RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS
as per the Choice Based Credit System (CBCS)
designed in accordance with
Learning Outcomes-Based Curriculum
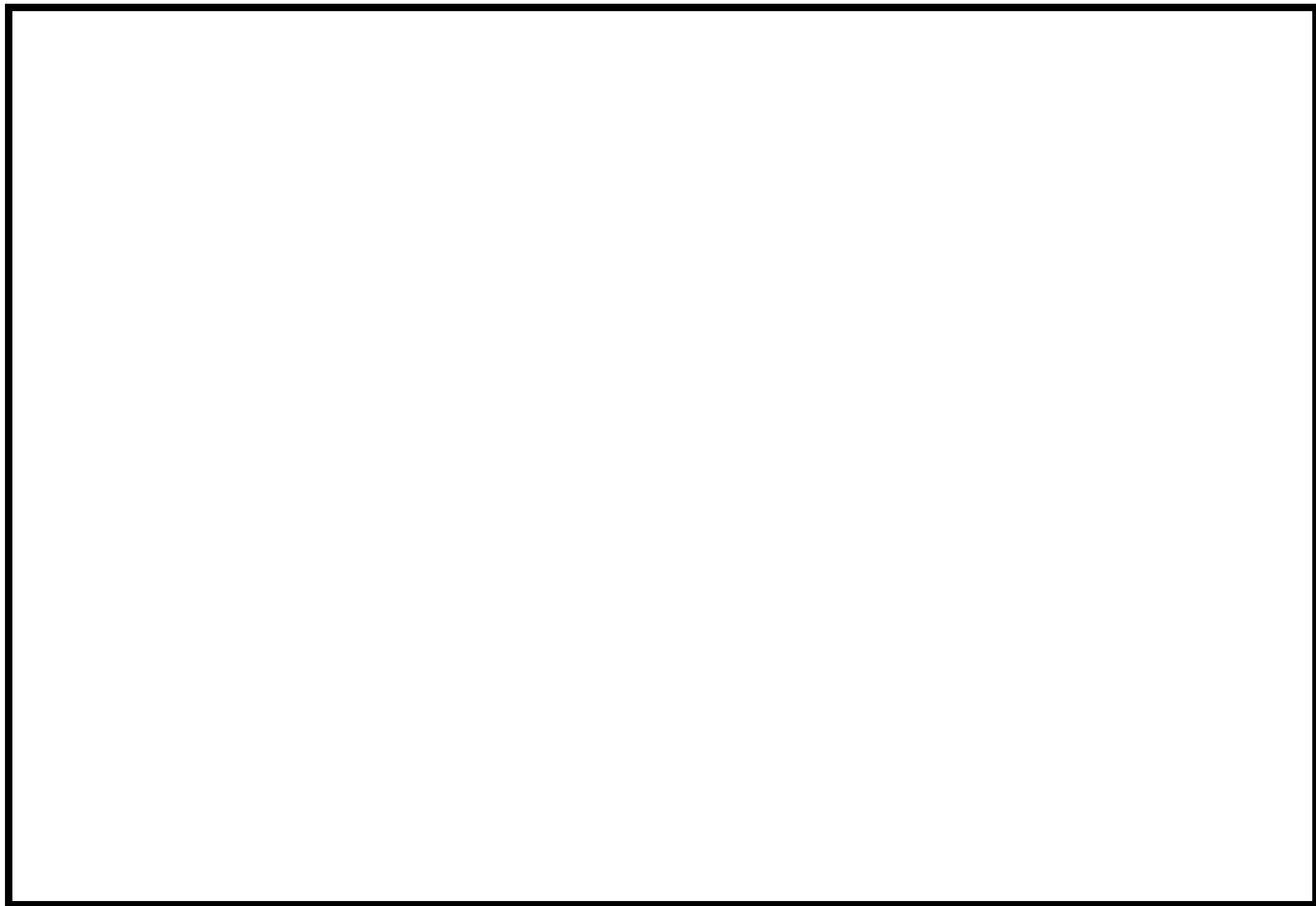Framework (LOCF) of National Education Policy
(NEP) 2020
for

B.A. Statistics

Academic Year 2021-22 and onwards

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BOS COMMITTEE (NEP- GEOGRAPHY)
B.A./B.Sc. STATISTICS PROGRAM 2021-22

1	**Prof. V. S. Shigehalli** **Department of Mathematics, RCU Belagavi**	Chairman
2	**Prof. S. M. Hancihnal** Anjuman Arts, Science and Commerce College Vijaypur	Member
3	**Prof. P. S. Chanagond** S S Mamadapur Science College Badami	Member
4	**Prof. S. M. Hiremath** KRCES GGD and BMP Commerce and SVS Science College Baihongal	Member
5	**Dr. Prakash R Kengnal** STC Arts and Commerce College, Banhatti	Member

Preamble

Several reforms in our education system has been proposed and developed by Ministry of HRD as National Education Policy (NEP)2020 which includes broad based multidisciplinary undergraduate education with necessary knowledge, skills and competencies. It also proposes to bring equity, efficiency and academic excellence at different levels of education. NEP also recommended multidisciplinary undergraduate programmes with multiple exit and multiple entry options with the provision of Certificate/Diploma/Degrees at each of the exits.

Probability and Statistics is the language of uncertainties, riddled modern information age. Statistics facilitates the decision making process by quantifying the element of chance or uncertainties. Its descriptive and inferential procedures not only formulate the basis of the growth of almost all disciplines of the contemporary world, and also provide an array of employment avenues in all fields. This is a rigorous program in Probability Theory , Statistical Inference, Multivariate Analysis, Linear Models and Regression Analysis and Sample surveys and Design of Experiments designed to give a sound foundation in fundamentals and training in practical Statistics leading to statistical data analysis. The six semester 166 credit program has a variety of elective courses to choose from including enough courses on statistical software. A person successfully completing the program will have enough knowledge and expertise to statistically analyze small and large univariate and multivariate data sets, work in software/data analytics industry as domain expert, independently consult for statistical data analysis. The program has proved to be one of the best in traditional Indian Universities/Institutes and has demand from students within and outside the State/Country.

Syllabus & Regulations Governing the Choice-Based Credit System (CBCS) for the Three-Years (Six Semesters) Bachelor of Arts (B.A

With Applied Statistics as Minor without practicals & other course as Major without practicals Program Structure

MODEL CURRICULUM

Degree Program: B.A. Degree

Discipline Core: Statistics   **Total Credits for the Program:** 136 (till 6th Semester)

Program Outcomes

By the end of the program the students will be able to:

1. Acquire fundamental/systematic or coherent understanding of the academic field ofStatistics and its different learning areas and applications.

2. Develop and demonstrate an ability to understand major concepts in variousdisciplines of Statistics.

3. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applyingappropriate principles and methodologies to solve a wide range of problems associatedwith Statistics.

4. Understand procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public serviceand private sectors.

5. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findingsof the experiment/investigations.

6. Have a knowledge regarding use of data analytics tools like Excel and R-programming.

7. Developed ability to critically assess a standard report having graphics, probabilitystatements.

8. Analyze, interpret the data and hence help policy makers to take a proper decision.

9. Recognize the importance of statistical modelling and computing, and the role of approximation and mathematical approaches to analyze the real problems using variousstatistical tools.

10. Demonstrate relevant generic skills and global competencies such as

    (i) Problem-solving skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle   open-ended problems, that belong to the disciplinary-area boundaries;

    (ii) Investigative skills, including skills of independent thinking of Statistics-related issues and problems;

    (iii) Communication skills involving the ability to listen carefully, to read texts and reference material analytically and to present   information in a concise manner to different groups/audiences of technical or popular nature;

    (iv) Analytical skills involving paying attention to details and ability to construct logical Arguments using   correct   technical language related to   Statistics and ability to translate

them with popular language when needed; ICT skills;

    (v)   Personal skills such as the ability to work both independently and in a group.

11.   Undertake research projects by using research skills- preparation of questionnaire, conducting national sample survey, research projects using sample survey, sampling techniques.

12. Understand and apply principles of least squares to fit a model to the given data, study the association between the variables, applications of Probability Theory and Probability Distributions.

RANI CHANNAMMA UNIVERSITY
VIdyaSangam, NH-4, Belagavi. -591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Statistics Discipline Scheme for the four Years Statistics B.A. Undergraduate Honors Programme with effect from 2021-22

B.A. SEMESTER-I

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L1	21BAL1LK1	Kannada	40	60	100	4	-	-	3	2
	21BAL1LFK1	Functional Kannada								
L2	21BA1L2LEN2	English	40	60	100	4	-	-	3	2
	21BAL2LHI2	Hindi								
	21BA1L2LSN2	Sanskrit								
	21BA1L2LTE2	Telugu								
	21BA1L2LUR2	Urdu								
DSC1	21BA1STSDSCT1	Descriptive Statistics – I	40	60	100	3	-	-	3	2
	21BA1STSDSCP1	Descriptive Statistics – I	30	70	100	3	-	-	3	2
DSC1	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
SEC1	21BA1SE1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BA1V1PE1	Physical Education- Yoga	25	-	25	-	-	2	1	-
VBC2	21BA1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC	21BA1STSOECT1	Statistics in Competitive Examinations	40	60	100	3	-	-	3	2
		Total Marks		**800**		**Semester Credits**			**25**	

B.A. SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BA2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BA2L3FKL2	Functional Kannada								
L4	21BA2L4EN2	English	40	60	100	4	-	-	3	2
	21BA2L4HI2	Hindi								
	21BA2L4SN2	Sanskrit								
	21BA2L4TE2	Telugu								
	21BA2L4UR2	Urdu								
DSC2	21BA1STSDSCT2	Probability and Distributions	40	60	100	3	-	-	3	2
	21BA1STSDSCP2	Statistics for Economics	40	60	100	3	-	-	3	2
DSC2	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
AECC1	21BA2AE1ES2	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BA2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BA2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BA1STSDSCT1	Statistical Methods	40	60	100	3	-	-	3	2
		Total Marks	800			Semester Credits			25	

B.A. SEMESTER-III										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L5	21BA3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BA3L5LFK3	Functional Kannada								
L6	21BA3L6EN3	English	40	60	100	4	-	-	3	2
	21BA3L6HI3	Hindi								
	21BA3L6SN3	Sanskrit								
	21BA3L6TE3	Telugu								
	21BA3L6UR3	Urdu								
DSC3	21BA1STSDSCT3	Exact Sampling Distributions and Statistical Inference	40	60	100	3	-	-	3	2
	21BA1STSDSCP3	Sampling Techniques	40	60	100	3	-	-	3	2
DSC3	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
SEC2	21BA3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BA3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BA3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BA1STSDSCT3	Business Statistics	40	60	100	3	-	-	3	2
		Total Marks	800			Semester Credits			25	

B.A. SEMESTER-IV

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BA4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BA4L7LFK4	Functional Kannada								
L8	21BA4L8EN4	English	40	60	100	4	-	-	3	2
	21BA4L8HI4	Hindi								
	21BA4L8SN4	Sanskrit								
	21BA4L8TE4	Telugu								
	21BA4L8UR4	Urdu								
DSC4	21BA1STSDSCT4	ANOVA and Design of Experiments	40	60	100	3	-	-	3	2
	21BA1STSDSCP4	Regression Analysis and Econometrics	40	60	100	3	-	-	3	2
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			40	60	100	-	-	4	2	2
AECC2	21BA4AE1ES2	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BA4V5PE4	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC8	21BA4V6NC3	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC4	21BA1STSDSCT4	Quantitative Aptitude	40	60	100	3	-	-	3	2
		Total Marks	800			Semester Credits	25			

B.A. SEMESTER-V

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
STATISTICS AS A MINOR										
DSC5	**21BA1STSDSCP5**	**Statistical Quality Control**	**40**	**60**	**100**	**4**	**-**	**-**	**3**	**2**
DSC5	Another Department Code as a Major Subject	Another Department Course Title	40	60	100	4	-	-	3	2
			40	60	100	4	-	4	2	2
DSE1	Another Department	Another Department Course Title	40	60	100	3	-	4	2	2
VC1 (Any one)	21BA5VCGEG5.1A	Basics of Map Making	40	60	100	3	-	-	3	2
	21BA5VCGEG5.1B	Mobile Asset Mapping								
VBC9	21BA5V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC10	21BA5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BA5SE3CS3	Cyber Security	25	25	50	1	-	2	2	2
			Total Marks		600	Semester Credits			22	

B.A. SEMESTER-VI

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
STATISTICS AS MINOR										
DSC6	21BA1STSDSCP6	Operations Research	40	60	100	4	-	-	3	2
DSC6	Another Department Code as a Major Subject	Another Department Course Title	40	60	100	4	-	-	3	2
			40	60	100	4	-	4	2	2
DSE2	Another Department Code	Another Department Course Title	40	60	100	3	-	4	2	2
VC2 (Any one)	21BA6VCGEG6.1A	Open Source GIS	40	60	100	3	-	-	3	2
	21BA6VCGEG6.1B	Landscape and Layout Mapping								
INT1	21BA6 INT1L	Internship	25	50	75	-	-	2	2	2
VBC1	21BA6V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC2	21BA6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BA6SE4CS4	Professional Communication	25	25	50	1	-	2	2	2
		Total Marks	675			Semester Credits		24		
		Total Marks for BA Program	4475			Total Credits for BA Program		136		

Semester 1

Course Title: B.A	
Total Contact Hours: 42	Course Credits:3
Formative Assessment Marks: 40	Duration of ESA/Exam: 2hours
	Summative Assessment Marks: 60

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Organize, manage and present data.	X	X		X								
2. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.	X						X					
3. Analyze statistical data using measures of central tendency, dispersion.				X				X		X		
4. Understand Skewness and Kurtosis and their use in studying various characteristics of data.			X									
5. Know concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient.			X									
6. Carryout spatial analysis.							X					
7. Understand the Price and Quantity Index numbers and their different measures, understand the applicability of cost of living Index number.									X	X		
8. Know the components and Need for Time series, understand the different methods of studying trend and Seasonal Index.	X								X	X		
9. Solve problems of economics concerns using demand analysis, supply functions, Gini's coefficient and Lorenz Curve.									X	X		
10. Understand basic concepts, important theorems on probability and their use in solving problem.											X	

11.Know random variable, mathematical expectation, and numerical problems on mathematical expectation.	X										X	
12. Understand the most common discrete and continuous probability distributions										X		

and their real life applications.													
13. Understand the nature of data and to perform appropriate analysis.												X	X
14. Carry out time series analysis and predict the future values of given trend.												X	X
15. Analyze the Seasonal Indies by using different methods.	X												X	X

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

<center>BA Semester 1</center>

Title of the Course: Applied statistics

Course 1: Descriptive Statistics-I		Course 2:Descriptive Statistics-II	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	42	3	42

Content of Course 1: Descriptive Statistics-I	**42 Hrs**
Unit – 1 :Introduction to Statistics and Basic Concepts	**12 Hrs**
Meaning, origin, definition, functions, limitations and applications of Statistics. Primary and secondary data, different methods of collection of primary data with merits and demerits. Sources of secondary data. Classification: meaning, objectives, types of classifications- Chronological, Geographical, Qualitative and Quantitative classifications with illustrations. Definition of some important terms - class, class limits, class intervals, width of class interval, open-end classes, inclusive and exclusive classes. Formation of discrete and continuous frequency distributions. Tabulation: meaning, objectives and rules of tabulation, format of a statistical table and its parts. Types of table, examples of preparation of a blank table and tables with numerical information.	
Unit – 2 :Diagrammatic and Graphical representation of Data	**10 Hrs**
Diagrams: Meaning, importance of diagrams and general rules of construction of diagrams. Types of Diagrams – simple, multiple, component, percentage bar diagrams and pie diagrams with simple illustrations. Graphs: Types of Graphs – Histogram, frequency Polygon, frequency curve and Ogives, simple problems, location of mode, median and partition values from the graphs. Difference between diagrams and graphs.	

Unit – 3:Measures of Central Tendency	10 Hrs
Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency: Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures. Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only.	
Unit – 4:Measures of Dispersion	**10 Hrs**
Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data. **Skewness and Kurtosis:** Skewness- Definition, objectives and types of skewness, explanation of positive and negative skewness with diagrams. Measures of skewness- Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness. Simple problems. Kurtosis: Definition and types of kurtosis. Explanation of types of kurtosis with neat diagrams. Measure of skewness based on moments. Difference between skewness and kurtosis.	

References

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay

3. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

4. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Content of Course 2:Descriptive Statistics-II	42 Hrs
Unit – 1 :Correlation	**12 Hrs**
Definition of relationship, Definition, Types of correlation, Methods of measuring correlation, Scatter diagram, Correlation Coefficient for quantitative data: Prof. Karl Pearson's coefficient of linear correlation, its properties, Correlation Coefficient for qualitative data: Spearman's rank correlation coefficient, its properties. Simple regression analysis- regression equations by method of least squares, linear regression coefficients and its properties. Angle between the regression lines.	
Unit – 2: Association of Attributes	**10 Hrs**
Meaning of association of attributes, definition of class of the first order and second order. Methods of studying association. Yule's coefficient of association and its interpretation. Determination of Yule's coefficient of association in case of two attributes.	
Unit – 3: Spatial Statistics	**10 Hrs**
History and introduction, spatial characterization, spatial dependence, spatial auto correlation, spatial association, spatial scaling, spatial sampling, errors in spatial analysis.	
Unit:4: Multivariate data Analysis	**10 Hrs**
Introduction: Yule's notations, distribution of two variables, distribution of three or more variables, primary and secondary subscripts, Plane of regression and its derivation, estimation of regression coefficients a and b in case of three variables, partial regression coefficient in terms of delta, Residual, properties of residuals, Standard deviation of residuals, Multiple and partial correlation, definition, derivation and their standard properties.	

