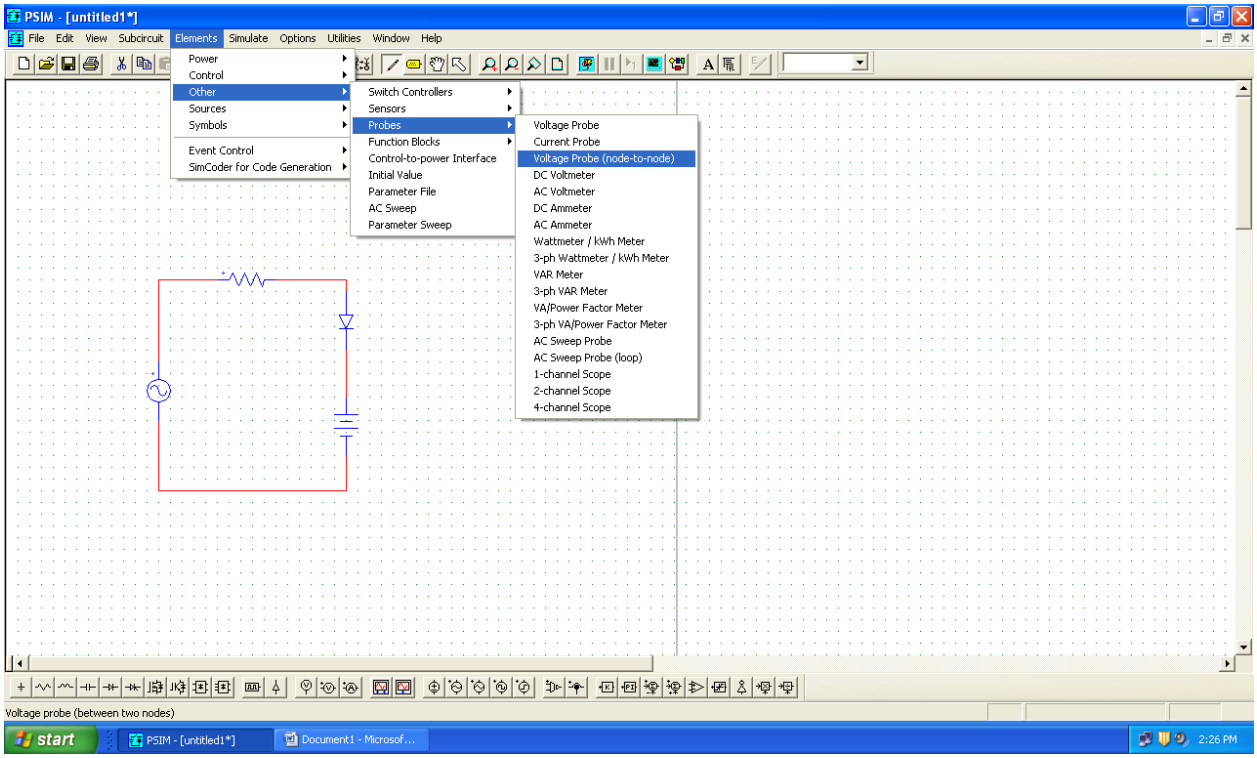
Select the dc source



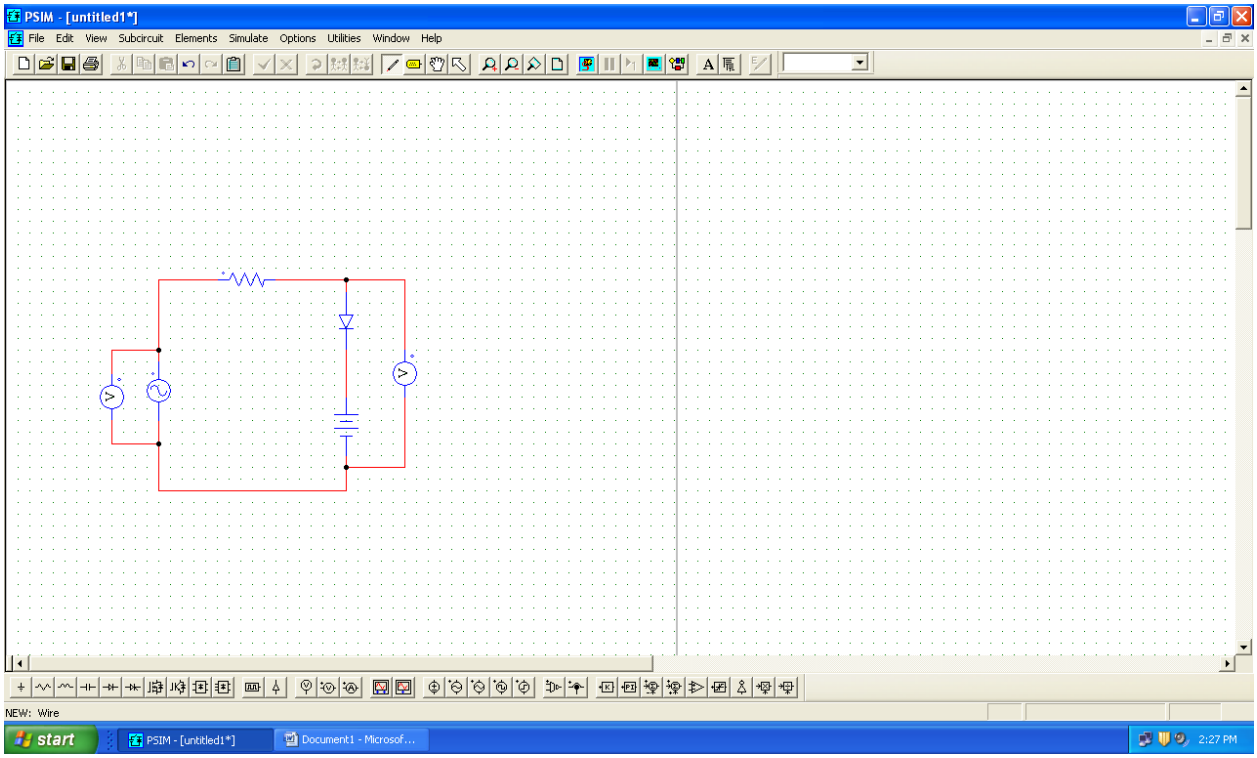
Connect the elements by using wiring tool



