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Paper Code: MEC-909

Pre Ph.D.
THIRD SEMESTER EXAMINATION, 2016-17
ADVANCE DIGITAL COMMUNICATION

[Time: 3 hrs.]   [Max. Marks: 100]

Note: Attempt *ALL* questions. Assume suitable data, if required. All question carry equal marks.

1. Attempt any *four* parts of the following: -   **(5x4=20)**

(a) Explain discrete random variables? Find its probability mass function and statistical average?

(b) Discuss with example the difference between conditional probability and independent events. What is Bernoulli Irials?

(c) Write down the salient feature of Gaussian random variable. Explain Chebyshev's inequality?

(d) The input to noisy communication channel is a binary random variable X with P(X=0)= P(X=1)=1/2. The output of the channel Z is given by Z=X+Y, Where Y is the additive noise introduced by the Channel noise Y has the pdf.

$$F_Y(y) = \frac{1}{\sqrt{2\pi}} \exp\left(\frac{-y^2}{2}\right) \qquad -\infty < y < \infty$$

and X and Y are statistically independent.

(i) Find the pdf of output Z.

(ii) Calculate conditional pdf $f_{z/x}(z/X = 0)$ and $f_{z/x}(z/X = 1)$.

(e) Write down and prove the Axioms of probability theory and their properties?

(f) A committee of 5 persons is to selected randomly from a group of 5 men and 10 women.

(i) Find the probability that the committee consists of 2 men & 3 women.

(ii) Find the probability that the committee consists of all women.

2. Attempt any *four* parts of the following: -   **(5x4=20)**

(a) What is random process? Define the term Stationary, time average and Ergodicity?

(b) Explain with suitable example Markof process & narrate its application?

(c) Explain Poisson processes & Wiener Processes.

(d) Two dice are thrown. The sum of the points appearing on the dice is an RV x. Find the values taken by x, and the corresponding probabilities.

(e) A binary symmetric channel (BSC) error probability is *Pe*. The probability of transmitting 1 is Q, & that is transmitting 0 is 1-Q(fig.below). Determine the probabilities of receiving 1 & 0 at the receiver.
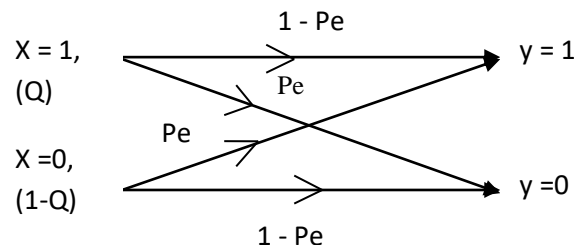
(f) In an experiment, a trial consist of four successive tosses of a coin if we define an RV x as the number of head appearing in a trial, determine $P_x(x)$ and $F_x(x)$.

3. Attempt any *two* parts of the following: - **(10x2=20)**

(a) Define nyquist criteria for zero ISI and correlative level coding, define Duo binary coding?

(b) What is the need of equalization? Discuss Adaptive linear equalizer and one algorithm for performing the optimization automatically and adaptively.

(c) Define digital modulation schemes& explain operating principle of ASK, FSK, PSK?

4. Attempt any *two* parts of the following: - **(10x2=20)**

(a) Distinguish between relevant & irrelevant noise explain their roll in signal detection also find the joint probability density function of noise vector.

(b) Give the schematic diagram of M-ary optimum receiver using matched filters. Explain its operation for optimum detection of received message signal?

(c) What is linear Estimation? How sample mean estimation & linear mean squared error estimate determined?

5. Attempt any *two* parts of the following: - **(10x2=20)**

(a) Explain multi-channel digital communication in AWGN channels with the help of block diagram? Also discuss coherent and non-coherent detection technique for multichannel digital communication.

(b) Define multi carrier communication, differentiate single carrier versus multi carrier modulation? Explain OFDM with the help of diagram.

(c) What is the multiple access technique; find out the capacity of any one multiple access method with relevant figures and mathematical support?