Code No. 3305

FACULTY OF INFORMATICS

B.E. 2/4 (IT) II-Semester (Supplementary) Examination, January 2011

PROBABILITY AND RANDOM PROCESS

Time : Three Hours] [Maximum Marks : 75

*Answer **ALL** questions from Part A. Answer any **FIVE** questions from Part B.*

PART—A (Marks : 25)

1. If X and Y are two random variables; prove that E(X + Y) = E(X) + E(Y). 2
2. Two dice are rolled, find the probability that the first die should contain even number or a total of '8'. 3
3. State the properties of Moment Generating Function (MGF). 2
4. State Cauchy Schwartz Inequality. 2
5. State properties of joint probability function (F(x, y)). 3
6. Explain ergodicity. 2
7. If X and Y are independent random variables (IRV) prove that :
$V(aX - bY) = a^2V(X) + b^2 V(Y)$ ($\because$ a, b constants). 3
8. If X(t) = P + Qt where P and Q are independent r.v.s. with E(P) = P; E(Q) = ϕV; Var(P) = π^2; Var(q) = σ_2^2 find $R(t_1, t_2)$. 3
9. Define Noise. 2
10. State the properties of Cross Correlation. 3

PART—B (Marks : 50)

11. (a) State and prove Baye's theorem. 5
(b) For a certain binary communication channel, the probability that a transmitted '0' is received as a '0' is 0·95 and the probability that a transmitted '1' is received as '1' is 0·90. If the probability that a '0' is transmitted is 0·4 find the probability that '1' is received. 5
12. (a) Find Mean and Variance of Poisson random variable. 5
(b) A r.v. X has mean 12 and variance 9 and an unknown probability distribution. Find P(6 < X < 18) by using Tchebycheff's theorem. 5

13. (a) Find the power spectral density of WSS process with autocorrelation function : $R(\tau) = e^{-\alpha\tau^2}$. 5

(b) State the properties of Cross-correlation. 5

14. (a) If the power spectral density of WSS process is given by :

$$s(w) = \begin{cases} \frac{b}{a}(a - |w|) & |w| \le a \\ 0 & |w| > a \end{cases}$$

find autocorrelation function of the process. 5

(b) Prove that $S_{yy}(w) = |H(w)|^2 S_{xx}(w)$. 5

15. Two random processes X(t); Y(t) are defined by $X(t) = A \cos w_0 t + B \sin w_0 t$ and $Y(t) = B \cos w_0 t - A \sin w_0 t$, show that X(t) and Y(t) are jointly wide sense stationary if A and B are uncorrelated r.v's with zero means and the same variances and w_0 is a const. 10

16. The two dimensional r.v's has a joint density $f(x, y) = 8xy$, $0 < x < y < 1$. Find :

(i) Mdf's of f(x); g(y).

(ii) Are X and Y independent ?

(iii) V(Y)

(iv) Cov(X, Y)

(v) $P(X < 1/2 \cap Y < 1/4)$. 10

17. (a) X(t) is the input voltage to a circuit and Y(t) is the output voltage {X(t)} in a stationary random process with mean zero and $R_{XX}(\tau) = e^{-\alpha|\tau|}$ and $H(w) = \frac{R}{R + iLW}$. Find $S_{YY}(w)$ and $R_{YY}(\tau)$.

(b) Explain the terms :

(i) WSS

(ii) Markov Process

(iii) Central Limit Theorem. 5+5