Code No: NR221101 **NR**

II B.Tech II Semester Supplementary Examinations, April/May 2005
PROBABILTY & RANDOM VARIABLES
(Bio-Medical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and prove Bayes theorem of probability.
   (b) In a single throw of two dice, what is the probability of obtaining a sum of at least 10?

2. (a) Explain random variables and probability mass function each with an example.
   (b) Define probability density function. List its properties.

3. (a) State and Prove any four properties of characteristic function.
   (b) Find the density function of the distribution for which the characteristic function is $\phi(\mathrm{t}) = e^{-\frac{-t^2\sigma^2}{2}}$

4. (a) Explain the concept of Random process.
   (b) An ergoic random process is known to have an auto correlation function of the form $\begin{array}{l} \mathrm{R_{xx}}(\tau) = 1 - |\tau|, |\tau| \, 1 \\ \quad = 0, |\tau| > 1 \end{array}$

   Show the spectral density is given by
   $\mathrm{S_{xx}}(\omega) = \left[\frac{\mathrm{Sin}\omega/2}{\omega/2}\right]^2$

5. A Random process n(t) has a power spectral density g(f) $=\eta/2$for$-\alpha \leq f \leq \alpha$ Random process is passed through a low pass filter which has transfer function H(f) = 2for$-\mathrm{f_m} \leq \mathrm{f} \leq \mathrm{f_m}$andH(f) = 0 otherwise. Find the PSD of the waveform at the o/p of the filter.

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.

7. In TV receivers, the antenna is often mounted on a tall mask and a long lossy cable is used to connect the antenna and receiver. To overcome the effect of noisy cable, a preamplifier is mounted on the antenna. The parameters of the different stages are
   Preamplifier gain = 20 dB
   Preamplifier Noise figure = 6 dB
   Lossy cable noisy figure = 3 dB
   Cable Loss = -20 dB
   Receiver front end gain = 60 dB
   Receiver Noise figure = 16 dB
   Determine the overall noise figure of the system.

8. (a) A code is composed of dots and dashes. Assume that a dash is three times as long as the dot and has one-third the probability of occurrence.

   (b) Suppose 100 voltage levels are employed to transmit 100 equally likely messages. Assume the system to be a Gaussian channel with $\lambda = 3.5$ and bandwidth $B = 10^4$Hz Find S/N.

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