Module: Electricity

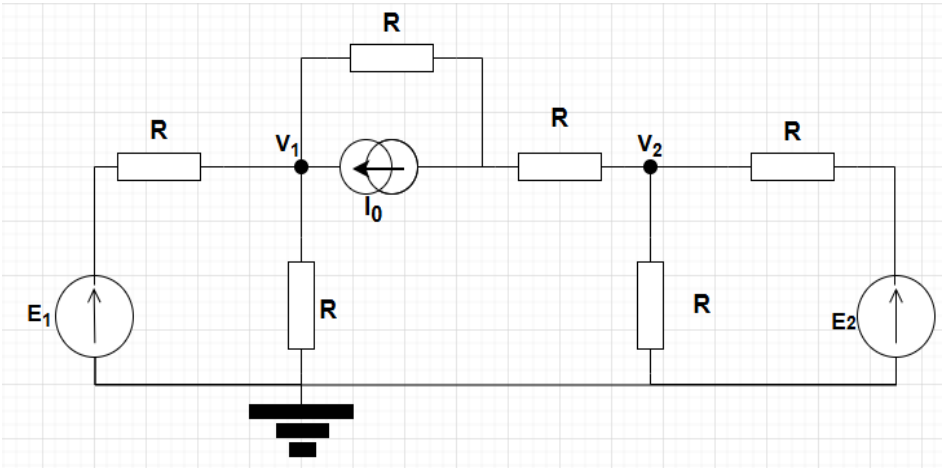
Tutorial Worksheet No. 5:

Duration: 3 weeks (one method / week)

Exercises to do in class: 1 , 2

Assignment to submit: 3

Exercise 1:



Part A

Find the voltages V1 and V2 using the following methods:

- The mesh current method
- The nodal voltage method
- The superposition method

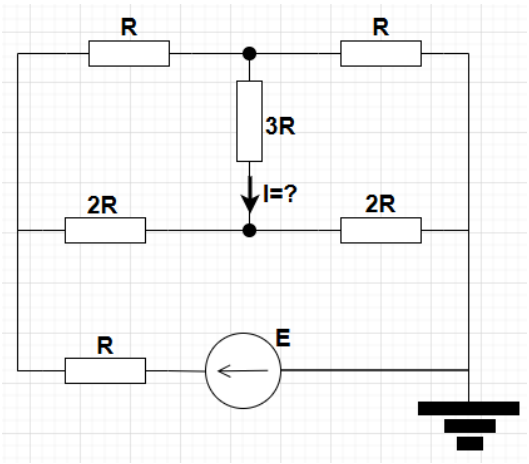
We have :

$\boldsymbol{E_1 = 20\sqrt{2}\sin(\omega t)}$ **[V]**

$\boldsymbol{E_2 = 10\sqrt{2}\sin(\omega t)}$ **[V]**

$\boldsymbol{I_0 = 3\sqrt{2}\sin(\omega t)}$ **[A]**

$\boldsymbol{R = 10}$ **[Ω]**



Part B

Find the current I using the following methods:

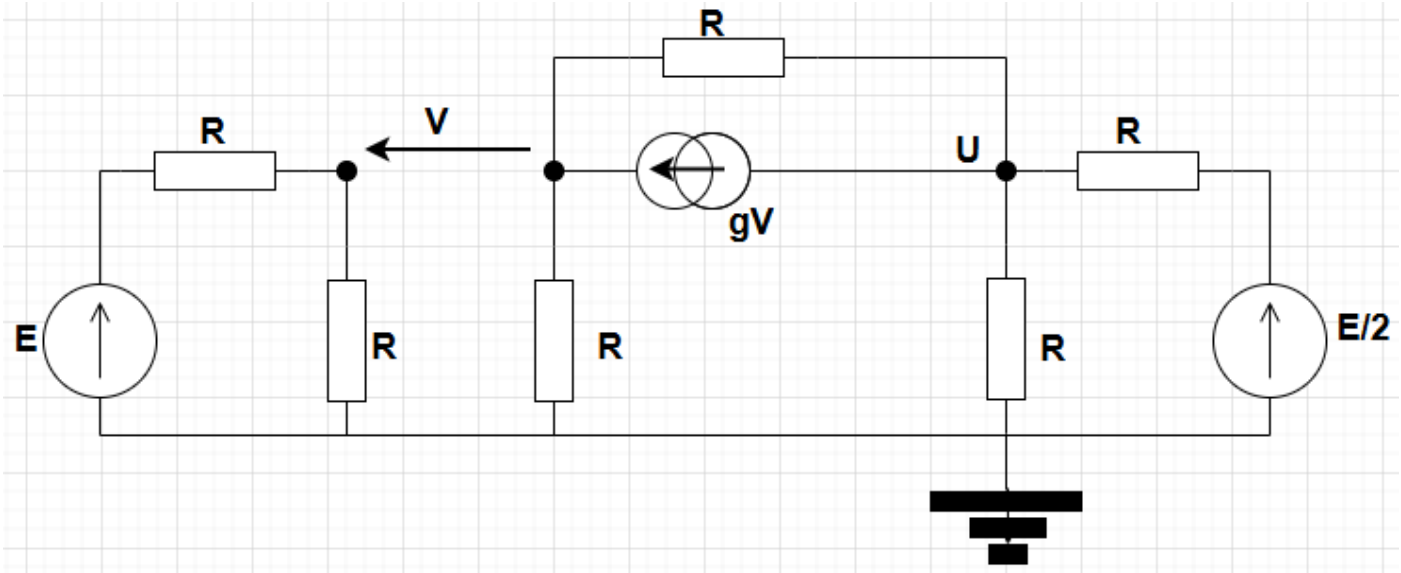
- The mesh current method
- The nodal voltage method

