LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

THIRDSEMESTER – APRIL 2018

16PST3MC02 /ST3816/ST3812- STOCHASTIC PROCESSES

Date: 26-04-2018 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

Section – A

Answer all the questions **10 X 2 = 20 marks**

1. Define state space and time space of a stochastic process.

2. Define a transition probability matrix.

3. When a stochastic process is called Markov?

4. Write two properties of periodicity of a Markov chain.

5. Define recurrence and transient states of a Markov chain.

6. When a process is said to be covariance stationary ?

7. State the basic limit theorem of Markov process.

8. Define sub-martingale of a stochastic process.

9. Define a branching process.

10. State Abel lemma.

Section – B

Answer any five questions **5 X 8 = 40 marks**

11. Explain (i) process with stationary independent increments (ii) Martingales
12. Define communication of states and show that communication is an equivalence relation.
13. State the necessary and sufficient condition for a state to be recurrent.
14. Derive a system of differential equations of a pure birth process.
15. Explain renewal process with two examples.
16. Show that the variance of a sum as a Martingale.
17. Establish the relationship of probability generating function for a branching process.
18. Explain stationary process with two examples.

Section- C

Answer any two questions **2 X 20 = 40 marks**

19. (a)Show that the three dimensional random walk is transient.

(b) Prove that state i is recurrent or transient according to whether $Q_{ii} = 1$ or 0 respectively.

(15+5) marks.

20.(a) Derive backward and forward Kolmogorov differential equations for a birth and death process.

(b) Derive the Yule process. (10 + 10) marks.

21.(a) Derive the mean and variance of branching process.

(b) If π is the probability of eventual extinction , show that it satisfies the equation $\varphi(s) = s$.

(10 + 10) marks.

22.(a) Show that the moving average process is covariance stationary.

(b) Explain (i) Wald's martingale (ii) Doob's martingale. (iii) Right regular sequences and induced Martingales for Markov chains. (6 + 14)marks.

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