PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

22MA4D3 : PROBABILITY& STATISTICS
Semester : IV

Course Code	22MA4D3	Course Delivery Method	Blended Mode
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of offering : 2023-24	Year of Revision: 2023-24	Percentage of Revision : 20%

Course Objectives : The objective of this course is to introduce the basic concepts of statistics like probability theory, distributions, correlation, regression and sampling distributions.

COURSE OUTCOME	Upon successful completion of this course, students will be able to:
CO1	Understand the basic concepts of probability and related results.
CO2	Understand various properties of expectation, variance and generating functions.
CO3	Apply binomial and poisson distributions to solve problems in Engineering and related fields.
CO4	Solve the problems using correlation and regression analysis.
CO5	Solve the statistical problems with different statistical techniques like chi-square distribution.

Mapping of Course Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**2**	**0**	**0**	**0**	**0**	**0**	**0**
CO2	**0**	**0**	**0**	**0**	**0**	**0**	**3**
CO3	**0**	**0**	**3**	**0**	**0**	**0**	**0**
CO4	**0**	**0**	**0**	**0**	**0**	**0**	**3**
CO5	**3**	**0**	**0**	**0**	**0**	**0**	**0**

Unit	Learning Units	Lecture Hours
I	**Theory of Probability-I:** Random Experiment, Sample Space & Elementary Events, Event, Axiomatic probability, Some theorems on probability, Boole's Inequality, Conditional Probability, Multiplication theorem of probability, Independent events, Multiplication theorem on probability for independent Events, Extension of Multiplication theorem of Probability to n Events, Baye's theorem. (Sections 3.8.1, 3.8.2, 3.8.5 and 3.9 to 3.14 of Chapter 3 & 4.2 of Chapter 4 of [1])	12
II	**Random Variables and Distribution functions**: Distribution Function, Discrete random variable, Continuous random variable, Two Dimensional Random variables. Mathematical expectation**,** Moments of a distribution function, Moment generating functions. [5.2 to 5.5(up to 5.5.5.) of Chapter- 5, Chapter 6 except 6.7]	12
III	**Probability Distributions:** Discrete, Binomial and Poisson distributions and their properties. [8.1 to 8.5 of Chapter 8]	12
IV	**Correlation and Regression**: Correlation, Karl pearson's coefficient of correlation, Calculation of correlation coefficient for bivariant frequency distribution, Spearman's rank correlation coefficient. **Linear regression:** Regression coefficients and their properties - Angle between two lines of regression. [10.1 to 10.5 and 10.7.1 of Chapter 10 and Chapter 11 (upto 11.2.3)]	12
V	**Sampling distribution**: Sampling and small sample tests. **Exact sampling distributions**: χ^2, t and F-distributions. [Chapter-14, Chapter 15 up to 15.6.4 and Chapter 16 up to 16.6 except 16.4]	12

Prescribed Text Book:

1. Gupta S.C.and Kapoor V.K, **Fundamentals of Mathematical Statistics**, 11th Edition, New Delhi, Sultan Chand & Sons.

Reference Book:

1. Walpole Myers, Keying Ye, **Probability and Statistics for Engineers and Scientists**, 9th edition, Pearson Publications

Course has focus on : **E**mployability / **S**kill Development

Websites of Interest:

1. www. nptel.ac.in
2. www.epgp.inflibnet.ac.in
3. www.ocw.mit.edu

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M. Sc. Mathematics
Fourth Semester
22MA4D3 - PROBABILITY & STATISTICS

Time:3 hours **Max. Marks : 70**

SECTION - A

Answer all questions. **(5x4=20)**

1 a) State and prove addition theorem of probability. (CO1, L2)

(OR)

b) If two dice are thrown what is the probability that the sum is (i) greater than 8 and (ii) neither 7 nor 11?. (CO1, L2)

2 a) A continuous random variable X has p.d.f. $f(x) = 3x^2$, where $0 \leq x \leq 1$. Find a and b such that (i) $P(X \leq a) = P(X > a)$ and (ii) $P(X > b) = 0.05$ (CO2, L2)

(OR)

b) If X is a random variable, then prove that $V(aX+b) = a^2V(X)$ (CO2, L2)

3 a) Two coins are thrown simultaneously. Find the probability of getting at least seven heads. (CO3, L2)

(OR)

b) A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality? (CO3, L2)

4 a) In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible: Variance of X = 9, Regression equations : $8X - 10Y + 66 = 0$, $40X - 18Y = 214$. Find (i) the mean values of X and Y and (ii) the correlation coefficient between X an Y. (CO4, L2)

(OR)

b) Define regression coefficients and also write the properties of regression coefficients. (CO4, L2)

5 a) Define chi-square distribution of goodness of fit. (CO5, L2)

(OR)

b) Write properties of F-distribution. (CO5, L2)

SECTION - B

Answer the following questions. All questions carry equal marks. (5X10=50)

6 (a) State and prove Baye's theorem. (CO1, L3)

(OR)

(b) In 2023, there will be three candidates for the position of principal- Mr. Chatterjee, Mr. Iyyengar and Dr. Singh, whose chances of getting appointment are in the proportion 4: 2: 3 respectively. The probability that Mr. Chatterjee if selected would introduce Co-education in the college is 0.3. The probabilities of Mr. Iyyengar and Dr. Singh doing the same are respectively 0.5 and 0.8. What is the probability that there will be co-education in the college in 2024? If there is co-education in the college in 2024, what is the probability that Dr. Singh is the principal? (CO1, L3)

7 (a) A random variable X has the following probability function: (CO2, L3)

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i)Find k (ii) Evaluate $P(X < 6)$ (iii) $P(X \geq 6)$ and (iv) $P(0 < X < 5)$

(OR)

(b) If $X_1, X_2, \ldots X_n$ are random variables, then Prove that

$$E(X_1 + X_2 + \ldots . X_n) = E(X_1) + E(X_2) + \ldots . E(X_n)$$

(CO2, L3)

8 (a) Using MGF derive mean and variance of Binomial distribution. (CO3, L4)

(OR)

(b) In a Poisson frequency distribution, frequency corresponding to 3 successes is 2/3 times frequency corresponding to 4 successes. Find the mean and standard deviation of the distribution. (CO3, L4)

9 (a) Calculate Karl-Pearson's coefficient of correlation between expenditure on advertising and sales from the data given below advertising

Expenses (000's)	39	65	62	90	82	75	25	98	36	78
Sales (Lakhs Rs.)	47	53	58	86	62	68	60	91	51	84

(CO4, L4)

(OR)

(b) Obtain the equations of two lines of regression for the following data. (CO4, L4)
Also obtain the estimate of X for Y = 70

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

10 (a) The number of scooter accidents per month in a certain town were as follows:

12 8 20 2 14 10 15 6 9 4

Are there frequencies in agreement with the belief that accident conditions were the same during this 10 month period? (CO5, L4)

(OR)

(b) In a sample of 1000 people in Maharashtra, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this State at 1% level of significance ? (CO5, L4)

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