



Syllabus

For B.A. 5th Semester Courses in Statistics
(June 2019 onwards)

Contents:

- Theory Syllabus for Courses:
 - ASTA0501 – Probability & Sampling Distributions (A)
 - ASTA0502 – Sampling Techniques
 - ASTA0503 – Applied Statistics (A)

- Practical Course Syllabus for: ASTA05PR

- Evaluation and Assessment guidelines.

T.Y. B.A.

Course: ASTA0501

Title: Probability & Sampling Distributions (A)

Course Objectives:

- 1) To understand the patterns in the data of large populations.
- 2) To obtain data summarizing methods.
- 3) To know the relationship between various distributions.

Course Outcomes (COs):

- 1) Students are aware of the concept and derivation of important statistical functions of variables namely moment generating function, cumulant generating function, joint probability mass functions, marginal densities, conditional distributions (expectation and variance)
- 2) Students are knowledgeable of the Properties and Uses of various discrete distributions (Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial)
- 3) Students are knowledgeable of the Properties and Uses of Normal Distribution

Unit 1

(15 L)

Univariate and Bivariate random variables (Discrete and Continuous)

Probability generating functions, Moment Generating Function, Cumulant generating Function. Their properties. Relationship between moments and cumulants and their uses.
Discrete joint probability mass function, Continuous joint probability density function.
Marginal densities, covariance, correlation coefficient.
Independence of random variables.
Conditional Distribution, conditional expectation and conditional variance.

Unit 2

(15 L)

Standard Univariate Discrete Probability Distributions:

Uniform Distribution, Bernoulli's Distribution, Binomial Distribution, Poisson Distribution Geometric Distribution, Negative Binomial Distribution:

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

Mode, Median, Derivation of m.g.f., c.g.f., Moments, Additive property, Recurrence Relationship for central moments. Skewness and Kurtosis.

Limiting distribution (without proof)

Truncated Binomial and Truncated Poisson distributions.: p.m.f. Mean and variance.

(With simple illustrations)

Unit 3

Normal Distribution

(15 L)

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

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. Distribution of random variables : M.g.f, C.g.f.
2. Bivariate Probability Distribution and Joint m.g.f.
3. Binomial Distribution
4. Poisson Distribution
5. Geometric and Negative Binomial distribution.
6. Normal 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 ASTA05PR (0501)

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 (Definition, 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%

T.Y. B.A.

Course: ASTA0502

Title: Sampling Techniques

Course Objectives:

- 1) To understand various sampling techniques.
- 2) To apply these techniques in real life situations.
- 3) Comparison of sampling techniques.

Number of lectures: 45

Course Outcomes (COs):

1. Students are knowledgeable about various sampling methods available to estimate parameters of the population.
2. Students are able to prove (by derivation) the various properties of the estimators in each sampling scheme.
3. Students are able to compare estimators of a population parameter with a view to select an appropriate one.

Unit 1: Simple Random Sampling (with and without replacement)

(15 L)

SRS for Variables:

Estimation of population Mean and Total. Expectation and Variance of these Estimators. Unbiased estimators of the variance of these estimators

SRS for Attributes:

Estimation of Population proportion and Variance of these estimators.

Estimation of sample size based on desired accuracy, in case of variables and attributes.

Confidence interval for Population Mean and Proportion.

Unit 2

(20L)

Ratio and Regression Estimators under SRSWOR:

Ratio estimators for population mean, ratio and total. Expectation and M.S.E. of Estimators.

Unbiased Estimators of M.S.E.

Regression estimation of population mean and total.

Expectation. Variance and Minimum variance.

Comparison of ratio estimator, regression estimator and mean per unit estimator

Stratified Random Sampling:

Concepts of Stratified population and stratified sample.

Estimation of population mean and Total based on stratified sample. Expectation and variance of estimator of population mean and Total assuming SRSWOR within strata. Unbiased estimator of the variances of these estimators.

Proportional allocation, Optimum allocation with and without varying costs. Comparison of simple random sampling and stratified random sampling with proportional and optimum allocations (Neyman. Allocation)

Unit 3

(10L)

Systematic Random Sampling.

