

Time: 3 hours

Max. Marks: 80

- N.B. :** 1) Question no. 1 is compulsory
 2) Answer any 3 questions from remaining five questions

Q1 Answer any four questions

- a. Define mathematical, statistical, and axiomatic definitions of probability. **05**
- b. Define PDF and CDF of random variables with properties. **05**
- c. Define Autocorrelation Function. List the properties. **05**
- d. Explain the central limit theorem **05**
- e. Define n^{th} order stationary process. When will it become a WSS process? **05**

- Q2 a. 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
 i) '1' is received ii) a '1' was transmitted given that a '1' was received iii) Error Probability **10**
- b. Find mean and variance of binomial distribution using characteristic function **10**

- Q3 a. If the probability of success is 0.2, how many trials are necessary in order that probability of at least one success is greater than 0.5? **10**
- b. The joint pdf of the random variables (X, Y) is given by **10**
- $$f(x, y) = kxye^{-(x^2+y^2)}, x > 0, y > 0$$
- $$= 0, \text{ elsewhere}$$
- Find the value of k and prove that X and Y are independent.

- Q4 a. Prove that for a linear time invariant system, if the input is a WSS process, then output is also WSS Process. **10**
- b. Find the equation of the regression line from the following data. Calculate MSE. **10**

X	1	3	5	7	9	10
Y	9	8	10	12	11	13

- Q5 a. If the WSS process X (t) is given by $X(t) = 10 \cos(100t + \theta)$, where θ is uniformly distributed over $(-\pi, \pi)$. Prove that X (t) is correlation ergodic. **10**
- b. If two random variables X and Y are independent, find the pdf of $Z=X+Y$ if $f(X)=5e^{-5x}$ and $f(Y)=2e^{-2y}$, $x > 0$ and $y > 0$ **10**

- Q6 a. Find the correlation coefficient for the bivariate random variable (x, y) having the joint probability function. **10**
- $$f(x, y) = \frac{3}{2} (x^2 + y^2) ; 0 \leq x \leq 1; 0 \leq y \leq 1$$
- $$= 0 ; \text{ elsewhere} \quad \mathbf{10}$$
- b. Write a note on
 i) Bayes Theorem ii) Gaussian process
