ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2011

REGULATIONS : 2008

FOURTH SEMESTER

080380009 - PROBABILITY AND RANDOM PROCESSES

(COMMON TO BIOMEDICAL / ECE)

Time : 3 Hours Max. Marks : 100

PART - A

(10 x 2 = 20 Marks)

ANSWER ALL QUESTIONS

1. Given the random variable with density function $f(x) = 2x$, $0 < x < 1 = 0$, elsewhere , find the p.d.f of $Y = 8X^3$
2. If a boy throwing stones at a target, what is the probability that his 10th throw is his 5th hit, if the probability of hitting the target at any trail is ½
3. The Joint p.d.f of two dimensional variable (X,Y) is given by $f(X,Y) = 2$, $0< X<1, 0< Y < 2 = 0$, elsewhere , find the Marginal density function of X and Y
4. If X and Y are independent random variables, find the correlation coefficient between X and Y
5. What are the difference between a SSS process and WSS process
6. State any two process of Poisson process
7. Define cross correlation function and state any two of its properties
8. State Wiener – Khinchin theorem of a random process
9. Explain time invariant system
10. Describe Band pass noise.

PART - B

(5 x 16 = 80 Marks)

ANSWER ALL QUESTIONS

11. (a) (i). In a normal distribution, 31% of the items are under 45 and 8 % are above 64. Find mean and variance of the distribution (8)

(ii). Derive mean and variance of Gamma distribution (8)

(OR)

11.(b) (i). A and B shoot independently until each has hit his target. The probability of their hitting the target at each shot are 3/5 and 5/7 respectively. Find the probability that B will require more shots than A (8)

(ii). Derive the MGF of Normal distribution (8)

12.(a) (i). Find the mean value of X and Y and coefficient of correlation from the equations $2Y - X = 50$ & $3Y – 2X = 10$ (8)

(ii). The joint probability density function of random variables X and Y is $f(x,y) = 8xy$, $o < x < 1, 0 < y < x = 0$, elsewhere , find the conditional probability function of X and Y & Y and X (8)

(OR)

12.(b) (i). If the joint probability density function of random variables X and Y is $f(x,y)= K(6-x-y)$, $0 < x < 2, 2 < y < 4 = 0$, elsewhere, find (1) the value of K (2) $P(x+y)<3$ and (3) $P[x < 1/ y<3]$ (8)

(ii). A coin is tossed 10 times. What is the probability of getting 3 or 4 or 5 heads by using Central limit theorem (8)

13.(a) (i). Show that the random process $X(t) = A\cos(\omega t + \theta)$ is a WSS process, if A and ω are constants and θ is uniformly distributed random variable in $(0, 2\pi)$ (8)

(ii). Three boys A,B,C are throwing a ball each other. A always throw the ball to B and B always throw the ball to C. But C is just as likely to throw the ball to B as to A. Show that the process is Markovian. Also find the transition matrix and classify the states (8)

(OR)

(b) (i). Suppose that a customer arrives at a bank according to Poisson process with a mean rate of 3 per minutes, find the probability that a time interval of 2 minutes (a) exactly 4 customers arrive and (b) more than 4 customers arrive (8)

(ii). In the fair coin experiment, we define the process X(t) as follows.

$X(t) = \sin(\pi t)$, if head shows and $= 2t$, if tail shows, find (a) $E[X(t)]$ and (b) $F[x(t)]$ for $t = 0.25$ (8)

14.(a) (i). Determine mean and variance of $R_{xx}(\tau) = [(4\tau^2 + 100) / (\tau^2 + 4)]$ (8)

(ii). If X(t) and Y(t) are two WSS random processes and $E\{[X(0) + Y(0)]^2\} = 0$, prove that $R_{xx}(\tau) = R_{xy}(\tau) = R_{yy}(\tau)$ (8)

(OR)

(b) (i). Determine $R_{xx}(\tau)$ if $\delta_{xx}(\omega) = [1 / (4 = \omega^2)^2]$ (8)

(ii). Find the auto correlation function of random process $X(t)=\sin(\omega t + \Phi)$ where ω is a constant and Φ is a random variable uniformly distributed in $(0, 2\pi)$ (8)

15.(a) (i). Determine the auto correlation of white noise (8)

(ii). If the input to a linear time – invariant system is a zero mean, while Gaussian process {N(t)} and {y(t)} is the output. Prove that $E[Y(t)] = 0$ and $\delta_{yy}(\omega) = [N_0 (N(\omega))^2] / 2$ (8)

(OR)

15.(b) (i). If N(t) is a band limited white noise such that $\delta_{NN}(\omega) = N_0 / 2$, for $|\omega| < \omega_g$ = 0, elsewhere, find the auto correlation function of N(t) (8)

(ii). A source of noise is a Gaussian with a mean of 0.4V and a S.D of 0.15V. For what percentage of time would you expect the measured noise voltage to exceed 0.7V (8)

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