Sem - V (old) R-2007 ENTC — RSA 22/11/16
Random Signal Analysis

QP Code : 79996

(3 Hours) [Total Marks : 100

N.B. : (1) Question No.1 is compulsory.
(2) Solve any four from the remaining six questions.
(3) Assume suitable data wherever necessary.

1 (a) State and explain the three axioms of probability. 5
(b) Define random Variable and random process. 5
(c) Write two characteristics of the Normal distribution. 5
(d) When is a stochastic process said to be ergodic? 5

2. (a) Define probability distribution function of random variable. State important properties of it and prove. 10
(b) Suppose $f_X(x) = 2x/\pi^2$, $0 < x < \pi$, and $Y = \sin X$. Determine $f_Y(y)$. 10

3. (a) Suppose X and Y are two random variables. Define covariance and correlation coefficient of X and Y. When do we say that X and Y are 10
(i) orthogonal
(ii) independent and
(iii) uncorrelated? Are uncorrelated random variables independent?
(b) A stationary process is given by $X(t) = 10 \cos [100t + \Theta]$ where Θ is a random variable with uniform probability distribution in the interval $[-\pi, \pi]$. Show that it is a wide sense stationary process. 10

4. (a) State and prove Bayes Theorem. 10
(b) Obtain the Mean and Autocorrelation of the output process Y (t) if WSS input is applied to LTI systems. 10

5. (a) Explain Power Spectral Density. State its important properties and prove any one property. 10
(b) State and prove Chapman-kolmogorov equation. 10

6. (a) A random variable has the following exponential probability density function $f_X(x) = Ke^{-|x|}$ Determine the value of K and corresponding distribution function. 10

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b)Three boys A,B and C are throwing a ball to each other .A always throws the ball to B and B always throws 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.Find the transition matrix and classify the states. 10

7) Write short notes on 20

a) Central limit theorem.
b) Moment generating function.
c) Ergodic process.
d) Sequence of random variable.

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