Code No: NR210402 **NR**

II B.Tech I Semester Supplementary Examinations, November 2005
PROBABILITY & RANDOM VARIABLES
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) List and explain the properties of probability density function
   (b) Three newspapers A, B and C are published in a city and a survey of readers indicates the following:
   20% read A, 16% read B, 14% read C, 8% read A and B, 5% read A and C, 2% read A, B and C.
   For one adult chosen at random, compute the probability that:
   i. he reads none of the papers.
   ii. he reads exactly one of the papers
   iii. he reads at least A and B if it is known that he reads at least one of the papers published.

   [7+9]

2. (a) Explain the Gaussian distribution with a neat sketches of pdF and cdF.
   (b) An analog signal received at the detector (measured in microvolts) may be modeled as a Gaussian random variable N (200,256) at a fixed point in time. What is the probability that the signal will exceed 240 μ vs. what is the probability that the signal is larger than 240 μ V, given that it is larger than 210 μ Vs?

   [8+8]

3. (a) Find the moment generating function of the random variable having probability density function
   f_X (x) = x, $0 \leq x \leq 1$
   = -2-x, $1 \leq x \leq 2$
   = 0, else where
   (b) Find the moment generating function of the random variable whose moments are $m_r = (r+1)!2^r$.

   [8+8]

4. (a) Which are the following are suitable auto correlation functions?
   i. $A\cos\varpi_0\tau$
   ii. $A\Pi(\tau/\tau_0)$ where $\Pi(x)$ is a unit area rectangular function

(b) Suppose we are given a cross power spectrum defined by

$$S_{xx}(\varpi) = a + ((jb\varpi/w)); -\mathrm{W} < \varpi < \mathrm{W}$$

$$= 0 : \text{Elsewhere}$$

Where W > 0, a and b are real constants. Find the cross correlation function.

[8+8]

5. Find the input auto correlation function, output autocorrelation and o/p spectral density of RC low pass filter, where the filter is subjected to a white noise of spectral density $N_0/2$. [16]

6. (a) Explain how partition noise is present in electron devices?

   (b) Explain the usefulness of knowing the noise power spectral density of a network.

[8+8]

7. (a) Derive the equation for narrow band noise and illustrate all its properties

   (b) Show their noise figure F of a n/w is given by F= $\frac{Go(f)}{K^2 Gin(f)}$ where Go(f), Gin(f), and K are respectively open circuited voltage, spectral density and the voltage gain of n/w.

[10+6]

8. (a) Obtain the Shannon - Hartley law giving the, relation amongst channel capacity, bandwidth and signal to noise ratio of a continuous system.

   (b) Consider a message sequence having alphabets Q_1, Q_2, Q_3 and Q_4 with probabilities 1/2, 1/4, 1/8 and 1/8 respectively.

      i. Calculate the entropy of the message sequence,

      ii. Find the information rate of the message rate is 1 message / second,

      iii. What is the rate at which binary signals are transmitted if the signal is sent after encoding Q_1, Q_2, Q_3 and Q_4 is 00, 01, 10 and 11.

[8+2+3+3]

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