ANURAG Engineering College
(An Autonomous Institution)
II B. Tech I Semester Supplementary Examinations, Jan/Feb-2024
PROBABILITY THEORY AND STOCHASTIC PROCESS
(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 Hours   Max. Marks: 75

Section – A (Short Answer type questions)   (25 Marks)
Answer All Questions

		Course Outcome	B.T Level	Marks
1.	Write the axioms of probability.	CO1	L1	2M
2.	Define a discrete sample space and a continuous sample space. Give an example of each	CO1	L1	3M
3.	If the variance of a random variable X is $Var(X)$, then Find the variance of a random variable $Y = aX$.	CO2	L3	2M
4.	Define the Gaussian random variable	CO2	L1	3M
5.	State the Central Limit Theorem Give an example of its practical application	CO3	L1	2M
6.	List and explain at least three key properties of jointly Gaussian random variables.	CO3	L2	3M
7.	Describe the autocorrelation function and cross-correlation function.	CO4	L1	2M
8.	Differentiate between deterministic and nondeterministic processes in the context of stochastic processes.	CO4	L2	3M
9.	What is the cross-power density spectrum? Write its properties	CO5	L1	2M
10.	What is meant by 'narrow band noise' and how does it differ from wideband noise in signal processing?	CO5	L2	3M

Section B (Essay Questions)
Answer all questions, each question carries equal marks.   (5 X 10M = 50M)

			Course Outcome	B.T Level	Marks
11.	A)	State Bayes' theorem. An email filtering system is designed to identify spam emails. Historically, 20% of emails received are spam. The system has an 80% success rate at identifying spam emails correctly and a 95% success rate at identifying non-spam emails correctly. If an incoming email is flagged as spam by the system, what is the probability that it is indeed a spam email?	CO1	L3	10M

OR

	B)	Distinguish between mutually exclusive events & independent events. Define the following and explain with an example. i. Sample space ii. Event iii. Mutually exclusive events iv. Collective by exclusive events	CO1	L2	10M

12.	A)	For the random variable 'x' whose density function is $f(x) = 1/(b-a)$ $a \leq x \leq b$ $= 0 \; otherwise$ Determine (i) Moment Generating Function (ii) Mean and Variance	CO2	L3	10M

OR

	B)	Compare and contrast the characteristics and properties of the Binomial, Poisson, Uniform, and Gaussian distributions. Discuss the applications of these distributions in various fields	CO2	L2	10M

13. A) Define conditional distribution and density functions and list their properties.   CO3   L3   10M

If the joint PDF of the two-dimensional random variable (x, y) is given by: $f_{XY}(x, y) = 2; for = 0 < x < 1; 0 < y < x;$
$= 0$ Otherwise
Find the marginal density function of X and Y.
OR

B) Define two joint central moments for two-dimensional random variables X and Y. Show that the mean value of a weighted sum of random variables equals the weighted sum of mean values   CO3   L2   10M

14. A) Explain the concept of first order and second-order wide-sense stationary processes. How do these differ from an Nth order and strict-sense stationary process?   CO4   L2   10M
OR

B) List and explain various properties of the Autocorrelation function and Compare the Cross Correlation Function with the Autocorrelation function with an example.   CO4   L2   10M

15. A) how the power spectrum relates to the autocorrelation function?
Consider a stochastic process $X(t)$ with an autocorrelation function $R_X(\tau) = e^{-|\tau|}$ Calculate the power spectrum $S_X(f)$ of this process.   CO5   L3   10M
OR

B) What is narrow-band noise? Write Quadrature representation of narrow-band noise and its properties   CO5   L2   10M