



Syllabus

For B.Sc 4th Semester Courses in Statistics
(June 2018 onwards)

- **Contents:**

Theory Syllabus for Courses:

- SSTA0401- Probability and Sampling Distributions (B)
- SSTA0402– Analysis of variance & Design of Experiment
- SSTA0403 – Industrial Statistics

- Practical Course Syllabus for: SSTA04PR
- Evaluation and Assessment guidelines.

S.Y. B.Sc. Statistics

Course: SSTA0401

Title: Probability & Sampling distributions (B)

Course Objectives:

1. To understand the patterns in the data of large populations.
2. To obtain the central location and dispersion of the data.
3. To know the relationship between various distributions.

Number of lectures: 45

Course Outcomes:

On completion of the course the learner should be able to:

1. Understand properties and uses of various continuous distributions (Rectangular, Exponential, Laplace, Gamma and Beta)
2. Calculate transformation of continuous (1D and 2D) random variables using Jacobian.
3. Comprehend properties and uses of other continuous distributions (Chi-Square, t, F distribution).

Unit 1

(15 L)

Transformation of random variables & Standard Univariate Continuous Probability Distributions.

One-dimensional and two-dimensional continuous random variables.

Jacobian of Transformation, Simple illustrations related to standard distributions

Rectangular and Exponential distributions, Laplace distribution, Gamma distribution (with single and double parameter). Beta distribution (Type I and Type II)

The following aspects to be discussed wherever applicable to the above stated distributions:

Mode, Median, Derivation of M.g.f., C.g.f., Moments, Skewness and Kurtosis. Additive property. Limiting distribution (without proof)

Unit 2

(15 L)

Chi-Square Distribution:

Definition, its M.G.F., C.G.F, Moments, Mode, Derivation of distribution of Sum of Squares of standard normal variates, Additive property. Distributions of Sample Mean, Sample Variance and their independence for a sample drawn from Normal population. Asymptotic Property (without proof)

Applications of Chi-Square Distribution:

Test of significance for specified variance of Normal population.

Test for independence of attributes (2x2 and r x c contingency tables without derivation of the test statistic), Yate's correction. Test for Goodness of Fit.

Unit 3

t-distribution :

(15L)

Definition of Student's t-statistic. Derivation of its density function. Moments. Asymptotic property (without proof).

Applications of t-distribution:

Tests of significance for:

- i) Single population mean.
- ii) Difference between two population means
 - a) with equal variances based on independent samples.
 - b) based on paired observations.

F-distribution:

Definition., Derivation of density function Derivation of distribution of reciprocal of F-variate. Moments, mode. Test for equality for two variances of two normal populations. Relationship between F, Chi-Square and t-distributions.

List of Recommended Reference books

1. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor: 8th edition, Sultan Chand & Sons.
2. Outline of Statistical Theory – Volume I, A.M. Goon, M. K. Gupta, B. Dasgupta: 3rd edition, The World Press Pvt Ltd.
3. Introduction to Theory of Statistics, Mood, Graybill and Boes: 3rd edition, Mc Graw-Hill Publishers.
4. Introduction to Mathematical Statistics, R. V. Hogg & A. T. Craig: 4th edition, Collier Mc Millan Publishers.
5. Probability and Statistical Inference, R. V. Hogg & E. A. Tanis: 3rd edition, Mc Millan Publishing Co.
6. Mathematical Statistics, John E. Freund: 5th edition, Prentice-Hall of India Pvt Ltd.

Topics for Practicals

1. Rectangular and Exponential distribution.
2. Chi-Square Distribution.
3. t-Distribution.
4. F-Distribution

Evaluation (Theory):

Total marks per course - 100.

CIA- 40 marks

CIA 1: Written test -20 marks

CIA 2: Written test -20 marks

End Semester Examination – 60 marks

One question from each unit for 20 marks, with internal choice.

Total marks per question with choice – 25 to 30

Evaluation of SSTA04PR (0401)

Total marks - 50.

Group Project – 15 marks

Journal – 5 marks.

End Semester Practical Examination – 30 marks.

