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B.Sc I YEAR: STATISTICS SYLLABUS

I SEMISTER

PAPER – I Descriptive Statistics

w.e.f. 2020-2021

UNIT-I

Introduction to Statistics: Importance of Statistics. Scope of Statistics in different fields. Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Ogives, Pie. Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean. Median and Mode throughgraph.

UNIT-II

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance. Central and Non-Central moments and their interrelationship. Sheppard's correction for moments. Skewness and kurtosis.

UNIT-III

Curve fitting: Bi- variate data, Principle of least squares, fitting of degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, Fitting of power curve and exponentialcurves.

Correlation: Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Bi-variate frequency distribution, correlation coefficient for bi-variate data and simple problems. Concept of multiple and partial correlation coefficients (three variables only) and properties

UNIT-IV

Regression : Concept of Regression, Linear Regression: Regression lines, Regression coefficients and it's properties, Regressions lines for bi-variate data and simple problems. Correlation vs regression.

Attributes: Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingencytable: Square contingency**,** Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

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B.Sc I YEAR: STATISTICS

PRACTICAL SYLLABUS

I SEMISTER

PAPER – I Descriptive Statistics

w.e.f. 2020-2021

1. Graphical presentation of data (Histogram, frequencypolygon,Ogives).
2. Diagrammatic presentation of data (BarandPie).
3. Computation of measures of central tendency(Mean, MedianandMode)
4. Computation of measures of dispersion(Q.D, M.DandS.D)
5. Computation of non-central, central moments, β_1 and β_2 for ungroupeddata.
6. Computation of non-central, central moments, β_1 and β_2 and Sheppard's corrections forgroupeddata.
7. Computation of Karl Pearson's coefficients of Skewness and Bowley's coefficientsofSkewness.
8. Fitting of straight line by the method ofleastsquares
9. Fitting of parabola by the method ofleastsquares
10. Fitting of power curve of the type by the method ofleastsquares.
11. Fitting of exponential curve of the type and by the method ofleastsquares.
12. Computation of correlation coefficient and regression lines forungroupeddata
13. Computation of correlation coefficient, forming regression lines forgroupeddata
14. Computation of Yule's coefficientofassociation
15. Computation of Pearson's, Tcherprows coefficient ofcontingency

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B.Sc I YEAR: STATISTICS SYLLABUS

II SEMISTER

PAPER – I PROBABILITY AND PROBABILITY DISTRIBUTIONS

w.e.f. 2020-2021

UNIT I:

IntroductiontoProbability: BasicConceptsofProbability,randomexperiments,trial,outcome, samplespace, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events, Addition and multiplication theorems of probability for 2 and for n events.Boole's inequality and Baye's theorem and its applications in real lifeproblems.

UNIT II:

Random variable: Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function. Probability density function, Distribution function and its properties. For given pmf, pdf calculation of moments, coefficient of skewness and kurtosis. Bivariate random variable - meaning, joint, marginal and conditional Distributions, independence of random variables and simple problems.

Mathematical expectation : Mathematical expectation of a random variable and function of a random variable. Moments and covariance using mathematical expectation with examples. Addition and Multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F and their properties. Chebyshev and Cauchy - Schwartz inequalities.

UNITIII:

Discrete Distributions: Binomial, Poisson, Negative Binomial, Geometric distributions: Definitions, means, variances, M.G.F, C.F, C.G.F, P.G.F, additive property if exists. Possion approximation to Binomial distribution. Hyper-geometric distribution: Defination, mean and variance.

UNIT I V:

Continuous Distributions: Rectangular, Exponential, Gamma, Beta Distributions: mean , variance, M.G.F, C.G.F, C.F. Normal Distribution: Definition, Importance, Properties, M.G.F, CF, additive property.

B.Sc I YEAR: STATISTICS SYLLABUS

II SEMISTER

PAPER – I PROBABILITY AND PROBABILITY DISTRIBUTIONS

w.e.f. 2020-2021

Practicals

List of Experiments:

1. Fitting of Binomial distribution –Directmethod.
2. Fitting of binomial distribution – RecurrencerelationMethod.
3. Fitting of Poisson distribution –Directmethod.
4. Fitting of Poisson distribution - RecurrencerelationMethod.
5. Fitting of NegativeBinomialdistribution.
6. Fitting ofGeometricdistribution.
7. Fitting of Normal distribution –Areasmethod.
8. Fitting of Normal distribution –Ordinatesmethod.
9. Fitting ofExponentialdistribution.

