JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, June/July-2014
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(Common to ECE, ETM)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1.a) Distinguish between mutually exclusive events and independent events.
 b) In a single throw of two dice, what is the probability of obtaining a sum of at least 10?
 c) State and prove Baye's theorem of probability.

2.a) If the mean and variance of the binomial distribution are 6 and 1.5 respectively. Find $E[X - P(X \geq 3)]$.
 b) What is the distribution function of mixed random variable? Discuss what do you mean by density function?

3.a) State and prove properties of moment generating function of a random variable X.
 b) For a function $Y = (X - m_x)/\sigma_x$, prove that mean is zero and variance is 1.

4.a) Define and explain the properties of conditional density functions.
 b) Joint probabilities of two random variables X and Y are given in Figure.

Y \ X	1	2	3
1	0.2	0.1	0.2
2	0.15	0.2	0.15

Find out:
i) Joint and marginal distribution functions and plot.
ii) Joint and marginal density functions and plot.

5.a) For two zero mean Gaussian random variables X and Y show that their joint characteristic function is
$$\varphi XY(\omega_1,\omega_2) = \exp\{-1/2[\sigma X^2\omega_1^2 + 2\rho\sigma_X\sigma_Y\omega_1\omega_2 + \sigma Y^2\omega_2^2]\}.$$
 b) Random variables Z and W are defined by $Z = X+aY$ $W = X-aY$. Where 'a' is a real number? Determine 'a' such that Z and W are orthogonal.

6.a) Determine if the constant process $X(t) = A$, where A is a random variable with mean A and variance σA^2 is mean ergodic.
 b) Let $N(t)$ be a zero mean wide sense stationary noise process for which $R_{NN}(\tau) = (No/2)\ \delta(t)$ where No > 0 is a finite constant. Determine whether N(t) is mean ergodic.
 c) A random process consists of three sample functions $x(t, s_1) = 2$, $x(t, s_2) = 2\cos t$ and $x(t, s_3) = 3 \sin t$ each occurring with equal probability. Is the process stationary in any sense?

7.a) Consider a random process $X(t) = \cos(\omega t + \theta)$ where ω is a real constant and θ is a uniform random variable in $(0, \pi/2)$. Show that $X(t)$ is not a WSS process. Also find the average power in the process.

b) Find the Auto Correlation Function of the following PSDs:
i) $S_{xx}(\omega) = (157 + 12\omega^2)/(16+\omega^2)(9+\omega^2)$
ii) $S_{xx}(\omega) = 8/(9+\omega^2)^2$.

8.a) Define noise temperature and noise figure.

b) Bring out the significance of noise figure in determining the performance of a communication system.

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