Grid Template - End Semester Examination (Theory)

Q. No	Knowledge (Definitions, Descriptive Notes, Theoretical Proofs)	Understanding & Application (Illustration/Numerical Problems)	Marks
1.	15	05	20
2.	15	05	20
3.	15	05	20
Total	45	15	60
Weightage (%)	75%	25%	100%

S.Y. B.Sc. Statistics

Course: SSTA0402

Title: Analysis of Variance & Design of Experiments

Course Objectives:

1. To introduce and apply the techniques and methodology available for designing and analysis of experiments.
2. To emphasize the need for sound and unambiguous interpretation of experimentation.

Number of lectures: 45

Course Outcomes:

On completion of the course the learner should be able to:

1. Understand analysis of variance (one-way and two-way).
2. Comprehend the principles of design of experiments, and how they are incorporated into various basic designs, namely, Completely Randomised design (CRD), Randomised Block design (RBD) and Latin Square design (LSD).
3. Derive proofs of theorems pertaining to properties of estimators used in the above-mentioned designs.
4. Handling the above designs in case of missing observations.
5. Know the construction and procedure of factorial experiments (22 and 23)

- Unit 1. Analysis of Variance (Fixed effect models): **(15 lectures)**
One-way classification (With equal and unequal observations per class)
Mathematical model and its assumptions. Estimation of parameters by Least Squares Method. Expectation and variance of the estimators. Expectation of various sums of squares, ANOVA table
Multiple comparisons of treatments
(i) Least Significant difference test. (ii) Tukey's test. (iii) Dunnet's test.
Two-way classification (with one observation per cell)
Mathematical model and its assumptions. Estimation of parameters by Least Squares Method. Expectation and variance of the estimators. Expectation of various sums of squares. ANOVA table
- Unit 2. Design of Experiments: **(15 lectures)**
Experiment, experimental unit, treatment, replicate, block, experimental error and precision.
Principles of design of experiment: Replication, Randomization and Local Control.
Choice of size, shape of plots and block in different agriculture and non-agriculture experiments.
- Completely randomized design. (CRD) & Randomized block design (RBD).
Mathematical model and its assumptions. Expectation of various sums of squares Estimation of parameters by Least Squares Method. ANOVA table
Standard errors of treatment differences.
Efficiency of RBD over CRD.
Missing plot technique for one observation in RBD.
- Unit 3. Latin square design (LSD) **(15 lectures)**
Mathematical model and its assumptions. Expectation of various sums of squares Estimation of parameters by Least Squares Method. Standard errors of treatment differences, ANOVA table.
Efficiency of CRD over RBD.
Missing plot technique for one observation in LSD.
Symmetrical Factorial Experiments:
Purpose and advantages.
 2^2 , 2^3 experiments. Calculation of main and interactions effects.
Yates method.
Analysis of 2^2 , 2^3 experiments
Concepts of Confounding in 2^3 experiments.

List of Recommended Reference books:

1. Fundamentals of Applied Statistics: S.C. Gupta and V.K. Kapoor, 3rd edition, Sultan Chand & Sons.
2. Designs and Analysis of Experiments: M. N. Das and N.C. Giri 2nd edition, Wiley Eastern Ltd.
3. Designs and Analysis of Experiments : D.C. Montgomery, 6th edition, Wiley Eastern Ltd.
4. Applied Multivariate Analysis and Experimental Designs: N. Krishnan Namboodiri, Lewis F. Carter. Hubert M. Blalock. JR., 1st edition, McGraw –Hill, Inc.
5. Experimental Designs: William G. Cochran, Gertrude M. Cox, 2nd edition, Bombay, Asia Publishing House.
6. The Design of Experiments: Sir Ronald A. Fisher, 9th edition, Collier Macmillan Publishers.

Topics for Practicals

1. One Way ANOVA / CRD.
2. Two Way ANOVA / RBD.
3. LSD.
4. Missing Plot Technique.
5. Factorial Experiment.

Evaluation (Theory):

Total marks per course - 100.

