Sohag University | Analog Communication

Faculty of Engineering | Third Year - communication

Electrical Engineering Department

SHEET1

Problem 1

Signals $g_1(t) = 10^4 \text{rect}\,(10^4 t)$ and $g_2(t) = \delta(t)$ are applied at the inputs of the ideal low-pass filters $H_1(\omega) = \text{rect}\,(\omega/40,000\pi)$ and $H_2(\omega) = \text{rect}\,(\omega/20,000\pi)$ (Fig. P3.4-1). The outputs $y_1(t)$ and $y_2(t)$ of these filters are multiplied to obtain the signal $y(t) = y_1(t)y_2(t)$.

(a) Sketch $G_1(\omega)$ and $G_2(\omega)$.

(b) Sketch $H_1(\omega)$ and $H_2(\omega)$.

(c) Sketch $Y_1(\omega)$ and $Y_2(\omega)$.

(d) Find the bandwidths of $y_1(t)$, $y_2(t)$, and $y(t)$.

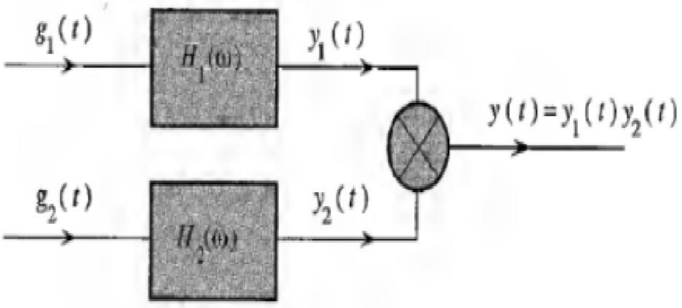

Figure P3.4-1

Problem 2

Determine the maximum bandwidth of a signal that can be transmitted through the low-pass RC filter in Fig. 3.27a with $R = 1000$ and $C = 10^{-9}$ if, over this bandwidth, the amplitude response (gain) variation is to be within 5% and the time delay variation is to be within 2%.

Problem3

EXAMPLE 3.23 Figure 3.42a shows a random binary pulse train $g(t)$. The pulse width is $T_b/2$, and one binary digit is transmitted every T_b seconds. A binary 1 is transmitted by the positive pulse, and a binary 0 is transmitted by the negative pulse. The two symbols are equally likely and occur randomly. We shall determine the autocorrelation function, the PSD, and the essential bandwidth of this signal.