

國立清華大學 102 學年度碩士班考試入學試題

系所班組別：生醫工程與環境科學系 丙組(醫學物理與工程組)

考試科目 (代碼)：生醫訊號與系統 (2402)

共 2 頁，第 1 頁 \*請在【答案卷、卡】作答

1. (10%) What is sampling theorem? Please give an example to describe.

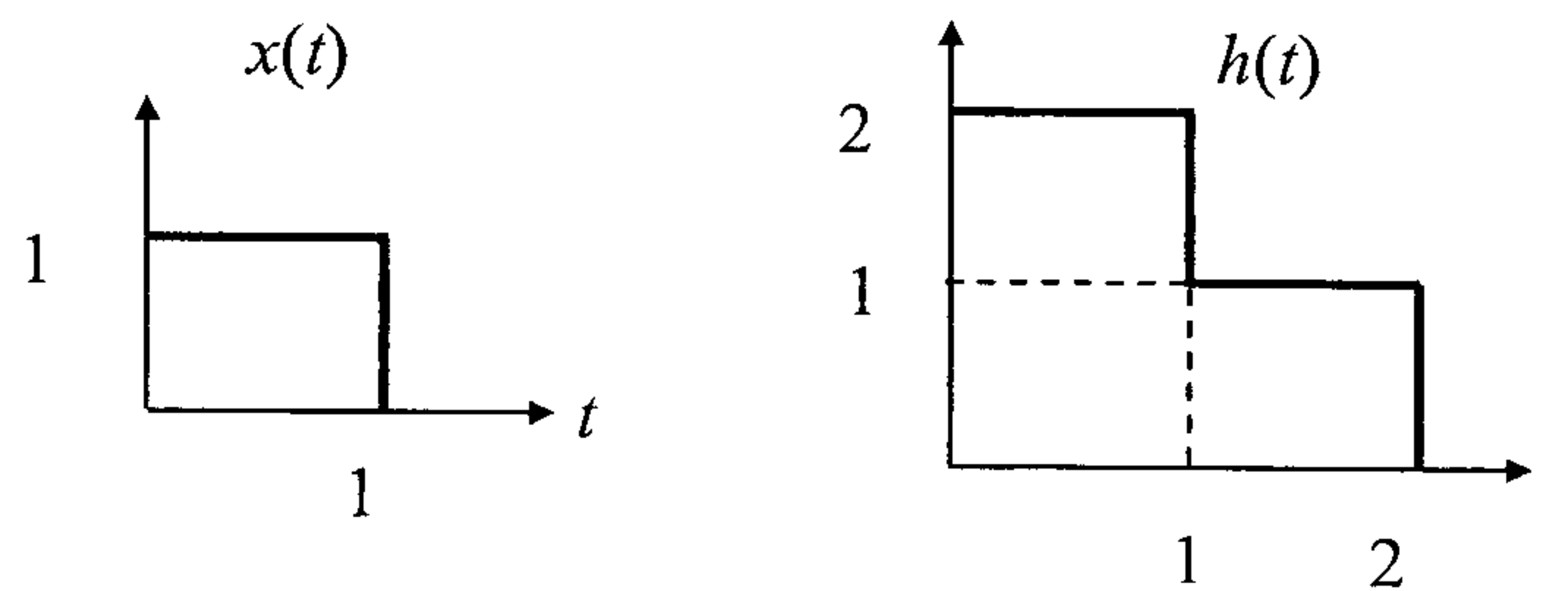
2. (5%) (a) Find the even and odd parts of the signal:

$$x(t) = e^{-2t} \cos(t)$$

(10%) (b) Sketch the even and odd parts of the discrete-time signal:

$$g[n] = u[n] - u[n - 4]$$

3. (15%) Calculate  $y(t) = x(t) * h(t)$ . (\* convolution)



4. (a) A periodic continuous-time signal  $x(t)$ , please describe the complex exponential Fourier series representation of  $x(t)$ . (5%)

(b) What is the physical meaning of the Fourier series coefficients ( $a_k$ )? (5%)

