Department of Statistics
Central University of Rajasthan

(REVISED SYLLABUS 2022)

SYLLABUS
for

Integrated M. Sc. STATISTICS
(Semester I to VI)

Proposed to be implemented for the batches 2020 onwards.

Department of Statistics
School of Mathematics Statistics and Computational Sciences
Central University of Rajasthan
Bandarsindri, NH-8, Kishangarh, Ajmer, Rajasthan-305801

Programme Objective:

The main objective of Integrated M.Sc. in Statistics programme in CURaj is to facilitate higher secondary passed students to learn, practice and make career in the art of information analysis for the purpose of decision making on concerned problems. Analysis can be done by using well accepted principle and scientific methods developed in Statistics. As these students have chosen the statistics at an early stage of their learning, they have an opportunity of better understanding fundamentals of statistics and equip themselves to work as a professional statistician. Training in statistical computing will enhance their job opportunities and professional skills.

Learning outcome of this program,

Post Graduates of the Integrated M.Sc. Statistics program will be able to:

- Have a broad background in Statistics, an appreciation of how its various sub disciplines are inter-related, acquire an in-depth knowledge about topics chosen from those offered through the department.
- Develop the ability to effectively and aptly use techniques of representing and dealing with random phenomenon by using basic principles and statistical concepts.
- Learn art of gathering information by sampling and designing experiments and analyzing it and also to be able to assist practitioners for drawing inferences by using their experimental outcomes.
- Be able to independently read statistical literatures including survey articles, scholarly books, and online sources.
- Have the versatility to work effectively in a broad range of companies (including R&D sectors of financial, pharmaceutical, market research, software development companies, consultancy, etc.), or analytic, scientific, government, financial, health, teaching and other positions or continue for higher education.

Revised Course Outline

Integrated M.Sc. Statistics

I to VI Semester

Semester	Revised Code	Title	Credit	Hours per week			
				Lectures	Tutorial	Practical	
I	STA 101	Descriptive Statistics	4	4	0	0	Core
	STA 102	Practicals using Excel	2	0	0	2	Core
	STA 181	Introduction to Excel	3	2	1	0	SEC
II	STA 103	Probability and Random Variable	4	4	0	0	Core
	STA 104	Practicals using Excel	2	0	0	2	Core
III	STA 201	Probability Distributions	4	4	0	0	Core
	STA 202	Practicals using R	2	0	0	2	Core
	STA 281	Introduction to R	3	2	1	0	SEC
IV	STA 203	Statistical Inference-I	4	4	0	0	Core
	STA 204	Practicals using R	2	0	0	2	Core
	STA 282	Statistical Methods	4	4	0	0	SEC
V	STA 301	Statistical Inference-II	4	4	0	0	Core
	STA 302	Operations Research	4	4	0	0	Core
	STA 303	Applied Statistics	4	4	0	0	Core
	STA 304	Practicals using R	3	0	0	3	Core
		Open Elective (Science)	3	3	0	0	Core
		Open Elective (Social Science)	3	3	0	0	Core
VI	STA 305	Statistical Quality Control	4	4	0	0	Core
	STA 306	Sample Surveys	4	4	0	0	Core
	STA 307	Design of Experiments	4	4	0	0	Core
	STA 308	Practicals using R	3	0	0	3	Core
		Open Elective (Science/Social Science)	3	3	0	0	Core
	STA 381	Minor Project/Field trip/internship	4	-	-	-	SEC

FIRST SEMESTER

Course Name: Descriptive Statistics		Course Code: STA 101
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Basic Mathematics

Course Objective:

1. To make the students aware of different type of data sets and their graphical representations introducing of descriptive statistical measures, including those for two variables.

Course Outcomes: After completion of this course student will able to

1. Understand basic concepts of statistical data.
2. Recognize different diagrammatic tools for visualization of data
3. Apply different statistical measures to describe the data.
4. Asses relationship between two variables.
5. Interpret the statistical results

Course Content:

Unit No.	Unit Contents	No. of Hours
1.	Meaning and scope of the word 'Statistics'. Data types, measurement of scale, classification and tabulation, graphical and diagrammatic representation: Bar diagrams, multiple and stack bar diagrams, histogram, frequency polygon, frequency Curve, O- give, Pie-diagram, Boxplot, Stem and leaf diagrams. Measures of Central Tendency: Concept, requirements of a good measure. mathematical average, positional average with properties, merits and demerits. weighted average, combined mean, Graphical method of determination of Median, Mode and Quartile.	15
2.	Measures of Dispersion: Concept, requirements of a good measure of dispersion, absolute and relative measure, Range, quartile deviation, mean deviation, variance and standard deviation with its coefficient, combined variance, interrelationship between the range, QD, MD and SD. Minimal properties of MD and mean square deviation with proof. Moments: Raw and central moments, relationship between raw and central moments, Sheppard correction for moments (without derivations), skewness, type and its, measurement of skewness. Kurtosis, types and its measurement.	15
3.	Bivariate Data. Scatter diagram. The concept of dependency, illustrative real-life examples. Covariance: Definition, Effect of change of origin	15

