

國立中央大學通訊工程學系 96 學年度碩士在職專班入學筆試

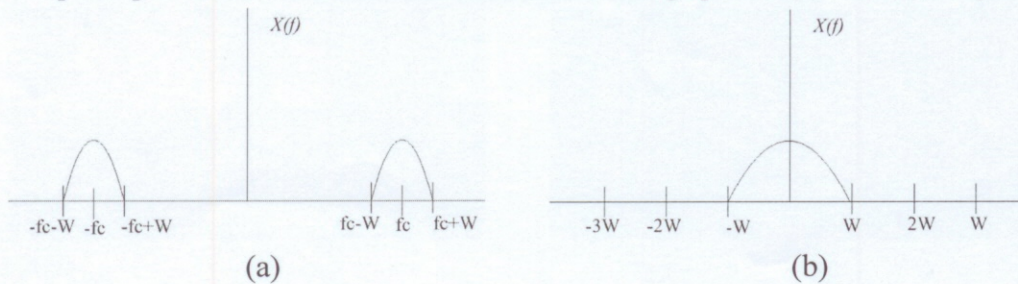
【基本通訊概論】試卷

考試地點：通訊館一樓 E1-109 室

考試時間：100 分鐘

試題總分：100 分

1. [10 %] What are the bandwidths of the following spectra (a) and (b), respectively?



2. [10 %] Sketch a complete processing block diagram of a digital communication system for the transmitter and the receiver.
3. [10%] Find the matched filter impulse response $h(t)$ for the signal $s(t) = A \sin(2\pi f_c t), 0 \leq t \leq T$ and sketch a correlator receiver implementation structure.
4. [10 %] Assume that an analog audio voice-frequency (VF) telephone signal occupies a band from 300 to 3400 Hz. The signal is to be converted to a PCM signal for transmission over digital telephone system.
- (a) What is the minimum sampling frequency to avoid aliasing?
- (b) In order to allow the use of a low-cost low-pass anti-aliasing filter with reasonable transition band, the VF signal is oversampled with a sampling frequency of 8 ksamples/sec. Assume that each sample value is represented by 8 bits. What is the bit rate of the binary PCM signal?
5. [10 %] Test X and Y for independence if $f_{XY}(x, y) = Ae^{-|x|-2|y|}$.
Prove your answers.
6. [10 %] In a AM signal, both sidebands and the carrier wave are transmitted, as shown by $s(t) = A_c[1 + k_a m(t)] \cos(2\pi f_c t)$, where $A_c \cos(2\pi f_c t)$ is the carrier wave, $m(t)$ is the message signal, and k_a is a constant that determines the percentage modulation.
Please find the average power of the full AM signal.

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7. [10 %] A narrow band noise $n(t)$ is represented as

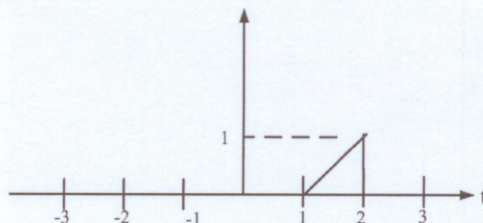
$$n(t) = n_I(t) \cos(2\pi f_c t) - n_Q(t) \sin(2\pi f_c t).$$

We may represent the noise $n(t)$ in terms of its envelope and phase components. Please write down the mathematical expressions of the envelope and the phase components in terms of $n_I(t)$ and $n_Q(t)$.

8. [10 %] A signal with a waveform shown in the following figure is fed into the system with the impulse response:

$$h(t) = 5\delta(t) - 2\delta(t - 5).$$

Please sketch the output waveform of the system output.



9. [10 %] Sketch the double-sided amplitude and phase spectra of

$$x(t) = 10 \cos(4\pi t + \pi/6) + 3 \sin(10\pi t + 2\pi/3).$$

10. [10 %]

(a) Given the input binary sequence 1100100010, sketch the waveforms of the in-phase and quadrature components of a modulated wave obtained by using the QPSK modulation.

(b) Let P_{eI} and P_{eQ} denote the probabilities of symbol error for the in-phase and quadrature channels of a narrowband digital communication system. What is the average probability of symbol error for the overall system?