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II B.Sc. STATISTICS SYLLABUS

SEMESTER – III,

Subject : STATISTICS

Paper III: STATISTICAL INFERENCE

(w.e.f.2020-2021)

UNITI:

Concepts: Population, Sample, Parameter, statistic, Sampling distribution, Standard error. convergence in probability and convergence in distribution, law of large numbers, central limit theorem (statements only). Student's t- distribution, F – Distribution, x^2-Distribution: Definitions, properties and their applications.

UNITII:

Theory of estimation: Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, &sufficiency and. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's. Binomial, Poisson &Normal Population parameters estimate by MLE method. Confidence Intervals.

Additional Input: Crammer's Rao inequality.

UNITIII:

Testing of Hypothesis: Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Neyman- Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

UNITIV:

Large sample Tests: large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. standard deviation(s) and correlation coefficient(s).

Small Sample tests: t-testforsinglemean,differenceofmeansandpairedt-test.χ2-testforgoodness of fitand independence of attributes. F-test for equality of variances.

UNITV:

Non-parametric tests- their advantages and disadvantages, comparison with parametric tests. Measurement scale- nominal, ordinal, interval and ratio. One sample runs test, sign test and Wilcoxon- signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon – Mann-Whitney U test, Wald Wolfowitz's runs test.

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II B.Sc. STATISTICS PRACTICAL SYLLABUS

SEMESTER – III,

Subject : STATISTICS

Paper III: STATISTICAL INFERENCE

(w.e.f.2020-2021)

List of Experiments:

1. Large sample test for differenceofmeans
2. Large sample test forsingleproportion
3. Large sample test for differenceofproportions
4. Large sample test for difference ofstandarddeviations
5. Large sample test forcorrelationcoefficient
6. Small sample test forsinglemean
7. Small sample test for differenceofmeans
8. Small sample test forcorrelationcoefficient
9. Pairedt-test(pairedsamples).
10. Small sample test for single variance(x 2 -test)
11. Small sample test for differenceofvariances(F-test)
12. x 2 - test for goodness of fit and independenceofattributes
13. Nonparametric tests for single sample(run test, sign test and Wilcoxon signedranktest)
14. Nonparametric tests for related samples (sign test and Wilcoxon signedranktest)
15. Nonparametric tests for two independent samples (Median test, Wilcoxon –Mann- Whitney - U test,Wald - Wolfowitz' srunstest)

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II B.Sc. STATISTICS SYLLABUS

SEMESTER – IV,

Subject : STATISTICS

Paper IV: SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS

(w.e.f.2020-2021)

UNIT I:

Simple Random Sampling (with and without replacement): Notations and terminology, various probabilities of selection. Random numbers tables and its uses. Methods of selecting simple random sample, lottery method, method based on random numbers. Estimates of population total, mean and their variances and standarderrors,determinationofsamplesize,simplerandomsamplingofattributes.

Additional Input: Sampling Theory , Principles of Sample survey, Sampling and non sampling errors, types of sampling.

UNIT II:

Stratified random sampling: Stratified random sampling, Advantages and Disadvantages of Stratified Random sampling, Estimation of population mean, and its variance. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.

Systematic sampling: Systematic sampling definition when N = nk and merits and demerits of systematic sampling - estimate of mean and its variance. Comparison of systematic sampling with Stratified and SRSWOR.

UNIT III:

Analysis of variance : Analysis of variance(ANOVA) –Definition and assumptions. One-way with equal and unequal classification, Two wayclassification.

Design of Experiments: Definition, Principles of design of experiments, CRD: Layout, advantages and disadvantage and Statistical analysis of Completely Randomized Design(C.R.D).

UNIT IV:

Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) with their layouts and Analysis,

MissingplottechniqueinRBDandLSD.EfficiencyRBDoverCRD,EfficiencyofLSDoverRBDand CRD.

Factorial experiments – Main effects and interaction effects of 2^2 and 2^3 factorial experiments and theirStatistical analysis. Yates procedure to find factorial effect totals.

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II B.Sc.

SEMESTER – IV,

Subject : STATISTICS

Paper IV: SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS

PRACTICAL SYLLABUS

(w.e.f.2020-2021)

List ofExperiments:

SamplingTechniques:

Estimation of population mean and its variance by

1. Simple random sampling with and without replacement. Comparison between SRSWRand SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison betweenproportional and optimum allocationswith SRSWOR.
3. Systematic sampling with N=nk. Comparison of systematic sampling with Stratified andSRSWOR.

Design of Experiments:

4. ANOVA - one - way classification with equal and unequal numberofobservations
5. ANOVA Two-way classification with equal numberofobservations.
6. Analysis ofCRD.
7. Analysis of RBD Comparison of relative efficiency of CRDwithRBD
8. Estimation of single missing observation in RBD anditsanalysis
9. Analysis of LSD and efficiency of LSD over CRDandRBD
10. Estimation of single missing observation in LSD anditsanalysis
11. Analysis of 2^2 with RBDlayout
12. Analysis of 2^3 withRBDlayout

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II B.Sc. STATISTICS SYLLABUS

SEMESTER – IV,

Subject : STATISTICS

Paper V: APPLIED STATISTICS

(w.e.f.2020-2021)

UNIT I:

Time Series: Time Series and its components with illustrations, additive, multiplicativemodels. Trend: Estimation of trend by free hand curve method, method of semi averages.Determination of trend by least squares (Linear trend, parabolic trend only), moving averages method.

UNIT II:

Seasonal Component: Determination of seasonal indices by simple averages method, ratio to moving average, Ratio to trend and Link relative methods, Depersonalization.

UNIT III:

Growth curves: Modified exponential curve, Logistic curve and Grompertz curve, fitting of growth curves by the method of three selected points and partial sums.Detrending. Effect of elimination of trend on other components of the time series

UNIT IV:

Index numbers: Concept, construction, problems involved in the construction of index numbers, uses and limitations. Simple and weighted index numbers. Laspayer's, Paasche's and Fisher's index numbers, Criterion of a good index number, Fisher's ideal index numbers. Cost of living index number and wholesale price indexnumber.

UNIT V:

Vital Statistics: Introduction, definition and uses of vital statistics, sources of vital statistics. easures of different Mortality and Fertility rates, Measurement of population growth. Life tables: construction and uses of lifetables.

Additional Input: Official Statistics – Functions and organization of CSO & NSSO.

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II B.Sc. STATISTICS PRACTICAL SYLLABUS

SEMESTER – IV,

Subject : STATISTICS

Paper V: APPLIED STATISTICS

(w.e.f.2020-2021)

List of Experiments:

Time Series:

1. Measurement of trend by method of moving averages(odd andevenperiod)
2. Measurement of trend by method of Least squares(linearandparabola)
3. Determination of seasonal indices by methodsimpleaverages
4. Determination of seasonal indices by method of Ratio tomovingaverages
5. Determination of seasonal indices by method ofRatio totrend
6. DeterminationofseasonalindicesbymethodofLinkrelatives

Index Numbers:

7. Computation of simpleindexnumbers.
8. Computation of all weighted indexnumbers.
9. Computation ofreversaltests.

Vital Statistics:

10. Computation of variousMortalityrates
11. Computation of variousFertilityrates
12. Computation of variousReproductionrates.
13. Construction ofLifeTables

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III B.Sc., (MSCs)

V - SEMESTER

Subject- STATISTICS

SYLLABUS

Paper –VI : OperationsResearch-I

UNIT-I:

Introduction of OR – Origin and developmentof OR – Nature and features of OR – Scientific Method in OR – Modelingin OR – Advantages and limitations of Models-General Solution methods of OR models – Applications of Operation Research. Linear programming problem (LPP) - Mathematical formulationof the problem - illustrations on Mathematical formulation of Linear programming of problem. Graphical solution of linear programming problems. Some exceptional cases - Alternative solutions, Unbounded solutions, non-existing feasible solutions by Graphical method.

UNITII:

General linear programming Problem (GLP) – Definitionand Matrix form of GLP problem, Slack variable, Surplus variable, unrestricted Variable, Standard form of LPP and Canonical form of LPP. Definitions of Solution, Basic Solution, Degenerate Solution, Basic feasible Solution and OptimumBasic Feasible Solution. Introduction to Simplex method and Computational procedure of simplex algorithm. Solving LPP by Simplex method (Maximization case and Minimization case)

UNITIII:

Artificial variable technique - Big-M method and Two-phase simplex method, Degeneracy in LPP and method to resolve degeneracy. Alternative solution, Unbounded solution, Non existing feasible solution and Solution of simultaneous equations by Simplex method.

UNITIV:

Duality in Linear Programming –Concept of duality - Definition of Primal and Dual Problems, General rules for converting any primal into its Dual, Economic interpretation of duality, Relation between the solution of Primal and Dual problem (statements only). Using duality to solve primal problem.Dual Simplex Method.

PostOptimalAnalysis-ChangesincostVector**C**,ChangesintheRequirementVector**b**and changes in the Coefficient Matrix **A**.Structural Changes in a LPP.)

Additional topics: Integer programming problem – concept – applications of integer programming Concept of Non linear programming problem.

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III B.Sc., (MSCs)

V - SEMESTER

Subject- STATISTICS

PRACTICAL SYLLABUS

Paper –VI : OperationsResearch-I

Practical/LabtobeperformedonacomputerusingOR/Statisticalpackages

1. TosolveLinearProgrammingProblemusingGraphicalMethodwith
   - (i) Unbounded solution
   - (ii) Infeasiblesolution
   - (iii) Alternativeormultiple solutions.
2. SolutionofLPP withsimplexmethod.
3. ProblemsolvingusingCharnes-Mmethod.
4. ProblemsolvingusingTwoPhasemethod.
5. IllustrationoffollowingspecialcasesinLPPusingSimplexmethod
   - (i) Unrestrictedvariables
   - (ii) Unbounded solution
   - (iii) Infeasiblesolution
   - (iv) Alternativeormultiplesolutions.
6. ProblemsbasedonPrincipleof Duality.
7. ProblemsbasedonDualsimplexmethod.
8. Problems based on post optimality analysis

Practical'sSkillsOutcomes:

Onsuccessful completionofthispracticalcourse, studentshallbeableto:

1. SolveLPPusingGraphicalmethod
2. SolvetheLPPusingSimplexmethod,BigMmethodandTwoPhasemethod
3. Solvetheproblemsusingprincipleofduality
4. SolvetheProblemsusingDualSimplexmethod
5. SolvetheproblemsforPostOptimal Analysis

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III B.Sc., (MSCs)

V - SEMESTER

Subject- STATISTICS

SYLLABUS

Paper –VII : OperationsResearch-II

Objective:Toenrichtheknowledgeofstudentswithadvancedtechniquesoflinear programming problem along with real life applications.

UNITI:

Transportation Problem - Introduction, Mathematical formulation of Transportation problem.Initial Basic feasiblesolutionof Transportationproblem -North-West cornerrule, Lowest costentrymethod, Vogel's approximation method.Method of finding optimal solution-MODI method(U-V method). Degeneracy in transportation problem, Resolution of degeneracy, Unbalanced transportation problem. Maximization TP.Transhipment Problem.

Additional Input : stepping stone method.

UNITII:

Assignment Problem - Introduction, Mathematical formulation of Assignment problem, Reduction theorem (statement only), Hungarian Method for solving Assignment problem, Unbalanced Assignment problem.The Traveling salesman problem, Formulation of Traveling salesman problem as an Assignment problem and Solution procedure.

UNITIII:

Sequencing problem: Introduction and assumptions of sequencing problem, Sequencing of n jobs and one machine problem.Johnson's algorithm for n jobs and two machines problem- problems withn- jobson two machines,algorithm for n jobs on three machines problem- problems with n- jobs onthree machines, algorithm for n jobs on m machines problem, problems with n-jobs on m-machines.

UNITIV:

Network Scheduling: Basic Components of a network, nodes and arcs, events and activities–RulesofNetworkconstruction–Timecalculationsinnetworks-CriticalPathMethod(CPM)and PERT.

Additional Input : Time cost optimization method.

UNITV:

Game Theory: Two- person zero-sum games. Pure and Mixed strategies. Maxmin and Minimax Principles - Saddle point and its existence. Games without Saddle point-Mixed strategies. Solution of 2 x 2 rectangular games. Graphical method of solving 2 x n and m x 2 games. Dominance Property.

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III B.Sc., (MSCs)

V - SEMESTER

Subject- STATISTICS

PRACTICAL SYLLABUS

Paper –VII : OperationsResearch-II

Practical/LabtobeperformedonacomputerusingOR/ Statisticalpackages

1. IBFSoftransportationproblembyusingNorth-Westcornerrule,Matrix minimum method and VAM
2. Optimumsolutiontobalancedandunbalancedtransportationproblemsby MODImethod(both maximizationandminimizationcases)
3. Solution of Assignment problem using Hungarian method (both maximization and minimization cases),
4. Solutionofsequencingproblem—processingofn jobsthroughtwo machines
5. Solutionofsequencingproblem -processingofnjobsthrough three machines
6. ToperformProjectschedulingofagivenproject(Deterministiccase-CPM).
7. ToperformProjectschedulingofagivenproject(Probabilisticcase-PERT).
8. Graphicalmethodofsolvingfor mx2and 2xngames.
9. Solutionofmxn gamesbydominance rule.
10. Linearprogrammingmethodforsolvingmxngames.