Exercise 12:

A signal $f(t)$ is given by the gaussian signal $f(t) = \exp\left\{-\left(\frac{t}{T}\right)^2\right\}$.

$f(t)$ is modulated by means of a cosine with a carrier frequency f_0 so that the signal $s(t) = f(t) \cdot \cos\left(2\pi \frac{t}{T_0}\right)$ is produced with $T >> T_0$.

(a) Determine approximately the analytic spectrum $S^0(\omega)$
(b) Specify approximately the equivalent low pass spectrum $S_T(\omega)$

Exercise 13:

Given is a signal $s(t) = \cos(\omega_0 t) + 2 \cdot \sin(2 \cdot \omega_0 t) + 3 \cdot \cos\left(3 \cdot \omega_0 t + \frac{\pi}{2}\right)$

(a) Specify the Hilbert transform $\hat{s}(t)$
(b) Determine the equivalent low pass signal $f_T(t)$ for $f(t) = \cos(\omega_0 t) + 2 \cdot \sin(2 \cdot \omega_0 t)$ and write down the inphase component $u(t)$ und the quadrature component $v(t)$ for ω_0 as carrier frequency.

Exercise 14:

1. Find the Laplace transforms of

1. $s_1(t) = \mathrm{e}^{(-2\mathrm{t}+4)} \cdot \epsilon(\mathrm{t})$
2. $s_2(t) = \left(1 - \mathrm{e}^{-\mathrm{t}}\right) \cdot \epsilon(\mathrm{t})$
3. $s_3(t) = (t-2) \cdot \epsilon(t-1)$
4. $s_4(t) = \cos\left(t - \frac{1}{4}\pi\right) \cdot \epsilon\left(t - \frac{1}{4}\pi\right)$
5. $s_5(t) = \cos\left(t - \frac{1}{4}\pi\right) \cdot \epsilon(t)$

2. Sketch the pole-zero diagrams of the following systems. Are they stable? Why, or why not?

1. $H_{\mathrm{LP},1}(p) = \frac{(p+1)^2}{(p^2+1)}$
2. $H_{\mathrm{LP},2}(p) = \frac{2(p^2+4)}{p(p^2+1)(p+2)}$