Универзитет у Источном Сарајеву
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ИСПИТ ИЗ ОСНОВА ЕЛЕКТРОТЕХНИКЕ 1

27. 06. 2013. - Рјешења

1.

$$\left|\vec{F}_{12}\right| = \left|\vec{F}_{21}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q_1 Q_2}{L^2} = 14,4\ \mu\text{N}.$$

2.

a) За област $r < R_1 \quad \Rightarrow$

$D_1 = 0, \quad E_1 = 0,$

За област $R_1 \le r \le R_2 \quad \Rightarrow$

$$D_2 = \frac{r^3 - R_1^3}{4r^2\pi\left(R_2^3 - R_1^3\right)}Q_1, \quad E_2 = \frac{Q_1}{4\pi\varepsilon_0\varepsilon_{r2}}\cdot\frac{r^3 - R_1^3}{r^2\left(R_2^3 - R_1^3\right)}.$$

За област $R_2 \le r \le R_3 \quad \Rightarrow$

$D_3 = 0, \quad E_3 = 0,$

За област $R_3 \le r \le R_4 \quad \Rightarrow$

$$D_4 = \frac{Q_0 + Q_1}{4r^2\pi}, \quad E_4 = \frac{D_4}{\varepsilon_0\varepsilon_{r1}} = \frac{Q_0 + Q_1}{4\pi\varepsilon_0\varepsilon_{r1}r^2}.$$

За област $R_4 \le r \le R_5 \quad \Rightarrow$

$D_5 = 0, \quad E_5 = 0,$

За област $R_5 \le r < \infty \quad \Rightarrow$

$$D_6 = \frac{Q_0 + Q_1}{4r^2\pi}, \quad E_6 = \frac{D_6}{\varepsilon_0} = \frac{Q_0 + Q_1}{4\pi\varepsilon_0 r^2}.$$

За област $R_3 \le r \le R_4 \quad \Rightarrow$

$$V'\left(R_3\right) = \frac{Q_0 + Q_1}{4\pi\varepsilon_0\varepsilon_{r1}}\left(\frac{R_4 - R_3}{R_3 R_4}\right).$$

За област $R_1 \le r \le R_2 \quad \Rightarrow$

$$V''(r) = \frac{Q_1}{4\pi\varepsilon_0\varepsilon_{r2}\left(R_2^3 - R_1^3\right)}\left(\frac{R_2^2 - r}{2} + \frac{R_1^3}{R_2} - \frac{R_1^3}{r}\right) + V\left(R_3\right).$$

За област $0 \le r \le R_1 \quad \Rightarrow$

$$V'''(r) = \frac{Q_1}{4\pi\varepsilon_0\varepsilon_{r2}\left(R_2^3 - R_1^3\right)}\left(\frac{R_2^2 - R_1^2}{2} + \frac{R_1^3}{R_2} - R_1^2\right) + V(R_3).$$

б) $$U_{0R5} = \frac{Q_1}{4\pi\varepsilon_0\varepsilon_{r2}\left(R_2^3 - R_1^3\right)}\left(\frac{R_2^2 - R_1^2}{2} + \frac{R_1^3}{R_2} - R_1^2\right) + \frac{Q_0 + Q_1}{4\pi\varepsilon_0\varepsilon_{r1}}\left(\frac{R_4 - R_3}{R_3 R_4}\right).$$

в) $$W = \frac{\left(Q_0 + Q_1\right)^2}{8\pi\varepsilon_0\varepsilon_{r1}}\left(\frac{R_4 - R_3}{R_3 R_4}\right).$$

3.

$U_{\max} = 34,66$ kV.

4.

$I_{13} = -70$ mA, $I_{12} = 50$ mA, $I_{23} = 20$ mA,
$I_{10} = -10$ mA, $I_{20} = 20$ mA, $I_{30} = -20$ mA.

5.

$U_{AB}^V = E_T = 31,5$ V.

6.

$R = R' = 20\ \Omega$