

ANURAG Engineering College
(An Autonomous Institution)

II B.Tech I Semester Supplementary Examinations, June/July-2024
PROBABILITY THEORY & STOCHASTIC PROCESSES
(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. One card is drawn from a regular deck of 52 cards. What is the probability of the card being either red or a king?	CO1	L1	2M
2. Write probability axioms and define probability as a relative frequency.	CO1	L1	3M
3. State and prove any two properties of variance of random variable.	CO2	L2	2M
4. Explain the characteristic function of a random variable X.	CO2	L1	3M
5. Explain about the “Joint Central Moments”.	CO3	L1	2M
6. If X & Y are statistically independent random variables and $W=X+Y$, then find PDF of W.	CO3	L1	3M
7. Explain the concept of stationary random process.	CO4	L2	2M
8. State and prove any three properties of auto correlation function.	CO4	L1	3M
9. If the Autocorrelation function of a random process is $R_{XX}(\tau) = Ke^{-K \tau }$. Find the power density spectrum?	CO5	L1	2M
10. What is the Trade-off between bandwidth and SNR?	CO5	L2	3M

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

11. A) A missile can be accidentally launched if two relays A and B both have failed. The probabilities of A and B failing are known to be 0.01 and 0.03, respectively. It is also known that B is more likely to fail (probability 0.06) if A has failed. i) What is the probability of an accidental missile launch? ii) What is the probability that A will fail if B has failed? Are the Events ‘A’ fails and ‘B’ fails statistically independent?	CO1	L3	10M
OR			
B) i) State and Prove that Conditional Probability and Total Probability. ii) A fair coin is tossed 4 times. Write the sample space and find the probability of the event that a) Number of heads is more than the number of Tails b) Tails occur in the second and fourth tosses of the coin.	CO1	L3	6M 4M
12. A) Distinguish between Probability Distribution and Probability Density functions and their properties.	CO2	L3	10M
OR			
B) A random variable X has a probability density $f_x(x) = \frac{\pi}{16} \cos(\pi x/8), -4 \leq x \leq 4.$ Find: a) Mean value $E[X]$, b) Second order moment $E[X^2]$ and c) Variance σ_X^2	CO2	L3	10M

13. A) i) Write short notes on “Jointly Gaussian Random variables”. CO3 L3 5M
 ii) Write short notes on “Point conditioning” and “Interval conditioning”. 5M
- OR**
- B) A Joint density is given by CO3 L3 10M

$$f_{XY}(x, y) = \begin{cases} \frac{2}{43}(x + 0.5y)^2, & 0 < x < 2 \text{ and } 0 < y < 3 \\ 0, & \text{otherwise} \end{cases}$$
- i) Find all the first and second order moment
 ii) Find the Covariance.
14. A) Two random processes $X(t)$ and $Y(t)$ be defined by CO4 L3 10M
 $X(t) = A \cos \omega t + B \sin \omega t$ and $Y(t) = B \cos \omega t - A \sin \omega t$, where A & B are two random variables and ω is a constant. Find the cross-correlation function and show that $X(t)$ and $Y(t)$ are jointly WSS.
- OR**
- B) i) Explain the following with respect to Random process. CO4 L3 5M
 a) Time average & b) Ergodic
- ii) Auto correlation function of a random process $X(t)$ is given as 5M
 $R_{XX}(\tau) = 25 + \frac{4}{1+6\tau}$. Find mean, mean square, variance of random process.
15. A) State and prove that power density spectrum and their properties. CO5 L3 10M
- OR**
- B) i) Derive the average noise figure of cascaded amplifier networks. CO5 L3 5M
 ii) Explain the following terms 5M
 a) Effective Noise temperature b) Thermal Noise.