References

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). The New Statistical Analysis of Data, Springer
3. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
4. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.
5. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay
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BA Semester 2 Title of the

Course: Applied Statistics

Course 3: Statistics for Economics		Course 4:Probability and Distributions	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	42	3	42

Content of Course 3: Statistics for Economics	42 Hrs
Unit – 1 :Supply and Demand	**10 Hrs**
How Markets Work, Markets and Welfare Markets and competition; determinants of individual demand/supply; demand/supply schedule and demand/supply curve; market versus individual demand/supply; shifts in the demand/supply curve, demand and supply together; how prices allocate resources; elasticity and its application; controls on prices; taxes and the costs of taxation; consumer surplus; producer surplus and the efficiency of the markets.	
Unit – 2:Measuring income inequality: Lorenz curve & Gini Coefficient	**10 Hrs**
Measuring income inequality: Pareto law of Distribution, Lorenz curve and Gini's Coefficient, Limitations and interpretations of GC.	
Unit – 3:Index numbers	**12 Hrs**

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test, factor reversal test, and Circular test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.	
Unit 4:Time Series Analysis	**10 Hrs**
Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.	

References

1. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay

2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi.

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2. Students are encouraged to use resources available on open sources.

Content of Course 4: Probability and Distributions	42 Hrs
Unit – 1 :Introduction to Probability	**10 Hrs**
Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.	
Unit – 2:Random Variable and Mathematical Expectation	**10 Hrs**
Definition of a random variable, discrete & continuous random variable, probability mass function, probability density function, distribution function. Definition of mathematical expectation, expected mean and variance of discrete random variable. Properties of Mathematical expectation. Statement of addition and multiplication theorem of expectation. Numerical problems on mathematical expectation.	
Unit – 3:Discrete Distributions	**12 Hrs**
Binomial Distribution: Definition of Binomial Distribution, mean and Variance of Binomial distribution, numerical problems on binomial distribution. Uses of binomial distribution. Fitting of Binomial distribution and obtaining expected probabilities. Simple problems. **Poisson Distribution:** Definition of Poisson distribution. Mean, Variance and its properties of Poisson variate. Uses of Poisson distribution. Simple problems on Poisson distribution. Computing probabilities for large n and small p for the given λ, finding λ for given two successive probabilities. Conditions for Poisson distribution as limiting form of Binomial distribution. Fitting of Poisson distribution.	
Unit – 4 : Normal Distribution	**10 Hrs**
Definition of normal variate. Application of Normal distribution Definition of standard normal variate, standard normal distribution and properties of normal curve. Conditions under which binomial distribution tend to normal distribution (Statement only). Finding probabilities and expected numbers when mean and variance are given quartile deviation, mean deviation and standard deviation and problems.	

References

1. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay

2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd., Calcutta

3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi.

4. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Pedagogy

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Formative Assessment: 40 marks	
Assessment Occasion/ type	**Weightage in marks**
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment/Seminar (7 marks)+Attendance(3marks)	10
Total	40

RANI CHANNAMMA UNIVERSITY
Department of Statistics

I Semester B.A Statistics

Sub: **Code:**   **Maximum Marks: 60**

    a.   **Answer any Six Questions from Question 1**   **b. Answer any Three each Questions from Question 2,3,4and 5**

Q.No.1.	Answer any Six Questions (At least Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit-I)a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II)a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III)a.	4X3=12
	b. c. d.	
Q.No.5.	(Should cover Entire Unit-IV)a. b. c. d.	4X3=12

List of Open Electives

1. Statistics in Competitive Examinations

2. Statistical Methods

3. Business Statistics

4. Quantitative Aptitude

Course Objectives

To train the students to solve the problems of statistics that appear in most of the competitive exams conducted by Banking, State and Central Governments and other agencies.

Course Outcomes (CO)

After the successful completion of the course, the students will be able to develop the data analysis skills required for Competitive Examinations.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Contents

Unit 1: Collection Classification and Presentation of Statistical Data   **(6 hours)**

Primary and Secondary data, Methods of data collection; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of frequency distributions.

Unit 2: Measures of Central Tendency and Dispersion   **(12 hours)**

Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency, Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures.

Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only.

Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of

dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.

Unit 3: Aptitude Ability and Reasoning **(14 hours)**

Area, Banker's Discount, Surds and Indices, Ratio and Proportion, Simple Interest, Problems on Trains, Profit and Loss, Compound Interest.

Reasoning: Number series, Analogy, Classifications, Blood relations Coding-decoding, Puzzle test, Logical Venn diagram. Alphabet-test, Alpha-numerical sequence puzzle, Mathematical operations, Numbers, ranking & time sequence test, Logical sequence test, Arithmetical operations.

Unit 4: Introduction to Probability (10 hours)

Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.

References

1. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay.
3. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Course Objectives

This is an open elective course for social science and life science students.
The students will learn the elements of descriptive statistics, probability, statistical
methods such as tests of hypotheses, correlation and regression.

Course Outcomes (CO)

Students will be able to

CO1. Acquire the knowledge of statistical methods.

CO2.Identify types of data and visualization, analysis and interpretation.

CO3.Know about elementary probability and probability models.

CO4.Employ suitable test procedures for given data set.

Pedagogy

The course is taught using traditional chalk and talk method using problem solving
through examples and exercises. Students are encouraged to use resources available on
open sources.

Contents

Unit 1: Introduction **(10 Hours)**

Definition and scope of Statistics. Data: quantitative and qualitative, attributes, variables, scales of
measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram
and ogives. Concepts of statistical population and sample. Sampling from finite population - Simple random
sampling, Stratified and systematic random sampling procedures (definitions and methods only). Concepts
of sampling and non-sampling errors.

Unit 2: Univariate and Bivariate Data Analysis **(10 Hours)**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile
deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.
Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation.

Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Unit 3: Probability and Distributions   (12 Hours)

Probability: Random experiment, trial, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable.

Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

Unit 4: Sampling Distributions and Testing of Hypothesis   (10 Hours)

Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications.

Statistical Hypothesis – null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation.

Test for single mean, equality of two means, single variance, and equality of two variances for normal populations.

References

1. Daniel, W. W. (2007 Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley

2. T.W. Anderson and Jeremy D. Finn(1996). The New Statistical Analysis of Data, Springer.

3. MukhyopadyayaP(1999). Applied Statistics, New Central book Agency , Calcutta.

4. Ross,S.M.(2014) Introduction to Probability and Statistics For Engineers and Scientists.

5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, New Delhi.

Course Objectives

1. Provide an introduction to basics of statistics within a financial context.
2. To enable students to use statistical techniques for analysis and interpretation of business data.

Course Outcomes (CO)

Upon the completion of this course students should be able to:

CO1.Frame and formulate management decision problems.

CO2.Understand the basic concepts underlying quantitative

analysis.

CO3.Use sound judgment in the applications of quantitative methods to management decisions.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Contents

Unit 1: Statistical Data and Descriptive Statistics   (12 hours)
Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross- sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles). Measures of Variation: absolute and relative. Range,

quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit 2: Simple Correlation and Regression Analysis (10 Hours) Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; Rank Correlation.

Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

Unit 3: Index Numbers (10 hours)

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.

Unit 4: Time Series Analysis (10 hours)

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time

series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

References

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.

2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K.Viswanathan, Business Statistics: A First Course, Pearson Education.

3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education.

4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chandand Sons, New Delhi.

5. Vohra N. D., Business Statistics, McGraw Hill Education.

6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc Graw Hill Education.

7. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.

8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

Course Objective

To train the students in the aspects of numerical ability, reasoning techniques and mental ability for competitive examinations conducted by various public and private boards.

Course Outcomes (CO)

After the successful completion of the course, the students will be able to develop the general skills required to Competitive Examinations.

Pedagogy

Activity based teaching and learning along with theoretical aspects using classroom teaching, group discussions and seminars.

Contents

Unit 1: Numerical Aptitude I   (10 hours)

Number Systems, Computation of Whole Numbers, Decimals and Fractions and relationship between Numbers, Fundamental arithmetical operations.

Unit 2: Numerical Aptitude II   (12 hours)

Percentages, Ratios and Proportions, Average, interest, Profit and Loss, Discount use of Tables and Graphs Time and Distance, Ratio and Time, Time and Work.

Unit 3: Reasoning and Mental Ability I   (10 hours)

Coding-Decoding, Symbol notations, Number Series, Analogy & Classification , Blood relations, Direction Sense, Liner arrangement.

Unit 4: Reasoning and Mental Ability II   (10 hours)

Ranking and Comparison, Input & output, Assumptions, Conclusion & Inferences.

References:

1. Aggarwal R.S., Quantitative Aptitude: by, Publication by S, Chand
2. Ningappa A H ,Mental Ability: Ashok Publication.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS

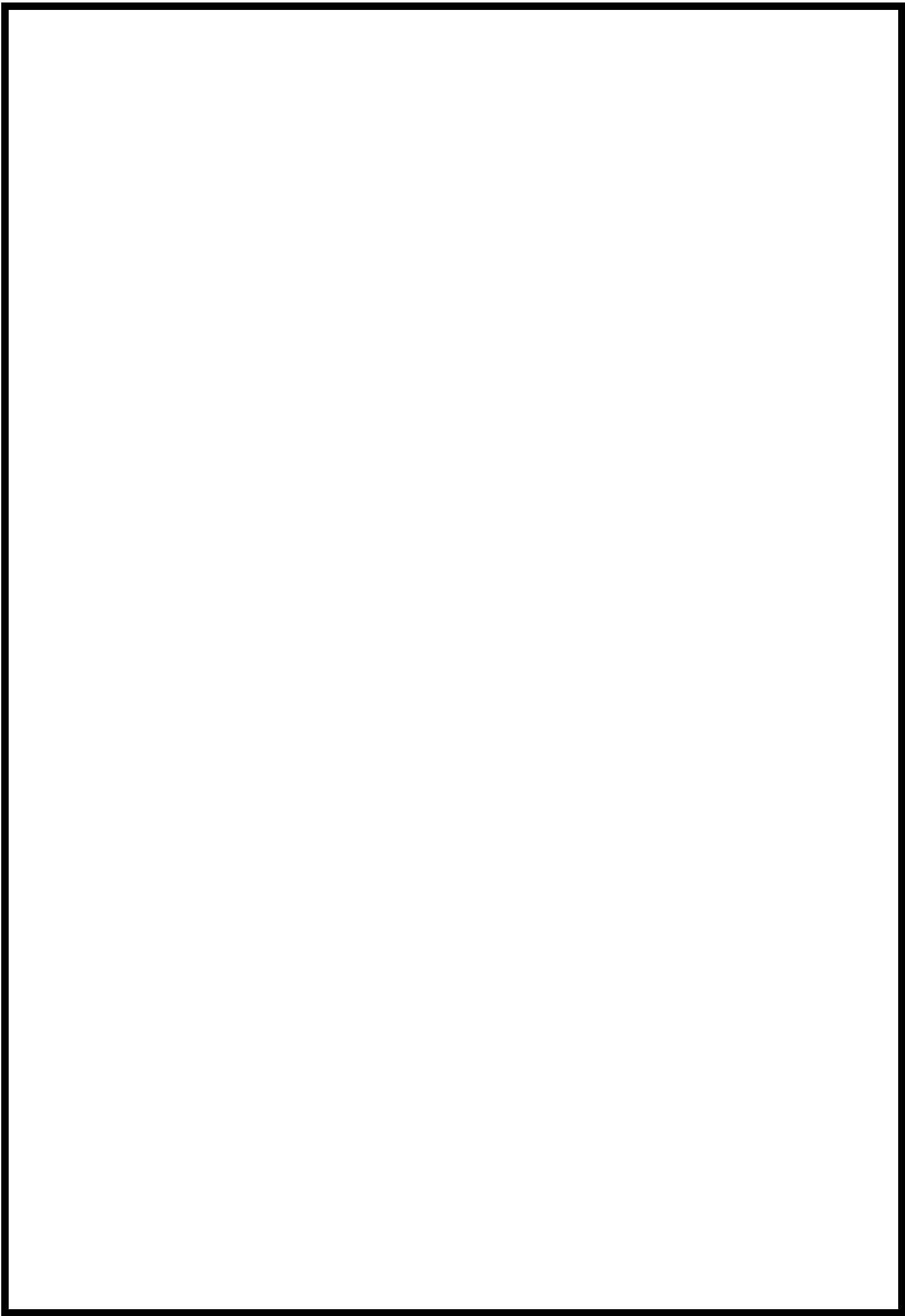as per the Choice Based Credit System (CBCS) designed in accordance with

Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

for

B.A. Statistics

Academic Year 2021-22 and onwards

RANI CHANNAMMA UNIVERSITY, BELAGAVI

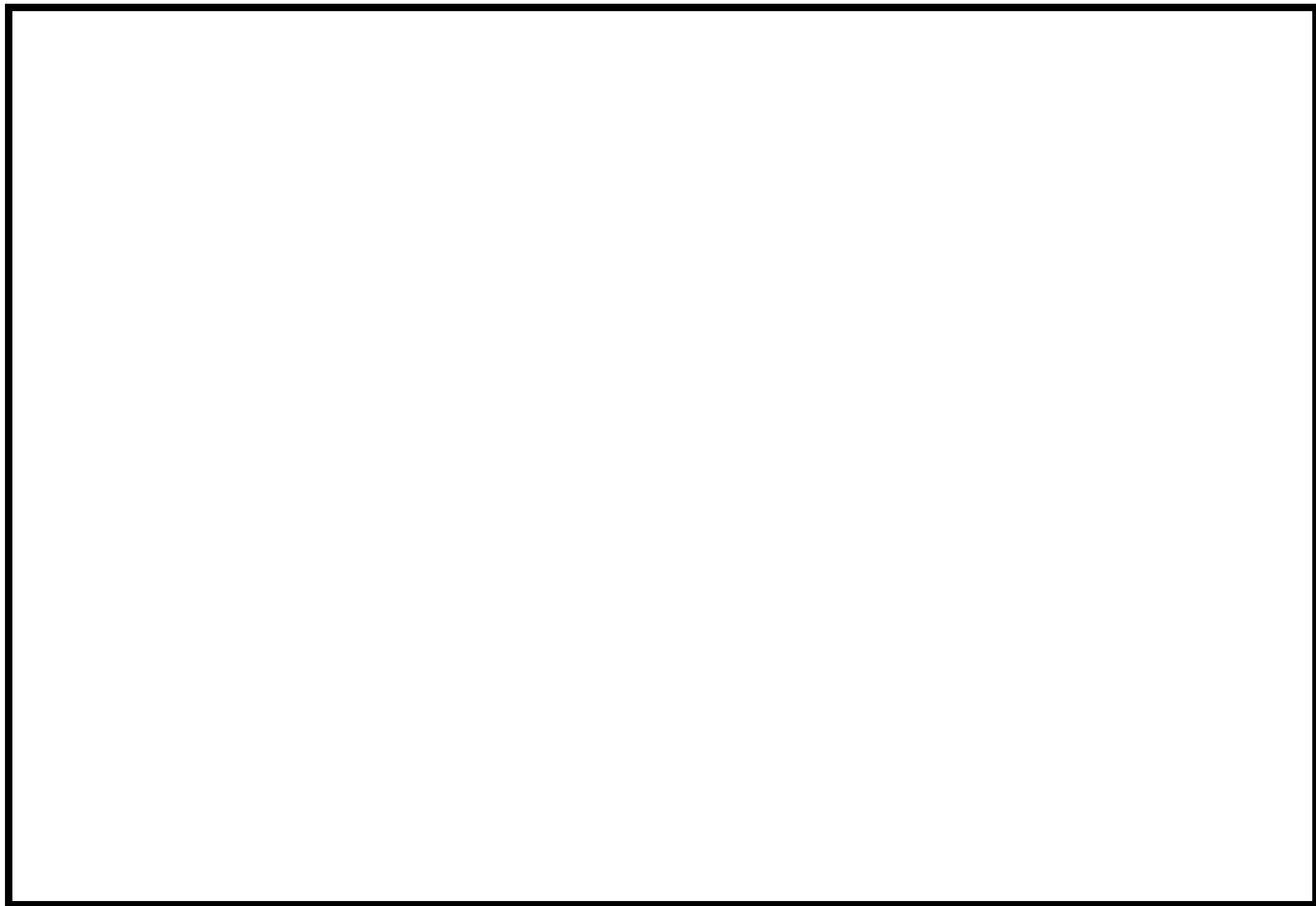## BOS COMMITTEE (NEP- STATISTICS)
B.A. STATISTICS (I & II SEM) PROGRAM 2021-22

1	**Prof. V. S. Shigehalli** **Department of Mathematics, RCU Belagavi**	Chairman
2	**Prof. S. M. Hancihnal** Anjuman Arts, Science and Commerce College Vijaypur	Member
3	**Prof. P. S. Chanagond** S SMamadapur Science College Badami	Member
4	**Prof. S. M. Hiremath** KRCES GGD and BMP Commerce and SVS Science CollegeBaihongal	Member
5	**Dr. Prakash R Kengnal** STC Arts and Commerce College, Banhatti	Member

BOS COMMITTEE (NEP- STATISTICS)

B.A. STATISTICS (III & IV SEM) PROGRAM 2022-23

1	**Prof. Vishwanath B. Awati,** Department of Mathematics, RCU Belagavi	Chairman
2	**Prof. N. S. Patil,** MGVC Arts, Com and Science College, Muddebihal	Member
3	**Dr. A. T. Shreenivas** - BLDE New Arts College, Tikota	Member

Preamble

Several reforms in our education system has been proposed and developed by MinistryofHRDasNationalEducationPolicy(NEP)2020whichincludesbroadbasedmultidisciplinaryundergraduate education with necessary knowledge, skills and competencies. It also proposesto bring equity, efficiency and academic excellence at different levels of education. NEP alsorecommended multidisciplinary undergraduate programmes with multiple exit and multipleentryoptions with the provision ofCertificate/Diploma/Degreesat each ofthe exits.

