TM242103R

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2024

2023 ADMISSIONS REGULAR

SEMESTER II - CORE COURSE

ST2C07TM - Stochastic Processes

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Explain (i) Assessable state (ii) Essential state (iii) Periodic state
2. Define a process with independent increment.
3. State Basic limit theorem for a M.C.
4. Examine whether the population is extinct or not
   $P(s)=(\frac{c}{c+1})^e (1-\frac{s}{c+1})^{-e}$
5. Explain random walk in space.
6. State and prove the additive property of Poisson process.
7. Define continuous time Markov chain.
8. Define Birth - Death process.
9. Explain Renewal process.
10. Define Renewal function.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. State and prove mean ergodic theorem.
12. For the three state Markov chain with TPM $P = \begin{bmatrix} 0.40 & 0.35 & 0.25 \\ 0.75 & 0.18 & 0.07 \\ 0.15 & 0.12 & 0.73 \end{bmatrix}$
    Obtain the stationary distribution πk .
13. Let P(s) be the pgf associated with the offspring distribution P_k and $P_n(s)$ is asociated with X_n. Then show that $P_n(s) = P_{n-1}[P(s)]$.
14. If $H_n(s)$ is the pgf of z_n and $P(s)$is the p.g.f of offspring then show that $H_n(s) = SP[H_{n-1}(s)]$.
15. Derive the waiting time distribution of Poisson process.
16. Derive the waiting time distribution for Birth - Death process.
17. Using Wald's equation evaluate, $E[S_{N(t)+1}]$.
18. Explain Kolmogrov's backward differential equation.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Define (i) Ergodic Markov chain (ii)Define Doubly stochastic Markov chain (iii) Stationary distribution for a MC. (iv) If the states are transient there can not exist a stationary distribution.
20. Define random walk. State and prove Polya's theorem for recurrence.

21. Find the Steady state solution for M/M/s queue.
22. State and prove the central limit theorem for renewal process.