Internationale Elektrotechnik-Olympiade der Schulen der Euroregion Neisse

NEISSE - ELEKTRO 2017

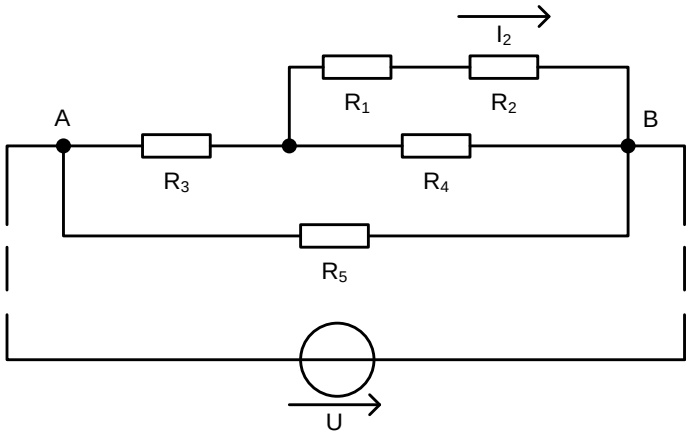
Name:

……..……

1	2	3	4	5	Σ

Please use a separate sheet of paper for each task. Write your name on each of these papers.

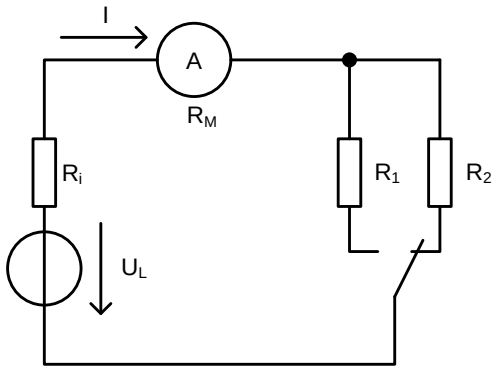
Task 1



$R_1 = 7\ \Omega$, $R_2 = 13\ \Omega$, $R_3 = 24\ \Omega$, $R_4 = 80\ \Omega$, $R_5 = 160\ \Omega$

a) Calculate the total resistance R_{AB} between A and B for the circuit (without voltage source).
b) On point A and B a voltage source is connected. You measure the current on resistor R_2 with $I_2 = 1$ A. Calculate the voltage and current for each resistor and the voltage source.

Task 2



With the circuit the following measurements were made:

- with $R_1 = 20\ \Omega$: $I = I_1 = 0{,}240$ A
- with $R_2 = 50\ \Omega$: $I = I_2 = 0{,}109$ A

The current meter has an inner resistance of $R_M = 2\ \Omega$.

Calculate R_i and U_L for the voltage source!

Task 3

A loaded capacitor with capacity of C_0 = 1 µF and voltage U_0 = 1 kV will be parallel connected with three serial connected uncharged capacitors C_1 = 1µF, C_2 = 2 µF, C_3 = 3 µF.

a) Draw the circuit and mark all voltages with arrows.
b) Calculate the total capacitance C.
c) Calculate the voltages U_0, U_1, U_2, U_3 and charges Q_0, Q_1, Q_2, Q_3 after connecting.

Task 4

A heater (resistor) needs a power of P = 20 kW with a DC voltage of 440 V. It is connected with a 2,4 km long cable. The cable has two wires of copper (conductivity $\kappa = 56 \cdot 10^6$ A/(Vm)) with diameter of 8 mm each. (area A of circle with diameter d: $A = \pi / 4 \cdot d^2$)

a) How many percent of the in the cable injected power is lost in the cable?
b) Which voltage is needed at the beginning of the cable?

Task 5

For an ideal transformer with two coils the following is known:

- primary voltage (sine wave form): $U_1 = 230\ V_{\approx}$
- secondary voltage: $U_2 = 10\ V_{\approx}$
- number of turns in primary coil: $N_1 = 2001$
- secondary load resistor: $R_2 = 10\ \Omega$

a) Calculate the value of primary current I_1.
b) Determine the number of turns in the secondary winding.

The load resistor is replaced by a temperature-sensitive resistor of $R_2 = 10\ \Omega$ at 20°C. The resistor has a coefficient α = 0,004/K and is heated to 90°C.

c) Calculate the new value of primary current I_1.

Before end, write your name on each paper and fold your exercise sheet according the picture: