

## 科目：通訊系統導論

適用：電機系(通訊工程)

編號：351

考生注意：

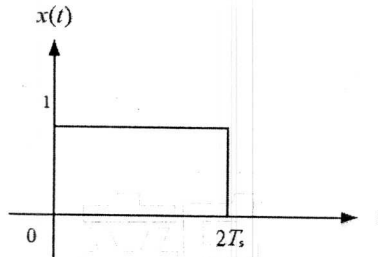
1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

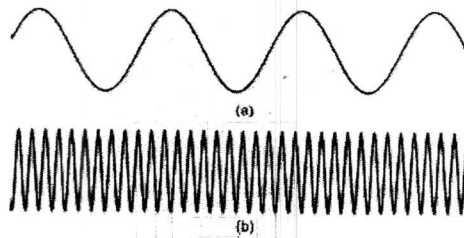
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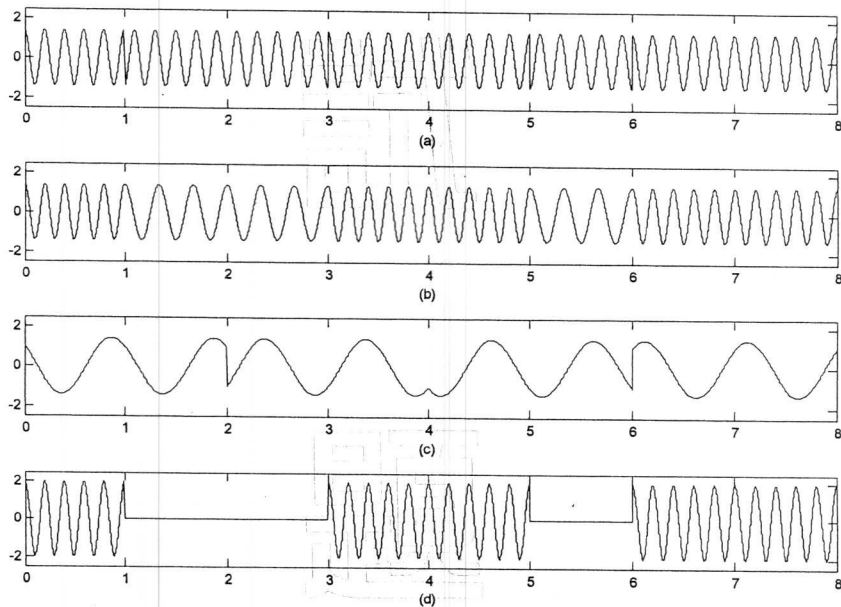
1. (10%) Calculate the Fourier Transform of the following signal  $x(t)$ .



2. (10%) In the following figures, (a) is the message signal and (b) is the carrier wave. Modulate the message signal using this carrier with amplitude-modulation (AM) and frequency-modulation (FM). Plot the resultant AM and FM signals, respectively.



3. (10%) In the following four figures, determine which is binary amplitude-shift keying (BASK), binary frequency-shift keying (BFSK), binary phase-shift keying (BPSK), and quadriphase-shift keying (QPSK) signals, respectively.



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4. (10%) Plot the signal constellations for BASK, BFSK, BPSK, and QPSK signals, respectively.

5. (20%) Consider the signal transmission over a real additive Gaussian noise channel:  
 $y = u + w$

where  $u$  is equally likely to be  $u_A$  or  $u_B$  and  $w \sim N(0, N_0/2)$  is real Gaussian noise.

Show that the probability of detection error with an optimal detector is

$$Q\left(\frac{|u_A - u_B|}{2\sqrt{N_0/2}}\right)$$

where  $Q(a) = P\{w > a\}$  denotes the tail probability of the Gaussian random variable  $w$ .

6. Briefly explain each of the followings:

- (a) (8%) Describe the working principle of envelope detector for demodulating AM signals.
- (b) (8%) Can envelope detector be used to demodulate BASK signals? Why?
- (c) (8%) What is time-division multiple access (TDMA)? And, what is time-division duplex (TDD)?
- (d) (8%) Why can the frequency-hopping (FH) technique provide security and resist jamming in communications?
- (e) (8%) Describe the stationarity conditions for strict-sense stationary, wide-sense stationary, and cyclostationary random processes, respectively.