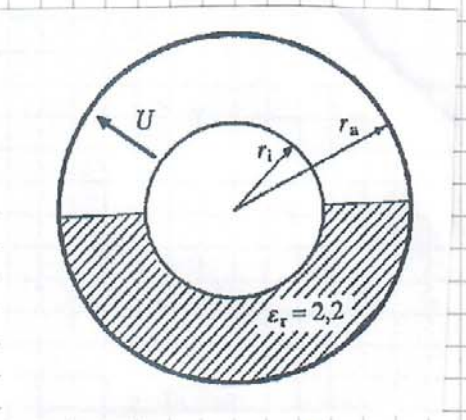
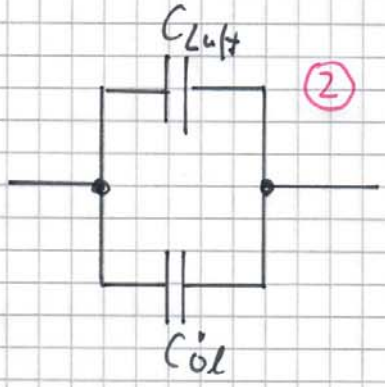
1. Aufgabe



$\hat{=}$



(2) Parallelschaltung!

1.1 $\underline{C} = \frac{1}{2} \cdot \frac{2\pi\varepsilon_0 \cdot l}{\ln(r_a/r_i)} + \frac{1}{2} \cdot \frac{2\pi\varepsilon_0\cdot\varepsilon_r \cdot l}{\ln(r_a/r_i)} = 50\,pF + 110\,pF = \underline{160\,pF}$ (2)

(C_{Luft} / $C_{Öl}$; Halbzylinder!)

$\rightarrow \frac{2\pi \cdot 8{,}854\cdot 10^{-12}\,\frac{As}{Vm} \cdot 0{,}4\,m}{\ln\left(\frac{6{,}92}{5{,}54}\right)} = 100 \cdot 10^{-12}\,F$

1.2 $\underline{Q} = C \cdot U = 160 \cdot 10^{-12}\,\frac{As}{V} \cdot 100\,V = \underline{16\,nAs}$ (2)

1.3 $C_{Luft} = 50\,pF \rightarrow \underline{Q_{Luft} = 5\,nAs}$ (2) (obere Hälfte)

$C_{Öl} = 110\,pF \rightarrow \underline{Q_{Öl} = 11\,nAs}$ (1) (untere Hälfte)

1.4 $Q = \oint \vec{D} \cdot d\vec{A} \rightarrow Q = D \cdot \underbrace{l \cdot \pi \cdot r}_{\text{Halbzylinder - Oberfläche}}$

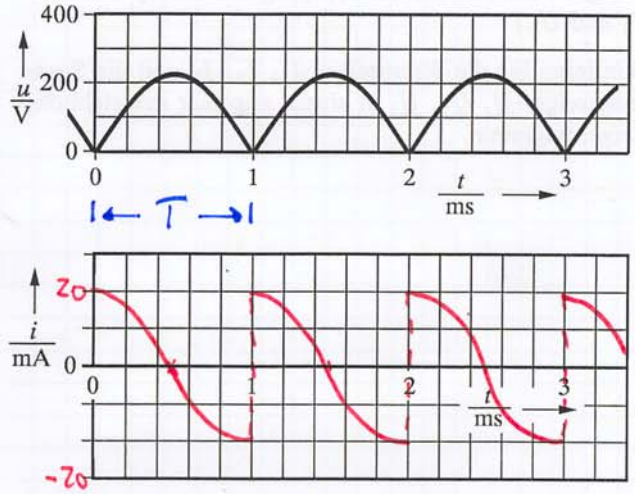
$\rightarrow \underline{D_{Luft}} = \frac{Q_{Luft}}{l \cdot \pi \cdot r_i} = \frac{5 \cdot 10^{-9}\,As}{0{,}4\,m \cdot \pi \cdot 5{,}54 \cdot 10^{-2}\,m} = \underline{71{,}85\,n\,\frac{As}{m^2}}$ (3)

$\underline{E_{Luft}} = \frac{D_{Luft}}{\varepsilon_0} = \underline{8{,}1\,\frac{kV}{m}}$ (2)

$\underline{E_{Öl} = 8{,}11\,\frac{kV}{m}}$ (1) ($\hat{=} E_{Luft}$!)

$\underline{D_{Öl}} = \frac{Q_{Öl}}{l \cdot \pi \cdot r_i} = 2{,}2 \cdot D_{Luft} = \underline{158{,}0\,n\,\frac{As}{m^2}}$ (2) $\rightarrow E_{Öl} = \frac{D_{Öl}}{\varepsilon_0 \cdot \varepsilon_r}$

2. Aufgabe



(6)

a) $T = 1\,ms \rightarrow f = \frac{1}{T} = 1\,kHz$ (4)

b) $0 \le t \le 1\,ms$: $u = 229\,V \cdot \left| \sin\left(\pi \cdot 10^3 \cdot \frac{t}{s}\right) \right|$

$= 229\,V \cdot \sin\left(\pi \cdot 10^3 \cdot \frac{t}{s}\right)$

$i(t) = C \cdot \frac{du}{dt}$ (2) $= 27{,}8 \cdot 10^{-9}\,\frac{As}{V} \cdot \pi \cdot 10^3 \cdot \frac{1}{s} \cdot 229\,V \cdot \cos\left(\pi \cdot 10^3 \cdot \frac{t}{s}\right)$ (6)

$= 20\,mA \cdot \cos\left(\pi \cdot 10^3 \cdot \frac{t}{s}\right) = 20\,mA \cdot \cos\left(\pi \cdot \frac{t}{ms}\right) = i(t)$

(2)