Circuit Theory

MATLAB Assignment

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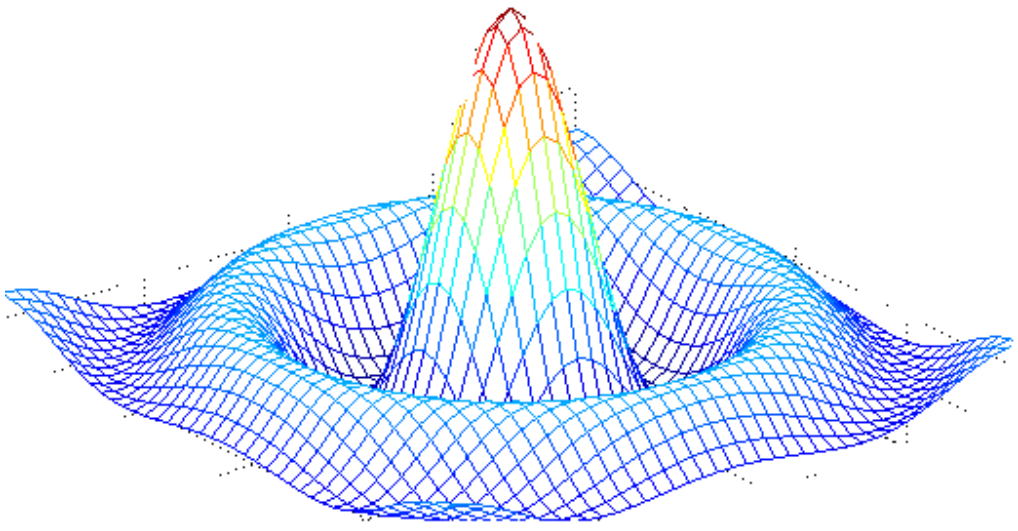
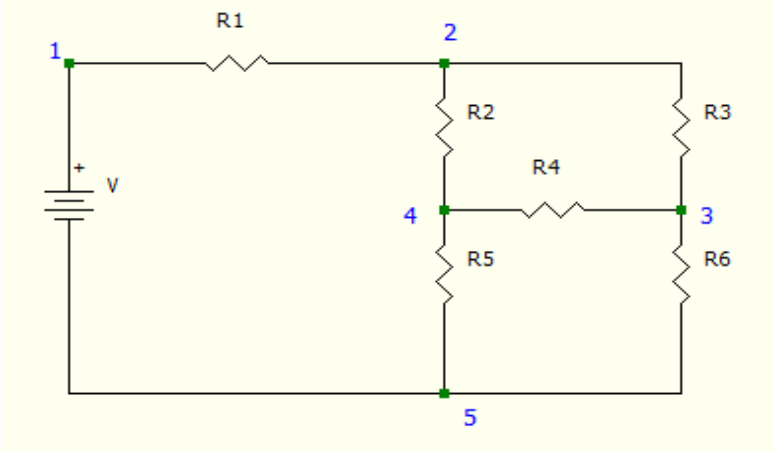


Question 1

CIRCUIT DIAGRAM:



PROGRAM CODE:

```
clear all;
close all;
clc;
%The circuit diagram is as shown.
V=input('Enter the value of voltage source in the figure:\n');
R=zeros(1,6);
```

```
disp('Enter the six resistors R1,R2,R3,R4,R5,R6:');
for i=1:6
    R(i)=input('');
end
disp('Applying Loop analysis to the given circuit:');
r=[R(1)+R(2)+R(5) -R(2) -R(5);R(2) -R(2)-R(3)-R(4) R(4);R(5) R(4) -R(4)-R(5)-
R(6)]
v=[V;0;0]
I=inv(r)*v;
disp('The loop currents are:');
disp('I1=');
disp(I(1));
disp('I2=');
disp(I(2));
disp('I3=');
disp(I(3));
disp('Hence the current through the 2 ohm resistor is:');
disp(I(3)-I(2));
```

OUTPUT:

Enter the value of voltage source in the figure:

10

Enter the six resistors R1,R2,R3,R4,R5,R6:

6

4

6

2

8

15

Applying Loop analysis to the given circuit:

r =

```
   18    -4    -8
    4   -12     2
    8     2   -25
```

v =

```
   10
    0
    0
```

The loop currents are:

I1=

```
    0.7341
```

I2=

```
    0.2877
```

I3=

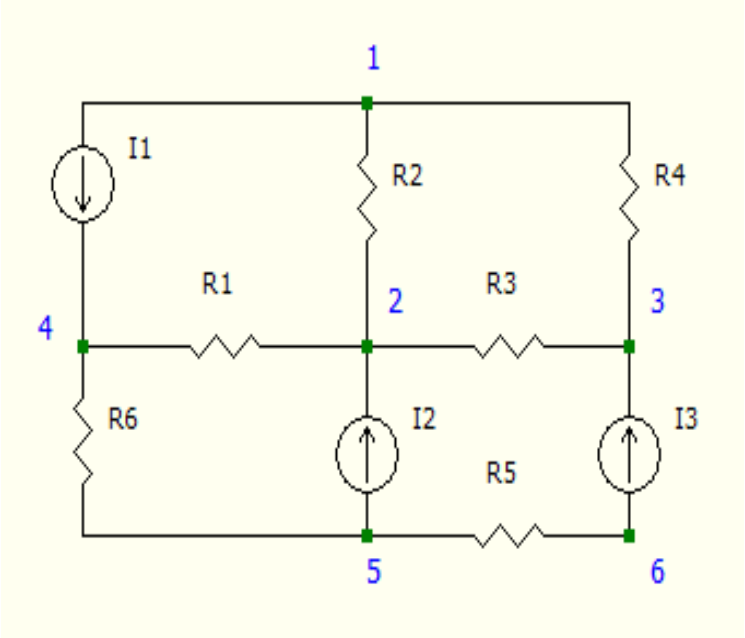
```
    0.2579
```

Hence the current through the 2 ohm resistor is:

```
   -0.0298
```

Question 2

CIRCUIT DIAGRAM:



PROGRAM CODE:

```
clear all;
close all;
clc;
%The circuit diagram is as shown.
I=zeros(1,3);
disp('Enter the three current sources I1,I2,I3:');
for i=1:3
    I(i)=input('');
end
R=zeros(1,6);
disp('Enter the six resistors R1,R2,R3,R4,R5,R6:');
for i=1:6
```

```
    R(i)=input('');
end
disp('Let the node 5 be grounded.');
disp('Applying KCL to the given circuit:');
r=[0 -1/R(1) 0 1/R(1)+1/R(6);-1/R(2) 1/R(1)+1/R(2)+1/R(3) -1/R(3) -1/R(1);-
1/R(4) -1/R(3) 1/R(3)+1/R(4) 0;-1/R(2)-1/R(4) 1/R(2) 1/R(4) 0];
i=[I(1);I(2);I(3);I(1)];
%This variable v stores from V1 to V4 only.
v=inv(r)*i;
v(5)=0;
disp('The nodal voltages are:');
disp('V1=');
disp(v(1));
disp('V2=');
disp(v(2));
disp('V3=');
disp(v(3));
disp('V4=');
disp(v(4));
%Since the node 5 was grounded.
disp('V5=');
disp(v(5));
disp('V6=');
disp(-I(3)*R(5));
```

OUTPUT:

The circuit diagram is as shown:

Enter the three current sources I1,I2,I3:

3

4

6

Enter the six resistors R1,R2,R3,R4,R5,R6:

2

5

3

6

8

4

Let the node 5 be grounded.

