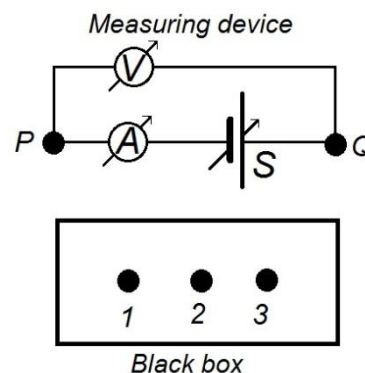


Experimental Problem no. 2 (10 points)

Electrical Black Box

This experimental problem propose an analysis for an electrical black box, which has three terminals - denoted by 1,2,3. To discover the elements that compose it, it is provided a measuring device comprising a voltage source variable (denoted by S), connected in series with an ammeter (denoted by A); the two terminals of the device are denoted by P and Q. To the same terminals P and Q is mounted a voltmeter (denoted by V). Ammeter and power supply have negligible internal resistance; internal resistance of the voltmeter can be considered as being infinite.



The terminals 1, 2 and P are placed in electrical contact. If terminals 3 and Q are also in electrical contact and the tension furnished by the source varies, pairs of values (indicated by the measuring instruments) are obtained. These data are given in the table 1. Current intensity is positive when the current passes through the ammeter from P to Q.

Table 1

U(V)	-6	-4	-2	0	2	4
I(A)	-0,2	1,2	2,6	4,0	5,4	6,8

Then, terminals 2, 3, P are putted in electrical contact. If and terminals 1, Q are also in electrical contact, the pairs of values indicated by the measuring instruments - where the voltage supplied by the source varies - are given in table 2.

Table 2

U(V)	0	2	4	6	8	10
I(A)	-5,2	-4,0	-2,8	-1,6	-0,4	+0,8

Finally, terminals 3, 1, P are putted in electrical contact. If terminals 2, Q are also in electrical contact, the pairs of values indicated by the measuring instruments - where the voltage supplied by the source varies - are given in table 3.

Table 3

U(V)	-6	-4	-2	0	2
I(A)	-0,6	0	0,6	1,2	1,8

Assume that all current-voltage dependencies are linear.

In this problem, calculation of errors is NOT requested.

Task 1

1.a. Plot current - voltage dependence for the data set in Table 1.

1.b. Determine the numerical values of the intersections with coordinate axes of the graph . Determine also the slope of graph outlined in task 1.a. If applicable, write the result as a fraction.

1.c. Plot current - voltage dependence for the data set in Table 2.

1.d. Determine the numerical values of the intersections with coordinate axes of the graph . Determine also the slope of graph outlined in task 1.a. If applicable, write the result as a fraction.

1.e. Plot current - voltage dependence for the data set in Table 3.

1.f. Determine the numerical values of the intersections with coordinate axes of the graph outlined in task 1.e . Determine also the slope of graph outlined in task 1.e. If applicable, write the result as a fraction.

Task 2

2.a. Determine the values of the electrical resistance of the resistors and electromotive force (emf) of ideal voltage sources that form the simplest circuit (a circuit triangle, delta, Δ), which has the behavior described by the above data. Keep in mind that the ideal voltage source connected in series with the resistor having the lowest electrical resistance, has an emf of 10V.

2.b. Draw the equivalent circuit diagram for black box. Write on diagram the values of electrical resistance and emf of the sources - as they results in the task 2.a.

Task 3

3.a. For the equivalent circuit that you have determined in the task no. 2, plot the current-voltage dependence, when the terminals P and Q are in electrical contact with terminals 1 and 2 respectively. Write numerical values of the intersections with the axes of coordinates of the graph plotted.

© Topic was proposed by:

Prof. Dr. Delia DAVIDESCU
Conf. Univ. Dr. Adrian DAFINEI

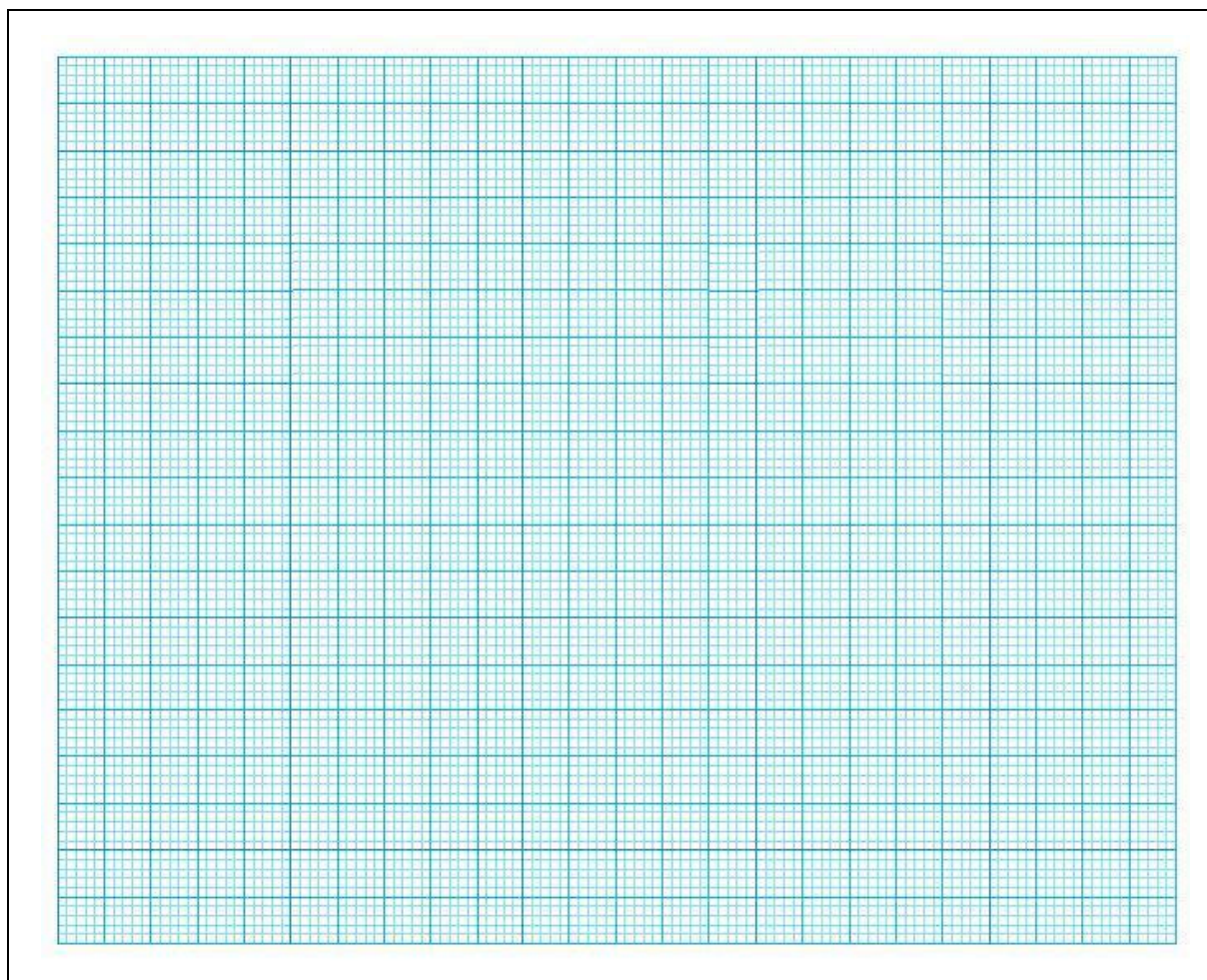
Answer sheet

Experimental Problem nr. 2 (10 points)