Probability and Statistics is the language of uncertainties, riddled modern informationage. Statistics facilitates the decision making process by quantifying the element of chance oruncertainties. Its descriptive and inferential procedures not only formulate the basis of thegrowth of almost all disciplines of the contemporary world, and also provide an array ofemploymentavenuesinallfields.ThisisarigorousprograminProbabilityTheory,StatisticalInference, Multivariate Analysis, Linear Models and Regression Analysis and Sample surveysand Design of Experimentsdesigned to give a sound foundation in fundamentals and traininginpractical Statistics leadingto statistical dataanalysis.

The six semester 166 credit program has a variety of elective courses to choose from including enough courses on statistical software. A person successfully completing the program will have enough knowledge and expertise to statistically analyze small and large univariate and multivariate data sets, work in software/data analytics industry as domain expert, independently consult for statistical data analysis. The program has proved to be one of the best in traditional Indian Universities/Institutes and has demand from students within and outside the State/Country.

Syllabus & Regulations Governing the Choice-Based Credit System (CBCS) for the Three-Years (Six Semesters) Bachelor of Arts (B.A

With Applied Statistics as Minor without practicals& other course as Major without practicalsProgram Structure

MODEL CURRICULUM

Degree Program: B.A. Degree

DisciplineCore: Statistics   **Total Credits for the Program:**146 (till 6th Semester)

ProgramOutcomes

Bythe endofthe programthestudents willbeable to:

1. Acquirefundamental/systematicorcoherentunderstandingoftheacademicfieldofStatisticsand its different learningareas andapplications.

2. Develop and demonstrate an ability to understand major concepts in variousdisciplines ofStatistics.

3. Demonstrate the ability to use skills in Statistics and different practicing areas forformulatingandtacklingStatisticsrelatedproblemsandidentifyingandapplyingappropriate principles and methodologies to solve a wide range of problems associatedwith Statistics.

4. Understandproceduralknowledgethatcreatesdifferenttypesofprofessionalsrelatedtosubjecta reaofStatistics,includingprofessionalsengagedingovernment/publicserviceandprivatesectors.

5. PlanandexecuteStatisticalexperimentsorinvestigations,analyzeandinterpretdata/informatio n collected using appropriate methods, including the use of appropriatestatisticalsoftwareincludingprogramminglanguages,andreportaccuratelythefindi ngsoftheexperiment/investigations.

6. HaveaknowledgeregardinguseofdataanalyticstoolslikeExcelandR-programming.

7. Developed ability to critically assess a standard report having graphics, probabilitystatements.

8. Analyze,interpretthedataand hencehelp policymakersto takeaproperdecision.

9. Recognize the importance of statistical modelling andcomputing,andthe role ofapproximationandmathematicalapproachestoanalyzetherealproblemsusingvariousstatistic altools.

10. Demonstraterelevant genericskillsandglobalcompetenciessuchas
    (i) Problem-solving skills that are required to solve different types of Statistics relatedproblemswithwell-definedsolutions,andtackleopen-endedproblems,thatbelong

tothedisciplinary-area boundaries;

(ii) I
nvestigative skills, including skills of independent thinking of Statistics-related issues andproblems;

(iii) Communicationskillsinvolvingtheabilitytolistencarefully,toreadtextsandreferencemate rialanalyticallyandtopresentinformationinaconcisemannertodifferentgroups/audience s of technical or popular nature;

(iv) Analytical skills involving paying attention to details and ability to construct logical Arguments using correct technical language related to Statistics and ability to translate them with popular language when needed; ICT skills;

(v) Personals kills such as the ability to work both independently and in a group.

11. Undertakeresearchprojectsbyusingresearchskills-
preparationofquestionnaire,conductingnationalsamplesurvey,researchprojectsusingsampl esurvey,samplingtechniques.

12. Understand and apply principles of least squares to fit a model to the given data, study theassociationbetweenthevariables,applicationsofProbabilityTheoryandProbabilityDistribu tions.

RANI CHANNAMMAUNIVERSITY

VIdyaSangam, NH-4, Belagavi. -591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Statistics Discipline Scheme for the four Years BA Statistics

Undergraduate Honors Programme with effect from 2021-22

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L1	21BAL1LK1	Kannada	40	60	100	4	-	-	3	2
	21BAL1LFK1	Functional Kannada								
L2	21BA1L2LEN2	English	40	60	100	4	-	-	3	2
	21BAL2LHI2	Hindi								
	21BA1L2LSN2	Sanskrit								
	21BA1L2LTE2	Telugu								
	21BA1L2LUR2	Urdu								
DSC1	21BA1STSDSCT1	Descriptive Statistics – I	40	60	100	3	-	-	3	2
	21BA1STSDSCT2	Descriptive Statistics – I	40	60	100	3	-	-	3	2
DSC1	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
SEC1	21BA1SE1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BA1V1PE1	Physical Education- Yoga	25	-	25	-	-	2	1	-
VBC2	21BA1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC	21BA1STSOECT1	Statistics in Competitive Examinations	40	60	100	3	-	-	3	2
		Total Marks	800			Semester Credits	25			

B.A. SEMESTER-I

B.A. SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BA2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BA2L3FKL2	Functional Kannada								
L4	21BA2L4EN2	English	40	60	100	4	-	-	3	2
	21BA2L4HI2	Hindi								
	21BA2L4SN2	Sanskrit								
	21BA2L4TE2	Telugu								
	21BA2L4UR2	Urdu								
DSC2	21BA2STSDSCT1	Statistics for Economics	40	60	100	3	-	-	3	2
	21BA2STSDSCT2	Probability and Distributions	40	60	100	3	-	-	3	2
DSC2	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
AECC1	21BA2AE1ES2	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BA2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BA2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BA2STSOECT1	Statistical Methods	40	60	100	3	-	-	3	2
		Total Marks		**800**		**Semester Credits**				**25**

B.A. SEMESTER-III

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L5	21BA3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BA3L5LFK3	Functional Kannada								
L6	21BA3L6EN3	English	40	60	100	4	-	-	3	2
	21BA3L6HI3	Hindi								
	21BA3L6SN3	Sanskrit								
	21BA3L6TE3	Telugu								
	21BA3L6UR3	Urdu								
DSC3	21BA3STSDSCT1	Exact Sampling Distributions and Statistical Inference	40	60	100	3	-	-	3	2
	21BA3STSDSCT2	Sampling Techniques	40	60	100	3	-	-	3	2
DSC3	Another Department Code	Another Department Course Title	40	60	100	3	-	-	4	2
			40	60	100	3	-	4	2	2
SEC2	21BA3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BA3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BA3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BA3STSOECT1	Data Analysis With SPSS	40	60	100	3	-	-	3	2
		Total Marks	**800**			**Semester Credits**			**25**	

B.A. SEMESTER-IV

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BA4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BA4L7LFK4	Functional Kannada								
L8	21BA4L8EN4	English	40	60	100	4	-	-	3	2
	21BA4L8HI4	Hindi								
	21BA4L8SN4	Sanskrit								
	21BA4L8TE4	Telugu								
	21BA4L8UR4	Urdu								
DSC4	21BA4STSDSCT1	ANOVA and Design of Experiments	40	60	100	3	-	-	3	2
	21BA4STSDSCT2	Regression Analysis and Econometrics	40	60	100	3	-	-	3	2
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			40	60	100	-	-	4	2	2
AECC2	21BA4AE1ES2	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BA4V5PE4	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC8	21BA4V6NC3	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC4	21BA4STSOECT1	Quantitative Analysis Technique	40	60	100	3	-	-	3	2
		Total Marks	**800**			**Semester Credits**			**25**	

B.A. SEMESTER-V

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
STATISTICS AS A MINOR										
DSC5	21BA1STSDSCP5	Statistical Quality Control	40	60	100	4	-	-	3	2
DSC5	Another Department CodeasaMajorSubject	Another Department Course Title	40	60	100	4	-	-	3	2
			40	60	100	4	-	4	2	2
DSE1	Another Department	Another Department Course Title	40	60	100	3	-	4	2	2
VC1 (Any one)	21BA5VCGEG5.1A	Basics of Map Making	40	60	100	3	-	-	3	2
	21BA5VCGEG5.1B	Mobile AssetMapping								
VBC9	21BA5V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC10	21BA5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BA5SE3CS3	Cyber Security	25	25	50	1	-	2	2	2
		Total Marks			**600**	**Semester Credits**			**22**	

B.A. SEMESTER-VI

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
STATISTICS AS MINOR										
DSC6	21BA1STSDSCP6	Operations Research	40	60	100	4	-	-	3	2
DSC6	AnotherDepartmentCode asaMajorSubject	Another Department Course Title	40	60	100	4	-	-	3	2
			40	60	100	4	-	4	2	2
DSE2	AnotherDepartmentCode	Another Department Course Title	40	60	100	3	-	4	2	2
VC2 (Any one)	21BA6VCGEG6.1A	Open Source GIS	40	60	100	3	-	-	3	2
	21BA6VCGEG6.1B	Landscape and Layout Mapping								
INT1	21BA6 INT1L	Internship	25	50	75	-	-	2	2	2
VBC1	21BA6V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC2	21BA6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BA6SE4CS4	Professional Communication	25	25	50	1	-	2	2	2
		Total Marks	**675**			**Semester Credits**			**24**	
		Total Marks for BA Program	**4475**			**Total Credits for BA Program**			**146**	

BA

Semester 1

Course Title: B.A Statistics	
Total Contact Hours: 42	Course Credits:3
Formative Assessment Marks:40	Duration of ESA/Exam: 2hours
	Summative Assessment Marks: 60

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Organize, manage and present data.	X	X		X								
2. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.	X						X					
3. Analyze statistical data using measures of central tendency, dispersion.				X				X		X		
4. Understand Skewness and Kurtosis and their use in studying various characteristics of data.			X									
5. Know concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient.			X									
6. Carryout spatial analysis.							X					
7. Understand the Price and Quantity Index numbers and their different measures, understand the applicability of cost of living Index number.									X	X		
8. Know the components and Need for Time series, understand the different methods of studying trend and Seasonal Index.	X								X	X		

Course Outcome										
9. Solve problems of economics concerns using demand analysis, supply functions, Gini's coefficient and Lorenz Curve.							X	X		
10. Understand basic concepts, important theorems on probability and their use in solving problem.									X	
11.Know random variable, mathematical expectation, and numerical problems on mathematical expectation.	X								X	
12. Understand the most common discrete and continuous probability distributions and their real life applications.								X		
13. Understand the nature of data and to perform appropriate analysis.									X	X
14. Carry out time series analysis and predict the future values of given trend.									X	X
15. Analyze the Seasonal Indies by using different methods.	X								X	X

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

BA Semester 1

Title of the Course: BA Statistics

Course 1: Descriptive Statistics-I		Course 2:Descriptive Statistics-II	
Number of Theory Credits	**Number of lecture hours/semester**	**Number of Theory Credits**	**Number of lecture hours/semester**
3	42	3	42

Content of Course 1: Descriptive Statistics-I	42 Hrs
Unit – 1 :Introduction to Statistics and Basic Concepts	**12 Hrs**
Meaning, origin, definition, functions, limitations and applications of Statistics. Primary and secondary data, different methods of collection of primary data with merits and demerits. Sources of secondary data. Classification: meaning, objectives, types of classifications- Chronological, Geographical, Qualitative and Quantitative classifications with illustrations. Definition of some important terms - class, class limits, class intervals, width of class interval, open-end classes, inclusive and exclusive classes. Formation of discrete and continuous frequency distributions. Tabulation: meaning, objectives and rules of tabulation, format of a statistical table and its parts. Types of table, examples of preparation of a blank table and tables with numerical information.	
Unit – 2 :Diagrammatic and Graphical representation of Data	**10 Hrs**
Diagrams: Meaning, importance of diagrams and general rules of construction of diagrams. Types of Diagrams – simple, multiple, component, percentage bar diagrams and pie diagrams with simple illustrations. Graphs:TypesofGraphs–Histogram,frequencyPolygon,frequencycurveandOgives,simple problems, location of mode, median and partition values from the graphs. Difference between diagrams and graphs.	
Unit – 3:Measures of Central Tendency	**10 Hrs**

Meaning of central tendency and essentials of a good measure of central tendency. Types of measuresofcentraltendency:Arithmeticmean,Median,Mode,Geometricmeanand Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures. Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only.	
Unit – 4:Measures of Dispersion	**10 Hrs**
Meaningandobjectivesofmeasuresofdispersion.Essentialsofagoodmeasureofdispersion, absoluteandrelativemeasuresofdispersion.Typesofmeasuresofdispersion-Range,Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data. **Skewness and Kurtosis:** Skewness- Definition, objectives and types of skewness, explanation of positive and negative skewness with diagrams. Measures of skewness- Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness. Simpleproblems. Kurtosis:Definition and types of kurtosis. Explanation of types of kurtosis with neat diagrams. Measure of skewness based on moments. Difference between skewness and kurtosis.	

References

1. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications,Bijapur.

2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House,Bombay

3. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd.,Calcutta

4. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand,New Delhi

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solvingthrough examples andexercises.

2. Students are encouraged to use resources available on open sources.

Content of Course 2:Descriptive Statistics-II	42 Hrs
Unit – 1 :Correlation	**12 Hrs**
Definition of relationship, Definition, Types of correlation, Methods of measuring correlation, Scatter diagram, Correlation Coefficient for quantitative data: Prof. Karl Pearson's coefficient of linear correlation, its properties, Correlation Coefficient for qualitative data: Spearman's rank correlation coefficient, its properties. Simple regression analysis-regression equations by method of least squares, linear regression coefficients and its properties. Angle between the regression lines.	
Unit – 2: Association of Attributes	**10 Hrs**
Meaning of association of attributes, definition of class of the first order and second order. Methods of studying association. Yule's coefficient of association and its interpretation. Determination of Yule's coefficient of association in case of two attributes.	
Unit – 3: Spatial Statistics	**10 Hrs**
History and introduction, spatial characterization, spatial dependence, spatial auto correlation, spatial association, spatial scaling, spatial sampling, errors in spatial analysis.	
Unit:4: Multivariate data Analysis	**10 Hrs**
Introduction: Yule's notations, distribution of two variables, distribution of three or more variables, primary and secondary subscripts, Plane of regression and its derivation, estimation of regression coefficients a and b in case of three variables, partial regression coefficient in terms of delta, Residual, properties of residuals, Standard deviation of residuals, Multiple and partial correlation, definition, derivation and their standard properties.	

References

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition,Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). The New Statistical Analysis of Data,Springer
3. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
4. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications,Bijapur.
5. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House,Bombay
6. Gupta S P. and V K Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solvingthrough examples andexercises.

2. Students are encouraged to use resources available on open sources.

Title of the Course: BA Statistics

Course 3: Statistics for Economics		Course 4:Probability and Distributions	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
3	4	3	4

Content of Course 3: Statistics for Economics	42 Hrs
Unit – 1 :Supply and Demand	**10 Hrs**
How Markets Work, Markets and Welfare Markets and competition; determinants of individual demand/supply; demand/supply schedule and demand/supply curve; market versus individual demand/supply; shifts in the demand/supply curve, demand and supply together; how prices allocate resources; elasticity and its application; controls on prices; taxes and the costs of taxation; consumer surplus; producer surplus and the efficiency of the markets.	
Unit – 2:Measuring income inequality: Lorenz curve & Gini Coefficient	**10 Hrs**
Measuring income inequality: Pareto law of Distribution, Lorenz curve and Gini's Coefficient, Limitations and interpretations of GC.	
Unit – 3:Index numbers	**12 Hrs**
Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method,weightedaggregateandweightedaverageofrelativesmethod,importanttypes of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's,methodofobtainingpriceandquantityindexnumbers,testsconsistencyofindex numbers, time reversal test, factor reversal test, and Circular test for index numbers,Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the constructionof consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNPDeflator.	
Unit 4:Time Series Analysis	**10 Hrs**

Introduction, definition and components of Time series, illustrations, Additive, Multiplicativeandmixedmodels,analysisoftimeseries,methodsofstudyingtimeseries: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction fromseasonal variation, Irregular variation- definition, illustrations.	

References

1. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House,Bombay

2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd.,Calcutta

3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solvingthrough examples andexercises.

2. Students are encouraged to use resources available on opensources.

Content of Course 4: Probability and Distributions	42 Hrs
Unit – 1 :Introduction to Probability	**10 Hrs**
Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.	
Unit – 2:Random Variable and Mathematical Expectation	**10 Hrs**
Definitionofarandomvariable,discrete&continuousrandomvariable,probabilitymassfunction, probability density function, distribution function. Definition of mathematical expectation, expected mean and variance of discrete random variable. Properties of Mathematical expectation. Statement of addition and multiplication theorem of expectation. Numerical problems on mathematicalexpectation.	

