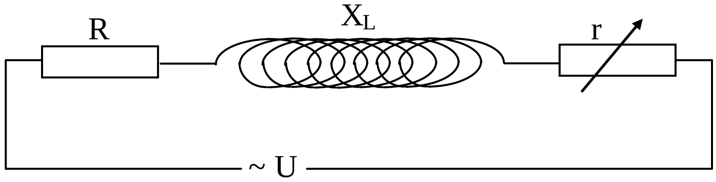
MINISTERUL EDUCATIEI NATIONALE
INSPECTORATUL SCOLAR JUDETEAN GALATI
CONCURSUL NATIONAL EVRIKA 2000

# SOLUTII CLASA A XII-A - EVRIKA

**1.**

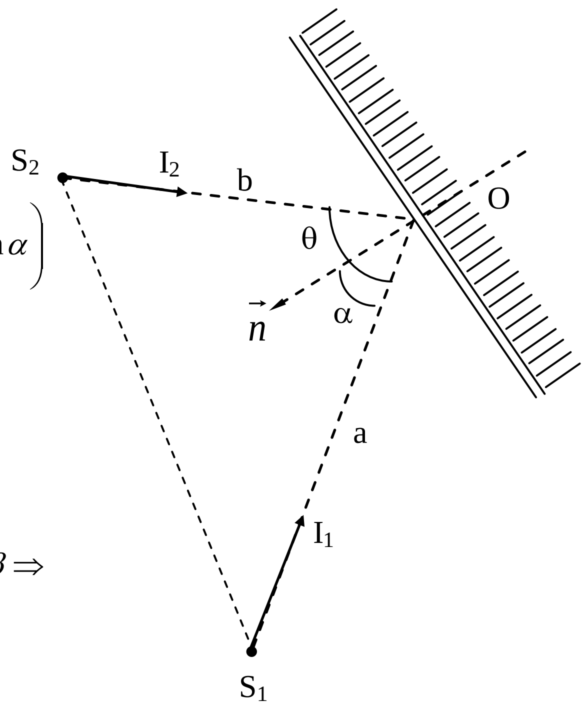



$$P_R = r \cdot I^2 = r \cdot \frac{U^2}{(r+R)^2 + X_L^2} \quad \Rightarrow \quad P(r) = \frac{U^2}{r + \frac{Z_b^2}{r} + 2R}$$

$$P(r) \text{ este maxima daca } r = \frac{Z_b^2}{r} \quad \Rightarrow \quad r = Z_b$$

$$\begin{cases} S_b = Z_b I \\ P_r = rI^2 \end{cases} \Rightarrow \quad P_r^{\max} = S_b = \sqrt{P^2 + Q^2} = 15W$$

**2.** Iluminarea totala in punctul O al placii este :




$$E_0 = \frac{I_1 \cos\alpha}{a^2} + \frac{I_2 \cos(\theta - \alpha)}{b^2}$$

$$E_0(d) = \left(\frac{I_1}{a^2} + \frac{I_2}{b^2}\cos\theta\right) \cdot \left(\cos\alpha + \frac{a^2 I_2 \sin\theta}{b^2 I_1 + a^2 I_2 \cos\theta}\sin\alpha\right)$$

daca in relatia de mai sus se face substitutia :

$$tg\beta = \frac{a^2 I_2 \sin\theta}{b^2 I_1 + a^2 I_2 \cos\theta} \quad \text{se obtine:}$$

$$E_0(\alpha) = \frac{1}{\cos\beta}\left(\frac{I_1}{a^2} + \frac{I_2}{b^2}\cos\theta\right)\cos(\alpha - \beta)$$

$E_0(\alpha)$ este maxima cand $\cos(\alpha - \beta) = 1 \Rightarrow \alpha = \alpha^* = \beta \Rightarrow$

$$\alpha^* = arctg\,\frac{a^2 I_2 \sin\theta}{b^2 I_1 + a^2 I_2 \cos\theta} \Rightarrow$$

in aceste conditii :

$$E_0^{\max} = E_0(\alpha^*) = \frac{1}{\cos\beta}\left(\frac{I_1}{a^2} + \frac{I_2}{b^2}\cos\theta\right) = \sqrt{\left(\frac{I_1}{a^2}\right)^2 + \left(\frac{I_2}{b^2}\right)^2 + \frac{2 I_1 I_2 \cos\theta}{a^2 b^2}}$$

b). in acest caz $a = b, \theta = \frac{\pi}{2}$ si $I_2 = kI_1, k > 0.$

$$\alpha^* = arctg(k) \quad \Rightarrow \quad E_0^{\max} = \frac{I_1}{a^2}\sqrt{1 + k^2}$$

**3.** Lungimea de unda asociata a electronului calculata nerelativist este :

$$\lambda_0 = \frac{h}{\sqrt{2em_0U}}$$ in care h este constanta lui Planck iar U tensiunea de accelerare.

Aceeasi lungime de unda calculata relativist este :

$$\lambda = \frac{h}{\sqrt{2em_0U\left(\frac{eU}{2m_0C^2}+1\right)}} \quad \text{sau} \quad \lambda = \frac{h}{\sqrt{2em_0U}} \cdot \frac{1}{\sqrt{1+kU}} = \frac{\lambda_0}{\sqrt{1+kU}}$$

Eroarea relativa (procentuala) este :

$$\frac{\Delta\lambda}{\lambda} \cdot 100 = \frac{\lambda_0 - \lambda}{\lambda} \cdot 100 = \varepsilon\% \qquad \Rightarrow \qquad \varepsilon\% = 100\left(\sqrt{1+kU} - 1\right)$$

din care explicitand valoarea tensiunii se obtine solutia problemei :

$$U = \frac{1}{k}\left[\left(1+\frac{\varepsilon\%}{100}\right) - 1\right] \cong 2{,}2 \cdot 10^5 V$$