

Code No: 53019

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year I Semester Examinations, December-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

- 1.a) Distinguish between mutually exclusive events and independent events.
 - b) State and prove Bayes theorem of probability.
 - c) What is the probability of picking an ace and a king from a deck of 52 cards?
- 2.a) Let X is a Gaussian random Variable with zero mean and variance σ^2 . Let $Y = X^2$. Find mean of Random Variable Y .
 - b) Explain the Rayleigh probability density function with help of diagrams.
- 3.a) Let X be a continuous random variable with pdf $f_x(x) = 8/x^3, x > 2$. Find $E[W]$ where $W = X/3$.
 - b) Find the density function of the distribution for which the characteristic function is $\phi(t) = e^{-\frac{t^2 \sigma^2}{2}}$
- 4.a) The joint probability density function of two random variables X and Y is given by $f(x, y) = \begin{cases} C(2x+y) & 0 \leq x \leq 1, 0 \leq y \leq 2 \\ 0 & \text{elsewhere} \end{cases}$, find
 - i) the value of 'C'
 - ii) marginal distribution functions of X and Y .
 - b) A distribution with unknown mean μ has variance equal to 1.5. Use central limit theorem to find how large a sample should be taken from the distribution in order that the probability will be at least 0.95 that the sample mean will be within 0.5 of the population mean.
- 5.a) For two zero mean Gaussian random variables X and Y show that their joint characteristic function is $\phi_{XY}(\omega_1, \omega_2) = \exp\{-1/2[\sigma_X^2 \omega_1^2 + 2\rho\sigma_X\sigma_Y\omega_1\omega_2 + \sigma_Y^2 \omega_2^2]\}$.
 - b) State and prove any two properties of joint characteristic functions.
- 6.a) Given that the autocorrelation function for a stationary ergodic process with no periodic components is $R(T) = 25 + \frac{4}{(1+6T^2)}$, find the mean and variance of the process $\{X(t)\}$.
 - b) If a Gaussian random process $X(t)$ is WSS, then show that it is strictly stationary.
- 7.a) Derive the relation between PSDs of input and output random process of an LTI system.
 - b) A WSS noise process $N(t)$ has ACF $R_{NN}(\tau) = Pe^{-3|\tau|}$. Find PSD and plot both ACF and PSD.
- 8.a) Define white noise. Find the A.C.F of the white noise.
 - b) Bring out the significance of noise figure in determining the performance of a communication system.