Sampling procedure. Estimation of population mean and total.

(Assuming $N = nk$)

Expectation and variance of estimators.

Expression for variance in terms of (i) S^2 and S^2_{WSY} (ii) intra class correlation coefficient.

List Of Recommended Reference Books

1. Sampling Techniques: W.G. Cochran, 3rd edition, Wiley Eastern Ltd.
2. Sampling Theory and Methods: M.N.Murthy, 1st edition, Statistical Publishing Society.
3. Sampling Theory: Des Raj, 1st edition, McGraw-Hill Publishing Co.
4. Sampling Theory of Surveys with Applications: P.V.Sukhatme and B.V.Sukhatme, 3rd edition, Iowa State University Press.
5. Fundamentals of Applied Statistics: S.C.Gupta and V.K.Kapoor, 3rd edition, Sultan Chand & Sons.

Topics for Practicals.

1. SRS for variables.
2. SRS for attributes.
3. Estimation of samples size in case of SRS.
4. Confidence Limits in case of SRS.
5. Stratified random sampling.
6. Ratio and Regression methods of estimations.
7. Systematic sampling.

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 ASTA05PR (0502)

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 (Definition, 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%

T.Y.B.A STATISTICS
Title: Applied Statistics (A)

Course: ASTA0503

Course Objectives:

To apply Statistics to the Insurance industry.

Number of lectures: 45

Course Outcomes (COs):

- 1) Students are aware of the concept of Vital Statistics.
- 2) Students are able to read life tables and calculate the various life table functions.
- 3) Students are able to understand and calculate several quantities pertaining to the field of Actuarial Science (Compound Interest & Annuities Certain, Life Annuities, Assurance Benefits)

Unit 1 (15L)

Concepts of Vital Statistics & Mortality Tables:

Vital Statistics:

Crude death rate, Age specific death rate & Standardized death rate.

Crude birth rate, General fertility rate, Age specific fertility rate & Total fertility rate. Gross & Net Reproduction rates.

Mortality Table:

Various mortality functions. Probabilities of living and dying. The force of mortality. Estimation of μ_x from the mortality table.

Mortality table as a population model. Stationary population.
Expectation of life and Average life at death. Central death rate.

Unit 2.

(15L)

Compound Interest and Annuities Certain:

Accumulated value and present value, nominal and effective rates of interest. Discount and discounted value, Varying rates of interest. Equation of value. Equated time of payment.
Present and accumulated values of annuity certain, perpetuity (immediate and due) with and without deferment period.

Present and accumulated values of

- i) increasing annuity
- ii) increasing annuity when successive installments form
 - a) arithmetic progression
 - b) geometric progression.

Redemption of Loan.

Unit 3.

(15L)

Assurance Benefits:

Present value in terms of commutation functions of Life annuities and Temporary life annuities (immediate and due) with and without deferment period. Present values of variable and increasing life annuities (immediate and due)

Present value of assurance benefits in terms of commutation functions of i) pure endowment assurance ii) temporary assurance iii) endowment assurance iv) whole life assurance v) double endowment assurance vi) increasing temporary assurance vii) increasing whole life assurance viii) special endowment assurance ix) deferred temporary assurance x) deferred whole life assurance.

Net premiums and Level annual premiums for the various assurance plans.

Natural and Office premiums.

List Of Recommended Reference Books

- 1) Neill A.: Life Contingencies, First edition, Heineman educational books London
- 2) Dixit S.P., Modi C.S., Joshi R.V.: Mathematical Basis of Life Assurance, First edition Insurance Institute of India
- 3) Gupta S. C. & Kapoor V. K.: Fundamentals of Applied Statistics, Fourth edition, Sultan Chand & Sons.

TOPICS FOR PRACTICALS

- 1. Mortality tables & Vital Statistics
- 2. Annuities
- 3. Life annuities
- 4. Assurance benefits

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 ASTA05PR (0502)

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 (Definition, Descriptive Notes, Theoretical Proofs)	Understanding & Application (Illustration/Numerical Problems)	Marks
1.	15	05	20
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