Unit – 3 :Discrete Distributions	12 Hrs
Binomial Distribution: Definition of Binomial Distribution, mean and Variance of Binomial distribution, numerical problems on binomial distribution. Uses of binomial distribution. Fitting of Binomial distribution and obtaining expected probabilities. Simple problems. **Poisson Distribution:** Definition of Poisson distribution. Mean, Variance and its properties of Poisson variate. Uses of Poisson distribution. Simple problems on Poisson distribution. Computing probabilities for large and small p for the given λ, finding λ for given two successive probabilities. Conditions for Poisson distribution as limiting form of Binomial distribution. Fitting of Poisson distribution.	
Unit – 4 : Normal Distribution	10 Hrs
Definition of normal variate. Application of Normal distribution Definition of standard normal variate, standard normal distribution and properties of normal curve. Conditions under which binomial distribution tend to normal distribution (Statement only). Finding probabilities and expected numbers when mean and variance are given quartile deviation, mean deviation and standard deviation and problems.	

References

1. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House,Bombay

2. Mukhopadhaya, P. Applied Statistics, New Central Book Agency (P) Ltd.,Calcutta

3. Gupta S P. and V K Kapoor Fundamentals of Mathematical Statistics, Sultan Chand, NewDelhi.
4. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solvingthrough examples andexercises.

2. Students are encouraged to use resources available on opensources.

Formative Assessment: 40 marks	
Assessment Occasion/ type	**Weightage in marks**
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2ndInternalAssessmentTestfor30marks1hrafter15weeks.Average oftwotestsshouldbeconsidered.	30
Assignment/Seminar (7 marks)+Attendance(3marks)	10
Total	40

Question Paper Pattern:
RANICHANNAMMAUNIVERSITY
Department of Statistics

I Semester B.A Statistics

Sub: **Code:**   **MaximumMarks: 60**

       a.   **Answer any Six Questions from Question1**

       b.   **Answer any Three each Questions from Question2,3,4 and 5**

Q.No.1.	**Answer any Six Questions (At least Two question from EachUnit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.5.	**(Should cover Entire Unit-IV)a.** **b.** **c.** **d.**	**4X3=12**

List of Open Electives

1. Statistics in Competitive Examinations

2. Statistical Methods

3. Business Statistics

4. Quantitative Aptitude

1. Statistics in Competitive Examinations (Open Elective)

Course Objectives

To train the students to solve the problems of statistics that appear in most of the competitive exams conducted by Banking, State and Central Governments and other agencies.

Course Outcomes (CO)

Afterthesuccessfulcompletionofthecourse,thestudentswillbeabletodevelopthedataanalysis skills required for Competitive Examinations.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Contents

Unit 1: Collection Classification and Presentation of Statistical Data **(6 hours)**
Primary and Secondary data, Methods of data collection; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of frequency distributions.

Unit 2: Measures of Central Tendency and Dispersion **(12 hours)** Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency, Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures.

Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only.

Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.

Unit 3: Aptitude Ability and Reasoning **(14 hours)**

Area, Banker's Discount, Surds and Indices, Ratio and Proportion, Simple Interest, Problems on Trains, Profit and Loss, Compound Interest.

Reasoning: Number series, Analogy, Classifications, Blood relations Coding-decoding, Puzzle test, Logical Venn diagram. Alphabet-test, Alpha-numerical sequence puzzle, Mathematical operations, Numbers, ranking & time sequence test, Logical sequence test, Arithmetical operations.

Unit 4: Introduction to Probability (10hours)

Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.

References

1. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
2. Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay.
3. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

2. Statistical Methods (Open Elective)

Course Objectives

This is an open elective course for social science and life science students.

The students will learn the elements of descriptive statistics, probability, statistical methods such as tests of hypotheses, correlation and regression.

Course Outcomes (CO)

Students will be able to

CO1. Acquire the knowledge of statistical methods.

CO2.Identify types of data and visualization, analysis and interpretation. CO3.Know about elementary probability and probability models.

CO4.Employ suitable test procedures for given data set.

Pedagogy

The course is taught using traditional chalk and talk method using problem solving through examples and exercises. Students are encouraged to use resources available on open sources.

Contents

Unit 1:Introduction   **(10Hours)**

Definition and scope of statistics. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram an dogives. Concepts of statistical population and sample. Sampling from finite population-Simplerandom sampling, Stratified and systematic random sampling procedures (definitions and methods only). Concepts of sampling and non-sampling errors.

Unit 2: Univariate and Bivariate Data Analysis   **(10 Hours)**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis. Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponentialcurves.

Unit 3: Probability and Distributions   **(12Hours)**

Probability: Random experiment, trial, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable. Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

Unit 4: Sampling Distributions and Testing of Hypothesis   **(10 Hours)**

Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications. Statistical Hypothesis –null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation. Test for single mean, equality of two means, single variance, and equality of two variances for normal populations.

References

1. Daniel, W. W. (2007 Biostatistics - A Foundation for Analysis in the Health Sciences,Wiley
2. T.W. Anderson and Jeremy D. Finn(1996). The New Statistical Analysis of Data,Springer.
3. MukhyopadyayaP(1999). Applied Statistics, New Central book Agency ,Calcutta.
4. Ross,S.M.(2014) Introduction to Probability and Statistics For Engineers andScientists.
5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, NewDelhi.

3. Business Statistics (Open Elective)

Course Objectives

1. Provide an introduction to basics of statistics within a financialcontext.
2. To enable students to use statistical techniques for analysis and interpretation ofbusiness data.

Course Outcomes (CO)

Upon the completion of this course students should be able to:

CO1.Frame and formulate management decision problems.

CO2.Understand the basic concepts underlying quantitative analysis.

CO3.Use sound judgment in the applications of quantitative methods to management decisions.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples andexercises.

2. Students are encouraged to use resources available on opensources.

Contents

Unit 1: Statistical Data and Descriptive Statistics   **(12   hours)**

Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross-sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles). Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit 2: Simple Correlation and Regression Analysis   **(10   Hours)**

Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; Rank Correlation.

Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation;Propertiesofregressioncoefficients;RelationshipbetweenCorrelationandRegression coefficients; Standard Error of Estimate and its use in interpreting theresults.

Unit 3:IndexNumbers   (10 hours)

Definition,Problemsinvolvedintheconstructionofindexnumbers,methodsofconstructingindex numbersofpricesandquantities,simpleaggregateandpricerelativesmethod,weightedaggregate   and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall- Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers.Definition and measurement of Inflation rate – CPI and GNPDeflator.

Unit 4: TimeSeries Analysis   (10hours)

Introduction, definition and components of Timeseries, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

References

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., PearsonEducation.
2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K.Viswanathan, Business Statistics: A First Course, PearsonEducation.
3. Siegel Andrew F. Practical Business Statistics. McGraw HillEducation.
4. Gupta,S.P.,andArchanaAgarwal.BusinessStatistics,SultanChandandSons,NewDelhi.
5. Vohra N. D., Business Statistics, McGraw Hill Education.
6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc Graw HillEducation.
7. Gupta, S.C. Fundamentals of Statistics. Himalaya PublishingHouse.
8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

4. Quantitative Aptitude (Open Elective)

Course Objective

To train the students in the aspects of numerical ability, reasoning techniques and mental ability for competitive examinations conducted by various public and private boards.

Course Outcomes (CO)

After the successful completion of the course, the students will be able to develop hegeneral skills required to Competitive Examinations.

Pedagogy

Activity based teaching and learning along with theoretical aspects using classroom teaching, group discussions and seminars.

Contents

Unit 1: Numerical Aptitude I   (10 hours)
Number Systems, Computation of Whole Numbers, Decimals and Fractions and relationship between Numbers, Fundamental arithmetical operations.

Unit 2: Numerical Aptitude II   (12hours)
Percentages, Ratios and Proportions, Average, interest, Profit and Loss, Discount use of Tables and Graphs Time and Distance, Ratio and Time, Time and Work.

Unit 3: Reasoning and Mental ability I   (10 hours)

Coding-Decoding, Symbol notations, Number Series, Analogy & Classification , Blood relations, Direction Sense, Liner arrangement.

Unit 4: Reasoning and MentalAbility II   (10hours)
Ranking and Comparison, Input & output, Assumptions, Conclusion & Inferences.

References:
1. Aggarwal R.S., Quantitative Aptitude: by, Publication by S,Chand
2. Ningappa A H ,Mental Ability: AshokPublication.

Semester – III

BA Statistics

The course STATISTICS in III semester has two papers (Paper V & VI) for 06 credits: Each paper has 03 credits. Both the papers are compulsory. Details of the courses are as under.

Course No.5 (Paper-I): Title of the Course (Paper-I): **21BA3STSDSCT1**
: **Title of Paper: EXACT SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE**

Year	II	**Course Code: 21BA3STSDSCT1**	**Credits**	03
Sem.	III	**Course Title: Title of Paper: EXACT SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE**	**Hours**	42

Course Pre-requisites, if any	NA		
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA:.03 hrs.	

Number of TheoryCredits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
3	42	0	0

Syllabus- Course 5: 21BA3STSDSCT1 : Title- EXACT SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE	Total Hrs: 42
UNIT-I Sampling distribution and Estimation	20 hrs
Definition of basic concepts: population, sample, parameter and statistic. Definition of a Random Sample, Sampling distribution of a Statistic along with examples, Definition of standard error, Standard error of mean, standard deviation, proportion, difference of means and difference of proportions. Uses of standard error and simple problems. Definition of the terms – Estimate, Estimation, Point estimation and interval estimation. Meaning of confidence interval, confidence limits and confidence co-efficient with examples. Construction of 95% and 99% confidence intervals - mean, difference of means, proportion and difference of proportions for large samples only and their numerical problems on the construction of 95% and 99% confidence limits.	
UNIT-II Testing of Hypothesis	10 hrs
Explanation of terms – Statistical hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, critical region, size of the test, power of the test with examples. Definition of type–I and type–II errors. Large sample tests- Test of significance of population mean, test of significance of equality of means of two populations, test of significance of population proportion and test of significance of equality proportion of two populations.	

Unit-III Chi-Square, *t* - test and F-test Distributions	12 hrs
Introduction to Chi-square distribution, definition of Chi-square variate. Properties of Chi-square distribution. Applications of Chi-square distribution. Chi-square test of goodness of fit. Problems on Chi-square test of Goodness of fit and independence of attributes. Definition, assumption and properties of t-test. t-test for testing population mean, equality of sample means and paired t-test. Applications of t-test. Simple problems. Definition, assumption and properties of F-statistic. F-test for equality of variances and its applications. Numerical problems.	

Books recommended.

1. Ramchandran, K.M. and Tsokos C. P. (2009). Mathematical Statistics with Applications, Academic Press.

2. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

3. Mukhopadhyaya, P. (2011). Applied Statistics, Books and Allied Ltd.

4. Gupta, S C. and V. K. Kapoor. (2018). Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi, 11th Edition.

5. Gani S. G.(2003). Sankhyshastra and Ganakayantra, Udaya Ravi Publications, Bijapur.

Semester – III
Subject: BA STATISTICS
Discipline Specific Course (DSC)

Course No.-6 (Paper No. II): Title of the Course : 21BA3STSDSCT2: SAMPLING TECHNIQUES

Year	II	Course Code: 21BA3STSDSCT2		Credits	03
Sem.	III	Course Title: SAMPLING TECHNIQUES		Hours	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

Course Outcome (CO):

After successful completion of this course, students will be able to:

CO 1 : Know the concept of Population, Sample, Sampling unit, sampling design, sampling frame, sampling scheme, need for samping.

CO 2 : Apply different sampling methods for designing and selecting a sample from a population.

CO 3 : Design good questionnaire relevant to a survey for a specific investigation.

CO 4 : Explain sampling and non-sampling errors.

Syllabus-Course 6: 21BA3STSDSCT2 : Title- SAMPLING TECHNIQUES	Total Hrs: 42
Unit-I Basic Concepts of Sampling	**08 hrs**
Meaning of population, population size, finite population, infinite population, sample, sample size, sampling, sampling technique, sampling unit, sampling frame, census and sample survey, advantages of sampling. Examples of sampling. Types of errors in sample survey-Sampling errors and non-sampling errors, non response errors, response errors and tabulation errors. Advantages of sampling over complete census. Limitation of sampling. Planning of sample survey and its execution.	
Unit-II Simple Random Sampling	**14 hrs**
Introduction and definition of Simple Random Sampling (SRS), Notations and formulae for estimating population mean, total and variance. Methods of obtaining simple random sample-Lottery method and Random numbers table method. Merits and demerits of Simple Random Sampling. Simple problems on simple random sampling method.	
Unit-III Stratified Random and Systematic Random Sampling Techniques	**20 hrs**
Need for stratification, stratifying factors, improvement of method over SRS, Definition of strata, stratification, and stratified random sampling. Notations and formulae for estimating population mean, total and variance. Methods of allocation and sample size in different strata-Equal allocation, Proportional allocation and Optimal allocation. Determination of Bowley's formulae for proportional allocation and Neyman's formula for optimal allocation. Advantages and disadvantages of stratified random sampling method. Simple problems on stratified random sampling method, Proportional and Optimal allocation. Definition of systematic random sampling. Explanation of methods of obtaining systematic random samples. Examples of systematic random sample. Formulae for estimating population mean, total and variance. Applications of systematic random sampling method. Merits and demerits of systematic random sampling method. Simple problems on systematic random sampling method.	

Books recommended.

1. Parimal Mukhopadhyay (2008). Theory and methods of Survey Sampling, PHI publications.

2. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

3. Gupta S. C. and V. K. Kapoor (2018). Fundamentals of Applied Statistics, Sultan Chand, New Delhi

4. Gani S. G.(2003). Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Title of the Course: OEC-3: DATA ANALYSIS WITH SPSS

(Open Elective)
OEC-3 : Title of the Course : 21BA3STSOECT1: Data Analysis With SPSS

Year	II	Course Code: 21BA3STSOECT1		Credits	03
Sem.	III	Course Title: Data Analysis With SPSS		Hours	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

Course Outcome (CO):

After the completion of this course, students will be able to:

CO 1 : Use SPSS software for cleaning and presentation of data.

CO 2 : Present the data in the form of diagrams and graphs.

CO 3 : Analyze univariate, bivariate and multivariate data.

Syllabus-Course OEC-3 : 21BA3STSOECT1 : Title- DATA ANALYSIS WITH SPSS	Total Hrs: 42
Unit-I Introduction	**18 hrs**
Need of SPSS, preparation of coding sheet of the questionnaire, defining the type of variable and data, constructing the database – defining variable name, type of variable, width of variable name, labeling, assigning the numeric value to the characteristic, declare measurement of scale of data. **Data Editing in SPSS**: Enter the data based on type of data case wise for different variables, defining the grouping of variable for repeated measures. transforming the data into same variable and different variable,	
Unit-II Tabulation and Graphical representation	**12 hrs**
Formation of frequency distribution, representation of frequency distribution by graphs, construction cross table, P-P plots and Q-Q Plots.	
Unit-III Univariate, Bivariate and multivariate Data analysis	**12 hrs**
Calculation of Measures of central tendency, Dispersion, Karl-Pearson's correlation, Regression, fitting different curves, testing of hypothesis- t-test for single mean, difference of means for independent samples, one-way ANOVA.	

Note: Various techniques studied in the paper has to be demonstrated using SPSS software.

Books recommended.

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig (2007). Introduction to Mathematical Statistics, Pearson Education, Asia.
2. Irwin Miller and Marylees Miller, John E. Freunds (2006). Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia.
3. Sheldon Ross (2007). Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint.
4. Gardener, M (2012). Beginning R: The Statistical Programming Language, Wiley Publications.
5. Cunningham, B.J (2012). Using SPSS: An Interactive Hands-on approach.

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Social Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A
1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks
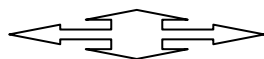
Part-B
2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks
   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

Semester-IV

Course : BA STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in IV semester has two papers (Paper VII & VIII) for 06 credits: Each paper has 03 credits. Both the papers are compulsory. Details of the courses are as under.

Course No.7 (Paper-I): Title of the Course (Paper-I): **21BA4STSDSCT1: Title of Paper: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS**

Year	II	Course Code: 21BA4STSDSCT1		Credits	03
Sem.	IV	**Course Title: Title of Paper: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS**		**Hours**	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.03 hrs.		

Course Outcome (CO):

After the successful completion of the course, the students will be able to:

CO 1   : Develop strategic plans for experimentation in scientific research projects.

CO 2 : Apply the principles of Design of Experiment to generate experimental designs.

CO 3 : Develop problem solving skills for the application of Design of experiments to Agriculture and controlled laboratory experiments.