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5. (10%) (a) Find the Fourier transform and sketch the spectrum of  $x(t)$ .

$$x(t) = \begin{cases} 1, & |t| < 1 \\ 0, & |t| > 1 \end{cases}$$

(10%) (b) Find the inverse Fourier transform of  $X(j\omega)$  and sketch the corresponding time-domain function.

$$X(j\omega) = \begin{cases} 1, & |\omega| < 1 \\ 0, & |\omega| > 1 \end{cases}$$

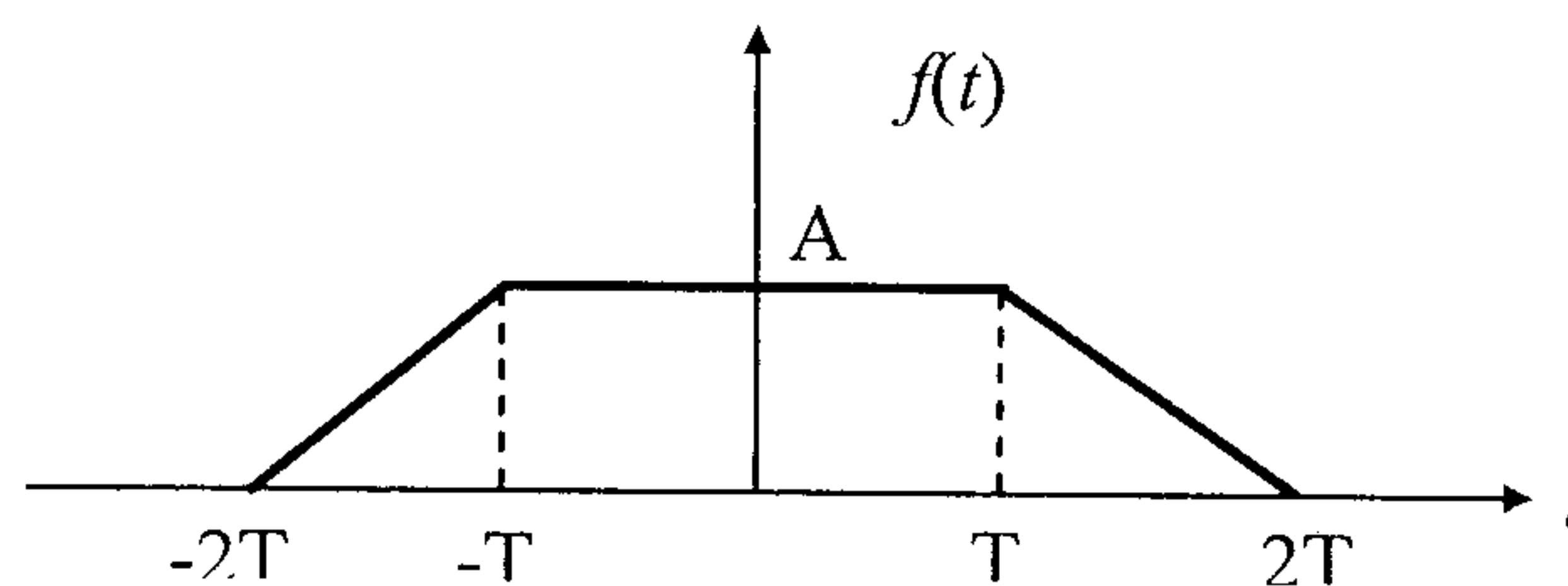
6. Consider a stable LTI system. ( $y(t)$  is output and  $x(t)$  is input)

$$\frac{d^2 y(t)}{dt^2} + 4 \frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$$

(10%) (a) What is the system's frequency response  $H(j\omega)$ ?

(5%) (b) What is the impulse response  $h(t)$  of this system?

7. (15%) Find Fourier Transform of  $f(t)$ .



$$\text{Hint: } F\left\{\frac{d^2}{dt^2} f(t)\right\} = (i\omega)^2 F\{f(t)\}$$