

# 中原大學 100 學年度 碩士班 入學考試

3 月 19 日 15:30~17:00

通訊工程碩士學位學程

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：通信理論

(共 1 頁第 1 頁)

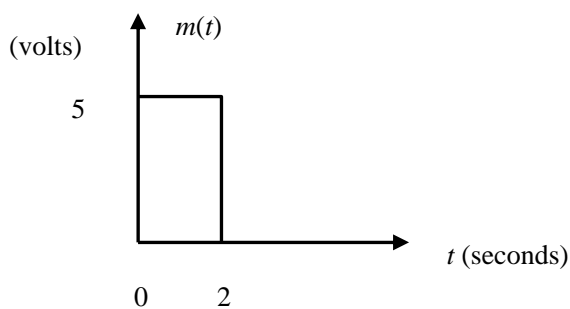
■ 可使用計算機，惟僅限不具可程式及多重記憶者

□ 不可使用計算機

1. An FM modulator has output

$$x(t) = 20 \cos[\omega_c t + 2\pi f_D \int_0^t m(\xi) d\xi]$$

where  $f_D = 10$  Hz/volt and  $m(t)$  is shown below. (a) Sketch the phase deviation in radians. (5%) (b) Sketch the frequency deviation in Hz. (5%) (c) Determine the peak frequency deviation in Hz. (10%)



2. A delta modulator has the message signal

$$m(t) = 2\sin[2\pi(20)t] + 5\sin[2\pi(10)t]$$

Determine the minimum sampling frequency required to avoid slope overload, assuming that the impulse weight (or step size)  $\delta$  is 0.1. (20%)

3. A sinusoidal signal of frequency 10 Hz is to be sampled periodically. (a) Find the maximum allowable time interval between samples. (5%) (b) Samples are taken at a rate of 30 samples/sec. Construct a plot of the sampled signal spectrum in order to illustrate that this is an acceptable sampling rate to allow recovery of the original sinusoid. (5%) (c) The samples are spaced 1/15 seconds apart. Construct a plot of the sampled signal spectrum that shows what the recovered signal will be if the samples are passed through a lowpass filter such that only the lowest frequency spectral lines are passed. (10%)

4. Assume we have an information source with output alphabet probabilities: {0.16, 0.06, 0.10, 0.14, 0.18, 0.24, 0.12}. We want to use 0, 1, and 2 (rather than the traditional 0 and 1) to design a ternary Huffman code. (a) Give the resulting codes for the seven alphabets. You need to show the coding process in a tree diagram. (10%) (b) What is the average coding length  $L$  for an alphabet? (5%) (c) Compute the entropy  $H$  of the source and compare it with the value of  $L$ . (5%)

5. Explain the following terminologies: (a) eye diagram (5%); (b) group delay (5%); (c) direct sequence spread spectrum (5%); (d) rate-distortion function (5%).