

Syllabus

2nd Semester

**Bachelor of Arts(Multidisciplinary)/
Bachelor of Science in Physical
Sciences**

Statistics

240/STAT/CC201

| Statistics- B.Sc. Physical Science or B.A. (Multidisciplinary)(2024-25) | | | |
|--|---|-----------|-------|
| Part A – Introduction | | | |
| Subject | Statistics | | |
| Semester | II | | |
| Name of the Course | Probability Theory | | |
| Course Code | STAT 201 | | |
| Course ID | | | |
| Course Type: (CC/ MIC/ MDC/VOC/ AEC/ VAC/SEC) | CC | | |
| Pre-requisite for the course (if any) | Mathematics as a subject at 4.0 Level (Class-XII) | | |
| Course Learning Outcomes(CLOs) | <p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Explain what probability is and how to express it numerically as a ratio, a decimal and a percentage. 2. Determine the probability of different experimental results. 3. Distinguish marginal and conditional probabilities and apply properties of expectation to various probabilistic problems. 4. Understand generating functions and its properties. | | |
| Credits | Theory | Practical | Total |
| | 3 | 1 | 4 |
| Contact Hours | 3 | 2 | 5 |
| Internal Assessment Marks | 25 | 5 | 30 |
| End Term Assessment Marks | 50 | 20 | 70 |

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|------------------|---------|---------|-----|
| Examination Time | 3 Hours | 3 Hours | 100 |
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Part B - Course Content

Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering the entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

| Unit | Topic | Contact Hours |
|------|--|---------------|
| I | Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, exclusive, equally likely and independent events; Definition of probability: classical, relative frequency, statistical and axiomatic approach: Addition and multiplication laws of probability and their extension to n events. | 12 |
| II | Boole's inequality; Bayes theorem and its applications. Random Variable and Probability Functions: Definition and properties of random variable, discrete and continuous random variable, probability mass and density functions, distribution functions. | 12 |
| III | Concepts of bivariate random variable: joint, marginal and conditional distributions. Mathematical Expectation: Definition and its properties-moments, measures of location, dispersion, skewness and kurtosis. Addition and multiplication theorem of expectation. | 12 |
| IV | Generating Functions: Moments generating function, cumulant generating function and probability generating function along with their properties. | 12 |

Practical

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|---|----|
| <p>The practical component of the course has two parts,</p> <p>(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook:</p> <ol style="list-style-type: none"> 1. Problems based on exclusive, exhaustive and independent event. 2. Problems related to addition and multiplication laws of probability 3. Problems of Bayes theorem and its applications. 4. Problem of discrete and continuous random variables. | 30 |
|---|----|



5. Problem related to joint, marginal and conditional distributions
6. Problem of skewness and kurtosis by mathematical expectation.
7. Problem related to moments generating function.
8. Problem related to cumulant generating function.

(B)The following practicals will be done using mathematical software(such as Python with libraries like NumPy, SciPy, and Matplotlib or R) and their record will be maintained in the practical note book:

1. Coin Tossing Experiment (Random Experiment, Trial, Sample Point, Sample Space)
2. Dice Rolling Experiment (Operation of Events)
3. To visualize the significance of Bayes theorem.
4. To understand fundamental concepts of random variable.
5. Understand and compute the mathematical expectation (mean) moments (first four moments), measures of location (mean, median, mode), dispersion (variance, standard deviation), skewness and kurtosis
6. Addition and multiplication theorems of expectation To find variance of combined series and coefficient of variations.
7. To compute and visualize the moment generating function (MGF) and cumulant generating function (CGF) for a given probability distribution and to derive moments and cumulants from these functions.
8. To compute and visualize the probability generating function (PGF) for a given discrete probability distribution and to derive probabilities and moments from the PGF.

Suggested Evaluation Methods

Internal Assessment:

> Theory 25

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 10
- Mid-Term Exam: 10

> Practicum 5

- Seminar/Demonstration/Viva-voce/Lab records etc.: 5

End Term Examination:

> Theory 50

- Written Examination

> Practicum 20

- Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2. Baisnab and M. Jas, Element of Probability and Statistics, Tata McGraw Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
4. P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.