



Answer all questions



Q1: (8 Marks)

Put true or false for each sentences and correct the false one:

1. A correlator is type of matched filter. .
2. Quantization noise error can be reduced by increasing the quantization levels.
3. Noncoherent detection means detection with carrier phase information.
4. If $\frac{\Delta f}{B} \ll 1$ we have FSK wideband system and if $\frac{\Delta f}{B} > 1$ we have narrowband FSK system.
5. BPSK and QPSK don not have the same bit-error probability.
6. A channel can typically be modeled as a linear filter with addition of noise.
7. For orthogonal FSK signaling, tones must have a frequency separation that is multiple of $1/(2T)$ Hz.
8. Spread spectrum modulation can be used to minimize the effect of interference.

Q2:

- a) What are the advantages of digital modulation? (4 Marks)
- b) Find the modulation rate and the bandwidth required for transmission data with a 8-PSK system using 24Mb/s and a carrier frequency of 160MHz? (4 Marks)

Q3:

- a) Draw a noncoherent Binary FSK receiver? (4 Marks)
- b) Show how to generate and detect a DPSK signal for the binary sequence b_k : (4 Marks)

$\{b_k\}$		1	0	0	1	1	0	0	0	1	1
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Q4:

A band limited signal $m(t)$ of 6 MHz bandwidth is sampled at rate of $66\frac{1}{6}\%$ higher than the Nyquist rate. The maximum allowable error in the sample amplitude is 0.15% of the peak amplitude m_p . Assume binary encoding. Find the minimum bandwidth of the channel to transmit the encoded binary signal? If 8 such signals are time multiplexed on a single line, What are the capacity and the bandwidth of this line? (8 Marks)

Q5: Compare the average power requirements of a binary PSK, DPSK and noncoherent FSK schemes operating at a data rate of 1k bits/sec over a bandpass channel having a bandwidth of 3k Hz and the noise PSD at the receiver inputs is $\frac{n}{2} = 10^{-10}$ W/Hz, and $P_e = 10^{-5}$. Give your comments on the answer. (8 Marks)

$\text{erfc}(\sqrt{x})$	x	$\text{erfc}(\sqrt{x})$	x	$\text{erfc}(\sqrt{x})$	x	$\text{erfc}(\sqrt{x})$	x
9×10^{-1}	0.007895	9×10^{-6}	7.667845	9×10^{-9}	16.523043	9×10^{-12}	25.525468
8×10^{-1}	0.032092	8×10^{-6}	7.779146	8×10^{-9}	16.637556	8×10^{-12}	25.641072
7×10^{-1}	0.074236	7×10^{-6}	7.905424	7×10^{-9}	16.767404	7×10^{-12}	25.772145
6×10^{-1}	0.137498	6×10^{-6}	8.051325	6×10^{-9}	16.917335	6×10^{-12}	25.923472
5×10^{-1}	0.227468	5×10^{-6}	8.224055	5×10^{-9}	17.094711	5×10^{-12}	26.102474
4×10^{-1}	0.354163	4×10^{-6}	8.435695	4×10^{-9}	17.311866	4×10^{-12}	26.321584
3×10^{-1}	0.537097	3×10^{-6}	8.708911	3×10^{-9}	17.591929	3×10^{-12}	26.604113
2×10^{-1}	0.821187	2×10^{-6}	9.094647	2×10^{-9}	17.986844	2×10^{-12}	27.002402
1×10^{-1}	1.352772	1×10^{-6}	9.755711	1×10^{-9}	18.662447	1×10^{-12}	27.683512
9×10^{-2}	1.437187	9×10^{-7}	9.856363	9×10^{-10}	18.765192	9×10^{-13}	27.787068
8×10^{-2}	1.532451	8×10^{-7}	9.968934	8×10^{-10}	18.880068	8×10^{-13}	27.902841
7×10^{-2}	1.641510	7×10^{-7}	10.096618	7×10^{-10}	19.010323	7×10^{-13}	28.034103
6×10^{-2}	1.768692	6×10^{-7}	10.244100	6×10^{-10}	19.160717	6×10^{-13}	28.185646
5×10^{-2}	1.920729	5×10^{-7}	10.418644	5×10^{-10}	19.338631	5×10^{-13}	28.364901
4×10^{-2}	2.108942	4×10^{-7}	10.632424	4×10^{-10}	19.556431	4×10^{-13}	28.584317
3×10^{-2}	2.354646	3×10^{-7}	10.908279	3×10^{-10}	19.837306	3×10^{-13}	28.867233
2×10^{-2}	2.705947	2×10^{-7}	11.297521	2×10^{-10}	20.233329	2×10^{-13}	29.266055
1×10^{-2}	3.317448	1×10^{-7}	11.964063	1×10^{-10}	20.910728	1×10^{-13}	29.948044
9×10^{-3}	3.411413	9×10^{-8}	12.065497	9×10^{-11}	21.013737	9×10^{-14}	30.051730
8×10^{-3}	3.516737	8×10^{-8}	12.178926	8×10^{-11}	21.128904	8×10^{-14}	30.167647
7×10^{-3}	3.636484	7×10^{-8}	12.307565	7×10^{-11}	21.259485	7×10^{-14}	30.296072
6×10^{-3}	3.775151	6×10^{-8}	12.456124	6×10^{-11}	21.410252	6×10^{-14}	30.450801
5×10^{-3}	3.939719	5×10^{-8}	12.631910	5×10^{-11}	21.588599	5×10^{-14}	30.630273
4×10^{-3}	4.141908	4×10^{-8}	12.847166	4×10^{-11}	21.806920	4×10^{-14}	30.849952
3×10^{-3}	4.403734	3×10^{-8}	13.124855	3×10^{-11}	22.088452	3×10^{-14}	31.133201
2×10^{-3}	4.774768	2×10^{-8}	13.516556	2×10^{-11}	22.485373	2×10^{-14}	31.532483
1×10^{-3}	5.413783	1×10^{-8}	14.186994	1×10^{-11}	23.164238	1×10^{-14}	32.215232
9×10^{-4}	5.511380	9×10^{-9}	14.288989	9×10^{-12}	23.267462	9×10^{-15}	32.319030
8×10^{-4}	5.620616	8×10^{-9}	14.403035	8×10^{-12}	23.382868	8×10^{-15}	32.435073
7×10^{-4}	5.744623	7×10^{-9}	14.532363	7×10^{-12}	23.513717	7×10^{-15}	32.566638
6×10^{-4}	5.887989	6×10^{-9}	14.681703	6×10^{-12}	23.664789	6×10^{-15}	32.718529
5×10^{-4}	6.057833	5×10^{-9}	14.858393	5×10^{-12}	23.843492	5×10^{-15}	32.898190
4×10^{-4}	6.266097	4×10^{-9}	15.074727	4×10^{-12}	24.062243	4×10^{-15}	33.118096
3×10^{-4}	6.535197	3×10^{-9}	15.353760	3×10^{-12}	24.344317	3×10^{-15}	33.401635
2×10^{-4}	6.915542	2×10^{-9}	15.747279	2×10^{-12}	24.741981	2×10^{-15}	33.801318
1×10^{-4}	7.568353	1×10^{-9}	16.420627	1×10^{-12}	25.422064	1×10^{-15}	34.484730



مع تمنياتي للجميع بالتوفيق