

Session: 2025-26**Part A – Introduction**

Subject	Statistics		
Semester	III		
Name of the Course	Probability Distributions		
Course Code	CC-A3		
Course ID	240/STAT/CC301		
Course Type: (CC/MIC/MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: <ol style="list-style-type: none">1. Explain and illustrate the concept of distribution function.2. Understand various types of generating function and cumulants.3. Explain and illustrate the concept of a discrete probability distribution.4. Explain and illustrate the concept of a continuous probability distribution.5. Apply various probability distributions to a variety of problems.		
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
Examination Time	3 Hours	3 Hours	100
Part B - Course Content			

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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 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	Bernoulli distribution: Definition and its moments. Binominal distribution: Definition, mean, mode, mean deviation about mean, moments, moment generating function (m.g.f.), characteristic function (c.f.), probability generating function (p.g.f.), additive property, cumulants.	12
II	Poisson Distribution: Definition , median, mode, moments, m.g.f., c.f. ,p.g.f, additive property of independent poisson variate and cumulants. Negative Binominal distribution: Definition, mean,, m.g.f., p.g.f., moments and cumulants.	11
III	Discrete uniform distribution. Geometric distribution: Definition, moments, m g.f. and Lack of memory. Hypergeometric distribution: Definition, mean and variance . Continuous Uniform distribution: Definition, Moments, mean deviation, m.g.f. and c.f.	11
IV	Normal distribution: mode, median,moments, m.g.f., and c..f. , points of inflexion, mean deviation about mean, area property. Gamma distribution: m.g.f. properties of Gamma distribution, Beta distribution of first and second kind, Exponential Distribution.	11
Practical		
<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 related to Bernoulli distribution. 2. Problems related to Binomial distribution. 3. Problem related to Poisson distribution. 4. Problems related to Geometric distribution. 5. Problems related to Normal distribution. 6. Problems related to Gamma distribution. 		30

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...ing 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. To fit Bernoulli distribution to the given data.
2. To fit Binomial distribution to the given data.
3. To fit Binomial distribution to the given frequency distribution.
4. To fit Poisson distribution to the given data.
5. To fit Poisson distribution to the frequency distribution using method of ordinates.
6. To fit Geometric distribution to the given data.
7. To fit Binomial distribution to the given data.
8. Problem based on area property of Normal distribution.
9. To fit Normal distribution to the given data.

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. S. C. Gupta & V. K. Kapoor (2020). *Fundamental of Mathematical Statistics*. Sultan Chand & Sons.
2. J. E. Freund (1962) , *Mathematical Statistics (Prentice Hall)*. Inc. Engle wood Cliffs, NJ.
3. R.V. Hogg, J. W. Mckean & A. T. Craig (2013). *Introduction to Mathematical Statistics*. Pearson Education India.
4. A. M. Goon, M. K. Gupta & B. Dasgupta (1975), *Fundamentals Of Statistics, Vol -I*. World Press Private Limited.

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Semester-IV**Session: 2025-26****Part A – Introduction**

Subject	Statistics		
Semester	IV		
Name of the Course	Sampling & Design of Experiments		
Course Code	CC-A4		
Course ID	240/STAT/CC401		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	CC		
Course Learning Outcomes (CLOs)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Concepts of census, sampling and sample surveys. Simple random sampling techniques, population parameter estimations, and use of random number tables. 2. Stratified random sampling methodologies, comparing and contrasting various allocation strategies. 3. Systematic random sampling, assessing its strengths, weaknesses, and distinguishing it from simple random sampling. 4. Fixed, random, and mixed effect models, perform ANOVA on one-way and two-way data, and test main effects and find expectations of sum of squares. 5. Experiment terminologies, concepts like blocks and replication, and design efficiency. They will grasp the need for experimental design and principles. 		
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

