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06EC61

Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Digital Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. State and prove sampling theorem for band-limited signal. **(08 Marks)**

b. The signal $g(t) = 10\cos(20\pi t)\cos(200\pi t)$ is sampled at the rate of 250 samples/second.

(i) Determine the spectrum of the resulting sampled signal. **(06 Marks)**

(ii) Specify the cutoff frequency of ideal reconstruction filter so as to recover g(t) from its sampled version. **(03 Marks)**

(iii) What is the Nyquist rate for g(t)? **(03 Marks)**

2 a. Explain the types of uniform quantization. **(06 Marks)**

b. A signal x(t) is uniformly distributed in the range $\pm x_{max}$. Calculate maximum signal to noise ratio for this signal. **(07 Marks)**

c. Show that for $\mu = A$, the μ-law and A-law have the same companding gain. **(07 Marks)**

3 a. Explain with relevant mathematical relations a Delta Modulator transmitter and receiver. **(10 Marks)**

b. Using the predictability theory, prove that the transmission of encoded error signal is sufficient for reasonable reconstruction of signal. With the help of block diagram, suggest any one technique to transmit and receive encoded errors. What are the limitations and advantages of such technique with reference to linear or uniform PCM? **(10 Marks)**

4 a. State and prove the Nyquist criterion for distortionless baseband transmission. **(08 Marks)**

b. What is correlative coding? **(04 Marks)**

c. Explain the need for precoder in a duobinary signaling. For input binary data 0011100 obtain the output of precoder and output of duobinary coder. Explain how data can be detected at the receiver. **(08 Marks)**

PART – B

5 a. Binary data is transmitted at a rate of 10^6 bits per second over a microwave link. Assuming channel noise is AWGN with zero mean and power spectral density at receiver input, is 10^{-10} Watts/Hz, find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. Determine the minimum channel bandwidth required. **(10 Marks)**

b. In an ASK system symbol '1' is transmitted by transmitting a sinusoidal carrier of amplitude $\sqrt{\frac{2E_b}{T_b}}$, where E_b is the bit energy and T_b is symbol duration and when symbol is '0' no signal is transmitted. If symbol '0' and '1' occur with equal probability, S.T. the average probability of error P_e is given by

$P_e = \frac{1}{2}\text{erfc}\left(\sqrt{\frac{E_{av}}{2N_o}}\right)$. Assuming coherent detection and channel noise is AWG with zero mean and PSD $N_o/2$. E_{av} is the average signal energy. **(10 Marks)**

6 a. Two functions $S_1(t)$ and $S_2(t)$ are shown in Fig.Q6(a).

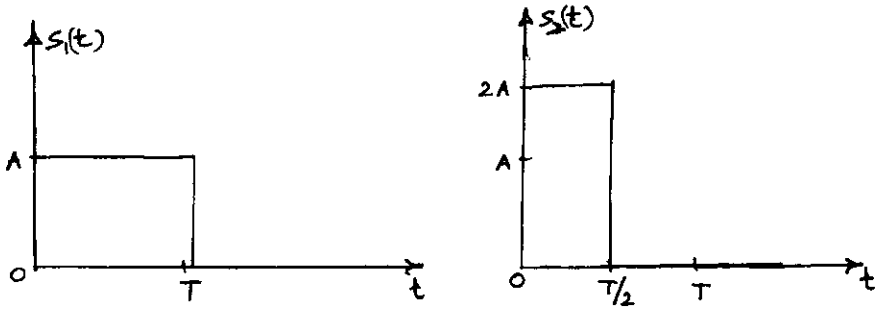

Fig.Q6(a)

The interval is $0 \leq t \leq$ seconds. Using Gram-Schmidt procedure express these functions in terms of orthonormal functions. Also sketch $\phi_1(t)$ and $\phi_2(t)$. **(10 Marks)**

b. What is a correlation? What is the difference and similarity between correlator and matched filter? **(10 Marks)**

7 a. A PN sequence is generated using linear feedback shift resister with number of stages equal to 10. The chip rate is 10 per/sec. Find
(i) PN sequence length (ii) Chip duration of PN sequence (iii) Period of PN sequence. **(06 Marks)**

b. Explain with neat figure FH/MFSK transmitter and receiver. **(06 Marks)**

c. What are pseudo-noise sequences? Why they are used in spread spectrum modulation? **(08 Marks)**

8 Write short notes on:

a. Coherent quadrature modulation. **(06 Marks)**

b. Generation of pseudo-noise (PN) sequences **(10 Marks)**

c. Applications of Direct sequence spread spectrum. **(04 Marks)**

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