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10EC/TE61

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is natural sampling? Explain its implementation using both time domain and frequency domain analysis. **(08 Marks)**

b. A signal g(t) = 10cos20πt cos200πt is ideally sampled at a rate of 250 samples/sec. Determine the spectrum of the sampled signal. Specify the cut off frequency of ideal reconstruction filter to recover the signal g(t) from its sampled version. **(06 Marks)**

c. Four messages W, W, W and 3W are to be time division multiplexed with 'W' being '2000'. Set up the TDM scheme and find the speed of commutator and also calculate the transmission bandwidth. **(06 Marks)**

2 a. Derive an expression for the output signal to quantization noise ratio of a uniform quantiser of midtread type. Assuming a loading factor of 4 is the quantiser show that $(SNR)_0 = 6n - 7.2db$ where 'n' is the number of bits per sample. **(08 Marks)**

b. What is a regenerative repeater? With block diagram, explain the 3 main operations of regenerative repeater. **(06 Marks)**

c. A signal of bandwidth 3.4K is converted to PCM bit stream with 1024 levels. Determine the number of bits/sec generated by PCM. Assume that signal is sampled at 20% above Nyquist rate. **(06 Marks)**

3 a. Explain briefly the basic operation of a delta modulator system. **(06 Marks)**

b. Derive the power spectral density of NRZ polar binary data. **(06 Marks)**

c. For a sinusoidal modulating signal $x(t) = A_0\cos(2\pi f_0 t)$, show that the output signal to quantizing noise ratio in a delta modulated system under the assumption of no slope overload error is given by

$$(SNR)_0 = \frac{3f_s^3}{8\pi^2 f_0^2 f_m}$$

f_s = sampling frequency

f_m = cut off frequency of LPF in receiver. **(08 Marks)**

4 a. Derive Nyquist criterion for distortion less baseband binary transmission and mention its practical limitation and solution to it. **(10 Marks)**

b. Binary data 00110111 is applied to input of duobinary system with precoder. Construct the precoder o/p, duobinary coder output and corresponding receiver output for initial bit 'O'. Suppose due to error during transmission, the level produced by second digit is reduced to zero. Construct the new receiver output compare the receiver output with and without error and comment. **(06 Marks)**

c. Write a brief note on eye pattern. **(04 Marks)**

PART – B

5 a. Derive an expression for the probability of error in coherent detection of binary FSK. **(10 Marks)**

b. A binary data is transmitted over AWGN channel using binary PSK at a rate of 1 megabits/s. It is desired to have $P_e < 10^{-4}$. Noise PSD is 10^{-12} w/hz. Determine average carrier power required at receiver input if detection is coherent type. [Given $(\text{erf}\sqrt{2.5}) = 0.9998$)]. **(04 Marks)**

c. Explain QPSK transmitter and receiver with neat block diagram followed by waveforms and equations. **(06 Marks)**

6 a. What is the significance of Gram Schmidt orthogonalization procedure? Apply GS for the following signals and obtain the respective orthonormal basis functions.

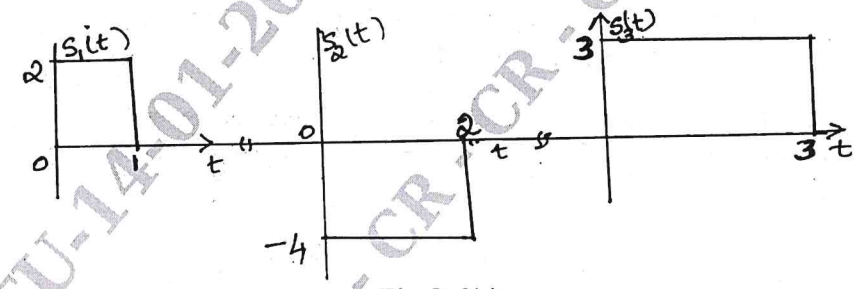

Fig.Q.6(a) **(10 Marks)**

b. Show that for a noisy input, the mean value of j^{th} correlator output x_j depends only on the signal S_{ij} and all the correlators output x_j $j = 1, 2 \ldots N$ have variance equal to PSD No/2 of AWGN and covariance of the correlator is zero. **(10 Marks)**

7 a. What is optimum receiver with respect to digital modulation scheme? Draw the schematic of correlation receiver and explain its features. **(08 Marks)**

b. Derive an expression for impulse response of matched filter while maximizing its signal to noise ratio at the output. **(06 Marks)**

c. Obtain the output of a matched filter if the input s(t) is a rectangular pulse of amplitude 'A' and duration 'T'. **(06 Marks)**

8 a. What is spread spectrum technique mention its applications and features? **(06 Marks)**

b. Explain the properties of PN sequences with suitable examples. **(09 Marks)**

c. Explain the slow frequency hopping spread spectrum using block diagram. **(05 Marks)**

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