



St. Xavier's College – Autonomous Mumbai

S.Y.B.Sc Syllabus For 4th Semester Courses in STATISTICS (June 2015 onwards)

Contents:

Theory Syllabus for Courses:

- S.STA.4.01 - Probability and Sampling Distributions (B)
- S.STA.4.02 – Analysis of variance & Design of Experiment
- S.STA.4.03 – Industrial Statistics

Practical Course Syllabus for: S.STA.4.PR

S.Y.B.Sc
(STATISTICS)

SEMESTER 4

COURSE : S.STA.4.01

PROBABILITY & SAMPLING DISTRIBUTIONS (B) [45 LECTURES]

LEARNING OBJECTIVE :

- 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.**

Unit 1

Transformation of random variables.

(15 L)

One-dimensional and two-dimensional continuous random variables. Jacobian of Transformation, Simple illustrations related to standard distributions

Normal Distribution: Definition. Derivation of its M.G.F., C.G.F., Mean, Median, Mode, S.D., M.D. Recurrence Relationship for moments. Distribution of linear function of Normal variables. Fitting of Normal Distribution. Central Limit Theorem with proof for i.i.d.r.v.s. Log Normal Distribution : Determination of Mean and Variance and its properties

Unit 2

Chi-Square Distribution:

(15 L)

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 Practicals

1. Normal Distribution.
2. Chi-Square Distribution.
3. t-Distribution.
4. F-Distribution.

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.

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SEMESTER 4

COURSE : S.STA.4.02.

Analysis of Variance & Design of Experiments

[45 LECTURES]

LEARNING OBJECTIVES :

- 4) **To introduce and apply the techniques and methodology available for designing and analysis of experiments.**
- 5) **To emphasize the need for sound and unambiguous interpretation of experimentation.**

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-only mention when/where used.

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 relative to 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 LSD over RBD/ CRD.

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.

Topics for Practicals

- One Way ANOVA / CRD.
- Two Way ANOVA / RBD.
- LSD..
- Missing Plot Technique.
- Factorial Experiment.

References

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.

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SEMESTER 4

COURSE : S.STA.4.03

INDUSTRIAL STATISTICS.

[45 LECTURES]

LEARNING OBJECTIVES :

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

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

Topics for Practicals.

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

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.