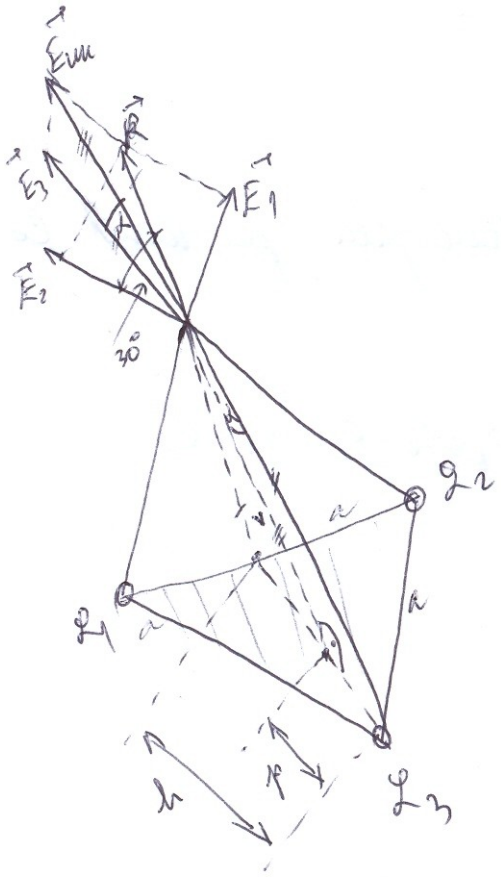
1. **(25 бодова)**



$q_1 = q_2 = q_3$

$\vec{E}$

$|E_1| = |E_2| = |E_3| = |E| \cdots\cdots 2p)$

$E_1^2 = E_2^2 + R^2 - 2E_2 R\cos 30^\circ .....3p)$

$R = E\sqrt{3} .....2p)$

$R^2 = E_3^2 + E_{uk}^2 - 2E_3 E_{uk}\cos\alpha .....5p)$

$\cos\alpha = \dfrac{v}{a}$

$h = \dfrac{a\sqrt{3}}{2}, p = \dfrac{a\sqrt{3}}{3} .....3p)$

$a^2 = v^2 + \left(\dfrac{a\sqrt{3}}{3}\right)^2$

$v = \sqrt{\frac{2}{3}}a$

$\cos\alpha = \sqrt{\frac{2}{3}}$.....$2p$)

$R^2 = E_3^2 + E_{uk}^2 - 2E_3E_{uk}\cos\alpha$ .....$2p$)

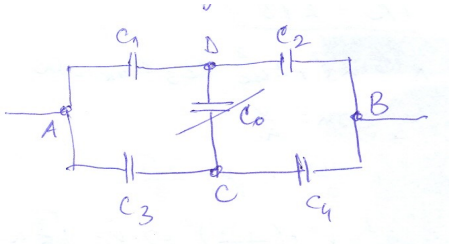
$E_{uk}^2 - 2\sqrt{\frac{2}{3}}EE_{uk} - 2E^2 = 0$.....$3p$)

$E_{uk} = \sqrt{6}E$

$E_{uk} = \frac{\sqrt{6}}{4\pi\varepsilon_0}\frac{q}{a^2}$.....$3p$)

Слика 2

2. Како је $C_1 = C_2 = C_3 = C_4$ тачке C и D су истом потенцијалу па кондензатор C_0 можемо искључити. Еквивалентна шема приказана на слици 3.



Слика 3

$C_1 = C_2 = C_3 = C_4 \Rightarrow$

$\frac{1}{C_{12}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{2}{C} \Rightarrow C_{12} = \frac{C}{2}$.....$5p$)

$\frac{1}{C_{34}} = \frac{1}{C_3} + \frac{1}{C_4} = \frac{2}{C} \Rightarrow C_{34} = \frac{C}{2}$.....$5p$)

$C_e = C_{12} + C_{34} = \frac{C}{2} + \frac{C}{2} = C$.....$5p$)

(15 бодова)

3. Укупан отпор прстена је: **(25 бодова)**

$R = R_1 + R_2$.....$2p$)

$R_1 = \frac{1}{3}R, R_2 = \frac{2}{3}R$.....$2p$)

