THIRD SEMESTER M.A. DEGREE EXAMINATION, NOVEMBER 2025

(CUCSS-PG)

(Regular/Supplementary/Improvement)

CC22PMST3C10 – STOCHASTIC PROCESSES

(Statistics)

(2022 Admission onwards)

Time : Three Hours   Maximum : 30 Weightage

PART A

Answer any *four* questions. Each question carries 2 weightage.

1. What is transition probability of a Markov process?

2. Define Random Walk. How it is related to Birth and Death process?

3. Define Markov process. Give an example.

4. What are the properties of a Poisson process?

5. Define renewal equation. Explain the uses.

6. How can we compute n step transition probabilities?

7. Discuss the distributional properties of Brownian motion process.

(4 × 2 = 8 Weightage)

PART B

Answer any *four* questions. Each question carries 3 weightage.

8. Derive the Chapman-Kolmogorov equation for a Markov process.

9. Let {N(t), t > O} be a Poisson process with rate A. Calculate E[N(t). N(t + s)]

10. For a renewal process $\{N(t), t \geq 0\}$, prove the renewal function $m(t) = \sum_{n=1}^{\infty} F_n(t)$, $F_n(t) = P(N(t) \geq n)$.

11. Explain:

    (a) Branching process.

    (b) Brownian Motion process.

    (c) Compound Poisson process.

12. Obtain the steady state probability distribution of a M/M/1 model.

13. Find the distribution of interarrival time distribution of a Poisson distribution.

14. State and prove elementary renewal theorem.

(4 × 3 = 12 Weightage)

PART C

Answer any *two* questions. Each question carries 5 weightage.

15. Derive the distribution of first hitting time of a Brownian motion process.

16. With probability 1, prove that $\frac{N(t)}{t} \to 1/\mu$ as $t \to \infty$, for a renewal process

17. (a) Discuss the state properties of a Markov chain

(b) Examine the properties of the transition probability matrix $\begin{bmatrix} .5 & .5 & 0 \\ 0 & .5 & .5 \\ 0 & 0 & 1 \end{bmatrix}$.

18. State and prove central limit theorem on renewal process. Stochastic process having independent increment is a Markov process. Is the converse true?

(2 × 5 = 10 Weightage)

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