	and scale. Karl Pearson's coefficient of correlation (r): Definition, Properties, Spearman's rank correlation coefficient: Definition, Interpretation. Derivation of the formula for without ties and Modification of the formula for with-ties computation, variance of linear combination of variables. Correlation coefficient for discrete frequency distribution.	
4.	Concept of regression, Lines of regression, Principal of least square and cure fitting. Fitting of lines of regression by the least square method. Regression coefficients (b_{xy}, b_{yx}) and their geometric interpretations, Properties. Derivation of the point of intersection of two regression lines and the acute angle between the two lines of regression.	15
Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/Text Books:		
1.	Rohatgi, V. K., & Saleh, A. M. E. (2015). An introduction to probability and statistics. John Wiley & Sons.	
2.	Mukhopadhyay, P.(2012), Mathematical Statistics, new Central Book Agency Pvt. Ltd., Calcutta.	
3.	Hoel P. G. (2016), Introduction to Mathematical Statistics, Asia Publishing House.	
4.	Meyer, P. L. (1965). Introductory probability and statistical applications. Oxford and IBH Publishing.	
5.	Roussas, G. G. (1997). A course in mathematical statistics. Elsevier.	
6.	Goon, A. M. (1987). Fundamentals of Statistics Vol. 1. The world press.	

Course Name: Practicals using Excel		Course Code: STA 102
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 4 hours/ week	End Semester Examination: 100 Marks	3
		Total: 3

Course Pre-requisites: Student must have knowledge of

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Course Objective:

1. Developing skills to represent and analysis data sets using MS Excel.

List of Practicals

Students will be required to do practical, based on topics listed below, using MS Excel:

1. Data entry and basic operations using excel
2. Diagrammatic (Multiple stack bar diagrams, histogram, stem and leaf, pie chart) and graphical (Frequency polygon, frequency curve) presentation of the frequency distribution.
3. Measures of Central tendency – I (ungrouped data).
4. Measures of Central tendency – II (grouped data).
5. Measures of Central tendency – III (pooled data).
6. Computation of quartiles by use of Ogive curves,
7. Measures of the Dispersion – I (ungrouped data).
8. Measures of the Dispersion – II (grouped data).
9. Moments, Skewness & Kurtosis-I (ungrouped data).
10. Moments, Skewness & Kurtosis-II (grouped data).
11. Computation of raw, central moments, Pearson's coefficient of skewness and kurtosis.
12. Scatter diagram for bivariate data and interoperation.
13. Product moment correlation and Spearman Rank correlation (tied with un tied rank)
14. Correlation coefficient for bivariate frequency data.
15. Curve fitting using method of least squares

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. David, M. (2017). Statistics for managers, using Microsoft excel. Pearson Education India.

Course Name: Introduction to Excel		Course Code: STA 181
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 3 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 2
Practical: 2 hours/ week	Total: 100 Marks	Practical: 1
		Total: 3

Course Pre-requisites: Student must have knowledge of

1. Excel
2. Basic mathematics

Course Objective:

This course introduces fundamental concepts of Microsoft excel with focus on excel functions are used for statistical data. The course emphasizes the basic concept of statistics, visualization and manual statistical calculation by using excel.

Course Outcomes: After completion of this course student will able to

1. Enter, clean, transform, merge and reshape data.
2. Implement excel function on statistical data.
3. Create informative visualization of data set.
4. Arrange and short the statistical data for basic statistical analysis.

Course Content:

Unit No.	Unit Contents	No. of Hours
1.	Basic of Excel: Format cell, find and select, Data Validation, Keyboard shortcut.	10
2.	Excel Functions: Count and sum, logical, cell reference, date and time, lookup & reference, round, shorting and filtering, logical function.	10
3.	Data storage and data representation: Data storage, pivot table, frequency table, Various chart: Bar chart, Pie chart, Line Chart, Ogive, frequency curve and frequency polygon	10
4.	Statistical Function in excel: calculation of mean, median and mode for frequency data, pivot table, pivot chart. Correlation and curve fitting simple linear regression.	15

Assessment:

CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written

Reference/ Text Books:

1.	David, M. (2017). Statistics for managers, using Microsoft excel. Pearson Education India.	

2.	Larson, R., & Farber, B. (2019). Elementary statistics. Pearson Education Canada.	
3.	Moriarty, B., Held, B., & Richardson, T. (2022). Microsoft Excel Functions and Formulas: With Excel 2021/Microsoft 365. Stylus Publishing, LLC.	
E-Resources:		
1.	Microsoft Excel Step by Step (Office 2021 and Microsoft 365). URL: Microsoft Excel Step by Step (Office 2021 and Microsoft 365) (pearsoncmg.com)	

SECOND SEMESTER

Course Name: Probability and Random Variables		**Course Code: STA 103**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessments: 20 + 20 Marks	Theory: 4
	Total Marks: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Descriptive Statistics
2. Set Theory
3. Calculus

Course Objective:

1. To introduce the notion of probability, random variable and expectation, based on which statistical theory and tools have been developed.

