

Approved Syllabus of B.A./B.Sc. (CBCS) Statistics Syllabus in BOS Statistics
Mahatma Gandhi University, Nalgonda



B.A./B.SC. (CBCS) (STATISTICS) SYLLABUS
(With Mathematics Combination only)
With effect from the Academic Year: 2025-26 Onwards

Year	Sem	Paper code	Theory/ Practical	Paper Title	Cred its	Work Load (Hours/ Week)	Total Marks
I	I	BS-101-T	Paper-I	Basic Statistics And Probability	4	4	100
		BS-101-P	Practical -I	Basic Statistical Analysis Lab using Excel & R	1	2	25
	II	BS-202-T	Paper-II	Probability Distributions	4	4	100
		BS-202-P	Practical -II	Probability Distributions Lab using Excel & R	1	2	25
II	III	BS-303-T	Paper-III	Statistical Inference	4	4	100
		BS-303-P	Practical-III	Statistical Inference lab using Excel & R	1	2	25
	IV	BS-404-T	Paper-IV	Analysis of Correlation, Regression and Basic Experimental Designs	4	4	100
		BS-404-P	Practical-IV	Analysis of Correlation, Regression and Basic Experimental Designs Lab	1	2	25
	V	BS-505-T	Paper-V	Sampling Theory & Operation Research	4	4	100
		BS-505-P	Practical-5	Sampling Theory & Operation Research Lab	1	2	25
III	V	BS-501-SEC	SEC-1	Skill Enhancement Course -1 (University Specified)	2	2	50
		BS-502-SEC	SEC-2	Skill Enhancement Course -1 (Subject Specified: Data Collection, Presentation and Interpretation)	2	2	50
	VI	BS-501-MDC	MDC	Statistical Analysis	4	4	100
		BS-505-VAC	VAC	Value Added Course-1	3	3	75
	VI	BS-606-T	Paper-VI	Industrial Statistics	4	4	100
		BS-606-P	Paper-VI	Industrial Statistics	1	2	25
	VI	BS-603-SEC	SEC-3	Skill Enhancement Course -2 (University Specified)	2	2	50
		BS-604-SEC	SEC-4	Skill Enhancement Course -2 (Subject Specified: Data Scaling Techniques and Report Writing)	2	2	50
	VI	BS-602-VAC	VAC	Value Added Course-2	3	3	75
		BS-601	Internship	Data Analysis Project	4	8	100

Note: No of credits = No of theory hours for teaching + twice the no. of credits for practical teaching

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Approved Syllabus of B.A./B.Sc. (CBCS) Statistics Syllabus in BOS Statistics

1. Skill Enhancement Courses (SEC) are offered for Statistics students in Sem-V & VI with continuation offered for who are willing improve the practical skills in conducting of election forecasts / exit poll surveys.
2. Multi-disciplinary course and Value-added courses are offered in Final year.
3. Optional paper course is offered if statistics students are willing to opt.

B.SC. FIRST YEAR I-SEMESTER SYLLABUS

BS-101T: PAPER-I (Theory): BASIC STATISTICS AND PROBABILITY

[4 HPW :: 4 Credits :: 100 Marks (External:80 & Internal:20)]

Course Objectives:

1. Able to compute and analyse the data sets (with different measurement of scales of variables in data sets: nominal, ordinal, interval, Ratio scales) based descriptive statistics like, Central tendencies, Dispersions, Moments, Skewness and Kurtosis.
2. Able to familiar in to prepare the Basic descriptive statistical report using descriptives.
3. Strong foundations on the computation of the probability for the events and usage of addition, multiplication and Bayes theorems for probability computation, where ever the situation occurs.
4. Understanding the concept of one and two-dimensional random variable(s), probability mass / density distribution functions and their properties and transformation of one two dimensional random variables.
5. Understanding the procedure of evaluation Central and Non-central Moments for the random variables and also its evaluation from various generating functions.

UNIT-I

Basic Statistics: Definitions, Measures, Properties and Importance of Central tendencies, Dispersions, Absolute and Relative measures of dispersions, Central and Non-central moments, Skewness and kurtosis and their inter-relationships and computations to the raw & grouped data and data sets, Usage in the domains of image analysis, pattern recognitions, Preparation of descriptive statistical analysis report based on the above descriptive statistics.

