26. Internationale Elektrotechnik-Olympiade der Schulen der Euroregion Neisse

NEISSE-ELEKTRO 2020

Name:

School:

1	2	3	4	5	Σ

Tasks for the finale; 90 min; with formulary (English edition)
Please use a separate sheet of paper for each task.
Write your name and school on each of these papers.

Task 1 (24 points)
Given is the electrical circuit according to figure 1.

R_i = 10 Ω
R_1 ... R_7 = 80 Ω
I_5 = 125 mA

a) Calculate the equivalent resistance between A and B for R_1 … R_7.

b) Calculate all currents and voltages for all resistors.

c) Calculate the voltages U_{AB} and U_S.

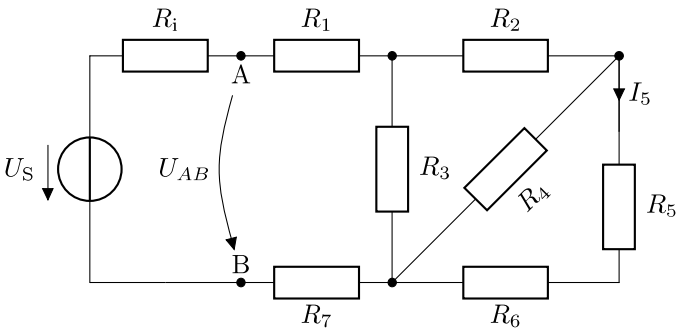

figure 1

Task 2 (14 points)
The AC circuit given by figure 2 is supplied by a voltage of U_{AB} = 100V with a frequency of
f = 1000 Hz.

The values, indicated on the measuring instruments are:
U = 100 V, I = 4,6 A and P = 347 W.

a) Calculate the value of the resistance R.

b) Calculate the value of the capacitance C.

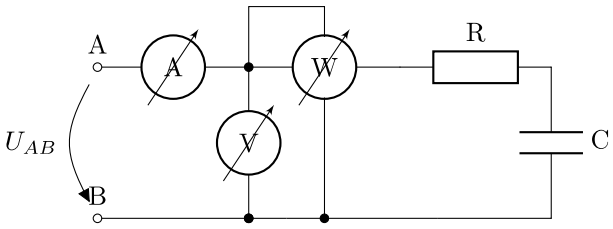

figure 2

Task 3 (14 points)
A sheet of paper with a thickness of d = 0,2 mm is put into a plate capacitor (area A = 0,4 m², distance d_1 = 1mm (vacuum), permitivity $\varepsilon_0 = 8{,}85 \cdot 10^{-12}$ As/Vm).

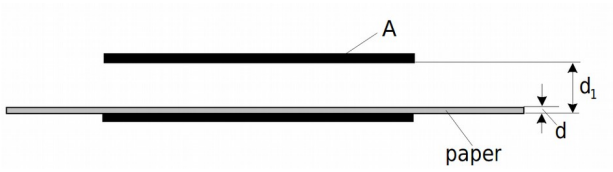

figure 3

The measured capacity is C = 4,0 nF.

a) Calculate the capacity of the paper (distance d).

b) Calculate the permittivity ε_r of the paper.

Task 4 (14 points)
A very long superconducting cable with a very small diameter can carry a maximum current of I = 4000 A. (μ_r (air) ≈ μ_r (vacuum) = 1)

a) Calculate the magnetic field strength H and the magnetic flux density B for this case in a distance d of 1 m and 5 m.

b) calculate the minimum distance d from the cable where B is less than 100 μT.

Task 5 (14 points)
The transformer in figure 4 has three windings. Winding N_0 is connected to a source u_{12} = 24 Vac with frequency f = 500 Hz.

N_0 = 200 N_1 = 30 N_2 = 100

a)
Calculate the voltages u_{ab} and u_{cd}!

b)
A load is connected to u_{cd} and a current I_2 = 2A flows in winding N_2. Calculate the current in winding N_0. Calculate with efficiency η = 0,93 and the above voltages.

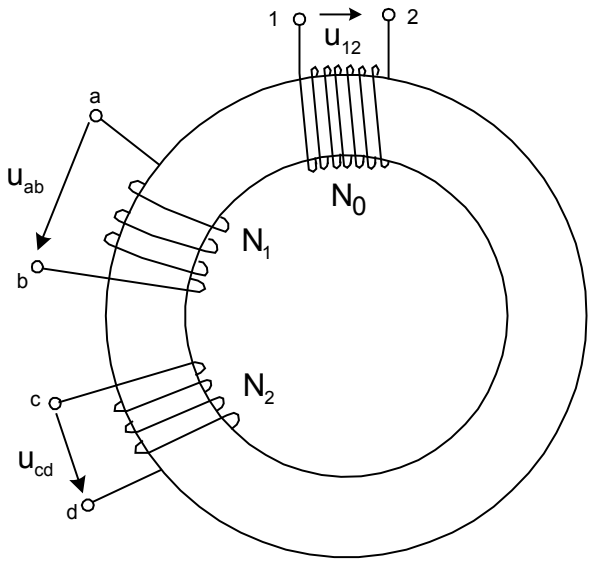

figure 4

Before end, write your **name and school on each paper**.
- until 12 o'clock, 28th march 2020: Send two photos with a **overview** of all papers with front an back side to neisse-elektro@hszg.de
- until 12 o'clock, 30th march 2020: Send a **detailed** photo or scan of **each** of your sheets to neisse-elektro@hszg.de (single or multiple emails)
See www.hszg.de/neisse-elektro → "Vorbereitung Przygotowanie Priprava" for more informations

Version 2020-03-27 12:00