R20 Regulation *Subject code:3P4DA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech IV Semester Regular/Supplementary Examinations, September 2023

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(ELECTRONICS& COMMUNICATION ENGINEERING)

Maximum Marks: 70 Date:13.09.2023 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Define probability of the event with an example.
2 What is the condition for a function to be a random variable?
3 Define Gaussian random variable.
4 If the probability of a bulb being defective is 0.8, then what is the probability of the bulb not being defective?
5 Define cross-covariance function.
6 Define joint characteristic function.
7 Define wide-sense stationary process.
8 Define auto correlation function.
9 Define cross power density spectrum.
10 Define white noise.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 A binary communication channel carries data as one of two types of signals denoted by 0 and 1. Owing to noise, a transmitted 0 is sometimes received as 1 and a transmitted 1 is sometimes received as 0. For a given channel, assume a probability of 0.94 that a transmitted 0 is correctly received as 0 and a probability of 0.91 that a transmitted 1 is received as a 1. Further assume a probability of 0.45 of transmitting a 0, if a signal is sent. [10]
Determine: i)Probability that a 1 is received
ii)Probability that a 0 was received
iii)Probability that a 1 was transmitted, given that a 1 was received
iv)Probability that a 0 was transmitted, given that a 0 was received
v)Probability of error

OR

12 (a) State and prove Bayes' theorem. [4]
(b) Define the term Independent events. State the conditions for Independence of
i) any two events A and B ii) any three events A,B and C [3+3]

13 A random variable X has the following probability distribution. [10]

X= x	0	1	2	3	4	5	6	7	8
P(x)	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

(i) Find the value of a (ii) Evaluate $P(X < 4)$, $P(0 < X < 4)$

(iii) Find the distribution function of X.

OR

14 (a) Explain Probability Density Function and Mention its properties. [5]

(b) A random variable X has a pdf. [5]

$$f_X(x) = \begin{cases} C(1-x^4) & \text{for } -1 \le x \le 1 \\ 0 & \text{Otherwise} \end{cases}$$

i) Find C ii) $P(|x| < 1/2)$ iii) $F_X(x)$

15 Find MGF of the RV X, whose pdf is given by $f(x) = \lambda e^{-\lambda x}$, $x > 0$ and hence find the first four central moments. [10]

OR

16 If the joint pdf of (X, Y) is given by $f_{XY}(x, y) = x + y$; $0 \le x, y \le 1$, find the pdf of $U = XY$. [10]

17 Define autocorrelation function of a random process. Write properties of auto correlation function of a WSS process and prove any three of them. [10]

OR

18 Consider the random process X(t) with $X(t) = A\cos(A^2 t + \varphi)$, where φ is a uniformly distributed random variable in $(-\pi, \pi)$. Prove that X(t) is WSS process or not. [10]

19 Find the power spectral density of the random process whose auto correlation function is

$$R(\tau) = \begin{cases} 1 - |\tau|, |\tau| \le 1 \\ 0, elesewhere \end{cases}.$$ [10]

OR

20 Derive the relationship between cross-power spectrum and cross-correlation function. [10]