ELM361 Analog Communication Systems
Homework #1
Due: 17.10.2017

1. Consider a filter with impulse response $h(t)$ and transfer function $H(f)$. If we apply the input signal $x(t)$ whose Fourier spectrum is $X(f) = (a + j2\pi f)/(b + j2\pi f)$ to the filter, at the output, we obtain the following signal $y(t) = ae^{-bt}u(t)$ where $a = 4527$ rad/s.
   a. Find the transfer function $H(f)$ of the filter. (15 p)
   b. Find the amplitude response of the filter. (5 p.)
   c. Find the phase response of the filter. (5 p.)
   d. Find the group delay of the filter. (5 p.)
   e. Comment on the characteristic of the filter. Low-pass or high-pass? (5 p.)
   f. Find the 3 dB bandwidth. (10 p.)
   g. Find the output $y(t)$ of the filter for the input signal $g(t) = \cos(1000\pi t) + \cos(3000\pi t)$. (55 p.)