# Lab nr 05
# TETRODE AND PENTODE TUBES

**Golas:** The purpose of this lab is for you to gain familiarity with the vacuum tubes and measuring of static characteristics of tetrode and pentode.

**Warning:** The power supplies produce voltages up to 500V. Please do not touch metallic parts of the circuit when the power supplies are switched on.

## 1 Experiment

1.1 Built the measuring system shown in Fig. 1.
1.2 Measure the following:
a) Tetrode. $Ia = f(Ua)$, with $US2 = const.$, $US1 = const.$
b) Pentode. $Ia = f(Ua)$, with $US2 = const.$, $US1 = const.$
c) Pentode. $Ia = f(US1)$, with $Ua = US2 = const.$
d) Pentode. $IS2 = f(Ua)$, with $US2 = const.$, $US1 = const.$
Based on the maximum admittance power of anode and grid choose the voltage range to use.
1.3 Draw the functions pointed out in 1.2 and find the parameters of the tube by graphic method. Based on the obtained data verify the equation of the tube. Explain how the dynatron effect is eliminated in the pentode.

## 2 Background

2.1 Electron emission (Thermionic emission In details).
2.2 Vacuum tubes (I/V characteristics).
2.3 Parameters and applications of vacuum tubes.
2.4 Gas containing tubes.

## Literature


[1] J. Hennel *Lampy elektronowe.*
[2] A. M. Boncz-Brujewicz *Zastosowanie lamp elektronowych w fizyce doświadczalnej.*
[3] I.P. Żerebcow *Radiotechnika.*
[4] Własow *Lampy elektronowe.*
*[5] http://www.one-electron.com/Misc_Docs.html*
[6] http://www.fonar.com.pl/audio/teoria/podstawy/wzm1/wzm.htm
[7] http://studentweb.eku.edu/justin_holton/svetlana/tubeworks.html
[8] http://mysite.du.edu/~etuttle/electron/elect27.htm
[9] http://www.techretriever.org/topics/Pentode?PHPSESSID=62oc1v8fjfc8tcgnvno7l7s9s0
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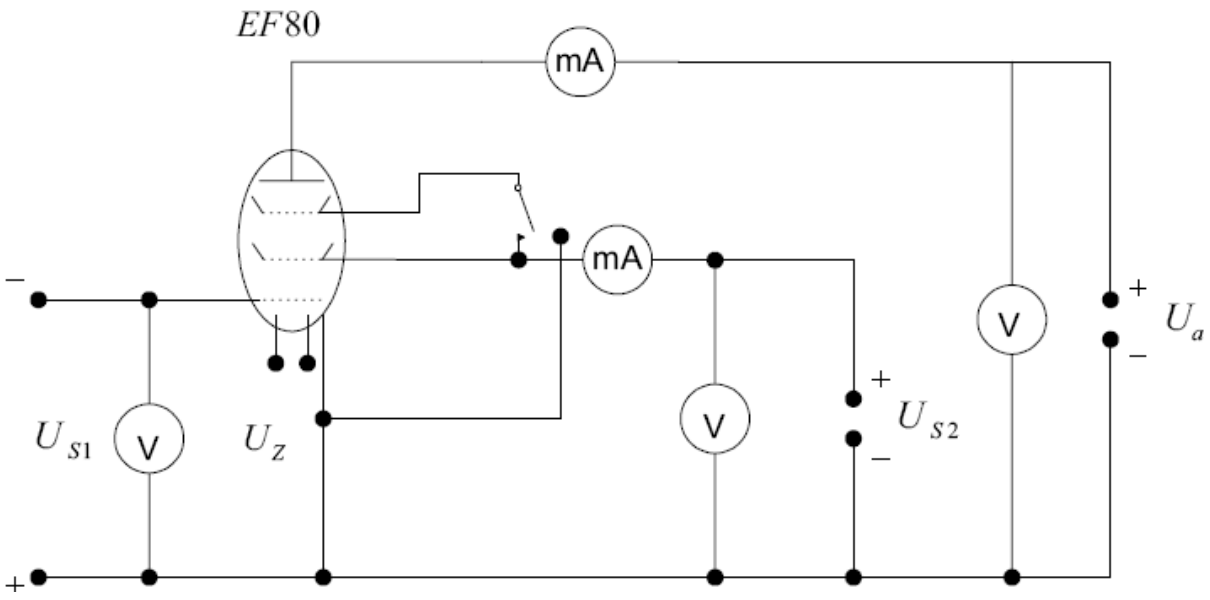


Fig.1: Scheme of the circuit for the measurement of the static characteristics of tetrode and pentode.

Definitions:

$U_a$ - Plate (anode) to cathode voltage.
$I_a$ - Plate current (anode current)
$U_s$ - grid to cathode voltage.

Tube parameters.
Dynamic plate resistance: $r_a = \Delta U_a/\Delta I_a$ with constant grid voltage $U_s$ ($\Delta$ - symbol for change).
Transconductance: $g_m = \Delta I_a/\Delta U_s$ with constant plate voltage $U_a$.
Amplification factor: $\mu = \Delta U_a/\Delta U_s$ with constant plate current $I_a$.

There is a relationship between amplification factor $\mu$, plate resistance $r_a$ and transconductance $g_m$ : $\mu = r_a \times g_m$.

Gain = $(\mu \times R_a)/( r_a+R_a)$ where $R_a$ is anode resistor resistance.