FIZIKA II 1 UNI

Formule

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OPOMBE

Formule za Fiziko II *

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1 Elektrika

1.1 Coulombov zakon

$$F_e = \frac{e_1 e_2}{4\pi\epsilon_0 r^2} = eE$$

$$V(A) = \int_A^\infty \mathbf{Edl}$$

$$U = V(A) - V(B)$$

Krožna zanka:

$$E(x) = \frac{ex}{4\epsilon_0\pi(r^2+x^2)^{3/2}}$$

$$V = \frac{e}{4\pi\epsilon_0\sqrt{r^2+z^2}}$$

Dipol:

$$\mathbf{p}_e = e\,\mathbf{d}$$

$$E = \frac{e}{4\pi\epsilon_0 d^3}$$

$$V = \frac{e}{4\pi\epsilon_0 d^2}$$

1.2 Gaussov zakon

$$\oint \mathbf{DdS} = e$$

$$\oint \mathbf{EdS} = \frac{e}{\epsilon_0}$$

$$\mathbf{D} = \epsilon\mathbf{E}$$

Polje ravnine:

$$E = \frac{\sigma}{2\epsilon_0} = \frac{e/S}{2\epsilon_0}$$

Krogla:

$$E = \frac{e}{4\pi\epsilon_0 r^2}$$

1.3 Električni tok, delo in energija

$$I = \frac{de}{dt} = \frac{Q}{t}$$

$$\Delta_e = \int Idt$$

$$j = \frac{I}{S}$$

$$e = CU$$

$$U = RI$$

$$U_g = U_0 - IR_n$$

$$I_g = I_0 - UG_n$$

$$R = \frac{\xi\cdot l}{S}$$

$$P = UI = RI^2 = \frac{U^2}{R}$$

$$A = \int Fds = \int Md\varphi = \int Pdt = \Delta W$$

$$Q = A = \int Pdt = \int UIdt$$

$$W_e = \frac{CU^2}{2} = \frac{e^2}{2C}$$

$$W_p = qV$$

$$\Delta W_p + \Delta W_k = 0$$

$$w_e = \frac{W_e}{V} = \frac{\epsilon_0 E^2}{2}$$

Efektivna napetost, tok in moč:

$$U_{ef} = \sqrt{\frac{1}{T}\int_0^T U^2 dt}$$

$$I_{ef} = \sqrt{\frac{1}{T}\int_0^T I^2 dt}$$

$$\bar{P} = \frac{1}{2}U_0 I_0 = \frac{U_0}{\sqrt{2}}\frac{I_0}{\sqrt{2}} = U_{ef}I_{ef}$$

1.4 Kondenzator

Ploščati kondenzator:

$$C = \frac{\epsilon A}{d}$$

Valjasti kondenzator:

$$C = \frac{2\pi\epsilon l}{ln\frac{r_2}{r_1}}$$

Kroglasti kondenzator:

$$C = \frac{4\pi\epsilon r_2 r_1}{r_2 - r_1}$$

1.4.1 Praznenje

$$U_c = U_0 e^{-\frac{t}{RC}}$$

$$I_c = I_0 e^{-\frac{t}{RC}}$$

$$t = R'Cln(\frac{U_0}{U_{min}})$$

$$R' = \frac{R_n R}{R_n + R}$$

1.4.2 Polnenje

$$U_c = U_g(1 - e^{(-\frac{t}{RC})})$$

$$I_c = \frac{U_g}{R} e^{-\frac{t}{RC}}$$

$$t = R'Cln(\frac{U_0}{U_{min}})$$

$$R' = \frac{R_n R}{R_n + R}$$

1.4.3 Admitanca

$$Z_C = \frac{1}{\omega C}$$

2 Magnetizem

$$F = IBl\sin\varphi$$

$$\mathbf{F} = e \cdot \mathbf{v} \times \mathbf{B}$$

$$B = \mu_0 H = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 NI}{l}$$

$$M = (N)ISB\sin\varphi = J\varphi$$

$$U_i = \frac{d\Phi_m}{dt} = -BS\omega\sin(\omega t) = v(B \times l)$$

$$\Phi_m = \int BdS = BS\cos(\omega t) = [Vs]$$

$$\Phi_m = \int \mathbf{BdS}$$

$$L = \frac{\mu_0 N^2 S}{l} = \frac{\Phi}{I}$$

$$W_m = \frac{LI^2}{2} = p_m B\cos\varphi$$

$$\mathbf{p}_m = (N)I\mathbf{S}$$

$$w_m = \frac{B^2}{2\mu_0} = \frac{HB}{2}$$

Nihajni čas mag igle ali tuljave:

$$t_0 = 2\pi\sqrt{\frac{J}{p_m B}}$$

Delec v magnetnem polju:

$$R = \frac{mv}{QB}$$

$$\omega = \frac{v}{R} = \frac{QB}{m}$$

$$ev \times B = \frac{mv^2}{r}$$

2.1 Biot-Savartov zakon

$$d\mathbf{B} = \frac{\mu_0 I(\mathbf{r} \times \mathbf{dl})}{4\pi r^3}$$

2.2 Zakon o mag. pretoku

$$\oint \mathbf{BdS} = 0$$

2.3 Amperov zakon

$$\oint \mathbf{HdS} = 0$$

$$B = \mu_0 H$$

H okoli vodnika in dolge tuljave:

$$H = \frac{I}{2\pi r} = \frac{NI}{l}$$

2.4 Induktivnost

Lastna induktivnost:

$$\Phi_m = L \cdot I$$

Dolga ravna tuljava:

$$L = \frac{\mu_0 NS}{l}$$

Svitek:

$$L = \frac{\mu_0 N^2 hln(b/a)}{2\pi}$$

Koaks:

$$L = \frac{\mu_0 Iln(b/a)}{2\pi}$$

V smeri toka velja:

$$U_i = -L\frac{dl}{dt}$$

2.5 Magnetna upornost

$$R_m = \frac{I}{\mu_r \mu_0 S}$$

2.6 Električni nihajni krog

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$t_0 = 2\pi\sqrt{LC}$$

$$\beta = \frac{R}{2L}$$

$$\omega' = \sqrt{\omega_0^2 + \beta^2}$$

3 EMV

$$j(x) = j_0 e^{-\mu x} = j_0 2^{-x/x_{1/2}}$$

$$j_{\check{c}}^* = \sigma T^4$$

$$j_s = e j_{\check{c}}^*$$

$$\lambda_m T = k_w$$

$$\frac{dj_{\check{c}}^*}{d\lambda} = \frac{2\pi hc^2}{\lambda^5} \frac{1}{e^{\frac{hc}{\lambda kT}} - 1}$$

$$p = P_0 e^{\mu d}$$

$$\mathbf{E} = \mathbf{B} \times \mathbf{c}$$

$$j = wc$$

$$w = \frac{1}{2}\epsilon_0 E_0^2 \sin\omega t + \frac{1}{2}\frac{B_0^2}{2\mu_0}\sin^2\omega t$$

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = \lambda\nu$$

4 Fotometrija

$$P = \frac{dW}{dt}$$

$$j = \frac{dP}{dS}$$

$$I = \frac{dP}{d\Omega} = r^2 j$$

$$B = \frac{dI}{dS'} = \frac{I}{S_0\cos\varphi}$$

5 Geometrijska optika

$$n = \frac{c_0}{c}$$

$$\frac{\sin\alpha}{\sin\beta} = \frac{n_2}{n_1}$$

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

$$f = \frac{|r|}{2}$$

$$xx' = f^2$$

$$\frac{S}{P} = \frac{b}{a}$$

$$D = \frac{1}{f_{leča}}$$

Daljnovidnost:

$$f_{očal} = \frac{a_0 a_{min}}{a_{min} - a_0}$$

Kratkovidnost:

$$\frac{1}{f_{očal}} = \frac{1}{a_{željena}} - \frac{1}{a_{očesa}}$$

Leča:

$$\frac{1}{a} + \frac{1}{b} = (\frac{n_{leče}}{n_{medija}} - 1)(\frac{1}{r_1} + \frac{1}{r_2})$$

Lupa:

$$N = \frac{\tan\alpha}{\tan\alpha_0} = \frac{a_0}{f}$$

Mikroskop:

$$N = \frac{\tan\alpha}{\tan\alpha_0} = \frac{a_0 x'}{f f'}$$

Daljnogled:

$$N = \frac{\tan\alpha}{\tan\alpha_0} = \frac{f}{f'}$$

Prizma;

$$\delta = (n-1)\gamma$$

Odboj na tanki plasti:

$$\Delta = 2h\sqrt{n_1^2 - n_0^2 \sin^2\alpha} = N\lambda$$

6 Valovna optika

$$\alpha_B + \beta = \frac{\pi}{2} \quad \tan\alpha_B = n$$

6.1 Interferenca

Odboj na tanki plasti:

$$\Delta = 2h\sqrt{n_1^2 - n_0^2 \sin^2\alpha} = N\lambda$$

6.1.1 Več rež

Ojačitve : $d\sin\alpha = N\lambda$
Oslabitve: $d\sin\alpha = (2N+1)\frac{\lambda}{2}$
Število rež: $n = \frac{a}{\lambda}$

6.1.2 Ena reža

Ojačitev: $\frac{d}{2}\sin\alpha = n\lambda$
Oslabitev: $\frac{d}{2}\sin\alpha = (2n+1)\frac{\lambda}{2}$

7 PTR

$$\gamma = \frac{1}{(1-\frac{v_0^2}{c^2})^{1/2}} = \frac{1}{(1-\beta^2)^{1/2}}$$

$x = \gamma(x' + v_0 t')$ $\quad x' = \gamma(x - v_0 t)$
$y = y'$ $\quad y' = y$
$z = z'$ $\quad z' = z$
$t = \gamma(t' + \frac{v_0}{c^2}x')$ $\quad t' = \gamma(t - \frac{v_0}{c^2}x)$

$$t = \gamma\tau$$

$$\Delta x = \frac{\Delta x_0}{\gamma}$$

$$\mathbf{P} = \gamma m_0 \mathbf{v} = m_r \mathbf{v}$$

$$E = \gamma m_0 c^2 = m_r c^2 = m_0 c^2 + W_k$$

$$E^2 = (Pc)^2 + (m_0 c^2)^2$$

$$c_0 P = \sqrt{W_k^2 + 2E_0 W_k}$$

Transformacija hitrosti:

$$v_x = \frac{v_i' - v_L}{1 - \frac{v_i' v_L}{c_0^2}}$$

Obratna transformacija hitrosti:

$$v_x = \frac{v_i' + v_L}{1 + \frac{v_i' v_L}{c_0^2}}$$

8 Kvantna mehanika

$$E = h\nu$$

$$W_k^{max} = h\nu - A_{iz}$$

$$P = \frac{h\nu}{c} = \frac{h}{\lambda}$$

$$\lambda_B = \frac{h}{P} = \frac{h}{\gamma m_0 v}$$

$$\hbar = \frac{h}{2\pi}$$

Svetlobni tlak:

$$p = \frac{j}{c}$$

$$W_n = -\frac{W_e}{n^2}$$

9 Konstante

Hitrost svetlobe:

$$c = 3 \cdot 10^8\,\mathrm{m/s}$$

Stefanova konstanta:

$$\sigma = 5,67 \cdot 10^{-8}\,\mathrm{W/m^2K^4}$$

Planckova konstanta:

$$h = 6,6 \cdot 10^{-34}\,\mathrm{Js}$$

Boltzmanova konstanta:

$$k = 1,38 \cdot 10^{-23}\,\mathrm{J/K}$$

Wienova konstanta:

$$k_w = 2,9 \cdot 10^{-3}\,\mathrm{mK}$$

Masa elektrona:

$$m_e = 9,1 \cdot 10^{-31}\,\mathrm{kg}$$

Masa protona:

$$m_p = 1,67 \cdot 10^{-27}\mathrm{kg}$$