S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Syllabus for: F.Y.B.Sc.

Program: B.Sc.

Course Code: Statistics (RUSSTA)

(Choice Based Credit System (CBCS) with effect from academic year 2018-19)

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F.Y.B.Sc. STATISTICS Syllabus
Credit Based Semester Grading System

Preamble

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B. Sc. Statistics program is of 120 credits spread over six semesters. This program is offered at the Department of Statistics, Ramnarain Ruia Autonomous College, Matunga, Mumbai.

The program develops a wide range of skills beyond knowledge of statistical topics, including mathematical, computational and non-mathematical skills.
The program emphasizes on theory and applications of statistics. It is well structured to provide the knowledge and skills in depth necessary for the employability of students in industry, other organizations, as well as in academics.

Ramnarain Ruia Autonomous College has the academic autonomy. The independent projects and presentation work is one of the important components of this program. The syllabus offers four courses in the first year (two semesters) and it covers most of the basic core concepts. The second year syllabus has four core and two of applied nature courses. The syllabus has been framed to have a good balance of theory, methods and applications of statistics. The third year offers two courses of core statistics and two courses of applied statistics in each semester. Practical courses in all three years are designed to enhance the ability of students to study the applications of the core courses and to develop the interpretation skills. The presentations on various topics develop students' public speaking and communication skills.

Objective of Course

In the first year, there will be two courses in Statistics per semester. The following are the objectives of these courses:

1. To understand various data types and to learn visualization techniques.
2. To enable learners to summarize data quantitative and graphical methods.
3. To enable learners with concepts of probability and probability distributions
4. To equip learners with requisite quantitative techniques.
5. To develop learner's presentation and communication skills.

Learning Outcomes

1. Learners will be able to visualize data using elementary graphs and diagrams and will be able to apply appropriate measures for quantitative and qualitative data.
2. Learners will be able to choose and apply an appropriate statistical analysis or modeling methods to solve problems arising in different fields.
3. Learners will be able to use statistical tools to solve problems from different fields.
4. Learners will be able to engage in interpretation of wide range of information from variety of disciplines including quantitative analysis.

SEMESTER I

Title of Course	DESCRIPTIVE STATISTICS I				
Course Code	**UNIT**	**TOPICS**	**Credits**	**L / Week**	
RUSSTA101	I	Types of Data and Data Condensation	2	1	
	II	Measures of central tendency		1	
	III	Measures of Dispersion, Skewness & Kurtosis		1	
Title of Course	**STATISTICAL METHODS - I**				
RUSSTA102	I	Elementary Probability Theory	2	1	
	II	Discrete random variable		1	
	III	Some Standard Discrete Distributions		1	
RUSSTAP101	Practical based on courses above		2	6	

SEMESTER II

Title of Course	DESCRIPTIVE STATISTICS II				
Course Code	**UNIT**	**TOPICS**	**Credits**	**L / Week**	
RUSSTA201	I	Correlation and Regression Analysis	2	1	
	II	Time Series		1	
	III	Index Numbers		1	
Title of Course	**STATISTICAL METHODS – II**				
RUSSTA202	I	Continuous random variable and Standard Continuous Distribution	2	1	
	II	Normal Distribution		1	
	III	Elementary topics on Estimation and Testing of hypothesis		1	
RUSSTAP201	Practical based on courses above		2	6	

COURSE RUSSTA101: DESCRIPTIVE STATISTICS I

Unit I - Types of Data and Data Condensation: • **Global Success stories of Statistics/Analytics in various fields.** • Concept of Population and Sample. Finite, Infinite Population, Notion of SRS, SRSWOR and SRSWR • Different types of scales: Nominal, Ordinal, Interval and Ratio. • Methods of Data Collection: i) Primary data: concept of a Questionnaire and a Schedule, ii) Secondary Data • Types of data: Qualitative and Quantitative Data; Time Series Data and Cross Section Data, Discrete and Continuous Data • Tabulation • Dichotomous classification- for two and three attributes, Verification for consistency • Association of attributes: Yule's coefficient of association Q. Yule's coefficient of Colligation Y, Relation between Q and Y (with proof). • Univariate frequency distribution of discrete and continuous variables. Cumulative frequency distribution • Data Visualization: Graphs and Diagrams: Histogram, Polygon/curve, Ogives. Heat Map, Tree map. • Bivariate Frequency Distribution of discrete and continuous variables	15 Lectures
Unit II–Measures of central tendency • Concept of central tendency of data, Requirements of good measures of central tendency. • Location parameters : Median, Quartiles, Deciles, and Percentiles • Mathematical averages Arithmetic mean (Simple, weighted mean, combined mean), Geometric mean, Harmonic mean, Mode, Trimmed mean. • Empirical relation between mean, median and mode • Merits and demerits of using different measures & their applicability.	15 Lectures
Unit III - Measures of Dispersion, Skewness & Kurtosis • Concept of dispersion, Requirements of good measure • Absolute and Relative measures of dispersion: Range, Quartile Deviation, Inter Quartile Range, Mean absolute deviation, Standard deviation. • Variance and Combined variance, raw moments and central moments and relations between them. Their properties • Concept of Skewness and Kurtosis: Measures of Skewness: Karl Pearson's, Bowley's and Coefficient of skewness based on moments. Measure of Kurtosis. Absolute and relative measures of skewness. • Box Plot: Outliers	15 Lectures

