Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/ Supplementary/Improvement) Examination, April 2026
(2020 to 2023 Admissions)
DISCIPLINE SPECIFIC ELECTIVE IN STATISTICS
6B13CSTA : Stochastic Processes

Time : 3 Hours Max. Marks : 48

PART – A

(Short Answer)

Answer **all** questions. **1** mark **each**.

1. Define joint probability mass function of a bivariate random variable.
2. Give any two properties of probability generating function.
3. Define independence of two random variables.
4. What is Markov property ?
5. Define auto covariance function of a stochastic process.
6. What is meant by offspring distribution ? **(1×6=6)**

PART – B

(Short Essay)

Answer **any 7** questions. **2** marks **each**.

7. Let X and Y be two independent random variables with probability generating function. The pgf of a random variable is exp $\{2(s-1)\}$. Obtain $P(X = 0)$ and $P(X = 2)$.
8. Define stochastic process. Give an example stating its state space and time space.

P.T.O.

9. A bivariate random variable (X, Y) has joint pdf $f(x, y) = 4xy$, $0 < x, y < 1$. Find the pdf of $(X|Y)$.
10. Define irreducibility in a Markov chain.
11. Define ergodic state of a Markov chain.
12. What is the relationship between the Poisson process and exponential distribution ?
13. State any two properties of Poisson process.
14. Give an example for a compound Poisson process.
15. Define a stochastic process with independent increments. Give one example. **(2×7=14)**

PART – C

(Essay)

Answer **any 4** questions. **4** marks **each**.

16. Obtain the probability generating function of a random variable with pmf $f(x) = \frac{1}{4}$, $x = 0, 1, 2, 3$. Hence obtain its mean.
17. Define transition probability matrix of a Markov chain. Explain its properties with an example.
18. Explain the concept of accessibility of states. How is it related to communication ? Give an example of two states that do not communicate.
19. In a Poisson process with rate $\lambda = 4$ per hour, find the probability that at least 3 events occur in one hour.
20. For a branching process $\{X_n\}$ with offspring distribution : $p_0 = 0.2$, $p_1 = 0.5$, $p_2 = 0.3$, find the expected number of individuals in the second generation if $X_0 = 1$.
21. Differentiate between strict sense and wide sense stationarity of stochastic processes with suitable examples. **(4×4=16)**

PART – D

(Essay)

Answer **any 2** questions. **6** marks **each**.

22. The joint pdf of (X, Y) is $f(x, y) = k(2x + 3y), 0 \le x, y \le 2$. Find (i) value of k (ii) marginal pdf of X and Y and (iii) conditional pdf of X given Y and Y given X.
23. Classify the states of a Markov chain with transition probability matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \end{bmatrix}$.
24. What are the postulates of a Poisson process ? Obtain the mean and variance of a Poisson process.
25. A branching process has offspring distribution $P(X = 0) = 0.4$, $P(X = 1) = 0.4$, $P(X = 2) = 0.2$.
 a) Compute the mean and variance of the offspring distribution.
 b) Find the extinction probability. **(2×6=12)**

____