Code No: 53019 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November - 2015

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) If A and B are any events, not necessarily mutually exclusive events, derive an expression for probability of A Union B. When A and B are mutually exclusive, what happens to the above expression derived?

b) Consider the game of three cards. You shuffle a deck of three cards: ace, 2, 3. With the ace worth 1 point, you draw cards until your total is 3 or more. You win if your total is 3. What is P[W], the probability that you win?

c) State and derive the theorem on Total probability. [4+4+7]

2.a) Let X be a continuous random variable with pdf $f_x(x)=8/x3$, $x > 2$. Find E[W] where W = X/3.

b) An analog signal received at the detector (measured in micro volts) 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 μV? What is the probability that the signal is larger than 240 μV, given that it is larger than 210 μV? [7+8]

3.a) For a function $Y=(X-mx)/\sigma x$, prove that mean is zero and variance is 1.

b) State and prove properties of characteristic function of a random variable X. [8+7]

4.a) If $f_{X,Y}(X,Y) = 0.5e^{-(|X|+|Y|)}$, when X and Y are two random variables, if Z=X+Y, find $f_Z(Z)$.

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. [8+7]

5.a) Random variables X and Y have the joint density function $f_{X,Y}(x, y) = (x + y)^2/40$ $-1 < x < 1$ and $-3 < y < 3$, find all the third order moments for X and Y.

b) Show that the variance of a weighted sum of uncorrected random variables equals the weighted sum of the variances of the random variables. [7+8]

6.a) Define cross correlation function of two random processes X(t) and Y(t) and state the properties of cross correlation function.

b) Explain about mean and correlation Ergodic processes. [8+7]

7.a) A WSS noise process N(t) has ACF $R_{NN}(\tau) = P$. Find PSD and plot both ACF and PSD.

b) 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. [8+7]

8.a) Define white noise. Find the A.C.F of the white noise.

b) Describe the quadrature representation of narrowband noise. [8+7]

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