

Semester-V

PAPER NO-14: STOCHASTIC PROCESSES

1. Probability Distributions
 - 1.1. Generating Functions
 - 1.2. Bivariate Probability Generating Function
 - 1.3. Introduction: Stochastic Process
 - 1.4. Stationary Process
2. Markov Chains
 - 2.1 Definition of Markov Chain
 - 2.2 Transition Probability Matrix
 - 2.3 Order of Markov Chain
 - 2.4 Markov Chain as Graphs
 - 2.5 Higher Transition Probabilities
 - 2.6 Generalization of Independent Bernoulli Trials
 - 2.7 Classification of States and Chains
 - 2.8 Stability of Markov System
 - 2.9 Graph Theoretic Approach
- 3 Poisson Process
 - 3.1 Postulates of Poisson Process
 - 3.2 Properties of Poisson Process
 - 3.3 Inter-arrival Time
 - 3.4 Pure Birth Process
 - 3.5 Yule Furry Process
 - 3.6 Birth and Death Process
 - 3.7 Pure Death Process
4. Queuing System
 - 4.1 General concept
 - 4.2 Steady State Distribution
 - 4.3 The Queuing Model, M/M/1 with finite and infinite system capacity
 - 4.4 Waiting Time Distribution
5. Gambler's Ruin Problem
 - 5.1 Classical Ruin Problem
 - 5.2 Expected Duration of the Game

WEEK-WISE DETAILS

Week 1-3: Probability Distributions

- Medhi, J. (2009): *Stochastic Processes*, New Age International Publishers. pp. 1-12, 15-17, 49-51, 322-326
- Basu, A.K. (2005): *Introduction to Stochastic Processes*, Narosa Publishing. pp. 4

Week 3-7: Markov Chains

- Medhi, J. (2009): *Stochastic Processes*, New Age International Publishers. pp. 62-87, 94-97, 99-100

Week 7-10: Poisson Processes

- Medhi, J. (2009): *Stochastic Processes*, New Age International Publishers. pp. 138-152, 159-161, 165-170
- Bhat, B.R. (2000): *Stochastic Models: Analysis and Applications*, New Age International Publishers. pp. 199-201

Week 10-11: Queuing Systems

- Medhi, J. (1994): *Stochastic Processes*, New Age International Publishers pp. 407-417
- Taha, H. (1995): *Operations Research: An Introduction*, Prentice- Hall India, pp. 564-567

Week 12: Gambler's Ruin Problem

- Feller, William (1968): *Introduction to probability Theory and Its Applications, Vol I*, 3rd Edition, Wiley International. pp. 342-349

Practical/ Lab work

LIST OF PRACTICALS

1. Calculation of Transition Probability Matrix
2. Identification of characteristics of Reducible chains.
3. Identification of characteristics of Irreducible chains.
4. Identification of types of classes
5. Identification of ergodic Transition Probability Matrix
6. Stationarity of Markov Chain
7. Graphical representation of Markov Chain
8. Computation of probabilities in case of generalizations if independent Bernoulli trials.
9. Calculation of probabilities for given birth and death rates
10. Calculation of birth and death rates for given probabilities
11. Calculation of probabilities for Pure Birth Process
12. Calculation of probabilities for Pure Death Process
13. Calculation of probabilities for Birth and Death Process
14. Calculation of probabilities for Yule Furry Process
15. Computation of inter-arrival time for a Poisson process.
16. Calculation of Probability for (M/M/1) model
17. Calculation of parameters for (M/M/1) model
18. Probability computation for (M/M/1):(N, GD) model
19. Parameter estimation for (M/M/1):(N, GD) model
20. Change in behavior of queue as N tends to infinity.
21. Calculation of generating function in case of ruin problem for different amounts of stake.
22. Computation of expected duration of the game for different amounts of stake.
23. Computation of probabilities when one player is infinitely rich.
24. Effect on expected duration when the players are competent and one player is infinitely rich.
25. Effect on expected duration when the players are not competent and one player is infinitely rich.