Homework 1

Communication Systems (EE 308), Autumn'19

1) The following problems from Haykin, Chapter 2: 2.1 to 2.13, 2.15 and 2.21 on pp. 70-72.

2) Consider the band-pass signal:

$$g(t) = \cos(2\pi(f_c + f_m)t),$$

where $f_c \gg f_m$.

   (a) Find the complex envelope, say $\tilde{g}(t)$, of $g(t)$.

   (b) Find the Fourier transform of the signal $\tilde{g}(t)$, say $\tilde{G}(f)$, and compute the Fourier transform of $g(t)$ using $\tilde{G}(f)$.

3) Consider the band-pass signal:

$$g(t) = \exp(-a|t|)\cos(2\pi f_c t),$$

where $a > 0$ and f_c is large enough such that the amplitude spectrum of $g(t)$ is negligible outside narrow bands around $\pm f_c$. Using complex envelopes, find the output $y(t)$ when $g(t)$ is input to a band-pass filter with frequency response:

$$H(f) = \begin{cases} e^{-j2\pi|f|t_0}, & f_c - B \le |f| \le f_c + B, \\ 0, & \text{else}, \end{cases}$$

where $t_0 > 0$ and $B > 0$.