

中原大學 96 學年度碩士班入學考試

96/03/25 16:00~17:30 電子工程學系通訊組)

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目：通訊系統

(共 2 頁第 1 頁)

■可使用計算機，惟僅限不具可程式及多重記憶者 □不可使用計算機

請詳述解題過程，只寫答案或最後結果，將給予扣分

1. The output signal from an AM modulator is

$$u(t) = 5 \cos 1800\pi t + 20 \cos 2000\pi t + 5 \cos 2200\pi t$$

- (a) Determine the modulating signal $m(t)$ and the carrier $c(t)$. 10%
- (b) Determine the modulation index. 5%
- (c) Determine the ratio of the power in the sidebands to the power in the carrier. 5%

2. A superheterodyne FM receiver operates in the frequency range of 88~108 MHz. The IF and local-oscillator frequencies are chosen such that $f_{IF} < f_{LO}$. We require that the image frequency f_{IM} fall outside of the 88~108 MHz region. Determine the minimum required f_{IF} and the range of variation in f_{LO} . 10%

3. Consider the following block code $C = \{(000000), (010101), (101010), (111111)\}$

- (a) Is the code linear? Explain. 5%
- (b) What is the minimum Hamming distance for this code? 5%
- (c) For a BSC channel with uncoded error-rate $p = 10^{-3}$, what is the bit error probability for this code? 10%

4. A matched filter has the frequency response

$$H(f) = \frac{1 - e^{-j2\pi ft}}{j2\pi f}$$

- (a) Determine the impulse response $h(t)$ corresponding to $H(f)$. 10%
- (b) Determine the signal waveform to which the filter characteristic is matched. 5%

5. The two equivalent low-pass signals shown in figure are used to transmit a binary sequence over an additive white Gaussian noise channel. The received signal can be expressed as

$$r_i(t) = s_i(t) + z(t), 0 \leq t \leq T, i = 1, 2$$

where $z(t)$ is a zero-mean Gaussian noise process.

- (a) Determine the transmitted energy in $s_1(t)$ and $s_2(t)$ and the cross-correlation coefficient ρ_{12} . 10%

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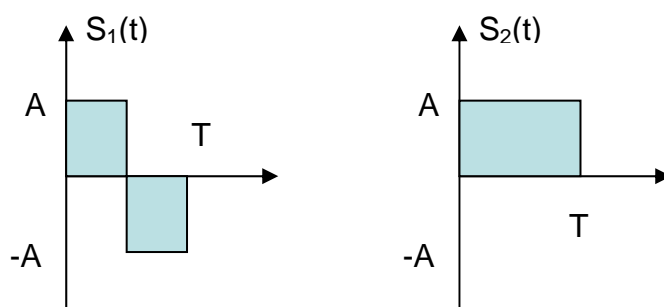
科目：通訊系統

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- (b) Suppose the receiver is implemented by means of coherent detection using two matched filters, one matched to $s_1(t)$ and the other to $s_2(t)$. Sketch the equivalent low-pass impulse responses of the matched filters. 5%
- (c) Sketch the noise-free response of the two matched filters when the transmitted signal is $s_2(t)$. 5%



6. (a) If $x(t) = A \cos(2\pi ft + \theta)$ indicates the voltage across a 1Ω , evaluate $x(t)$ is a energy or power type signal? 5%
- (b) If the amplitude $A = \sqrt{20}$ volts, what is the power represented by dBW and dBm? 5%
- (c) If the signal $x(t)$ is amplified with a gain 10, what is the output power (represented by dBW and dBm) of amplifier? 5%