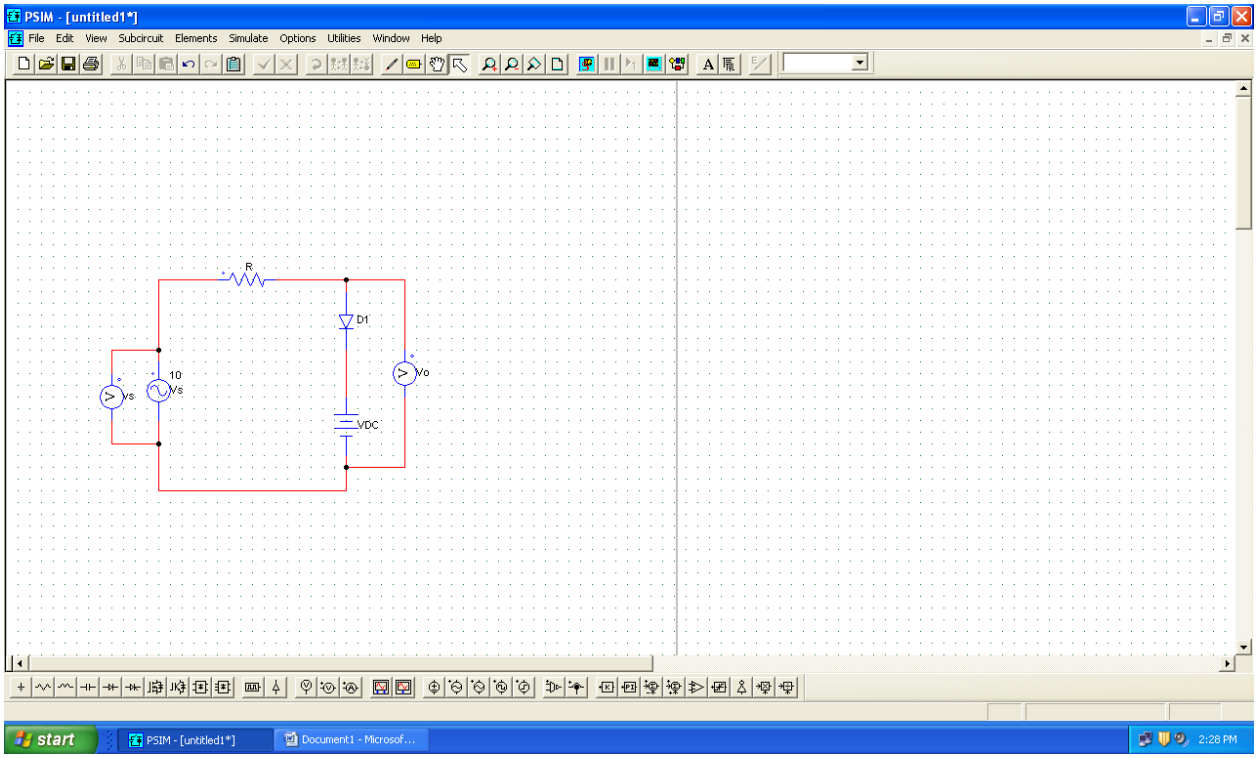
Select the volt meter



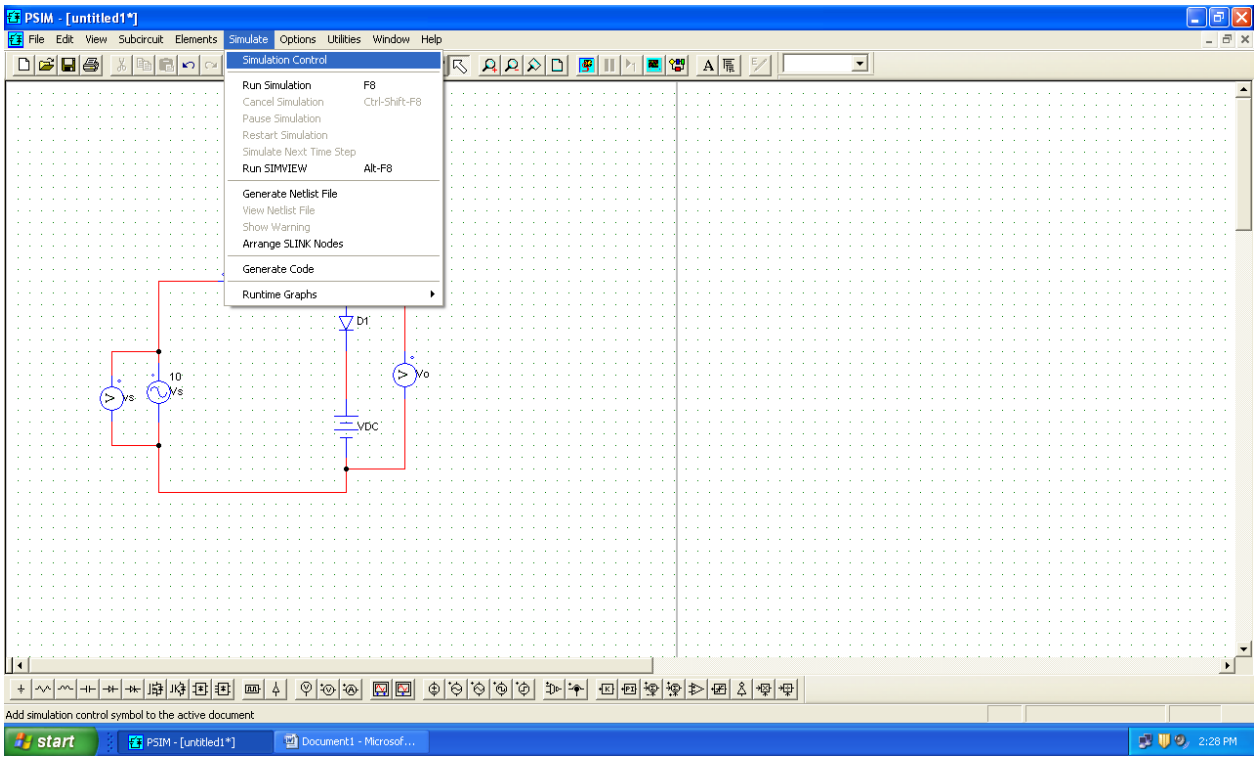
Connect the circuit as shown below

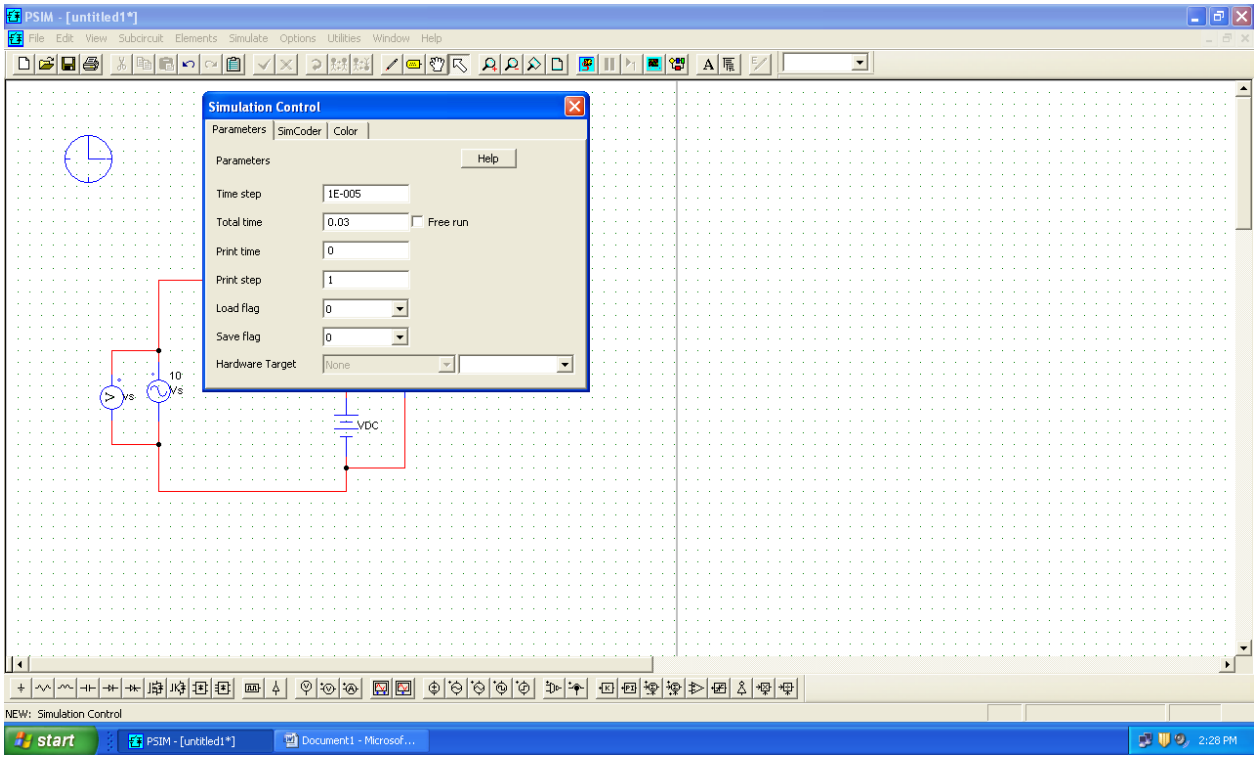


Give the labeling to every element

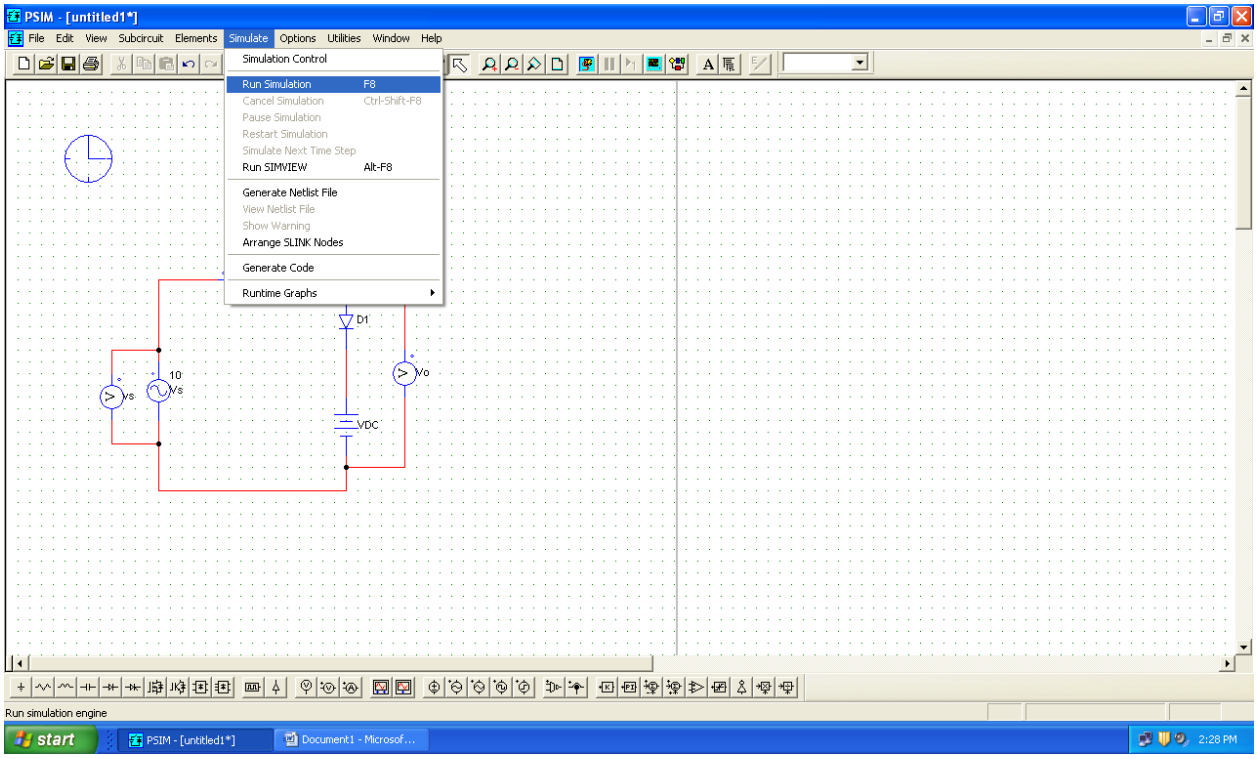


Select the simulation control

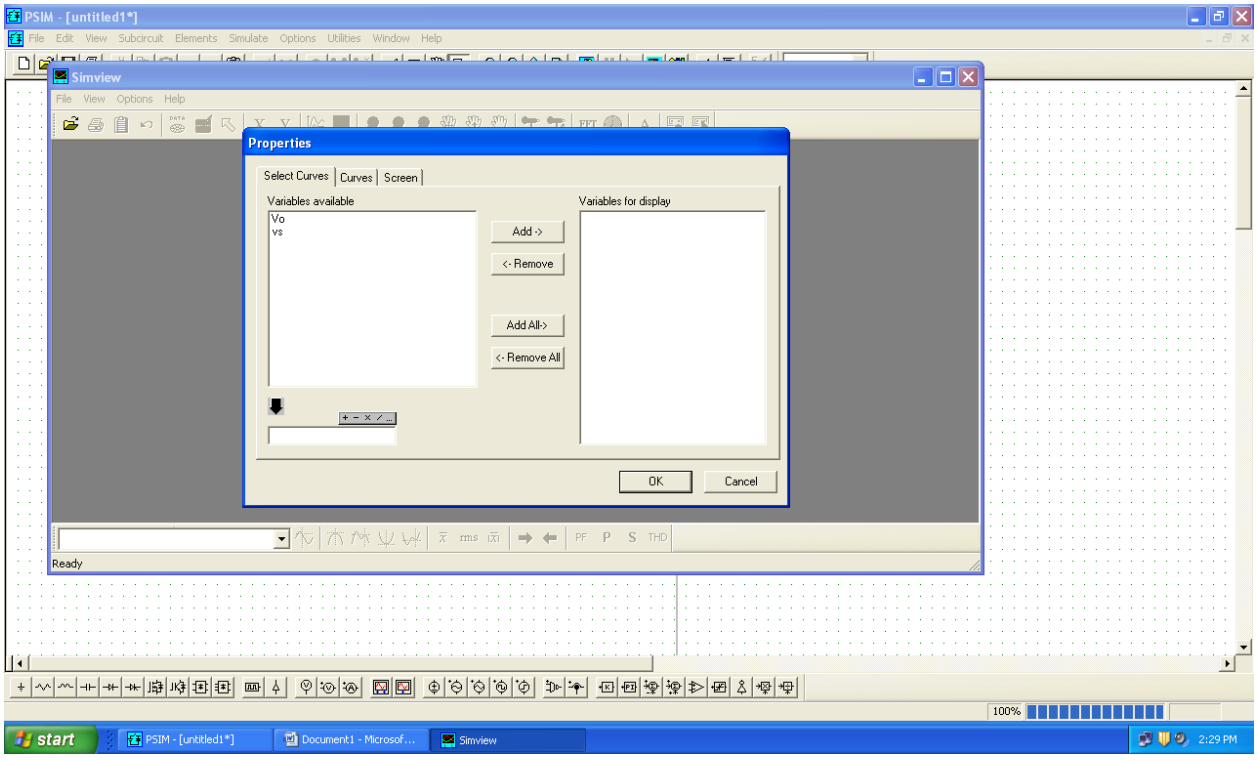


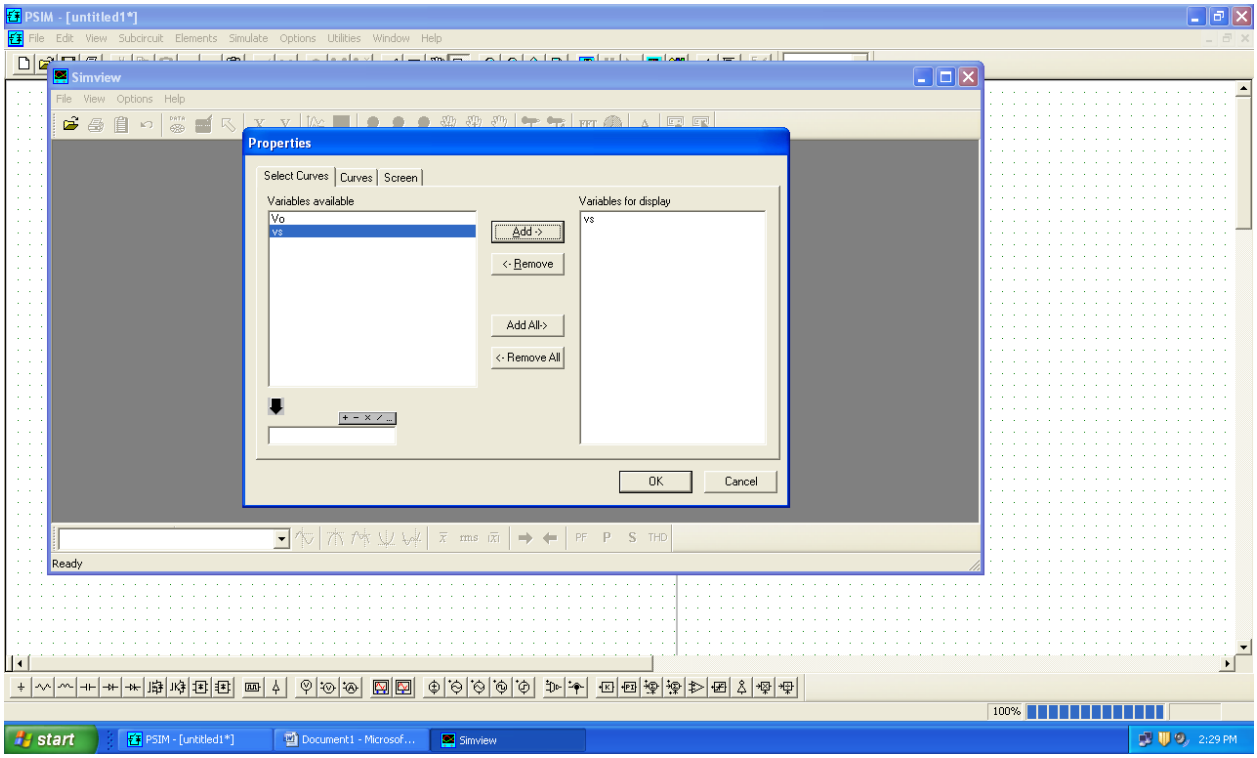


run the circuit by using run simulation

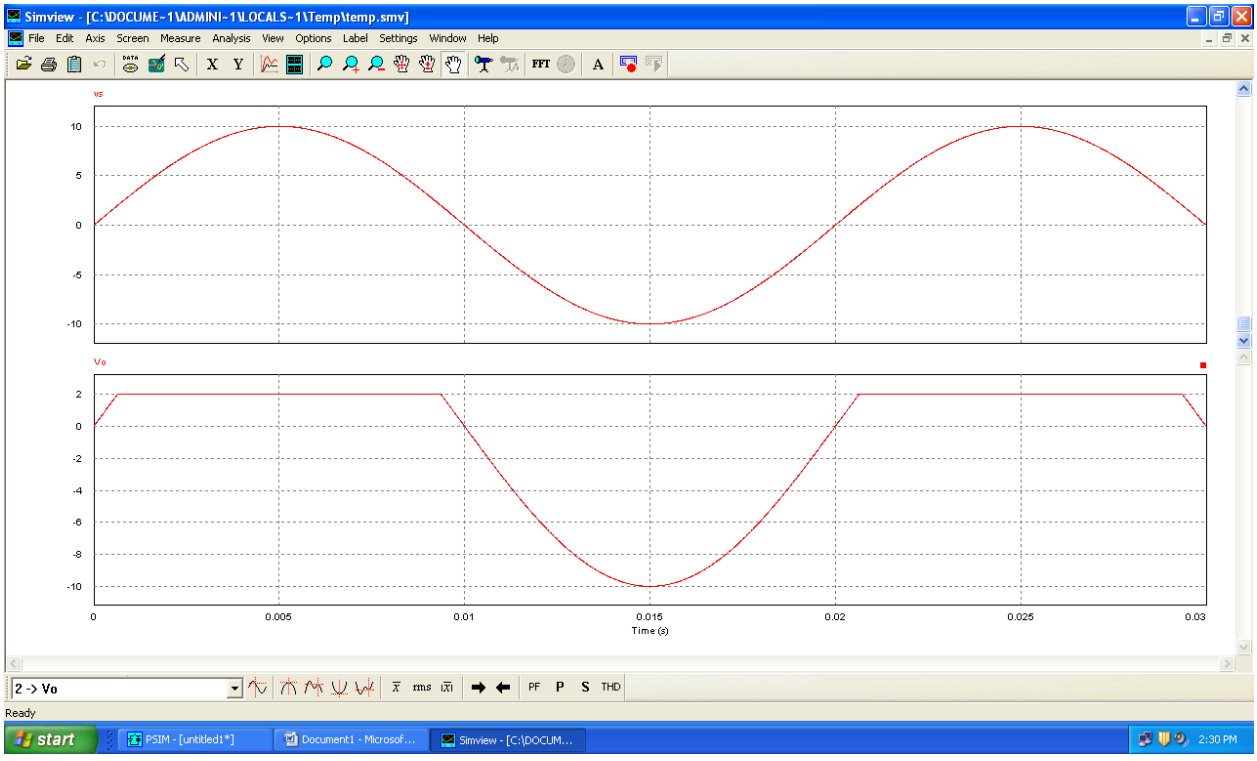


Select any measurable quantity to measure





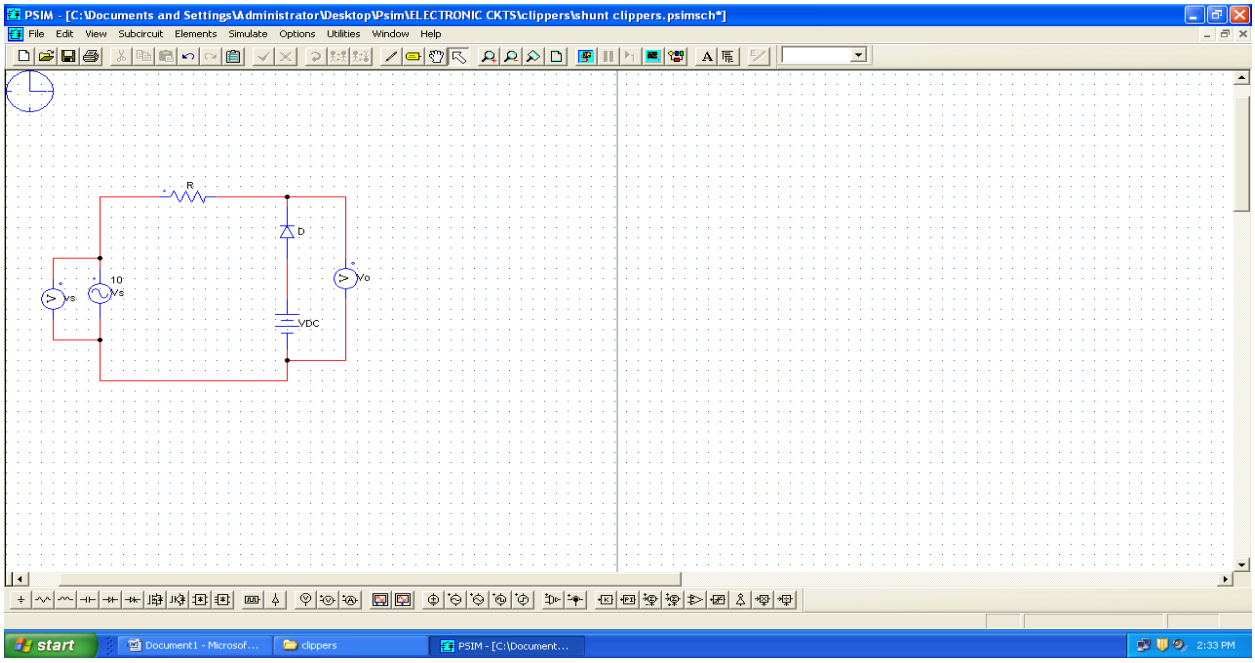
Output waveforms



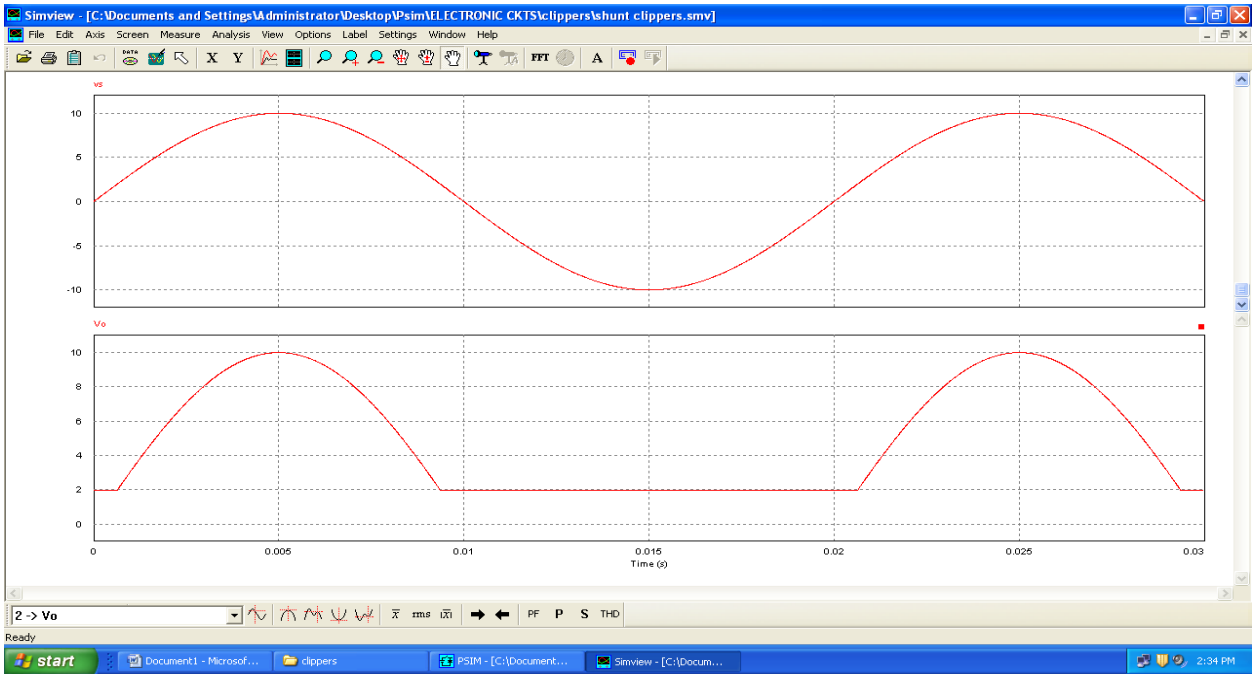
Below reference

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram

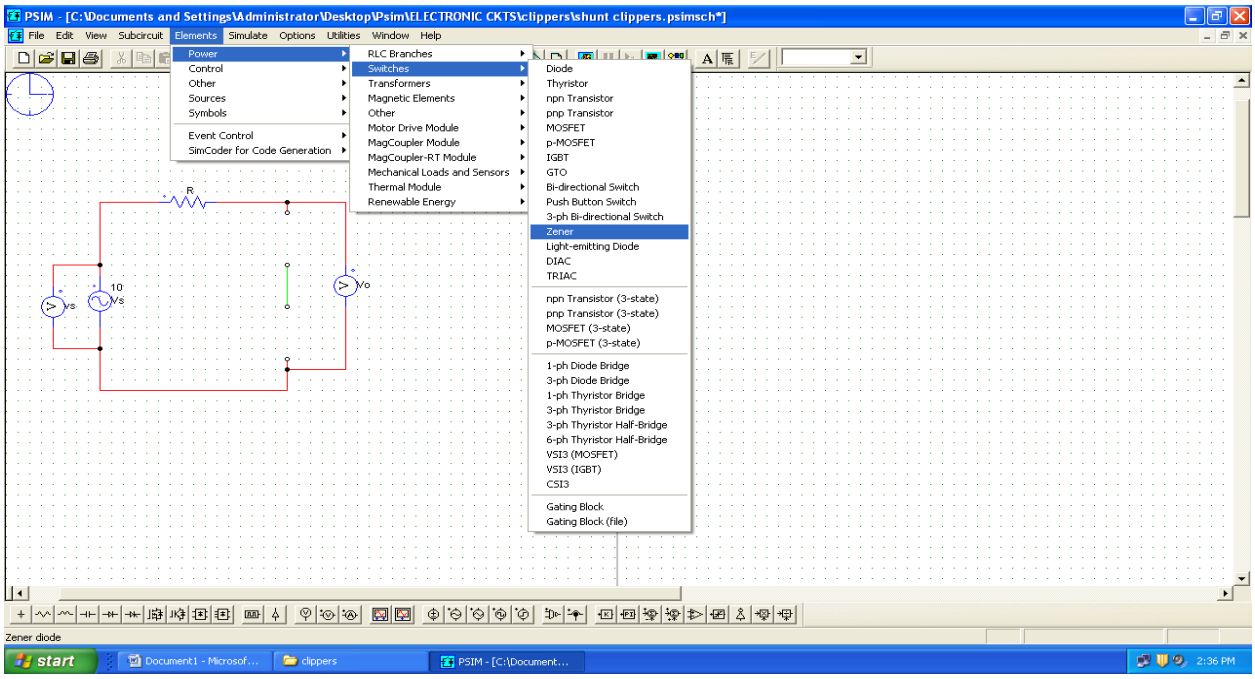


Output waveforms



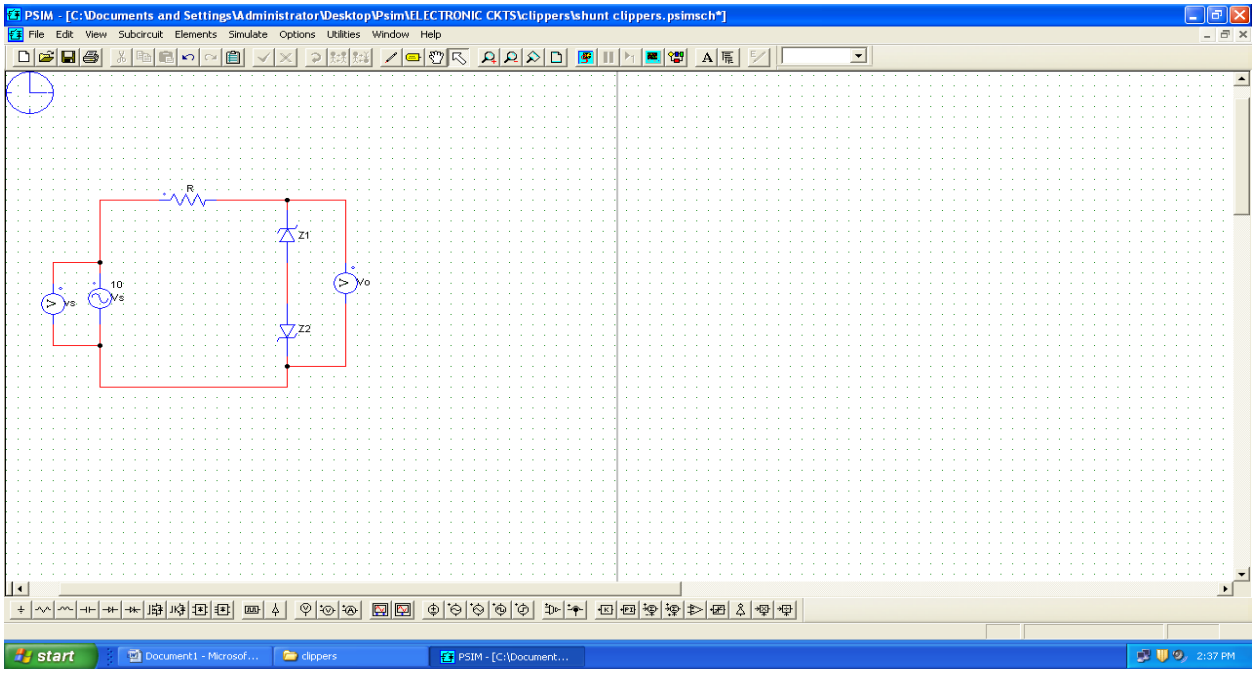
Clipper above and below the reference

Selection of Zener diode:

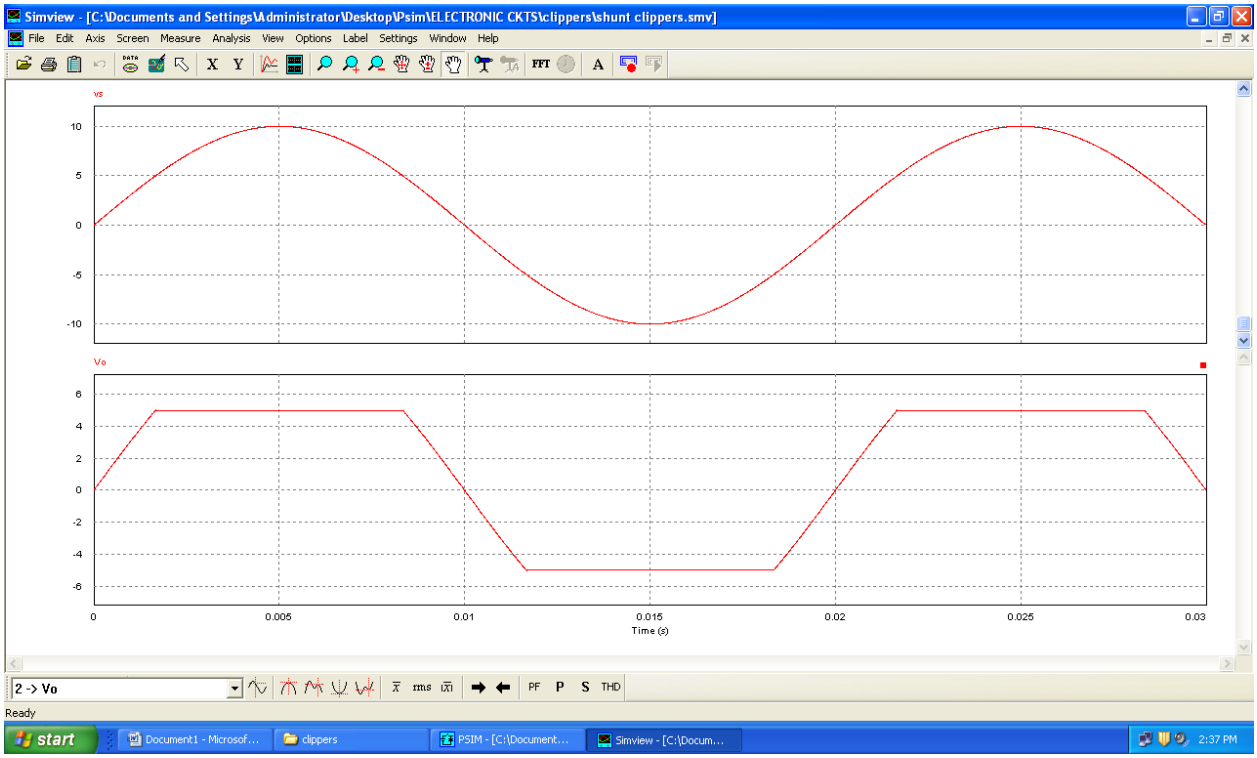


Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram



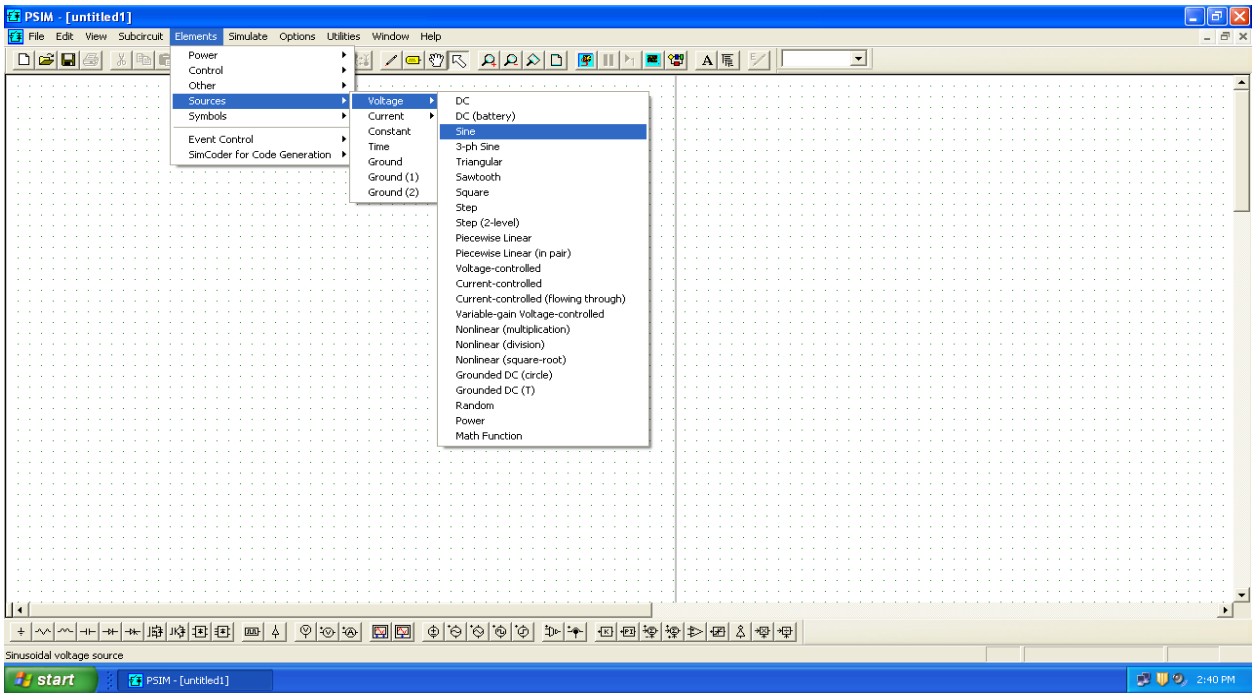
Output waveforms



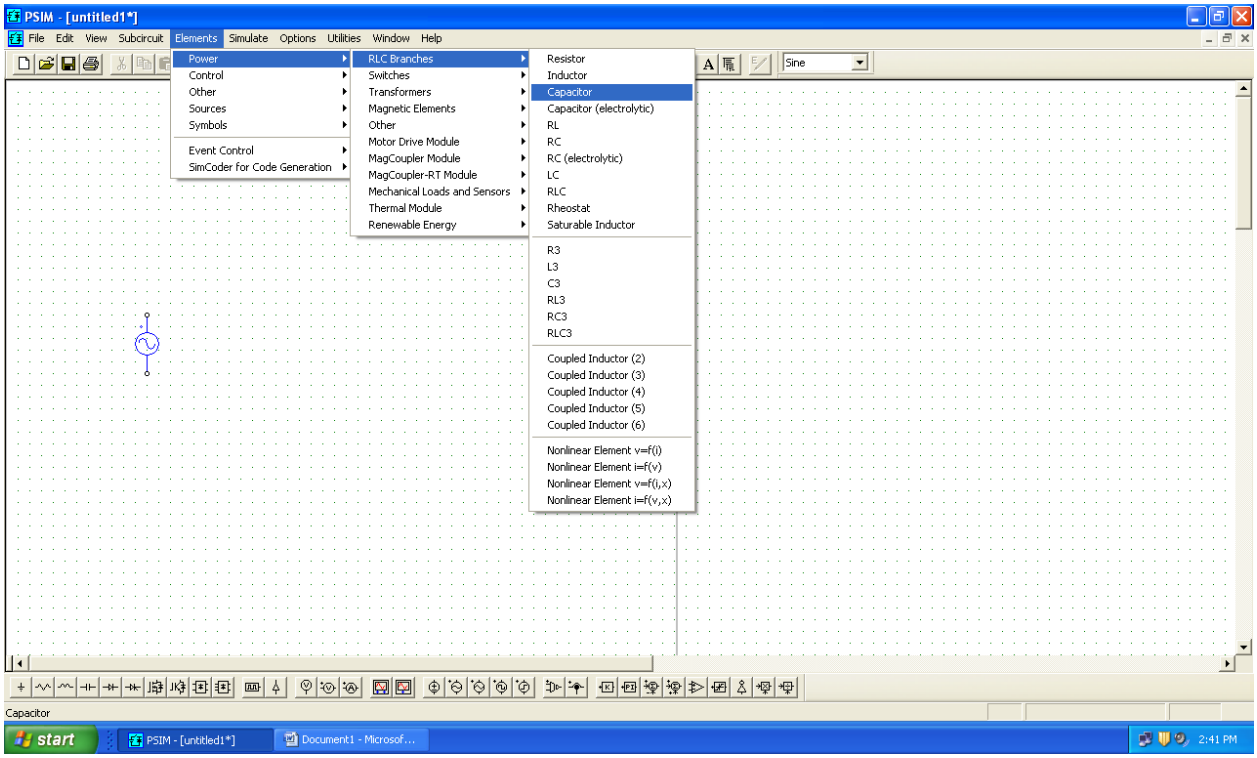
CLAMPERS

Negative clampers

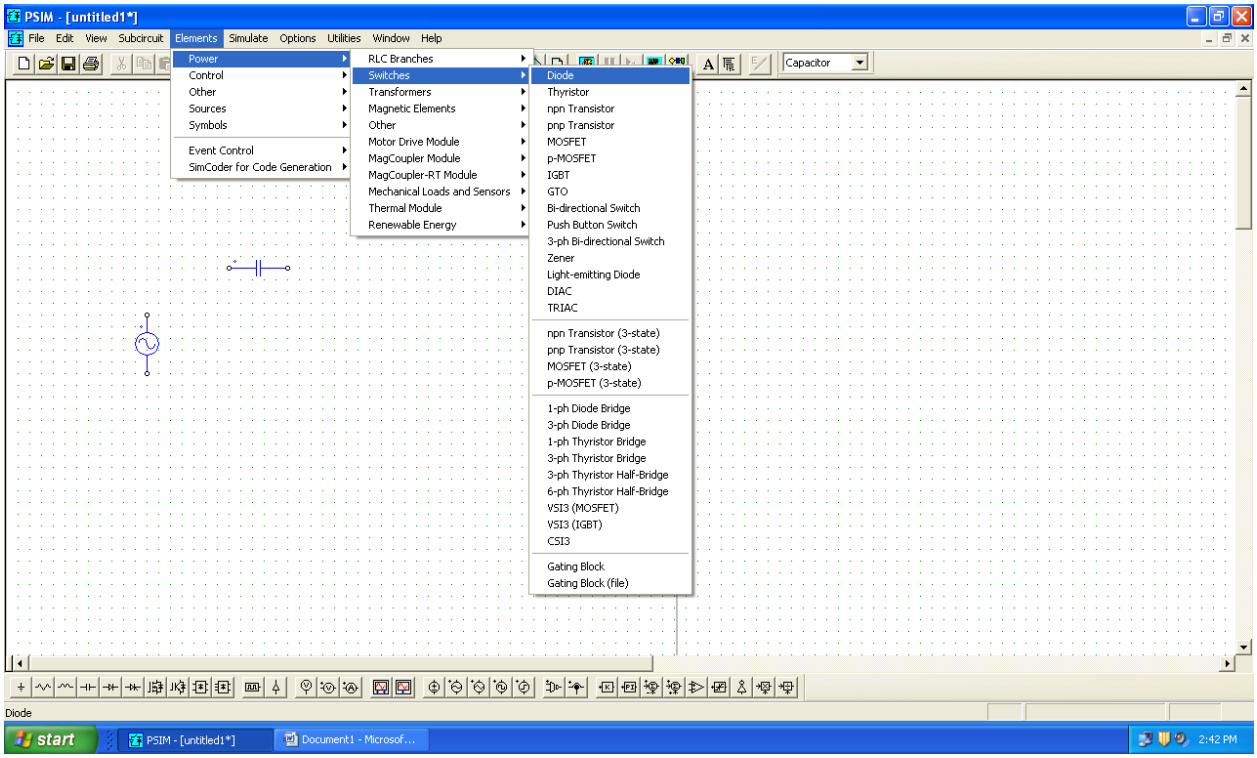
Select source



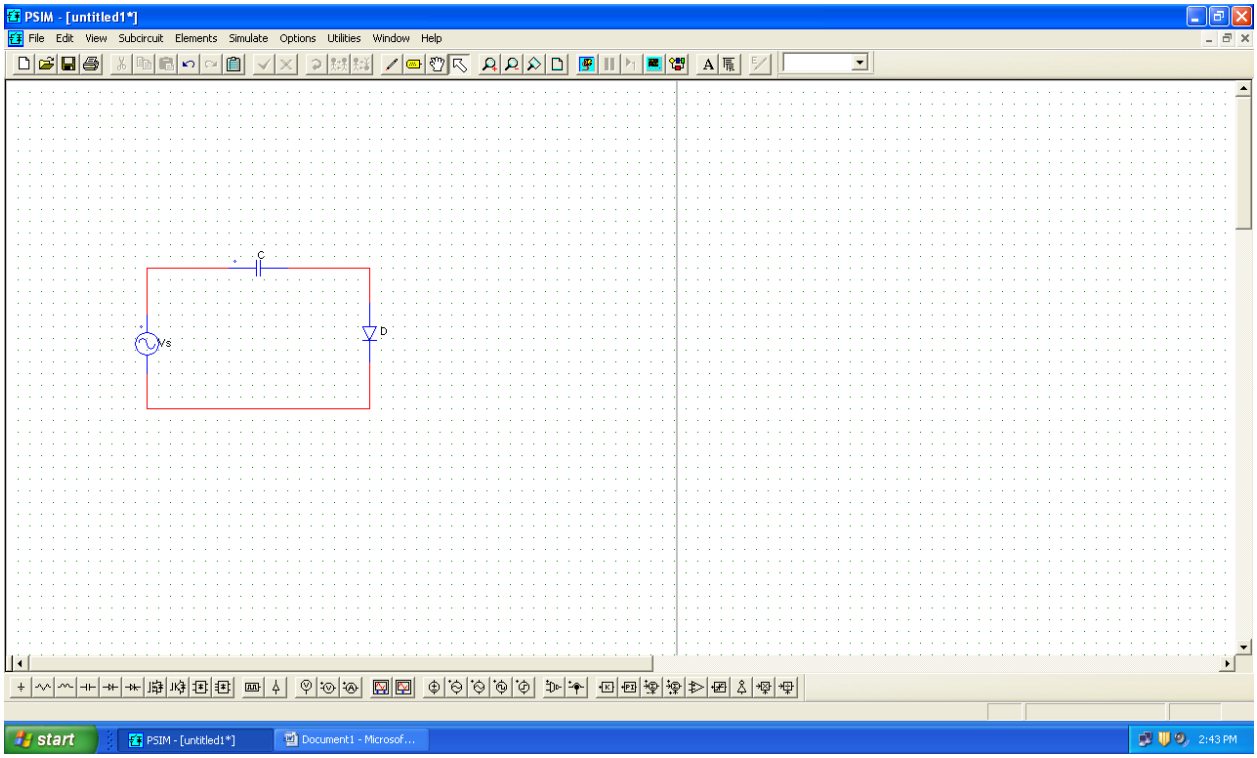
Select the capacitor



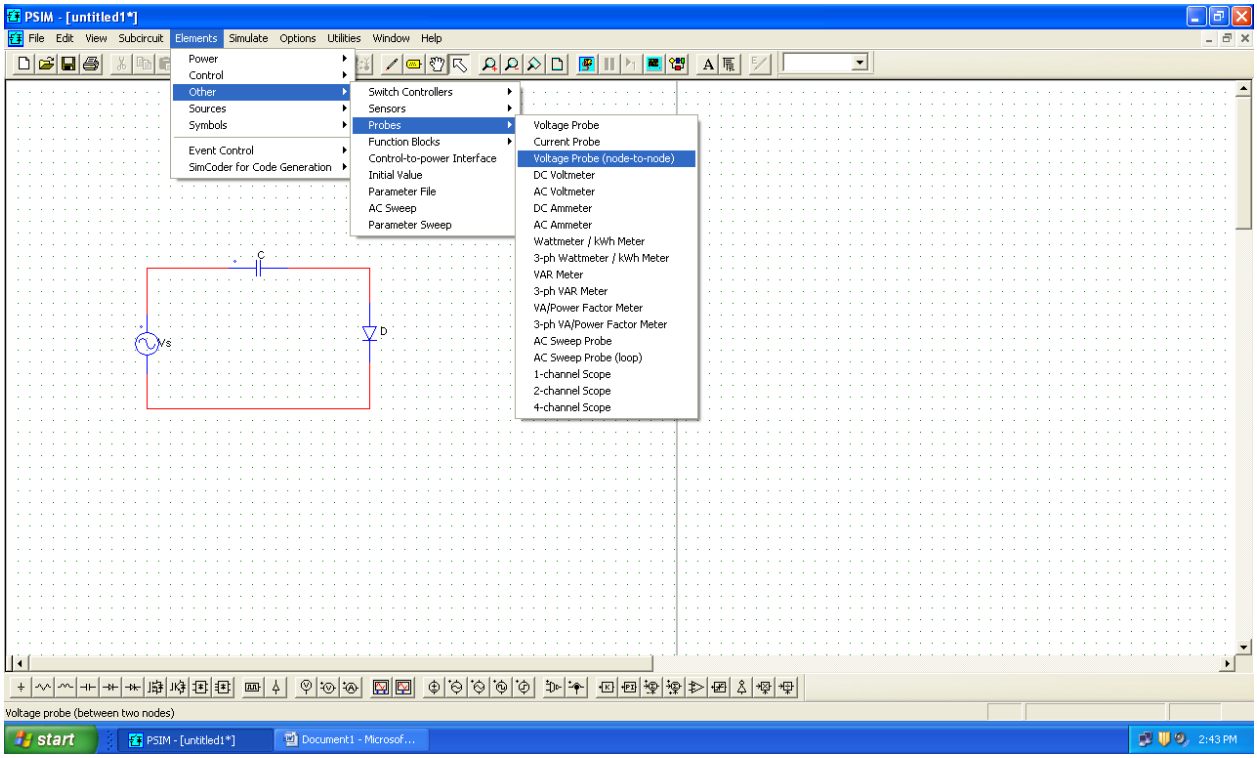
Select the diode



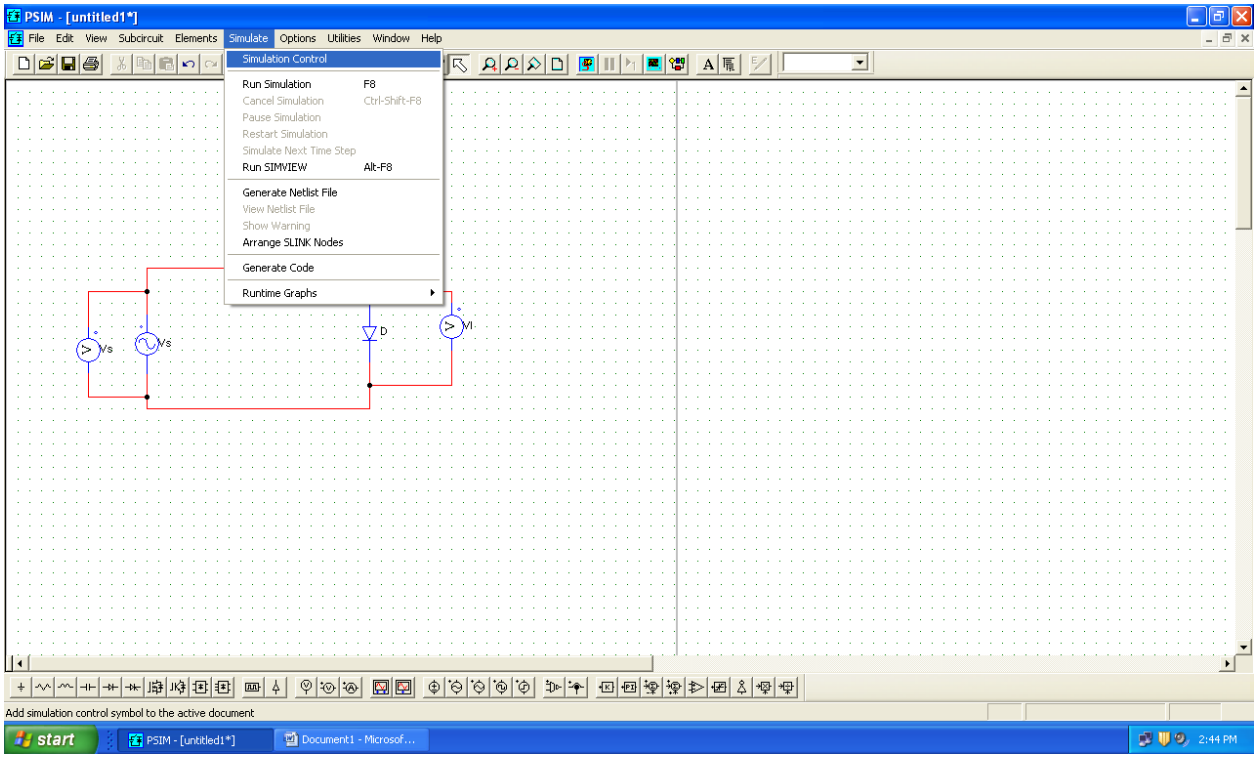
Connect the circuit using wiring tool



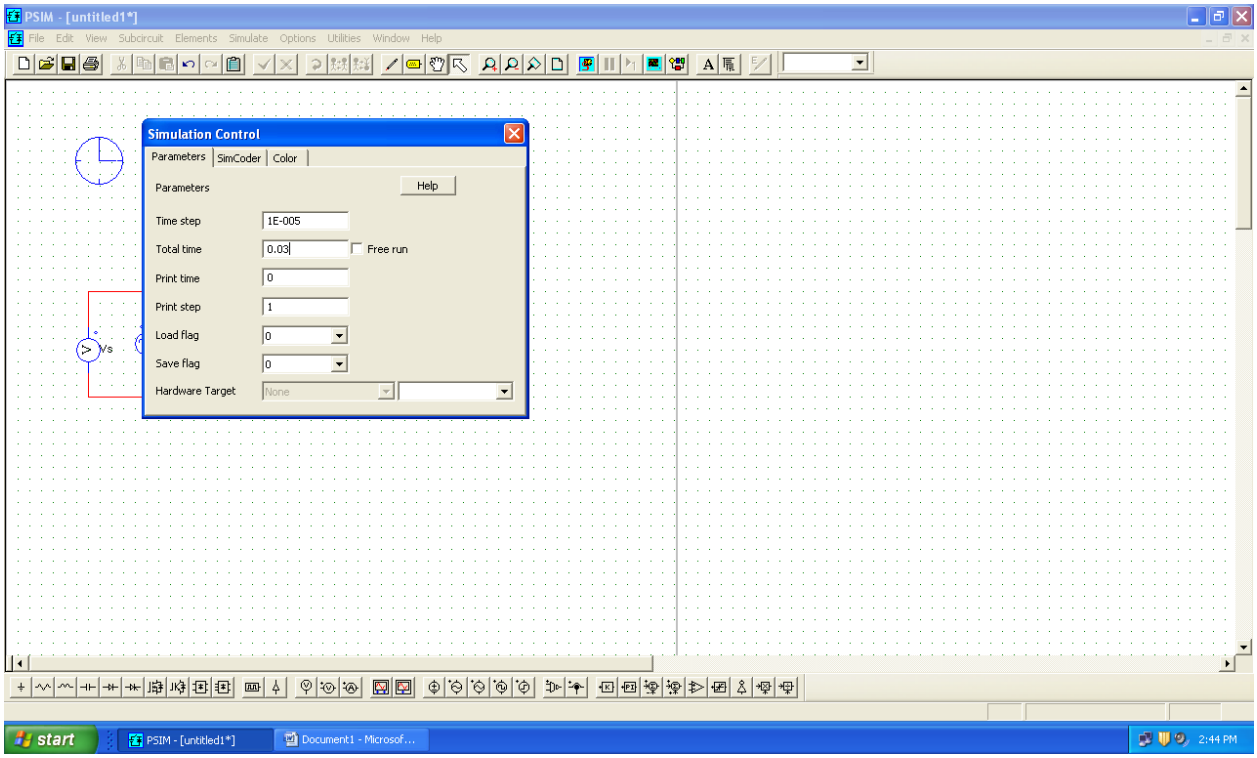
Select volt meter



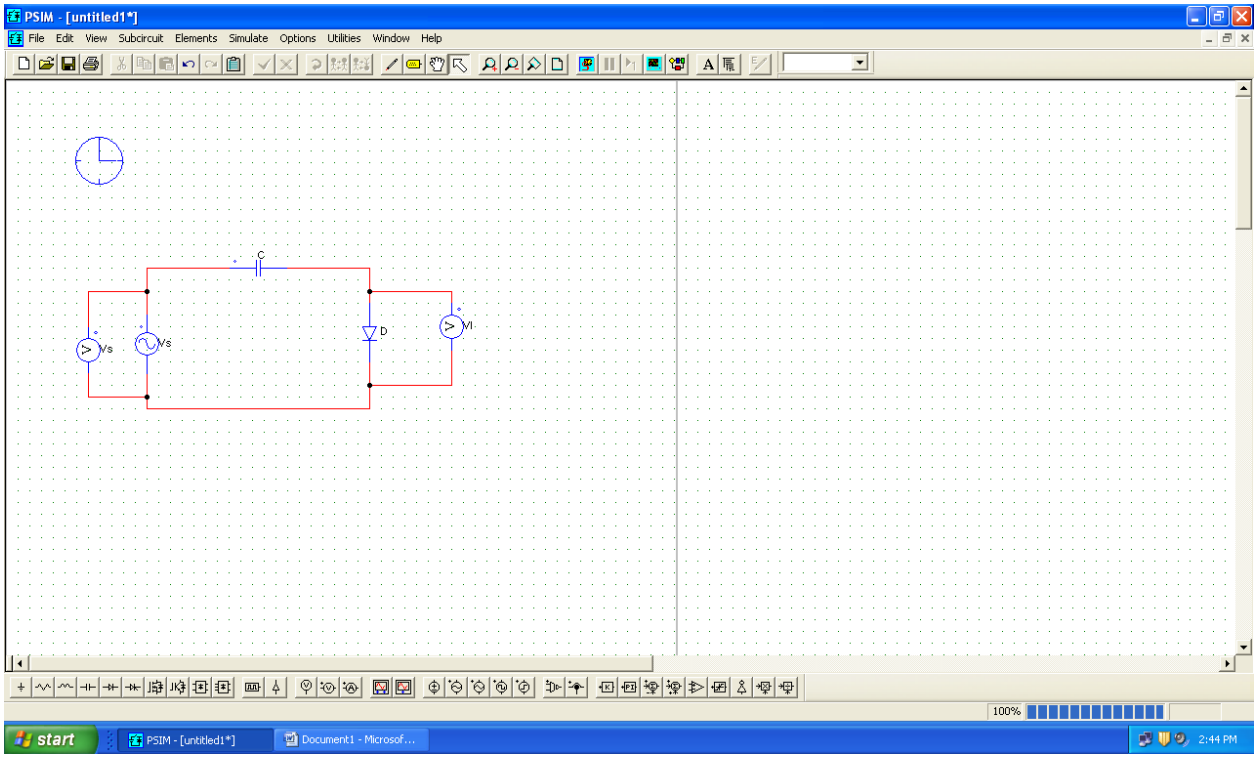
select simulation control



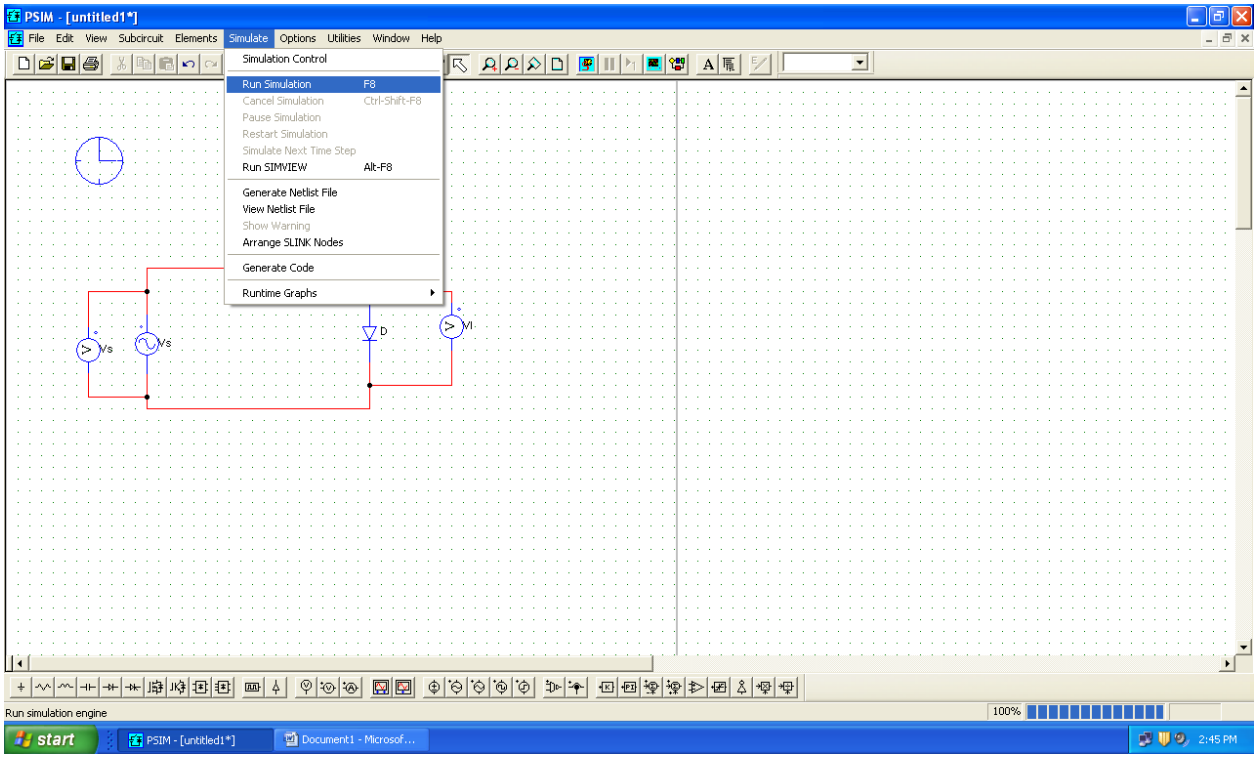
Give the values as shown below



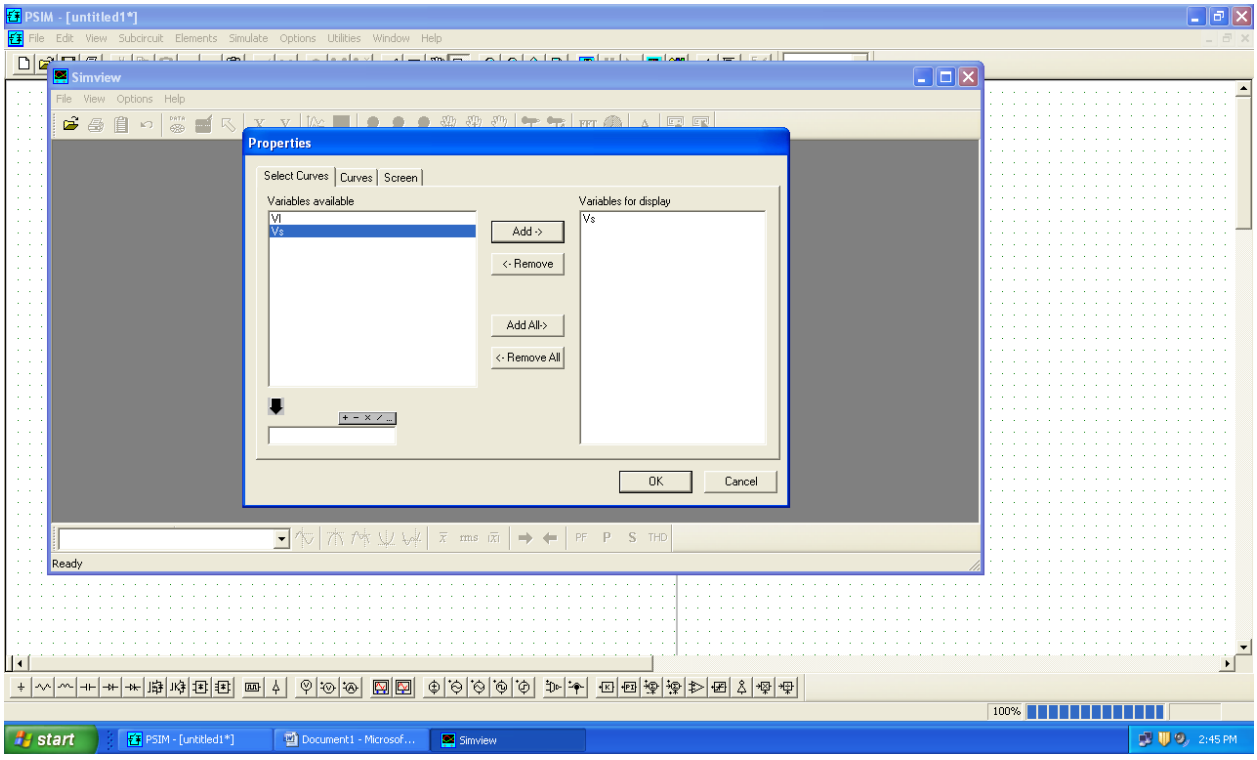
Give the proper labeling to all the elements



