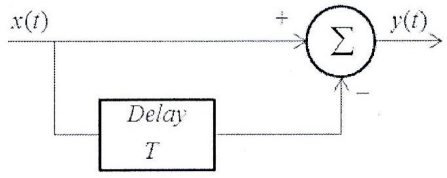
S-72.1140 Transmission Methods in Communication Systems

Closed-book exam on 28.10.2010

1 Determine and sketch impulse and frequency response for the circuit shown below:



2 Find maximum frequency and phase deviation for the signal

$$x(t) = 10\cos\left[\pi 10^8 t + 5\sin 2\pi 10^3 t\right].$$

3 Determine bandwidth for the signal $x(t) = 10\cos\left[8\cdot 10^9 t + 6\sin 4\pi 10^3 t\right]$.

4 Let us consider an analog baseband communication system with additive Gaussian noise channel having power spectral density $\eta/2$ and transfer function $H_c(\omega) = (1 + j\omega/W)^{-1}$. At the receiver the channel response is compensated by the filter

$$H_{eq}(\omega) = \begin{cases} 1/H_c(\omega) & 0 \le |\omega| \le W \\ 0 & \text{otherwise} \end{cases}$$

that is placed immediately after the channel. Obtain the expression for SNR after the filter $H_{eq}(\omega)$ in terms of transmission bandwidth B [Hz], receiver power S_x [W] and noise power spectral density η [W/Hz].

5 Show that if c_i and c_j are two code vectors in an (n,k) linear block code, their sum is also a code vector. Hint: Syndrome decoding is based on the same important equation.