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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 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	<p>Sample Survey: Concepts of census and sample survey, basic concepts in sampling. Sampling and Non sampling errors. Principal steps involved in a sample survey; limitation of sampling.</p> <p>Some basic Sampling methods: Simple Random Sampling (SRS) with and without replacement. Use of random number tables, determination of sample size, estimation of mean and its variance in case of simple random sampling. Estimators of proportions and ratios.</p>	12
II	<p>Stratified random sampling: Concept and importance of Stratified random sampling, estimation of population mean and its variance in the stratified random sampling. allocation of sample size, proportional allocation, optimum allocation.</p> <p>systematic random sampling: Principle of systematic random sampling, estimation of mean and its variance, comparison of Systematic random sampling with Simple random sampling,</p>	11
III	<p>Analysis of variance (ANOVA): Definition, assumptions of ANOVA test, one-way and two-way classifications for fixed effect model with one observation per cell.</p> <p>Introduction to Design of Experiments: Definitions of experiment, treatment, experimental unit and experimental error; need for design of experiments; concepts of blocks, replication, efficiency of a design and precision; significance of factors like size and shape of plots and blocks;</p>	12
IV	<p>Completely Randomized Design (CRD) and Randomized Block Design (RBD): Layout, applications and statistical analysis of CRD and RBD for one observation per cell, least square estimates of</p>	10

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effects, expectation of sum of squares, critical differences, advantages and disadvantages of CRD and RBD, efficiency of RBD relative to CRD.

Practical

The practical component of the course has two parts

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(A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook.

1. Draw a random sample of size 5 from Normal Population with given mean and variance.
2. Determine which sampling method (with or without replacement) would result in a more efficient estimate of the population mean, given a fixed sample size and variability.
3. Estimates population mean and its variance using data obtained through stratified random sampling, employing proportional and Neyman allocation methods.
4. Estimates population mean and its variance using systematic random sampling and compare them with results from simple random sampling.
5. Draw a random sample from Chi square distribution with given degree of freedom.
6. Analyze the data using completely randomized design.
7. Analyze the data using randomized block design.
8. Determine the critical difference between means of any 30 two treatments/blocks in randomized block design.
9. Obtain the efficiency of RBD relative to CRD.

(B) The following practical 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. Write a Python program to draw a random sample of size 5 from a normal distribution with a given mean and variance.
2. To write a Python function to compare sampling with and without replacement in terms of the efficiency of estimating the population mean for a fixed sample size and variability.
3. To write a Python program to estimate the population mean and its variance using stratified random sampling with proportional and Neyman allocation methods.
4. To write a Python program to estimate the population mean and its variance using systematic random sampling and compare the results with simple random sampling.
5. To write a Python program to draw a random sample from a Chi-square distribution with a given degree of freedom.
6. To write a Python program to analyse experimental data using a Completely Randomized Design (CRD).

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7. To write a Python program to analyse experimental data using a Randomized Block Design (RBD).
8. To write a Python program to determine the critical difference between means of any two treatments or blocks in a Randomized Block Design and to compute the efficiency of RBD relative to CRD.

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. S.C. Gupta & V.K. Kapoor (2014), *Fundamentals of Applied Statistics*. Sultan Chand & Sons.
2. D. Singh & F.S. Chaudhry (2020), *Sampling Techniques*. New age International.
3. W.G. Cochran (2007), *Sampling Techniques*. Wiley Publishers.
4. D. Raj & P. Chandhok (1998), *Sampling Theory*. Narosa Publishing House
5. D.C. Montgomery (2004), *Design and Analysis of Experiment*. Wiley Publishers.



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Session: 2025-26

Part A – Introduction

Subject	Mathematics		
Semester	III		
Name of the Course	Statistical tools for data analysis		
Course Code	MDC-3		
Course ID			
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	MDC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: <ol style="list-style-type: none">1. Get introduction to Statistics, data types, collection, classification, and presentation methods.2. Have knowledge of Measures of Central Tendency and Dispersion: Mean, median, mode, quartiles, standard deviation.3. Understand Linear Regression and Correlation: Principles of least squares, regression lines, correlation coefficient.4. Know about types of sampling techniques and Testing of Hypothesis.		
	Theory	Practical	Total
Credits	2	1	3
Contact Hours	2	2	4

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Internal Assessment Marks	15	5	20
End Term Assessment Marks	35	20	55
Examination Time	2 Hours	2 Hours	75

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 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	Introduction of Statistics, Basic knowledge of various types of data, Collection, classification, and tabulation of data. Presentation of data: histograms, frequency polygon, frequency curve and ogives.	8
II	Measures of Central Tendency: Mean, median, mode, partition values. Measures of Dispersion: Absolute and relative measures of range, quartile deviation, mean deviation, standard deviation, coefficient of variation.	8
III	Correlation for Bivariate Data: Concept and types of correlation, Karl Pearson Coefficient of correlation and rank correlation coefficient. Linear Regression: Concept of regression, principle of least squares and fitting of straight line, properties of regression coefficients, standard error of estimate obtained from regression line, Angle between two lines of regression. Difference between correlation and regression.	7
IV	Sample population, characteristics of good sample. Types of sampling techniques, Sampling Errors, Testing of Hypothesis-Meaning, Type -I and Type-II Errors, Level of significance,	7

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Definition of Chi-Square statistic test, Definitions of t-test and F-test.

Practical

The practical component of the course has one part of Problem Solving: Questions related to the practical problems based on the following topics will be worked out and record will be maintained in the Practical Notebook:

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1. Problems based on sub divided and multiple bar chart.
2. Problems based on Histogram and frequency polygon for the given data.
3. Problems based on ogives.
4. Problems based on Mean, Median and Mode.
5. Problems based on the quartile deviation and mean deviation. standard deviation, variance and coefficient of variation.
6. Problems based on standard deviation, variance and coefficient of variation.
7. Problems related to mean deviation about mean and its coefficient of dispersion based on mean deviation for the data.
8. Problems to find Karl Pearson Coefficient of correlation.
9. Problems to find the rank correlation coefficient.
10. Problems related to find the equation of the lines of regression.
11. Problems based on regression coefficients and standard error of estimate.
12. Problems related to fitting a straight line using the principle of least square for the given data.
13. Problems related to sampling techniques and sampling errors.
14. Problems based on testing of Hypothesis.
15. Problems based on Chi-Square statistic test.

Suggested Evaluation Methods

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<p>Internal Assessment:</p> <p>➤ Theory 15</p> <ul style="list-style-type: none"> ● Class Participation: 4 ● Seminar/presentation/assignment/quiz/class test etc.: 4 ● Mid-Term Exam: 7 <p>➤ Practicum 5</p> <ul style="list-style-type: none"> ● Seminar/Demonstration/Viva-voce/Lab records etc.: 5 	<p>End Term Examination:</p> <p>➤ Theory 35</p> <ul style="list-style-type: none"> ● Written Examination <p>➤ Practicum 20</p> <ul style="list-style-type: none"> ● Lab record, viva-voce, write up and execution of the program
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Part C-Learning Resources

Recommended Books:

1. A. M. Goon, M. K. Gupta & B. D. Gupta (1968), *Fundamentals of Statistics Vol-I*. Calcutta Statistical Association Bulletin
2. S. C. Gupta & V. K. Kapoor (2002), *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons.
3. S. Bernstein & R. Bernstein (1999), *Elements of Statistics II*, Schaum's outline series.
4. I. Miller & M. Miller (2014). *John E. Freund's Mathematical Statistics with Applications (Vol. 6)*. Upper Saddle River, NJ: Prentice Hall.
5. S. M. Ross (2014). *Introduction to Probability Models (11th edition)*. Elsevier.
6. R. V. Hogg, J. W. McKean & A. T. Craig (2013), *Introduction to Mathematical Statistics (7th Edition)*. Pearson Education India.
7. S. David (2003). *Elementary Probability (2nd Edition)*. Cambridge University Press.
8. J. Pitman (1993). *Probability*. Springer-Verlag.



Session: 2025-26

Part A – Introduction

Subject	Mathematics		
Semester	III		
Name of the Course	Statistical Methods		
Course Code	MIC-3		
Course ID			
Course Type: (CC/MIC/ MDC/ VOC/AEC/VA C/SEC)	MIC		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: <ol style="list-style-type: none">1. Identify and explain the uses of statistics in various fields like economics, business, health, and social sciences.2. Understand the concept of frequency and non-frequency data.3. Organize and present grouped data using diagrams and graphs.4. Understand and calculate root mean square deviation and distinguish between population and sample standard deviation.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6
Internal Assessment Marks	15	15	30
End Term Assessment Marks	35	35	70

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