EASTERN MEDITERRANEAN UNIVERSITY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

EENG223

CIRCUIT THEORY I

# EXPERIMENT 7

# PSPICE

Student Name & Student Number

1…….....

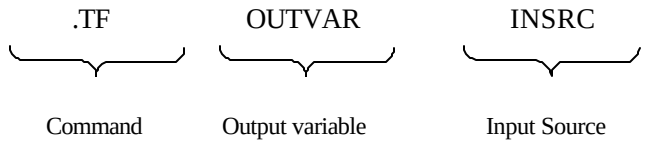
2……

3……

- **The .TF Control Statement**

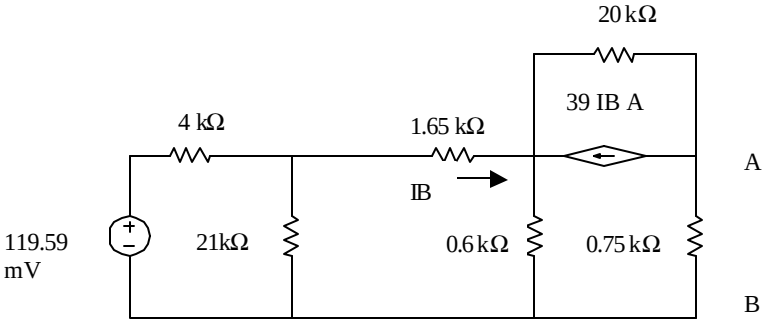
Computes three characteristics of the circuit
1. Ratio of the output variable to the input variable (transfer function gain).
2. The resistance with respect to the input source.
3. The output resistance with respect to the terminals of the output element.

.TF control statements contain three fields:



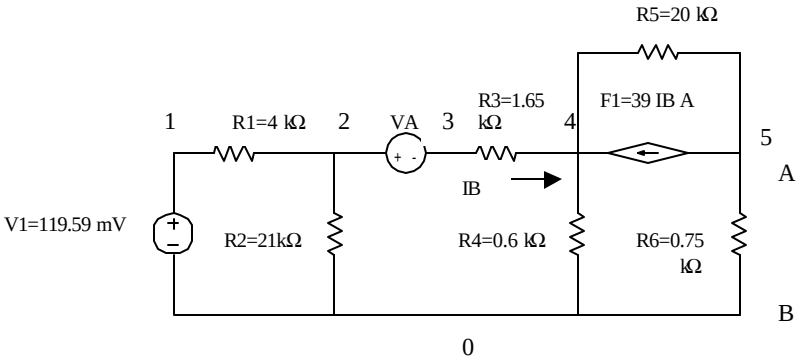

You may use the .TF control statement to find the Thevenin equivalent with respect to a designated pair of terminals.

Example 1: Write a Pspice program to find the Thevenin equivalent w.r.t. terminals A,B.




SOLUTION OF EX1
```
V1  1  0   DC      119.59e-3
R1   1 2   4e3
R2   2 0   21e3
VA  2  3   DC      0
R3   3 4   1.65e3
R4   4 0   600
R5   4 5   20e3
F1   5 4   VA      39
R6   5 0   750
.TF   V(5,0)       V1
.END
```

The following circuit prepared for Pspice analysis.

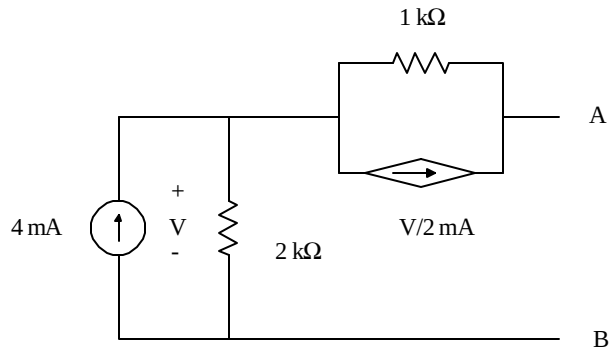



*** SMALL SIGNAL CHARACTERITICS

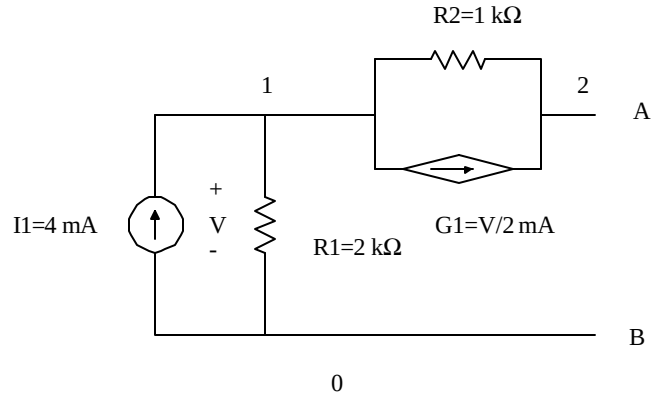
V(5,0)/V1=-8.359E-01
INPUT RESISTANCE AT V1=1.5235E+04
OUTPUT RESISTANCE AT V(5,0)=7.446E+02