Syllabus-Course 7: 21BA4STSDSCT1: Title of Paper: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS	Total Hrs: 42
Unit-I Analysis of Variance: One-Way and Two-way Classification	**18 hrs**
Definition of analysis of variance and its basic assumptions. Meaning of assignable and chance variations. ANOVA for one-way classified data-definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various component sum of squares, degrees of freedom and ANOVA table. Simple numerical problems one-way classified data. Analysis of variance for two-way classification – definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various component sum of squares. Degrees of freedom and ANOVA table. Simple numerical problems on two way classified data.	
Unit-II Design of Experiments: Completely Randomized Design	**12 hrs**
Definition of terms - Experiment, treatment, experimental unit, experimental	

material, yield, block, precision, experimental error, uniformity trials, and efficiency. Basic principles of design of experiments – Replication, Randomization and Local control. Completely Randomized Design (CRD) -definition, layout, linear mathematical model, assumptions, hypothesis, splitting up of sum of squares into various component sum of squares, degrees of freedom and ANOVA table. Merits, demerits and applications of CRD. Simple numerical problems.	
Unit-III Randomized Block Design	**12 hrs**
Introduction and definition of Randomized Block Design (RBD), layout, linear mathematical model, assumptions, statistical hypothesis, splitting up of total sum of squares into various component sum of squares, degree of freedom, and ANOVA table. Merits and demerits of RBD. Applications of RBD. Comparison between CRD and RBD. Simple problems.	

Books recommended.

1. Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments, II Edition Wiley Eastern Ltd., New Delhi

2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1998). Fundamentals of Statistics, Vol. II, The world Press Pvt. Ltd. Kolkatta.

3. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

4. Gupta S. C. and V. K. Kapoor (2018). Fundamentals of Applied Statistics, Sultan Chand, New Delhi.

5. Mukhopadhaya, P. (2011). Applied Statistics, Books and Allied Ltd.

6. Gani S. G.(2003). Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

Semester – IV

Course : BA STATISTICS
Discipline Specific Course (DSC)

Course No.-8 (Paper No. II): Title of the Course: 21BA4STSDSCT2 : REGRESSION ANALYSIS AND ECONOMETRICS

Year	II	Course Code: 21BA4STSDSCT2		Credits	03
Sem.	IV	Course Title: Title of Paper: REGRESSION ANALYSIS AND ECONOMETRICS		Hours	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.03 hrs.		

Course Outcome (CO):

After completion of the course, students will be able to:

CO 1 : Provide a wider and deeper exposure to the econometric techniques and their application to the discipline of Economics.

CO 2 : Gain an understanding of how to solve problems using econometrics that are common to economic modeling.

CO 3 : Develop ability to accurately translate complex economic problems into models and so as to solve them by applying econometric techniques.

Syllabus-Course 8: 21BA4STSDSCT2: Title- REGRESSION ANALYSIS AND ECONOMETRICS	Total Hrs: 42
Unit-I: Introduction to Econometrics and Simple Regression Analysis	**18 hrs**
Econometrics – definitions – scope – methodology – types. Quantification of hypothetical linear relationship using appropriate data. Two variable regression model, assumptions, method of least squares properties. maximum likelihood method, testing of hypotheses using point and interval estimates, forecasting solving problems using SPSS.	
Unit-II : Multiple Regression Analysis	**12 hrs**
Nonlinear relationships – transformation of variables – functional forms – three variable regression model – applications using SPSS. General linear model (matrix approach) – specification – OLS estimators –The properties of the estimated regression coefficients, hypothesis testing and the construction of confidence intervals of the regression model, problems.	

Unit-III: Problems in regression analysis	12 hrs
Violation of classical assumptions – multicollinearity – autocorrelation — problems – causes – consequences – remedial measures – model specification and diagnostic testing.	

Books recommended.

1. Damodar N. Gujarathi (2009). Basic Econometrics, New Delhi: Tata McGraw Hill

2. Companies Johnston, J. (1972). Econometric Methods, 2nd Edition, McGraw Hill International.

3. Koutsoyiannis, A. (2004). Theory of Econometrics, 2nd Edition, , Palgrave Macmillan Limited

4. Maddala, G.S. and Lahiri, K. (2009). Introduction to Econometrics, 4th Edition, John Wiley & Sons

5. G.M.K. Madanani (1980). Introduction to Econometrics, second edition, Oxford & IBH Publishing company, New Delhi.

6. Gupta, S.C. and Kapoor, V. K. (2020). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Semester – IV

Course : BA STATISTICS

OEC-4: Title of the Course: 21BA4STSOECT1: Quantitative Analysis Techniques

Year	II	Course Code: 21BA4STSOECT1	Credits	03
Sem.	IV	Course Title: Title of Paper: Quantitative Analysis Techniques	Hours	42
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.03 hrs.	

Course Outcome (CO):

After the completion of this course, students will be able to:

CO 1 : Carryout correlation and regression analysis

CO 2 : Formulate and solve linear programming problems

CO 3 : Formulate and solve transportation and assignment problems

Syllabus-Course OEC-4 : 21BA4STSOECT1: Title- Quantitative Analysis Techniques	Total Hrs: 42
Unit-I Correlation and regression analysis	18 hrs
Correlation- Definition, Types - Simple, multiple, partial. Causation - Spurious, positive, negative, perfect and no correlation, explanation with examples. Importance of	

correlation analysis. Measurement of correlation- scatter diagram, Karl Pearson's coefficient of correlation, Properties of coefficient of correlation, interpretation. Spearman's coefficient of rank correlation – with and without ties, interpretation. Coefficient of determination and its interpretation.

Regression-Definition, regression lines/equations of X on Y and Y on X. Properties of regression coefficients and regression lines/equations. Principle of least squares and fitting of linear, quadratic and exponential curves. Uses of regression analysis. Comparison between correlation and regression.

Unit-II Linear programming problem (LPP)	**12 hrs**
Definition and scope of Operations Research (OR). Modeling and solution. Linear Programming Problem (L.P.P): Definition, Standard forms. Formulation of LPP. Basic Solutions, degenerate and non-degenerate solutions. Graphical method of solving LPP. Criteria for unbounded, Multiple and infeasible solutions.	
Unit-III Transportation problem and Assignment Problem	**12 hrs**
Transportation problem: Mathematical formulation. Existence of feasible solution. Finding initial basic feasible solution: North West Corner Rule, matrix minima method and Vogel's method. Unbalanced transportation problem. **Assignment Problem:** Mathematical Formulation and Hungarian algorithm. Unbalanced assignment problem.	

Books recommended.

References

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I, 8th Ed., The World Press, Kolkata.

2. Ross, S.M. (2014). Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, AcademicPress.

3. KanthiSwaroop, Manmohan and P. K. Gupta (2013). Operation Research, Sultan Chand New Delhi.

4. Mustafi, C.K.(2006). Operations Research Methods and Practice, 3/e.NewAge Publication.

5. Narag. A.S.(1970). Linear Programming and Decision Making. Sultan Chand and Co.

6. Sharma, J K.(2013). Operations Research: Theory and Applications (5/e). New Delhi: Laxmi Publications.

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Social Science
04 - Year UG Honors programme: 2022-24

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

7. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

8. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks
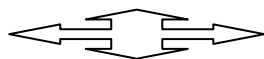
Part-C

9. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub
   questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.A. in Applied Statistics
Effective from2023-24

Sem.	Type ofCourse	Theory/Practical	Course Code	CourseTitle	Instruction hour/week	Totalh ours /sem	Duration ofExam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**015AST011**	Distributions and Survival Analysis	04hrs	56	02hrs	40	60	100	04
	DSCC-10	Theory	**015AST012**	Industrial Statistics	04hrs	56	02hrs	40	60	100	04
	DSCC-11	Theory	**015AST013**	Population Studies	04hrs	56	02hrs	40	60	100	04
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Theory	**015AST061**	Basics of Computer Fundamentals	02hrs	28	01hr	20	30	50	02
	Total										**26**
VI	DSCC-12	Theory	**016AST011**	Non-Parametric Inference	04hrs	56	02hrs	40	60	100	04
	DSCC-1**3**	Theory	**016AST012**	Operations Research	04hrs	56	02hrs	40	60	100	04
	DSCC-14	Theory	**016AST013**	Statistics for National Development	04hrs	56	02hrs	40	60	100	04
	Other subject										04
	Other subject										04
	Other subject										04
	Internship/ SEC-4	Theory	016AST061	Quantitative Aptitude for Competitive Examinations/ Project	02hrs	28	01hr	20	30	50	02
	Total										**26**

B.A. Semester–V

DisciplineSpecificCourse(DSC)-9

Course Title: Distributions and Survival Analysis

Course Code:015AST011

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-9	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1:Solve problems of various analytical environments using different distributions and their

properties.

CO2: Practical knowledge of carrying out numerical analysis

CO3: Explain Life Tables, types of life tables, its functions, construction.

CO4: Know survival models, concepts of survival analysis, notion of ageing.

Unit	Title:	56.hrs/s em
UnitI	Discrete distributions: Rectangular, Geometric, Negative Binomial, Hypergeometric, Multinomial- definition through probability mass function, mean, variance, moments, p.g.f., m.g.f., other properties and applications.	14Hrs
UnitII	Continuous distributions: Uniform, Exponential, lognormal, Pareto, Gamma and Weibull– definition through probability density function, mean, variance, moments, m.g.f., other properties and applications. Bivariate normal distribution- definition through probability density function, marginal and conditional distribution.	14Hrs
UnitIII	Survival Concepts: Life distributions, survival functions, failure rate, Integrated hazard function, residual life time, mean residual life time. Notion of aging:IFR, IFRA, DMRL, NBU, NBUE classes of life distributions and their dual classes. Common Life Distributions: binomial, Poisson, exponential, Weibull, gamma, Pareto and log-normal distributions.	14Hrs
UnitIV	Censoring Schemes: Type I, Type II and progressive or random censoring with biological examples. Estimation of mean survival time and variance of the estimator for Type I and Type II censored data with numerical examples. Non-parametric methods: Actuarial and Kaplan-Meier methods for estimating survival function and variance of the Estimator.	14Hrs

References:

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
2. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.
3. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,10th Edition, Pearson Education, New Delhi.
4. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.
5. Ross, S. M. (2014). Introduction to Probability Models. 11th Edition, Elsevier science.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–V

DisciplineSpecificCourse(DSC)-10

Course Title: Industrial Statistics

Course Code:015AST012

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-10	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1 :   Learn about process control and product control, different limits and causes of variation.

CO2 :   Understand control chart for variables and process capability.

CO3 :   Understand lot acceptance sampling and sampling plans.

CO4 :   Construct control charts

CO5 :   Know acceptance sampling plans

Unit	Title:	56.hrs/ sem
UnitI	**Statistical Quality Control:** Concept of quality and its management - quality planning, quality control and quality improvement, quality pioneers, quality costs. Meaning, aims and objectives of statistical quality control. Concept of variations and its impact, chance & assignable causes of variation. Relevance of exploratory data analysis, run plot, lag plot, frequency distribution and other QC tools. Statistical quality control, Process control, Product control, Importance & uses of statistical quality control in industry. Introduction to control charts.	14 Hrs
UnitII	**Control charts for variables:** Theoretical basis and practical background of control charts for variables. 3σ - Limits, Warning limits and Probability limits. Derivation of control limits and construction of $\overline{X}$ & R charts and $\overline{X}$ & S charts. Interpretation Criteria for detecting lack of control. Rational subgroups, Natural tolerance limits and specification limits, Process capability studies.	14 Hrs
UnitIII	**Control charts for attributes:** Theoretical basis and practical background of control charts for attributes. Fraction defective p-chart, number of defectives np-chart, number of defects per unit C – chart, and U – chart, derivation of control limits and interpretations.	14 Hrs
UnitIV	**Acceptance Sampling (Product Control) :** Lot Acceptance Sampling – Sampling Inspection,100 % inspection and rectifying	14 Hrs

inspection AQL, LTPD, Producer's Risk and Consumer's Risk. Acceptance sampling plans – single and double sampling plans by attributes.	

References:

1. Montgomery D.C. (1996) Introduction to Statistical Quality Control, Wiley, New York.
2. Grant E.L. (1980) Statistical Quality Control McGraw Hill, New York.
3. Weetherhill G.B. and Brow D.W. (1991) Statistical Process Control. Chapman and Hall, London.
4. Gupta S C and Kapoor V K. Fundamentals of Applied Statistics. S Chand & Sons.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

Course Title: Population Studies
Course Code:015AST013

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-14	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1 : Acquire knowledge about the size, composition, organization and distribution of the population.

CO2 : Perform basic demographic analysis using various techniques.

CO3 : Study the trend of population growth which describes the past evolution, present distribution and future changes in the population of an area.

CO4 : Acquire knowledge about the construction of life table and its applications in demographic analysis.

Unit	Title:	42.hrs/ sem
UnitI	**Introduction and Sources of Demographic Data :** Demography**:** Its definition, nature, and scope. Sources of demographic data – salient features of Census, Civil Registration System, Demographic Surveys, their limitations and uses. Coverage and content errors. Vital Statistics: Introduction, definition, and uses of Vital statistics. Sources of data on Vital statistics. Measurement of population, rates, and ratios of vital events.	14 hrs
UnitII	**Measures of Fertility :** Basic concepts and terms used in the study of fertility. Measures of fertility- Crude Birth Rate (CBR), General fertility rate (GFR), Age-Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), use of Birth order statistics, Child Women ratio.	14 hrs
UnitIII	**Measures of Mortality** Basic concepts and definitions of mortality. Measures of mortality- Crude Death Rate (CDR), Age Specific Death Rate(ASDR), Standardized death rates, Neonatal, Perinatal and Postnatal mortality rates, Maternal and Infant mortality rates. Cause Specific Death Rate.	14 hrs

Unit IV	**Measures of reproduction and Life Tables :**	14 hrs
	Measures of reproduction- Gross Reproduction rate and Net Reproduction rate. Measurement of population growth rate- simple growth rate and compound growth rate. Pearl's Vital Index. Population Estimation,	
	Life tables : Components of a life table, force of mortality and expectation of life table, types of life tables. Construction of life tables using Reed-Merrell's method , Greville's method. Uses of life tables.	

References	
1	Bhende, Asha and Tara Kanitkar, (2004): Principles of Population Studies, 5th Ed. Himalaya Publishers, New Delhi.
2	Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
3	Keyfitz, N and Caswell. H (2005): Applied Mathematical Demography, Springer.
4	Mishra, B. D, (1981): An Introduction to the Study of Population, South Asian Publishers, Pvt. Ltd.
5	Ramakumar, R, (1986): Technical Demography, Wiley Eastern Ltd, New Delhi.
6	Pathak, K. B and F. Ram, (1998): Techniques of Demographic Analysis, Himalaya Publishing House, Mumbai.
7	Pressat, R, (1972): Demographic Analysis, Edward Arnold, London.
8	Shryock, H. S. et al (1979): The Methods & Materials of Demography, Condensed Edition by Stockwell, E. G, Academic Press, New York.
9	Srinivasan K. (1998): Basic Demographic Techniques & Applications, Sage Publications, New Delhi

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–V
Skill Enhancement Course: SEC-3

Course Title:BASICS OFCOMPUTER FUNDAMENTALS

Course Code:015AST061

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
SEC-3	Theory	02	02	30hrs.	1hr.	20	30	50

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO 1: Acquire confidence in using computer techniques available to users;

CO 2: Understand data, information and file management;

CO 3: Create documents using Word processor, Spreadsheet& Presentation Software;

CO 4: Understand computer networks, Internet;

CO 5: Use e-Governance applications;

Unit	Title:	30 Hrs/ sem
UnitI	**Introduction:** **Word Processing:** Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document. **Spread Sheet:** Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet. **Introduction to Data Analysis Using Excel,Descriptive Statistics using Excel,Graphical presentation using Excel,** Construction of Frequency Tables and Cross Tables.	15 Hrs
UnitII	Use of **Analysis ToolPak for performing:** Anova, Correlation, Covariance, F-Test Two-Sample for Variances, Random Number Generation Rank and Percentile Regression Sampling, t-Test, z-Test.	15 Hrs

References:

1. V.K.Kapoor (2004), Information Technology and computer applications, Sultan Chand and sons, New   Delhi.
2. Joseph Schmuller (2016),Statistical Analysis with Excel For Dummies.
3. Vikash Gupta (2001), Condex Computer course kit, Dreamtech,Publications,New Delhi.
4. Rajaaraman and Niharika (2014), Fundamentals of Computers, PHI,NewDelhi.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	5
InternalAssessmentTest2	5
Quiz/Assignment/SmallProject	5
Seminar	5
Total	**20Marks**
FormativeAssessmentasperguidelines.	

B.A. in Applied Statistics

VI Semester

W. e. f.: 2023-24

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-12

Course Title: Non-parametric Inference
Course Code:016AST011

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-12	Theory	04	04	56hrs.	2hrs.	40	60	100

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Understand general concepts of non-parametric statistics

CO2: Know the importance of non-parametric tests

CO3: Perform various non-parametric tests

CO4: Know various applications of these tests

Unit	Title:	56.hrs/ sem
UnitI	Introduction to nonparametric and distribution-free tests, advantages and limitations.One sample tests: Kolmogorov-Smirnov test, sign test, Wilcoxon signed rank test. Applications of these tests.	14 Hrs
UnitII	Two sample tests: Mann-Whitney test (Wilcoxon rank sum test), Wald-Wolfowitz Run test, signed rank and Wilcoxon signed rank test. Applications of these tests.	14 Hrs
UnitIII	Two sampleand other nonparametric tests : Kolmogorov-Smirnov test, Spearman's rank, linear rank statistics, Chi-square goodness of fit and independence of attributes. Applications of these tests.	14 Hrs
UnitIV	Several samples: median test, Kruskal -Wallis test, Friedman's test.Applications of these tests.	14 Hrs

References:

1. Rohatgi V.K. (1984). An Introduction to Probability Theory and Mathematical Statistics. Wiley Eastern, New Delhi.
2. Jayant V. Deshpande, IshaDewan: Non-parametric Statistics, Theory and Methods,;

3. Jean Gibbons and Subhabrata Chakraborti: Non-Parametric Statistical Inference.CRC Press

4.V.K. Rohatgi,StatisticalInference,WILEY Series

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-13

Course Title:**Operations Research**
Course Code:**016AST012**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-13	Theory	04	04	56hrs.	2hrs.	40	60	100

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1 :   Formulate a linear programming problem and solve it for optimal solution using graphical Methods.

