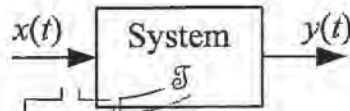


1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

1. Let  $x(t)$  and  $y(t)$  be the input and output signals, respectively, of a system, as follows:



Symbolically, this is expressed as  $y(t) = \mathcal{S}[x(t)]$ .

- (a) (5%) Mathematically state the conditions that  $\mathcal{S}$  is a linear system.
  - (b) (5%) Determine whether the system  $\mathcal{S}[x(t)] = x(t)\cos(2\pi f_c t)$  is linear.
  - (c) (5%) Again, determine whether the system  $\mathcal{S}[x(t)] = [A + x(t)]\cos(2\pi f_c t)$  is linear, in which  $A$  is a constant.
2. (a) (8%) Write the mathematical expressions for amplitude-modulated (AM), double-sideband (DSB) modulated, single-sideband (SSB) modulated, and frequency-modulated (FM) signals, respectively.
- (b) (4%) Compare the systems with DSB modulated and SSB modulated signals in terms of the required bandwidth. Which one is better? Why?
- (c) (4%) Compare the systems with AM and DSB modulated signals in terms of the receiver implementation complexity. Which one is better? Why?
- (d) (4%) Compare the systems with AM and FM signals in terms of the demodulated-signal quality. Which one is better? Why?
3. (a) (6%) Write the mathematical expressions for binary amplitude-shift keying (BASK), binary phase-shift keying (BPSK), and binary frequency-shift keying (BFSK) signals, respectively.
- (b) (6%) Plot the signal constellations for BASK, BPSK, and BFSK signals, respectively.
- (c) (4%) For  $M$ -ary FSK signals ( $M > 2$ ), how many correlator/matched-filter branches are generally required for the demodulation? Why?
- (d) (4%) For  $M$ -ary PSK signals ( $M > 2$ ), how many correlator/matched-filter branches are generally required for the demodulation? Why?

科目：通訊系統導論

適用：電機系

考生注意：

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4. (10%) A message signal is given as



Draw the modulated signals after employing pulse-amplitude modulation (PAM), pulse-position modulation (PPM), and pulse-width modulation (PWM), respectively.

5. Explain each of the following:

- (a) (5%) Sampling theorem.
- (b) (5%) Nyquist criterion for zero intersymbol interference (ISI).
- (c) (5%) Channel capacity theorem.
- (d) (5%) Circuit switching system and packet switching system.
- (e) (5%) Fast frequency hopping system and slow frequency hopping system.
- (f) (5%) The purpose of source coding.
- (g) (5%) The purpose of channel coding.

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