U.S.N

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electronics and Communication Engineering
Semester End Examination; Dec. - 2015
Digital Communication Theory

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define with relevant equations mean, autocorrelation and auto covariance of a random process $X(t)$. 6

b. Define the power spectral density $S_X(f)$ of wide sense stationary process $X(t)$ and explain its properties. 8

c. A random variable X has the density,

$$f_X(x) = \begin{cases} \frac{3}{32}\left(-x^2+8x-12\right), & 2 \le x \le 6 \\ 0 & elsewhere \end{cases}$$

Find the following moments:

(i) m_0 (ii) m_1 (iii) m_2 (iv) μ_2 6

2 a. Define auto correlation of the process $X(t)$. Explain the properties of autocorrelation function. 8

b. Define with relevant equations cumulative distribution function, probability density function and central moments. 6

c. Consider the probability density function $f_X(x) = Ke^{-|x|}$ for $-\infty < x < \infty$. Find:

(i) The value of K (ii) $f_X(x)$ (iii) $P(1 \le X \le 2)$ 6

UNIT - II

3 a. State the sampling theorem, show that the spectrum of a sampling signal is $G_8(f) = f_s \sum_{n=-\infty}^{\infty} G(g - nf_s)$. 6

b. Explain the working of sample and hold circuit for obtaining flat top samples from a continuous time signal with necessary equations. 6

c. A band pass signal $g(t)$ with a spectrum shown in Fig. 3(c) is ideally sampled using a Dirac Comb. Sketch the spectrum of the samples signal $g_8(t)$ when f_s = 20, 30 and 40 Hz. Indicate if and how the signal can be recovered? 8

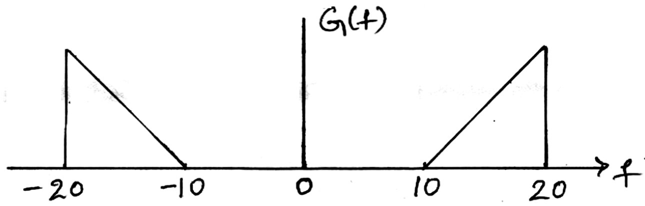

Fig 3(c)

4 a. With a block diagram, explain the generation and reconstruction of quadrature sampling of band pass signals. 8

b. A low-pass signal $g(t)$ is sampled to set $s(t)$ using flat top sampling method. Obtain the expression for the sampling signal $s(t)$ and its spectrum. Hence show that flat top sampling leads to amplitude distribution and explain how it is corrected during reconstruction. 12

UNIT - III

5 a. Explain the three basic functions of a regenerative repeater in a PCM system, with a block diagram of the regenerative repeater. 6

b. With diagrams, explain in detail the operation of DPCM transmitter and receiver. 8

c. For a binary PCM signal, determine 'L' if the compression parameter μ = 100 and minimum $[SNR]_{0,db} = 45dB$. Determine the $[SNR]_{0,db}$ in dB with this volume of L. 6

6. a. Explain the principle of delta modulation with relevant figures and mathematical expressions the functioning of DM transmitter and receiver. 10

b. What is the necessity of non-uniform quantization? Explain two companding methods used in practice. 10

UNIT - IV

7 a. What is correlative coding? Explain duobinary coding with and without precoding. 10

b. Sketch the encoded waveforms for the bit stream 1011010010 for the following schemes: 10

i) RZ unipolar ii) RZ polar iii) NRZ polar

iv) NRZ = bipolar v) Manchester coding

8 a. What is eye pattern? Explain how it is useful in understanding the ISI problem. 8

b. Obtain an expression for the power spectral density of NRZ polar format. 6

c. With necessary block diagram. Explain two modes of operation of an adaptive equalizer. 6

UNIT - V

9 a. Explain the generation and demodulation of DPSL wave with block diagrams. 10

b. Explain briefly phase tree and phase trellis in MSK. 6

c. Binary data are transmitted over a microwave link at the rate of 10^6 bps and PSD of noise at the receiver input is 10^{-10} watts per hertz. Find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. What is the required channel bandwidth? Take $\left(erfc(2.7) = 2\times10^{-4}\right)$. 4

10 a. Derive an expression for the average probability of symbol error of coherent binary FSK system. 10

b. With the help of a block diagrams, explain the operation of QPSK transmitter and receiver. 10

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