Exercise 2:

Consider the circuit below, composed of two voltage sources with RMS values E and E/2, a voltage-controlled current source (VCCS) with voltage V (with a gain g = 20/R), and 6 identical resistances of value R.

Find the voltage U using:

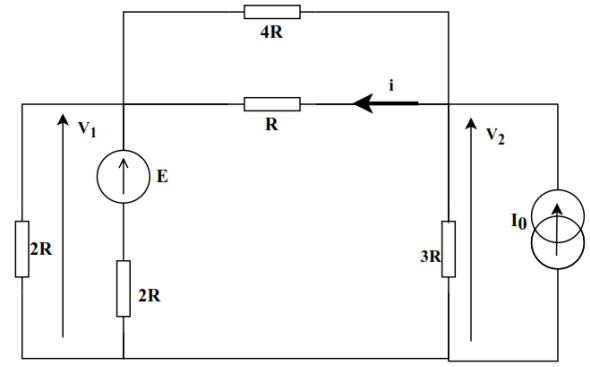
- The mesh current method
- The nodal voltage method
- The superposition method

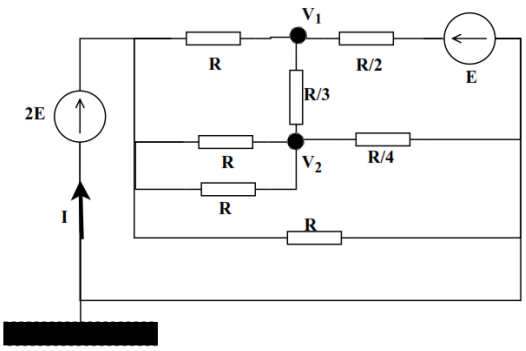


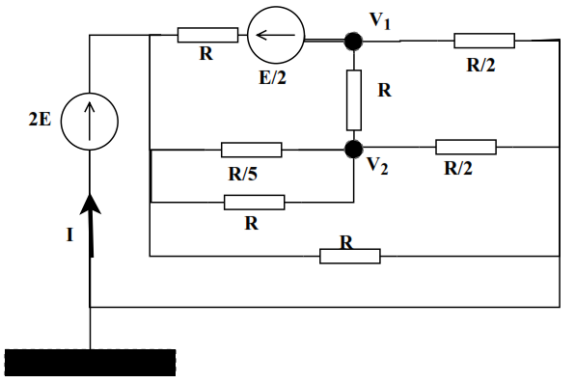
Exercise 3:

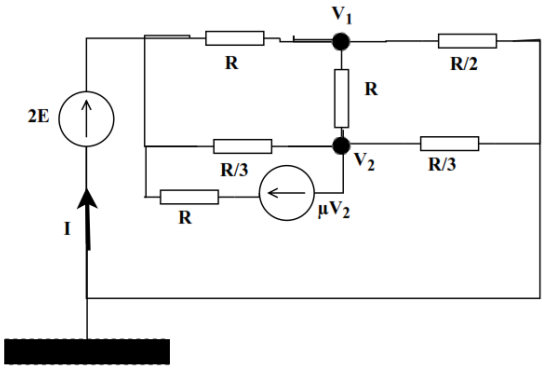
Given the 13 circuits below to analyze. Calculate the current i for each circuit using:

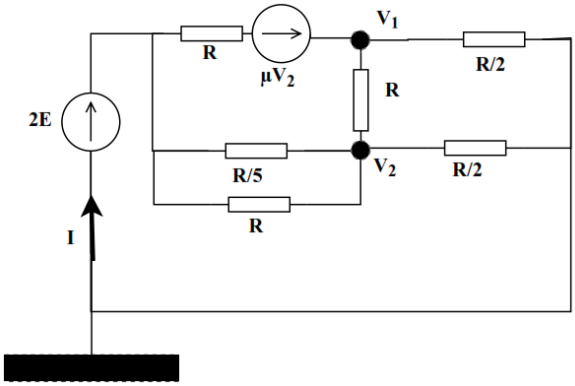
1. The mesh current method
2. The nodal voltage method
3. The superposition method

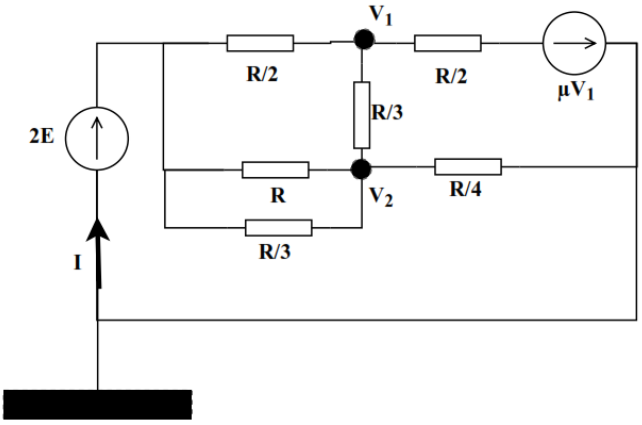


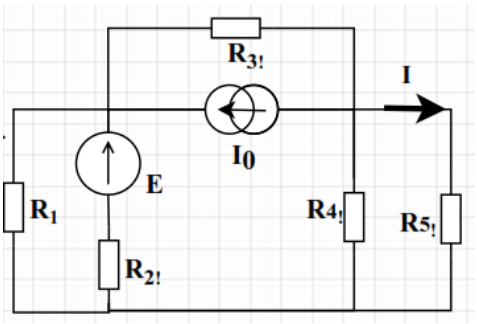


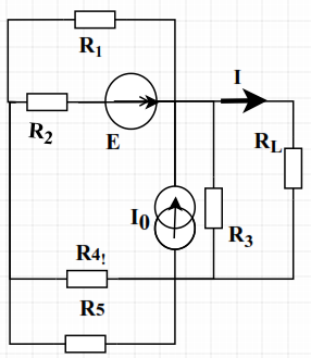


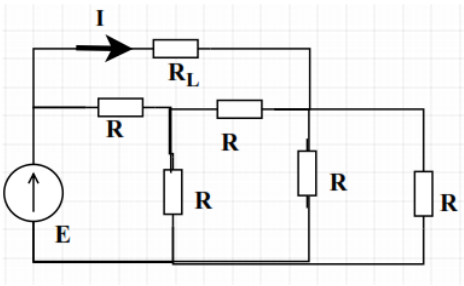


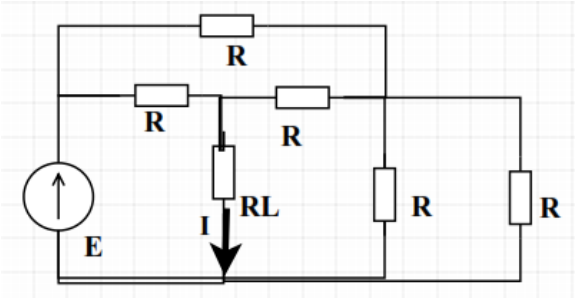


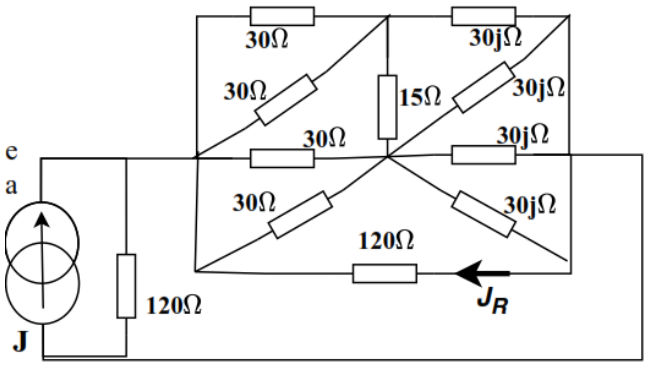


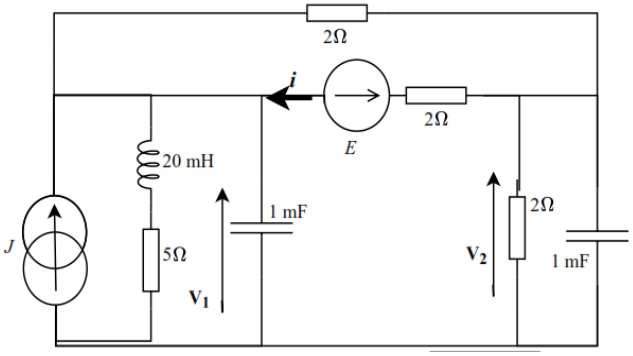