COURSE RUSSTA102: STATISTICAL METHODS - I

UNIT – I: Elementary Probability Theory - Trial, random experiment, sample point and sample space. - Definition of an event, Operation of events, mutually exclusive and exhaustive events. - Classical (Mathematical) and Empirical definitions of Probability and their properties. - Theorems on Addition and Multiplication of probabilities - Independence of events, Pair-wise and Mutual Independence for three events, Conditional probability, Bayes' theorem and its applications	15 Lectures
UNIT – II: Discrete random variable - Random variable. Definition and properties of probability distribution and cumulative distribution function of discrete random variable. - Raw and Central moments and their relationships. - Concepts of Skewness and Kurtosis and their uses. - Expectation of a random variable. Theorems on Expectation & Variance. Concept of Generating function, Moment Generating function, Cumulant generating function, Probability generating function - Joint probability mass function of two discrete random variables. Independence of two random variables. - Marginal and conditional distributions. Theorems on Expectation &Variance, - Covariance and Coefficient of Correlation.	15 Lectures
UNIT – III: Some Standard Discrete Distributions - Degenerate (one point) :-Discrete Uniform, Bernoulli, Binomial, Poisson and Hypergeometric distributions derivation of their mean and variance for all the above distributions. - Moment Generating Function and Cumulant Generating Function of Binomial and Poisson distribution. - Recurrence relationship for probabilities of Binomial and Poisson distributions, Poisson approximation to Binomial distribution, Binomial approximation to hypergeometric distribution.	15 Lectures

COURSE RUSSTA201: DESCRIPTIVE STATISTICS II

UNIT – I: Correlation, Simple linear Regression Analysis and Fitting of curves • Visualizing relationship using Bubble chart, Scatter Diagram, • Karl Pearson's Product moment correlation coefficient and its properties. • Spearman's Rank correlation.(With and without ties) • Concept of Simple linear regression. Principle of least squares. Fitting a straight line by method of least squares (Linear in Parameters) • Relationship between regression coefficients and correlation coefficient, cause and effect relationship, Spurious correlation. • Concept and use of coefficient of determination (R^2). • Measures of association with the help of Tau A, Tau B, Tau C, Gamma and Lambda, Somer's d • Fitting of curves reducible to linear form by transformation.	15 Lectures
UNIT – II : Time Series • Definition of time series. Components of time series. Models of time series. • Estimation of trend by: (i) Freehand Curve Method (ii) Method of Semi Average (iii)Method of Moving Average (iv) Method of Least Squares (Linear Trend only) • Estimation of seasonal component by i) Method of Simple Average ii) Ratio to Moving Average iii)Ratio to Trend Method • Simple exponential smoothing • Stationary Time series	15 Lectures
Unit - III : Index Numbers • Index numbers as comparative tool. Stages in the construction of Price Index Numbers. • Measures of Simple and Composite Index Numbers. Laspeyre's, Paasche's, Marshal-Edgeworth's, Dobisch & Bowley's and Fisher's Index Numbers formula • Quantity Index Numbers and Value Index Numbers Time reversal test, Factor reversal test, Circular test • Fixed base Index Numbers, Chain base Index Numbers. Base shifting, splicing and deflating • Cost of Living Index Number. Concept of Real Income.	15 Lectures

COURSE RUSSTA202: STATISTICAL METHODS – II

UNIT – I: Continuous random variable and some Standard Continuous Distributions • Concept of Continuous random variable and properties of its probability distribution • Probability density function and cumulative distribution function. • Their graphical representation. • Expectation of a random variable and its properties. Concept of M.G.F. and C.G.F. characteristics. Measures of location, dispersion, skewness and kurtosis. • Raw and central moments (simple illustrations). • Uniform, Exponential distribution (location and scale parameter), memory less property of exponential distribution, • Derivations of mean, median, variance, MG.F. and C.G.F. for Uniform and Exponential distributions.	15 Lectures
UNIT – II: Normal Distribution and Sampling Distribution • Normal distribution • Properties of Normal distribution/curve (without proof). Use of normal tables. • Normal approximation to Binomial and Poisson distribution (statement only) • Sample from a distribution: Concept of a statistic, estimate and its sampling distribution. Parameter, its estimator and bias, unbiasedness, standard error of an estimator. • Concept of Central Limit theorem (statement only) • Sampling distribution of sample mean and sample proportion difference between two population means and two proportions. • Standard errors of sample mean and sample proportion.	15 Lectures

