B.E. Eighth Semester (Electronics & Telecommunication / Electronics & Communication Engineering) (C.B.S.)

Elective - III : Random Signal Theory

P. Pages : 2 **NKT/KS/17/7567**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.

1. a) Suppose X is a random variable with an exponential PDF of the form $fx(x) = 2e^{-2x} u(x)$. A new random variable is created according to the transformation $y = 1 - x$. find $fy(y)$. **7**

b) Discuss uniform Random variable. Explain with diagram. **6**

OR

2. a) Find the characteristic function for a standard normal random variable. **7**

b) Let $P = Px(B)$, then prove $P(v^n = k) = \frac{n!}{K!(n-K)!} P^K (1-P)^{n-K}, K = 0,1,....,n$. **6**

3. a) Prove $f_{x,y}(x,y) = \frac{\partial^2}{\partial x \, \partial y} F_{x,y}(x,y)$. **7**

b) Prove that $E[xy] = \mu x \cdot \mu y$ if X & Y are independent random variable. **7**

OR

4. Suppose a random variable is equally likely to fall anywhere in the interval [a, b], then the PDF is the form - **14**

$$f_x(x) = \begin{cases} \frac{1}{b-a}, & a \le x \le b \\ 0, & \text{otherwise} \end{cases}$$

Find and sketch the corresponding CDF.

5. a) Suppose X is a Gaussian random variable with mean μ and variance, σ^2. A new random variable is formed according to $Y = aX + b$, find $f_y(y)$. **7**

b) Explain transformations of Random variable. **6**

OR

6. a) Suppose X & Y are independent and both have exponential distributions. $f_X(x) = a.\exp(-ax)u(x),\ f_Y(y) = b.\exp(-by)u(y)$ find, PDF of $Z = X + Y$. **7**

b) Discuss conditional probability. **6**

7. a) Write short note on Autocorrelation function with the help of examples. **7**

b) Suppose X is an exponential random variable with a PDF $f_X(x) = \exp(-x)v(x)$, find Y. **6**

OR

8. a) If X and Y are independent random variable, then find $E[XY], \text{conv}(X, Y)$. **7**

b) When a pair of random variables X and Y are said to be jointly Gaussian. **6**

9. a) Define autocorrelation function of a continuous random process, X(t). Also explain far discrete time processes, the autocorrelation function. **7**

b) Find Auto correlation of $X(t) = A\sin(wot)$. **7**

OR

10. a) Write short note on ergodicity. **7**

b) Explain wide sense stationary with examples. **7**

11. a) Discuss all the random processes used in linear systems. **6**

b) Write short notes on stochastics processes. **7**

OR

12. $X(t) = At + B$, A, B are independent random variables, both uniformly distributed over the interval (-1, 1). Calculate mean and Auto correlation. **13**

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