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Sixth Semester B.E. Degree Examination, June/July 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 and its reconstruction for low pass signals. (08 Marks)
- b. The signal $g(t) = 8\cos(200\pi t)\cos(400\pi t)$ is sampled at the rate of 625 samples per second.
 - i) Determine the spectrum of the resulting sampled signal.
 - ii) What is the Nyquist rate of $g(t)$?
 - iii) What should be the cut-off frequency of the ideal reconstruction filter? (07 Marks)
- c. Explain different channels used in digital communication. (05 Marks)

- 2 a. With suitable block diagram, explain the functioning of a PCM system. (06 Marks)
- b. Derive an expression for maximum signal-to-quantization noise ratio for PCM system that employs linear quantization techniques. (06 Marks)
- c. A PCM system uses a uniform quantizer followed by a 7-bit encoder. The bit rate of the system is 50 Mbps.
 - i) What is the message bandwidth for which the system operates satisfactorily?
 - ii) Determine output signal-to-noise ratio when a sinusoidal modulating signal of 1 MHz is applied to the input. (08 Marks)

- 3 a. Explain the principles of delta modulation. With relevant figures and mathematical expressions, explain the functioning of DM transmitter and receiver. (08 Marks)
- b. A modulating signal is given by $g(t) = z\sin(\alpha t)$. Find the maximum value of z for no slope overload distortion. The given step size $\delta = 2$ mV and sampling rate $f_s = 8$ KHz. (06 Marks)
- c. A binary data sequence is 10011011. Sketch the waveform for following formats:
 - i) Unipolar RZ
 - ii) Polar RZ
 - iii) Manchester (06 Marks)

- 4 a. Explain the effect of ISI in baseband binary PAM system with mathematical analysis. (07 Marks)
- b. Derive the following Nyquist condition for zero ISI:

$$\sum_{n=-\infty}^{\infty} P(f - nR_b) = T_b$$
 The notations have usual significance. (08 Marks)
- c. For the input binary data 1011101, obtain the output of the precoder and output of duo-binary coder. Explain how data can be detected at the receiver. (05 Marks)

PART – B

- 5 a. Obtain the signal space diagram and indicate coordinate values of message points for coherent binary PSK modulation. (06 Marks)
- b. In digital continuous wave communication system, the bit rate of NRZ data stream is 1 Mbps and carrier frequency is 100 MHz. Find symbol rate of the transmission and bandwidth requirement of the channel in the following cases of different techniques used:
 - i) BPSK
 - ii) QPSK
 - iii) 16-Ary PSK (06 Marks)
- c. With neat block diagram, explain working of QPSK transmitter and receiver. (08 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 e.g. $42+8=50$, will be treated as malpractice.

- 6 a. Explain the operation of DPSK transmitter and receiver. (06 Marks)
- b. Discuss two stages of Gram-Schmidt orthogonalization procedure to represent a set of 'M' energy signals $\{S_i(t)\}$ as linear combinations of N orthonormal basis functions for $N \leq M$ (08 Marks)
- c. Suppose $S_1(t)$, $S_2(t)$ and $S_3(t)$ are represented with reference to two basis functions $\phi_1(t)$ and $\phi_2(t)$. The coordinates of these signals are given by,
 $S_1 = (S_{11}, S_{12}) = (3, 0)$
 $S_2 = (S_{21}, S_{22}) = (-2, 3)$
 $S_3 = (S_{31}, S_{32}) = (-3, -3)$
 Draw the constellation diagram and express $S_1(t)$, $S_2(t)$ and $S_3(t)$ as a linear combination of the basis functions. (06 Marks)
- 7 a. Explain the subsystems of correlation receiver with block diagrams. (07 Marks)
- b. Discuss four properties of matched filters. (06 Marks)
- c. In a DSSS modulation, it is required to have a jamming margin greater than 26 dB. The ratio E_b / N_0 is 10. Determine the minimum processing gain and minimum number of stages required to generate the maximum length sequence. (07 Marks)
- 8 a. Consider a 3-stage feedback shift register. Generate maximum length sequence and for this sequence, verify three properties. (10 Marks)
- b. Obtain the expression for jamming margin (in dB) for spread spectrum system. (05 Marks)
- c. In DSSS, PN sequence is generated using 10 stage linear feedback shift register. Determine
 i) Number of 1's in one periodic length.
 ii) Normalized auto correlation values.
 iii) Processing gain. (05 Marks)

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