**Code: ICT 9A04303**

ICT

B.Tech II Year I Semester (R09) Supplementary Examinations, May 2013

**PROBABILITY THEORY & STOCHASTIC PROCESSES**

(Electronics & Communication Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Explain about theorem of total probability.
(b) Given that two events $A_1$ and $A_2$ are statistically independent, show that:
(i) $A_1$ is independent of $\bar{A}$. (ii) $\overline{A_1}$ is independent of $A_2$. (iii) $\overline{A_1}$ is independent of $\overline{A_2}$ .

2 (a) Write short notes on binomial distribution.
(b) A random variable x has the following distribution.

| $xi$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| $p(xi)$ | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |

(i) Find 'a'
(ii) Find $P(X \le 3), P(X \ge 3)$ and $P(0 < X < 5)$
(iii) Find the smallest value of $'x'$ for which $P(X \le x) > 0.5)$
(iv) Find the CDF $F_X(x)$.

3 (a) Write short notes on central moments and moments about the origin.
(b) A random variable X has a probability density

$$f_X(x) = \begin{cases} \left(1/2\right)\cos(x) & -\pi/2 < x < \pi/2 \\ 0, & else\ where \end{cases}$$

For the function g(X) = $2X^4$
(i) Find the mean value. (ii) Find the variable.

4 (a) Write short notes on sum of two random variables.
(b) Let $f_{XY}(x,y) = x + y\ for\ 0 \le x \le 1,\ 0 \le y \le 1$
= 0 elsewhere.
Find the conditional density of: (i) X given Y. (ii) Y given X.

5 (a) What is a linear transformation explain interns of Gaussian random variable.
(b) Random variables X and Y have the joint desnity

$$f_{XY}(x,y) = \begin{cases} \left(1/24\right) & 0 < x < 6\ and\ 0 < y < 4 \\ 0, & else\ where \end{cases}$$

What is the expected value of the function $g(X,Y) = (XY)^2$?

6 (a) Define and differentiate between random variable and random process.
(b) A random process is defined as $X(t) = A\cos(\omega t + \theta)$ where A is a constant and $'\theta'$ is a random variable, uniformly distributed over $(-\pi, \pi)$ check X(t) for stationarity.

7 (a) Explain the cross covariance and correlation coefficient.
(b) Two random processes U(t) and V(t) are defined as U(t) = X(t) + Y(t) and V(t) = 2 – X(t)+3 Y(t), where X(t) and Y(t) are two orthogonal stationary processes. $R_{uu}(\tau)$, $R_{vv}(\tau)$, $R_{uv}(\tau)$ in terms of $R_{XX}(\tau)$ and $R_{YY}(\tau)$.

8 (a) Derive the relationship between cross-power spectrum and cross-correlation function.
(b) The auto correlation function of an a periodic random process is $R_{XX}(\tau) = exp\left[-\frac{x^2}{2\sigma^2}\right]$. Find the PSD and average power of the signal.

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