CIA- 40 marks

CIA 1: Written test -20 marks

CIA 2: Written test -20 marks

End Semester Examination – 60 marks

One question from each unit for 20 marks, with internal choice.

Total marks per question with choice – 25 to 30

Evaluation of SSTA04PR (0402)

Total marks - 50.

Group Project – 15 marks

Journal – 5 marks.

End Semester Practical Examination – 30 marks.

Grid Template - End Semester Examination (Theory)

Q. No	Knowledge (Definitions, Descriptive Notes, Theoretical Proofs)	Understanding & Application (Illustration/Numerical Problems)	Marks
1.	15	05	20
2.	15	05	20
3.	15	05	20
Total	45	15	60
Weightage (%)	75%	25%	100%

S.Y. B.Sc. Statistics
Title: Industrial Statistics

Course: SSTA0403

Course Objectives:

1. To learn the applications of operations research in industry.
2. To plan and schedule projects.
3. To study quality control methods in industry.

Number of lectures: 45

Course Outcomes:

On completion of the course the learner should be able to:

1. Understand key aspects of statistical quality control (chance/assignable causes, process/product control, 3σ limits, process capability).
2. Draw up and interpret various control charts (\bar{X} and R, p, c, np).
3. Know different aspects of 'acceptance sampling plans' by attributes (single and double sampling plans).
4. Be introduced to the concept of 6σ .
5. Know simple Project Management techniques (PERT and CPM).

Unit 1.

Statistical Quality Control

(15L)

Introduction, Assignable causes, Chance causes, Process control, Product control, Shewhart's control charts, 3σ Limits.

X and R, p, c, np charts, their uses, p-chart with variable sample size, Problems involving setting up standards for future use. Process capability.

Unit 2

Acceptance Sampling

(15L)

Introduction to Lot Acceptance Sampling Plans by Attributes. Consumers Risk, Producers Risk. Single and Double Sampling Plans : OC function and OC curves, AQL, LTPD, ASN, ATI, AOQ. Concept of 6σ limits.

Unit 3.

CPM and PERT:

(15L)

Introduction, Basic concepts of network analysis

Definitions : Activity, Event, Dummy activity, Predecessor and successor activities and events. Rules for drawing network, Fulkerson's Rule.

Bar Diagram (Gantt Chart) and Network Diagram. Slack time and Float times. Critical path Method (CPM), Project evaluation review technique (PERT).

Project cost analysis, Updating, Resource Leveling, Resource Allocation

List of Recommended Reference books:

1. Statistical Quality Control: E. L. Grant., 2nd edition, McGraw-Hill Publishers.
2. Quality Control and Industrial Statistics: Duncan D.B. , 3rd edition, Taraporwala Sons & Co.
3. PERT and CPM Principles and Applications: Srinath, 2nd edition, East West Press Pvt Ltd.
4. Operations Research: Kantiswaroop, P.K. Gupta and Manmohan, 4th edition, Sultan Chand & Sons.
5. Operations Research: S. D. Sharma, 11th edition, Kedarnath, Ramnath & Co.
6. Operations Research: H.A. Taha, 6th edition, Prentice Hall of India.
7. Operations Research: V.K. Kapoor, 7th edition, Sultan Chand & Sons.

Topics for Practicals:

1. Statistical Quality Control.
2. Acceptance Sampling.
3. Network Analysis.

Evaluation (Theory):

Total marks per course - 100.

CIA- 40 marks

CIA 1: Written test -20 marks

CIA 2: Written test -20 marks

End Semester Examination – 60 marks

One question from each unit for 20 marks, with internal choice.

Total marks per question with choice – 25 to 30

Evaluation of SSTA04PR (0403)

Total marks - 50.

Group Project – 15 marks

Journal – 5 marks.

End Semester Practical Examination – 30 marks.

Grid Template - End Semester Examination (Theory)

Q. No	Knowledge (Definitions, Descriptive Notes, Theoretical Proofs)	Understanding & Application (Illustration/Numerical Problems)	Marks
1.	15	05	20
2.	15	05	20
3.	15	05	20
Total	45	15	60
Weightage (%)	75%	25%	100%