LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

U.G. DEGREE EXAMINATION – **ALLIED**

SECOND SEMESTER – **APRIL 2023**

UST 2302 – MATHEMATICAL STATISTICS

Date: 10-05-2023 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Definitions**	
a)	Probability mass function.	
b)	The uniqueness theorem of moment generating function.	
c)	Binomial distribution.	
d)	t- distribution.	
e)	Sample variance.	
2.	**Fill in the blanks**	
a)	Conditional probability function P(A/B) is _____.	
b)	Mean and variance of negative binomial distribution are _____.	
c)	The moment generating function of the Poisson distribution is _____.	
d)	Mean and variance of Chi-Square distribution is_____.	
e)	The sample Mean is _____.	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Match the following**	
a)	If X and Y are independent if and only if Cov(X,Y)	$\frac{1}{\theta}$ *and* $\frac{1}{\theta^2}$
b)	Hypergeometric Distribution	Continuous
c)	Mean and Variance of exponential distribution are	0
d)	Gamma Distribution	Discrete
e)	Uniform Distribution	$f(x) = \frac{1}{b-a}; a \le x \le b$
4.	**True or False**	
a)	In probability, a real-valued function, defined over the sample space of a random experiment, is called a random variable.	
b)	The mean of negative normal distribution is $\frac{n}{N}$.	
c)	Geometric distribution mean and variance are same.	
d)	The degrees of freedom for Chi-square distribution is n-1.	
e)	F test is used to test for equality of variances from two normal populations	
	SECTION B - K3 (CO2)	
	Answer any TWO of the following	**(2 x 10 = 20)**
5.	A random variable X has the following probability distribution:	

x	0	1	2	3	4	5	6	7	8

$p(x)$	k	3k	5k	7k	9k	11k	13k	15k	17k

(i) Determine the value of k.

(ii) Find $p(X < 3)$ and $p(0 < X < 5)$

6. Obtain the mean and variance of Geometric distribution.

7. Derive the mean and variance of Beta distribution of second kind.

8. Derive the mean and variance of the chi-square distribution.

SECTION C – K4 (CO3)

Answer any TWO of the following **(2 x 10 = 20)**

9. State and prove Chebyshev's inequality.

10. A manufacturer of pins knows that, 2% of the products are defective. If he sells pins in boxes of 100 and guarantees that not more than 4 pins will be defective.
    (i) What is the probability that a box will fail to that guaranteed quantity?
    (ii) Compute P(x=0) and P(x≤2)

11. Show that the geometric distribution lacks memory.

12. a) Explain F distribution and give the F-test statistic. (4)
    b) The mean weekly sales of soap bars in departmental stores was 146·3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153·7 and showed a standard deviation of 17·2. Was the advertising campaign successful? (6)

SECTION D – K5 (CO4)

Answer any ONE of the following **(1 x 20 = 20)**

13. Two random variables X and Y have the following joint probability density function,

$$f(x,y) = \begin{cases} 2 - x - y, & 0 \le x, y < 1 \\ 0, & Otherwiswe \end{cases}$$

Infer the results of,
    (i) The marginal probability density function of X and Y
    (ii) Conditional density function of X and Y
    (iii) Variance of X and Y
    (iv) Covariance between X and Y

14. State and prove the Lindeberg -Levy theorem

SECTION E – K6 (CO5)

Answer any ONE of the following **(1 x 20 = 20)**

15. a). (i) Define Correlation and classify the range of Karl Pearson's Correlation Coefficient. (4)
    (ii) Find r_{XY} for the following problem (8)

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

b) Define normal distribution and state the properties of normal distribution. (8)

16. a) Derive cumulative distribution function of a single order statistics. (10)
    b) Derive the joint probability density function of second order statistics. (10)

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