Eletricidade, Magnetismo e Circuitos – Formulário

1. Campo elétrico

$$F = \frac{k|q_1||q_2|}{K\,r^2} \qquad E_{\text{pontual}} = \frac{k|q|}{K\,r^2} \qquad \vec{E} = \frac{\vec{F}}{q_0}$$

2. Voltagem e corrente

$$V_{\text{A}} - V_{\text{B}} = \int_{\text{A}}^{\text{B}} E\,\mathrm{d}s \qquad U_{\text{e}} = q\,V \qquad \frac{m}{2}v^2 + q\,V = \frac{m}{2}v_0^2 + q\,V_0 \qquad I = \lim_{\Delta t \to 0}\frac{\Delta Q}{\Delta t}$$

$$\Delta Q = \int_{t_1}^{t_2} I\,\mathrm{d}t \qquad P = \lim_{\Delta t \to 0}\frac{\Delta U_{\text{e}}}{\Delta t} \qquad P = I\,\Delta V \qquad P_{\text{f.e.m.}} = I\,\varepsilon$$

3. Resistência

$$\Delta V = R\,I \qquad \Delta V_{\text{gerador}} = \varepsilon - r\,I \qquad \Delta V_{\text{recetor}} = \varepsilon + r\,I \qquad R = \rho\,\frac{L}{A}$$

$$R = R_{20}\,(1 + \alpha_{20}(T - 20)) \qquad R_{\text{s}} = R_1 + \cdots + R_n \qquad R_{\text{p}} = \left(\frac{1}{R_1} + \cdots + \frac{1}{R_n}\right)^{-1}$$

4. Capacidade

$$C_{\text{condutor}} = \frac{Q}{V_{\text{sup}}} \qquad C = \frac{Q}{\Delta V} \qquad V_{\text{máx}} = E_{\text{máx}}\,d \qquad U = \frac{1}{2}\,Q\,\Delta V$$

$$C_{\text{esf}} = \frac{K\,R_1 R_2}{k\,(R_2 - R_1)} \qquad C_{\text{plano}} = \frac{K\,A}{4\,\pi\,k\,d} \qquad C_{\text{p}} = C_1 + \cdots + C_n \qquad C_{\text{s}} = \left(\frac{1}{C_1} + \cdots + \frac{1}{C_n}\right)^{-1}$$

5. Circuitos de corrente contínua

$$I_1 + \ldots + I_n = 0 \qquad \Delta V_1 + \ldots + \Delta V_n = 0 \qquad \sum_{j=1}^{n} R_{ij}\,I_j = \varepsilon_i \quad (i = 1, \ldots, n)$$

6. Fluxo elétrico

$$\vec{E} = \sum_{i=1}^{n} \frac{k\,q_i(\vec{r} - \vec{r}_i)}{|\vec{r} - \vec{r}_i|^3} \qquad \Phi = A\,E\cos\theta \qquad \Phi(\text{S fechada}) = 4\,\pi\,k\,q_{\text{int}} \qquad E_{\text{plano}} = 2\,\pi\,k\,\sigma$$

$$E_{\text{fio}} = \frac{2\,k\,\lambda}{R} \qquad E_{\text{esf}} = \frac{kQ}{r^2} \quad (r > R)$$

7. Potencial

$$\mathrm{d}V = -\vec{E}\cdot\mathrm{d}\vec{r} \qquad E_s = -\frac{\mathrm{d}V}{\mathrm{d}s} \qquad V = -\int_{\infty}^{\text{P}} \vec{E}\cdot d\vec{r} \qquad V = \sum_{i=1}^{n}\frac{k\,q_i}{|\vec{r} - \vec{r}_i|}$$

$$V_{\text{esf}} = \frac{kQ}{r} \quad (r > R)$$

8. Campo magnético

$$\vec{F} = L\,\vec{I} \times \vec{B} \qquad \vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right) \qquad \vec{M} = \vec{m} \times \vec{B} \qquad \vec{m} = A\,I\,\hat{n}$$

$$r = \frac{m\,v}{q\,B} \qquad \omega = \frac{q\,B}{m} \qquad \oint_{\mathrm{C}} \vec{B} \cdot \mathrm{d}\vec{r} = 4\,\pi\,k_m\,I_{\mathrm{int}} \qquad B_{\text{fio reto}} = \frac{2\,k_{\mathrm{m}}\,I}{r}$$

$$F_{\text{fios retos}} = \frac{2\,k_{\mathrm{m}}\,L\,I_1\,I_2}{r} \qquad \frac{\partial B_x}{\partial x} + \frac{\partial B_y}{\partial y} + \frac{\partial B_z}{\partial z} = 0$$

9. Indução eletromagnética

$$\vec{E}_{\mathrm{i}} = \vec{v} \times \vec{B} \qquad \varepsilon_i = L\,|\vec{v} \times \vec{B}| \qquad \varepsilon_i = -\frac{\mathrm{d}\Psi}{\mathrm{d}t} \qquad \Psi = A\,B\cos\theta$$

$$\varepsilon_i = -L\,\frac{\mathrm{d}I}{\mathrm{d}t}$$

10. Processamento de sinais

$$\tilde{V}(s) = Z(s)\;\tilde{I}(s) \qquad Z_R = R \qquad Z_L = L\,s \qquad Z_C = \frac{1}{C\,s}$$

$$Z_{\mathrm{s}} = Z_1 + Z_2 \qquad Z_{\mathrm{p}} = \frac{Z_1 Z_2}{Z_1 + Z_2} \qquad \tilde{V}(s) = H(s)\;\tilde{V}_e(s)$$

11. Circuitos de corrente alternada

$$V = V_{\text{máx}}\cos(\omega\,t + \varphi) \qquad \omega = 2\,\pi\,f \qquad f = \frac{1}{T} \qquad \mathbf{V} = Z(\mathrm{i}\,\omega)\,\mathbf{I} \qquad Z(\mathrm{i}\,\omega) = R(\omega) + \mathrm{i}\,X(\omega)$$

$$\langle P \rangle = \frac{1}{2}\,V_{\text{máx}}\,I_{\text{máx}}\cos\varphi_Z \qquad V_{\text{ef}} = \frac{V_{\text{máx}}}{\sqrt{2}} \qquad I_{\text{ef}} = \frac{I_{\text{máx}}}{\sqrt{2}} \qquad \mathbf{V} = H(\mathrm{i}\,\omega)\,\mathbf{V}_e$$

12. Ondas eletromagnéticas e luz

$$\Phi(\text{S fech.}) = 4\,\pi\,k\,q_{\mathrm{int}} \qquad \Psi(\text{S fech.}) = 0 \qquad \oint_{\mathrm{C}} \vec{B} \cdot \mathrm{d}\vec{r} = 4\pi k_m I_{\mathrm{C}} + \frac{k_{\mathrm{m}}}{k}\frac{\mathrm{d}\Phi}{\mathrm{d}t} \qquad \oint_{\mathrm{C}} \vec{E} \cdot \mathrm{d}\vec{r} = -\frac{\mathrm{d}\Psi_{\mathrm{C}}}{\mathrm{d}t}$$

$$\frac{k_{\mathrm{m}}}{k} = \frac{1}{c^2} \qquad \frac{\partial^2 E}{\partial t^2} = c^2\,\frac{\partial^2 E}{\partial y^2} \qquad \frac{\partial^2 B}{\partial t^2} = c^2\,\frac{\partial^2 B}{\partial y^2} \qquad B = \frac{E}{c}$$

$$\vec{E} \times \vec{B} \longrightarrow \vec{v} \qquad c = \frac{\lambda}{T} = \lambda\,f \qquad E = E_{\text{máx}}\sin\left(\frac{2\pi\,x}{\lambda} - \omega\,t + \varphi\right) \qquad U = h\,f$$