Applying KCL to the given circuit:

The nodal voltages are:

V1=

50.7857

V2=

54

V3=

64.9286

V4=

40

V5=

0

V6=

-48

Question 3

CIRCUIT DIAGRAM:

1. **To calculate Thevenin Voltage:**

2. **To calculate Thevenin Resistance:**

PROGRAM CODE:

```
clear all;
close all;
clc;
%The circuit diagram is as shown
%To calculate Thevenin Voltage
disp('Enter the value of voltage source S:');
S=input('');
disp('Enter the value of current source I:');
I=input('');
R=zeros(1,3);
disp('Enter the resistances R1,R2,R3:');
for i=1:3
    R(i)=input('');
end
%Let the 5th node be grounded
V5=0;
V2=V5+S;
V3=V2-6*I;
V4=V5-I*R(3);
V1=(V3*(3+1/R(2))+V2/R(1))/(3+1/R(1)+1/R(2));
Vt=V4-V1;
disp('The voltages at the nodes 1,2,3,4,5 are:');
disp(V1);
disp(V2);
disp(V3);
disp(V4);
disp(V5);
disp('The Thevenin voltage is:');
disp(Vt);
%To calculate Thevenin Resistance
%The loop currents are I,i2,i3,i4
r=[-R(1)-R(2) R(1) -6;12 1 1;R(1) -R(1) 2];
v=[6*I;0;-2*I-S];
i=inv(r)*v;
disp('The short circuit current is:');
```

```
disp(i(3));
Rt=Vt/i(3);
disp('Hence the Thevenin resistance is:');
disp(abs(Rt));
disp('This Rth remains constant for different values of load resistances.');
%To calculate the power dissipated by 4 ohms
Il(1)=Vt/(abs(Rt)+4);
P=(Il(1)^2*4);
disp('The power dissipated by 4 ohm load (in watts) is:');
disp(P);
%Equivalent Norton circuit
disp('The equivalent Norton circuit has:');
disp('In=');
In=Vt/abs(Rt);
disp(In);
disp('Rn=');
disp(abs(Rt));
%To plot the graph1
Rl=4:4:40;
for i=1:10
    Il(i)=Vt/(abs(Rt)+Rl(i));
end
plot(Il,Vt);
xlabel('Load current----->');
ylabel('Thevenin Voltage----->');
title('Thevenin Voltage v\s Load current');
%To plot the graph2
t=0:.001:10;
plot(t,Vt);
xlabel('Time----->');
ylabel('Thevenin Voltage----->');
title('Thevenin Voltage v\s Time');
%To plot the graph3
plot(Il);
xlabel('Time----->');
ylabel('Load current----->');
title('Load current v\s Time');
```

OUTPUT:

```
Enter the value of voltage source S:
10
Enter the value of current source I:
8
Enter the resistances R1,R2,R3:
2
4
2
The voltages at the nodes 1,2,3,4,5 are:
  -31.6000

   10

  -38

  -16

    0
The Thevenin voltage is:
   15.6000

The short circuit current is:
   -5.3182

Hence the Thevenin resistance is:
    2.9333
```

This Rth remains constant for different values of load resistances.

The power dissipated by 4 ohm load (in watts) is:

20.2500

The equivalent Norton circuit has:

In=

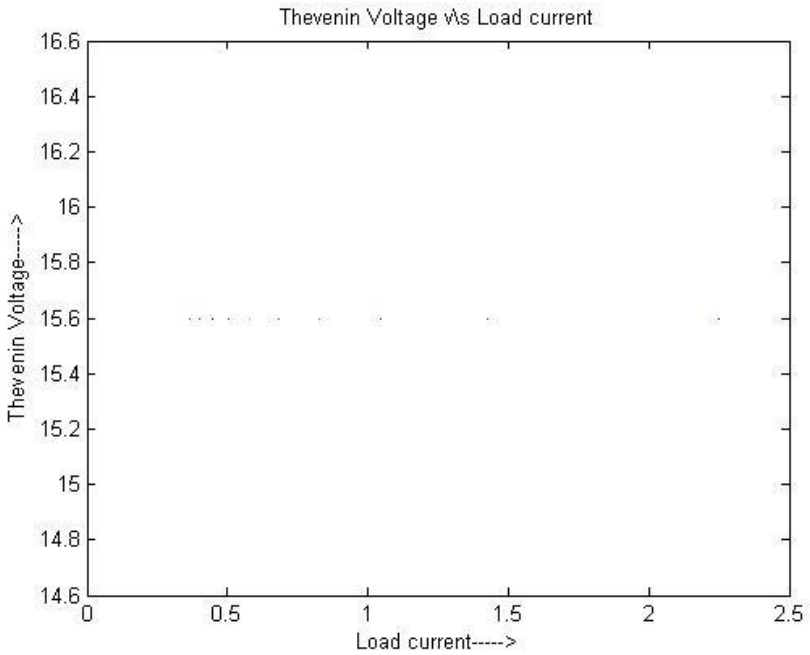
5.3182

Rn=

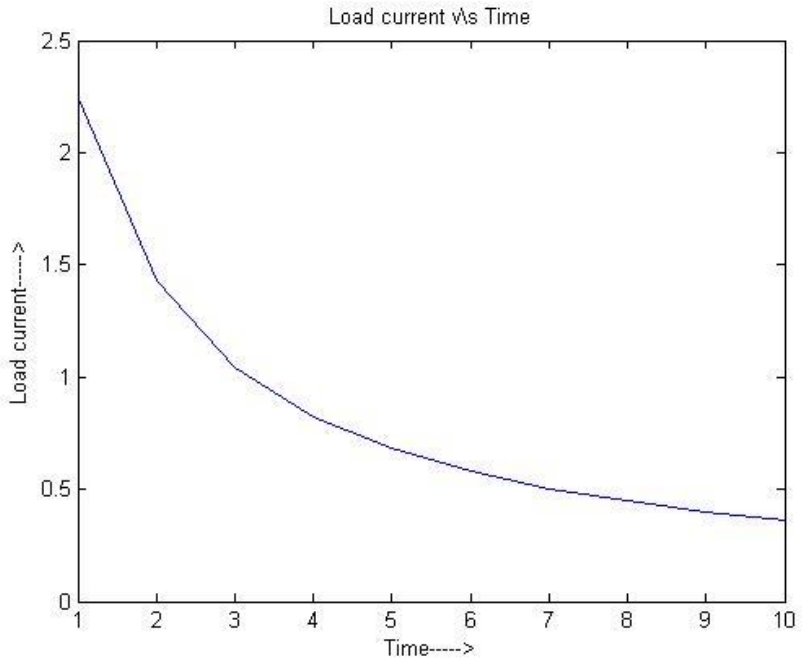
2.9333

GRAPHS:

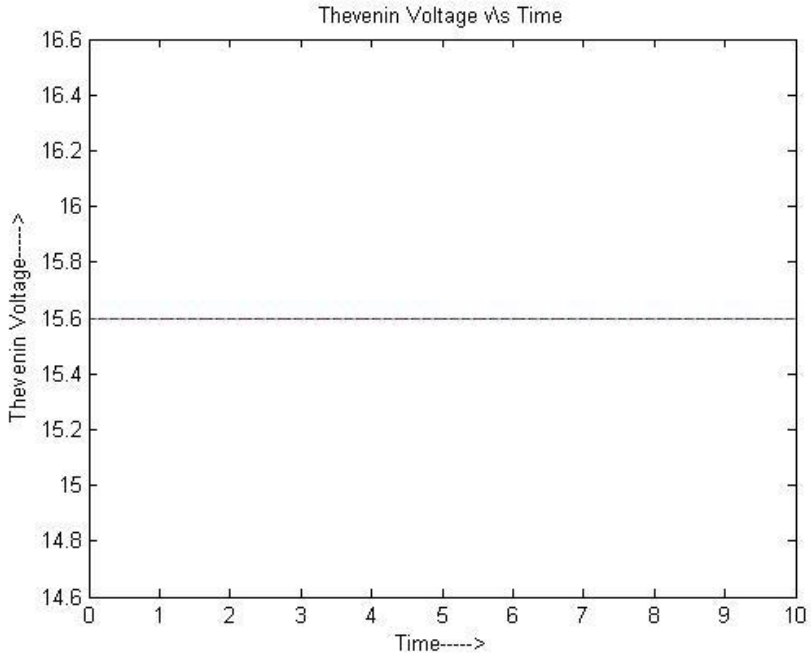
1. V_{TH} v\s I_L



2. I_L v\s t



3. V_{TH} v\s t



Question 4

CIRCUIT DIAGRAM:

1. **To calculate Thevenin Voltage:**

2. **To calculate Thevenin Resistance:**

PROGRAM CODE:

```
clear all;
close all;
clc;
%The circuit diagram is as shown.
disp('Enter the values of sources S1 and S2:');
S1=input('');
S2=input('');
R=zeros(1,6);
disp('Enter the resistors R1,R2,R3,R4,R5');
for i=1:5
    R(i)=input('');
end
%Let the 1st node be grounded
%To calculate Thevenin Voltage
V1=0;
V4=S1;
V5=S2;
x=[-1/R(3) 1/R(1)+1/R(2)+1/R(3);1/R(3)+1/R(4) -1/R(3)];
y=[V4/R(1);V5/R(4)];
v=inv(x)*y;
Vt=v(1);
disp('Thus the Vth is:');
disp(Vt);
%To calculate Thevenin Resistance
a=R(1)*R(2)/(R(1)+R(2));
b=a+R(3);
c=b*R(4)/(b+R(4));
d=c+R(5);
Rt=d;
disp('The Rth is:');
disp(Rt);
%Power dissipation by load
i=0;
for r=0:2:12
```

```
    i(1,(r/2)+1)=Vt/(Rt+r);
end
r=[0 2 4 6 8 10 12];
disp('Power dissipated varies as:');
P=(i.^2).*r
plot(r,P);
xlabel('Load Resistance');
ylabel('Power dissipated');
disp('Maximum power dissipated is: 9.3750 Watts');
disp('Maximum power is dissipated at 6 ohms load');
```

OUTPUT:

Enter the values of sources S1 and S2:

12

36

Enter the resistors R1,R2,R3,R4,R5

3

6

2

12

3

Thus the Vth is:

15

The Rth is:

6

Power dissipated varies as:

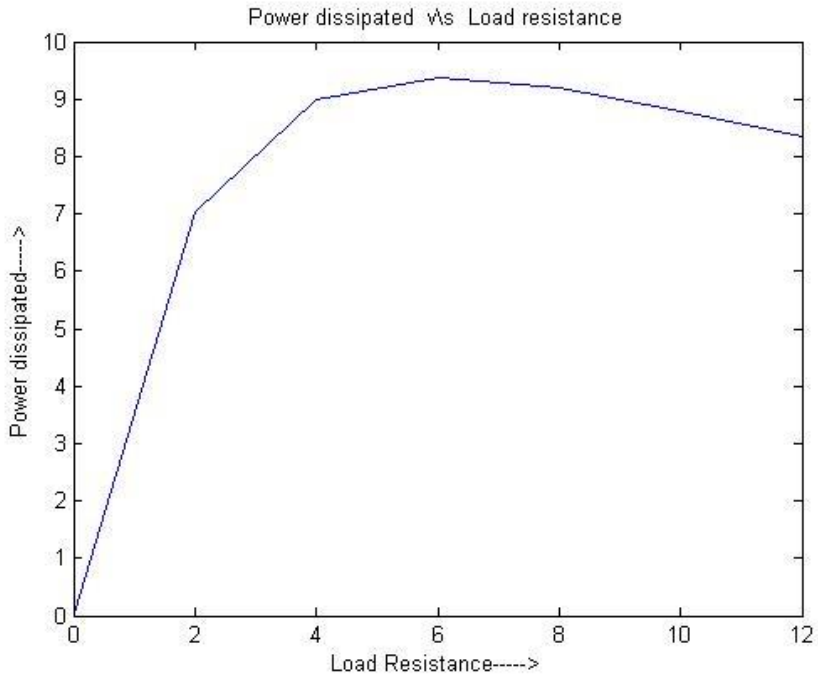
P =

0 7.0313 9.0000 9.3750 9.1837 8.7891 8.3333

Maximum power dissipated is: 9.3750 Watts

Maximum power is dissipated at 6 ohms load

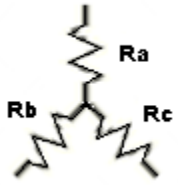
GRAPH:



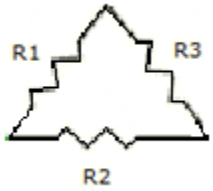
Question 5

CIRCUIT DIAGRAM:

Wye network



Delta network



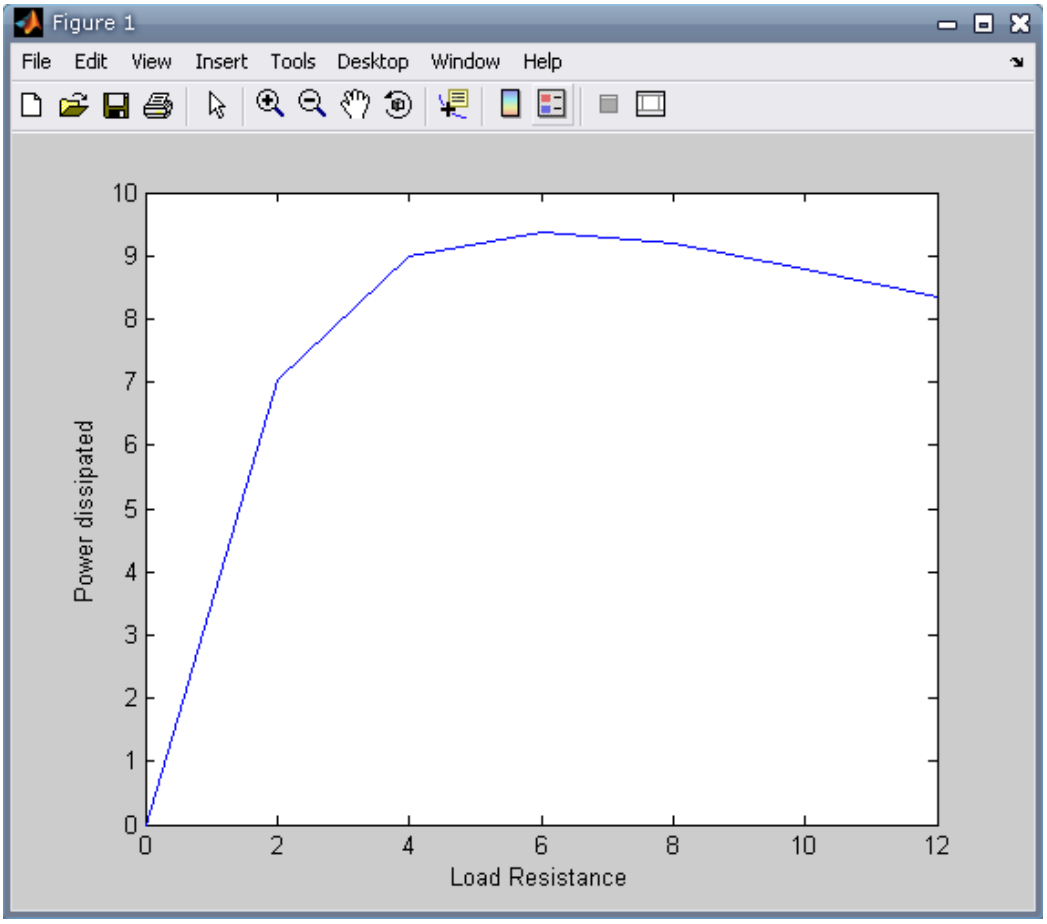
PROGRAM CODE:

```
clear all;
close all;
clc;
n=input('Choose: \n1. delta-wye \n2. wye-delta \n');
if n==1
d=input('Enter the value of R1, R2, R3 of Delta connected circuit :\n');
s=sum(d);
w(1,1)=d(1,1)*d(1,3)/s;
w(1,2)=d(1,1)*d(1,2)/s;
w(1,3)=d(1,2)*d(1,3)/s;
disp('The Ra, Rb, Rc of Wye connected circuit are :');
disp(w);
elseif n==2
w=input('Enter the value of Ra, Rb, Rc of Wye connected circuit :\n');
s=w(1,1)*w(1,2)+w(1,2)*w(1,3)+w(1,1)*w(1,3);
d(1,1)=s/w(1,3);
d(1,2)=s/w(1,1);
d(1,3)=s/w(1,2);
disp('The R1, R2, R3 of Delta connected circuit are :');
disp(d);
end
```

