

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] NOVEMBER-DECEMBER-2018

Paper Code: ETEC-303

Subject: Digital Communication

Time : 3 Hours

Maximum Marks :75

Note: Attempt any five questions including Q.no.1 which is compulsory.
Assume any missing data suitably. if not given.

- Q1** Attempt all questions:- **(5x5=25)**
- (a) Write a short note on PCM and explain the role of compander in PCM.
 - (b) Define mean, moment and variance of a random variable X.
 - (c) A television signal having a bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine.
 - (i) Code word length
 - (ii) Transmission bandwidth
 - (iii) Final bit rate
 - (iv) Output signal to quantization noise ratio.
 - (d) Explain about the Gram-Schmidt process in band pass digital transmission.
 - (e) Derive the probability of error for Binary ASK and Binary PSK systems and also compare them.

UNIT-I

- Q2** What is waveform coding? Explain its salient characteristics. Draw the RZ-unipolar, NRZ-bipolar, Manchester, NRZ-Unipolar, differential manchater for the data stream 11100101011. **(12.5)**

- Q3** What are the limitations of Delta modulation? Explain with a neat block diagram, the operation of a Adaptive delta modulation that eliminates the different noise that are occurring in Delta modulation. **(12.5)**

UNIT-II

- Q4** The joint PDF of random variables X and Y is given by

$$f_{xy}(x, y) = \frac{1}{4} e^{-|x| - |y|}$$

Where, $(-\infty < x < \infty, -\infty < y < \infty)$

Determine

- (i) Whether the random variable X and Y are statistically independent.
- (ii) The probability that $X \leq 1$ and $Y \leq 0$. **(12.5)**

- Q5** Define the stationary and non-stationary random processes. Also, drive the expression for power spectral density of wide sense stationary process. **(12.5)**

UNIT-III

- Q6** What is Matched Filter? Derive an expression for probability of error of a Matched filter receiver. **(12.5)**

- Q7** Explain briefly Inter Symbol Interference. How does the use of Nyquist impulse response of the overall communication system avoid the occurrence of Inter Symbol Interference? **(12.5)**

UNIT-IV

- Q8** Explain the concept of modulation and demodulation of Differential PSK with the help of neat diagrams. How is it different from DEPSK? **(12.5)**

- Q9** Define Minimum Shift Keying (MSK). Derive the expression for probability of error for MSK. **(12.5)**

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FIFTH SEMESTER [B.TECH] DECEMBER- 2017

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Note: Attempt any five questions including Q. No. 1 which is compulsory.
Select one question from each unit.

Q1. Attempt all: (5x5=25)

- A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is 50 Mb/s for the satisfactory operation of the system. Calculate the maximum message bandwidth.
- Let z be a random variable with probability density $f_z(z)=0.5$ in the range $-1 \leq z \leq 1$. Let the random variable $x=z$ and the random variable $y=z^2$. Obviously x and y are not independent since $x^2=y$. Show nonetheless, the x and y are uncorrelated.
- Explain QPSK and mention its merits also.
- What is Inter symbol Interference and how it can be eliminated?
- Explain Manchester code and Alternate Mark Inversion Code.

Unit-I

Q2. Explain Sampling theorem and different types of sampling in detail. A single $m(t)$ is band limited to 20 kHz is sampled at a frequency ' f_s ' kHz. An ideal LPF having cutoff frequency 37 kHz is used to reconstruct $m(t)$. Determine the minimum value of ' f_s ' required to reconstruct $m(t)$ without distortion. (12.5)

Q3. Give advantages and disadvantages of PCM. Bandwidth of the input to a pulse code modulator is restricted to 4 kHz. The signal varies from -3.8 V to +3.8V and has the average power of 30 mW. The required SNR is 20 dB. The modulator produces binary output. Assume uniform quantization. (12.5)

- Calculate the no. of bits required per sample.
- Outputs of 30 such PCM coders are time-multiplexed. What is the minimum required transmission bandwidth for the multiplexed signal?

Unit-II

Q4. A random communication signal has $P_x(x) = ae^{-b|x|}$ for all x , $-\infty < x < +\infty$ and $a=3$. (12.5)

Find:

- Relationship between a and b .
- CDF
- Probability that the random variable X lies between -1 and +2.

Q5. Given two random processes $X(t)$ and $Y(t)$ as

$$X(t) = Z_1(t) + 3Z_2(t-\pi)$$

$$Y(t) = Z_2(t-\tau) + Z_1(t-\tau)$$

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Here $Z_1(t)$ and $Z_2(t)$ are independent which noise processes each with a variance equal to 0.5. Determine: (12.5)

- a) Auto correlation function of $X(t)$ and $Y(t)$.
- b) Cross correlation function of $X(t)$ and $Y(t)$.