CO2 :   Solve transportation proband give the optimal solution.

CO3 :   Solve assignment problems and give the optimal solution.

CO4 :   Solve game problems using different techniques.

Unit	Title:	56.hrs/ sem
UnitI	**Linear Programming Problem:** Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Definition of terms- Objective function, feasible solution and Optimal solution. Mathematical formulation of linear programming problem in case of two variables with examples. Graphical method of solving LPP and merits and demerits. Simple numerical problems.	14 Hrs
UnitII	**Transportation Problem:** Introduction, definition of Transportation Problem (TP), balanced and unbalanced TP. Feasible solution, basic solution, basic feasible solution, degenerate solution, non-degenerate solution and optimal solution. Methods of finding initial basic feasible solution-North West Corner Rule, Matrix Minima method (lowest cost entry method) and Vogel's approximation method (Unit cost penalty method) and simple problems.	14 Hrs
UnitIII	**Assignment Problem:** Introduction and definition of Assignment problem, mathematical model, balanced and unbalanced assignment problem, Hungarian method of solving an AP, Distinction between Transportation Problem & Assignment Problem. Simple numerical problems on assignment	14 Hrs

UnitIV	Game Theory:	14 Hrs
	Introduction, two person zero sum games, Pure and mixed strategies, maximin and minimax principle, games with saddle point and without saddle points, solution of 2x2 rectangular games, 2xn and mx2 graphical method of solving game problems, dominance rule. Simple numerical problems.	

References:

1. Kanti Swarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.

2. Gupta, P.K. and Hira, D.S.: Operations Research, S. Chand & Company Ltd., New Delhi.

3. Gupta, R.K.: Operations Research, Krishna Prakashana Mandir, Meerut.

4. Sharma, S.D.: Operations Research, Kedarnath Ramnath & Co. Publishers, Meerut.

5. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.

6. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.

7. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-14

Course Title: Statistics for national Development
Course Code:016AST013

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-11	Theory	04	04	56hrs.	2hrs.	40	60	100

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Different methods of collection of data

CO2: Role of national sample survey office

CO3: Knowledge of different types of sample surveys

CO4:Know different development indices

CO5: Understand some population growth models

Unit	Title:	56.hrs/ sem
UnitI	An outline of present official statistical system in India, Role, function, and activities of Central and State Statistical organizations. Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), Registrar General Office and National Statistical Commission.	14 Hrs
UnitII	Scope and content of Population census of India. Population census methods, economic census. Methods of national income estimation, problems in the estimation of national income. System of collection of Agricultural Statistics. Crop yield, Production Statistics, Crop estimation and forecasting. Statistics related to industries, foreign trade, balance of payment, cost of living, inflation, educational and other social statistics.	14 Hrs
UnitIII	Economic development: Classical growth models of Adam Smith Malthus, Devid Richardo. Growth in per capita income and distributive justice. Indices of development, Human Development Index. Estimation of National Income: product approach, income approach and expenditure approach.	14 Hrs
UnitIV	Poverty measurement: measures of incidence and intensity, combined measures, Kakwani and Sen indices. Population growth models – exponential, logistic, Gompertz models. Population projection using Leslie matrix.	14 Hrs

References:

1. Morris H Hansen and William N Hurwitz. Sample Survey Methods and Theory, Volume 1: Methods and Applications (Wiley Classics Library).

2. Dr V K Gupta and Baidya Nath Mandal. Combinatorics in Sample Surveys VIS-A-VIS Controlled Selection.

3 Gupta, K. R. (2010). Economic Growth Models, Atlantic Publishers and Distributors, New Delhi.

4. Parimal Mukhopadhyay. Theory and Methods Of Survey Sampling

5. Ramkumar, R. (1986). Technical Demography, Wiley Eastern, New Delhi.

6. Sen, A. (1977). Poverty and Inequality, Stanford University Press, USA.

7. Bhende A and Kanitkar T. Principles of population studies, Himalaya publishing house.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI
SEC -4

Course Title:SEC: Quantitative Aptitude for Competitive Examinations

Course Code:016AST061

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
SEC-4	**Theory**	**02**	**02**	**30**		**20**	**30**	**50**

* in lieu of internship, 01 additional SEC/ Course based Activities may be offered

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1:Develop general skills required competitive exams

CO2: Develop general skills required to take decision logically

CO3: Solve critical problems related to classification, directions, etc.

Unit	Title: for SEC	28.hrs/ sem
UnitI	**Numerical Aptitude** Number Systems, H.C.F. and L.C.M. of Numbers, Square Roots and Cube Roots Fundamental arithmetical operations, Percentage, Profit and Loss, Ratio and Proportion, Simple Interest, Compound Interest, time and work.	14 Hrs
UnitII	**Reasoning and Mental Ability** Coding-Decoding, Symbol notations, Number Series, Analog and Classification, Blood Relations, Direction Sense. Ranking and Comparison, Input and Output, Assumptions, Conclusion and Inferences.	14 Hrs

References:

1. Aggarwal R. S., Quantitative Aptitude for Competitive Examination, S. Chand Publication.

2. Dinesh Khattar, The Pearson Guide To Quantitative Aptitude for Competitive Examination, Pearson Publication.

3. Ningappa A. H. Mental Ability, Ashok Publication.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	5
InternalAssessmentTest2	5
Quiz/Assignment/SmallProject	5
Seminar	5
Total	**20Marks**
FormativeAssessmentasperguidelines.	

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub

questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours

Prescribed

Internship for graduate Programme (As per UGC)

Course title	Internship Discipline specific
No. of contact hours	90
No. of credits	2
Method of evaluation	Presentation/Report of submission/Activity etc.,

- ❖ Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- ❖ Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session).
- ❖ Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20 hours.
- ❖ The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- ❖ The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC guidelines.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS
as per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020
for

B.Sc. Statistics

w.e.f.

Academic Year 2021-22 and onwards

Curriculum for B.Sc. Statistics of RCUB as per NEP 2020 w.e.f. 2021-22

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BOS COMMITTEE (NEP- STATISTICS)
B.A./B.Sc. STATISTICS PROGRAM 2021-22

1	**Prof. V. S. Shigehalli** **Department of Mathematics, RCU Belagavi**	Chairman
2	**Prof. S. M. Hanchinal** Anjuman Arts, Science and Commerce College Vijaypur	Member
3	**Prof. P. S. Chanagond** S.S. Mamadapur Science College Badami	Member
4	**Prof. S. M. Hiremath** KRCES GGD and BMP Commerce and SVS Science College Baihongal	Member
5	**Dr. Prakash R. Kengnal** STC Arts and Commerce College, Banhatti	Member

Curriculum for B.Sc. Statistics of RCUB as per NEP 2020 w.e.f. 2021-22

Preamble

Several reforms in our education system has been proposed and developed by Ministry of HRD as National Education Policy (NEP)2020 which includes broad based multidisciplinary undergraduate education with necessary knowledge, skills and competencies. It also proposes to bring equity, efficiency and academic excellence at different levels of education. NEP also recommended multidisciplinary undergraduate programmes with multiple exit and multiple entry options with the provision of Certificate/Diploma/Degrees at each of the exits.

Probability and Statistics is the language of uncertainties, riddled modern information age. Statistics facilitates the decision-making process by quantifying the element of chance or uncertainties. Its descriptive and inferential procedures not only formulate the basis of the growth of almost all disciplines of the contemporary world, and also provide an array of employment avenues in all fields. This is a rigorous program in Probability Theory, Statistical Inference, Multivariate Analysis, Linear Models and Regression Analysis and Sample surveys and Design of Experiments designed to give a sound foundation in fundamentals and training in practical Statistics leading to statistical data analysis.

The eight semester 176 credit program has a variety of elective courses to choose from including enough courses on statistical software. A person successfully completing the program will have enough knowledge and expertise to statistically analyze small and large univariate and multivariate data sets, pursue advanced courses in Statistics or a Ph.D. in Statistics, work in software/data analytics industry as domain expert, independently consult for statistical data analysis. The program has proved to be one of the best in traditional Indian Universities/Institutes and has demand from students within and outside the State/Country.

Name of the Degree Program: B.Sc.

Discipline Core: Statistics   **Total Credits for the Program: 176 (till 8th semesters)**

Year of Implementation: 2021-22

Program Outcomes:

By the end of the program the students will be able to:

1. Acquire fundamental/systematic or coherent understanding of the academic field of Statistics and its different learning areas and applications.

2. Develop and demonstrate an ability to understand major concepts in various disciplines of Statistics.

3. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.

4. Understand procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public service and private sectors.

5. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findings of the experiment/investigations.

6. Have a knowledge regarding use of data analytics tools like Excel and R-programming.

7. Developed ability to critically assess a standard report having graphics, probability statements.

8. Analyze, interpret the data and hence help policy makers to take a proper decision.

9. Recognize the importance of statistical modelling and computing, and the role of approximation and mathematical approaches to analyze the real problems using various statistical tools.

10. Demonstrate relevant generic skills and global competencies such as

    (i) Problem-solving skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle   open-ended problems, that

belong to the disciplinary-area boundaries;

(ii)   Investigative skills, including skills of independent thinking of Statistics-related issues andproblems;

(iii)   Communication skills involving the ability to listen carefully, to read texts and reference material analytically and to present   information in a concise manner todifferent groups/audiences of technical or popular nature;

(iv) Analytical skills involving paying attention to details and ability to construct logical Arguments   using   correct technical   language related to Statistics and ability totranslate them with popular language when needed; ICT skills

(v)   Personal skills such as the ability to work both independently and in a group.

11. Undertake research projects by using research skills- preparation of questionnaire, conducting national sample survey, research projects using sample survey, sampling techniques.

12. Understand and apply principles of least squares to fit a model to the given data, study the association between the variables, applications of Probability Theory and Probability Distributions.

RANI CHANNAMMA UNIVERSITY
VIdyaSangam, NH-4, Belagavi – 591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Statistics Major & One MinorDiscipline
Scheme for the Four Years Statistics B.Sc. Undergraduate Honors Programme with effect from 2021-22

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credits	Duration of exams(Hrs)
			IA	SEE	Total	L	T	P		
L1	21BSC1L1LK1	Kannada	30	70	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	30	70	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1STS1L	**Descriptive Statistics**	30	70	100	4	-	-	4	2
	21BSC1C1 STS 1P	**Practical**	15	35	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	30	70	100	4	-	-	4	2
			15	35	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency	15	35	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education- Yoga	15	35	50	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	15	35	50	-	-	2	1	-
OEC1	21BSC1O1STS1	Statistical Methods	30	70	100	3	-	-	3	2
			Total Marks		**750**	**Semester Credits**				**25**

SEMESTER-I

Curriculum for B.Sc. Statistics of RCUB as per NEP 2020 w.e.f. 2021-22

SEMESTER – II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Durationof exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2STS2L	**Probability and Distributions**	40	60	100	4	-	-	4	2
	21BSC2C2STS2P	**Practical**	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education-Yoga	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	Health & Wellness	25	-	25	-	-	2	1	-
OEC2	21BSC2O2STS2	Business Statistics	40	60	100	3	-	-	3	2
		Total Marks	**700**			**Semester Credits**			**25**	
Exit option with Certificate (with the completion of courses equal to a minimum of 48 credits)			**1400**						**50**	

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3STS1L	**Calculus and Probability Distributions**	40	60	100	4	-	-	4	2
	21BSC3C3STS1P	**Practical**	25	25	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BSC3O3STS3	Applied statistics	40	60	100	3	-	-	3	2
		Total Marks	**700**			**Semester Credits**			**25**	

SECOND YEAR: SEMESTER-III

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C2STS2L	**Statistical Inference-I**	40	60	100	4	-	-	4	2
	21BSC4C2STS2P	**Practical**	25	25	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC2	21BSC4AE1ES2	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education- Sports	25		25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S&G) / Cultural	25		25	-	-	2	1	-
OEC4	21BSC4O3STS4	Biostatistics	30	70	100	3	-	-	3	2
		Total Marks	**700**			**Semester Credits**			**25**	
Exit option with Diploma in Science (with the completion of courses equal to a minimum of 96 credits)OR continue studies with Major and Minor			**2800**						**100**	

Third Year: SEMESTER-V

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
Statistics as Major Discipline										
DSC5	21BSC5C5 STSMJ1L	**Matrix Algebra and RegressionAnalysis (3)**	40	60	100	3	-	-	3	2
	21BSC5C5STSMJ1P	**Practical**	25	25	50	-	-	4	2	3
DSC6	21BSC5C5STSMJ2L	**Analysis of variance and design ofexperiments(3)**	40	60	100	3	-	-	3	2
	21BSC5C5STSMJ2P	**Practical**	25	25	50	-	-	4	2	3
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	3
VC1	21BSC5VC1US	Unix & Shell Programming	40	60	100	3	-	-	3	2
	21BSC5VC1FD	Fundamentals of Data Science								
VBC9	21BSC5V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC10	21BSC5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BSC5SE3CS3	Cyber Security	25	25	50	1	-	2	2	2
			Total Marks		650	**Semester Credits**			22	

SEMESTER-VI

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
Statistics as Major Discipline										
DSC7	21BSC6C6STSMJ1L	**Statistical Inference-II**	40	60	100	3	-	-	3	2
	21BSC6C6STSMJ1P	**Practical**	25	25	50	-	-	4	2	3
DSC8	21BSC6C6STSMJ2L	**Sample Surveys and Statistics for National Development**	40	60	100	3	-	-	3	2
	21BSC6C6STSMJ2P	**Practical**	25	25	50	-	-	4	2	3
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	3
VC2	21BSC6VC2HT	Health Care Technologies	40	60	100	3	-	-	3	2
	21BSC6VC2DM	Digital Marketing								
INT1	21BSC6 INT1L	Internship	25	50	75	-	-	2	2	2
VBC1	21BSC6V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BSC6SE4CS4	Professional Communication	25	25	50	1	-	2	2	2
		Total Marks	**725**			**Semester Credits**			**24**	
Exit with Bachelor of Science Degree, B. Sc. (with the completion of courses equal to a minimum of 140 credits)or continue studies with the Major			**4125**			**Total Credits for BSC Program**			**146**	

Statistics Subject as a Minor Discipline

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5 As a Minor Subject	21BSC5C5STSMN1L	**Elements of Multivariate analysis and regression analysis**	40	60	100	3	-	-	3	2
	21BSC5C5STSMN1P	**Practical**	25	25	50	-	-	4	2	3

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC6 As a Minor Subject	21BSC6C6STSMN1L	**Sample Surveys and Design and Analysis of Experiments**	40	60	100	3	-	-	3	2
	21BSC6C6STSMN1P	**Practical**	25	25	50	-	-	4	2	3

Concept Note, Abbreviation Explanation and Coding:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her ownchoices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following ismechanism be adopted in the University:
    One credit (01) = One
    Theory Lecture (L)
    period of one (1) hour.
    One credit (01) = One
    Tutorial (T) period of
    one (1) hour.
    One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of **B.Sc**. **Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**
5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (eitherin same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. OEC: Students should opt OEC from departments other than major and minor disciplines

Curriculum for B.Sc. Statistics of RCUB as per NEP 2020 w.e.f. 2021-22

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1:   Language One
10. L2:   MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit,&Language Urdu
7. Code 1: Course in that semester.
8. STS: Statistics

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks . Averageof two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of Statistics

I Semester B.Sc Statistics

Sub: **Code:**   **Maximum Marks: 60**

a.   **Answer any Six Questions from Question 1   b. Answer**

any Three each Questions from Question 2,3,4and 5

Q.No.1.	Answer any Six Questions (At least Two question from EachUnit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit-I) a. b. c. d.	4X3=15
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=15
Q.No.4.	(Should cover Entire Unit-III) a.	4X3=15

	b. c. d.	
Q.No.5.	**(Should cover Entire Unit-IV)** **a.** **b.** **c.** **d.**	**4X3=15**

<div align="center">

COURSE-WISE SYLLABUS

Semester - I

</div>

Course Title: Descriptive Statistics	
Total Contact Hours: 56	Course Credits:04
Formative Assessment Marks: 40	Duration of ESA/Exam: 2 hours
	Summative Assessment Marks: 60

<div align="center">

Title of the Course: Descriptive Statistics

</div>

Number of TheoryCredits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	52

Content of Theory Course 1	56 Hrs
Unit – 1 : Introduction to Statistics	**14 Hrs**
Statistics: Definition and scope. Concepts of statistical population and sample (SRS, Stratified, Systematic and Cluster sampling methods Definitions only). Data: quantitative and qualitative, cross sectional and time-series, discrete and continuous. Scales of measurement: nominal, ordinal, interval and ratio. Presentation of data: tabular and graphical. Frequency distributions, cumulative frequency distributions and their graphical representations. Stem and leaf displays. (Ref. 4)	
Unit – 2: Univariate Data Analysis	**14 Hrs**
Measures of Central Tendency: Mean, weighted mean, Median, Mode, Geometric and harmonic means, properties, merits and limitations, relation between these measures. Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation and their relative measures. Gini's Coefficient, Lorenz Curve. Moments, Skewness and Kurtosis. Quantiles and measures based on them. Box Plot. Outliers. normal data sets. (Ref.10).	
Unit – 3: Bivariate Data Analysis	**14 Hrs**
Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's and Kendall's measures. Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination. (Ref. 10)	
Unit –4: Multivariate Data Analysis	**14 Hrs**
Analysis of Categorical Data: Contingency table, independence and association of attributes, measures of association - odds ratio, Pearson's and Yule's measure, Multivariate Frequencies, Multivariate Data Visualization, mean vector and dispersion matrix, Multiple linear regression, multiple and partial correlation coefficients. Residual error variance. (Ref. 7)	

References

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). The New Statistical Analysis of Data,Springer
3. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton &Company.
4. Gupta, S.C. (2018), Fundamental of Statistics, Himalaya Publishing House, 7th Edition.
5. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, SultanChand and Co. 12th Edition.
6. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to MathematicalStatistics, Pearson 7th Edition.
7. Joao Mendes Moreira, Andre C P L F de Carvalho, Tomas Horvath (2018), GeneralIntroduction to Data Analytics, Wiley.
8. Johnson, R.A. and Bhattacharyya, G.K. (2006), Statistics: Principles and methods. 5thEdition, John Wiley & Sons, New York.
9. Medhi, J. (2005), Statistical Methods, New Age International.
10. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.
11. Tukey, J.W. (1977), Exploratory Data Analysis, Addison-Wesley Publishing Co.