UNIT – VI: Basics of Theory of Estimation and Testing of hypothesis
• Point and Interval estimate of single mean, single proportion from sample of large size.
• Statistical tests: Concept of hypothesis, Null and Alternative Hypothesis, Types of Errors, Critical region, Level of significance, Power
• Large sample tests
    For testing specified value of population mean
    For testing specified value in difference of two means
    For testing specified value of population proportion
    For testing specified value of difference of population proportion
• Concept of p-value
	15 Lectures

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4 Kothari C.R.:"Research Methodology", Wiley Eastern Limited.
5 David S.:"Elementary Probability", Cambridge University Press.
6 Hoel P.G.:"Introduction to Mathematical Statistics", Asia Publishing House.
7 Hogg R.V. and Tannis E.P.:"Probability and Statistical Inference". McMillan Publishing Co. Inc.
8 PitanJim:"Probability", Narosa Publishing House.
9 Goon A.M., Gupta M.K., Dasgupta B.:"Fundamentals of Statistics", Volume II: The World Press Private Limited, Calcutta.
10. Gupta S.C., Kapoor V.K.: "Fundamentals of Mathematical Statistics", Sultan Chand &Sons
11. Gupta S.C., Kapoor V.K.: "Fundamentals of Applied Statistics", Sultan Chand & Sons

Distribution of topics for Practicals in Semester I

Course Code RUSSTAP101(A)		Course Code RUSSTAP101(B)	
Sr. No.	Practicals based on course	Sr. No.	Practicals based on course
1	Tabulation	1	Probability
2	Classification of Data	2	Discrete Random Variables
3	Attributes	3	Bivariate Probability Distributions
4	Diagrammatic representation	4	Binomial Distribution
5	Measures of central tendency	5	Poisson Distribution
6	Measures of dispersion	6	Hypergeometric Distribution
7	Practical using Excel and R i) Classification of Data and Diagrammatic representation ii) Measures of central tendency iii) Measures of dispersion	7	Practical using Excel and R i) Binomial distribution ii) Poisson distribution iii) Hypergeometric distribution

Distribution of topics for Practicals in Semester II

Course Code RUSSTAP201(A)		Course Code RUSSTAP201(B)	
Sr. No.	Practicals based on course	Sr. No.	Practicals based on course
1	Correlation analysis	1	Continuous Random Variables
2	Regression analysis	2	Uniform and Exponential Distributions
3	Fitting of curve	3	Normal Distribution
4	Time series	4	Sampling Distribution
5	Index number-I	5	Testing of Hypothesis
6	Index number-II	6	Large sample Tests
7	Practical using Excel and R i) Correlation analysis ii) Regression analysis iii) Fitting of curve	7	Practical using Excel and R i)Uniform and Exponential ii)Normal Distribution iii) Sampling Distribution iv) Testing of Hypotheses v) Large sample Tests

THEORY
Internal Assessment of Theory Core Courses Per Semester Per Course
1. One Class Test/ Project / Assignment / Presentation ..……..20 Marks.
2. One Class Test / Project / Assignment / Presentation ………20 Marks.

Semester End Examination

Theory: At the end of the semester, examination of two hours duration and 60 marks based on the three units shall be held for each course.

Pattern of **Theory question** paper at the end of the semester for **each course:**

There shall be THREE COMPULSORY Questions of 20 marks each (Internal Option).

Question1 based on Unit I, Question 2 based on Unit II, Question 3 based on Unit III.

PRACTICAL
Internal Assessment of Practical Core Courses per Semester per course
1. One Class Test ……. ..15 Marks.
2. Journal ……. ..05 Marks.

Practical Core Courses per Semester per course
1. Practical Examination ………30 Marks.

At the end of the semester, examination of one and half hours duration and 30 marks shall be held for **each course**.

Pattern of **Practical question** paper at the end of the semester for **each theory course**:

There shall be **Three** COMPULSORY Questions with internal choice.

Workload
Theory: 3 lectures per week per course.

Practicals: 3 lecture periods per course per week per batch. All three lecture periods of the practicals shall be conducted in succession together on a single day.

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