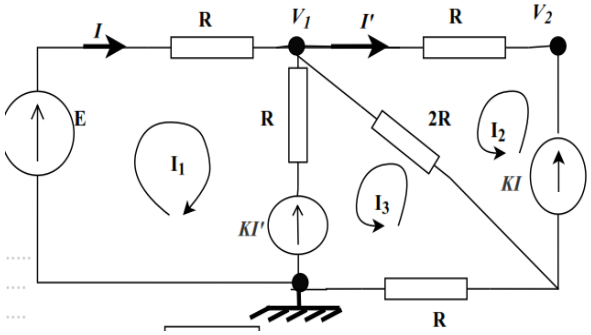












Exercise 4:

Find the current I using the following methods:

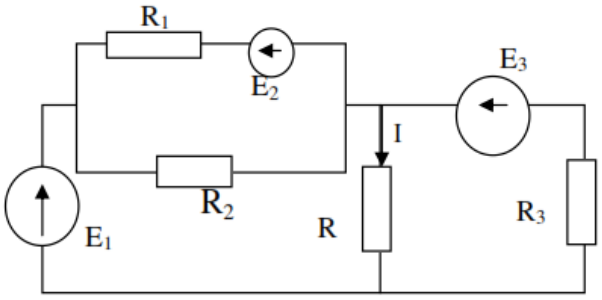
Circuit 1

$E_1 = E_2 = 10V$

$R_1 = R_3 = 10\ k\Omega$

$R = R_2 = 5\ k\Omega$

$E_3 = 5V$



Circuit 2

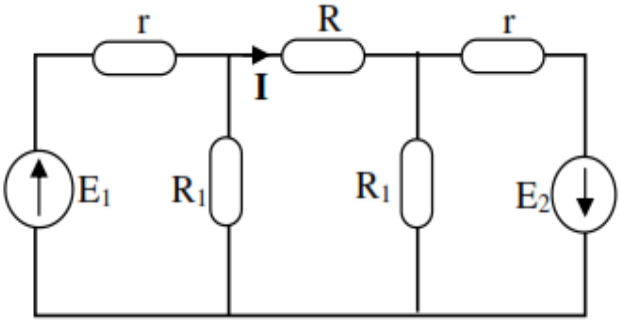
$E_1 = 1\ V$,

$E_2 = 2V$,

$r = 500\Omega$,

$R = 1\ k\Omega$,

$R_1 = 1{,}5\ K\Omega$;