Course Outcomes: After completion of this course student will able to

1. Recall concept of probability and related terminology
2. Differentiate discrete and continues random variables and its distribution..
3. Understand probability mass function, density function and distribution function.
4. Compute expectations of random variables.
5. Examine peakedness and skewness of distribution

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Concepts of experiments: deterministic, probabilistic, outcomes of experiments. Sample space, Discrete (finite and countably infinite) and continuous sample space, Event, Elementary event, Compound event. Algebra of events (Union, Intersection, Complementation), De Morgan's law. Definitions of Mutually exclusive events, Exhaustive events, Venn diagram. Definition; Axiomatic definition of probability; Addition theorem (Proof of the result up to three events), Elementary properties, Classical definition of Probability as a special case, Probability as an approximation to the relative frequency, illustrative examples for computation of events based on Permutations and Combinations, with and without replacements, impossible events, certain events. Definition of conditional probability of an event, Multiplication theorem for two events, Independence of events: Pairwise and Mutual Independence of events. Partition of sample space. Statement and proof of Bayes' theorem.	15
2.	Definition of random variable, Discrete and continuous and mixed type of random variables, Definition of distribution function, Distributions function (df) of random variable, Probability distribution of function of	15

	random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Probability density function (p.d.f.) and cumulative distribution function (c.d.f.) of a continuous random variable, relation between df and pmf/pdf, Median and Mode of a univariate discrete and continuous random variables.	
3.	Definition of expectation of a random variable, expectation of a function of a random variable, simple properties, Definitions of mean, variance of univariate distributions, Effect of change of origin and scale on mean and variance, Definition of raw, central moments, mean deviation. Pearson's coefficient of skewness, kurtosis, Definitions probability generating function (p.g.f.), moment generating function (m.g.f.) and characteristic function of a random variable, Effects of change of origin and scale. p.g.f. of sum of two independent random variables is the product of p.g.f.s (statement only), Derivation of mean and variance by using p.g.f.	15
Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	Mood A. M. , Grabyll R. A. and Boes D. C., Introduction to the theory of Statistics, Tata McGraw Hill	
2.	Mukhopadhyay, P., Mathematical Statistics, new Central Book Agency Pvt. Ltd., Calcutta.	
3.	AM Goon, M K Gupta and B. Das Gupta, Fundamentals of Statistics, Volume-I, World Press.	
4.	Ross Sheldon M., Introduction to Probability Models, Academic Press	
5.	Rao, B. L. S. Prakash, A first course in probability and Statistics, World Scientific.	

Course Name: Practicals using Excel		Course Code: STA 104
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 4 hours/ week	End Semester Examination: 100 Marks	3
	Total: 100 Marks	

Course Pre-requisites: Student must have knowledge of

1. Basic of Excel.

Course Objective:

1. Developing skills to find statistical measures and plot probability function using MS Excel.

List of Practical's

Students will be required to do practical, based on topics listed below, using MS Excel:

1. Advanced excel operations
2. Illustrations related to probability, Conditional probability, and Bayes Theorem.
3. Probability mass function plot of discrete r.v.
4. Probability density plot of continuous r.v.
5. Computation of expectation, variance, third and forth moment for pmf.
6. Computation of probabilities through probability generating function.

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

Microsoft Excel Step by Step (Office 2021 and Microsoft 365).
URL: Microsoft Excel Step by Step (Office 2021 and Microsoft 365) (pearsoncmg.com)

THIRD SEMESTER

Course Name: Probability Distributions		**Course Code: STA 201**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Basic Probability
2. Descriptive Statistics
3. Calculus

Course Objective:

1. The main objective is to introduce standard discrete and continuous distributions

Course Outcomes: After completion of this course student will able to

1. Differentiate discrete and continues random variables and its distribution.
2. Recognize basic probability distributions and their properties.
3. Identify distributions of functions of random variables.
4. Differentiate between sampling and exact sampling distributions.
5. Use various distributions for variety of real life situations.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Discrete Distribution: General concept of a finite discrete random variable De-generate, Discrete Uniform, Bernoulli, Binomial, Poisson and Geometric, Negative Binomial, Hyper geometric and Multinomial distributions with their properties and applications.	13
2.	Continuous Distribution: Rectangular, Normal distribution, Exponential, Gamma, and Beta (I and II kind) with their properties and applications. Normal distribution as limiting case of binomial and Poisson distribution. Function of random variables and their distributions.	17
3.	Concept of bivariate rv and their distribution function. Function of random variables in one dimensional and two dimensional using (i) Jacobian of transformation (ii) Distribution function and (iii) M.G.F. technique.	12
4.	Exact sampling distributions: Chi square distribution, Student's t-distribution and Snedecor's F distribution. Definitions, derivation of p.d.fs, sketch of p.d.fs. for various values of parameter, moments. Inter relation between t, F and χ^2. Applications of t, F and χ2 distributions.	18

Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	Hogg, R. V., & Craig, A. T. (1995). Introduction to mathematical statistics. (5"" edition). Englewood Hills, New Jersey.	
2.	Hogg, R. V., Tanis, E. A., & Zimmerman, D. L. (1977). Probability and statistical inference (Vol. 993). New York: Macmillan.	
3.	Mayer P.L. (1965). Introductory probability & Statistical Applications. Addison Weseley Publication Co., London	
4.	Goon A.M., Gupta A.K. and Dasgupta B. (2016). Fundamentals of Statistics (Vol. II) World Press, Calcutta.	