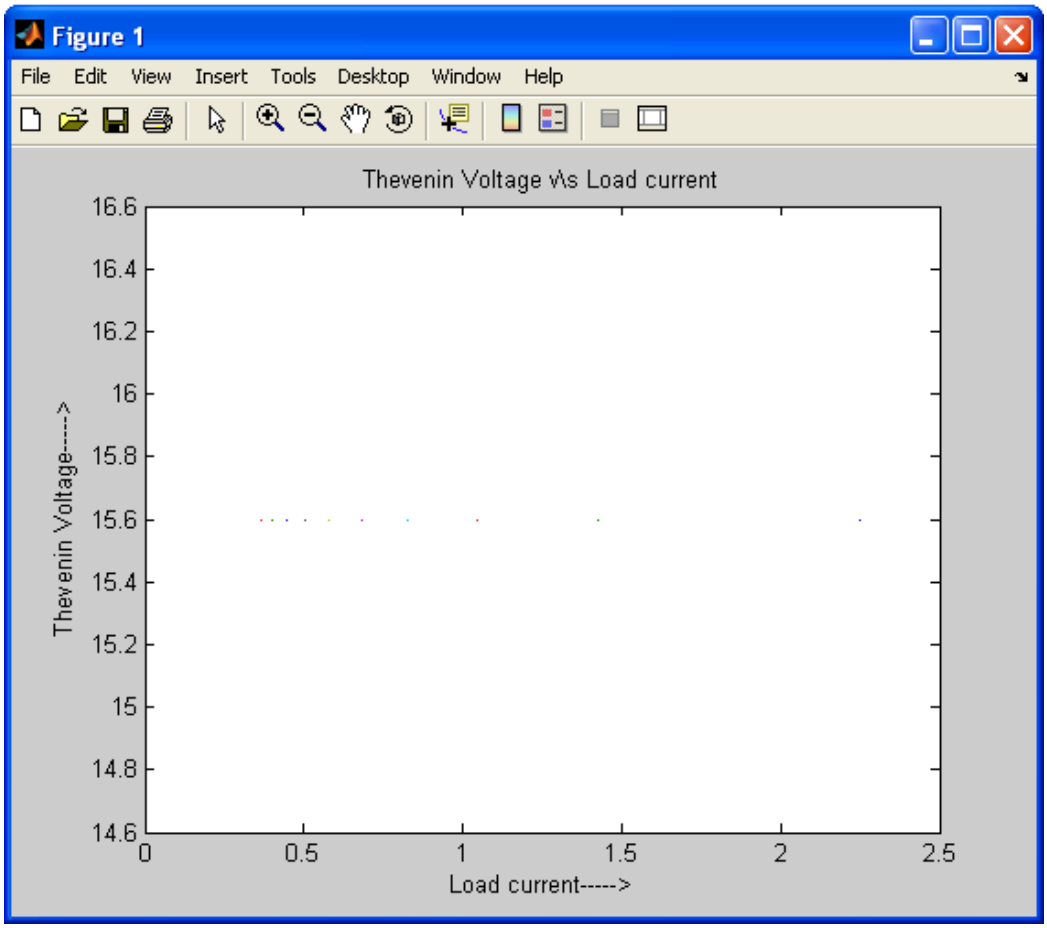
OUTPUT:

```
Choose:

1. delta-wye

2. wye-delta

1

Enter the value of R1, R2, R3 of Delta connected circuit :

[1 2 3]

The Ra, Rb, Rc of Wye connected circuit are :

   0.5000    0.3333    1.0000


Choose:

1. delta-wye

2. wye-delta

2

Enter the value of Ra, Rb, Rc of Wye connected circuit :

[1 2 3]

The R1, R2, R3 of Delta connected circuit are :

   3.6667   11.0000    5.5000
```

