Lab nr 01
Thevenin and Norton equivalents

Golas:
The purpose of this lab is for you to gain familiarity with the Thevenin's and Norton's theorems. A secondary purpose of this experiment is to use the Thevenin equivalent circuit to study the principle of maximum power transfer.

Warning:
Do not energize a circuit until your instructor checks it.
Remove all power before making changes in a circuit.

1 Experiment
1.1 Connect the circuit shown in Figure 1 (use power supply Nr 1).
1.2 Measure output voltages for two different values of load resistor (decade resistor).
1.3 Calculate the parameters of Thevenin and Norton equivalent circuits.
1.4 Repeat procedures 1.1, 1.2 and 1.3 for the power supply Nr 2.
1.5 As a last step of the experiment examine the power delivered from the supply to the load. Ask instructor which power supply is to be examined. For the chosen power supply connect the circuit shown in Figure 1. For different values of the load resistor (decade resistor) measure the voltage on it and calculate the power transferred to the load. Draw the function $P_{Load} = P_{Load}(R_{Load})$ and find maximum power dissipated in R_{Load}. Compare the values of Thevenin resistance with the load resistance for which maximum power is transferred from the power supply.
1.6 Estimate the input impedance of the voltmeter used.
1.7 Connect the circuit shown in Figure 2.
1.8 Measure Thevenin voltage.
1.9 Connect the circuit shown in Figure 3.
1.10 For different values of the load resistor R and capacitor C measure U_R voltage values and determine the parameters of Thevenin equivalent circuit.

2 Background
2.1 Thevenin's theorem and its applications.
2.2 Norton's theorem.
2.3 Ohm's Law and Kirchhoff's Laws.
2.4 Principle of maximum power transfer.
2.5 Phasors.

Literature

[1] R. C. Dorf Ed. *The Electrical Engineering Handbook*
[2] P. Horowitz, W. Hill, *The Art of Electronics.*
[3] S. Hamilton *An Analog Electronics Companion.*
[4] R.P. Feynman, R.B. Leighton, M. Sands, The *Feynmana Lectures on Physics, Vol.-II, Chapter 22.*

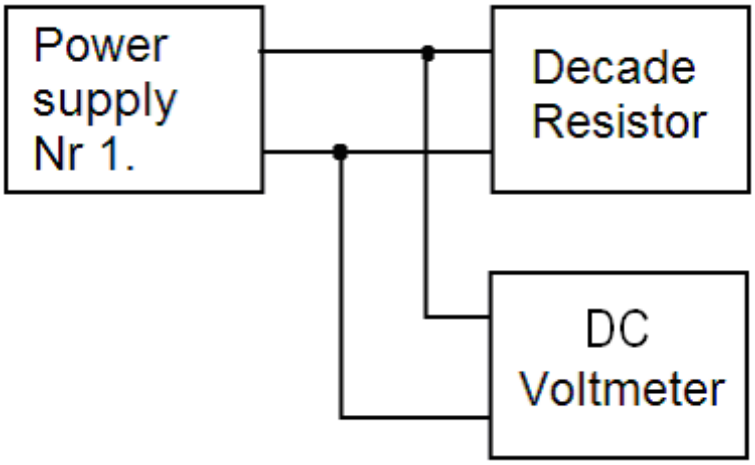

Fig.1. Scheme of the circuit used to study Thevenin's Theorem in the case of DC power supply.

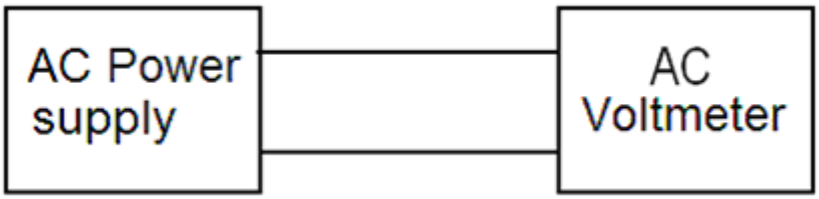

Fig.2. Scheme of the circuit used to measure Thevenin's Voltage in the case of AC power supply.

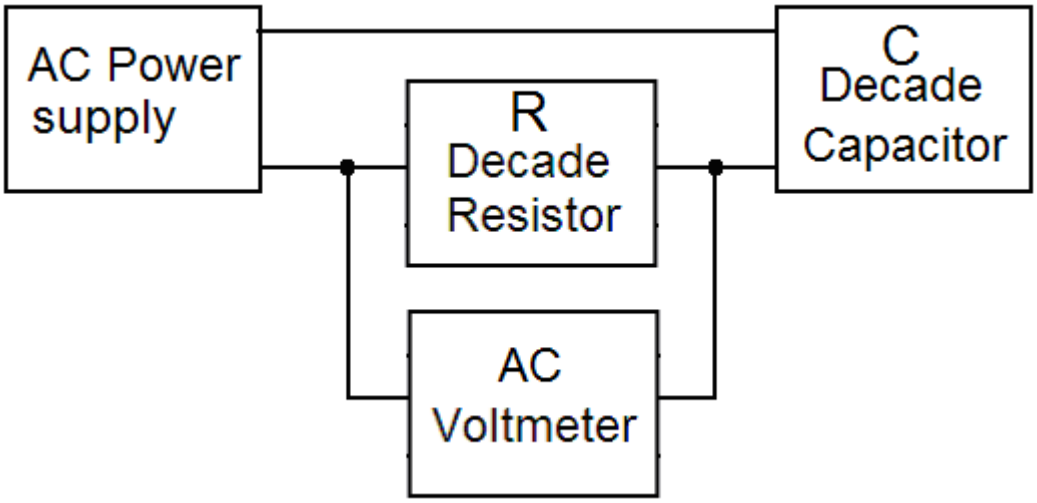

Fig.3. Scheme of the circuit used to determine Thevenin's (and/or Norton's) equivalent circuit of the AC power supply.