Course Name: Practicals using R		Course Code: STA 202
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 4 hours/ week	End Semester Examination: 100 Marks	3
		Total:3

Course Pre-requisites: Student must have knowledge of

1. R programming
2. Probability

Course Objective:

1. To enhance the computing, sketching simulating skills in R software.

List of Practicals

Students will be required to do practical, based on topics listed below, using R software:

1. Illustrations related to probability, Conditional probability, and Bayes theorem.
2. PMF sketch of Discrete Distributions: Uniform, Binomial, Poisson, Geometric, Negative Binomial, Hyper-geometric.
3. PDF sketch of Continuous Distributions: Rectangular, Exponential, Normal, Gamma and Beta-I and II.
4. Computation of Expectation, Variance, Mode, and Skewness and Kurtosis for above discrete and continuous distributions.
5. Computation of probabilities based on area property of normal distribution.
6. Fitting of distributions: Binomial, Poisson, Normal distributions.
7. Simulation of data from discrete and continuous distributions.

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

An Introduction to R: Notes on R: A Programming Environment for Data Analysis and Graphics (https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf)

Course Name: Introduction to R		**Course Code: STA 281**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 2 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 2
Practical: 2 hours/ week	Total: 100 Marks	Practical: 1
		Total: 3

Course Pre-requisites: Student must have knowledge of

1. Basic Computer knowledge
2. Basic Mathematics

Course Objective: In this course students will learn to

1. Use the programming language.
2. Basics of the R language.
3. Programming fundamentals.

Course Outcomes: After completion of this course student will able to

1. Understand the R programming.
2. Understand the different type of data types and data structure.
3. Perform the basic mathematical calculation by using R
4. Understand and apply the R function.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Interacting in R: Discovery of R, Get and install R, use the help system and find help from other sources, libraries of command, install packages. Basic operation and data types: Basic calculator operations, assign variables, vectors, objects, integers	10
2.	Data Structures in R: List, factor, data frames, modifying data frames, sub setting data frames, matrices and array, slicing in vectors, data frame and matrices. Diagrammatic and graphical representation, Calculation of measure of central tendency and dispersion. Correlation and regression.	17
3.	Functions in R: Introduction to functions, using built in functions, creating functions, functions of functions, input arguments of functions, and named arguments of functions, operators. Introduction to conditional statements: if-else, nested if-else, switch, logical arithmetic.	18

Assessment:

CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written

Reference/ Text Books:

1.	Dalgaard, P. (2020). Introductory statistics with R, Springer.	
2.	Crawley, M. J. (2012). The R book. John Wiley & Sons.	
3.	Braun, W. J., & Murdoch, D. J. (2021). A first course in statistical programming with R. Cambridge University Press.	

4.	Gardener, M. (2012). Beginning R: the statistical programming language. John Wiley & Sons.	
E-Resources:		
1.	An Introduction to R: Notes on R: A Programming Environment for Data Analysis and Graphics (https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf)	

FORTH SEMSTER

Course Name: Statistical Inference-I		**Course Code: STA 203**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Descriptive statistical measure
2. Probability and Random Variables
3. Probability Distribution

Course Objective:

1. The main objective is to build the theoretical foundation of Point Estimation and Testing of Hypothesis and to introduce the notion of order statistics

Course Outcomes: After completion of this course student will able to

1. Understand concept of order statistics and its applications
2. Recognize basic concepts of statistical inference.
3. Recognize different methods of parameter estimation
4. Recall various properties of estimators
5. Apply different statistical test procedures for different testing of hypothesis problems.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Order statistics: Definition, derivation of p.d.f. of ith order statistics, for a random sample of size n from a continuous distribution. Density of smallest and largest observations. Derivation of joint p. d. f. of i^{th} and j^{th} order statistics, statement of distribution of the sample range. Distribution of the sample median.	10
2.	Concept of Statistical inference, sampling method and complete enumeration, Definition of population, parameter, parameter space. Problem of estimation: point, intervals and testing of hypotheses. Definitions of an estimator mean squared error (MSE) of an estimator, comparison of estimators based on MSE function.	10
3.	Unbiased estimator, Illustration of unbiased estimator for the parameter and parametric function. Definitions of Consistency, Sufficient condition for consistency, concept of efficiency and sufficiency. Neyman- Factorization theorem (without proof). Methods of estimation: Methods of moments, concept of likelihood function, Maximum Likelihood, Properties of MLE (without proof), Estimation of the parameters of normal distribution and other standard distributions	13

	by MLE.	
4.	Hypothesis, types of hypothesis, problems of testing of hypothesis, critical region, type I and type II errors, probabilities of type I & type II errors. Power of a test, best critical region, Observed level of significance, concept of p-value, size of a test, level of significance. Definition of Most Powerful (MP) test, Neyman - Pearson (NP) lemma for simple null hypothesis against simple alternative hypothesis (with proof)- Illustrations. Power curve of a test.	12
Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	George Casella, Roger L. Berger (2002), Statistical Inference, 2nd ed., Thomson Learning.	
2.	Mukhopadhyay P. (1996): Mathematical Statistics, New central Book Agency (P) Ltd. Calcutta	
3.	Rohatgi, V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.	
4.	Goon, Gupta & Das Gupta (1991): An Outline of Statistical Theory, Vol. II, World Press.	
5.	Hogg, R.V. and Craig, A.T. (1971): Introduction to Mathematical Statistics, McMillan.	

