22STP313N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - **STATISTICS**

STOCHASTIC PROCESSES

Time: Three Hours | Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	In a Markov chain, if all states communicate with each other, the chain is said to be (a) Irreducible (b) Reducible (c) Absorbing (d) Recurrent	K1	CO1
	2	For a Markov chain X_n with state space S, $p_{ij} = P[X_{n+1}=j \mid X_n=i]$ for all $i,j \in S$, then (a) (j–i) step transition probabilities (b) n-step transition probabilities (c) One-step transition probabilities (d) Transition probabilities of order n	K2	CO1
2	3	$\{X_t, t \in T\}$ is a stochastic process. If the joint distribution of $X(t_1), X(t_2), ..., X(t_n)$ and $X(t_1 + h), X(t_2 + h), ..., X(t_n + h)$ is the same for all $h > 0$, then X(t) is (a) Weak stationary process (b) Strong stationary process (c) Process with independent increments (d) Markov process	K1	CO2
	4	The output variable depending linearly, on its own previous values and on a stochastic term is (a) Moving average model (b) Regressive model (c) Auto regressive model (d) Markov chain	K2	CO2
3	5	A random process {X(t)} that is not stationary in any sense is called (a) Stationary processes (b) Markov chain (c) Evolutionary processes (d) Markov processes	K1	CO3
	6	Kolmogorov backward and forward equations are used for (a) Continuous-time Markov chain (b) Discrete-time Markov chain (c) Renewal process (d) Poisson process	K2	CO3
4	7	A birth-and-death process is characterized by (a) λ and μ_t (b) λ_i and μ_i (c) λ_t and μ_i (d) λ_i and μ	K1	CO4
	8	Which is a special case of continuous-time Markov chain? (a) Discrete process (b) Continuous process (c) Birth–death process (d) Gaussian process	K2	CO4
5	9	Renewal theory generalizes Poisson process for arbitrary holding time (a) Markov chain theory (b) Semi-Markov processes theory (c) Renewal theory (d) Queuing theory	K1	CO5
	10	Which one of the following is constant in wide-sense stationary process? (a) Autocorrelation (b) Auto covariance (c) Variance (d) Mean	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the classification of states in a Markov chain.	K4	CO1
		(OR)		
	11.b.	Define Stochastic process with an example.		
2	12.a.	Define stationary transition probabilities.	K3	CO2
		(OR)		
	12.b.	Explain periodic and aperiodic chains.		
3	13.a.	Derive the Kolmogorov forward and backward equations.	K2	CO3
		(OR)		
	13.b.	Define absorption probability and duration of random walk.		
4	14.a.	Define a Poisson process and state its assumptions.	K3	CO4
		(OR)		
	14.b.	State the postulates for Poisson process.		
5	15.a.	Write short notes on renewal process.	K4	CO5
		(OR)		
	15.b.	Write short notes on wide sense stationary and strict sense stationary process.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Describe the method to determine higher order transition probabilities.	K4	CO1
2	17	Explain limiting behavior of n-step transition probabilities for a periodic irreducible positive recurrent chain.	K3	CO2
3	18	Find the second-step transition probability matrix using Chapman–Kolmogorov equation.	K4	CO3
4	19	Explain in detail the birth and death process.	K3	CO4
5	20	Derive the elementary renewal theorem.	K4	CO5

Z-Z-Z END