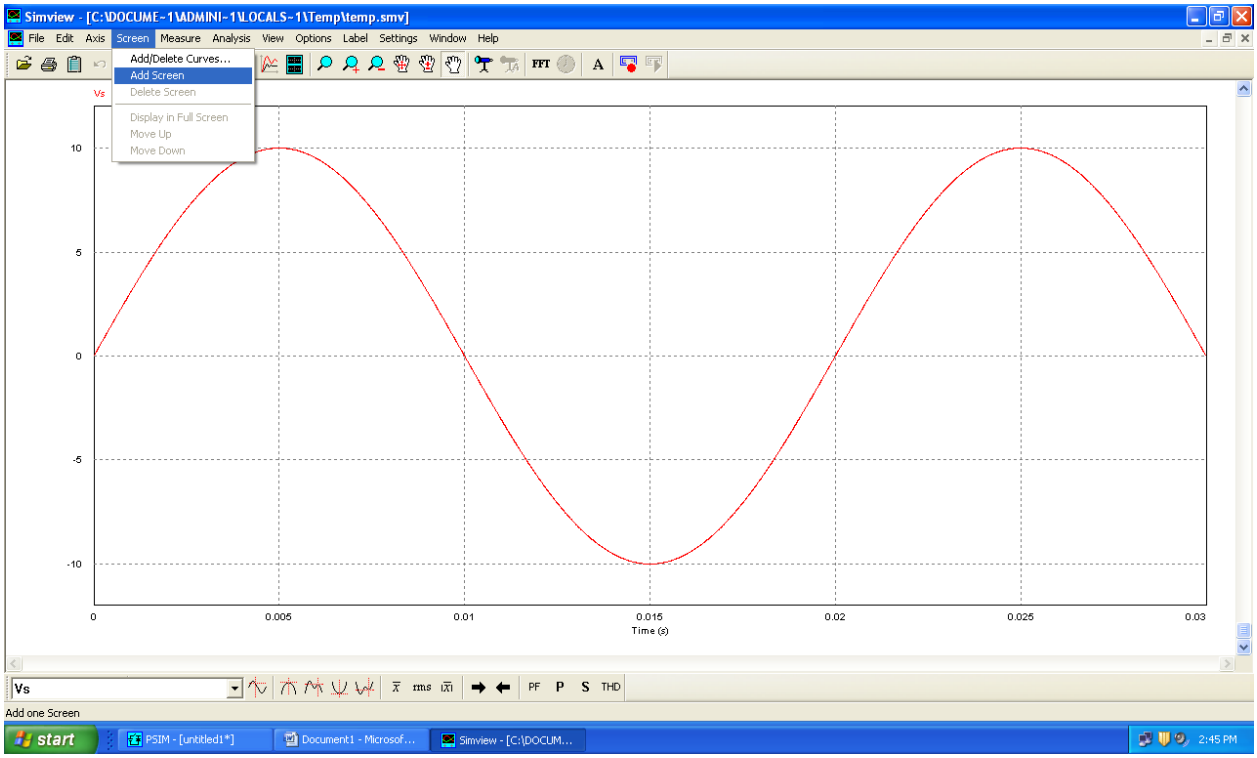
Run circuit using run simulation



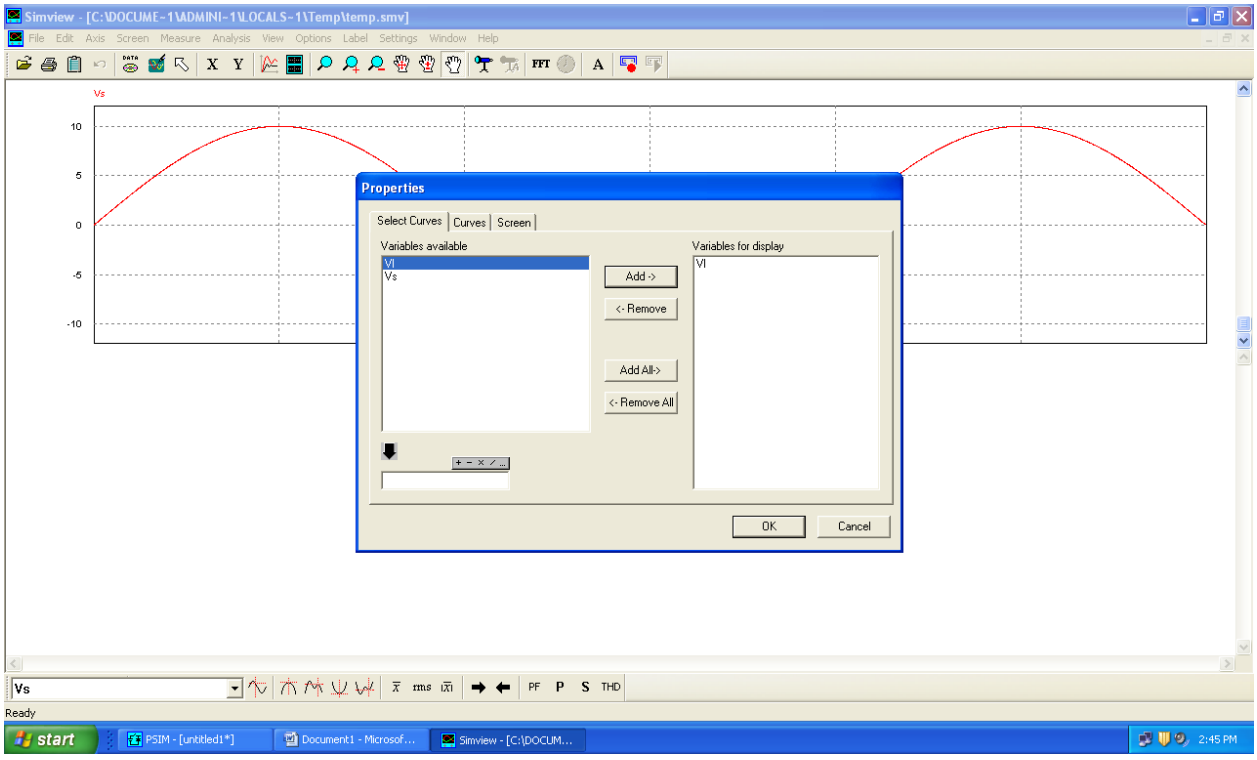
Selection of output waveform



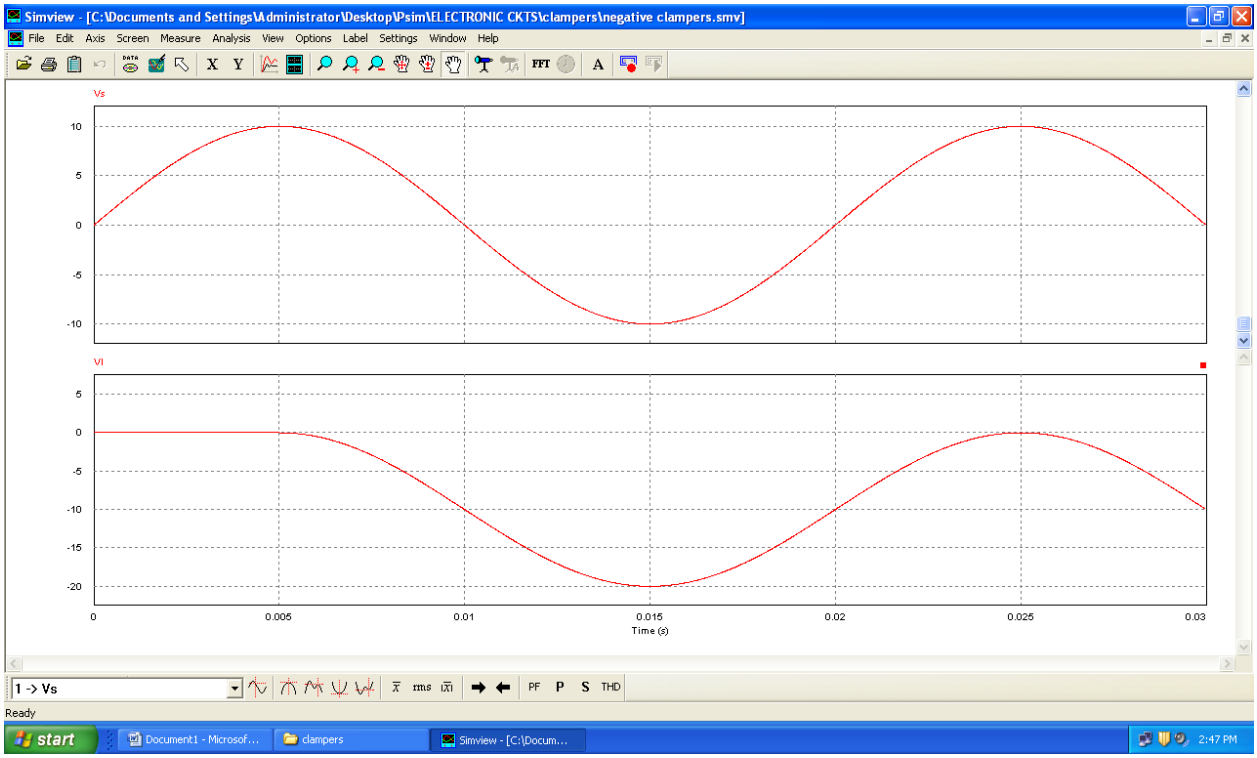
Selected waveform



Addition of other waveform



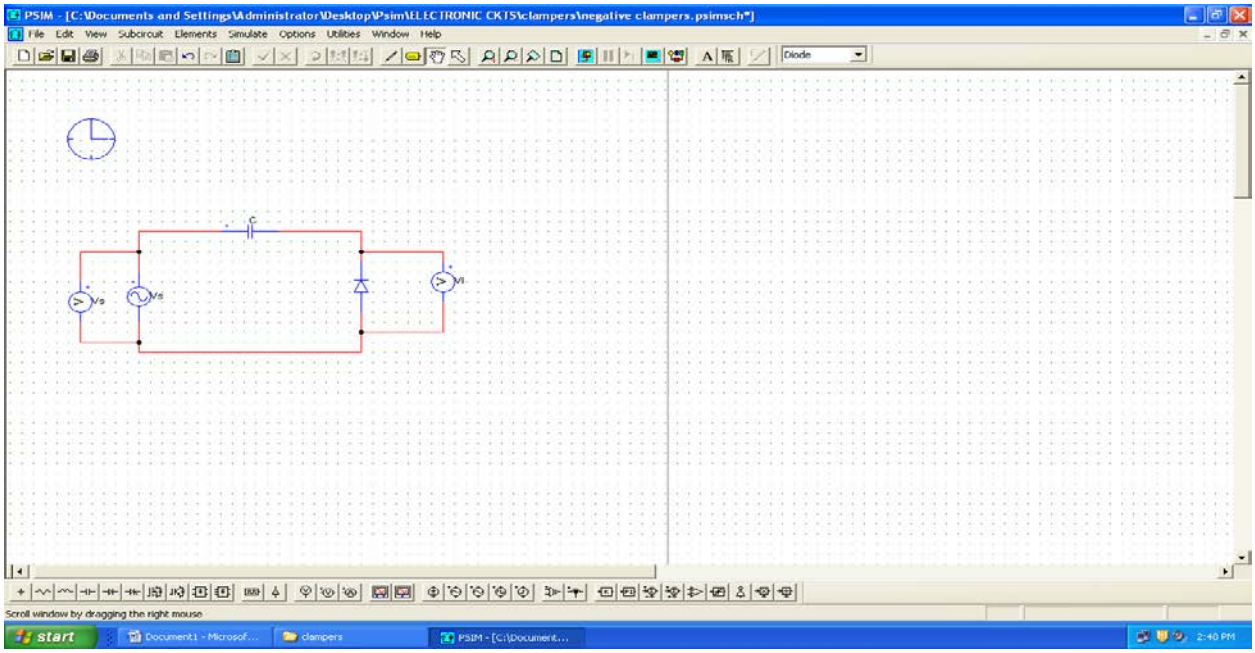
Output waveforms



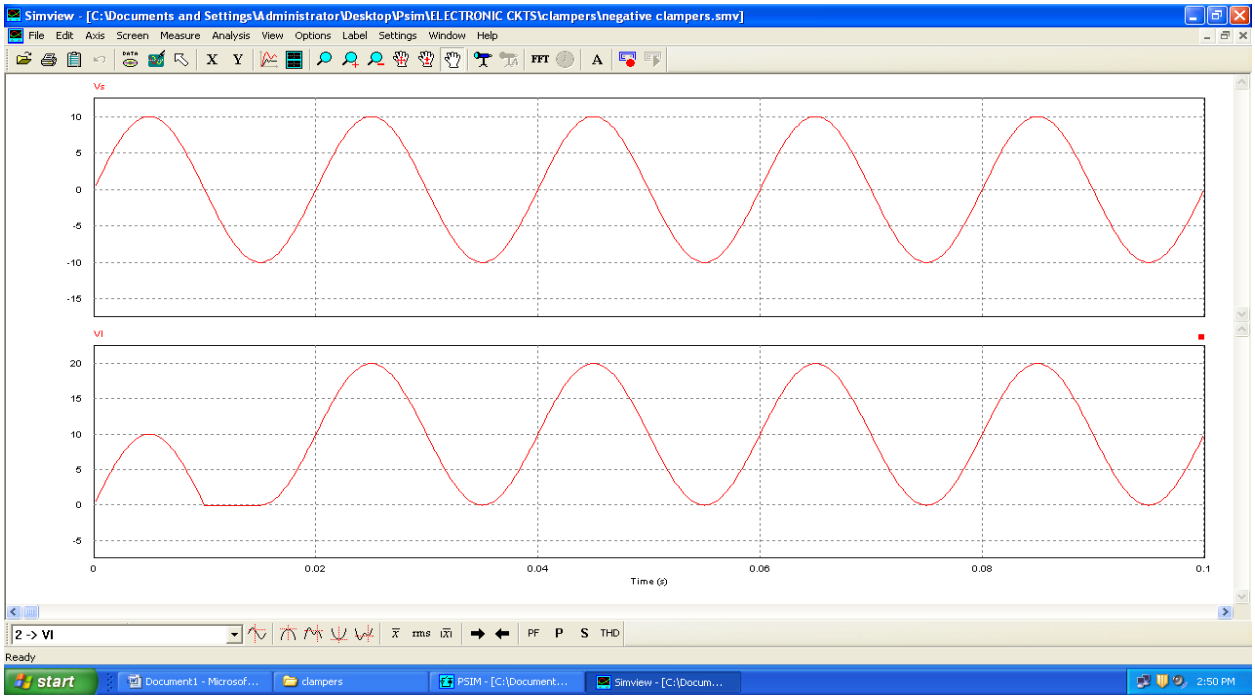
Positive clamper

Select the elements as shown above and connect them as shown in below figure with proper labeling