Unit-III

- Q6. Discuss the design and property of matched filter. (12.5)
- Q7. Explain the concept of Eye Diagram. (12.5)

Unit-IV

- Q8. Differentiate the following digital modulation schemes: (12.5)
- a) ASK
 - b) FSK
 - c) PSK
- Q9. Compare MSK with QPSK and explain how MSK is superior over QPSK. (12.5)

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END TERM EXAMINATION**FIFTH SEMESTER [B.TECH.] DECEMBER 2015-JANUARY 2016****Paper Code: ETEC-303****Subject: Digital Communication****Time: 3 Hours****Maximum Marks: 75****Note: Attempt any five questions including Q.no.1 which is compulsory.**

- Q1** (a) Explain the significance of Central Limit Theorem. (3)
 (b) Distinguish between Convolution and Correlation. (3)
 (c) With the help of PSD explain which one is more spectral efficient- BPSK or MSK. (4)
 (d) Show how a transversal filter can be used to realize PCM. (3)
 (e) What is the need of non-uniform quantization and how can it be achieved. (3)
 (f) Explain the significance of eye pattern. (3)
 (g) What is a Random Ergodic process? Explain with an example. (3)
 (h) What are the techniques uses to reduce ISI? (3)
- Q2** (a) Explain the process of generation of DPCM signal with block diagram. Show relevant wave forms. (6.5)
 (b) Show that in PCM, the Signal to Quantization Noise Ratio (SNR) is $4.8+6n$. (6)
- Q3** (a) What is Gaussian distribution? Why this distribution is used frequently in studying Noise effect in communication? (6)
 (b) PDF of a R.V "X" is given by:-

$$f_x(x) = \begin{cases} 0 & x \leq a \\ 1/b - a & a < x < b \\ 0 & x > b \end{cases}$$
 Find its CDF and draw it.
- Q4** (a) How a Correlation Receiver and Matched Filter Receiver are similar in their area of Operations? Use suitable block diagram to explain. (6)
 (b) Explain Granular Noise and Slope Overload Noise. How can it be overcome? (6.5)
- Q5** (a) Distinguish between Coherent and Non-coherent demodulations. (6)
 (b) Why do BPSK and QPSK manifest the same bit-error-probability relationship? (6.5)
- Q6** (a) Show that the penalty for using differential decoding in DPSK modem is about 3dB. (8)
 (b) With constellation diagram show how FSK offers best noise immunity compared to ASK and PSK. (4.5)
- Q7** Explain the following:
 (a) Differential Manchester encoding. (6.5)
 (b) Binomial and Poission distribution. (6)

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FIFTH SEMESTER [B.TECH] DECEMBER- 2016

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Note: Attempt any five questions including Q.No 1 which is compulsory.
Select one question from each unit.

Q1 Attempt all:

- (a) Discuss the properties and statistical characteristics of AWGN Channel. (5)
- (b) Represent the data 01001110 in Bipolar Return to Zero line coding format and AMI Line coding Format. (5)
- (c) Differentiate between Strict Sense Stationary (SSS) and Wide Sense Stationary (WSS) Random Processes with proper example. (5)
- (d) Explain the carrier recovery technique using Costas Receiver with help of block diagram. (5)
- (e) Obtain the relation for bandwidth requirement of FSK Modulated signal. (5)

UNIT-I

Q2 Explain the significance of Companding in Digital systems. Discuss the following compression techniques. (12.5)

- (i) μ -Law Compression
- (ii) A-Law Compression

Q3 With the help of Block diagrams explain the functionality of ADM Transmitter and receiver. Interpret the signal representation after each block. (12.5)

UNIT-II

Q4 Discuss about the following entities used for statistical analysis of Random signals.

- (i) Power Spectral Density
- (ii) Joint PDF
- (iii) Marginal PDF

Give the relevant mathematical treatment. (12.5)

Q5 Obtain the relation of Probability Density Function (PDF) of Gaussian distribution. Discuss the role of central limit Theorem in the analysis of Gaussian distribution. (12.5)

UNIT-III

Q6 Discuss analysis of following digital Receivers. (12.5)

- (a) Correlator Receiver
- (b) Maximum Likelihood Receiver

Q7 How would avoid Inter Symbol Interference (ISI) in Base band Digital Communication systems. Discuss in detail about any one of the methods to minimize ISI. How eye pattern is useful in determining ISI? (12.5)

UNIT-IV

Q8 Discuss the functioning of QPSK modulator and Demodulator with the help of Block Diagram. Draw the constellation diagram and obtain relation for Band width of QPSK signal. (12.5)

Q9 Write short notes on the following:-

- (a) M-ary Schemes along with merits and Demerits (6)
- (b) G-MSK Modulation Scheme (6.5)
