逢甲大學100學年度碩士班招生考試試題 編號：079 科目代碼：336

科目	通訊系統	適用系所	通訊工程學系	時間	100分鐘

※請務必在答案卷作答區內作答。 共 2頁第 1頁

1. Please briefly answer the following questions.
   (a) Please list the functions or uses of modulation in wireless communication systems. (5%)
   (b) What is the "coherent demodulation"? (5%)
   (c) What is the term "FDM" in analog communication systems? (5%)

2. An FM signal is given as

$$u(t) = 20\cos[2\pi f_c t + 100\pi \int_{-\infty}^{t} m(\tau)d\tau]$$

   where the message signal $m(t)$ has bandwidth W and $\max(|m(t)|)=A$.
   (a) Determine the peak-frequency deviation of $u(t)$. (5%)
   (b) Determine the power of $u(t)$. (5%)
   (c) Determine the bandwidth of $u(t)$ by Carson's rule. (5%)

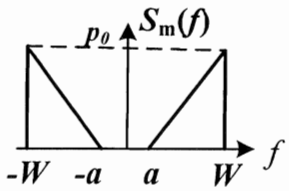
3. A signal $m(t)$ has power-spectral density as shown in Fig. 3(a). $m(t)$ is DSB AM modulated by the system as shown in Fig. 3(b) and transmitted. At the receiver site, the received signal is demodulated by the system also shown in Fig. 3(b), where $n(t)$ is assumed bandpass white Gaussian noise with power-spectral density

$$S_n(f) = N_0/2, \quad for \quad a \le |f - f_c| \le W .$$

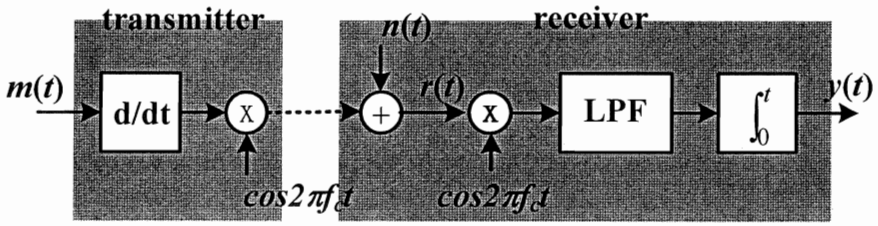
   The LPF at the receiver site has frequency response H(*f*),

$$H(f) = 1, \quad for \quad 0 \le |f| \le W ,$$

   where a is far smaller than W.
   (a) Express the output signal $y(t)$. (in terms of $m(t)$ and $n_c(t)$. $n_c(t)$ is the in-phase component of $n(t)$) (5%)
   (b) Determine the noise power at the receiver output. (10%)
   (c) Determine the output S/N, i.e., $[S/N]_o$. (5%)



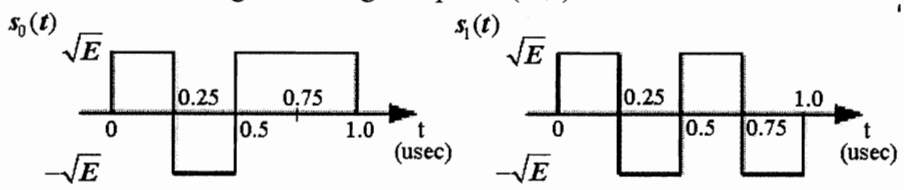
(a)



(b)

Fig. 3

4. For two signals sketched below, determine
   (a) each signal's energy (5%)
   (b) a single set of orthonormal basis functions which can be used to represent each signal (5%)
   (c) the distance between the signals in signal space. (5%)



5. Refer back to Problem 1, a baseband digital communication system uses these two signals to transmit information:
   (a) Sketch the impulse response $h_0(t)$ and $h_1(t)$, each with a sampling time of 1 μ sec, for filters matched to $s_0(t)$ and $s_1(t)$ respectively. (5%)
   (b) Sketch the optimum receiver for this system. Clearly label and define each function, and specify all parameter values. (5%)
   (c) Assume E=19.22, and that zero-mean, WSS (wide-sense stationary), AWGN with $N_0 = -60dBW / Hz$ is added to the transmitted signal. Determine the symbol error probability at the receiver output. (5%)
   (d) If the system organizes its information in words which are eight symbols in length, determine the word error probability at the receiver output. (5%)
   (e) Is the signal $s_1(t)$ the best possible choice when $s_0(t)$ is used for binary baseband signaling? If your answer is yes, explain why. If your answer is no, also explain why not and sketch a better choice for $s_1(t)$. (5%)

6. Assume a transmission channel has a bandwidth B = 4 kHz and a signal-to-noise ratio of 30 dB. Determine the maximum allowable information rate in bits per second for (a) 4-level (5%), (b) 128-level encoding. (5%)