Year	I	**Course Code:** 21BSC1C1STS1P	**Credits**	02
Sem.	I	**Course Title:** Practical Course - I	**Hours**	45
Course Pre-requisites, if any:		Knowledge of Excel		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

Content of Practical Course - I

(Computing all the practicals manually and using Excel)

1. Presentation of data by frequency tables, diagrams and graphs, stem and leaf, partitionvalues.

2. Arithmetic Mean (AM), geometric mean, harmonic mean, weighted AM, corrected mean.

3. Mode, median, partition values.

4. Absolute and relative measures of dispersion, Box plots.

5. Problems on moments, skewness and kurtosis.

6. Fitting of curves by least squares method.

7. Product moment correlation coefficient and rank correlation.

8. Regression of two variables.

9. Multivariate Descriptive statistics, mean Vector, dispersion matrix correlation matrix,Partial and Multiple correlation.

10. Problems on Association of attributes.

1. Statistical Methods (Open Elective)

Year	I	Course Code: 21BSC1O1STS1		Credits	03
Sem.	1	Course Title: Statistical Methods		Hours	40
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

Course Objectives

1. This is an open elective course for other than statistics students.

2. The students will learn the elements of descriptive statistics, probability, statistical methods such as tests of hypotheses, correlation and regression.

Course Outcomes

Students will be able to;

CO1. Acquire knowledge of statistical methods.

CO2. Identify types of data and visualization, analysis and interpretation.

CO3. Know about elementary probability and probability models.

CO4. Employ suitable test procedures for given data set.

Contents

Unit 1: Introduction   **10 Hours**

Definition and scope of Statistics. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives. Concepts of statistical population and sample. Sampling from finite population - Simple random sampling, Stratified and systematic random sampling procedures (definitions and methods only). Concepts of sampling and non-sampling errors.

Unit 2: Univariate and Bivariate Data Analysis   **10 Hours**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Unit 3: Probability and Distributions   10 Hours

Probability: Random experiment, trial, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable.

Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

Unit 4: Sampling Distributions and Testing of Hypothesis   10 Hours

Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications.

Statistical Hypothesis – null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation. Test for single mean, equality of two means, single variance, and equality of two variances for normal populations.

References

1. Daniel, W. W. (2007 Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley

2. T.W. Anderson and Jeremy D. Finn(1996). The New Statistical Analysis of Data, Springer.

3. Mukhyopadyaya P(1999). Applied Statistics, New Central book Agency, Calcutta.

4. Ross, S.M.(2014) Introduction to Probability and Statistics For Engineers and Scientists.

5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, New Delhi.

B.Sc.
Semester-II

Course Title: Probability and Distributions	
Total Contact Hours: 56	Course Credits:04
Formative Assessment Marks: 40	Duration of ESA/Exam: 2hours
	Summative Assessment Marks: 60

Course Pre-requisite(s): II PUC with Mathematics
Title of the Course: Probability and Distributions

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	52

Content of Theory Course 2	56Hrs
Unit –1 : Probability	14 Hrs
Random experiment, sample space and events, algebra of events. Definitions of Probability-Classical, statistical, subjective and axiomatic approaches – illustrations and applications, Addition rule, Conditional probability, independence of events and multiplication rule, Totalprobability rule, Bayes theorem- applications.	
Unit –2: Random Variables And Mathematical Expectation-(One Dimension)	14 Hrs
Definitions of discrete and continuous random variables, Distribution function, probability mass and density functions – properties and illustrations, Expectation of a random variable and rules of expectation and related results, Moments and moment generating function – properties and uses.	
Unit –3 : Standard Distributions	14 Hrs
Bernoulli, Binomial, Poisson, distributions– mean, variance, moments and m. g. f. recursive relations for probabilities and moments of Binomial and Poisson distributions, Normal distribution and its properties.	

Unit –4: Data Analysis Using R	14 Hrs
Introduction to R: Installation, command line environment, overview of capabilities, brief mention of open source philosophy. R as a calculator: The four basic arithmetic operations. Use of parentheses nesting up to arbitrary level. The power operation. Evaluation of simple expressions. Quotient and remainder operations for integers. Standard functions, e.g., sin, cos, exp, log. The different types of numbers in R: Division by zero leading to Inf or -Inf. NaN. NA.No need to go into details. Variables. Creating a vector using c(), seq() and colon operator. How functions map over vectors. Functions to summarize a vector: sum, mean, sd, median etc. Extracting a subset from the vector (by index, by property). R as a graphing calculator: Introduction to plotting. Plot(), lines(), abline(). No details about the graphics parameters except colour and line width. Barplot, Pie chart and Histogram. Box plot. Scatter plot and simple linear regression using lm(y~x). Problems on discrete and continuous probability distributions.	

References

1. Dudewitz. E.J. and Mishra. S. N. (1998), Modern Mathematical Statistics. John Wiley.

2. Goon A.M., Gupta M.K., Das Gupta .B. (1991), Fundamentals of Statistics, Vol. I,World Press, Calcutta.

3. Gupta. S.C and V.K. Kapoor (2020), Fundamentals of Mathematical Statistics, SultanChand and Co, 12th Edition.

4. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,Seventh Edition, Pearson Education, New Delhi.

5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007), Introduction to the Theory ofStatistics, 3rd Edition. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

6. Ross, S. (2002), A First Course in Probability, Prentice Hall.

7. Sudha G. Purohit, Sharad D. Gore, Shailaja R Deshmukh,(2009), Statistics Using R,Narosa Publishing House.

8. R for   beginners   by   Emmanuel   Paradis   (freely available   at **https://cran.r-project.org/doc/contrib/Paradisrdebuts_en.pdf**)

25

Year	I	**Course Code:** 21BSC1C1STS2P	**Credits**	02
Sem.	II	**Course Title:** Practical Course - II	**Hours**	45
Course Pre-requisites, if any:		Knowledge of Excel and R		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

Content of Practical Course 2: List of Experiments to be conducted

(Computing all the practicals manually and using Excel/R)

1. Two exercise on Descriptive statistics (Presentations,

   Summarizations, correlations,regression and Graphs using R)

2. Computing probability: using addition and multiplication theorems.

3. Conditional probability and Bayes' theorem.

4. Problems on pmf, expectation, variance, quantiles, skewness, kurtosis (Discrete Case).

5. Problems on pdf, expectation, variance, quantiles, skewness,

   kurtosis (Continuouscase).

6. Problems on discrete probability distributions(Binomial and Poisson)

7. Problems on Normal probability distributions

8. Computation of moments and Moment generating functions

   (Discrete and ContinuousCase).

9. Fitting of distributions Binomial, Poisson, Normal distributions.

10. Generation of random samples. (Binomial, Poisson, Normal)

Year	I	Course Code: 21BSC1O1STS2	Credits	03
Sem.	II	Course Title: **Business Statistics**	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

2. Business Statistics (Open Elective)

Course Objectives

1. Provide an introduction to basics of statistics within a financial context.

2. To enable students to use statistical techniques for analysis and interpretation of business data.

Course Outcomes (CO)

Upon the completion of this course students should be able to:

CO1.Frame and formulate management decision problems.

CO2. Understand the basic concepts underlying quantitative analysis.

CO3. Use sound judgment in the applications of quantitative methods to management decisions.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Contents

Unit 1: Statistical Data and Descriptive Statistics   10 Hours

Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross- sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles). Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit 2: Simple Correlation and Regression Analysis   10 Hours

Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; Rank Correlation.

Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

Unit 3: Index Numbers   *10 Hours*

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall-Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number:

Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.

Unit 4: Time Series Analysis   *10 Hours*

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

References

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.

2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K.Viswanathan, Business Statistics: A First Course, Pearson Education.

3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education.

4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.

5. Vohra N. D., Business Statistics, McGraw Hill Education.

6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc-Graw Hill Education.

7. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.

8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS

as per the Choice Based Credit System (CBCS) designed in accordance with

Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

for

B.Sc. Statistics

w.e.f.

Academic Year 2021-22 and onwards

Curriculum for B.Sc. Statistics of RCUB as per NEP 2020 w.e.f. 2021-22

RANI CHANNAMMA UNIVERSITY, BELAGAVI
BOS COMMITTEE (NEP- STATISTICS)
B.A./B.Sc. STATISTICS (I & II SEM) PROGRAM 2021-22

1	**Prof. V. S. Shigehalli** **Department of Mathematics, RCU Belagavi**	Chairman
2	**Prof. S. M. Hancihnal** Anjuman Arts, Science and Commerce College Vijaypur	Member
3	**Prof. P. S. Chanagond** S SMamadapur Science College Badami	Member
4	**Prof. S. M. Hiremath** KRCES GGD and BMP Commerce and SVS Science CollegeBaihongal	Member
5	**Dr. Prakash R Kengnal** STC Arts and Commerce College, Banhatti	Member

BOS COMMITTEE (NEP- STATISTICS)

B.A./B.Sc. STATISTICS (III & IV SEM) PROGRAM 2022-23

1	**Prof. Vishwanath B. Awati,** Department of Mathematics, RCU Belagavi	Chairman
2	**Prof. N. S. Patil,** MGVC Arts, Com and Science College, Muddebihal	Member
3	**Dr. A. T. Shreenivas** - BLDE New Arts College, Tikota	Member

Preamble

Several reforms in our education system has been proposed and developed by Ministry of HRD as National Education Policy (NEP)2020 which includes broad based multidisciplinary undergraduate education with necessary knowledge, skills and competencies. It also proposes to bring equity, efficiency and academic excellence at different levels of education. NEP also recommended multidisciplinary undergraduate programmes with multiple exit and multiple entry options with the provision of Certificate/Diploma/Degrees at each of the exits.

Probability and Statistics is the language of uncertainties, riddled modern information age. Statistics facilitates the decision-making process by quantifying the element of chance or uncertainties. Its descriptive and inferential procedures not only formulate the basis of the growth of almost all disciplines of the contemporary world, and also provide an array of employment avenues in all fields. This is a rigorous program in Probability Theory, Statistical Inference, Multivariate Analysis, Linear Models and Regression Analysis and Sample surveys and Design of Experiments designed to give a sound foundation in fundamentals and training in practical Statistics leading to statistical data analysis.

The eight semester 176 credit program has a variety of elective courses to choose from including enough courses on statistical software. A person successfully completing the program will have enough knowledge and expertise to statistically analyze small and large univariate and multivariate data sets, pursue advanced courses in Statistics or a Ph.D. in Statistics, work in software/data analytics industry as domain expert, independently consult for statistical data analysis. The program has proved to be one of the best in traditional Indian Universities/Institutes and has demand from students within and outside the State/Country.

Name of the Degree Program: B.Sc.

Discipline Core: Statistics   **Total Credits for the Program: 176 (till 8th semesters)**

Year of Implementation: 2021-22

Program Outcomes:

By the end of the program the students will be able to:

1. Acquire fundamental/systematic or coherent understanding of the academic field of Statistics and its different learning areas and applications.

2. Develop and demonstrate an ability to understand major concepts in various disciplines of Statistics.

3. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.

4. Understand procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public service and private sectors.

5. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findings of the experiment/investigations.

6. Have a knowledge regarding use of data analytics tools like Excel and R-programming.

7. Developed ability to critically assess a standard report having graphics, probability statements.

8. Analyze, interpret the data and hence help policy makers to take a proper decision.

9. Recognize the importance of statistical modelling and computing, and the role of approximation and mathematical approaches to analyze the real problems using various statistical tools.

10. Demonstrate relevant generic skills and global competencies such as
    (i) Problem-solving skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle   open-ended problems, that belong to the disciplinary-area boundaries;

    (ii)   Investigative skills, including skills of independent thinking of Statistics-related issues and problems;

(iii) Communication skills involving the ability to listen carefully, to read texts and reference material analytically and to present   information in a concise manner todifferent groups/audiences of technical or popular nature;

(iv) Analytical skills involving paying attention to details and ability to construct logical Arguments   using   correct technical   language related to Statistics and ability to translate them with popular language when needed; ICT skills

(v)   Personal skills such as the ability to work both independently and in a group.

11. Undertake research projects by using research skills- preparation of questionnaire, conducting national sample survey, research projects using sample survey, sampling techniques.

12. Understand and apply principles of least squares to fit a model to the given data, study the association between the variables, applications of Probability Theory and Probability Distributions.

RANI CHANNAMMA UNIVERSITY, BELAGAVI
VIdyaSangam, NH-4, Belagavi – 591156
Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Statistics Major & One MinorDiscipline Scheme for the Four Years Statistics B.Sc. Undergraduate Honors Programme with effect from 2021-22

SEMESTER-I

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credits	Duration of exams(Hrs)
			IA	SEE	Total	L	T	P		
L1	21BSC1L1LK1	Kannada								
	21BSC1L1LFK1	Functional Kannada	40	60	100	4	-	-	3	2
L2	21BSC1L2LEN2	English								
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu	40	60	100	4	-	-	3	2
DSC1	21BSC1C1STS1L	**Descriptive Statistics**	40	60	100	4	-	-	4	2
	21BSC1C1 STS 1P	**Practical**	25	25	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education- Yoga	25	25	50	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	25	50	-	-	2	1	-
OEC1	21BSC1O1STS1	Statistical Methods	40	60	100	3	-	-	3	2
		Total Marks	750			Semester Credits				25

SEMESTER – II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Durationof exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2STS2L	**Probability and Distributions**	40	60	100	4	-	-	4	2
	21BSC2C2STS2P	**Practical**	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education-Yoga	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	Health & Wellness	25	-	25	-	-	2	1	-
OEC2	21BSC2O2STS2	Business Statistics	40	60	100	3	-	-	3	2
		Total Marks	700			**Semester Credits**			25	
Exit option with Certificate (with the completion of courses equal to a minimum of 48 credits)			1400						50	

RANI CHANNAMMA UNIVERSITY, BELAGAVI
VIdyaSangam, NH-4, Belagavi – 591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Statistics Major & One MinorDiscipline Scheme for the Four Years Statistics B.Sc. Undergraduate Honors Programme with effect from 2022-23

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3STS1L	**Calculus and Probability Distributions**	40	60	100	4	-	-	4	2
	21BSC3C3STS1P	**Practical**	25	25	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BSC3O3STS3	Population Studies	40	60	100	3	-	-	3	2
			Total Marks		**700**	**Semester Credits**			**25**	

SECOND YEAR: SEMESTER-III

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
SEMESTER-IV										
			IA	SEE	Total	L	T	P		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C2STS2L	Statistical Inference-I	40	60	100	4	-	-	4	2
	21BSC4C2STS2P	Practical	25	25	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC2	21BSC4AE1ES2	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education- Sports	25		25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S&G) / Cultural	25		25	-	-	2	1	-
OEC4	21BSC4O3STS4	Basics of Operations Research	40	60	100	3	-	-	3	2
		Total Marks	**700**			**Semester Credits**			**25**	
Exit option with Diploma in Science (with the completion of courses equal to a minimum of 96 credits)OR continue studies with Major and Minor			**2800**						**100**	

Concept Note, Abbreviation Explanation and Coding:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her ownchoices, across various disciplines for completing a UG/PG program.

2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following ismechanism be adopted in the University:

    One credit (01) = One Theory Lecture (L) period of one (1) hour.One credit (01) = One Tutorial (T) period of one (1) hour.

    One credit (01) = One practical (P) period of two (2) hours.

3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL

4. In case of **B.Sc. Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**

5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**

6. Wherever there is a practical there will be no tutorial and vice-versa

7. A major subject is the subject that's the main focus of Core degree/concerned.

8. A minor is a secondary choice of subject that complements core major/ concerned.

9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.

10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (eitherin same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.

