14. Internationale Elektrotechnik-Olympiade der Schulen der Euroregion Neisse

NEISSE - ELEKTRO 2000

Name:.....

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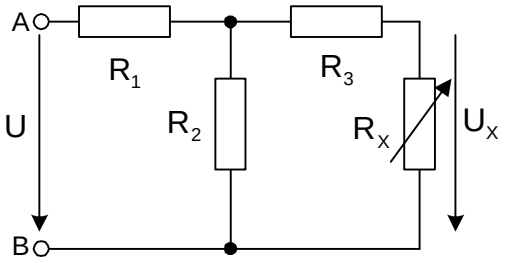
Tasks for the finale test
90 min ; with formulas (english edition)

1

The following circuit is given (figure).
The resistance R_X is setting to fulfill the condition: $U_X = 0{,}1U$

Calculate the value of R_X!

$R_1 = 1k\Omega$
$R_2 = 2k\Omega$
$R_3 = 3k\Omega$

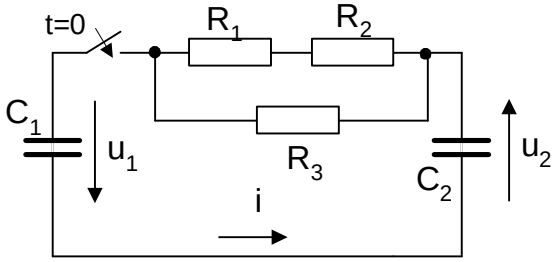


2

The following circuit is given (figure).

$C_1 = 5\ \mu F$ $C_2 = 1\ \mu F$
$R_1 = R_2 = R_3 = 1\ M\Omega$

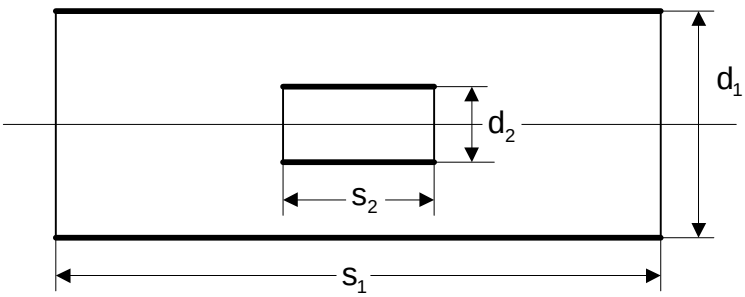
The capacitor C_1 is charged up to a voltage $U_1 = 200$ V. The circuit breaker is closed in the moment t = 0.



a) Calculate the values of the voltages u_1 und u_2 for the condition t>>0!
b) Calculate the total energy stored in the capacitors for the moments t<0 and t>>0!
c) Calculate the value of the electric current in the moment after closing the circuit breaker.
d) Calculate the time constant of the switching operation!

3

A small cylindrical coil 2 ($s_2 = 15cm$; $d_2 = 3cm$; $N_2 = 100$) is situated in the middle of a long cylindrical air-core coil 1 ($s_1 = 1m$; $d_1 = 8cm$; $N_1 = 800$).



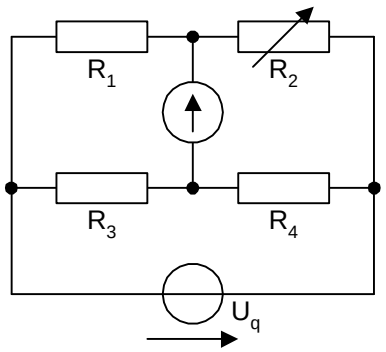
Coil 1 is connected to AC voltage u_1:

$u_1 = 100V \cdot \cos(2\pi \cdot f \cdot t)$ with

$f = 50kHz = 50000Hz$

Calculate the peak value of the voltage $\hat{u}_2$ measurably on the circuit points of the coil 2!

4



The following bridge circiut is given (figure).

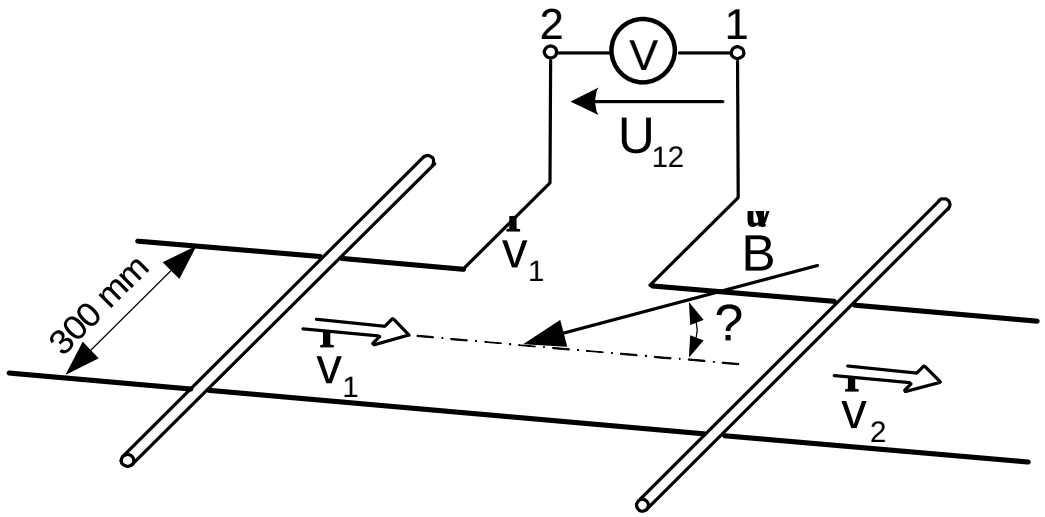
$R_1 = 200\ \Omega$;
$R_3 = 100\ \Omega$
$R_4 = 130\ \Omega$

The maximum load for all of the resistors is given by $P_{max} = 1$ W

a) Calculate the resistor R_2 for the bridge balance!
b) Calculate the maximum permissible value of the voltage U_q in case of bridge balance!

5

A homogeneous magnetic field B = 0.2T with down grade of $\beta = 20°$ against the plane of the both rails. On the rails are moved two metallic rods - always in contact with the rails - with the velocity $v_1 = 0.2$m/s and $v_2 = 0.5$m/s.



Calculate the voltage U_{12} indicated by the measurement device. The loop resistance of the measuring circuit is given by R_s, the internal resistance of the voltage meter is given by R_M. It is imperative: $R_M >> R_s$!