1 Corrent continu

$$k = 9 \cdot 10^9 = \frac{1}{4\pi\varepsilon_0} \implies \varepsilon_0 = \frac{1}{4\pi k}$$

$$\vec{F} = k\frac{qq'}{d^2}\vec{u} = q\vec{E}$$

$$\vec{E} = \frac{\vec{F}}{q'} = k\frac{q}{d^2}\vec{u}$$

$$W_{A\to B} = U_B - U_A = \int_A^B -q\vec{E}d\vec{r}$$

$$V_B - V_A = \frac{U_B - U_A}{q} = -\int_A^B \vec{E}d\vec{r}$$

$$\underset{\text{camp uniforme}}{\implies} V_B - V_A = -Er_{AB}$$

$$I = \frac{\Delta Q}{\Delta t}$$

$$P = \frac{\Delta U}{\Delta t} = \frac{\Delta Q \Delta V}{\Delta t} = I\Delta V$$

$$\Delta V = IR$$

$$R = \rho\frac{L}{S}$$

$$P_c = P_u + I^2 r$$

$$I = \frac{\varepsilon}{R_{eq} + r}$$

$$\text{Ah} \equiv 3600\text{C}$$

$$\sum I_e = \sum I_s$$

$$\sum \Delta V = 0$$

$$\text{Sèrie: } R_{eq} = \sum R$$

$$\text{Paral·lel: } \frac{1}{R_{eq}} = \sum \frac{1}{R}$$

$$\varepsilon_{Th} = V_A - V_B$$

$$R_{Th} = R_{eq}^{AB}$$

$$P_L \text{ màxima} \implies R_L = R_{Th}$$

$$C = \frac{Q}{\Delta V} = \frac{\varepsilon_0 S}{d}$$

$$\sigma = \frac{Q}{S}$$

$$E = \frac{\sigma}{\varepsilon_0}$$

$$U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}\varepsilon_0 E^2 Sd$$

$$\eta_E = \frac{1}{2}\varepsilon_0 E^2$$

2 Corrent altern

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$$v(t) = V_0 \cos(\omega t + \theta)$$

$$i(t) = I_0 \cos(\omega t + \theta - \varphi)$$

$$V_e = \frac{V_0}{\sqrt{2}} \quad I_e = \frac{I_0}{\sqrt{2}}$$

$$X = X_L - X_C = L\omega - \frac{1}{C\omega}$$

$$Z = \frac{V_0}{I_0} = \frac{V_e}{I_e} = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\varphi = \arctan\frac{X_L - X_C}{R}$$

$$\bar{V} = V_0\angle\theta \quad \bar{I} = I_0\angle(\theta - \varphi)$$

$$\bar{Z} = Z\angle\varphi = R + (X_L - X_C)j = \frac{\bar{V}}{\bar{I}}$$

$$S = V_e I_e$$

$$Q = S\sin\varphi = V_e I_e \sin\varphi$$

$$P = S\cos\varphi = V_e I_e \cos\varphi = I_e^2 R$$

$$\cos\varphi = 1 \implies X' = \frac{-Z^2}{X}$$

$$\text{Ressonància} \implies P \text{ màxima} \implies \omega_0 = \frac{1}{\sqrt{LC}}$$

$$\text{Ressonància} \implies P_R = \frac{V_e^2}{R}$$

$$\tau \equiv \text{amplada del pols}$$

$$BW = \frac{1}{\tau}$$

$$v_t = \frac{1}{2\tau}\frac{\text{bit}}{\text{s}} = \frac{1}{2\tau}\text{baud}$$

2.1 Transitoris

2.1.1 Càrrega RC

$$I_0 = \frac{\varepsilon}{R}$$

$$I(t) = I_0 e^{-t/\tau_C} = \frac{\varepsilon}{R} e^{-t/\tau_C}$$

$$\tau_C = RC$$

$$Q(t) = \varepsilon C \left(1 - e^{-t/\tau_C}\right)$$

2.1.2 Descàrrega RC

$$Q_0 = \varepsilon C = cRI_0$$

$$I(t) = I_0 e^{-t/\tau_C} = \frac{Q_0}{RC} e^{-t/\tau_C}$$

$$\tau_C = RC$$

$$Q(t) = Q_0 e^{-t/\tau_C} = RCI_0 e^{-t/\tau_C}$$

2.1.3 Càrrega RL

$$I_f = \frac{\varepsilon}{R}$$

$$I(t) = I_f \left(1 - e^{-t/\tau_L}\right) = \frac{\varepsilon}{R} \left(1 - e^{-t/\tau_L}\right)$$

$$\tau_L = \frac{L}{R}$$

$$U_L = \frac{1}{2} L I_f$$

2.1.4 Descàrrega RL

$$I_0 = \frac{\varepsilon}{R}$$

$$I(t) = I_0 e^{-t/\tau_L} = \frac{\varepsilon}{R} e^{-t/\tau_C}$$

$$U_R = \frac{1}{2} L I_0$$

2.2 Circuits filtre

$$f(\omega) = \frac{V_{out}}{V_{in}}$$

2.2.1 Filtre RC

$$V_{out} \text{ en condensador} \implies f(\omega) = \frac{1}{\sqrt{R^2 c^2 \omega^2 + 1}}$$

$$V_{out} \text{ en resistència} \implies f(\omega) = \frac{1}{\sqrt{\frac{1}{R^2 c^2 \omega^2} + 1}}$$