Course Name: Practicals using R		Course Code: STA 204
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 4 hours/ week	End Semester Examination: 100 Marks	3

Course Pre-requisites: Student must have knowledge of

1. Basic of R programming
2. Random Variables and Probability Distribution
3. Estimation and Tests of hypotheses

Course Objective:

1. To enhance the computing, sketching simulating skills in R software.

List of Practicals

Students will be required to do practical, based on topics listed below, using R software:

1. Density plot of maximum and minimum of sample for different discrete and continuous distributions.
2. Density of i-th order statistics.
3. Point estimation by Method of moments.
4. Maximum likelihood estimation.
5. Mean squared error and unbiasedness of an estimator
6. Type I and Type II errors
7. Most powerful critical region (NP Lemma)
8. Power curves.
9. Testing equality of means
10. Testing of equality of proportions
11. Testing equality of variance
12. Fitting regression line
13. Measures of associations

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. An Introduction to R: Notes on R: A Programming Environment for Data Analysis and Graphics (https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf)

Course Name: STATISTICAL METHODS		**Course Code: STA 282**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60Marks Internal Assessment: 40 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

Basic concepts in the descriptive statistical measures, methods of estimating and testing of hypotheses.

Course Objective:

1. to test the significance of proportions, means and standard deviations of the give test of hypotheses.
2. To know the method of estimation, confidence interval and to test the equality of means, variances of normal populations.
3. to understand the concepts of regression and its properties with applications.
4. to get the knowledge on sampling distributions and tests of significance on them.
5. to classify various parametric and non-parametric statistical techniques in various real life applications.

Course Outcomes: After completion of this course student will able to

1. test the significance of proportions, means and standard deviations of the give test of hypotheses.
2. estimate the parameters, confidence interval and to test the equality of means, variances of normal populations.
3. understand the concepts of regression and correlations with applications.
4. understand the sampling distributions and its tests of significance.
5. apply parametric and non-parametric statistical techniques.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1	Test of significance for small and large samples: sampling of attributes, tests for single proportion, difference of proportions. test of significance for single mean, difference of means and difference of standard deviations.	10
2	Method of least squares, confidence intervals and confidence limits, confidence intervals for large samples. test for the mean, equality of means, variance, equality of variances normal populations, p- value.	15
3	Regression: Regression lines and curves, properties of regression coefficients, angle between two lines of regression, standard error of estimate, correlation coefficient between observed and estimated value, correlation ratio, measures of correlation ratio, intra-class correlation.	15
4	Standard errors, sampling distributions of sample mean, sample variance, t, chi-square and F; tests of significance based on them, Small sample tests.	10

5	Theory of attributes: Independence and association of attributes. measures of association for two way classified data. consistency and independence of data with special reference to attributes. coefficient of colligation.	10
Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		

1. Conover, W. J., Practical Non-Parametric Statistics, third edition, John Wiley, NY, 2007.
2. Goon, M., Gupta, M.K. and Dasgupta, B. (2003). An outline of Statistical Theory, Vol. I, 4th Ed., World Press, Kolkata.
3. Hogg, R. V., McKean, J., and Craig, A. T. (2005). Introduction to mathematical statistics. Pearson Education.
4. Kennedy, W. J. and Gentle, J. E., Statistical Computing, Taylor & Francis, 1980.
5. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
6. Snedcor, G. W. and Cochran, W. G., Statistical Methods, seventh edition, Iowa State University Press, 1982.
7. Tanner, M. A., Tools for Statistical Inference, Springer-Verlag, 2011.

FIFTH SEMSTER

Course Name: Statistical Inference –II		**Course Code: STA 301**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination:60 Marks Internal Assessment: 20 + 20 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Method of estimation and testing of hypothesis

Course Objective:

1. The purpose is to enhance the existing knowledge of Point Estimation and Testing of Hypothesis and introduce the concept of Interval Estimation.

Course Outcomes: After completion of this course student will able to

1. Obtain minimum variance unbiased estimators for various parameters of distributions.
2. Recall basic concepts of hypothesis testing.
3. Understand applications of Neyman Pearson lemma for the construction of most powerful tests
4. Implement likelihood ratio test
5. Construct best confidence intervals for population parameters.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Statement and proof of Cramer Rao inequality. Definition of Minimum Variance Bound Unbiased Estimator (MVBUE) of $\phi(\theta)$, (statement only). Rao-Blackwell theorem, Lehmann-Scheffe theorem. Definition of MVUE, Procedure to obtain MVUE (statement only), examples. Minimum Variance Unbiased Estimator (MVUE) and Uniformly Minimum Variance Unbiased Estimator (UMVUE), complete sufficient statistic and uniqueness of UMVUE whenever it exists.	15
2.	Review of testing of hypothesis and examples of construction of MP test of level α for binomial, Poisson, uniform, exponential and normal models. Testing for one sided and two sided alternatives: Power function of a test, Monotone likelihood ratio properties, definition of uniformly most powerful (UMP) level α test. Statement of the theorem to obtain UMP level α test for one-sided alternative. Illustrative examples.	15
3.	Likelihood Ratio Test (LRT) and its properties: LRT for (i) mean and variance of normal population. (ii) The difference of two means and ratio of two variances of normal populations. Sequential probability ratio tests.	15

4.	The need and the concept of confidence interval, Pivotal method of confidence interval, Confidence interval for proportion, mean and variance of normal distribution. Large sample Confidence interval.	15
Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	George Casella, Roger L. Berger (2002), Statistical Inference, 2nd ed., Thomson Learning.	
2.	Mukhopadhyay P. (1996): Mathematical Statistics, New central Book Agency (P) Ltd. Calcutta.	
3.	Rohatgi, V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.	
4.	Goon, Gupta & Das Gupta (1991): An Outline of Statistical Theory, Vol. II, World Press.	
5.	Hogg, R.V. and Craig, A.T. (1971): Introduction to Mathematical Statistics, McMillan.	

