國立成功大學 107 學年度碩士班招生考試試題

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1) (25 marks) Determine the Fourier series representation of an impulse train expressed by $x(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_0)$.

2) (25 marks) Assume that the modulating signal $m(t)$ is a sinusoid of the form $m(t) = a\cos 2\pi f_m t$ (where $f_m \ll f_c$). Determine the DSB-SC AM signal and its upper and lower sidebands signals.

3) An angle-modulated signal is described by $x_c(t) = 10\cos[2\pi(10^6)t + 0.1\sin(10^3)\pi t]$.

   a) (10 marks) Consider $x_c(t)$ as a PM signal with its phase deviation constant $k_p=10$. Find modulating signal $m(t)$.

   b) (10 marks) Consider $x_c(t)$ as an FM signal with its frequency deviation constant $k_f = 10\pi$. Find modulating signal $m(t)$.

4) Multipath transmission occurs when a transmitted signal arrives at a receiver via two or more paths with different delays. A simple model for a multipath communication channel is shown in Fig. 1(a).

   a) (15 marks) Find the frequency response function $H(\omega)$ for this channel and plot $|H(\omega)|$ for $\alpha = 1$ and 0.5.

   b) (15 marks) To compensate for multipath-induced distortion, an equalization filter is often used. Ideally, the frequency response function of the equalization filter should be $H_{eq}(\omega) = \frac{1}{H(\omega)}$. A tapped delay-line filter, as shown in Fig. 1(b), is commonly utilized to approximate this equalization filter. Find the values for $a_1, a_2, ..., a_N$ in Fig. 1(b), assuming $\tau = T$ and $\alpha \ll 1$. (Hint: The following series expansion may be useful: $\frac{1}{1+x} = 1 - x + x^2 - x^3 + ...$, where $|x| < 1$.)
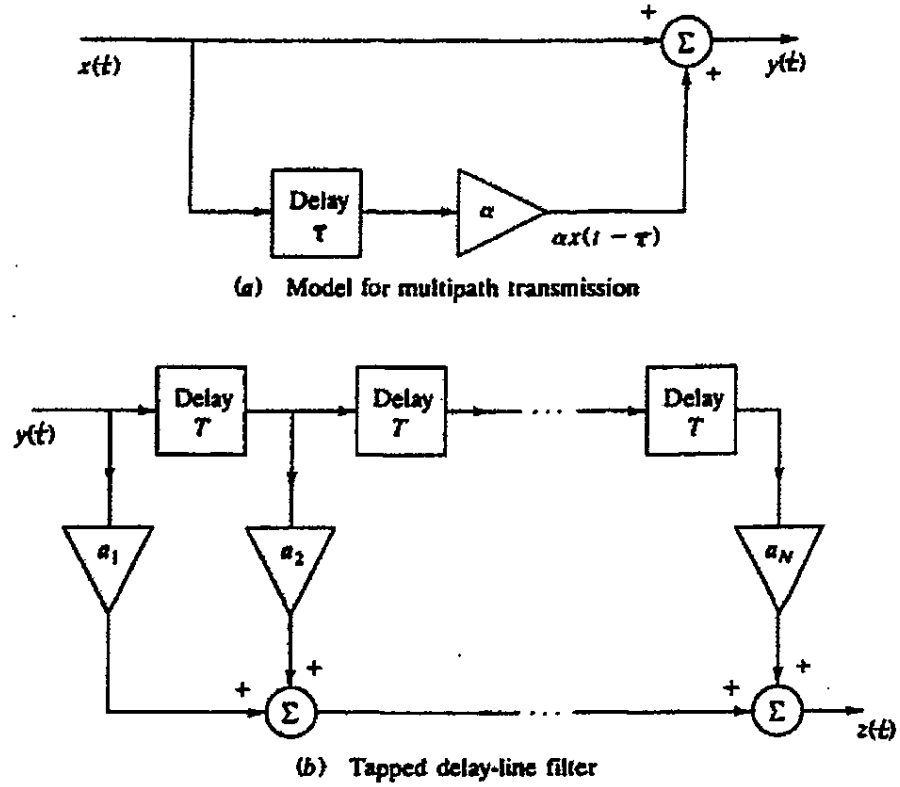
Fig. 1.　(a) Model for multipath transmission. (b) Tapped delay-line filter.