VOC=(V(5,0)/V(1))xV(1)=-0.1
$R_{TH}$=OUTPUT RESISTANCE=7.446E+02

Example 2:
Write a Pspice a program to find the Thevenin equivalent circuit w.r.t. terminals A,B.




The following circuit prepared for Pspice analysis




SOLTION OF EX2

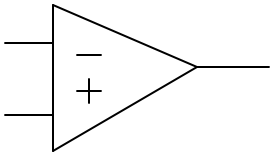
```
I1      0  1   DC     4M
R1      1  0   2K
R2      1  2   1K
G1      1  2   1  0   0.5M
.TF    V(2,0) I1
.END
```

***SMALL-SIGNAL CHARACTERISTICS
V(2,0)/I1=3.000E+03
INPUT RESISTANCE AT I1=2.000E+03
OUTPUT RESISTANCE AT V(2,0)=4.000E+03

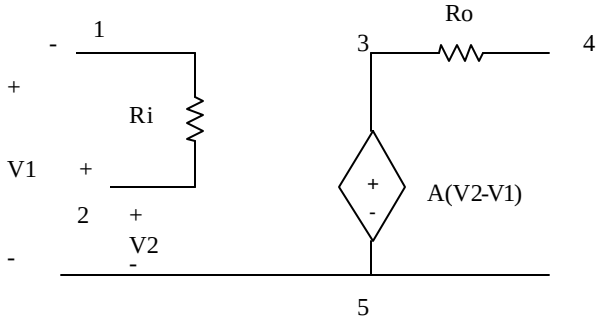
Voc=(V(2,0)/I1)xI1=3.000E+03(4.000E-03)=12 V
$R_{TH}$= OUTPUT RESISTANCE AT V(2,0)=4.00E+03

**OPERATIONAL AMPLIFIERS**

- Modeling Op Amps with resistors and dependent sources.



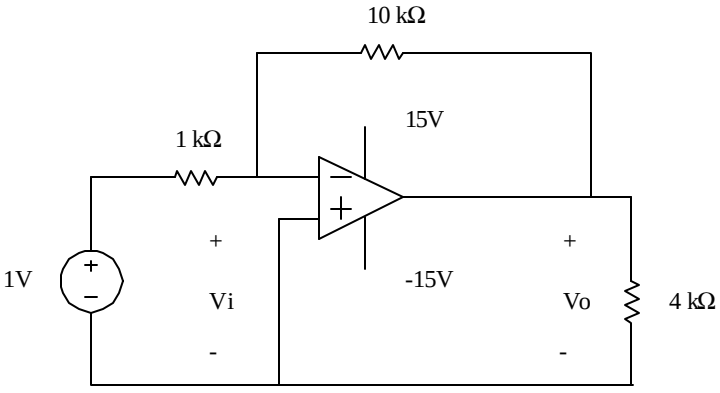
The equivalent circuit:

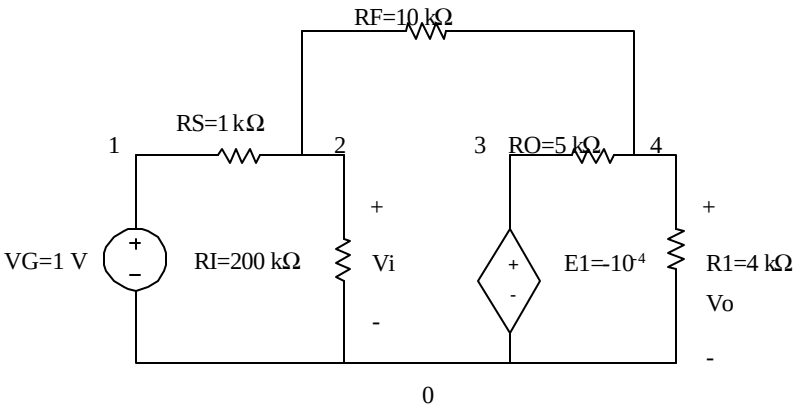



Pspice Description of equivalent circuit

| | | | |
|---|---|---|---|
| Ri | 1 | 2 | Value of Ri |
| Ro | 3 | 4 | Value of Ro |
| E*xxx* | 3 | 5 | 2 1 Value of A |

Example 3: Use Pspice to find Vi and Vo when Ri=200 kΩ, Ro=5 kΩ and A=$-10^4$.