UNIT-II

Probability: Basic concepts used for defining probability, Mathematical, Statistical and Axiomatic definitions of probability, their merits and demerits, Marginal, Joint and Conditional probabilities and independence of events, Multiplication & Addition theorems for 'n' events, Boole's inequality and Bayes' theorem, Problems on computation of Probability and including the usage of theorems.

UNIT-III

Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass, density and distribution functions with their properties and simple problems and illustrations, Notion of bivariate random variable, bivariate distribution, statements of its properties, Joint, marginal and conditional distributions, Independence of random variables, Transformation of one and two-dimensional random variable(s), simple problems on transformation of the random variable(s).

UNIT-IV

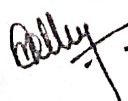
Mathematical Expectation: Mathematical expectation of a random variable, function of a random variable, Computation of raw and central moments, covariance using mathematical expectation with examples, Addition and multiplication theorems of expectation, Generating function, Definitions of moment generating function (MGF), cumulant generating function (CGF), probability generating function (PGF) and characteristic function (Ch.F), their basic properties, applications and computation of those for simple probability functions, Moment inequalities: Chebyshev's and Cauchy-Schwartz's inequalities and their applications.

Course Outcome:

1. Able to analyse the data sets by choosing appropriate statistical technique either manually or using Excel & R and preparing basic statistical report.
2. Able to compute the probability using counting methods / appropriate probability theorems.
3. Able to evaluate the distribution function from probability mass / density functions and vice-versa and also evaluation of probability function for the transformations of random variables.
4. Able to evaluate the Moments, MGF, CGF PGF and ChF for the random variables and evaluation Moments from the generating functions (MGF, CGF and ChF).
5. Able to identify the real time applications in various domains like Finance, business, insurance, clinical, medical, health, bio sciences, engineering and technology etc.

List of Reference Books:

1. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Sanjay Arora and Bansilal: New Mathematical Statistics, Satya Prakashan, New Delhi.
3. William Feller: Introduction to Probability theory and its applications. (Vol-I), Wiley.
4. S.P. Gupta: Statistical Methods, S Chand, New Delhi.



B.SC. FIRST YEAR I-SEMESTER SYLLABUS

BS-101-P: PAPER-I (Lab):

BASIC STATISTICAL ANALYSIS USING EXCEL & R

(2 HPW:: 1 Credit :: 25 Marks)

Basics of EXCEL: Excel- Data entry, editing and saving, establishing and copying formulae, creation of filters, sorting data, creation of databases usage of mathematical, statistical built in functions in excel, copy and paste and exporting to MS word document. Writing formulas for computation, drawing diagrams.

Basics of R-programming: Installation of R & R-studio, data importing / exporting. Basic Mathematical and statistical functions, writing simple programs and libraries/ usage packages.

1. Data Visualization Techniques (Histogram, Frequency curves & Polygon, Ogive curves, Bar (Simple, Component, Multiple, Percentage Bars) and Pie (Simple & multiple)
2. Computation of Central Tendencies, Dispersions, Moments (non-central and central).
3. Computation of coefficients of Skewness and Kurtosis.
4. Preparation of Statistical Analysis Report based on the descriptive statistics.

Note:

1. Each student has to spend minimum 15 weeks x 2 hours per week = 30 hours to practice on the system with the required software is mandatory.
2. Practice also be done on data sets available in web sources: www.kaggle.com, <https://cse.cmu.edu/~jimmy/datasets/>, <https://data.world/datasets/link>, <https://archive.ics.uci.edu>, (Few selected data sets are: Fishers Iris data set, heart failure clinical records, cancer, Mental Health Dataset, Indian Food Dataset, water-quality-1, etc.)
3. Establishing formulae in Excel cells and deriving the results and also usage existing Excel statistical functions in Excel.
4. Able to write an R-program for evaluation and also usage of libraries/ packages in R
5. Maintaining the Practical records is mandatory and without records candidates are not allowed to attend practical examination.
6. Answer any two out of four choosing at least one from each section of Excel and R having two questions in each.

B.SC. FIRST YEAR II-SEMESTER SYLLABUS
BS-202-T: PAPER-II (Theory): PROBABILITY DISTRIBUTIONS
[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal: 20)]

Course Objectives:

1. Able to choose / identify an appropriate standard probability distribution to fit the data.
2. Able to know and derive the properties of standard probability distributions (discrete and continuous) and knowing perfectly on the usage of each probability distribution in different domains.
3. Able to understand the concept of sampling distributions
4. Able to understand the exact sampling distributions, their properties and applications.

UNIT-I

Discrete distributions: Discrete *Uniform* and *Bernoulli* distributions: definitions, mean, variance and simple examples. *Binomial*, *Poisson*, *Negative-Binomial* and *Geometric* distributions: Physical conditions, derivation of probability mass functions, central and moments up to fourth order, median, mode, M.G.F, C.G.F., P.G.F., Ch. F, nature of the curve and, reproductive property (wherever exists) special properties if any and real-life applications in various domains and probability problems related to these distributions. Poisson approximation to Binomial distribution, Poisson approximation to Negative binomial distribution.

UNIT-II

Hyper-geometric distribution: definition, real life applications, derivation of probability function, mean, variance. Binomial approximation to Hyper-geometric distribution.

Continuous distributions: *Rectangular* and *Normal* distributions - definition, properties such as M.G.F, C.G.F., Ch. F, and moments up to fourth order, reproductive property, wherever exists and their real-life applications. Normal distribution as a limiting case of Binomial and Poisson distributions.

UNIT-III

Exponential, single and two parameter *Gamma* distributions: Definition, Moments up to fourth order, M.G.F, C.G.F., Ch. F., reproductive property (wherever exists), nature of the curves and their real-life applications special properties (if any) and problems. *Beta* distribution of two kinds: Definitions, mean and variance, nature of the curve, special properties (if any) & applications. *Cauchy* distribution: Definition, nature of the curve, derivation of density, Ch. f. and its special properties and its statistical significance.

UNIT-IV

Exact Sampling Distributions: Concepts of Population, Parameter, sample, Statistic, Sampling distribution and Standard error. Standard errors for various statistics. Exact sampling distributions: χ^2 , t and F Definitions, curves and properties of distributions and their interrelationships. Independence of sample mean and variance in random sampling from normal distributions.

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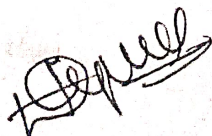
Approved Syllabus of B.A./B.Sc. (CBCS) Statistics Syllabus in BOS Statistics

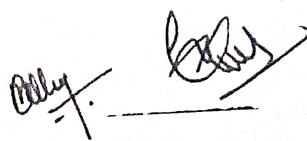
Course Outcome:

1. Able to evaluate the probability analyse the data sets by choosing appropriate statistical tool and preparing basic statistical report.
2. Able to compute the probability using counting methods / appropriate probability theorems.
3. Able to evaluate the distribution function from probability mass / density functions and vice-versa and also evaluation of probability function for the transformations of random variables.
4. Able to evaluate the Moments, MGF, CGF PGF and Ch. F. for any probability function.
5. Able to identify the real time applications for each distribution in various domains like Finance, business, insurance, clinical, medical, health, bio sciences, engineering and technology etc.

List of reference books:

1. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Sanjay Arora and Bansilal: New Mathematical Statistics, Satya Prakashan, New Delhi.
3. William Feller: Introduction to Probability theory and its applications. (Vol-I), Wiley.
4. Goon A M, Gupta M K, Das Gupta B: Fundamentals of Statistics. (Vol-I), The World Press (Pvt) Ltd., Kolkata.





B.SC. FIRST YEAR II-SEMESTER SYLLABUS

BS-202-P: PAPER-II (Lab):

PROBABILITY DISTRIBUTIONS USING MS-EXCEL & R

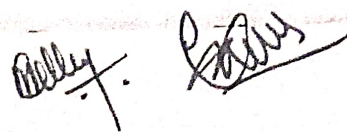
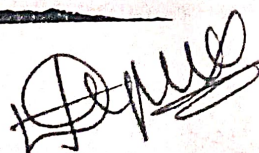
(2 HPW :: 1 Credit :: 25 Marks)

Topics to be covered:

1. Fitting of Binomial distribution (Direct & Recurrence relation Methods).
2. Fitting of Poisson distribution (Direct & Recurrence relation Methods).
3. Fitting of Negative Binomial (Direct & Recurrence relation Methods).
4. Fitting of Geometric distribution.
5. Fitting of Normal distribution (Areas & Ordinates method)
6. Fitting of Exponential distribution.
7. Fitting of Cauchy distribution.
8. Generation of random samples from Uniform (0,1) and Uniform (a, b) distributions.
9. Generation of random samples from Binomial, Poisson, Negative Binomial Distributions.
10. Generation of random samples from Normal and Exponential Distributions.

Note:

1. Each student has to spend minimum 15 weeks X 2 hours per week = 30 hours to practice on the system with the required software is mandatory.
2. Establishing formulae in Excel cells and deriving the results and also usage existing Excel statistical functions in Excel.
3. Writing R-program for evaluation and usage of libraries in R
4. Maintaining the Practical records is mandatory and without records candidates are not allowed to attend practical examination.
5. Answer any two out of four choosing at least one from each section of Excel and R having two questions in each.



B.SC. SECOND YEAR, III-SEMESTER SYLLABUS
BS-303-T: PAPER-III (Theory): STATISTICAL INFERENCE
(4 HPW:: 4 Credits :: 100 Marks: (External:80 & Internal:20))

Course Objectives:

1. Able to evaluate and familiar to estimate the parameter (if exists) for the any standard probability distribution(s) using methods of maximum likelihood and method of moments, and estimation of parameters using method of least squares.
2. Able to examine the estimator satisfies the criteria of good estimation (Consistency, unbiasedness, sufficiency) for standard distributions.
3. Able to evaluate and familiar the confidence interval estimates for the parameter using pivot method.
4. Framing statistical hypothesis and knowing the statistical test procedure.
5. Identifying the suitable large / small sample parametric / non parametric tests among the basic statistical tests.

UNIT –I

Point and Interval Estimation: Review on Sampling distributions; exponential family of distributions Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of a good estimator, Consistency (Definition, necessary conditions, problems); Unbiasedness (Definition, Median modal unbiasedness necessary conditions, problems);

UNIT –II

Sufficiency: Definition, properties, Statement of Neyman's Factorization theorem, one parameter exponential family, computation of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Methods of Estimation: Method of Moments and Method of Maximum likelihood estimation (MLE); their properties and computation for standard probability distributions (if exists), statements of asymptotic properties of MLE, Method of least squares, Concept of interval estimation, Confidence intervals of the parameters of normal population by Pivot method.

UNIT –III

Testing of Hypothesis: Concepts of statistical hypotheses, Statement and Proof of Neyman-Pearson's fundamental lemma for Randomized tests, Examples in case of Binomial, Poisson, Exponential and Normal distributions and their power of the test functions. **Large sample tests:** Tests for single sample mean, difference of means, single sample proportion, difference of proportions and difference of standard deviations. Order statistics: Definition, statements of their distributions and applications.

UNIT – IV

Small sample Tests: Tests for single sample mean, variance, difference of means (independent and related samples), equality of variances, Test for goodness of fit and independence of attributes.

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Non-parametric tests: Advantages and disadvantages, comparison with parametric tests. Use of Central Limit Theorem for normal approximations. Single sample Sign test and Runs test, Wilcoxon-signed rank test (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Woffowitz's runs test.

Course Outcome:

1. Familiar to estimate the parameter (if exists) for the any standard probability distribution(s) using methods of maximum likelihood and method of moments, and estimation of parameters using method of least squares.
2. Examine the estimator satisfies the criteria of good estimation (Consistency, unbiasedness, sufficiency) for standard distributions.
3. Evaluate and familiar the confidence interval estimates for the parameter using pivot method.
4. Framing statistical hypothesis and knowing the statistical test procedure.
5. Identifying the suitable large/small sample parametric/non-parametric tests among the basic statistical tests.

List of Reference Books:

1. V.K. Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
2. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd.,
3. V.K.Rohatgi: An introduction to probability and statistics. Wiley series.
4. Sanjay Arora and Bansilal: New Mathematical Statistics Satya Prakashan , New Delhi
5. Siegal, S., and Sidney: Non-parametric statistics for Behavioral Science. McGraw Hill.
6. Hogg, Tanis, Rao. Probability and Statistical Inference, 7th edition. Pearson Publication.



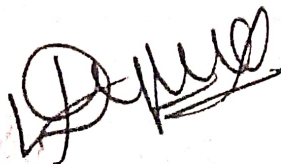
B.SC. SECOND YEAR, III-SEMESTER SYLLABUS
BS-33-P: PAPER – III (Lab):
STATISTICAL INFERENCE LAB USING EXCEL AND R
(2 HPW:: 1 Credit :: 25 Marks)

Topics to be covered:

1. Large sample tests for mean(s), proportion(s), Standard deviation(s).
2. Small sample tests for single sample mean and difference of means (related & independent).
3. Small sample test for single sample variance and equality of variances.
4. Test for goodness of fit and independence of attributes.
5. Nonparametric tests for two independent samples (Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test)

Note:

1. Practice can also be done on data sets available in web sources: www.kaggle.com, <https://data.world/datasets/link>, <https://archive.ics.uci.edu>, (Few selected data sets are: Fishers Iris data set, heart failure clinical records, cancer, Mental Health Dataset, Indian Food Dataset, water-quality-1, etc.)
2. Establishing formulae in Excel cells and deriving the results and also usage existing Excel statistical functions in Excel.
3. Writing R-program for evaluation and usage of libraries in R.
4. Maintaining the Practical records is mandatory.
5. Answer any two out of four choosing at least one each section of Excel and R having two questions in each.



B.SC. II YEAR, IV-SEMESTER SYLLABUS
BS-44T: PAPER-IV(Theory):
ANALYSIS OF CORRELATION, REGRESSION AND
DESIGN OF EXPERIMENTS

Course Objectives:

1. Able to understand and conducting experiment for the given task i.e. designing an experiment and carrying out its analysis.
2. Identifying the suitable complete block experimental design for the given data.
3. Identifying and carryout the complete analysis for the simple & multiple linear regression for the given data set.
4. Identifying the suitable measure of association / correlation for the given data set.

UNIT-I

Correlation Analysis: Concept of Correlation Different Correlation Measures: Scatters diagram, Karl Pearsons coefficient (raw & grouped data), Spearman's Rank Correlation, Correlation ratio, Concepts of Partial and Multiple correlation coefficients (only for three variables), Analysis of categorical data, their independence, Association and partial association of attributes, Various measures of association: (Yule's) for two-way data and coefficient of contingency (Pearson and Teherprow) and coefficient of colligation.

UNIT-II

Regression Analysis: Simple linear regression, Principle of least squares for estimation of Regression coefficients (linear, quadratic and power curves), properties of regression coefficients, Simple linear Regression Analysis and extending to Multiple linear Regression Analysis including Estimation of parameters and Computation of R^2 , Adjusted R^2 , MSE, lack of fit of the model, testing significance of regression coefficient(s).

Fisher's Z-transformation for population correlation coefficient(s) and testing the same in case of one sample and two samples

UNIT-III

Analysis of Variance: Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, Concept of Analysis of Variance (ANOVA), statistical models analysis for single factor and two factor (with one / m-observations per cell), Expectation of various sums of squares, Statistical analysis, Importance and applications of design of experiments, Concept of Critical difference, Post-hoc tests (DMR & LSD).

UNIT-IV

Design and Analysis of Experiments: Definition, Principles of experimental designs, Statistical planning for the experimentation Statistical linear models, estimation of parameters and Analysis of Completely

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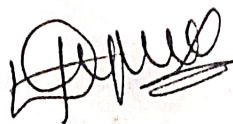
Randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D). Expectation of various sum of squares, Comparison of the efficiencies of above designs, Estimation one missing observation in RBD & LSD and their analysis

Course Outcomes:

1. Able to designing an experiment for the given task and carrying out its analysis.
2. Able to identify the suitable complete block experimental design and carrying out its analysis for the given data.
3. Able to identify the suitable model and carryout the complete analysis for the simple & multiple linear regression for the given data set.
4. Able to identify and compute the suitable measure of association / correlation for the given data set

List of Reference Books:

1. V.K. Kapoor and S.C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi
2. V.K. Kapoor and S.C. Gupta: Applied Statistics, Sultan Chand & Sons, New Delhi
3. Sanjay Arora and Bansilal: New Mathematical Statistics Satya Prakashan, New Delhi.



B.SC. II YEAR, IV-SEMESTER SYLLABUS

BS-44T: PAPER-IV(Lab):

ANALYSIS OF DESIGN OF EXPERIMENTS, CORRELATION & REGRESSION MODELS USING R

(2 HPW:: 1-Credit : 25 Marks)

Topics to be covered:

1. Analysis of single, two factor models and two factor model with m- per cell and computation of Critical Difference, post-hoc tests (DMR& LSD)
2. Analysis of CRD, RBD and LSD and computing the efficiencies one over other (RBD over CRD, LSD over RBD& CRD)
3. Estimation of missing observation in RBD & LSD and their Analysis .
4. Analysis of LSD with one missing observation and computation of Critical Difference.
5. Drawing of Scatter diagram
6. Computation of Karl Pearsons, Spearman's correlations for grouped & ungrouped data sets
7. Computation of correlation ratio.
8. Computation of multiple and partial correlation coefficients.
9. Fitting of simple Linear and Quadratic Regression models.
10. Fitting of log-linear regression models ($y = a x^b$, $y = a b^x$ & $y = a e^{bx}$)
11. Analysis of Simple linear Regression model.
12. Analysis of Multiple linear regression model
13. Computation of Yule's coefficient of association.
14. Computation of Pearson's, Tcherprows coefficient of contingency.

Note:

1. Practice on the following tests should be on small and large data sets available in www.kaggle.com.
2. Writing R-program for evaluation and usage of libraries in R.
3. Maintaining the Practical records is mandatory.
4. Answer any two out of four questions.

B.SC. III YEAR, V-SEMESTER SYLLABUS
BS-55-T: PAPER-V (Theory):
SAMPLING THEORY & OPERATIONS RESEARCH
(4 HPW :: 4 Credits :: 100 Marks: (External:80 & Internal:20))

UNIT - I

Sample Surveys: Concepts of population, sample, sampling unit, sample frame and standard error. Principal steps in sample surveys, need for sampling, census versus sample surveys, Primary and Secondary data, Formation of Questionnaire, Pilot surveys, sampling and non-sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling, Probability & non-probability sampling methods

Simple Random Sampling: Definition, merits, and demerits, Methods of drawing random samples under with and without replacements, Estimates of population mean, total, proportion, their variances using Simple Random Sampling With and Without Replacements, Comparison of efficiencies.

UNIT-II

Stratified and Systematic Samplings: Definition, merits, and demerits, estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods, (i) Stratified Random Sampling with Proportional and Neyman allocation, and (ii) Systematic Sampling when N is known, Comparison of relative efficiencies.

UNIT-III

Operations Research: Meaning and scope of OR, Convex sets and their properties, General linear Programming Problem (LPP), Formulation of LPP, Statements of Fundamental theorem of LPP and other related theorems, Optimal Solution of LPP by graphical, Simplex and Charner's & two-phase methods, Concept of duality of LPP, Dual Primal relationship, Statement of Fundamental Theorem of Duality, Concept of degeneracy and resolving it.

Unit -IV

Definition of transportation problem, TPP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum method and VAM, Optimal solution through MODI method for balanced and unbalanced transportation problem, Description of Assignment problem, Assignment problem as special case of TP and LPP, Unbalanced assignment problem, optimal solution using Hungarian method and traveling salesman problem and its solution, Problem of Sequencing, Optimal sequence of N jobs on two and three machines without passing.

Reference Books:

1. V.K.Kapoor and S.C.Gupta: Applied Statistics, Sultan Chand & Sons, New Delhi
2. Kanti Swaroop, P.K.Gupta and ManMohan: Operations Research, Sultan Chand.
3. S.D. Sharma: Operations Research
4. I.K. Sharma: Operations Research Theory and Applications, Macmillan Publishers India Ltd
5. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs, Wiley Eastern.

B.SC. THIRD YEAR, V-SEMESTER SYLLABUS

BS-55-P: PAPER-V (LAB):

SAMPLING THEORY & OPERATIONS RESEARCH USING R & TORA

1. Estimation of Population mean, population total and variance of these estimates by Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR
3. Systematic sampling with $N = nk$. Comparison of Systematic sampling with Stratified and SRSWOR
4. Measurement of trend by method of least squares and moving averages.
5. Solution of L.P. problem by simplex method and reading the solution of the dual problem from Optimal Simplex table.
6. Solution of L.P. problem by Big-M Method.
7. Two-phase simplex method.
8. IBFS for a transportation problem by North-West corner rule, Matrix minimum method and Vogel's approximation method and also Optimum solution to balanced and unbalanced transportation problem by MODI method.
9. Optimum solution to balanced and unbalanced Assignment problem by Hungarian method and also Solution of traveling salesman problem.
10. Computation of Optimal Sequence and idle time for N jobs on 2 and 3 machines.

B.SC. III-YEAR, VI-SEMESTER SYLLABUS

BS-66-T: PAPER-VI (Theory): INDUSTRIAL STATISTICS

(SQC, INDEX NUMBERS, OFFICIAL STATISTICS, TIME SERIES ANALYSIS, VITAL STATISTICS)
(4 HPW:: 4 Credits :: 100 Marks: (External:80 & Internal:20))

UNIT –I

Statistical Quality Control: Importance of SQC in industry. Dimensions of quality. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np with fixed and varying sample sizes) and their Interpretation. Control charts for attributes (c and u charts with fixed and varying sample sizes) and their Interpretation. Construction of control charts for Natural tolerance limits and specification limits, process capability index and modified control charts. **Acceptance sampling plans:** Single and Double sampling plans for attributes and their OC and ASN functions.

UNIT-II

Index Numbers: Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyres, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as an ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.
Demand Analysis: Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves. Leontief's, Pigou's methods of determining demand curve from time series data, limitations of these methods. Pigou's method from time series data. Pareto law of income distribution curves of concentration.

UNIT-III

Time series Analysis: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares and moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

Official Statistics: Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in the estimation of national income.

UNIT – IV

Vital statistics: Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios. Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate and Net reproductive rate. Life tables, construction and uses of life tables and Abridged life tables

Reference Books:

1. V.K. Kapoor and S.C.Gupta I. Fundamentals of Applied Statistics. Sultan Chand
2. Parimal Mukhopadhyay : Applied Statistics. New Central Book agency.
3. D.C. Montgomery: Introduction to Statistical Quality Control. Wiley
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

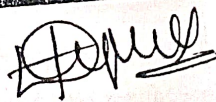
B.SC. THIRD YEAR, VI-SEMESTER SYLLABUS

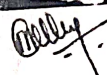
BS-66-T: PAPER-VI (Lab): INDUSTRIAL STATISTICS

(SQC, INDEX NUMBERS, OFFICIAL STATISTICS, TIME SERIES ANALYSIS, VITAL STATISTICS)

(2 HPW:: 1 Credit :: 25 Marks: (External:80 & Internal:20))

1. Construction control limits for charts for variables (Mean, range and standard deviation charts).
2. Construction control limits for charts for attributes (p, np (fixed and varying n.), c and u charts).
3. Designing a single & double sampling plan and construction of its OC and ASN curves.
4. Construction various Index numbers
5. Construction of Base shifting, splicing and Deflation, cost of living index numbers.
6. Determination of seasonal indices by the method of Ratio to moving averages.
7. Determination of seasonal indices by the method of Ratio to trend.
8. Determination of seasonal indices by the method of link Relatives.
9. Computation of various mortality and fertility rates
10. Construction of complete and abridged life tables.







B.Sc. III-Year V-Semester (CBCS) Statistics Syllabus

(With Mathematics Combination)

SEC-1: DATA COLLECTION, PRESENTATION AND INTERPRETATION [2 HPW with 2 Credits and 50 Marks]

UNIT-I

Basic Concepts on Population, Sample, Sampling unit, Parameter, Statistic, Standard error, Sample Size and its Determination, Steps in Sample design, Selecting the Problem and necessity of defining the Problem, designing a questionnaire and a schedule for collecting data for a set of objectives under study with illustrated examples, Methods for collecting Primary and Secondary data and their merits and demerits.

UNIT-II

Graphical computation of Data and Interpretation: Histogram, frequency curve, frequency polygon, ogive curves, Diagrammatic computation of Data and Interpretation: Bar diagrams (simple, component, multiple, percentage Bars), Pie diagram, Classification and Tabulation of data, Data Interpretation techniques, Precaution in Interpretation, Data interpretation problems.

Reference Books:

1. Kotahri, C.R (2009): Research Methodology: Methods and Techniques, 2nd Revised Ed. Reprint, New Age International Publishers
2. S. P. Gupta : Statistical Methods.

B.Sc. III Year VI Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

SEC- 2 : DATA SCALING TECHNIQUES AND REPORT WRITING [2 HPW with 2 Credits and 50 Marks]

UNIT – I

Qualitative and Quantitative data, Measurement of Scales: nominal, ordinal, interval and ratio scales, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques, Developing Likert-type Scales, Factor scales and Cumulative Scales their advantages and limitations.

UNIT-II

Interpretation and Report Writing: meaning of interpretation, technique of interpretation, precautions in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation, mechanics of writing a research report.

Reference Books :

1. SC Gupta and VK Kapoor : Fundamentals of Applied Statistics, Sultan Chand & Sons
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, The World Press Pvt. Ltd., Kolkata.

B.SC. III-YEAR, V-SEMESTER SYLLABUS

MDC: STATISTICAL ANALYSIS

(4 HPW:: 4-Credits :: 100 Marks (80 External; 20 Internal).

(offered for non-statistics students)

UNIT - I

Measures of Central Tendencies (Arithmetic Mean, Median, Mode); Measures of Dispersions (Range, Quartile Deviation, Mean Deviation, Standard Deviation), Central & Non central Moments, Skewness & Kurtosis computations for grouped and ungrouped data. Basic concepts to probability, Probability definitions (Mathematical, Statistical & Axiomatic), Addition, multiplication and Bayes Theorems on probability, simple problems on probability.

UNIT-II

Definition and sample examples of random variables and distribution function, probability mass function and probability density function. Mathematical expectation and moments-simple examples. Discrete probability distributions: Bernoulli, Binomial, Poisson. (Concept, definition, statements of mean and variance only) with real life examples. Continuous probability distributions: Uniform, Normal and Exponential distributions (concept, definition, statements of mean, variance and other properties).

UNIT - III

Empirical bivariate distributions, Covariance, Karl Pearson coefficient, Rank Correlation, Curve fitting by least squares principle. Simple linear regression. Concept and definition of population, parameter, sample, statistic, sampling distribution and standard error. Properties of Estimates: Unbiasedness, Consistency and Efficiency (concept and definition only), simple examples.

UNIT-IV

Concept of testing Statistical Hypothesis-Definition of Null and Alternative hypothesis, Critical region, Types of errors, level of Significance and Power of a Test, Tests of significance based on Chi-Square, t and F distributions and ANOVA (One and Two way) with examples (No mathematical derivation only methodology).

List of reference books:

1. V.K.Kapoor and S.C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. Goon A.M, Gupta M.K., Das Gupta B: Fundamentals of Statistics, Vol-I, the World Press Pvt. Ltd., Kolakota.
3. Charles M. Grinstead and Laurie Snell.J: Introduction to Probability, American Mathematical Society