Circuit diagram

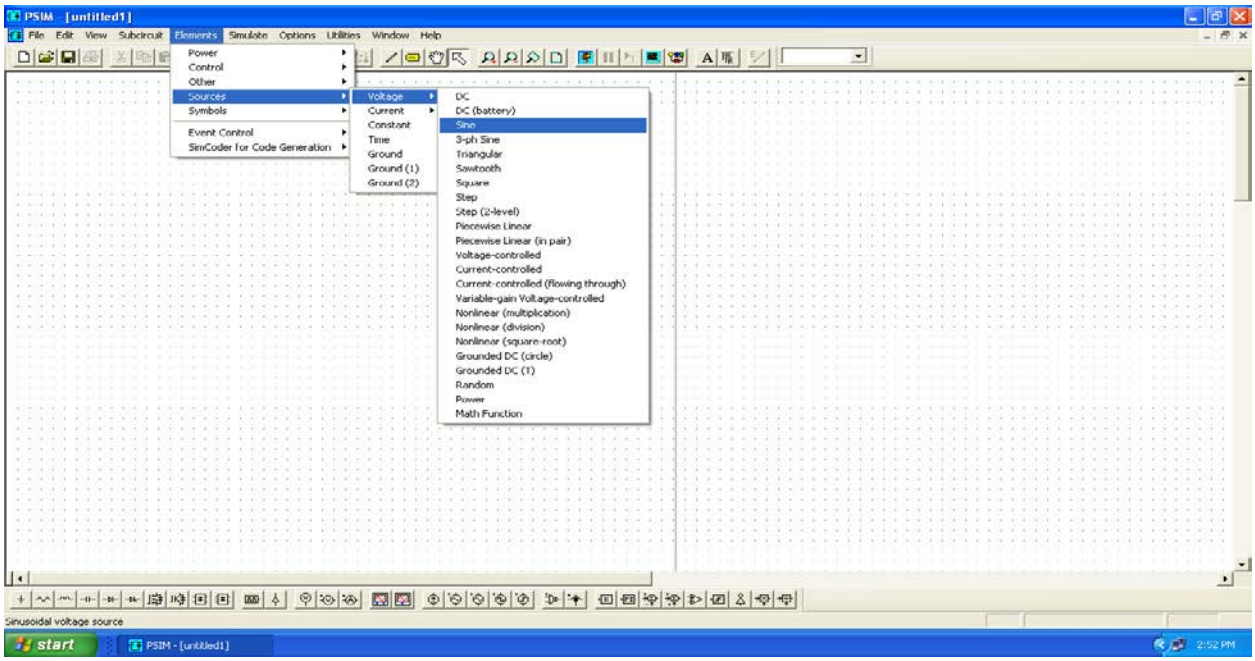


Output waveforms

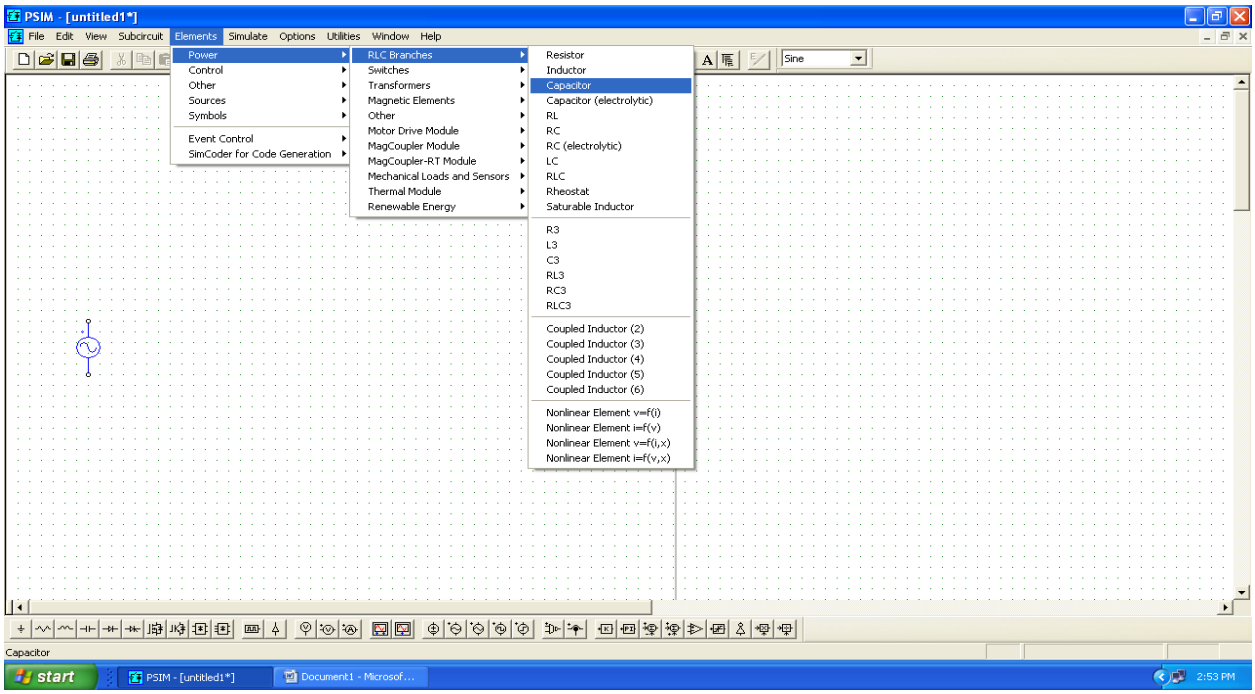


Multiplier circuit

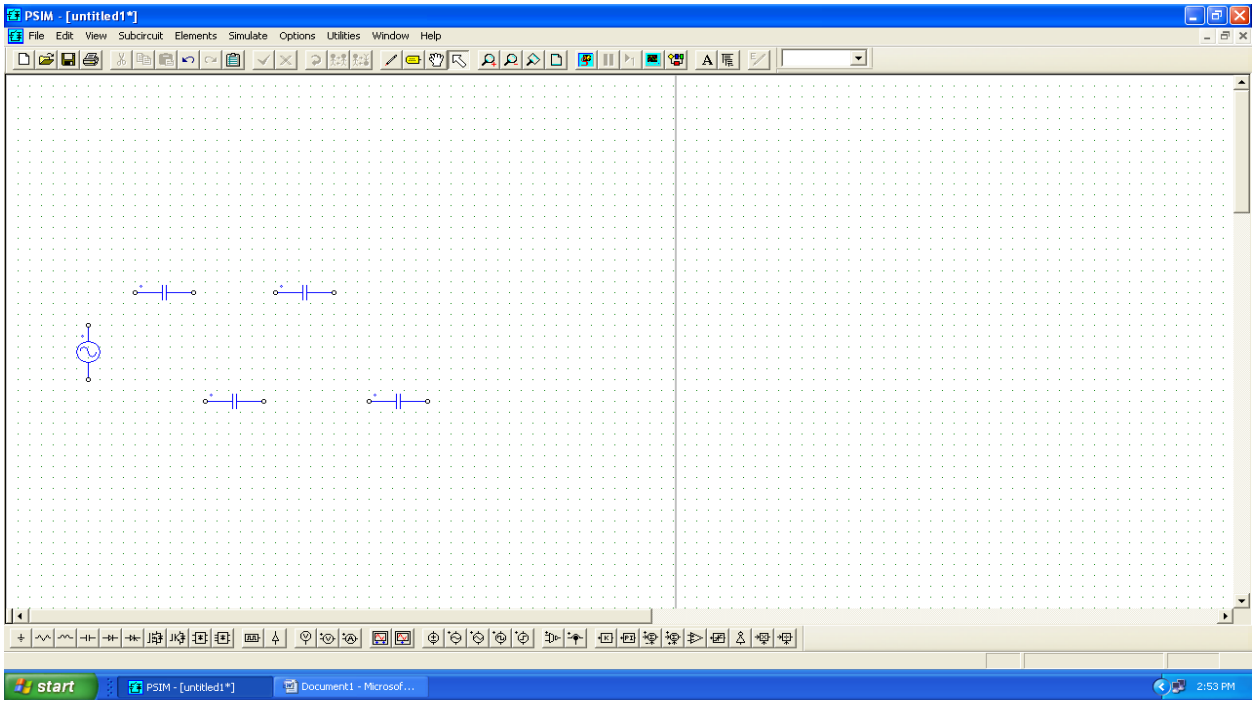
Select the source



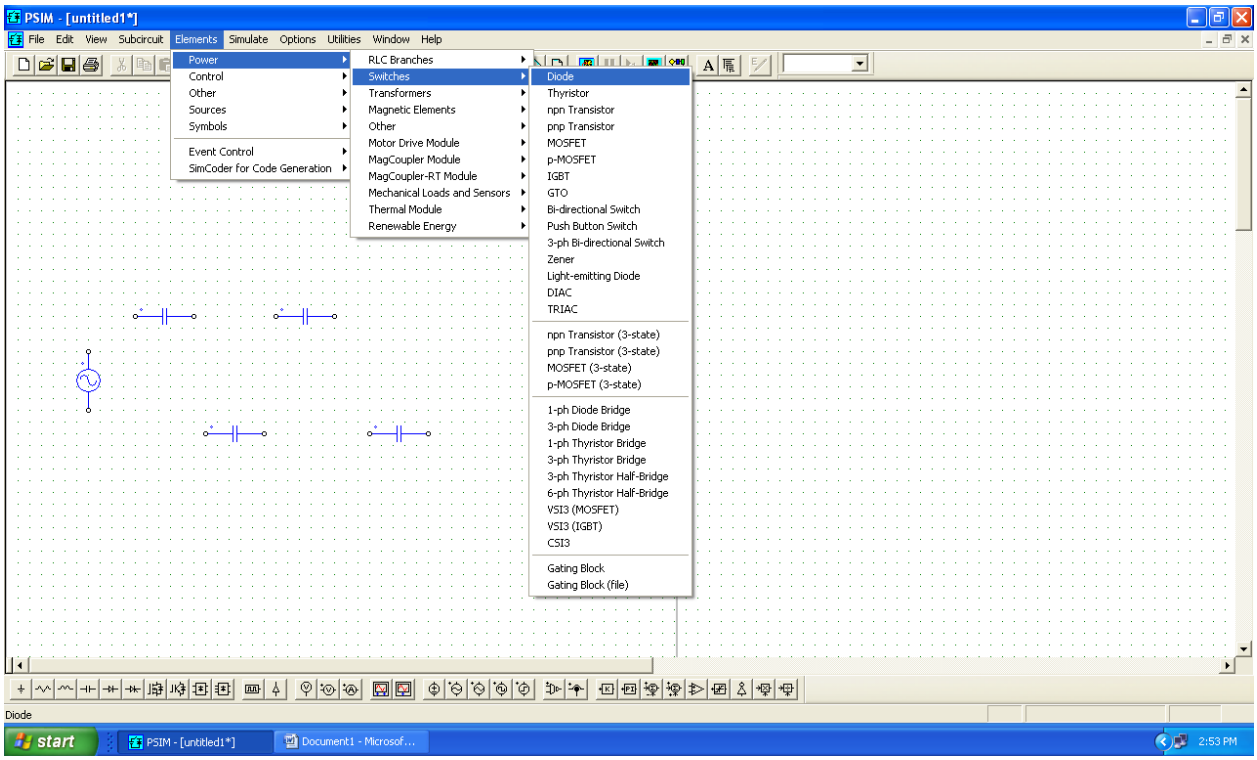
Select the capacitor

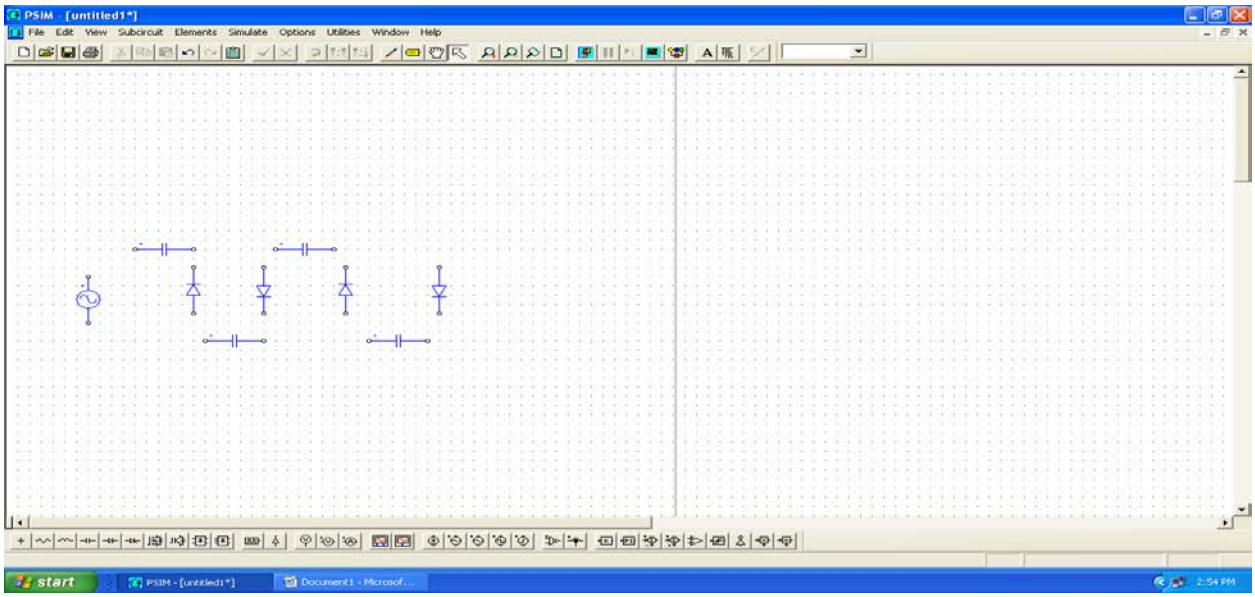


Select 4 capacitors

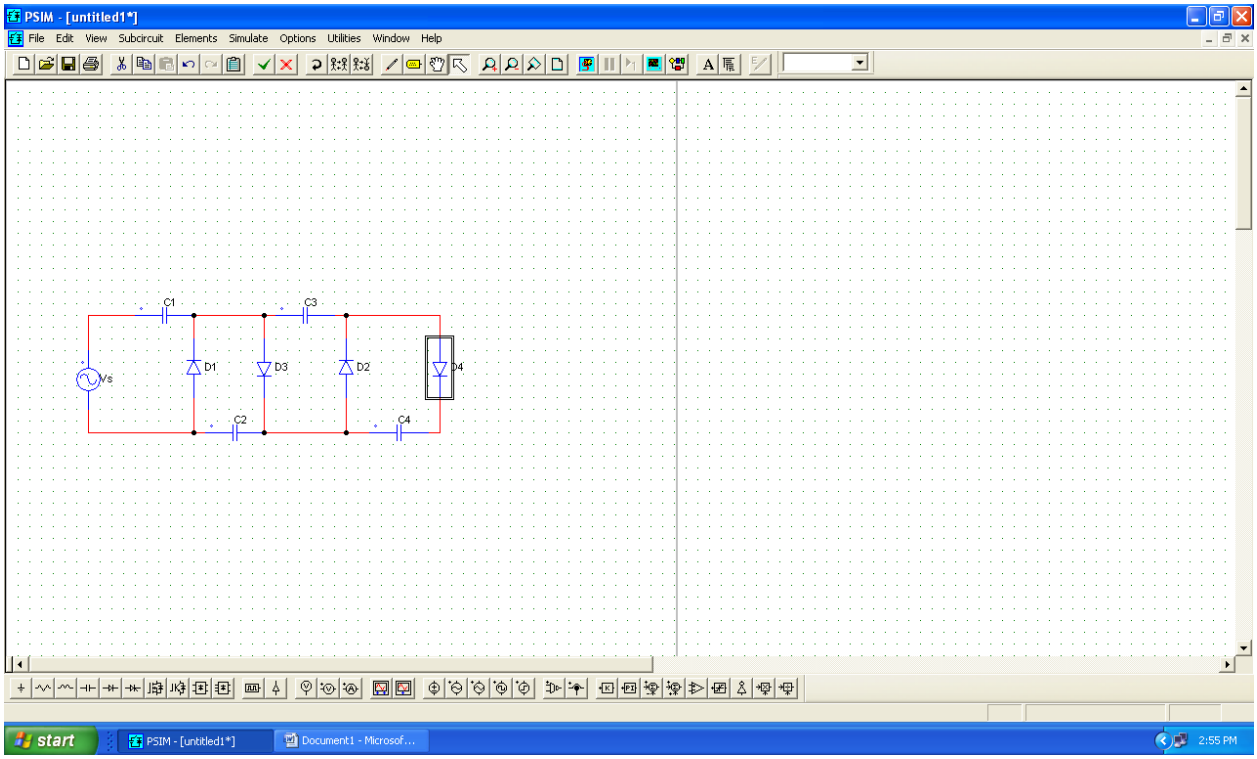


Select the diode

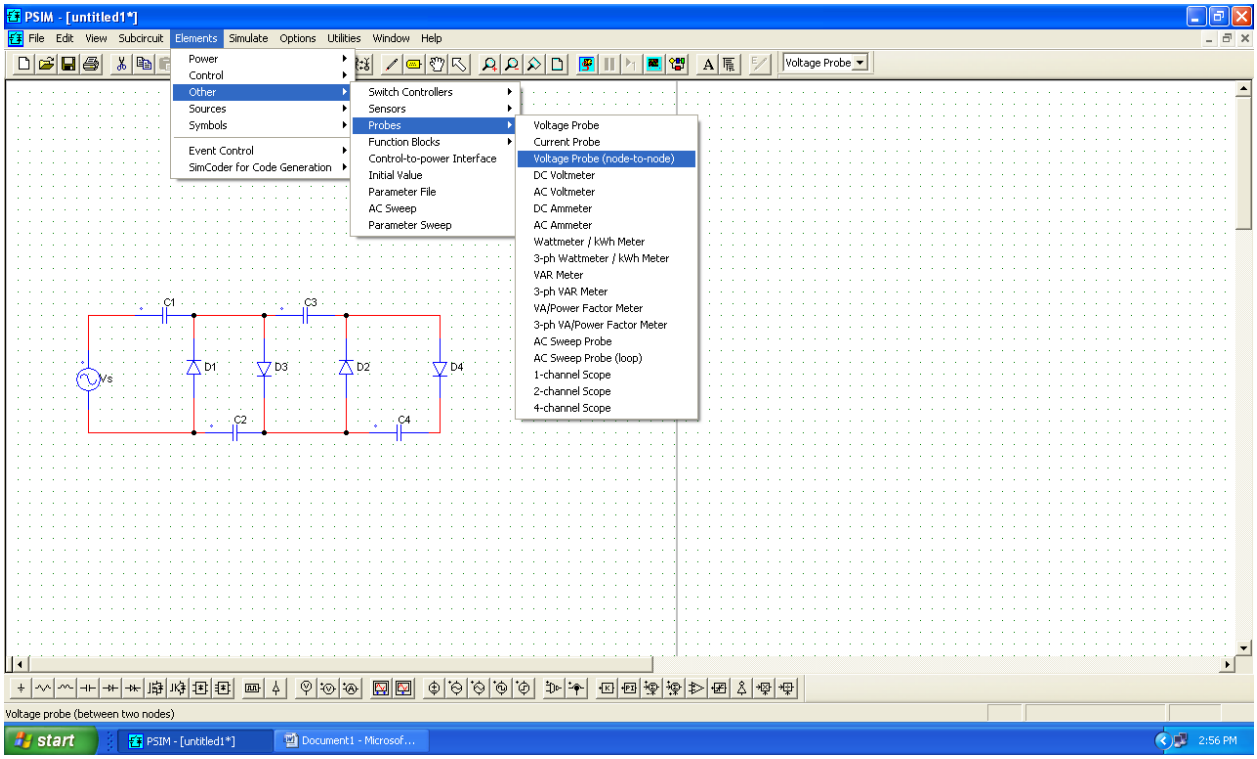




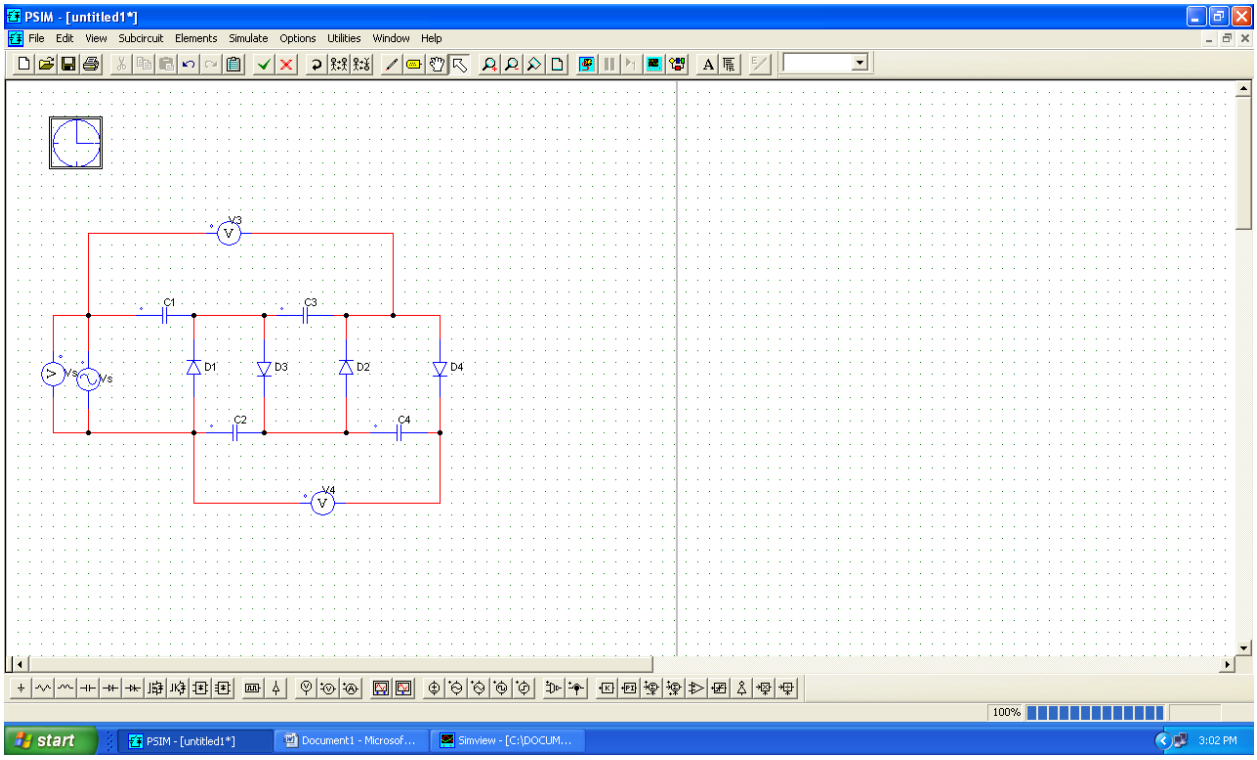
Connect the circuit using wiring tool



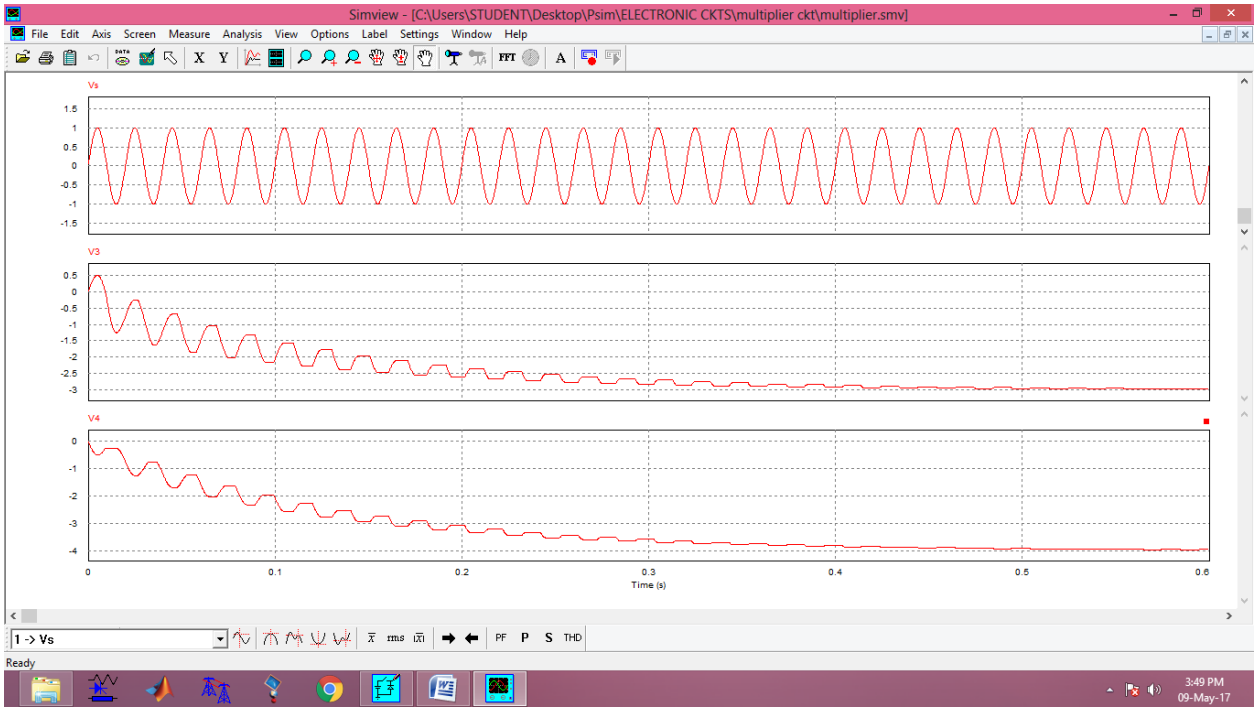
Select the volt meter



Connect as shown below using wiring tool

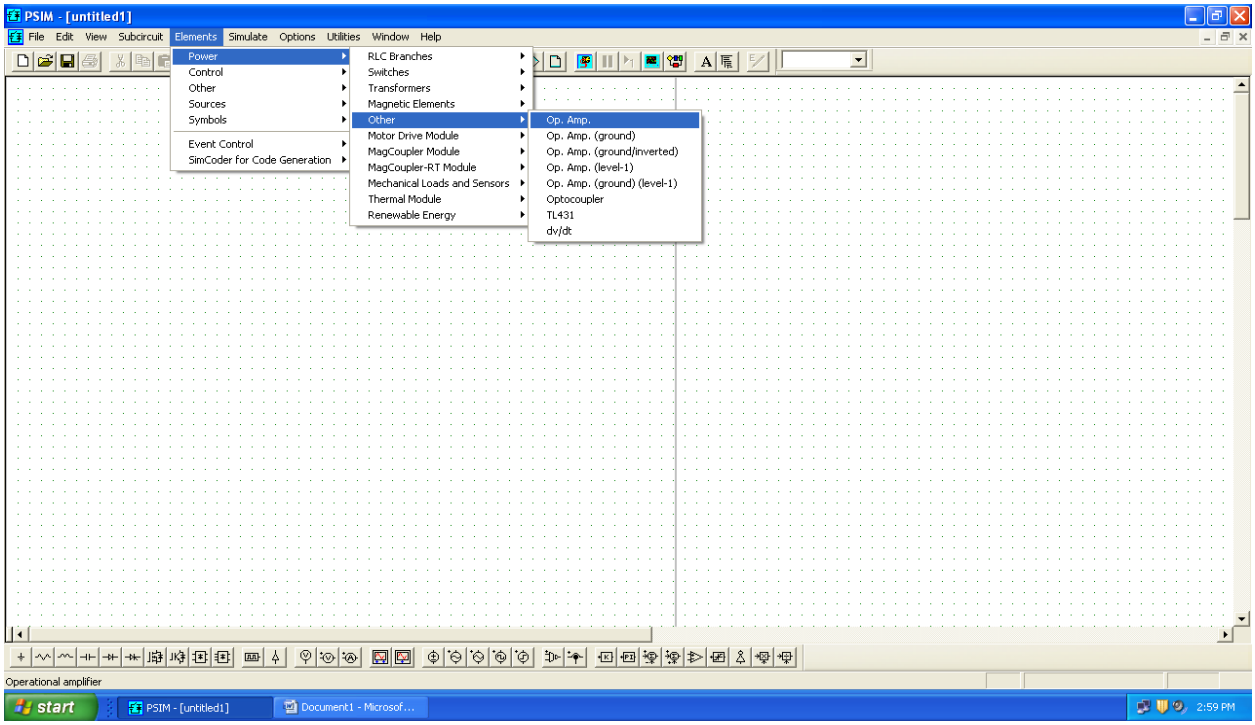


Output
waveforms

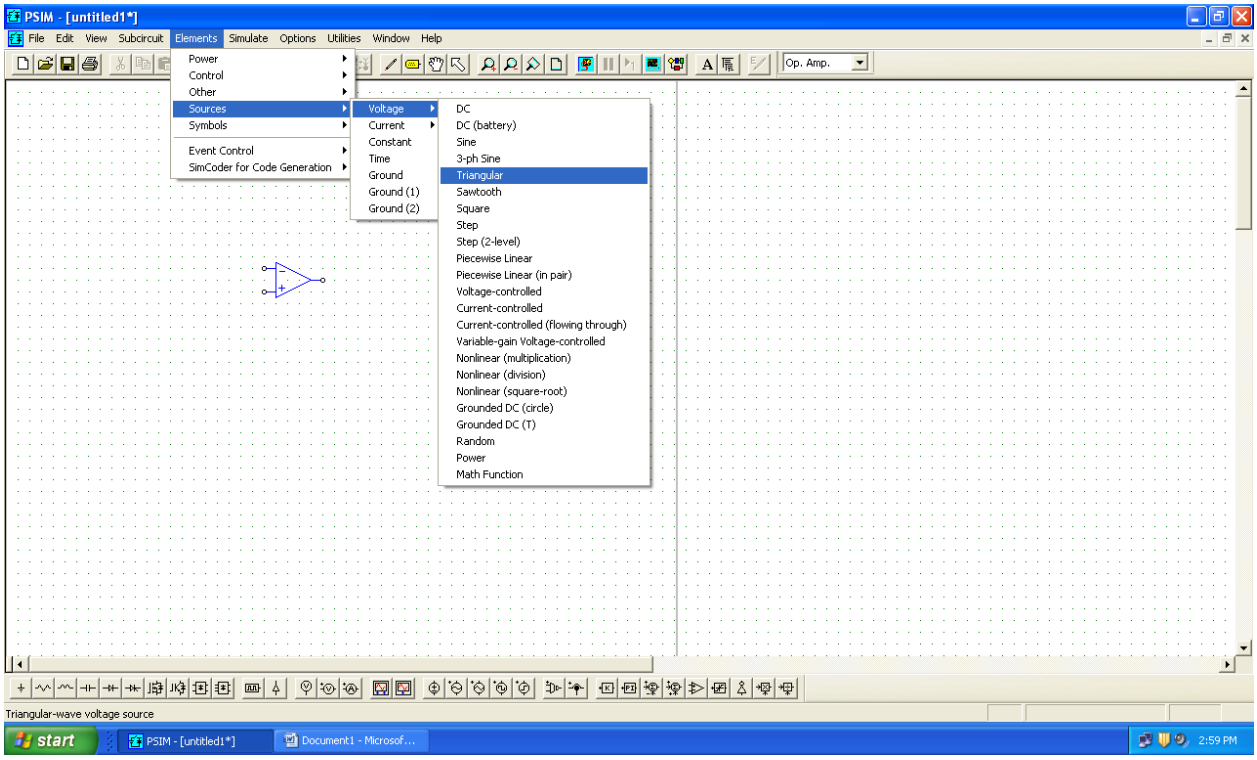


INTEGRATOR

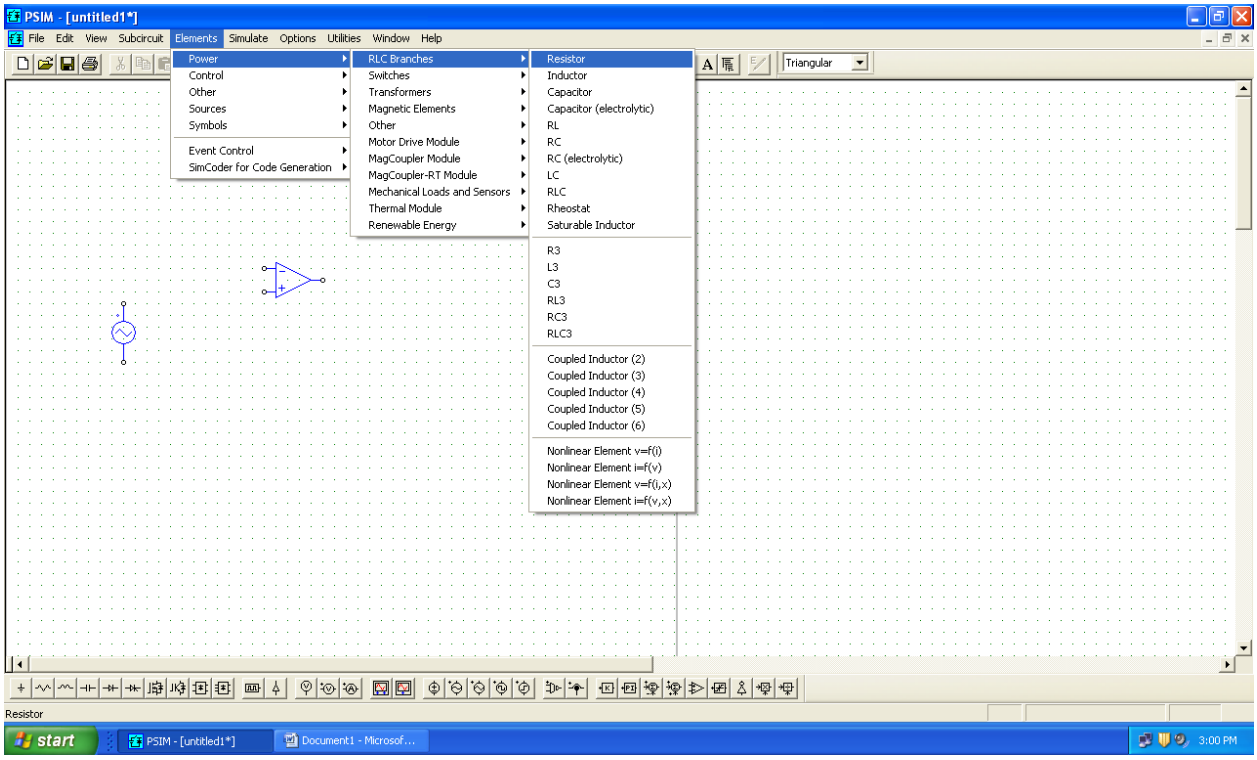
Select the op-amp



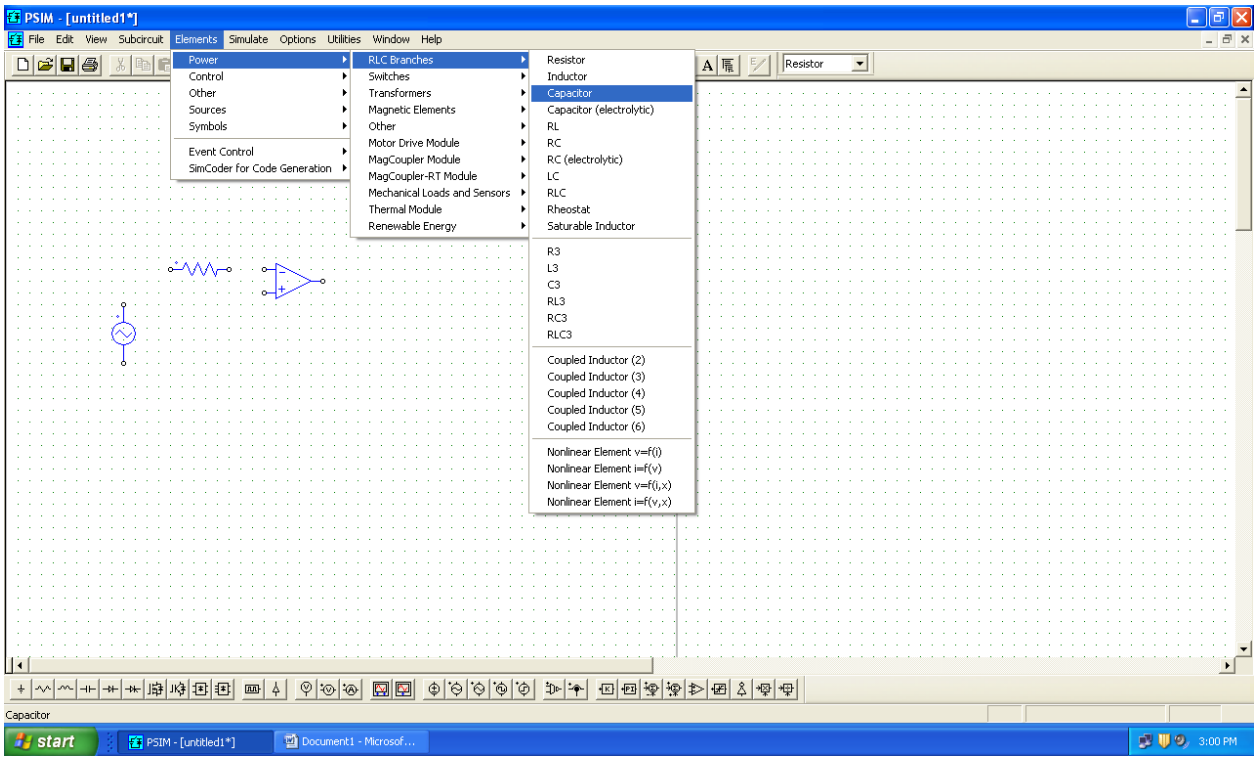
Select the triangular source



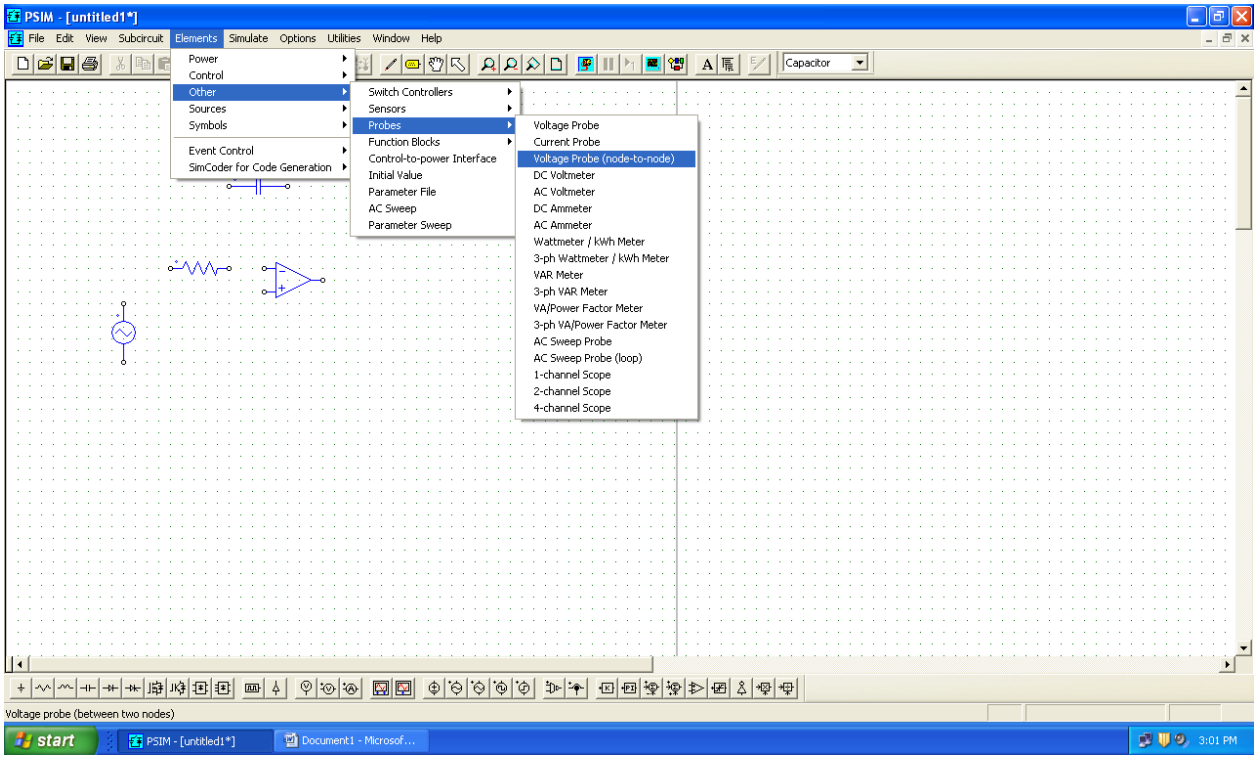
Select the resistor



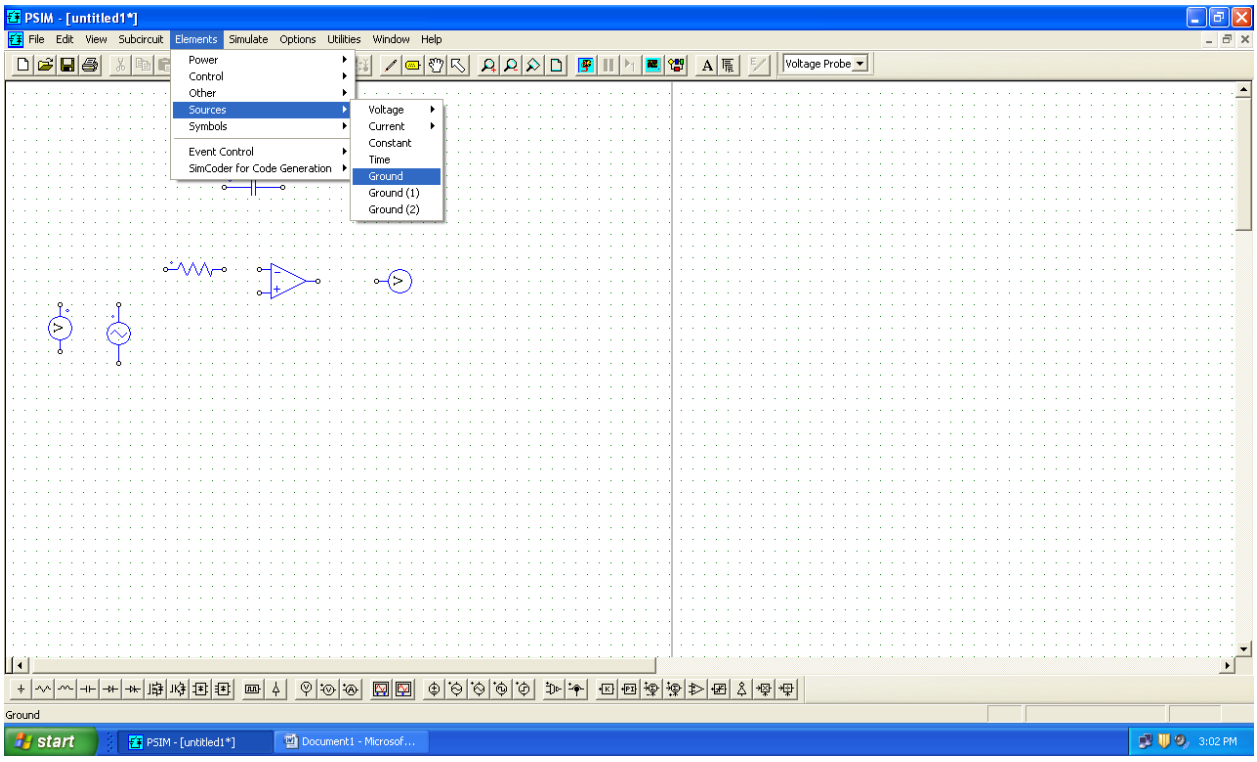
Select the capacitor



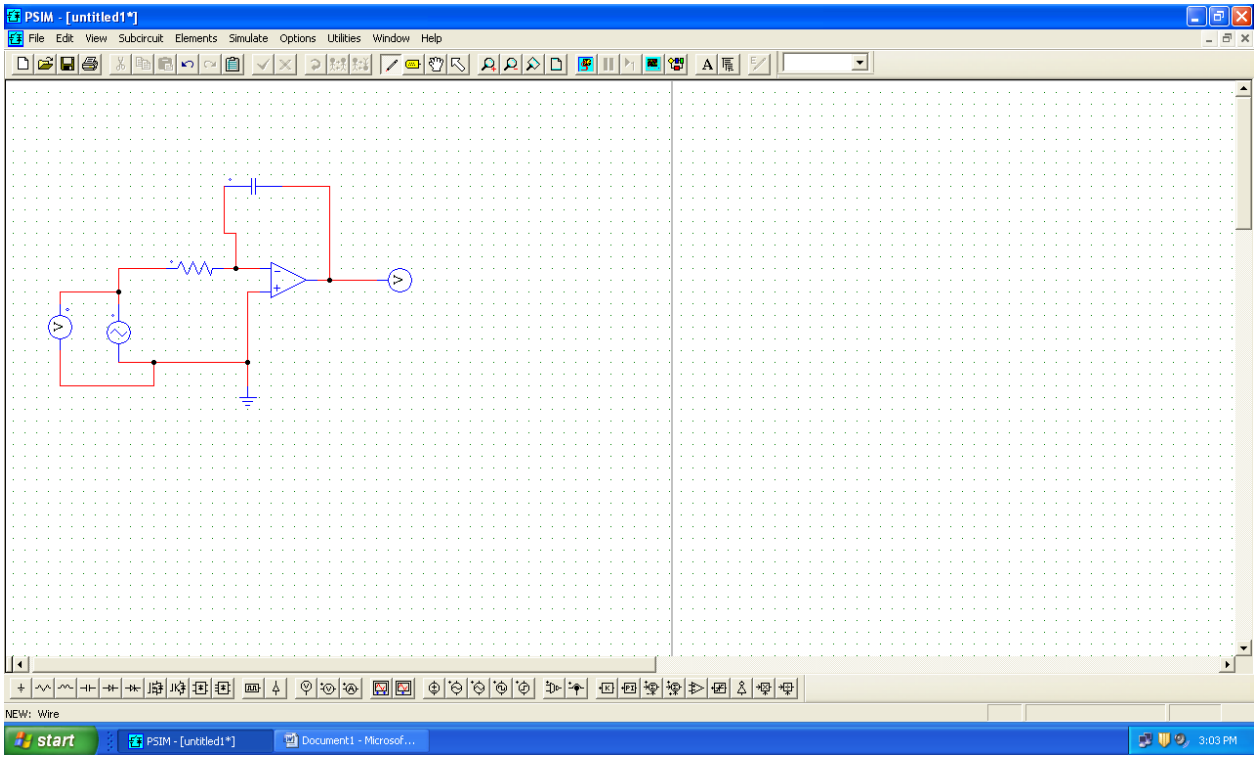
Select the volt meter



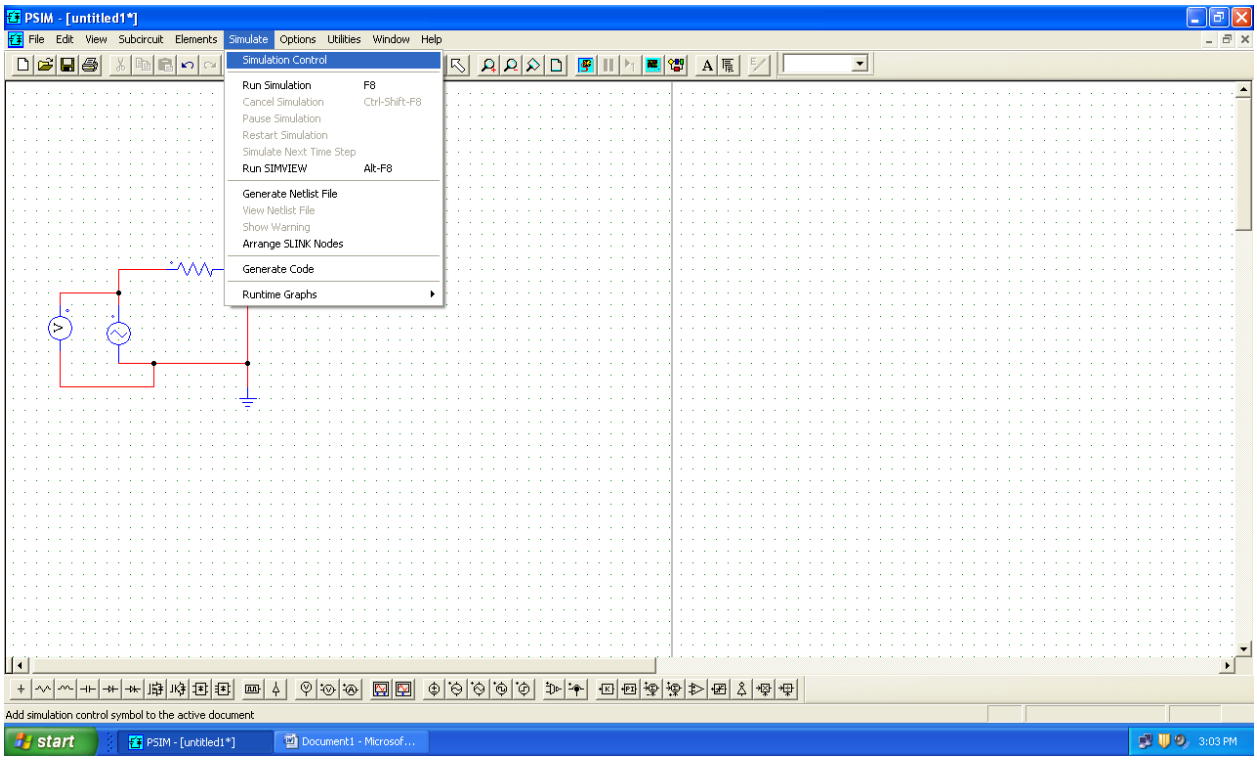
Select the ground

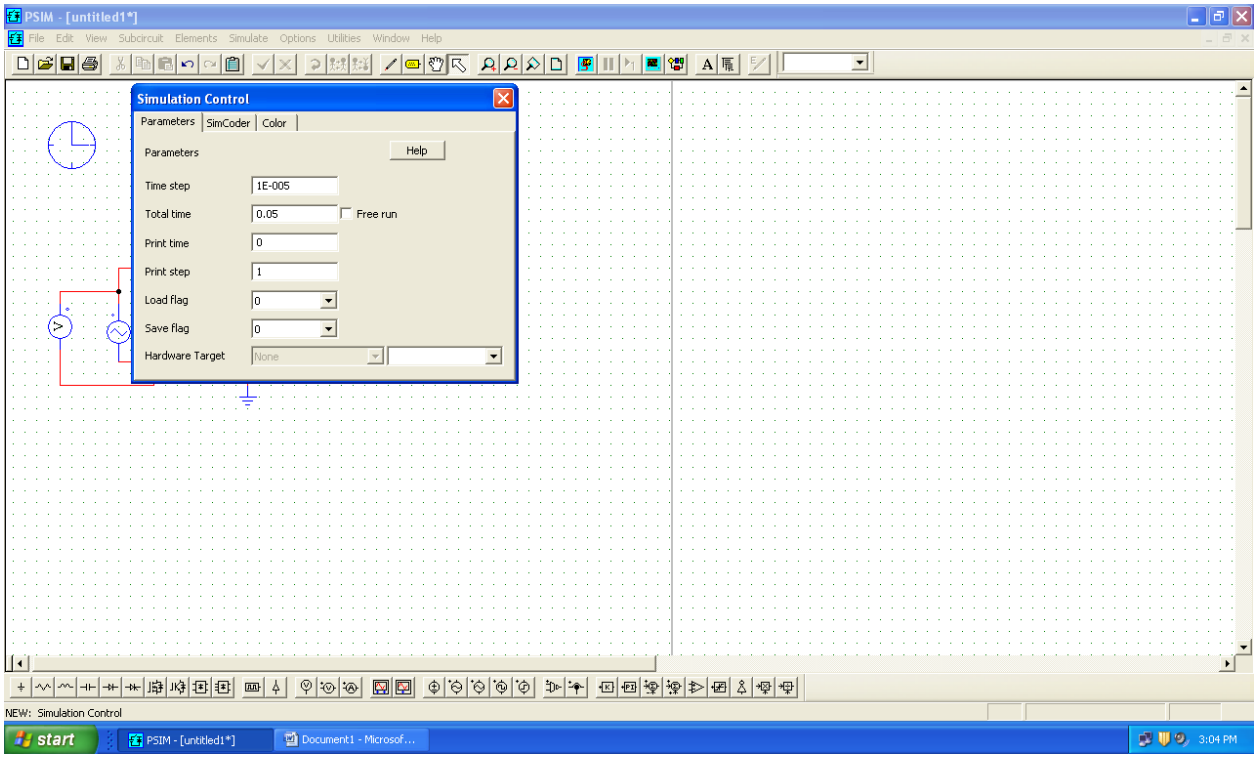


Connect the circuit using wiring tool

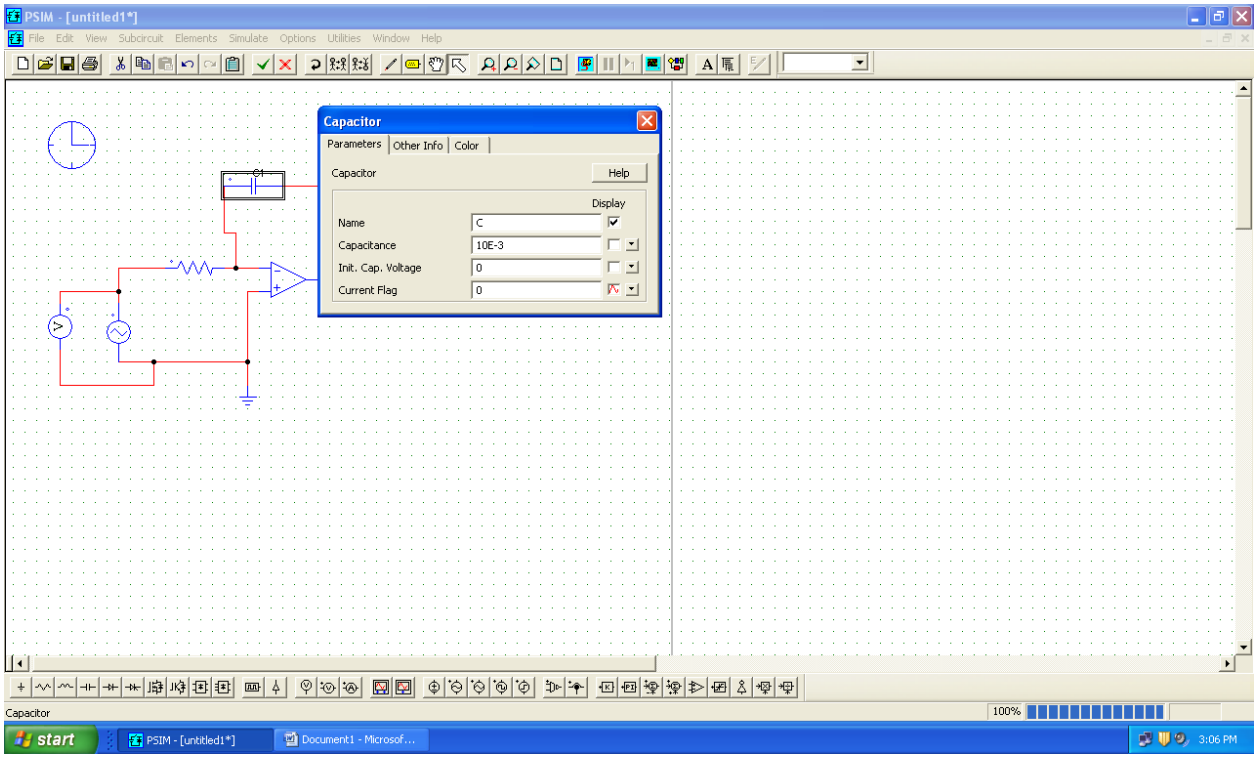


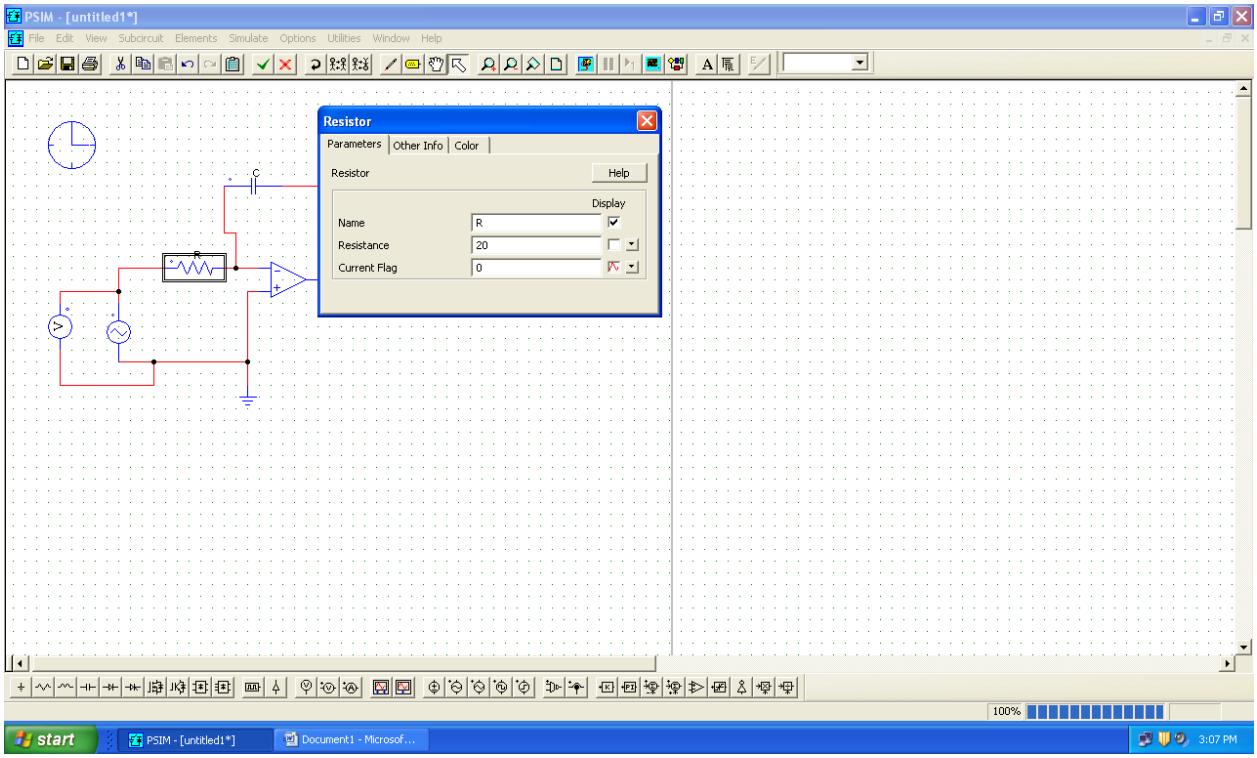
Select the simulate control

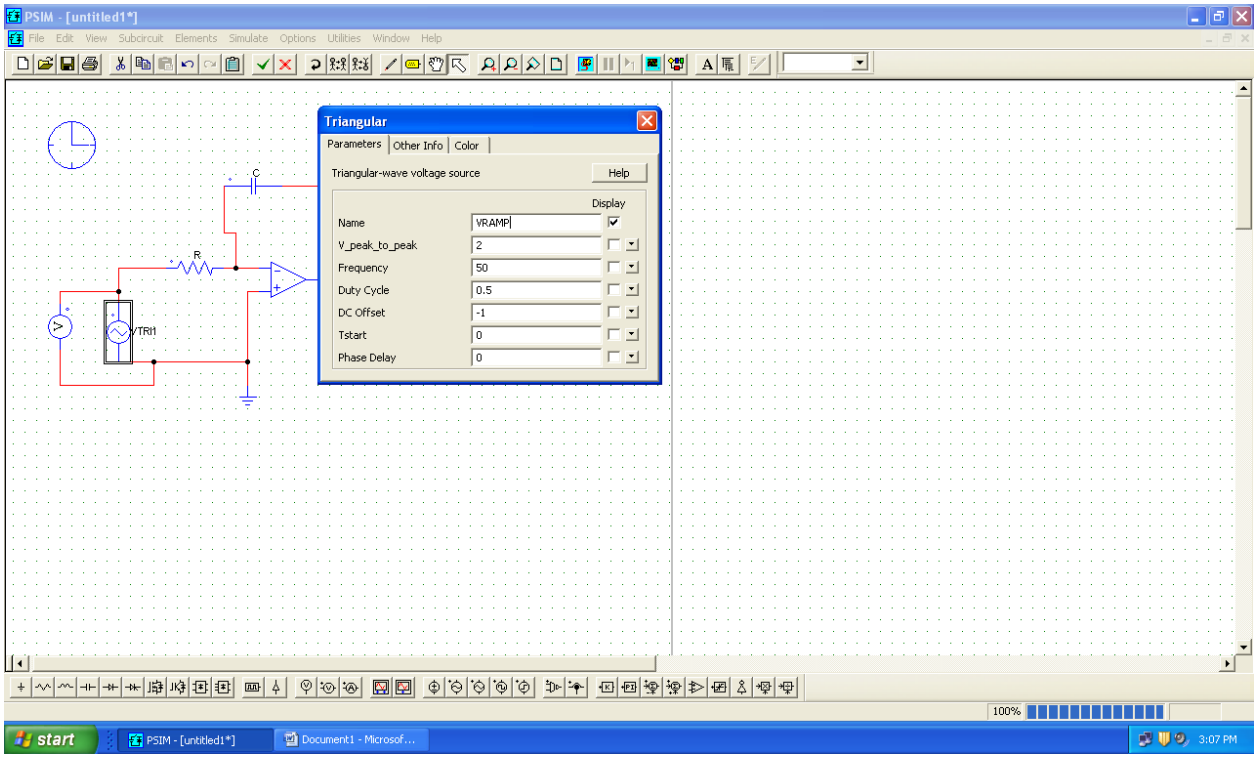


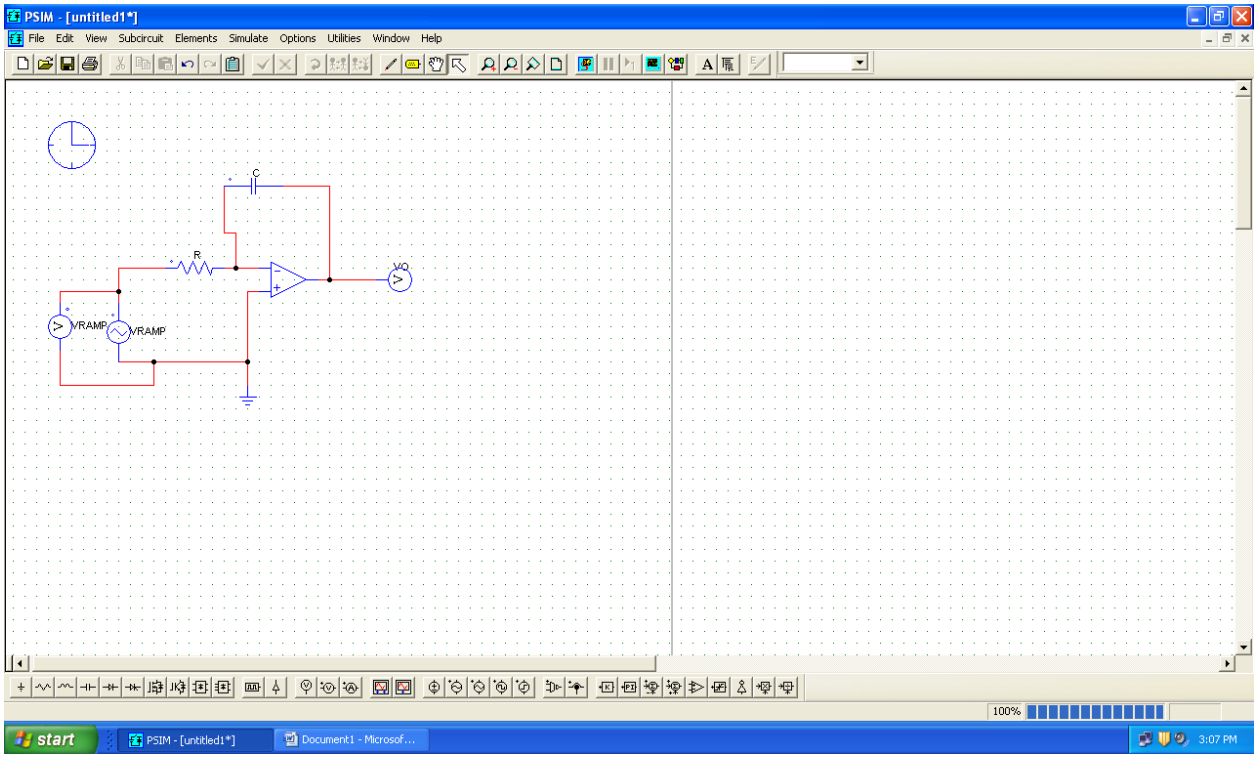


Select the proper values R,C and triangular source

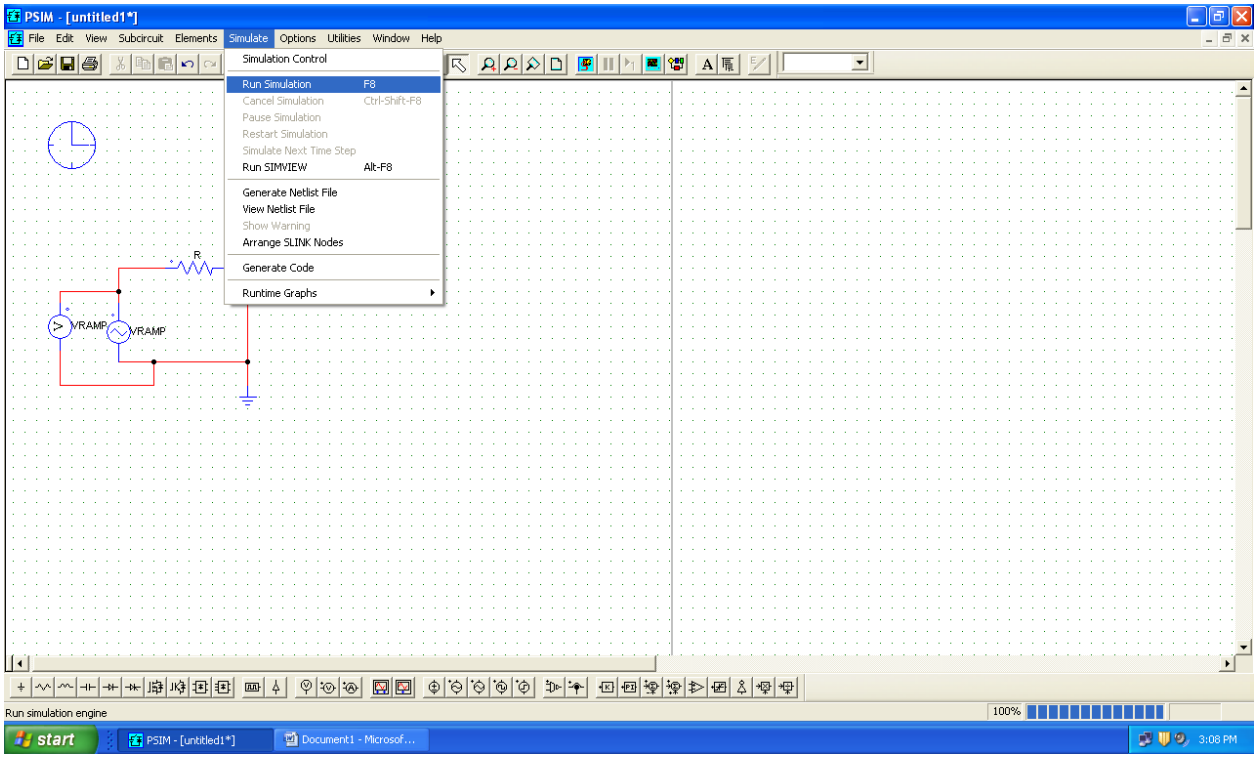



PSIM - [untitled1*]
Resistor
Parameters
Other Info
Color
Resistor
Help
Display
Name
R
Resistance
20
Current Flag
0
C
R
100%
start
PSIM - [untitled1*]
Document1 - Microsof...
3:07 PM

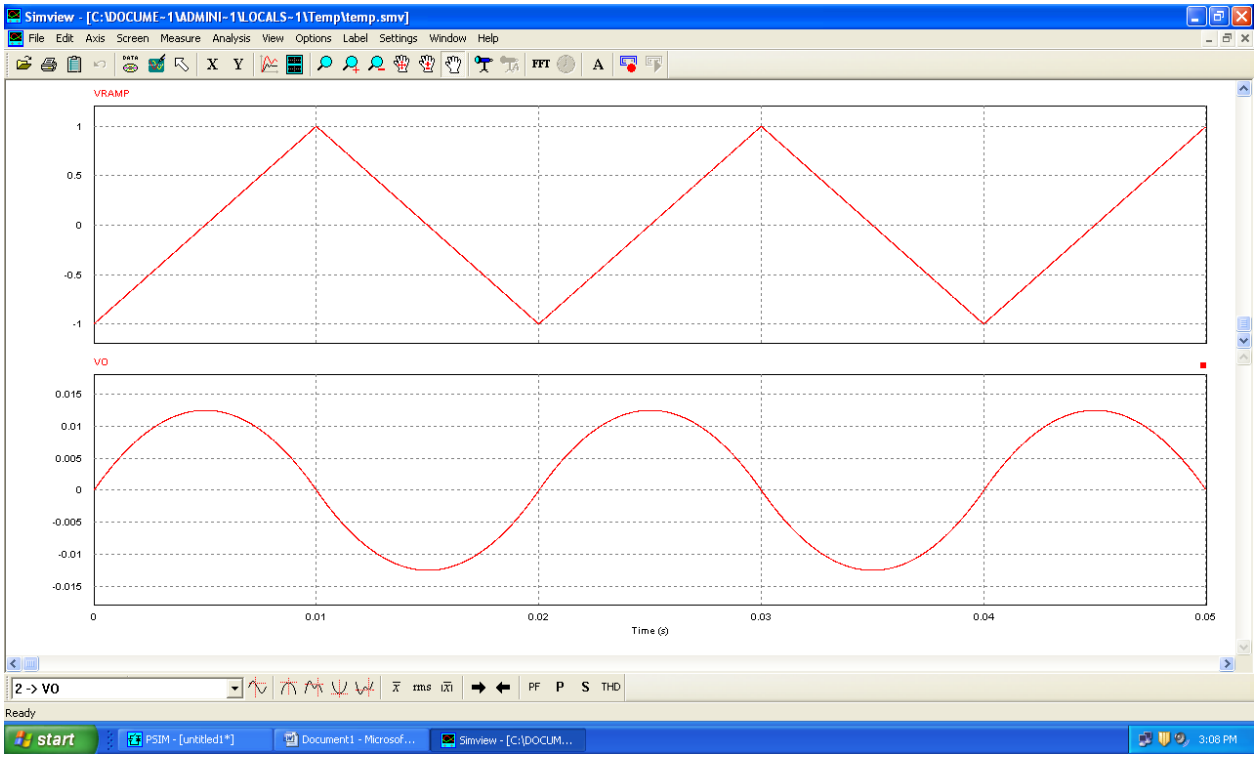

PSIM - [untitled1*]
Triangular
Parameters
Other Info
Color
Triangular-wave voltage source
Help
Display
Name
VRAMP
V_peak_to_peak
2
Frequency
50
Duty Cycle
0.5
DC Offset
-1
Tstart
0
Phase Delay
0
C
R
VTRI
100%
start
PSIM - [untitled1*]
Document1 - Microsof...
3:07 PM



Run the circuit

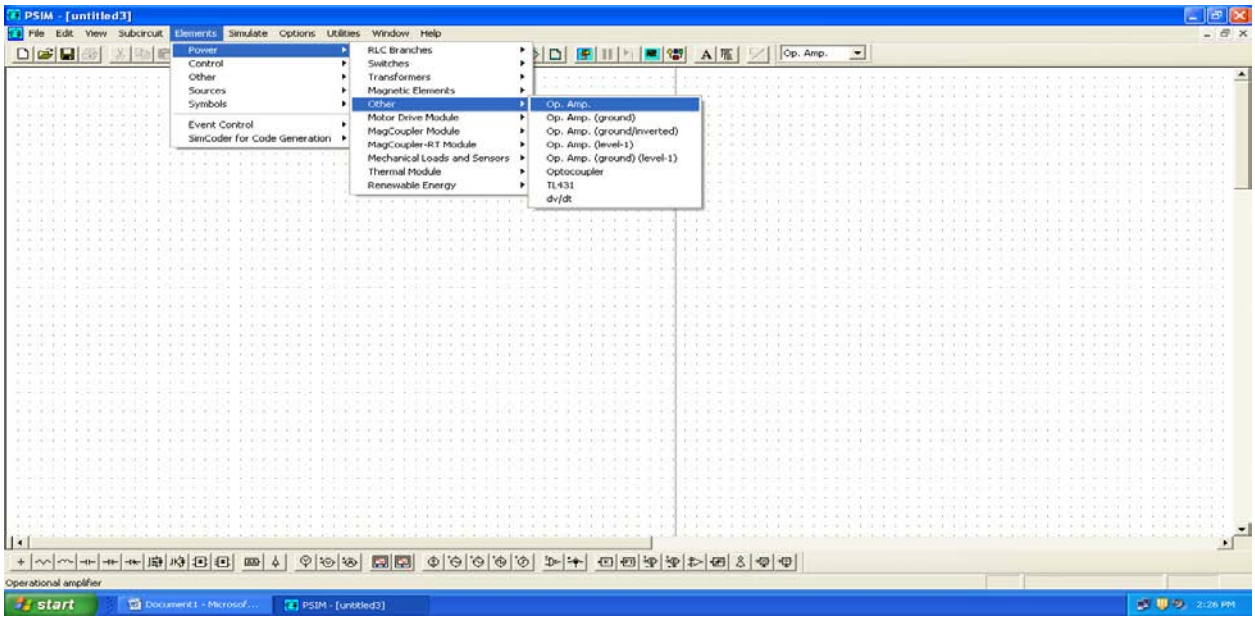


Output waveforms

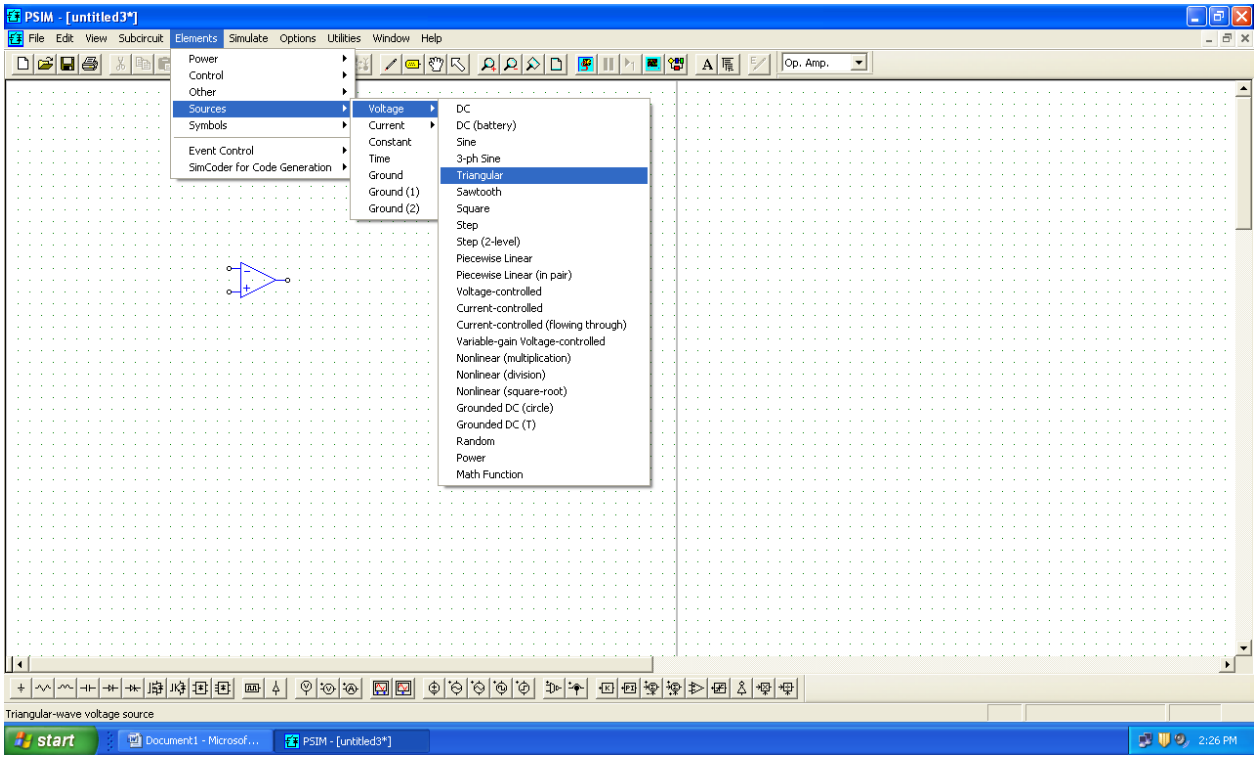


DIFFERENTIATOR

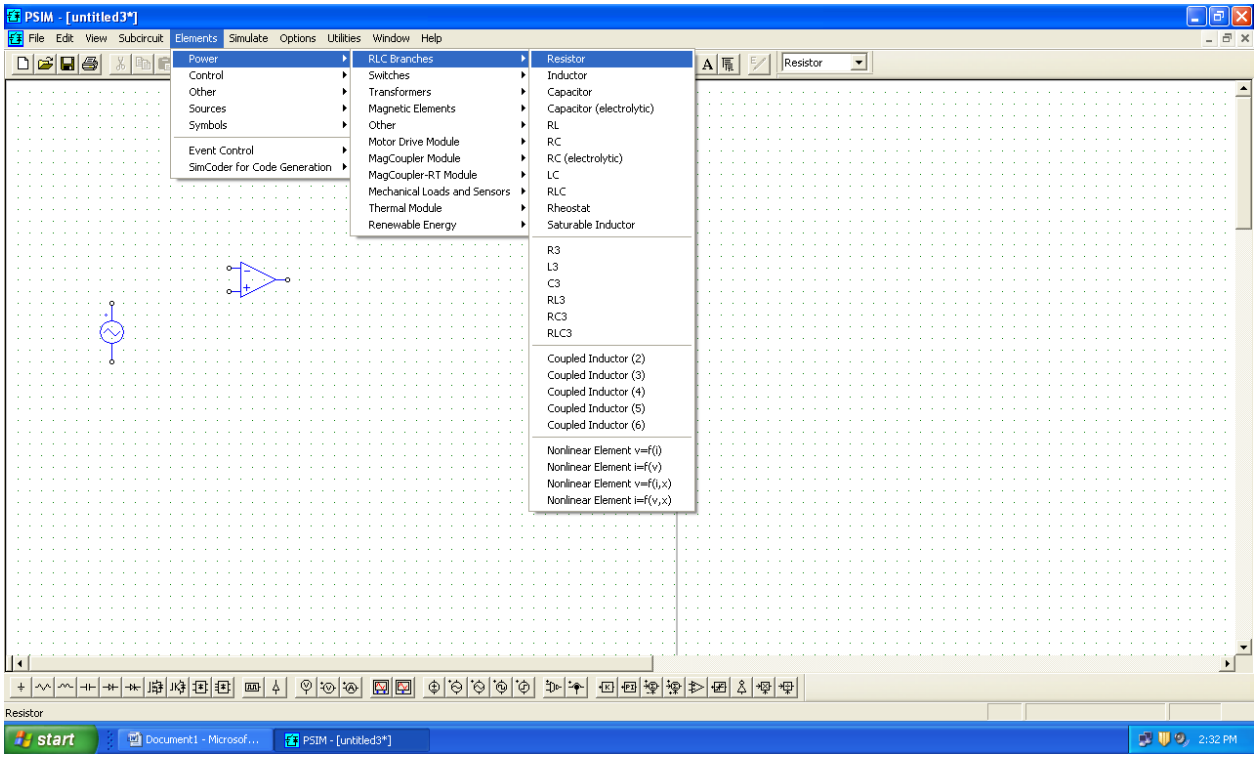
Select the op-amp



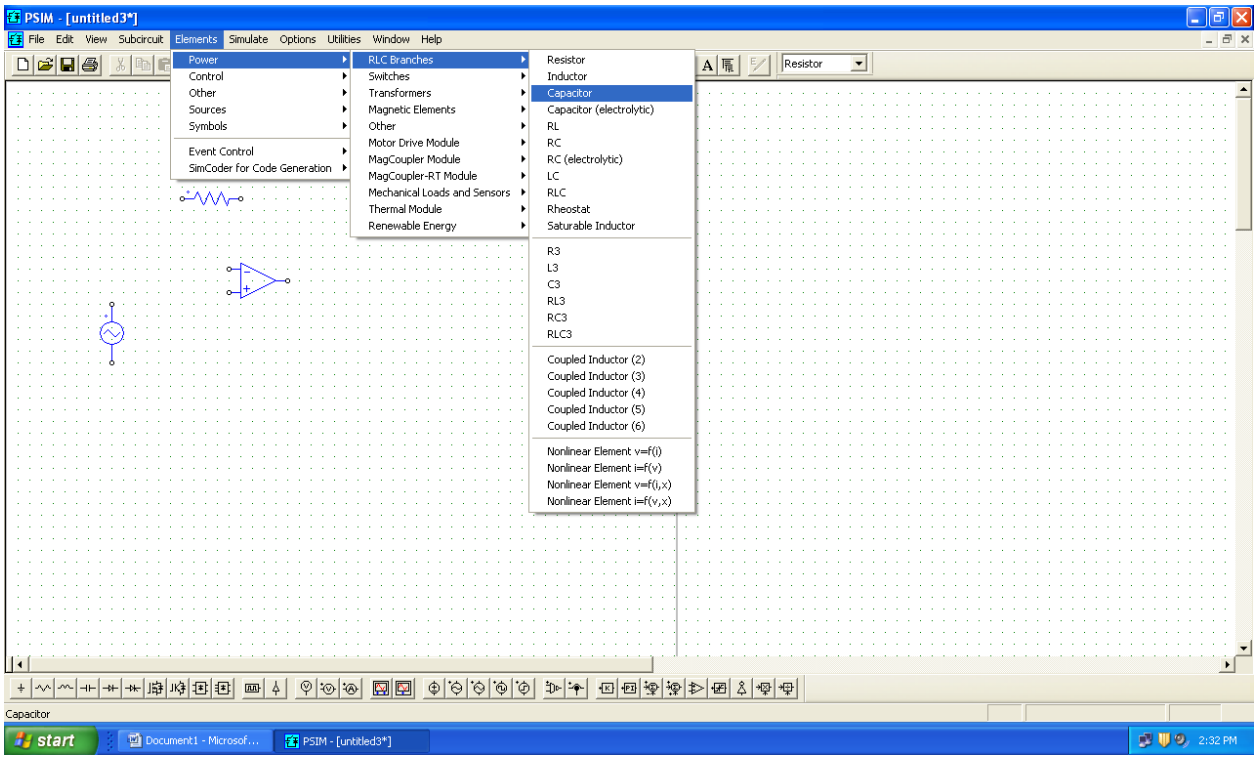
Select the triangular source



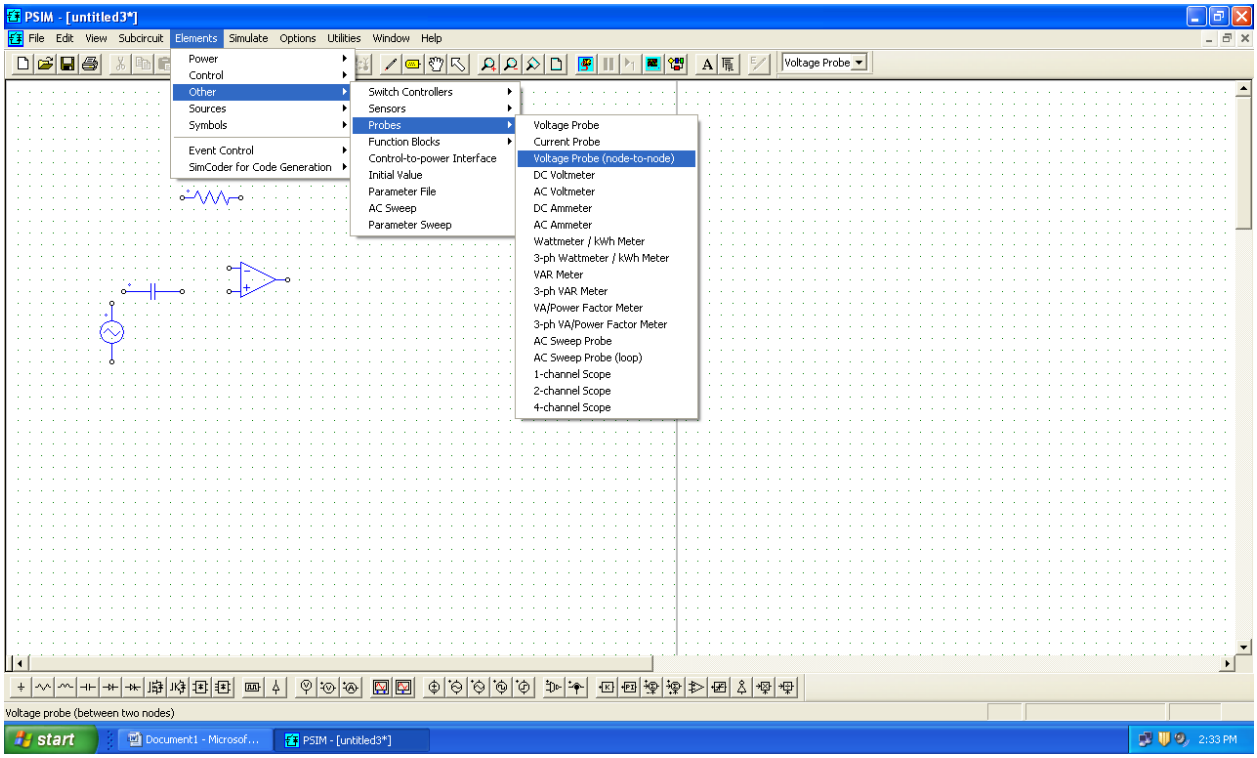
Select the resistor



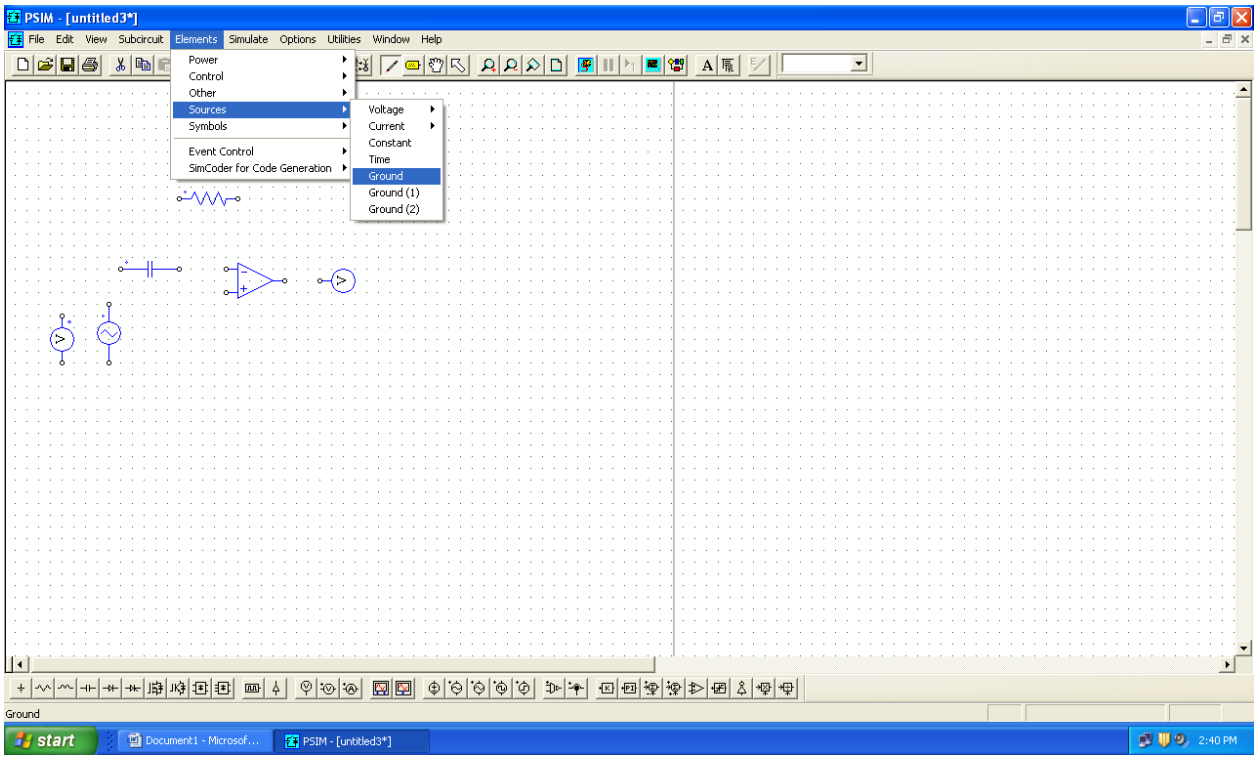
Select the capacitor



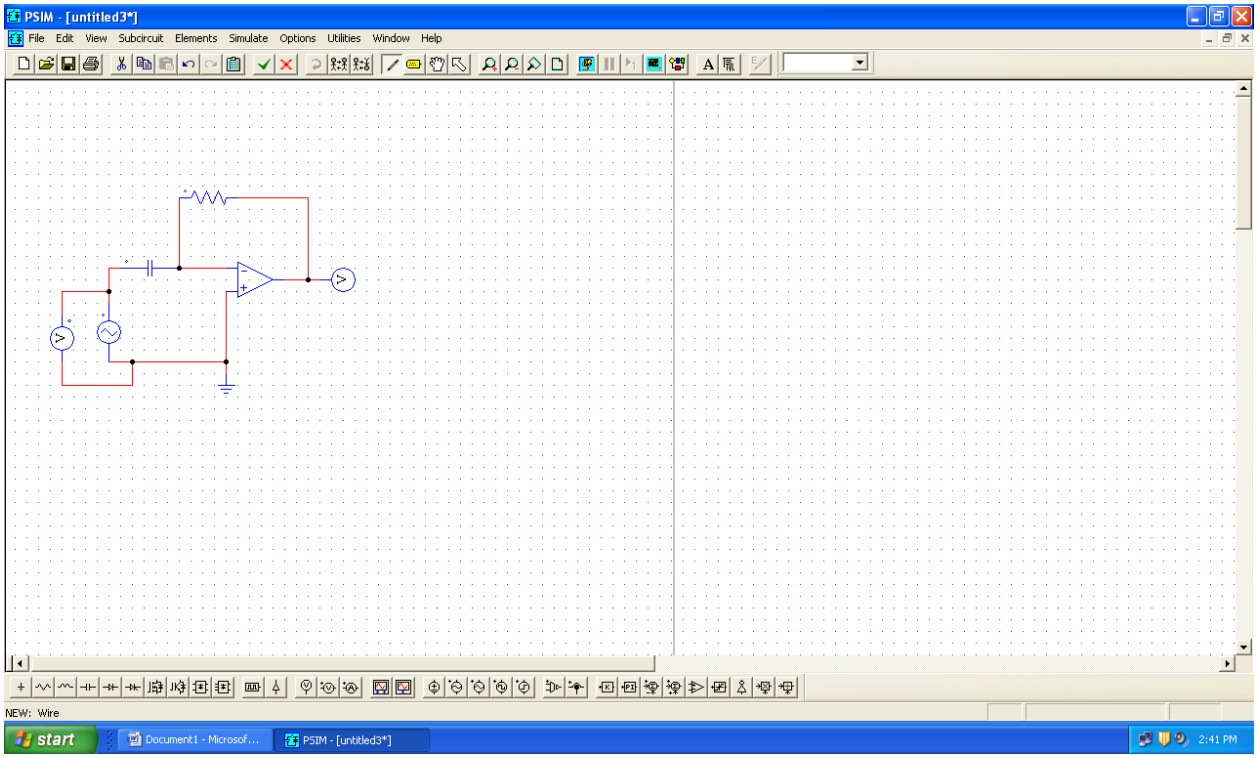
Select the volt meter



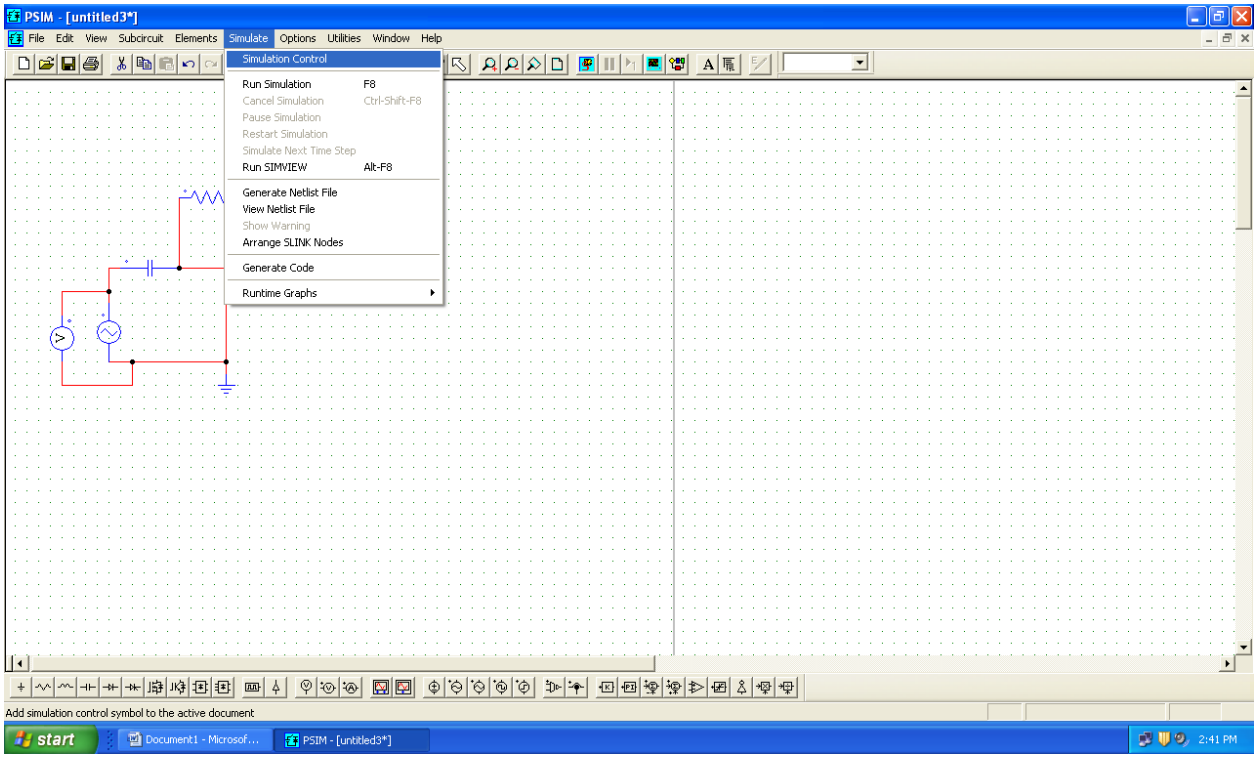
Select the ground

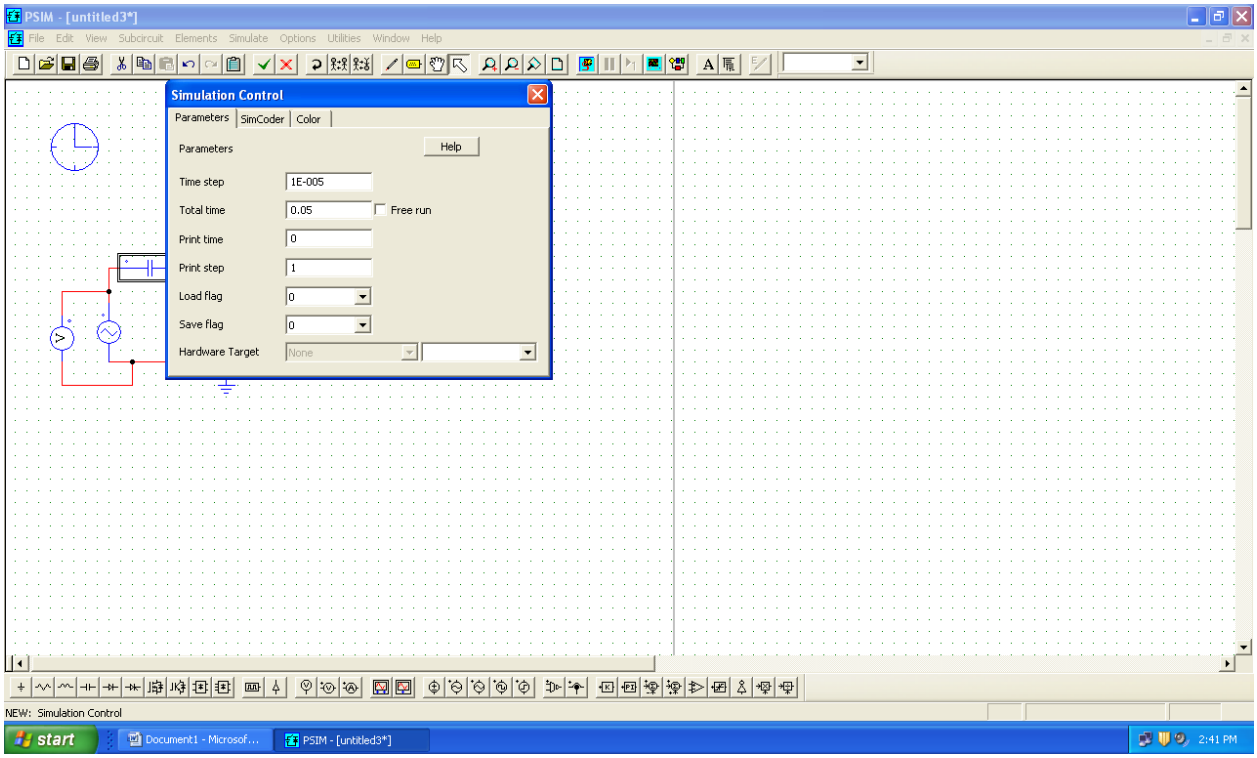


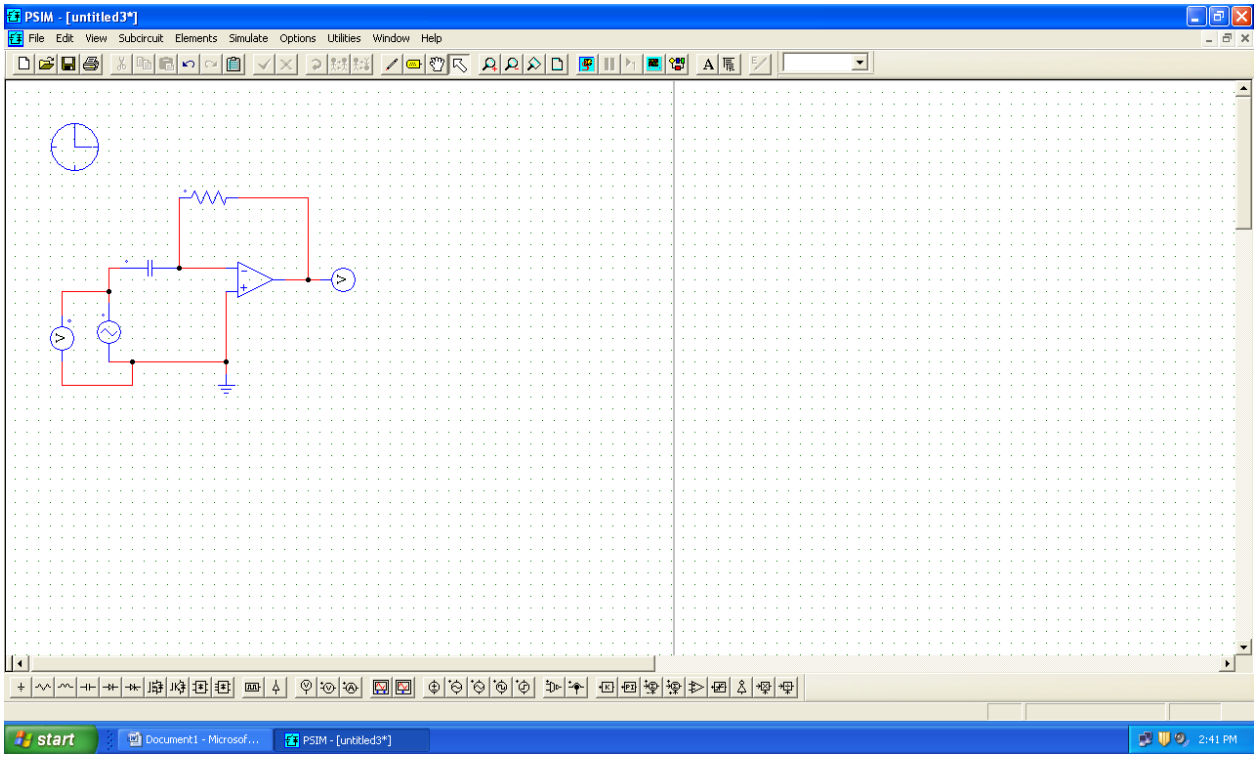
Connect the circuit using wiring tool



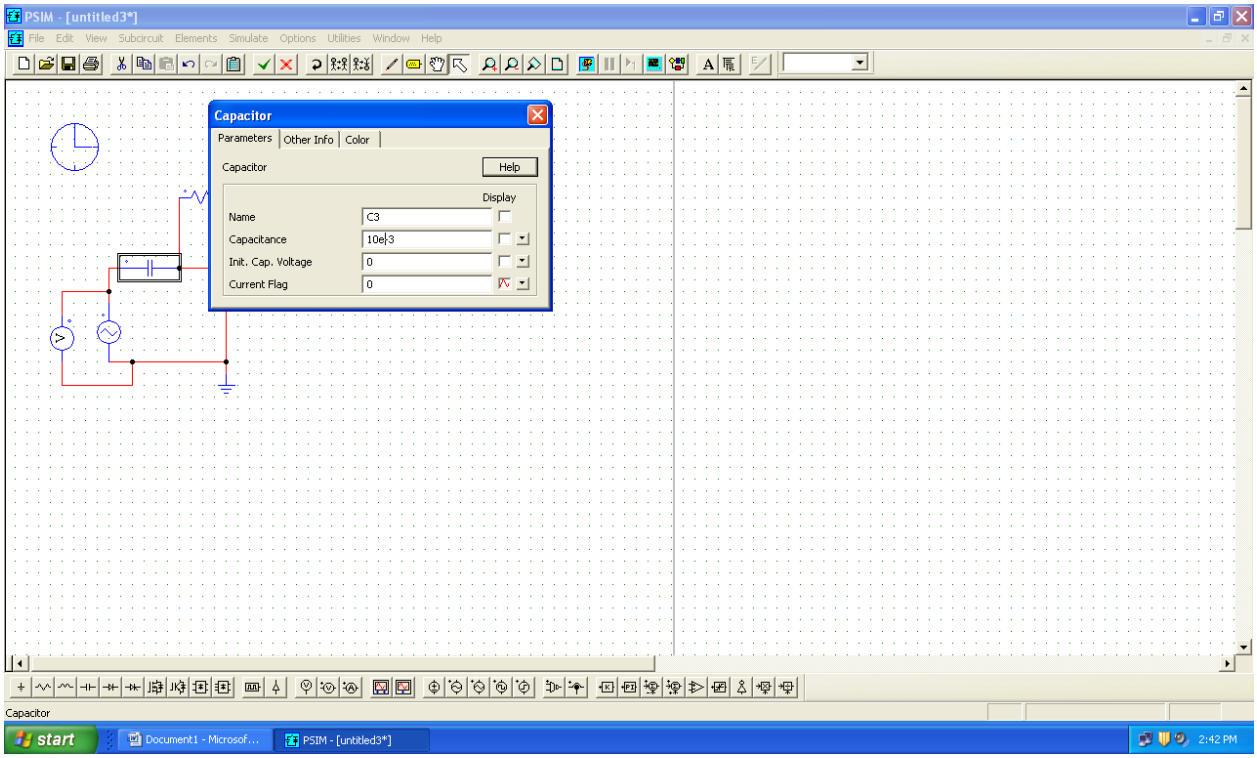
Select the simulation control

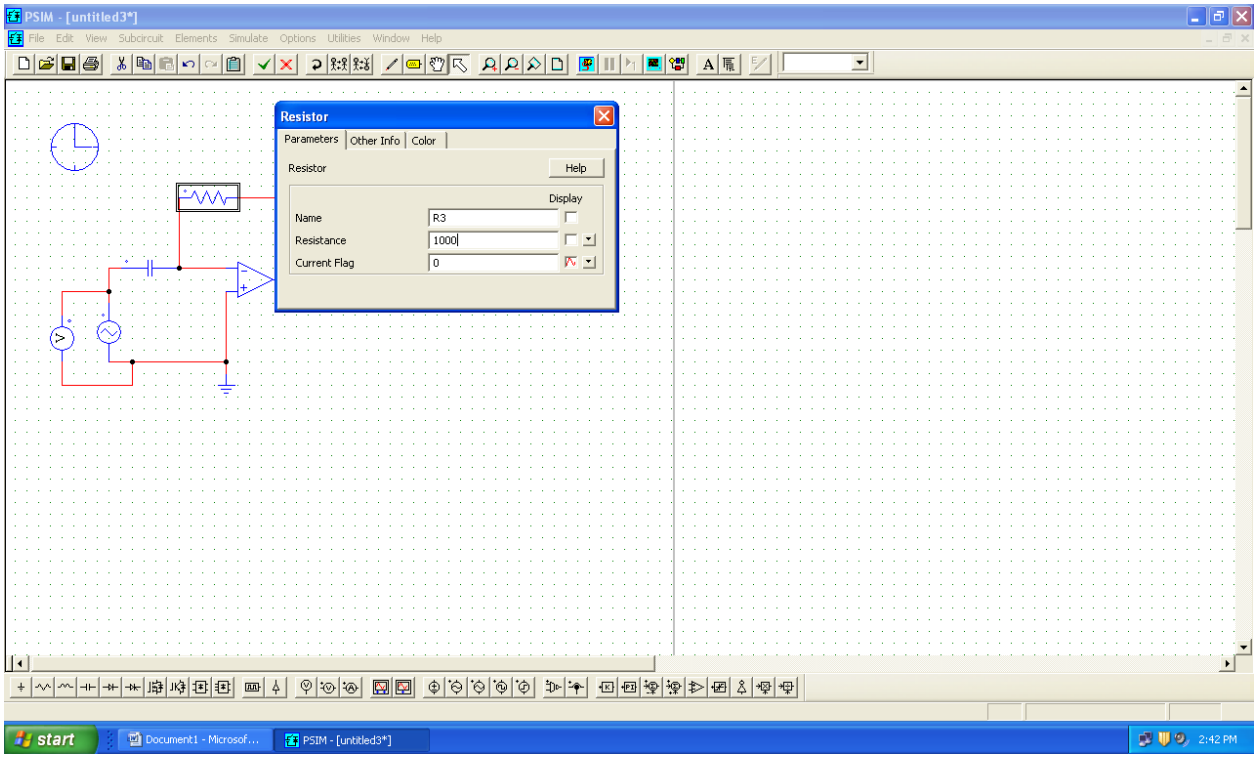


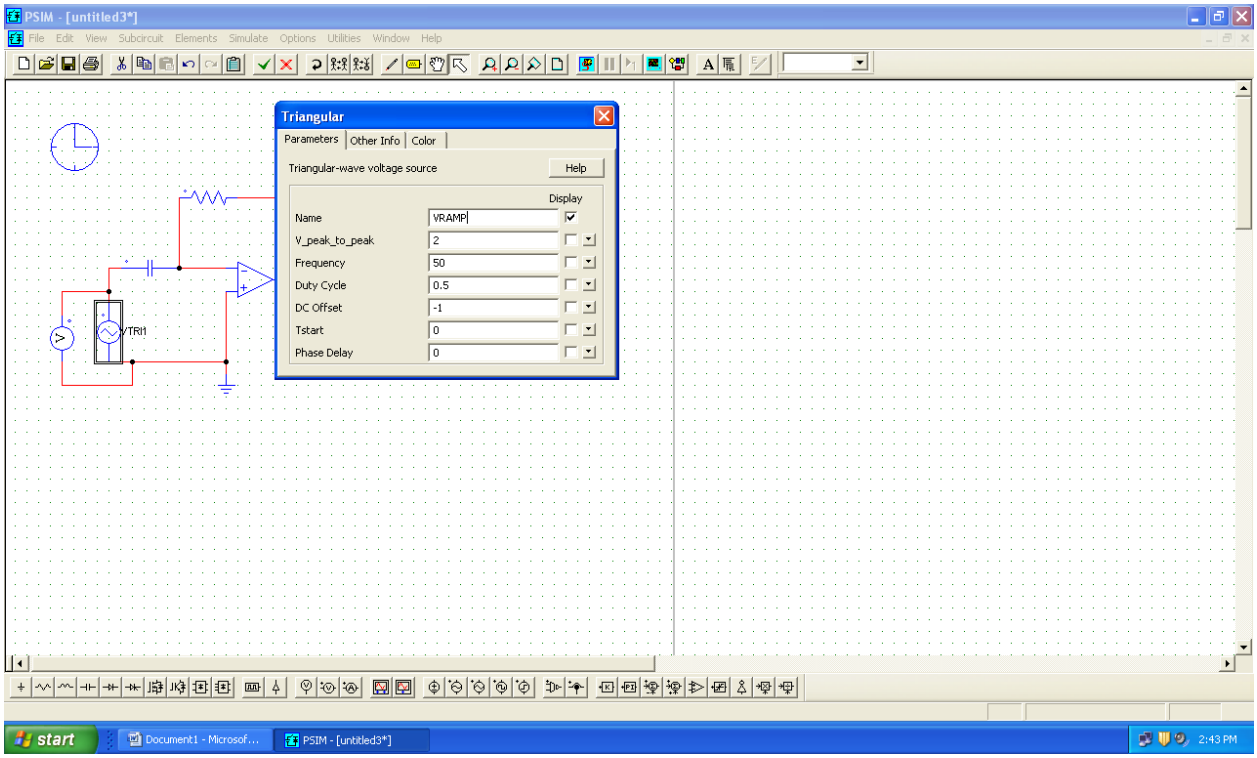

PSIM - [untitled3*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
Simulation Control
Parameters SimCoder Color
Parameters
Help
Time step 1E-005
Total time 0.05
Free run
Print time 0
Print step 1
Load flag 0
Save flag 0
Hardware Target None
NEW: Simulation Control
start
Document1 - Microsof...
PSIM - [untitled3*]
2:41 PM


PSIM - [untitled3*]
File Edit View Subcircuit Elements Simulate Options Utilities Window Help
start
Document1 - Microsof...
PSIM - [untitled3*]
2:41 PM

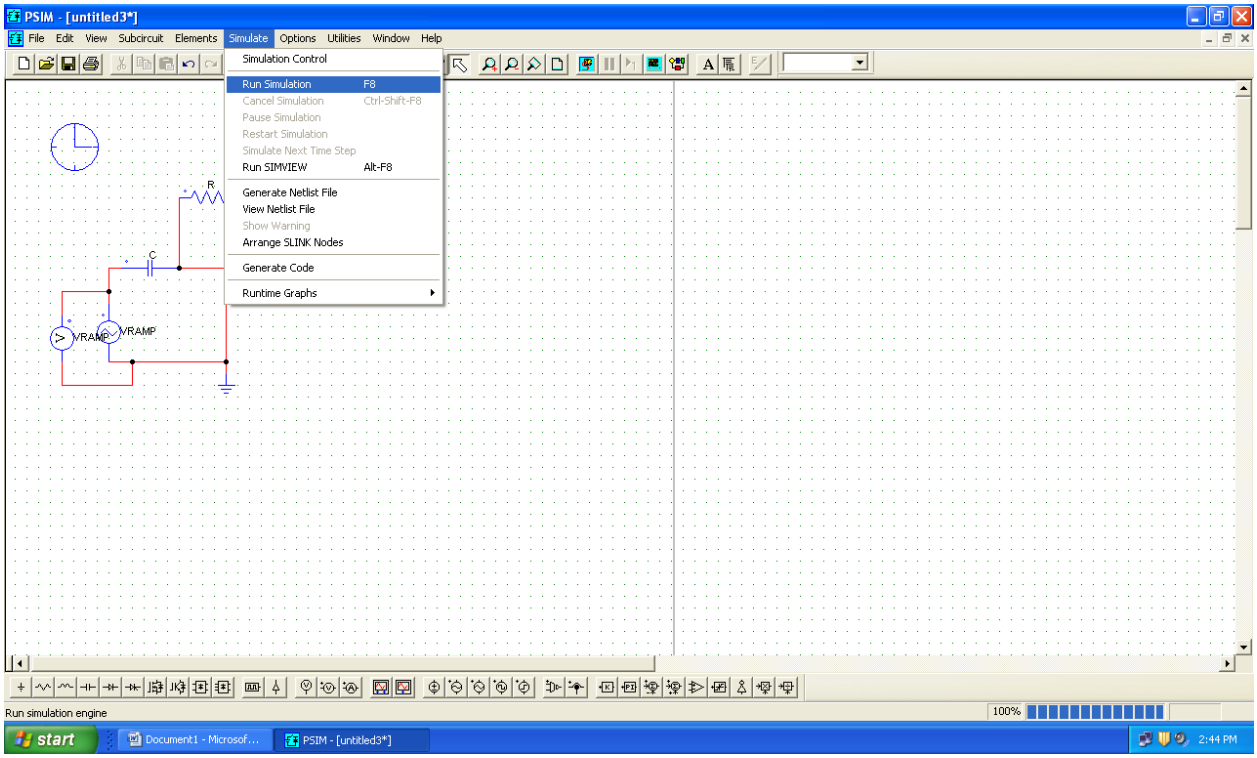
Select the proper values to R,C and triangular source



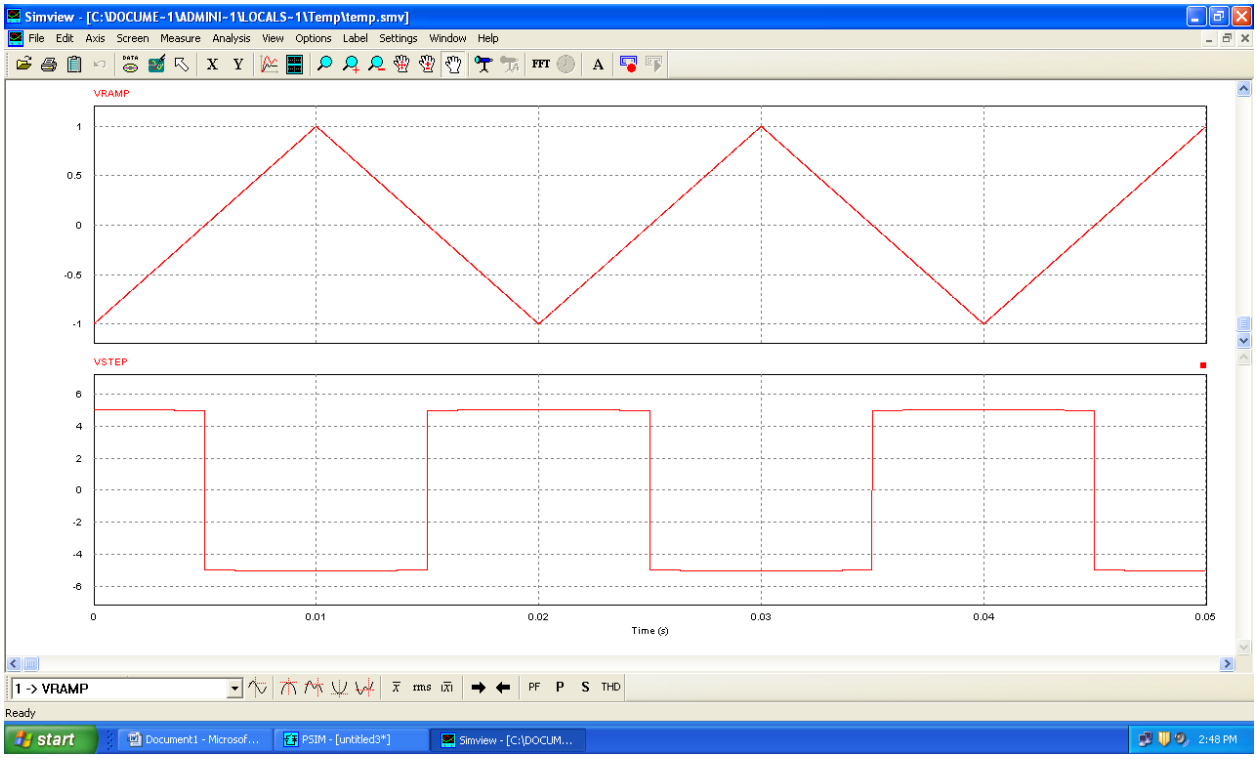




Run circuit using run simulation



Output waveforms



For more details contact

Mr. P. Rajasekhara Reddy

Assistant Professor

Department of Electrical and Electronics Engineering

Vasavi College of Engineering (Autonomous)

Email: rajashekhar.p@staff.vce.ac.in

Mobile: +91-9177207976

&

Dr. M. Chakravarthy

Professor and Head of the Department

Department of Electrical and Electronics Engineering

Vasavi College of Engineering (Autonomous)

Email: hodeee@staff.vce.ac.in

Mobile: +91-9849979136