LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FOURTH SEMESTER – **APRIL 2023**

UST 4401 – PROBABILTY AND DISTRIBUTIONS

Date: 04-05-2023 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
1.	**Define the following**
a)	Probability of an event.
b)	Marginal distribution.
c)	Discrete Uniform distribution.
d)	Continuous distributions.
e)	Random walk.
2.	**Fill in the blanks**
a)	If A and B are independent, then P(A∩B)= ___________.
b)	The first raw moment is called _________ of the distribution.
c)	Variance > mean in __________ distribution.
d)	The mean of gamma distribution with one parameter is _______________.
e)	A discrete parameter Markov process is called ________.
	SECTION A - K2 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
3.	**Match the following**
a)	At least one of the events A or B occurs — Poisson
b)	If X and Y are independent then E(XY) = — $N(\mu,\sigma^2)$
c)	Mean=Variance — Markov process
d)	Normal distribution — AUB
e)	Weather prediction models — E(X)E(Y)
4.	**True or False**
a)	The probability of impossible event is 1.
b)	Tossing a coin is an example of a random experiment.
c)	When the population size increases hypergeometric distribution tends to binomial distribution.
d)	If X and Y are two independent normal variates, then X-Y is not a normal variate.
e)	In Markov process future depends on both present and past states.
	SECTION B - K3 (CO2)
	Answer any TWO of the following **(2 x 10 = 20)**
5.	State and prove multiplication theorem of probability for independent events.
6.	A coffee connoisseur claims that he can distinguish between a cup of instant coffee and a cup of percolator coffee 75% of the time. It is agreed that his claim is accepted if he correctly identifies at least 5 of the 6 cups. Find his chances of having the claim (i) accepted, (ii) rejected, when he does have the ability he claims.
7.	Prove that exponential distribution has a lack of memory property.
8.	If particles are emitted from a radioactive source a rate of 20 per hour, find the probability that

	exactly 5 particles are emitted during a 15 minutes period.
SECTION C – K4 (CO3)	
	Answer any TWO of the following **(2 x 10 = 20)**
9.	State and prove Bayes' theorem.
10.	(a) A problem in statistics is given to 3 students, whose chance of solving it are ½, ¾ and ¼ respectively. What is the probability that the problem will be solved if all of them try independently? (b) Given P(A)= 0.4, P(AUB)=0.7. Find P(B), if A and B are mutually exclusive. (6+4)
11.	Derive the first three moments of Poisson distribution.
12.	If the initial stage probability distribution of a Markov chain is $P^{(0)}=(5/6 \quad 1/6)$ and the tpm of the chain is $\begin{pmatrix} 0 & 1 \\ 1/2 & 1/2 \end{pmatrix}$. Find the probability distribution of the chain after 2 steps.
SECTION D – K5 (CO4)	
	Answer any ONE of the following **(1 x 20 = 20)**
13.	The daily consumption of milk in a city, in excess of 20,000 litres, is approximately distributed as a gamma variate with parameters a=1/10,000 and λ=2. The city has a daily stock of 30,000 litres. What is the probability that the stock is insufficient on a particular day?
14.	(a) Derive mean and variance of Geometric distribution. (b) Find the probability density of geometric distribution if the value of p is 0.42; x = 1,2,3 and also calculate the mean and variance. (10+10)
SECTION E – K6 (CO5)	
	Answer any ONE of the following **(1 x 20 = 20)**
15.	Derive the moments of normal distribution.
16.	Suppose the customers arrive at a bank according to Poisson process with a mean rate of 3 per minute. Find the probability that during a time interval of 2 mins (i) exactly 4 customers arrive (ii) more than 4 customers arrive and (iii) fewer than 4 customers arrive.
