

St. Xavier's College (Autonomous), Ahmedabad
Syllabus of Semester – II of the following departments under Faculty of Science
based on Under Graduate Curriculum Framework – 2023 (NEP)
to be implemented from the Academic Year 2023-24.

FACULTY OF SCIENCE

DEPARTMENT OF STATISTICS

Course	Title	Content	Hours/Week	Credit
DSC-1 (Theory)	Probability Theory – 1	U-1: Probability U-2: Random variable and mathematical expectation U-3: Generating function U-4: Function of random variables	4 hrs	4
DSC-1 (Lab)	Statistics Practical-II	Practical using manual calculation and Excel and Experimental learning	8 hrs	4

BSc. (Hons.) Statistics

DSC-1(Theory) Probability Theory-1

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course (Total - 04 Credit)			Prerequisite(s) of the Course (if any)
	Lecture	Practical	Experiential Lab	
Probability Theory-1	4	0	0	Basic Mathematics, Observation & Analytical Skills

Course Outcomes:

- CO-1 Demonstrate the skill of identifying/designing the random experiments and their sample spaces. Apply ideas of probability theory, conditional probability, Bayes' theorem in real life situations.
- CO-2 Apply the idea of random variables and their expected values to study the behavior of random phenomenon occurring in business, industry and daily life activities.
- CO-3 Demonstrate the skill of finding generating functions such as probability generating function, moment generating function, cumulant generating function and factorial moment generating functions of different probability distributions.
- CO-4 Demonstrate the skill of finding function of random variables and finding their sums, products and ratio.

Learning Outcomes: After completion of this course, the students will be able to

- (1) Distinguish between random and non-random experiments
- (2) Identify Random variable and their mathematical expectation
- (3) Calculate the probabilities of events
- (4) Enumerate Generating function and Function of Random variable

Unit: 1 Probability

(20Hrs)

- Random experiments, trials, discrete and continuous sample space
- Events and their types.
- Axiomatic approach to probability and its properties.
- Theorems on probability.
- Definitions of equally likely cases, exhaustive cases, favourable cases.
- Classical and Empirical approach to probability.
- Conditional probability and its properties, Independence of two events, Pair wise and mutual independence for three events.
- Theorem on total probability.
- Bayes' theorem and its applications.

Unit: 2 Random variable and mathematical expectation

(20Hrs)

- Random variable and its types (Discrete and Continuous).
- Probability mass function, probability density function and distribution function.
- Properties of distribution function and theorems.
- Mathematical Expectation and its basic properties.
- Theorems on Mathematical Expectation.
- Raw and Central Moments and their recurrence relation.

Unit: 3 Generating Functions

(10Hrs)

- Probability Generating Function (p.g.f.).
- Moment generating function (m.g.f.) about origin and mean.
- Cumulant Generating Function (c.g.f.).
- Factorial moment generating function.
- Properties and uses of above topics.

Unit: 4 Functions of random variables

(10Hrs)

- Introduction
- Distribution Function Technique
- Basic idea and concept of Jacobian of transformation in derivation of distribution of function of random variable.
- Use of Jacobian in transformation of random variable
- Moment -Generating Function technique.
- General form of sum, product, ratio of two independent random variables.

References:

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). “The New Statistical Analysis of Data”, Springer.
3. Freedman, D., Pisani. R and Purves. R. (2014), “Statistics”, 4th Edition, W. W. Norton & Company.
4. Gupta, S.C. (2018), “Fundamental of Statistics”, Himalaya Publishing House, 7th Edition.
5. Gupta S.C. and V.K. Kapoor (2020), “Fundamental of Mathematical Statistics”, Sultan Chand and Co. 12th Edition.
6. Goon A.M., Gupta M.K. and Dasgupta B. (2002): “Fundamentals of Statistics”, Vol. I & II, 8th Edn. The World Press, Kolkata.
7. John E. Freund’s “Mathematical Statistics with Applications”, (7th Edn.), Pearson Education, Asia.
8. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): “Introduction to the Theory of Statistics”, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Suggested Online Links/Readings:

- <https://swayam.gov.in/explorer?searchText=statistics>
- <https://nptel.ac.in/course.html>
- <https://www.edx.org/search?q=statistics>
- <https://www.coursera.org/search?query=statistics&>

Pedagogy:

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.
2. Students are encouraged to use resources available on open sources.

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **Internal:** 50 marks (will be decided by the college)
- **External:** 50 marks (will be conducted by college)

DSC-1 (Lab) Statistics Practical-II

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course (Total - 04 Credit)			Prerequisite(s) of the Course (if any)
	Lecture	Practical	Experiential Lab	
Statistics Practical-II	0	2	2	Basic Mathematics, Observation & Analytical Skills

Computing all the practical manually and using Excel

1. Practical Based on Probability
2. Practical Based on Random variable
3. Practical Based on mathematical expectations
4. Practical Based on conditional and marginal distributions
5. Practical Based on generating function

Activities: (To be conducted in a group of two students)

- (1) Preparation of questionnaire
- (2) Applications of probabilities and random variables.
- (3) Case studies
- (4) Presentation
- (5) Report writing