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10EC/TE61

Sixth Semester B.E. Degree Examination, June/July 2019

Digital Communication

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. Compare analog and digital communication. (04 Marks)
b. Derive the interpolation formula for reconstructing the original signal from the sequence of sampled values. (08 Marks)
c. The signal $x(t) = 12 \cos(800\pi t) \cos^2 1800\pi t$ is ideally sampled at 4600 samples/sec. What is the minimum allowable sampling frequency? What is the range of the cut-off frequency for the lowpass filter? Draw the frequency components present in the output of the lowpass filter. (08 Marks)
- 2 a. Derive an expression for output SNR of the quantizer and show that $(SNR)_0 = 1.76 + 6n$ in db if a sinusoidal signal is quantized. (08 Marks)
b. What is the need for non-uniform quantization? Explain μ -law and A-law compounding. (08 Marks)
c. A PCM system uses a uniform quantizer followed by a 7 bit binary encoder. The bit rate of the system is equal to 50×10^6 bits/sec:
i) What is the sampling frequency?
ii) Calculate the $(SNR)_0$. (04 Marks)
- 3 a. What is slope overload distortion and granular noise in delta modulation and how can it be reduced? (08 Marks)
b. Obtain the expression for power spectral density of NRZ unipolar format. (06 Marks)
c. Explain T1 carrier system. (06 Marks)
- 4 a. Explain ISI. Derive an expression for Nyquist pulse shaping criterion for distortionless baseband binary transmission. (08 Marks)
b. Explain eye pattern. (06 Marks)
c. A continuous time signal is connected into a PCM wave. The number of quantization levels = 64. A synchronizing pulse is added at the end of each code word representing a sample of the analog signal. The resulting PCM is sent over a channel of bandwidth 24 kHz using a binary PAM system with raised cosine spectrum with roll of = 1.
i) Find the bit rate
ii) Find the sampling rate
iii) What is the highest frequency of the continuous time signal? (06 Marks)

PART – B

- 5 a. With a block diagram, explain coherent QPSK transmitter and receiver. (08 Marks)
b. Explain non-coherent DPSK system. (06 Marks)
c. For a given binary sequence 01101000 sketch the inphase and quadrature phase components of QPSK. Adding these two get the final waveform. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, $42+8=50$, will be treated as malpractice.

- 6 a. Explain the two stage Gram-Schmidt orthogonalization procedure to find the orthonormal functions. (10 Marks)
- b. Derive the equation for maximum likelihood estimation. (10 Marks)
- 7 a. List the properties of a matched filter receiver. (08 Marks)
- b. Show that the probability of bit error of a matched filter receiver is given by
- $$P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E_b}{N_0}} .$$
- (08 Marks)
- c. Let $s(t)$ be a rectangular pulse of amplitude A and duration T seconds, applied to the input of a filter matched to $s(t)$. Determine the output signal to noise ratio of the filter at $t = T$ in terms of noise power spectral density. (04 Marks)
- 8 a. What is spread spectrum? Explain the principle of direct sequence spread spectrum system. (08 Marks)
- b. Explain the properties of PN sequence. (06 Marks)
- c. In a DSSS it is required to have a jamming margin greater than 26 dB. The ratio E_b/N_0 is set at 10. Determine the minimum processing gain and the minimum number of stages required to generate the maximum length of sequence. (06 Marks)

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