Course Name: Operations Research		**Course Code: STA 302**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Understanding the variables in real life problems and some basic mathematical simplification knowledge in system of equations.

Course Objective:

1. Mathematical formulation of the L.P.P and can be able to find solution in different methods.
2. Formulate transportation problem and find optimum solution.
3. Understand the how to modeling an assignment problem and its solution.
4. Understand the how to modeling an job sequencing problem and its solution by different methods.
5. Construct network diagram and critical path for a given problem.

Course Outcomes: After completion of this course student will able to

1. Formulate the and find solution for the given problem.
2. Formulate transportation problem and find optimum solution.
3. Understand the how to modeling an assignment problem and its solution.
4. Understand the how to modeling an job sequencing problem and its solution by different methods.
5. Construct network diagram and critical path for a given problem.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Introduction to Operations Research, Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex, Two Phase Simplex and M-Charne's simplex methods. Concept of Duality, formulation of dual problem in L.P.P and primal- dual relationships.	12
2.	Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem.	10
3.	Assignment problem: Hungarian method to find optimal assignment, special cases (Multiple Solutions, Maximization case, unbalanced case, Restrictions on assignment) of assignment problem.	08
4.	Sequencing problem: Introduction to Sequencing and scheduling problem. Processing n jobs through 2, 3 and m machines. General n/m job-shop problem.	08
5.	Network Analysis: Construction of the Network diagram, Critical Path-float and slack analysis (Total float, free float, independent float), PERT/CPM, Project Time Crashing.	08

Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
2. Hadley, G: (2002) : Linear Programming, Narosa Publications
3. Hamdy A. Taha (2007). Operation research-An Introduction, Prentice Hall, 8th Ed., 2007
4. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
5. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali (2004). Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India.
6. Ravindran, A, Phillips, D.T., Solberg,J.J.(2005): Operations Research- Principles and Practice, John Wiley & Sons.
7. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India

Course Name: Applied Statistics		Course Code: STA 303
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20 + 20 Marks Total: 100 Marks	Theory: 4
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Mathematical statistics measures, variables and its independency.

Course Objective: After completion of this course student will able to

1. Find and understand different Index numbers.
2. Find the various vital statistical measures.
3. Learn about demographic measures and its models.
4. Understand the time series analysis and its seasonal trends by using moving averages.
5. Know the official statistics and also to know the corresponding organizations in India.

Course Outcomes: After completion of this course student will able to

1. Compute various Index numbers in different situations.
2. Calculate the various vital statistical measures.
3. Understand the demographic measures and its models.
4. Understand the trend of a product or an item in different time periods.
5. Applicability of the official statistical measures in census.

Course Content:

Unit No.	Unit Contents	No. of Hours
1.	Index Numbers: Meaning and utility of index numbers, problems in construction of index numbers. Unweighted and weighted index numbers using (i) aggregate method, (ii) average of price or quantity relative. Link and chain relatives' composition of index numbers. Construction of cost of living index number and wholesale price index number. Uses and limitations of index numbers. Criteria for a good index number	12
2.	Vital Statistics: Introduction and sources of vital statistics. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates. Life (Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables. Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).	12
3.	Scope and content of population census of India. Population, Composition, Dependency ratio, Errors in demographic data, Adjustment of age data. Chandrasekhar – Deming formula to check completeness of registration data. Models for population growth-Linear, Exponential, logarithmic, modified logarithmic, Gompertz and Logistic Curves.	12
4.	Introduction to times series, Components of a times series. Trend: Estimation of	12

	trend, method of semi averages, fitting a various mathematical curve, and growth curves. Method of moving averages. Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to Moving Averages and Link Relative method.	
5.	Indian Official Statistics: Present Official Statistical System in India relating to census of population, agriculture, industrial production, and prices; methods of collection of official statistics, their reliability and limitation and the principal publications containing such statistics. Also the various agencies responsible for the data collection- C.S.O., N.S.S.O., Office of Registrar General, their historical development, main functions and important publications.	12

Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
2. Cox, P.R. (1970): Applied Mathematical Demography, Sprinmger Verlag.
3. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
4. Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals Of Applied Statistics, 4th Edition(Reprint), Sultan Chand & Sons
5. Kendall M.G. (1976): Time Series, Charles Griffin.
6. Keyfitz N., Beckman John A.: Demogrphy through Problems S-Verlag New york.
7. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied
8. Spiegelman, M. (1969): Introduction to Demographic Analysis; Harvard University Press.

Course Name: Practicals using R		**Course Code: STA 304**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 6 hours/ week	End Semester Examination: 100 Marks	3

Course Pre-requisites: Student must have knowledge of

1. Random Variables and Probability Distribution
2. Estimation and Tests of hypotheses

Course Objective:

1. To enhance the computing, sketching simulating skills in R software.

Practical's

Students will be required to do practical, based on topics listed below, using R software:

1. Problems on MVBUE.
2. Power function of a test
3. LRT for mean and variance of normal population. Andthe difference of two means and ratio of two variances of normal populations.
4. Linear programming (graphical methods).
5. Simplex method.
6. Transportation problems.
7. Computation of various mortality and fertility rates.
8. Construction of life table and computation of expectation of life and force of mortality.
9. Construction of index numbers.
10. Tests for consistency of index numbers.
11. Construction of Consumer Price Index - interpretation.
12. Determination of secular trend by moving averages and least squares methods.