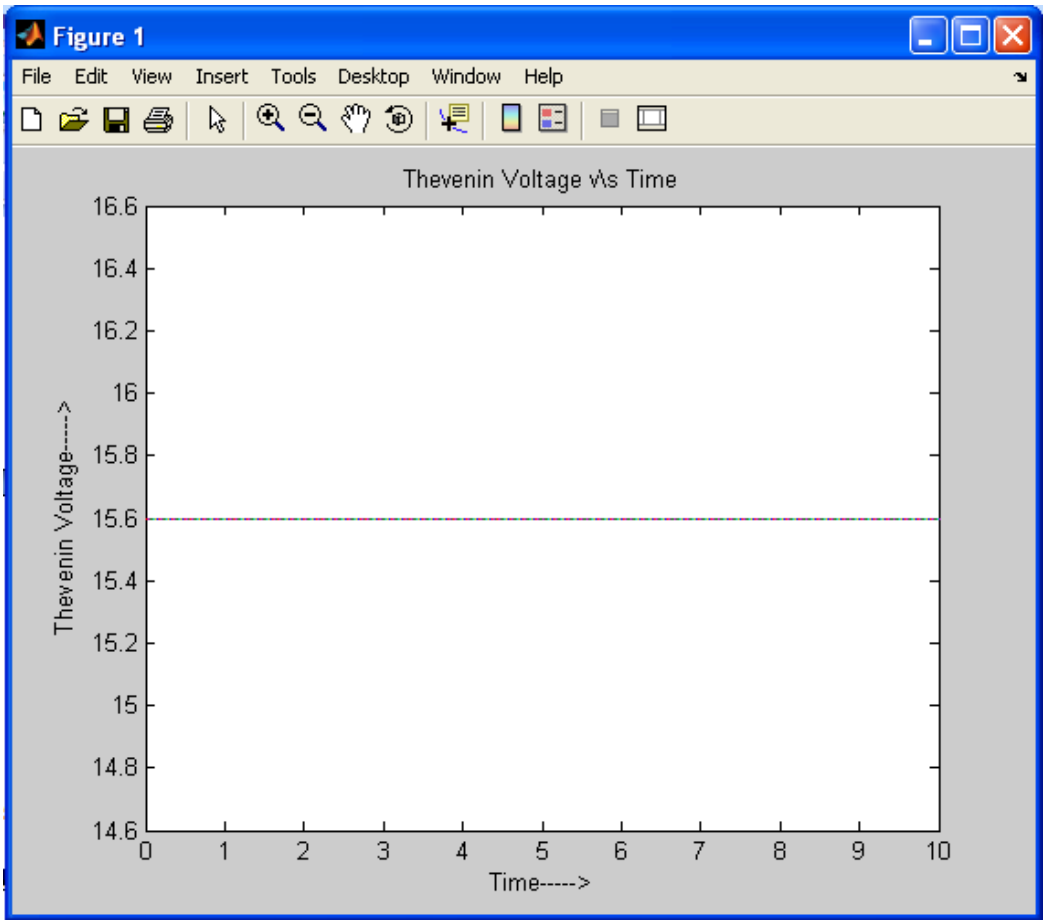
GRAPH: (Program 4)



GRAPH: (Program 3)



GRAPH: (Program 3)



GRAPH: (Program 3)