

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

(25 marks, 5 marks for each sub-question)

1. Answer the following questions:

- What are the names of 3G and 4G mobile cellular standards in Taiwan? Please write down their names (i.e., their abbreviations).
- What are the multiple access technologies used in 3G and 4G mobile cellular standards in Taiwan?
- In a wireless communication system, fading in received signals is a major performance-limiting factor. What are the distributions that fading signals may obey?
- Multipath propagation is another important issue impacting on the performance of a wireless communication system. Does fading in a channel have anything to do with multipath propagation? Please explain it.
- What is spread spectrum communication? How many different spread spectrum technologies exist? Please write down their names.

(25 marks)

- In a broadcasting communication system the transmitter power is 40 kW, the channel attenuation is 80 dB, and the noise-power-spectral density is 10^{-10} W/Hz. The message signal has a bandwidth of 10^4 Hz.
 - Find the pre-detection signal-to-noise ratio (SNR) for DSB and SSB modulations. (9 mark)
 - Find the output SNR if the modulation is DSB. (8 mark)
 - Find the output SNR if the modulation is SSB. (8 mark)

(25 marks, 5 marks for each sub-question)

- An angle-modulated signal with carrier frequency $f_c = 1$ MHz is described by the equation $x(t) = 10\cos(2\pi f_c t + 0.1\sin(2000\pi t))$
 - Find the power of the modulated signal.
 - Find the peak frequency deviation.
 - Find the peak phase deviation.
 - Determine whether this signal is narrowband or wideband.
 - Sketch the amplitude spectrum and estimate the bandwidth.

(25 marks)

- Consider the system in Figure 1. Suppose that $x(t) = \text{sinc}(2Wt)$, where $W = 1000$ Hz. The low-pass filter is ideal, with its cutoff frequency at 900 Hz. The high-pass filter is also ideal, with its cutoff frequency at 800 Hz. Is $g(t)$ a baseband signal, or a band-pass signal? Determine its bandwidth.

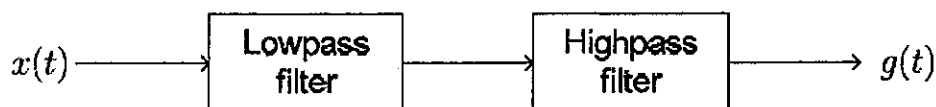


Figure 1. A cascaded low-pass and high-pass filters.