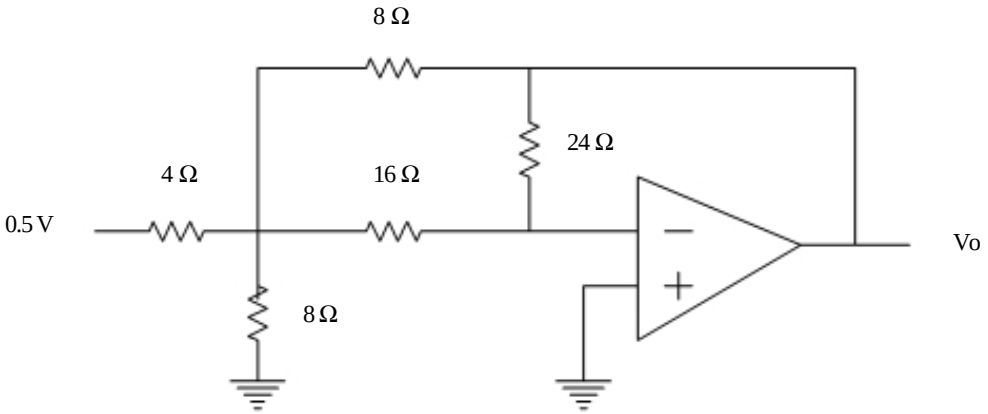




SOLUTION OF EX3

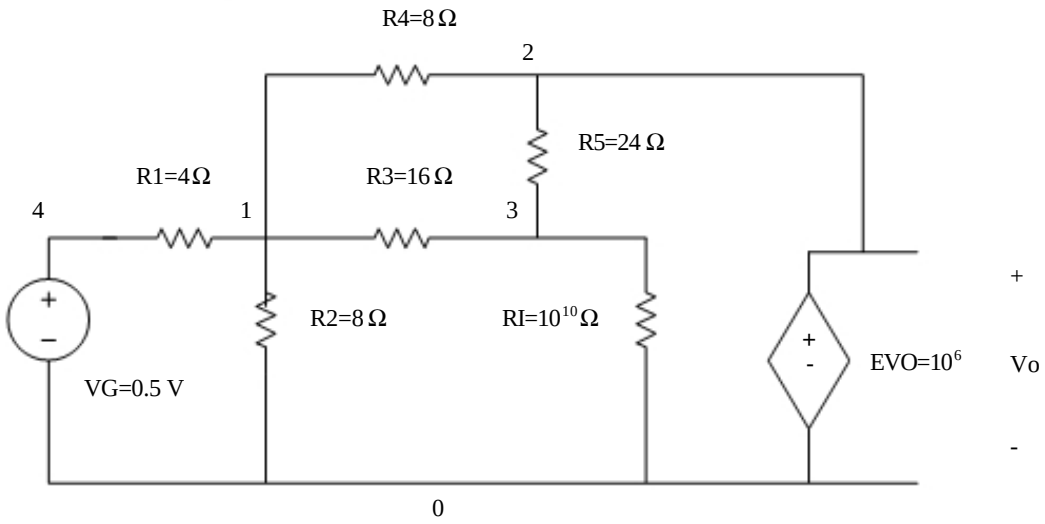
| | | | |
|---|---|---|---|
| VG | 1 0 | DC | 1 |
| RS | 1 2 | 1000 | |
| RI | 2 0 | 200e3 | |
| RF | 2 4 | 10e3 | |
| E1 | 3 0 | 2 0 | -10e3 |
| R0 | 3 4 | 5e3 | |
| R1 | 4 0 | 4e3 | |
| .DC | VG | 1 1 | 1 |
| .PRINT DC | | V(2,0) V(4,0) | |
| .END | | | |

V(2,0)=0.0027 V= Vi
V(4,0)=-9.969 V= V0

Example 4: (An idle opam).
Use Pspice to find Vo when opam is idle.




For an idle opam:
Ri Æ very large.
Ro Æ very small (0).
A Æ very large.




SOLUTION OF EX 4

```
VG      4   0    DC      0.5
R1      4   1    4
R2      1   0    8
R3      1   3    16
R4      1   2    8
R5      2   3    24
RI      3   0    1E10
EVO     2   0    3   0    1E6
.DC   VG        0.5  0.5          1
.PRINT  DC   V(2,0)
.END
```

V(2,0)=-2.500E-01