Electrical Black box

Task no. 1

1.a. Plotted current - tension characteristic for data in Table 1

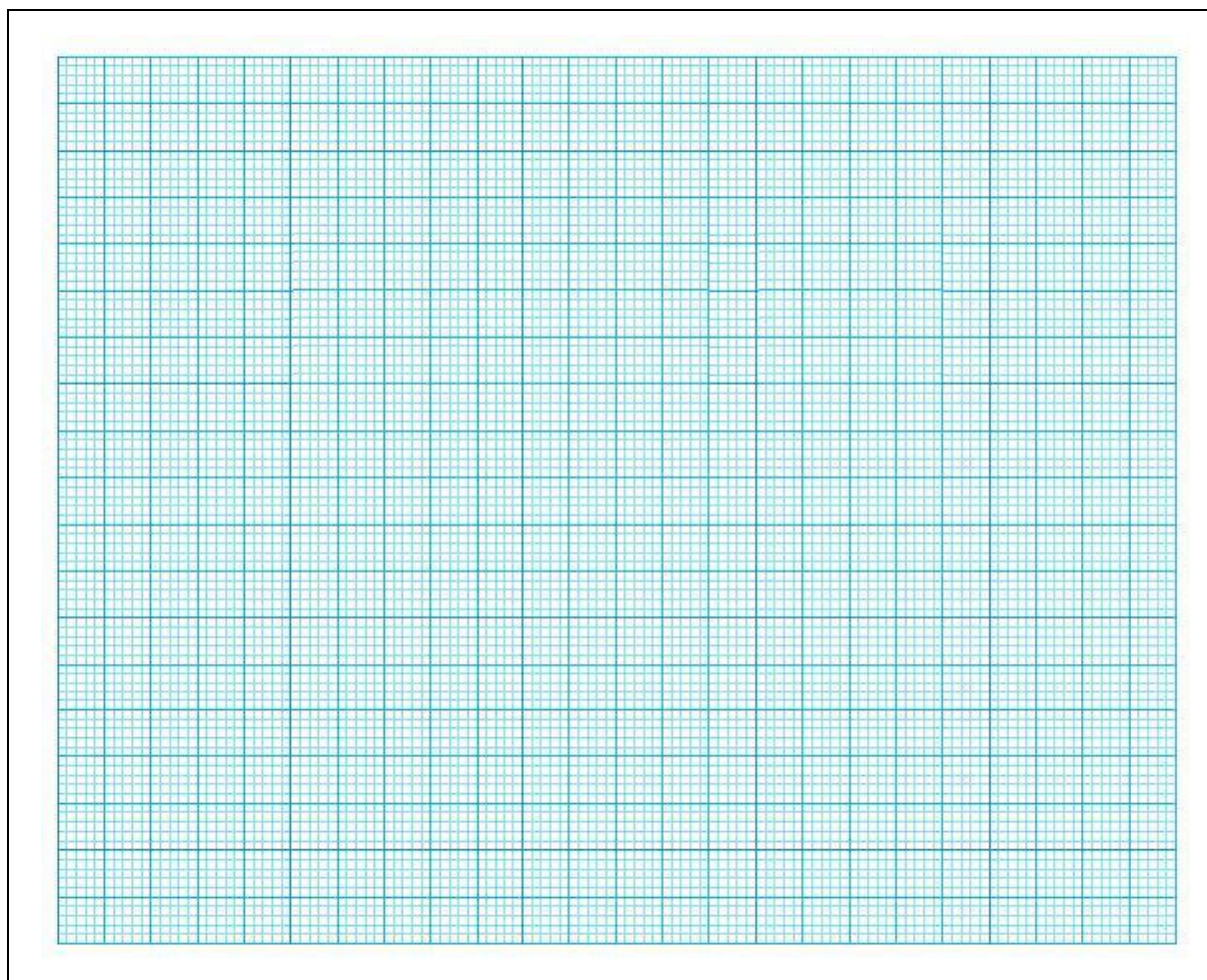


0,70p

1.b. Determined values of the intersection of current-voltage characteristic with the axes of coordinates. Determined value of the slope of line outlined in 1.a

