BASICS –
- Measurements of electrical signals basic parameters

1. Objectives

The aim of the exercise is:
- measurements of resistance, capacitance and inductance,
- measurements of voltages and currents,
- learning how to use the oscilloscope, as the primary instrument for measuring signals variable in time parameters,
- getting acquainted with the basic signal generator and arbitrary.

2. Tasks

2.1. Measurements of elementary parameters of basics electronic components

a) every student receives a resistor form the teacher
b) each student reads the resistance value (color coding or description) and notes it,
c) each member of the group, using multimeter available at the workplace, measures assigned resistor - the results should be noted (pay attention to the measurement method, determine the impact on the measurement results caused by keeping a resistor in the hands)
d) for selected by teacher capacitor or coil, the task of the group is to read the values of capacitance or inductance on the basis of the markings on the housing,
e) each group measures the capacitance or inductance (if possible, using multimeter available at the workplace, otherwise the multimeter ESCORT) and compares the results with the designation of the manufacturer; pay attention to the frequency of the measurement signal.

2.2. Measurements of voltages and currents

a) set the power supply available at the workstation to any voltage in the range of 5 - 15 V, and then measure the voltage using voltmeter and choosing the appropriate range – note the results,
b) for the available transformer measure the value (idling) of the effective voltage and medium voltage at the output of the secondary winding – note the results,
c) on the power supply set the voltage in the range of 5 - 10 V, then using the ammeter with the range 20 A measure maximum current capacity of source; compare indications of ammeter and ammeter built-in power supply, check the operation of current limiter.

2.3. Oscilloscope measurements

Connect the output of the generator to the oscilloscope.
a) generate a sine wave signal with an amplitude of 1 V and frequency of 1 kHz,
b) obtain a stable display of at least two periods of the signal (adjustment knob "time base") on the oscilloscope screen – in the absence of synchronization, check the trigger settings (trigger)
c) test different options for the channel settings:
- adjusting the amplification of the signal to get the largest waveform,

- for a stable image add offset (using generator) – observe what is happening on the oscilloscope screen when either the AC coupling (AC) and DC (DC) coupling is on – note down observations,
- with the generator on, get a horizontal line on the oscilloscope screen (select the internal input connection to GND) – with appropriate wheel center line position,

d) test triggers options:
- set the synchronization on the rising edge and then falling,
- test a single trigger mode - after completion of the acquisition by the oscilloscope, turn off the generator output (the button "Output") – if the acquisition has been carried out successfully despite the lack of image signal will remain visible on the screen,

e) measurement of waveforms parameters
- measure basic parameters of a stable image: amplitude, frequency, peak-to-peak value, effective value, the average value using the "measure" set of functions,
- using the "cursor" to perform measurements of peak-to-peak value and frequency and compare the obtained results,
- increase the amplitude of the signal to such an extent that the signal "does not fit" on the screen – check if the oscilloscope still correctly measures the signal parameters ("measure"),

f) recording the data from the oscilloscope
- Using the "save" to save the correct waveform on the storage media.

2.4. The signal generator

a) generate a square wave signal of 5 V, the minimum voltage value V_{min} = 0 V, a frequency of 1 MHz and the duty cycle factor D = 25%,
b) use the oscilloscope to measure rise time and fall time, and duty cycle factor,
c) to the second channel of the oscilloscope connect the generators second channel, using the same settings as channel 1, check the generator's function of adjusting the initial phase,
d) use the built-in arbitrary signals to generate the signal: $u(t) = |3 \sin (2\pi\ 1000\ t)|$ and then save it.

3. Readings

Data sheets of measurement equipment available on the workplace:
a) scope,
b) signal and arbitrary generator.