Снага која се издваја у прстену:

$P = R_1 I_1^2 + R_2 I_2^2 ....1p)$

$I = I_1 + I_2 .....1p)$

$E = I_1 R_1 .....1p)$

$E = I_2 R_2 \Rightarrow I_1 R_1 = I_2 R_2 .....1p)$

$\Rightarrow$

$I_1 = \frac{IR_2}{R_1 + R_2} = \frac{2}{3} I = 6A .....3p)$

$I_2 = \frac{IR_1}{R_1 + R_2} = \frac{1}{3} I = 3A .....3p)$

$P = \frac{6}{27} RI^2 \Rightarrow$

$R = \frac{27}{6} \frac{P}{I^2} = 6\Omega .....5p)$

Ако је контакт дуж пречника:

$R_1 = R_2 = \frac{R}{2} .....1p)$

$I_1 = I_2 = \frac{I}{2} .....1p)$

$P = R_1 I_1^2 + R_2 I_2^2 = \frac{RI^2}{4} = 121.5W .....4p)$

4.

Ако смјер наниже усвојимо као позитиван: **(15 бодова)**

а)

$B_A = B_{2A} - B_{1A} .....2p)$

$B_A = \frac{\mu_0}{2\pi} \frac{I_2}{d} - \frac{\mu_0}{2\pi} \frac{I_1}{d} .....2p)$

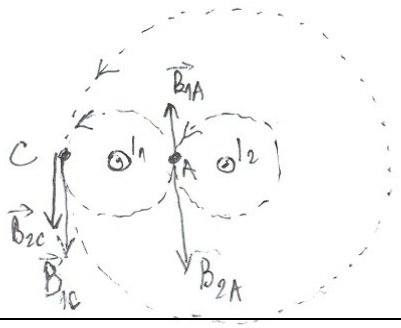
$B_A = \frac{\mu_0}{2\pi} \frac{I_2 - I_1}{d} = 20\mu T .....1p)$

$B_C = B_{1C} + B_{2C} .....2p)$

$B_C = \frac{\mu_0}{2\pi} \frac{I_1}{d} + \frac{\mu_0}{2\pi} \frac{I_2}{3d} .....2p)$

$B_C = \frac{\mu_0}{6\pi} \frac{3I_1 + I_2}{d} = 33.3\mu T .....1p)$

б)



$B_A = -B_{1A} - B_{2A}$

$B_A = -\frac{\mu_0}{2\pi}\left(\frac{I_1 + I_2}{d}\right) = -60\mu T$.....2.5$p$)

$B_C = B_{1C} - B_{2C}$

$B_C = \frac{\mu_0}{2\pi}\left(\frac{I_1}{d} - \frac{I_2}{3d}\right) = -6.67\mu T$.....2.5$p$)

Слика 4

5. **(20 бодова)**

$U = 10U_C$.....1p)

$U = I \cdot Z$.....1p)

$Z = \sqrt{R^2 + (X_L - X_C)^2}$.....2$p$)

$X_L = \omega L$.....1p)

$X_C = \frac{1}{\omega C}$.....1p)

$10U_C = I \cdot \sqrt{R^2 + (X_L - X_C)^2}$.....2$p$)

$U_C = I \cdot X_C$.....1)

$\sqrt{R^2 + (X_L - X_C)^2} = \frac{10}{\omega C}$.....1$p$)

....

$\omega^4 + \left(\frac{C^2R^2 - 2LC}{C^2L^2}\right)\omega^2 - \frac{99}{C^2L^2} = 0$.....2.5$p$)

$\omega^4 - 4.43 \cdot 10^4 \omega^2 - 6.18 \cdot 10^{10} = 0$.....2.5$p$)

$\omega^2 = t$

$t^2 - 4.43 \cdot 10^4 t - 6.18 \cdot 10^{10} = 0$.....1$p$)

$t_1 = 271730.9$.....1p)

$t_2 = -227430.9$.....1p)

$\omega = \sqrt{t_1} = 521.3 s^{-1}$.....1$p$)

$\nu = \frac{\omega}{2\pi} = 83 Hz$.....1$p$)