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. An Introduction to R: Notes on R: A Programming Environment for Data Analysis and Graphics (https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf)

SIXTH SEMESTER

Course Name: Statistical Quality Control		**Course Code: STA 305**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 40 Marks Total: 100 Marks	Theory: 4
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Probability
2. Standard probability distributions
3. Sample survey

Course Objective:

1. The main purpose of this paper is to introduce the most important field of applied statistics that contributes to quality control in almost all industries.

Course Outcomes: After completion of this course student will able to

1. Learning Process control and Product control
2. Knowing and understanding control charts and control limits.
3. Learning Sampling inspection plans for attributes and variables.
4. Perform various sampling plans to reduce consumer and producer risks.
5. Apply the SQC techniques to analyze the industrial data.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Statistical Quality Control, Causes of Variation, Statistical basis for Control Charts, Selection of Control Limits, Warning limits, Effect of Sample Size on Control limits.	15
2.	Errors in Making Inferences from Control Charts, Average run length. Control Chats for Variables and Attributes, Standardized Control Charts, CUSUM chart, MA, MR and EWMA charts	17
3.	Statistical process control with auto-correlated process data, Control chart for demerits per unit. Control charts for Individual Units. Control Charts for Short Production Runs.	15
4.	Producer's risk, Consumer's risk, Acceptance sampling plan, Single and double sampling plans by attributes, OC, ASN (and ATI), LTPD, AOQ and AOQL curves, Single sampling plan for variables, Lot-by-Lot Attribute Sampling Plans.	13

Internal Assessment:

CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/

		Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	D.C. Montgomery. (2009): Introduction to Statistical Quality Control. Wiley	
2.	Wetherill, G.B. Brown, D.W. (1991): Statistical Process Control Theory and Practice, Chapman & Hall.	
3.	Wetherill, G.B. (1977): Sampling Inspection and Quality control, Halsteed Press.	
4.	Duncan A.J. (1974): Quality Control and Industrial Statistics, IV Edision, Taraporewala and Sons.	
5.	Ott, E. R. (1977) : Process Quality Control (McGraw Hill)	

Course Name: Sample Survey		**Course Code: STA 306**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 40 Marks	Theory: 4
	Total: 100 Marks	
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Descriptive Statistics
2. Basic probability and probability distributions
3. Statistical Inference
4. Knowledge of R

Course Objective: After successfully completing this course, students should ordinarily expect to be able to:

1. Describe the purpose of conducting a survey and its overall process. For examples: principles of a sample survey, importance of sampling over complete enumeration, use of above ideas using real-life survey conducted by NSSO or other agencies.
2. Describe components of survey errors.
3. Describe designing of a questionnaire
4. Describe considerations for designing a sample
5. Describe steps in implementing a sample survey
6. Describe different methods of sampling designs
7. Describe different methods of estimation
8. Describe considerations in calculating estimates based on survey data

Course Outcomes: After completion of this course student will able to

1. Understand the basic principles underlying survey design and estimation.
2. Use of appropriate survey designs under different real-life situations and derive estimators of mean and total and their variances for each sampling design.
3. Implement systematic sampling, cluster sampling and two-stage sampling in real-life problems.
4. Describe different methods of estimation and derive estimators of mean and their MSE for each method of estimation
5. Conduct a sample survey in own domain/interest.

Course Content:

Unit No.	**Unit Contents**	**No. of Hours**
1.	Basic concept: Elementary units, sampling units, population, sampling frame, complete enumeration, need of sampling, random sample, requisites of a good sample, complete enumeration versus sampling, basic principles of a sample survey, sampling and non-sampling errors, types of sampling: non-probability and probability sampling, questionnaire and its characteristics, study (questionnaires, sampling design, methods followed in field investigation, principal findings, etc.) of some surveys by National Sample Surveys organization or other agencies.	16

2.	Simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of: population mean, total and proportion, variances of these estimates, estimates of their variances and sample size determination, exercises. Concept of Stratification, , real life situation where stratification can be used, methods of allocation, estimates of population mean and total, variances of these estimates, methods of allocation, Cost and variance analysis in stratified random sampling, gain in precision due to stratification, comparison amongst SRSWOR, stratification with proportional allocation and stratification with Neyman's, exercises.	18
3.	Systematic Sampling: Real life situations where systematic sampling is appropriate, Technique of drawing a sample using systematic sampling, Estimation of population mean and population total, Comparison of systematic sampling with SRSWOR and stratified sampling in the presence of linear trend. Idea of Circular Systematic Sampling, exercises. Cluster Sampling: Real life situations where cluster sampling is appropriate, technique of drawing a sample using cluster sampling, estimation of population mean and population total (with equal size clusters), concept of sub sampling, two-stage Sampling, Estimation of Population mean and variance of the estimate, exercises.	16
4.	Introduction to ratio, product and regression methods of estimation, Situations where (i) ratio method is appropriate, (ii) product method is appropriate and (iii) regression method is appropriate, estimation of population mean, evaluation of bias and variance to the first order of approximation, comparison with simple random sampling, exercises.	10

