

# 淡江大學八十八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

本試題共 2 頁

本試題雙面印製

1. Suppose we wish to transmit the signal  $x(t) = \frac{\sin 1000\pi t}{\pi t}$  using a modulator that creates the signal  $w(t) = (x(t) + A) \cos(10,000\pi t)$ . Determine the largest permissible value of the modulation index  $m$  that would allow asynchronous demodulation to be used to recover  $x(t)$  from  $w(t)$ .

2. (a) Consider the frequency-modulated signal  $y(t) = \cos(\omega_c t + m \cos \omega_m t)$  where  $\omega_c \gg \omega_m$  and  $m \ll \frac{\pi}{2}$ . Specify an approximation to  $Y(j\omega)$  for  $\omega > 0$ .

(b) For what values of  $\omega_0$  in the range  $-\pi < \omega_0 \leq \pi$  is amplitude modulation with carrier  $e^{j\omega_0 n}$  equivalent to amplitude modulation with carrier  $\cos \omega_0 n$ ?

3. Let  $x[n]$  be a discrete-time signal with spectrum  $X(e^{j\omega})$ , and let  $p(t)$  be a continuous-time pulse function with spectrum  $P(j\omega)$ . We form the signal  $y(t) = \sum_{n=-\infty}^{\infty} x[n] p(t-n)$ .

(a) Determine the spectrum  $Y(j\omega)$  in terms of  $X(e^{j\omega})$  and  $P(j\omega)$ .  
 (b) If  $p(t) = \begin{cases} \cos 8\pi t, & 0 \leq t \leq 1. \\ 0, & \text{elsewhere.} \end{cases}$   
 Determine  $P(j\omega)$  and  $Y(j\omega)$ .

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4. In practice it is often very difficult to build an amplifier at very low frequencies. Consequently, low-frequency amplifiers typically exploit the principle of amplitude modulation to shift the signal into a higher-frequency band. Such an amplifier is ref. to as a chopper amplifier and is illustrated in the the block diagram form in Fig. 1.

(a) Determine in terms of  $T$  the highest allowable frequency present in  $x(t)$ , if  $y(t)$  is to be proportional to  $x(t)$  (i.e. if the overall system is to be equivalent to an amplifier)

(b) With  $x(t)$  bandlimited as specified in part(a), determine the gain of the overall system in Fig. 1 in terms of  $A$  and  $T$ .

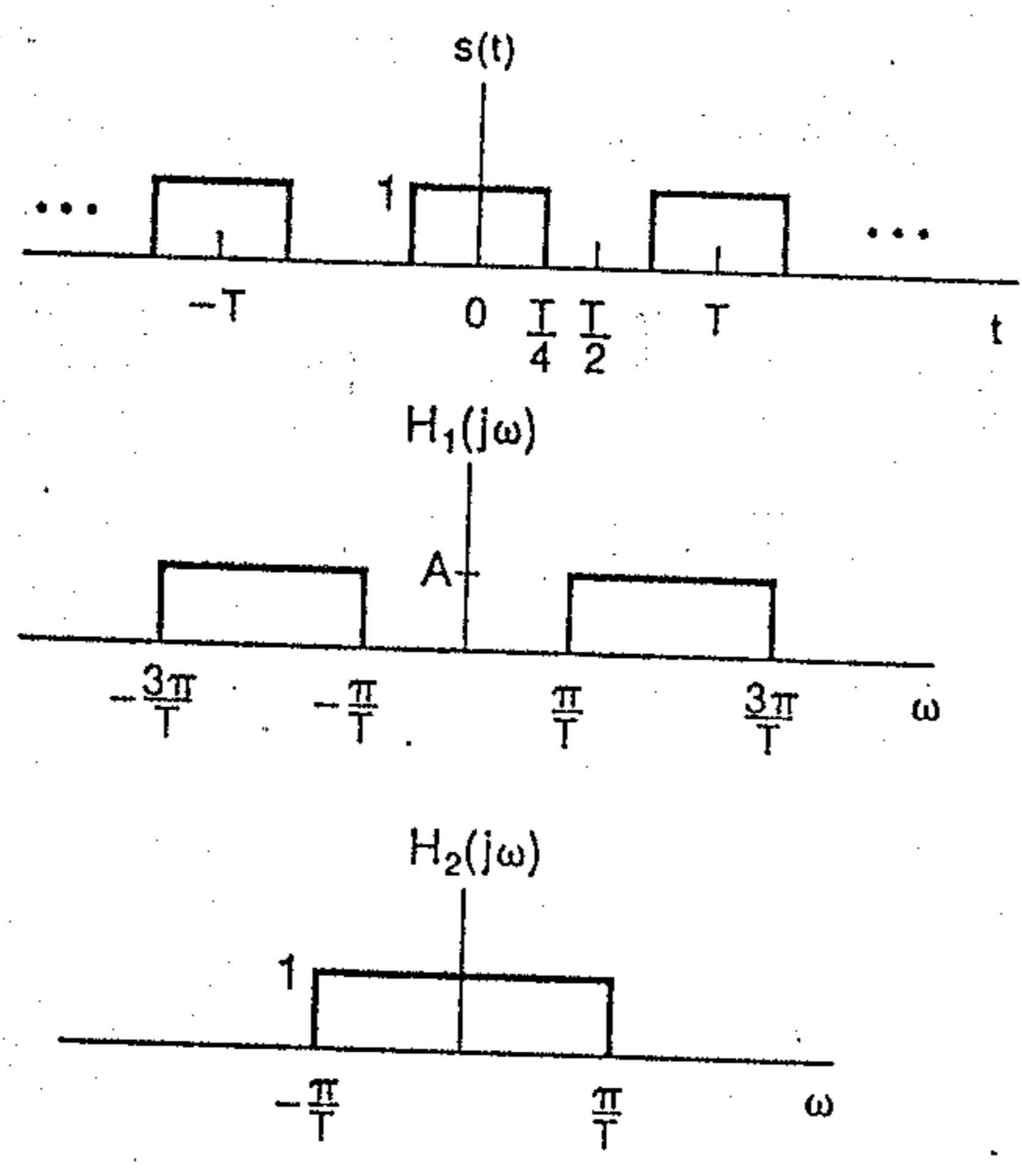
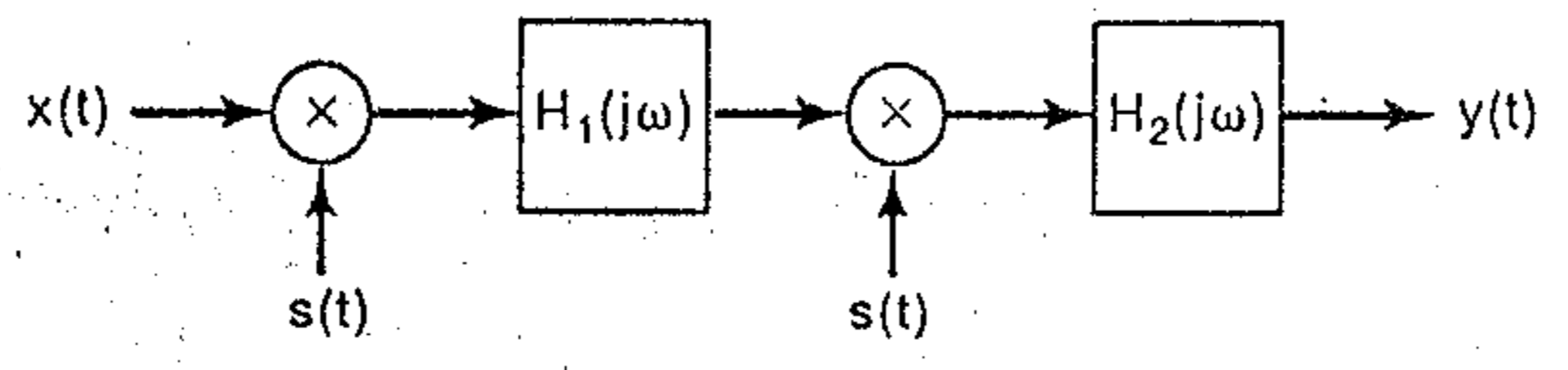


Fig. 1