27. Internationale Elektrotechnik-Olympiade der Schulen der Euroregion Neisse

NEISSE-ELEKTRO 2021

Exercise #2 - Capacitors, Charges

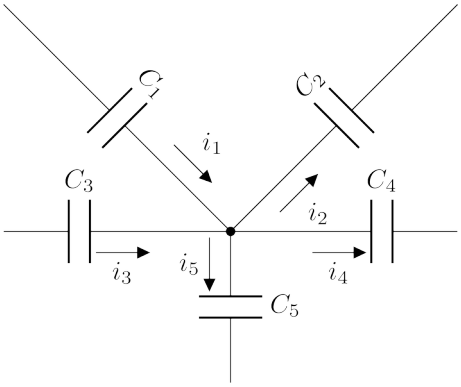
Official formula sheet: [hszg.de/neisse-elektro --> Aufgaben --> formula sheet2019.pdf]

1) A current of 1mA flows into a capacitor for 1 second. Calculate the increased value of the voltage for an capacitor A with C_A = 10µF. Which capacitor would be charged to 15V with the same current and time?

2) Calculate the capacitance of a capacitor with two plates with the area of A4 paper (210 mm x 297 mm). The distance between is 0.3 mm and filled with air. Calculate the capacitance if you fill the gap with fluid (ε_r=3.5).

3) You see a part of a circuit. Calculate the current i_5 of capacitor 5:

C_1=1µF, i_1=1mA, C_2=2µF, i_2=0.5mA, C_3=4µF, i_3=0.25mA, C_4=0.1µF, i_4=10mA, C_5=10uF



4) Without knowledge of the context of the formulas, can you explain why at least one formula seems wrong?

(a) $f=\frac{1}{2\pi\sqrt{L_1C_1C_2C_3}}$ (b) $f=\frac{1}{2\pi\sqrt{L_1(C_1+C_2+C_3)}}$

(c) $f=\frac{1}{2\pi\sqrt{L_1\left(C_3+\frac{C_1C_2}{C_1+C_2}\right)}}$ (d) $f=\frac{1}{2\pi\sqrt{L_1\left(\frac{C_1C_2C_3}{C_2C_3+C_1C_3+C_1C_2}\right)}}$

5) A capacitor C=1500µF in a photovoltaic inverter is charged to a voltage of 750V. If it is switched off it gets discharged by a resistor. Calculate the value of the resistor, that after a time of 3 min the voltage drops below 40V.

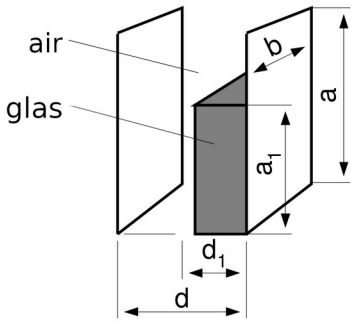
6) Calculate the capacitance.

a = b = 10cm
a_1 = 4cm

d = 5mm
d_1 = 2mm

$\varepsilon_0 = 8.85 \cdot 10^{-12}$ As / Vm

glas: $\varepsilon_r = 6$



You are invited to work on a collaborative document for the solution:
https://pad.gwdg.de/OedZi2wnQFi1BHsG7RQGMw