Internal Assessment:		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written

Reference/ Text Books:

1.	Cochran, W.G. (2007): Sampling Techniques , Third Edition, Wiley India Pvt. Ltd., New Delhi.
2.	Murthy, M. N. (1977): Sampling Theory and Methods, Statistical Publishing Society, Kolkata.
3.	Cochran, W.G.(2007): Sampling Techniques , Third Edition, Wiley India Pvt. Ltd., New Delhi. 2. Murthy, M. N. (1977): Sampling Theory and Methods, Statistical Publishing Society, Kolkata.
4.	Singh, D. and Chaudhary, F. S. (1986): Theory and Analysis of Sample Survey Designs, Wiley Eastern Ltd., New Delhi.
5.	RaghunathArnab (2017): Survey Sampling Theory and Applications, Academic Press, Elsevier.
6.	Mukhopadhyay P (2008): Theory and methods of survey sampling. Prentice-Hall of India, New Delhi.

E-Resources:	
1.	https://nptel.ac.in/courses
2.	http://mospi.nic.in/

Course Name: Design of Experiments		Course Code: STA 307
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Theory: 4 hours/ week	End Semester Examination: 60 Marks Internal Assessment: 20+20 Marks Total: 100 Marks	Theory: 4
		Total: 4

Course Pre-requisites: Student must have knowledge of

1. Normal, Chi-square, t, and F distributions, t-test

Course Objective:

1. Enable to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions.

Course Outcomes: After completion of this course student will able to

1. Understand the potential practical problems and applications of design of experiments in various fields.
2. Build a deeper understanding, and tools for analysis of experiments.
3. Describe how the analysis of the data from the experiment should be carried out.
4. Use a statistical computing package to analyse real-life data.
5. Appreciate the advantages and disadvantages of a design for a particular experiment.

Course Content:

Unit No.	Unit Contents	No. of Hours
1.	Basic terms in design of experiments: Experimental unit, treatment, layout of an experiment, basic principles of design of experiments: Replication, randomization and local control, choice of size and shape of a plot for uniformity trials, the empirical formula for the variance per unit area of plots.	15
2.	Completely Randomized Design (CRD), Randomized Block Design (RBD), and Latin Square Design (LSD): layout, mathematical model assumptions and interpretations, estimation of parameters, Standard Error (SE), estimate of σ as square root of Mean Error Sum of Square. Technique of one-way analysis of variance (ANOVA) and its applications, statement of Chochran's theorem (without proof) for justification of F-test. Tests for equality for treatment effects and its interpretation. Test for equality of two specified treatment effects using Critical Difference (CD), Model adequacy check using residual analysis.	20
3.	Missing plot technique: analysis of RBD with single missing observation, analysis of LSD with single missing observation.	10
4.	General description of factorial experiments, 2^2& 2^3 factorial experiments arranged in RBD. Definitions of main effects and interaction effects in 2^2& 2^3 factorial experiments. Model	15

	assumptions and its interpretation. Preparations of ANOVA table by Yate's procedure, test for main effects and interaction effects.	
Assessment		
CIA	Continuous Internal Assessment I	Written
	Continuous Internal Assessment II	Written/Assignment/ Viva/Presentation
ESE	End Semester Examination	Written
Reference/ Text Books:		
1.	Montgomery, D.C. (2001): Design and Analysis of Experiments, John Wiley and sons Inc., New Delhi.	
1.	Das, M. N., & Giri, N. C. (1986). Design and analysis of experiments. New Age International.	
2.	Hinkelmann, K., & Kempthorne, O. (2007). Design and analysis of experiments, volume 1: Introduction to experimental design (Vol. 1). John Wiley & Sons.	
3.	Hinkelmann, K., & Kempthorne, O. (2007). Design and analysis of experiments, volume 1: Introduction to experimental design (Vol. 1). John Wiley & Sons.	

Course Name: Practicals using R		**Course Code: STA 308**
Teaching Scheme	**Examination Scheme**	**Credit Allotted**
Practical: 6 hours/ week	End Semester Examination: 100 Marks	3

Course Pre-requisites: Student must have knowledge of

1. Measure of central tendency and dispersion
2. Standard probability distribution
3. Sampling techniques and random number

Course Objective:

1. To enhance the computing, sketching simulating skills in R software.

List of Practical's

Students will be required to do practical, based on topics listed below, using R software:

1. $\bar{X}$–R charts. (Standard values known and unknown)
2. np and p charts. (Standard values known and unknown).
3. Single sampling inspection plan by attributes
4. Analysis of CRD.
5. Analysis of 2^2 factorial experiment using RBD layout.
6. Analysis of 2^3 factorial experiment using RBD layout.
7. Analysis of 2^3 factorial experiment using RBD layout. (Complete confounding)
8. To select SRS with and without replacement.
9. For SRSWOR, estimate mean, standard error, the sample size.
10. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS.
11. Cluster sampling: estimation of mean or total, variance of the estimate, estimate of intra-class correlation coefficient, efficiency as compared to SRS.
12. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.

Assessment:

CIA	Continuous Internal Assessment I	Practical File
	Continuous Internal Assessment II	Viva\Regular evaluation
ESE	End Semester Examination	Written

Reference/ Text Books:

1. An Introduction to R: Notes on R: A Programming Environment for Data Analysis and Graphics (https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf)