

Collection of formulas for the examination Fundamentals of EE3

1. Constants:

$$\text{Electric field constant: } \epsilon_0 = (36\pi 10^9)^{-1} \text{ AsV}^{-1} \text{ m}^{-1}$$

$$\text{Magnetic field constant: } \mu_0 = 4\pi 10^{-7} \text{ VsA}^{-1} \text{ m}^{-1}$$

2. Unit: $1J = 1Ws = 1Nm$

3. Trigonometric and hyperbolic functions:

$$\sin x = -0.5j(e^{jx} - e^{-jx}) \quad \cos x = 0.5(e^{jx} + e^{-jx}) \quad \cos^2 x + \sin^2 x = 1$$

$$\sin(x + y) = \sin x \cos y + \sin y \cos x \quad \sin(x - y) = \sin x \cos y - \sin y \cos x$$

$$\cos(x + y) = \cos x \cos y - \sin x \sin y \quad \cos(x - y) = \cos x \cos y + \sin x \sin y$$

$$\sinh x = 0.5(e^x - e^{-x}) \quad \cosh x = 0.5(e^x + e^{-x}) \quad \cosh^2 x - \sinh^2 x = 1$$

4. Derivations and integrals:

$$\frac{d}{dt} \sin x = \cos x$$

$$\frac{d}{dt} \cos x = -\sin x$$

$$\frac{d}{dt} e^x = e^x$$

$$\frac{d}{dt} \ln x = 1/x$$

$$\frac{d}{dt} x^n = nx^{n-1}, \quad (\text{n must be integer})$$

$$\int \sin x \, dx = -\cos x + c$$

$$\int \cos x \, dx = \sin x + c$$

$$\int e^x \, dx = e^x + c$$

$$\int 1/x \, dx = \ln x + c$$

$$\int x^n \, dx = x^{n+1}/(n+1) + c, \quad (\text{n must be integer, } n \neq -1)$$

5. Fourier series for signals with period T:

$$f(t) = 0.5a_0 + \sum_{v=1}^{\infty} (a_v \cos k\omega t + b_v \sin k\omega t), \quad \omega = 2\pi/T$$

$$a_v = \frac{2}{T} \int_{t_0}^{t_0+T} f(t) \cos v\omega t \, dt$$

$$b_v = \frac{2}{T} \int_{t_0}^{t_0+T} f(t) \sin v\omega t \, dt$$

$k \cdot s(t)$ gives a series with $k \cdot c_v$

$a \cdot s_1(t) + b \cdot s_2(t)$ gives a series with $a \cdot c_{v1} + b \cdot c_{v2}$

$s(t - t_1)$ gives a series with $c_v \cdot e^{-jv\omega t_1}$

$s(-t)$ gives a series with c_v^*