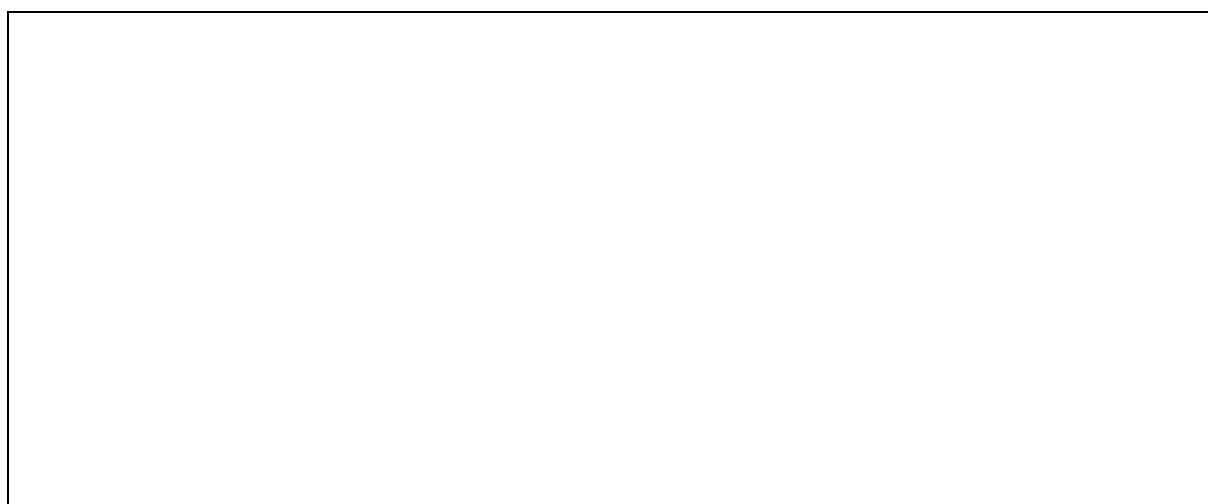
0,30p

1.c. Plotted current - tension characteristic for data in Table 2



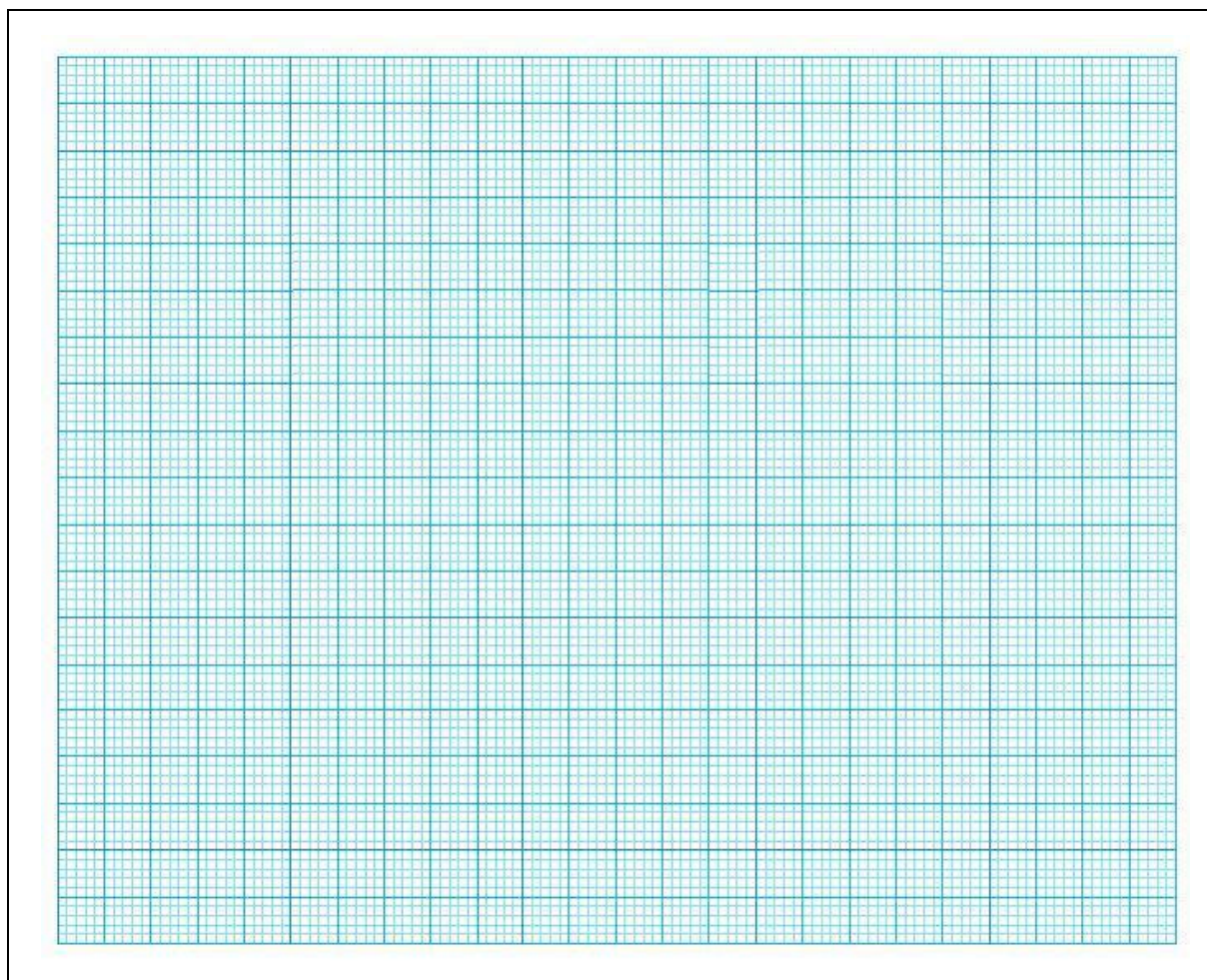
0,70p

1.d. Determined values of the intersection of current-voltage characteristic with the axes of coordinates. Determined value of the slope of line outlined in 1.c.



0,30p

1.e. Plotted current - tension characteristic for data in Table 3



0,70p

1.f. Determined values of the intersection of current-voltage characteristic with the axes of coordinates. Determined value of the slope of line outlined in 1.e.



0,30p

Task no. 2

2.a. Calculus of the values of the resistance of the resistors and electromotive force (emf) of ideal voltage sources that form the simplest circuit which has the behavior described by the above data.

4,60p

2.a. (further calculations)

2.a. (further calculations)

2.b. Drawing of the equivalent circuit diagram, having written the determined values of electrical resistances and electromotive voltages of sources

0,40p

Task no. 3

3.a. Plotting of the current-voltage dependence in the case of the terminals P and Q are bound to the terminals 1 and 2 respectively; writing of the numerical values of the intersections of graph with the axes of coordinates.

2,00p

3.a.

