

M. G. Science Institute, Ahmedabad

Autonomous | Affiliated to Gujarat University, Ahmedabad

(Managed by The Ahmedabad Education Society)

Department of Statistics

Bachelor of Science (Hons.) in Statistics

B.Sc. (Hons.) Statistics

4 Year, 8 Semester Full-Time Programme

Choice Based Credit System (CBCS) & Grading System

Outcome-Based Education Pattern

(Effective from Academic Year 2024-25)



Detailed Syllabus for STM121 Probability Theory & Random Variable

Semester: II	Course Title: Probability Theory & Random Variable	Credit: 4
Course No.: STM121		Hours: 4/week

Course Outcomes: On successful completion of the course the learner will be able to

CO	COGNITIVE ABILITIES	COURSE OUTCOMES
CO 1	REMEMBERING	Recall the principle of counting, describe random and non-random experiment.
CO 2	UNDERSTANDING	Explain basic concepts of probability. Create sample space for some random experiment and identify the events and their types. Understand the types of random variables.
CO 3	APPLYING	Apply the theory of probability to various real-life situations to find the probability of different types of events.
CO 4	ANALYSING	Explain definition of independence of events, concept of conditional probability, Bayes' theorem.
CO 5	EVALUATING	Justify the random variables in given situation and find the mathematical expectation and moment generating function.
CO 6	CREATING	Formulate univariate and bivariate probability distributions.

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	1		
CO 2	1	1		2	
CO 3	1	2	3		
CO 4	2	1	2	2	1
CO 5	1	1		1	
CO 6	1	1	2	3	1

Unit	Detailed Syllabus	No. of Hours of Teaching
I	Introduction to Probability Random Experiment, trial, sample point, sample space, definitions of equally likely, mutually exclusive, and exhaustive events. Definition of probability: classical, relative, and axiomatic approach and its properties.	15
II	Conditional Probability and Baye's theorem Conditional probability, multiplicative law of probability, Boole's inequality, Bonferroni's inequality, and Chebyshev's Inequality. Independence of events, law of total probability, Bayes theorem and its applications.	15
III	Random Variables: Discrete and Continuous (Univariate & Bivariate) Random Variable (rv) with its types, probability mass function (pmf), probability density function (pdf), cumulative distribution function (cdf) with illustrations.	15

	Concept of Joint Distributions, Joint probability mass function, and Joint probability density function. Marginal and conditional distributions, independence of random variables,	
IV	Mathematical Expectation and Generating Functions Mathematical expectation of Random variables, Definition, (expectation of sum/difference of random variable with properties, Expectation of a function of random variable, conditional expectation, and conditional variance. Product moments. Moment generating function (mgf), cumulant generating function (cgf), probability generating function (pgf) and their properties. Measures of location, skewness and kurtosis.	15

Suggested Reference Books:

1. Introduction to the Practice of Statistics, Moore, S. David; McCabe, P. George W. H. Freeman and Company, New York.
2. Basic Statistics, Agarwal, B. L., New Age International (P) Ltd.
3. Introduction to the theory of Statistics, Mood, A. M., Greybill, F.A., Boes, D.C., Mc Graw Hill.
4. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand and Sons, New Delhi.
5. Mathematical Statistics, P. Mukhopadhyay, New Central Book Agency (P) Ltd, Calcutta
6. An Introduction to Probability and Statistics, V. K. Rohatgi and A.K.Md. Ehsanes Saleh, Wiley Series.