

國立成功大學
110學年度碩士班招生考試試題

編 號：108

系 所：工程科學系

科 目：通信系統

日 期：0203

節 次：第 1 節

備 註：不可使用計算機

※ 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。

- 1) (20 marks, 4 marks each) Answer the following questions:
 - a) What is the key technology that makes 5G different from 4G?
 - b) What is the multiple access technique used in the second phase of 5G?
 - c) Polar code has been used in 5G for channel coding. What is the main purpose to use the channel coding in 5G?
 - d) 5G can support a data transmission speed at 1 Gbps. If so, what is the time duration of each bit in the 5G?
 - e) What is the major difference between a wireless communication system and a mobile communication system?

- 2) (20 marks, 5 marks each) Classify these signals into energy-type signals, power-type signals, and signals that are neither energy-type nor power-type signals. For energy-type and power-type signals, find the energy or the power content of the signal.
 - a) $x_1(t) = [e^{-t} \cos(t)]u_{-1}(t)$, where $u_{-1}(t)$ is a unit step function defined as $u_{-1}(t) = 1$ for $t \geq 0$, and $u_{-1}(t) = 0$ otherwise.
 - b) $x_2(t) = e^{-t} \cos(t)$.
 - c) $x_3(t) = \text{sgn}(t)$, where $\text{sgn}(t)$ is a sign function defined as $\text{sgn}(t) = 1$ for $t > 0$, and $\text{sgn}(t) = -1$ for $t < 0$.
 - d) $x_4(t) = A \cos(2\pi f_1 t) + B \cos(2\pi f_2 t)$.

- 3) (20 marks, 10 marks each) The modulating signal $m(t) = 2 \cos(4000\pi t) + 5 \cos(6000\pi t)$ is multiplied by the carrier $c(t) = 100 \cos(2\pi f_c t)$, where $f_c = 50$ kHz.
 - a) Determine the spectrum of the DSB modulated signal.
 - b) Sketch the spectrum of the DSB modulated signal.

- 4) (20 marks) The message signal $m(t)$, whose spectrum is shown in Fig. 1, is passed through the system shown in that figure. The bandpass filter has a bandwidth of $2W$ centered at f_0 , and the lowpass filter has a bandwidth of W .
 - a) (7 marks) Plot the spectra of the signals $x(t)$, $y_1(t)$, $y_2(t)$, $y_3(t)$, and $y_4(t)$.
 - b) (7 marks) What are the bandwidths of $x(t)$, $y_1(t)$, $y_2(t)$, $y_3(t)$, and $y_4(t)$?
 - c) (3 marks) What type of AM signal that this system aims to generate?
 - d) (3 marks) Is this modulator effective?

- 5) (20 marks, 5 marks each) An angle-modulated signal has the form of $u(t) = 100 \cos(2\pi f_c t + 4 \sin 2000\pi t)$, where $f_c = 10$ MHz is the carrier frequency.
 - a) Determine the average transmitted power.
 - b) What is the peak-phase deviation?

- c) Determine the peak-frequency deviation.
 d) Is this an FM or a PM signal? You need to give your explanation to justify your answer.

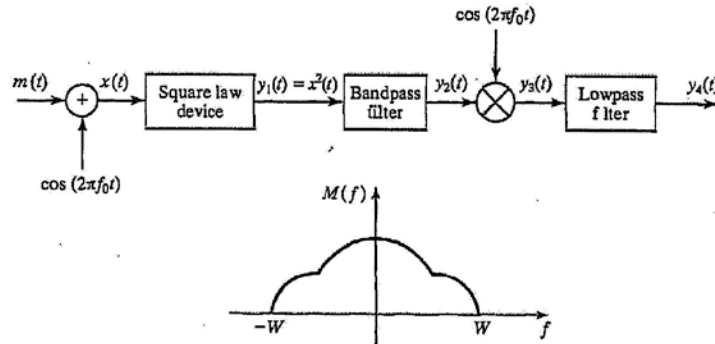


Fig. 1. Problem 4.