淡江大學九十三學年度碩士班招生考試試題

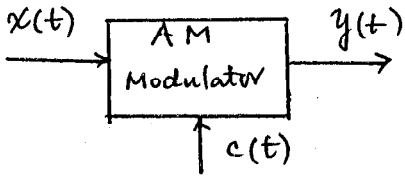
系別：電機工程學系　　科目：通 信 系 統

准帶項目請打「○」否則打「×」
○ 簡單型計算機

本試題共 2頁 1/2

本試題雙面印製

1. An Amplitude Modulator (AM) has a functional block diagram as shown in the following:



$$y(t) = 10\cos(2\pi \cdot 1800)t + 40\cos(2\pi \cdot 2000)t + 10\cos(2\pi \cdot 2200)t$$

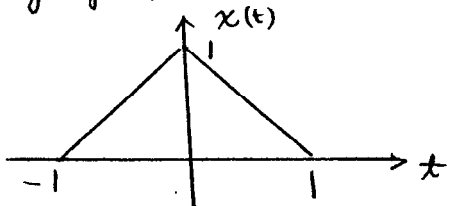
Where $x(t)$: Modulating signal, $c(t)$: carrier signal, $y(t)$: Modulated signal

(10%)(1.a) determine the modulating signal $x(t)$ and the carrier signal $c(t)$

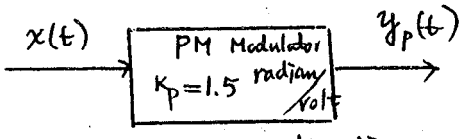
(5%)(1.b) Determine the Modulation index

(5%)(1.c) Determine the ratio of the power in the sidebands to the power in the carrier.

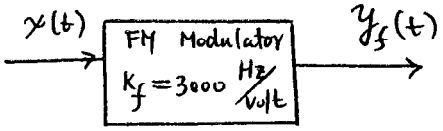
2. A signal (modulating signal) $x(t)$ has the following form.



This signal is applied to an FM (frequency modulator) or a PM (phase modulator) as shown in the following diagrams:



K_p: phase deviation constant



K_f: frequency deviation constant

(10%)(2.a) Find Fourier Transform $X(f)$ of $x(t)$. Give an estimate of the bandwidth of signal $x(t)$.

(5%)(2.b) Find the phase modulation index β_p of the phase modulator

(5%)(2.c) plot $y_p(t)$, assume carrier signal is $\cos 2\pi(1000)t$.

(5%)(2.d) Find the frequency modulation index β_f of the frequency modulator

(5%)(2.e) Plot $y_f(t)$, assume carrier signal is $\cos 2\pi(1000)t$.

◀注意背面尚有試題▶

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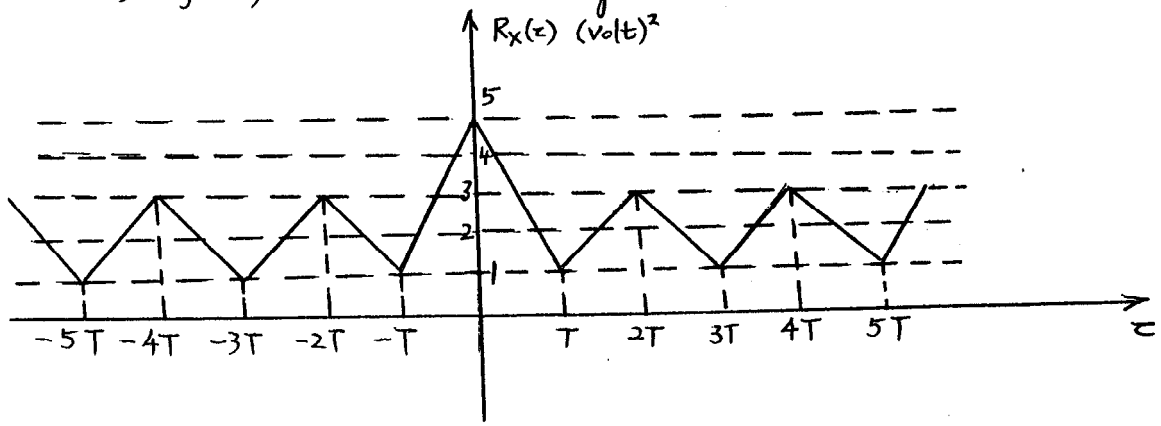
3. A random process $x(t)$ consists of a DC component $x_{dc}(t)$, a periodic component $x_p(t)$ and a random component $x_r(t)$, i.e.

$$x(t) = x_{dc}(t) + x_p(t) + x_r(t)$$

where $x_{dc}(t) = \sqrt{2}$ volts

Let $R_x(\tau)$ denote the autocorrelation function of $x(t)$ with a time shift of τ, it has the following form:



(10%)(3a) Find the average power of the periodic component $x_p(t)$

(10%)(3b) Find the average power of the random component $x_r(t)$

(5%)(3c) Find the total power of the signal $x(t)$

4. The demodulator of the binary antipodal signals

(25%)

$$s_1(t) = -s_2(t) = \begin{cases} \sqrt{\frac{E_b}{T}} & 0 \le t \le T \\ 0 & \text{otherwise} \end{cases}$$

can be accomplished by use of a single integrator as shown in the following figure which is sampled periodically at $t = KT$, $K = 0, \pm 1, \pm 2, \cdots$ The additive noise is zero-mean Gaussian with power-spectral density of $\frac{N_0}{2}$ W/Hz. Determine the output signal-to-Noise (SNR) of the demodulator at $t = T$.