

AP 2004 - I

2.0 Geg: $r = 4,3 \text{ cm}$; $h = 20,0 \text{ cm}$; $d = 2,5 \text{ mm}$; $\epsilon_r = 8,0$

2.1
$$C = \epsilon_0 \cdot \epsilon_r \cdot \frac{A}{d} = \epsilon_0 \cdot \epsilon_r \cdot \frac{r^2 \pi + 2r\pi h}{d} = \underline{1,7 \cdot 10^{-9} \text{ F}}$$

2.2
$$E_{\text{max}} = \frac{U_{\text{max}}}{d} \Leftrightarrow U_{\text{max}} = E_{\text{max}} \cdot d = 30 \cdot 10^6 \frac{\text{V}}{\text{m}} \cdot 2,5 \cdot 10^{-3} \text{ m}$$

$$= \underline{75 \text{ kV}} = U_{\text{max}}$$

$$Q_{\text{max}} = C \cdot U_{\text{max}} = \underline{1,3 \cdot 10^{-4} \text{ As}}$$

2.3.0 $U_0 = 6,0 \text{ kV}$

2.3.1 $U_M = 1,5 \text{ V}$; $t_B = 25 \cdot 3600 \text{ s}$; $I_M = 0,12 \text{ A}$

$$W_{\text{el}} = W_M = U \cdot I \cdot t = 1,5 \text{ V} \cdot 0,12 \text{ A} \cdot 25 \cdot 3600 \text{ s} = 6,48 \text{ kJ}$$

$$W_L = \frac{1}{2} C U^2 = \frac{1}{2} \cdot 1,7 \cdot 10^{-9} \text{ F} \cdot (6,0 \cdot 10^3 \text{ V})^2 = 0,0306 \text{ J}$$

Faktor $n = \frac{W_{\text{el}}}{W_L} = \frac{6,48 \cdot 10^3 \text{ J}}{0,0306 \text{ J}} = 2,1 \cdot 10^5$

Also $\underline{E_{\text{Mono}} = 2,1 \cdot 10^5 W_{\text{leid.}}}$

2.3.2 $U_0 = 6,0 \text{ kV}$; $R = 80 \Omega$

$t=0: U = R \cdot I \Leftrightarrow I = \frac{U_0}{R} = \frac{6,0 \cdot 10^3 \text{ V}}{80 \Omega} \Rightarrow \underline{I_0 = 75 \text{ A}}$

$t_E: Q(t_E) = 0,010 Q_0$
 $0,010 \check{Q}_0 = \check{Q}_0 \cdot e^{-t_E/RC} \Leftrightarrow e^{-t_E/RC} = 0,010$

$-t_E/RC = \ln(0,010)$

$\Leftrightarrow t_E = -RC \cdot \ln(0,010) = -$

$= -80 \Omega \cdot 1,7 \cdot 10^{-9} \frac{\text{As}}{\text{V}} \cdot \ln(0,010)$

$t_E = 0,63 \cdot 10^{-6} \text{ s} = \underline{0,63 \mu\text{s}}$