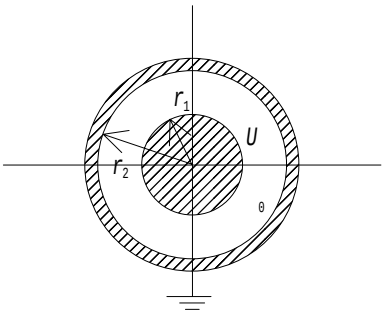
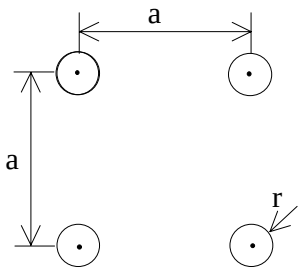
OSNOVE ELEKTROTEHNIKE I

Izpit, 14.9.1999

1. Izpeljite funkcijsko odvisnost polja $E(r)=f(r, r_1, r_2, U)$ krogeljnega kondenzatorja, ki ga priklju~imo na napetost U, in poi{~ite razmerje radijev r_2/r_1, pri katerem je $E(r_1)/E(r_2)=4$!

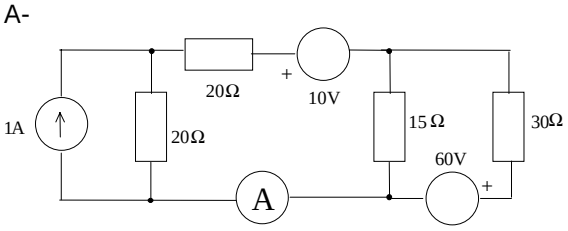


2. Dana sta dva vzporedna dvovoda. Izra~unajte napetost med zgornjima vodnikoma, ~e je spodnji dvovod priklju~en na napetost 100 V, $a = 40.r$!

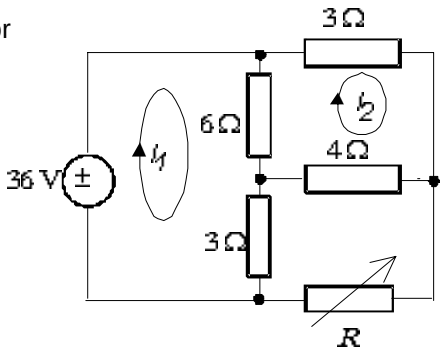


3. V plo{~at zra~ni kondenzator, ki ima plo{~i razmaknjeni za 10 mm in je priklju~en na napetost 2 kV, polo`imo vzporedno s plo{~ama dielektri~ni listi~ debeline 2 mm in $\varepsilon_r = 6$. Kolik{en je padec napetosti na listi~u?

4. Z uporabo Theveninovega teorema izra~unajte tok A-metra!



5. Dolo~ite najve~jo mo~, ki jo lahko spremenljiv upor sprejme od generatorja!



REZULTATI IZPITA OSNOVE ELEKTROTEHNIKE I (UNI)
14.9.1999

1)

$$\int_A \vec{D}.d\vec{A} = Q, \quad E(r).\oint_A dA = \frac{Q}{e}, \quad E(r) = \frac{Q}{4pe.r^2}$$

$$U = \int_{r_1}^{r_2} \vec{E}.d\vec{l} = \int_{r_1}^{r_2} E(r).dr = \int_{r_1}^{r_2} \frac{Q}{4pe}\frac{dr}{r^2} = \frac{Q}{4pe}.(\frac{1}{r_1} - \frac{1}{r_2})$$

$$E(r) = \frac{U}{\frac{1}{r_1} - \frac{1}{r_2}}.\frac{1}{r^2} \qquad \frac{E(r_1)}{E(r_2)} = \frac{r_2^2}{r_1^2} = 4 \quad \Rightarrow \quad \frac{r_2}{r_1} = 2$$

2)

$$V_1 = -\frac{1}{2pe_0}\left(q.\ln(a.\sqrt{2}) + (-q).\ln(a)\right) = -\frac{q}{2pe_0}.\ln\sqrt{2}$$

$$V_2 = -\frac{1}{2pe_0}\left(q.\ln(a) + (-q).\ln(a.\sqrt{2})\right) = \frac{q}{2pe_0}.\ln\sqrt{2}$$

$$V_2 - V_1 = \frac{q}{pe_0}.\ln\sqrt{2}$$

$$U = -\frac{2}{2pe_0}.\left(q.\ln(r) + (-q).\ln(a)\right) = \frac{q}{pe_0}.\ln\frac{a}{r}$$

$$V_2 - V_1 = \frac{U}{\ln\frac{a}{r}}.\ln\sqrt{2} = 9{,}4\ \text{V}$$

3)

$$U = \int_0^{1cm} E(x).dx = E_1.0{,}008 + E_2.0{,}002$$

$$E_1.e_1 = E_2.e_2, \quad E_1.1_1 = E_2.6$$

$$U = E_2.(0{,}008.6 + 0{,}002.1) \Rightarrow \quad E_2 = 40\ \text{kV/m}$$

$$U_2 = E_2.0{,}002 = 80\ \text{V}$$

4)

$$R_{Th} = \left(15 \| 30 + 40\right)\Omega = 50\ \Omega$$

$$U_{Th} = (20 - 10 - \frac{60}{15+30}.15)\text{V} = \text{-}10\ \text{V}$$

$$I_A = \frac{10}{50}\ \text{A} = 0{,}2\ \text{A}$$

5)

$$R_g = R_{Th} = \left(6 \| 3 + 4\right) \| 3\ \Omega = 2\ \Omega$$

$$I_1(6+3) - I_2.6 = 36$$

$$I_2.(3+4+6) - I_1.6 = 0$$

$$\Rightarrow I_2 = 2{,}67\text{A}$$

$$U_{Th} = 36 - 2{,}67.3 = 28\ \text{V}$$

$$P_{\max} = \frac{\left(\frac{U_{th}}{2}\right)^2}{R_g} = \frac{28^2}{4.2} = 98\ \text{W}$$