Circuit 3

$E = 10V$,

$I_0 = 0.1\ A$,

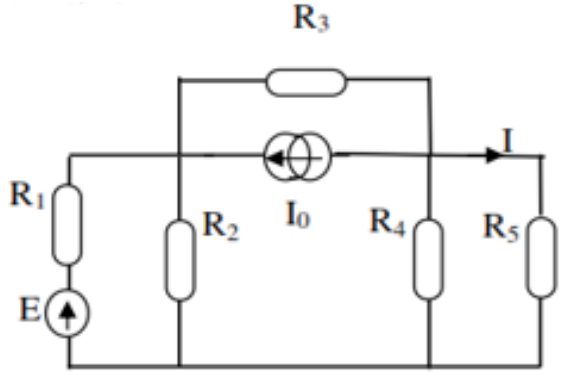
$R_1 = 10\Omega$,

$R_2 = 15\Omega$,

$R_3 = 8\Omega$,

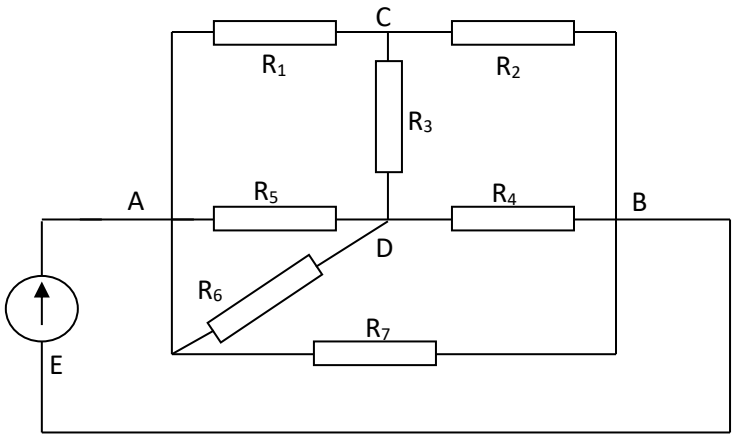
$R_4 = 14\Omega$,

$R_5 = 5\Omega$



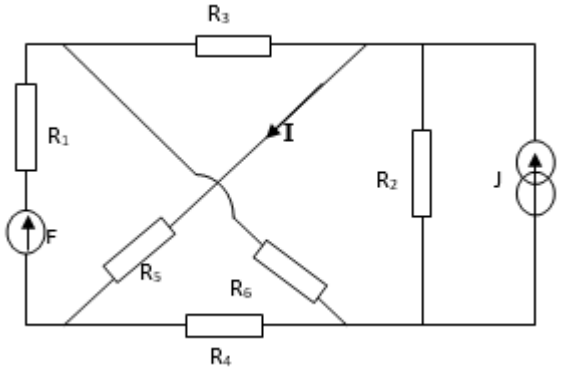
Circuit 4

E= 12 [V]
Ri = R
I_{R3} = ?



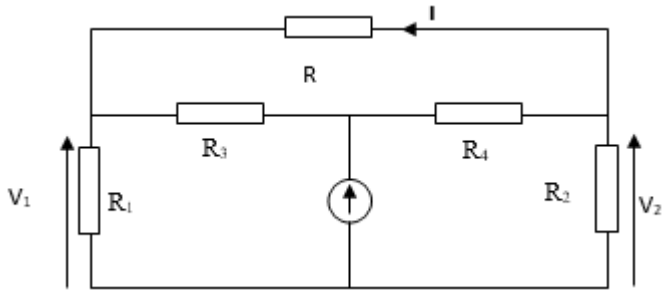
Circuit 5

$R_1 = 0{,}2\ k\Omega$ E = 0,1mV
$R_2 = R_6 = 1\ k\Omega$ J = 10 mA
$R_3 = 2\ k\Omega$
$R_4 = 0{,}5\ k\Omega$
$R_5 = 3\ k\Omega$



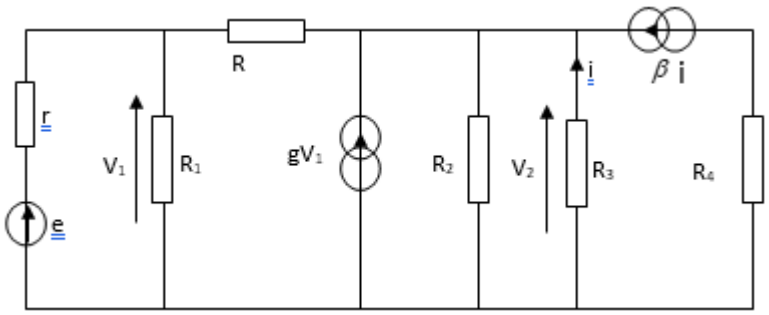
Circuit 6

$R_1 = 1\ k\Omega$ $R_2 = 0{,}5\ k\Omega$, $R_3 = 0{,}33\ k\Omega$, $R_4 = 0{,}25\ k\Omega$
$R = 0{,}1\ k\Omega$, e=12,4 V



Circuit 7

$r = 10\ \Omega$, $R_1 = 2\ k\Omega$, $R_2 = R_3 = 5\ k\Omega$,
$R = 1/g = 1\ k\Omega$, e = 1 V, $\beta = 50$



Circuit 8