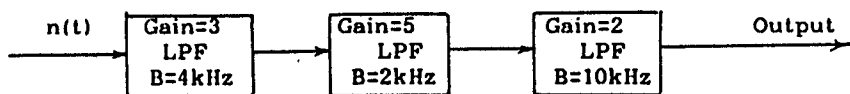


1. If $z(t) = t^2 - 3t + 5$, please find $z(t)\delta((-t+2)/2) = ?$ (10%)
2. Find $Z(f)$ in terms of $V(f)$ when $z(t) = 4v(t-3) + 5v(t/2)$. (10%)
3. A stationary random process $x(t)$ has the autocorrelation function $R_x(\tau) = 25\exp(-3|\tau|) + 125$. Find $E[x(t)]$? (10%)
4. $x(t) = 2\cos 2000\pi t$ is sampled by an ideal sampler with sampling frequency $f_s = 1500\text{Hz}$. If this sampled data sequence is interpolated by an ideal lowpass filter with bandwidth 750Hz , what is the output of lowpass filter? (10%)
5. Compute the noise power at the output of the system shown below, given that the input $n(t)$ has the power spectrum density function (10%)
 $G_n(f) = 0.001 \text{ Watt/Hz}, -\infty \leq f \leq \infty$



P.S.: Gain denotes amplitude gain. LPF denotes ideal lowpass filter.

6. Consider a five-repetition code with codeword 00000 and 11111 in a BSC with $P_e = 0.01$.
 (a) For error detection, find the probability of the undetected word error. (5%)
 (b) For error correction, find the probability of word decoding error. (5%)
7. Two given functions are
 $f(t) = \exp(-|t|); g(t) = 1 - A\exp(-2|t|)$
 (a) Determine the constant A such that $f(t)$ and $g(t)$ are orthogonal over the interval $-\infty$ to $+\infty$. (5%)
 (b) Repeat (a) for the interval $(-1, 1)$. (5%)
8. (10%) The impulse response of a given system is $h(t) = 1/2 \exp(-0.5t) u(t)$.
 (a) Determine the unit step response of the system.
 (b) A low-frequency periodic symmetric square wave with a 2-volt p/p amplitude is applied to the system. Compute the mean-square error between the input and the output of the system when the period of the square wave is 100 sec.
9. Discusses briefly the proper operation frequency range, propagation medium and applications for (a) Surface wave (地球表面波); (b) Sky wave (天波); (c) Direct wave (直射波)
10. (10%) Suppose that $x(t)$ is a real-valued energy signal with a Fourier Transform $X(f)$. If the positive-frequency portion of $X(f)$ is given in Figures 8(a)(b), find

$\int_{-\infty}^{\infty} x^2(t) dt = ?$

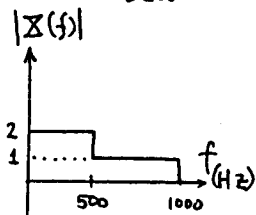


Figure 8(a)

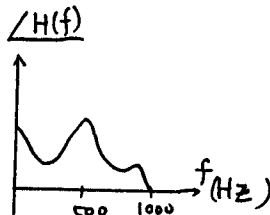


Figure 8(b)