LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

FIFTH SEMESTER – **APRIL 2024**

UST 5501 – APPLIED STOCHASTIC PROCESSES

Date: 16-04-2024 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
1.	**Fill in the blanks**
a)	The collection of outcomes of a stochastic random variable is ________________.
b)	A state i is said to be recurrent if $\sum_{i=1}^{n} f_{ii}^{n}$ is equal to ________________.
c)	The mean of Poisson process is __________.
d)	The interval between occurrences of two successive renewals is a renewal ______.
e)	The survival of family names is an example for __________ process.
2.	**Match the following**
a)	Second order process - Renewal density
b)	Markov chain - Branching process
c)	Inter arrival time - $E\{X(t)\}^2 < \infty$
d)	M ' (t) - Finite or countable state space
e)	Generating functions - Exponential distribution.
	SECTION A - K2 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
3.	**True or False**
a)	The sum of two covariance functions is not a covariance function.
b)	State i is aperiodic if d(i) = 2.
c)	P.G.F of Poisson process is exp(-λt)
d)	The mean waiting time between two consecutive renewals may be finite or infinite.
e)	Nuclear reactions can be studied by branching process.
4.	**Answer the following**
a)	Define Stochastic Process.
b)	What is a transition probability matrix?
c)	State the postulates for Poisson process.
d)	When a state is called transient?
e)	Define Branching process.
	SECTION B - K3 (CO2)
Answer any TWO of the following	**(2 x 10 = 20)**
5.	Describe spatially homogenous Markov chains.
6.	Show that the two-dimensional random walk is recurrent.
7.	Derive the Poisson process.
8.	Derive the mean and variance of branching process.
	SECTION C – K4 (CO3)
Answer any TWO of the following	**(2 x 10 = 20)**
9.	Discuss the classification of chains and their states.

10.	Derive the forward Kolmogorov differential equations for birth and death process.
11.	Explain Renewal process with two examples.
12.	If $m \leq 1$, prove that the probability of extinction is 1, where m is the first moment of X_n.
SECTION D – K5 (CO4)	
Answer any ONE of the following	**(1 x 20 = 20)**
13.	a) Describe the various classifications of stochastic processes according to time and state space with examples. b) State and Prove Chapman Kolmogorov equation (10+10)
14.	a) State and Prove Renewal theorem. b) Derive the mean and variance of Yule process. (10+10)
SECTION E – K6 (CO5)	
Answer any ONE of the following	**(1 x 20 = 20)**
15.	a) Explain block replacement policy in renewal process. b) Show that Poisson process can be viewed as a renewal process. (5 + 15)
16.	Show that the three dimensional random walk is transient.

$$$$$$$$$$$$$$