R22

Question Paper Code: R22A21HS01

ANURAG Engineering College

(An Autonomous Institution)

II B.Tech. I Semester Regular Examinations, Jan/Feb–2024

PROBABILITY AND STATISTICS

(COMMON TO CIVIL, CSE, IT AND AI&ML)

Time: 3 Hours **Max. Marks: 60**

Section – A (Short Answer type questions) (10 Marks)

Answer All Questions

		Course Outcome	B.T Level	Marks
1.	Define conditional probability of any two events of sample space	CO1	L1	1M
2.	Distinguish between discrete and continuous random variables	CO1	L2	1M
3.	Define variance of a random variable	CO2	L1	1M
4.	Write down the probability mass function of a Poisson distribution and what are the mean and variance of the distribution?	CO2	L1	1M
5.	State Area property of normal and or standard normal distribution	CO3	L2	1M
6.	Define t-distribution	CO3	L1	1M
7.	Define Null and Alternate Hypothesis	CO4	L1	1M
8.	Illustrate the errors in sampling	CO4	L2	1M
9.	Define stochastic process	CO5	L1	1M
10.	Define markov chain	CO5	L1	1M

Section B (Essay Questions)

Answer all questions, each question carries equal marks. **(5 X 10M = 50M)**

11. A)	i) Let A and B be the two events such that P(A)=1/2, P(B)=1/3 and $P(A\cap B)$=1/4 then obtain the conditional probabilities of the events.	CO1	L3	4M
	ii) A factory produces a certain type of outputs by three types of machine. The respective production figures are:Machine – I: 3,000 Units; Machine – II: 2,500 Units; Machine – III: 4,500 Units. Past experience shows that 1% of the output produced by the Machine – I is defective. The corresponding data for the other two machines are 1.2% and 2% respectively. An item is drawn at random from the day's production run and is found to be defective. What is the probability of getting a defective item? What is the probability that it comes from the output of Machine-I			6M
	OR			
B)	The error in reaction temperature, in ${}^{0}C$, for a controlled laboratory experiment is a continuous random variable X having the probability density function: $f(x)=\begin{cases}\frac{x^2}{3}, & -1<x<2\\ 0, & else\ where\end{cases}$, i) Verify that the above is probability density function or not ii) Find P(0<X<1), $P(0<X\leq 1.5)$ iii) Compute the mean, variance of X	CO1	L3	10M

12\. A) i) If X and Y are any two independent random variables, prove that $V(aX+bY) = a^2V(X) + b^2V(Y)$,where a and b are any two constants. CO2 L3 4M

ii) Given the following probability distribution of a discrete random variable X: 6M

Values of X, x	1	2	3	4	5	6	7
p(x)	0.05	0.10	0.30	0.30	0.10	0.10	0.05

Compute a) V(X) b) V(2X+7)

OR

B) The number of breakdowns of a computer is a random variable having Poisson distribution with a mean of 1.8 per month. Find the probability that the computer will function for a month. CO2 L3 10M

i) without any breakdowns
ii) with only one breakdown
iii) with at least 2 breakdowns

13\. A) In a distribution exactly normal, 10.03% of the items are under 25-kilogram weight and 89.97% of the items are under 70-kilogram weight. What are the mean and standard deviation of the distribution? CO3 L3 10M

OR

B) A population consists of observations 1, 4, 9, 16 and 25. Determine the mean and variance of the population. Write all the possible samples of size 2 without replacement. Construct the sampling distribution about mean. Show that the mean of sample means is equal to the population mean. CO3 L3 10M

14\. A) Samples of two types of electric light bulbs were tested for length of life and the following data were obtained: CO4 L3 10M

	Type-I	Type-II
Sample Size	8	7
Sample Mean	1,234hours	1,036hours
Sample S.D.	36hours	40hours

Is the difference in the means sufficient to warrant that the Type I is superior to the Type II regarding the length of life? (Use0.05 level of significance)

OR

B) An investigation of two kinds of photocopying equipment showed that 71 failures of the first kind of equipment took on the average 83.2 minutes to repair with a standard deviation of 19.3 minutes, while 75 failures of second kind of equipment took on the average of 90.8 minutes with a standard deviation of 21.4 minutes. Test the hypothesis that on the average it takes an equal amount of time to repair either kind of equipment at the 0.05 level of significance. CO4 L3 10M

15\. A) Assume that a man's profession can be classified as professional, skilled labourer, or unskilled labourer. Assume that, of the sons of professional men, 80 percent are professional, 10 percent are skilled labourers, and 10 percent are unskilled labourers. In the case of sons of skilled labourers, 60 percent are skilled labourers, 20 percent are professional, and 20 percent are unskilled. Finally, in the case of unskilled labourers, 50 percent of the sons are unskilled labourers, and 25 percent each are in the other two categories. Assume that every man has at least one son and form a Markov chain by following the profession of a randomly chosen son of a given family through several generations. CO5 L3 10M

i) Find a matrix of transition probabilities.

ii) Find the probability that a randomly chosen grandson of an unskilled labourer is a professional man.

OR

B) Consider a three-state Markov chain with the transition matrix with the initial probabilities P_0 =(0.1, 0.3, 0.6) CO5 L3 10M

$$P = \begin{bmatrix} 0 & \frac{1}{4} & \frac{3}{4} \\ \frac{1}{4} & \frac{1}{4} & \frac{1}{2} \\ \frac{1}{2} & 0 & \frac{1}{2} \end{bmatrix}$$

i) Find the probabilities after two transitions.

ii) Find limiting probabilities.