BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc | **SEMESTER : VIII**
BRANCH: MATH | **SESSION : SP/2025**

SUBJECT: MA413 STOCHASTIC PROCESS AND SIMULATION

TIME: 3 Hours | **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Find the mean and variance of Binomial distribution using the concept of probability generation function.	[5]	1	3
Q.1(b)	Define Laplace transform for a random variable. Find the mean and variance of Exponential distribution using its Laplace transform.	[5]	1	3
Q.2(a)	Write a short note on stationarity of a stochastic process. Why is it important?	[5]	2	1
Q.2(b)	Let X_n, $n \geq 1$ be uncorrelated random variables with mean 0 and variance 1. Verify if the process $\{X_n, n \geq 1\}$ is weakly stationary.	[5]	2	3
Q.3(a)	A particle performs a random walk with absorbing barriers at 0 and 4 and if it is at any other position r (r=1, 2, 3) then it moves to position r+1 with probability p and to position r-1 with probability q=1-p. Obtain the transition probability matrix and if X_n is the position of the particle after n moves, show that $\{X_n, n=1, 2, 3….\}$ is a Markov chain.	[5]	3	2
Q.3(b)	Suppose that the probability of a dry day (state 0) following a rainy day (state 1) is 1/3 and the probability of a rainy day following a dry day is ½. Given that June 1 of a certain year is a rainy day, what is the probability that June 5 of the same year will be a dry day?	[5]	3	3
Q.4(a)	What is a Poisson process? What are its postulates?	[5]	4	1
Q.4(b)	Suppose that customers arrive at a certain ticket counter following a Poisson Process with mean rate of 4 per minute. Then in an interval of 2 minutes, what is the probability that (i) exactly 3 customers will arrive? (ii) less than 3 customers will arrive? (iii) more than 3 customers will arrive?	[5]	4	3
Q.5(a)	Given u=0.5134 and v=0.3621 as values of two independent continuous uniform variates in the range (0,1), use them to simulate two independent normal variates each with mean 16 and standard deviation 9.	[5]	5	3
Q.5(b)	A random variable X has the following probability distribution: x: 2 4 6 8 10 P(X=x): 1/17 5/17 6/17 3/17 2/17 Write an algorithm to simulate X.	[5]	5	2

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