11. OEC: Students should opt OEC from departments other than major and minor disciplines

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1:   Language One
10. L2:   MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit,&Language Urdu
7. Code 1: Course in that semester.
8. STS: Statistics

ASSESSMENT METHODS

Theory: **Evaluation Scheme for Internal Assessment:**

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks . Averageof two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of Statistics

I Semester B.Sc Statistics

Sub: Code: **Maximum Marks: 60**

a.   Answer any Six Questions from Question 1   b. Answer
any Three each Questions from Question 2,3,4 and 5

Q.No.1.	**Answer any Six Questions (At least Two question from EachUnit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)** **a.** **b.** **c.** **d.**	**4X3=15**
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	**4X3=15**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=15**
Q.No.5.	**(Should cover Entire Unit-IV)** **a.** **b.** **c.** **d.**	**4X3=15**

COURSE-WISE SYLLABUS

Semester – I

Title of the Course: Descriptive Statistics

Year	I	**Course Code:** 21BSC1C1STS1L	**Credits**	04
Sem.	I	**Course Title:** Descriptive Statistics	**Hours**	56
Course Pre-requisites, if any:		II PUC with Mathematics		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	

Number of TheoryCredits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	52

Content of Theory Course 1	56 Hrs
Unit – 1 : Introduction to Statistics	**13 Hrs**
Statistics: Definition and scope. Concepts of statistical population and sample (SRS, Stratified, Systematic and Cluster sampling methods Definitions only). Data: quantitative and qualitative, cross sectional and time-series, discrete and continuous. Scales of measurement: nominal, ordinal, interval and ratio. Presentation of data: tabular and graphical. Frequency distributions, cumulative frequency distributions and their graphical representations. Stem and leaf displays. (Ref. 4)	
Unit – 2: Univariate Data Analysis	**18 Hrs**
Measures of Central Tendency: Mean, weighted mean, Median, Mode, Geometric and harmonic means, properties, merits and limitations, relation between these measures. Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation and their relative measures. Gini's Coefficient, Lorenz Curve. Moments, Skewness and Kurtosis. Quantiles and measures based on them. Box Plot. Outliers. normal data sets. (Ref.10).	
Unit – 3: Bivariate Data Analysis	**15 Hrs**
Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's and Kendall's measures. Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination. (Ref. 10)	
Unit –4: Multivariate Data Analysis	**10 Hrs**
Analysis of Categorical Data: Contingency table, independence and association of attributes, measures of association - odds ratio, Pearson's and Yule's measure, Multivariate Frequencies, Multivariate Data Visualization, mean vector and dispersion matrix, Multiple linear regression, multiple and partial correlation coefficients. Residual error variance. (Ref. 7)	

References

1. Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). The New Statistical Analysis of Data, Springer
3. Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
4. Gupta, S.C. (2018), Fundamental of Statistics, Himalaya Publishing House, 7th Edition.
5. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, SultanChand and Co. 12th Edition.
6. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to MathematicalStatistics, Pearson 7th Edition.
7. Joao Mendes Moreira, Andre C P L F de Carvalho, Tomas Horvath (2018), GeneralIntroduction to Data Analytics, Wiley.
8. Johnson, R.A. and Bhattacharyya, G.K. (2006), Statistics: Principles and methods. 5thEdition, John Wiley & Sons, New York.
9. Medhi, J. (2005), Statistical Methods, New Age International.
10. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.
11. Tukey, J.W. (1977), Exploratory Data Analysis, Addison-Wesley Publishing Co.

Content of Practical Course – I

Year	I	**Course Code:** 21BSC1C1STS1P	**Credits**	02
Sem.	I	**Course Title:** Practical Course - I	**Hours**	45
Course Pre-requisites, if any:		Knowledge of Excel		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 03 hrs.	

(Computing all the practicals manually and using Excel)

1. Presentation of data by frequency tables, diagrams and graphs, stem and leaf, partition values.

2. Arithmetic Mean (AM), geometric mean, harmonic mean, weighted AM, corrected mean.

3. Mode, median, partition values.

4. Absolute and relative measures of dispersion, Box plots.

5. Problems on moments, skewness and kurtosis.

6. Fitting of curves by least squares method.

7. Product moment correlation coefficient and rank correlation.

8. Regression of two variables.

9. Multivariate Descriptive statistics, mean Vector, dispersion matrix correlation matrix, Partial and Multiple correlation.

10. Problems on Association of attributes.

1.

1. Statistical Methods (Open Elective)

(OEC for other students)

Year	I	**Course Code:** 21BSC1O1STS1	**Credits**	03
Sem.	I	**Course Title: Statistical Methods**	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

Course Objectives

1. This is an open elective course for other than statistics students.
2. The students will learn the elements of descriptive statistics, probability, statistical methods such as tests of hypotheses, correlation and regression.

Course Outcomes

Students will be able to;

CO1. Acquire knowledge of statistical methods.

CO2. Identify types of data and visualization, analysis and interpretation.   CO3. Know about elementary probability and probability models.

CO4. Employ suitable test procedures for given data set.

Contents

Unit 1: Introduction   10 Hours

Definition and scope of Statistics. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives. Concepts of statistical population and sample. Sampling from finite population - Simple random sampling, Stratified and systematic random sampling procedures (definitions and methods only). Concepts of sampling and non-sampling errors.

Unit 2: Univariate and Bivariate Data Analysis   10 Hours

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Unit 3: Probability and Distributions   **12 Hours** Probability: Random experiment, trial, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable.

Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

Unit 4: Sampling Distributions and Testing of Hypothesis   **10 Hours**
Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications.

Statistical Hypothesis – null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation.

Test for single mean, equality of two means, single variance, and equality of two variances for normal populations.

References

1. Daniel, W. W. (2007 Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley
2. T.W. Anderson and Jeremy D. Finn(1996). The New Statistical Analysis of Data, Springer.
3. Mukhyopadyaya P(1999). Applied Statistics, New Central book Agency, Calcutta.
4. Ross, S.M.(2014) Introduction to Probability and Statistics For Engineers and Scientists.
5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, New Delhi.

B.Sc.

Semester-II

Title of the Course: Probability and Distributions

Year	I	**Course Code:** 21BSC2C2STS2L	**Credits**	04
Sem.	II	**Course Title:** Probability and Distributions	**Hours**	56
Course Pre-requisites, if any:		II PUC with Mathematics		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	52

Content of Theory Course 2	56Hrs
Unit –1 : Probability	14 Hrs
Random experiment, sample space and events, algebra of events. Definitions of Probability-Classical, statistical, subjective and axiomatic approaches – illustrations and applications, Addition rule, Conditional probability, independence of events and multiplication rule, Totalprobability rule, Bayes theorem- applications.	
Unit –2: Random Variables And Mathematical Expectation-(One Dimension)	14 Hrs
Definitions of discrete and continuous random variables, Distribution function, probability mass and density functions – properties and illustrations, Expectation of a random variable and rules of expectation and related results, Moments and moment generating function – properties and uses.	
Unit –3 : Standard Distributions	14 Hrs
Bernoulli, Binomial, Poisson, distributions– mean, variance, moments and m. g. f. recursive relations for probabilities and moments of Binomial and Poisson distributions, Normal distribution and its properties.	

Unit –4: Data Analysis Using R	14 Hrs
Introduction to R: Installation, command line environment, overview of capabilities, brief mention of open source philosophy. R as a calculator: The four basic arithmetic operations. Use of parentheses nesting up to arbitrary level. The power operation. Evaluation of simple expressions. Quotient and remainder operations for integers. Standard functions, e.g., sin, cos, exp, log. The different types of numbers in R: Division by zero leading to Inf or -Inf. NaN. NA. No need to go into details. Variables. Creating a vector using c(), seq() and colon operator. How functions map over vectors. Functions to summarize a vector: sum, mean, sd, median etc. Extracting a subset from the vector (by index, by property). R as a graphing calculator: Introduction to plotting. Plot(), lines(), abline(). No details about the graphics parameters except colour and line width. Barplot, Pie chart and Histogram. Box plot. Scatter plot and simple linear regression using lm(y~x). Problems on discrete and continuous probability distributions.	

References

2. Dudewitz. E.J. and Mishra. S. N. (1998), Modern Mathematical Statistics. John Wiley.

3. Goon A.M., Gupta M.K., Das Gupta .B. (1991), Fundamentals of Statistics, Vol. I, World Press, Calcutta.

4. Gupta. S.C and V.K. Kapoor (2020), Fundamentals of Mathematical Statistics, Sultan Chand and Co, 12th Edition.

5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, Seventh Edition, Pearson Education, New Delhi.

6. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007), Introduction to the Theory of Statistics, 3rd Edition. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

7. Ross, S. (2002), A First Course in Probability, Prentice Hall.

8. Sudha G. Purohit, Sharad D. Gore, Shailaja R Deshmukh,(2009), Statistics Using R, Narosa Publishing House.

9. Rfor beginners by Emmanuel Paradis (freely available at **https://cran.r-project.org/doc/contrib/Paradisrdebuts_en.pdf**)

Year	I	**Course Code:** 21BSC2C2STS2P	**Credits**	02
Sem.	II	**Course Title: Practical Course - II**	**Hours**	45
Course Pre-requisites, if any		Knowledge of Excel and R		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA:.03 hrs.	

Content of Practical Course 2: List of Experiments to be conducted

(Computing all the practicals manually and using Excel/R)

1. Two exercise on Descriptive statistics (Presentations, Summarizations, correlations,regression and Graphs using R)

2. Computing probability: using addition and multiplication theorems.

3. Conditional probability and Bayes' theorem.

4. Problems on pmf, expectation, variance, quantiles, skewness, kurtosis (Discrete Case).

5. Problems on pdf, expectation, variance, quantiles, skewness, kurtosis (Continuouscase).

6. Problems on discrete probability distributions(Binomial and Poisson)

7. Problems on Normal probability distributions

8. Computation of moments and Moment generating functions (Discrete and ContinuousCase).

9. Fitting of distributions Binomial, Poisson, Normal distributions.

10. Generation of random samples. (Binomial, Poisson, Normal)

Year	I	**Course Code:** 21BSC2O2STS2	**Credits**	03
Sem.	II	**Course Title: Business Statistics**	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

1. Business Statistics (Open Elective)

(OEC for other students)

Course Objectives

1. Provide an introduction to basics of statistics within a financial context.
2. To enable students to use statistical techniques for analysis and interpretation of business data.

Course Outcomes (CO)

Upon the completion of this course students should be able to:

CO1.Frame and formulate management decision problems.

CO2. Understand the basic concepts underlying quantitative analysis.

CO3. Use sound judgment in the applications of quantitative methods to management decisions.

Pedagogy

1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources.

Contents

Unit 1: Statistical Data and Descriptive Statistics   **10 Hours**

Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross- sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles). Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit 2: Simple Correlation and Regression Analysis   **10 Hours**

Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; Rank Correlation.

Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

Unit 3: Index Numbers   **10 Hours**

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall-Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.

Unit 4: Time Series Analysis   **10 Hours**

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of

trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

References

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.

2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K.Viswanathan, Business Statistics: A First Course, Pearson Education.

3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education.

4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.

5. Vohra N. D., Business Statistics, McGraw Hill Education.

6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc-Graw Hill Education.

7. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.

8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

B.Sc. Semester – III

Subject: STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in III semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-3 (Theory)**: 21BSC3C3STS1L**

Year	II	**Course Code:** 21BSC3C3STS1L	**Credits**	04
Sem.	III	**Course Title: Calculus and Probability Distributions**	**Hours**	56
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1   Judge continuity of a function, find integrations and solve problems of differentiability.

CO 2   Solve problems of various analytical environments using different distributions and their properties.

CO 3   Find sampling distributions of functions of random variables and explore their applications.

Syllabus- Course 3 (Theory): **21BSC3C3STS1L** : Title- Calculus and Probability Distributions	**Total Hrs: 56**
Unit-I : Calculus of one and more variables	**15 hrs**
Review of calculus of one variable: continuity, differentiability, mean value theorem and Taylor series expansion. Functions of several variables: Continuity, directional derivatives, differentials of functions of several variables, the gradient vector. The mean value theorem, a sufficient condition for the existence of the differential, partial derivatives of higher order and Taylor's formula. Applications of partial differentiation, Jacobians. Riemann integrals, integration by parts, mean value theorem. Multiple integrals and evaluation of multiple integrals by repeated integration, Mean-value theorem for multiple integrals. Sequences and Series of real numbers. convergence of sequences and series, tests for convergence of series. (Only results and applications)	
Unit-II Distribution of Random Variables (Two-dimensional)	**12 hrs**
Two dimensional random variables: Joint distribution, Marginal distribution and Conditional distributions of random variables, conditional expectation, covariance,	

correlation and moments.	
Distribution of functions of random variables using m.g.f. and distribution function. Transformation of variable technique (one and two variables).	
Chebyshev's inequality- proof and its use in approximating probabilities; Statements of Weak Law of Large Numbers; Convergence in law and Central Limit theorems – De-Moivre. (Some simple examples)	
Unit-III Probability Distributions-II	**16 hrs**
Discrete distributions: Rectangular, Geometric, Negative Binomial, Hypergeometric, Multinomial- definition through probability mass function, mean, variance, moments, p.g.f., m.g.f., other properties and applications. Continuous distributions: Uniform, Gamma, Exponential, Beta (type 1 and type 2), Cauchy, Weibull– definition through probability density function, mean, variance, moments, m.g.f., other properties and applications. Bivariate normal distribution- definition through probability density function, marginal and conditional distribution.	
Unit-IV Sampling Distributions and Simulation	**13 hrs**
Definitions of random sample, parameter and statistic, sampling distribution of sample mean, standard error of sample mean, sampling distribution of sample variance, standard error of sample variance. Exact sampling distributions: Chi square distribution- mean, variance, moments, mode, additive property. Student's and Fisher's t-distribution- mean, variance, moments and limiting form of t distribution. Snedecor's F-distribution: mean, variance and mode. Distribution of 1/F. Relationship between t, F and $\chi2$ distributions. Introduction to simulation. Generation of random observations from Uniform, Exponential, Normal, Binomial, Poisson distributions using inverse-method and R-codes.	

Books recommended.

1. Andre I Khuri (2003). Advanced Calculus with Applications in Statistics, Second Edition, John Wiley & Sons.
2. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer
3. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.
5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,10th Edition, Pearson Education, New Delhi.
6. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.
7. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.
8. Ross, S. M. (2014). Introduction to Probability Models. 11th Edition, Elsevier science.

9.   Ross, S. M. (2012). Simulation. Academic Press.
10. Shanthi Narayana (2000), Integral Calculus, S. Chand & Co. Ltd.
11. Shanti Narayana (2000). Differential Calculus, S. Chand & Co. Ltd.
12. Verzani, J. (2002). Simple R - Using R for Introductory Statistics.

<div align="center">Course No.-03 (Practical): 21BSC3C3STS1P</div>

Year	II	Course Code: 21BSC3C3STS1P	Credits	02
Sem.	III	**Course Title: Practical**	**Hours**	52
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA:.03 hrs.	

Course Outcome (CO):

After completion of course (Practical), students will be able to gain:

CO 1   Practical knowledge of handling various types of R-functions for calculus and probability

distributions.

CO 2   Practical knowledge of carrying out numerical analysis.

CO 3   The knowledge of simulating random observations from various probability distributions using R.

List of the Experiments for 52 hrs / Semesters

Note: The first practical assignment is on R-programming. Practical assignments 2 to 10 have to be first solved manually (using scientific calculators) and executed using R-programming.

1.   Demonstration of R functions for calculus, distribution of random variables, probability distributions, sampling distributions, simulation.

2.   Numerical differentiation and integration.

3.   Bivariate Probability Distributions - Marginal and Conditional distributions,

4.   Bivariate Probability Distributions - Conditional Mean, Conditional Variance, Correlation.

5.   Applications of Chebyshev's inequality (For standard distributions such as Normal, Exponential, Gamma).

6.   Applications of discrete probability distributions - Negative – Binomial, Geometric, Hyper geometric and discrete uniform, multinomial distributions.

7.   Applications of continuous probability distributions - Exponential, Gamma, Cauchy, Weibull distributions.

8.   Fitting of discrete and continuous distributions.

9. Generating random sample from discrete distributions.

10. Generating random sample from continuous distributions.

General instructions:

Computation of all the practicals manually and using Excel

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

Students have to attempt 3 practical questions out of four practical questions given, each carrying 7 marks.

1. **7 Marks**

2. **7 Marks**

3. **7 Marks**

4. **Viva 2 Marks**

5. **Journal 2 Marks**

Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Andre I Khuri (2003). Advanced Calculus with Applications in Statistics, Second Edition, John Wiley & Sons.

2. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer

3. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.

4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.

5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,10th Edition, Pearson Education, New Delhi.

6. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.

7. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.

8. Ross, S. M. (2012). Simulation. Academic Press.

9. Verzani, J. (2002). Simple R - Using R for Introductory Statistics.

B.Sc. Semester – III (OEC)

Subject: POPULATION STUDIES
(OEC for other students)

Year	II	**Course Code:** 21BSC303STS3		**Credits**	03
Sem.	III	**Course Title: POPULATION STUDIES**		**Hours**	42
Course Pre-requisites, if any			NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

After completion of course, students will be able to:

CO 1 : Study the concepts of Vital Statistics, sources of data, different measures of Fertility, Mortality and migration.

CO 2 : Understand the Growth rates- GRR and NRR and their interpretations.

Syllabus- OEC: 21BSC303STS3: Title- POPULATION STUDIES	Total Hrs: 42
Unit-I Introduction and Sources of Population Data	**14 hrs**
History, definition, nature and scope of population Studies. Sources of population data – salient features of Census, Civil Registration System, National Sample Surveys, Demographic Surveys, relative merits and demerits of these sources. Coverage and content errors. Use of balancing equations, Chandrasekar-Deming formula to check completeness of vital registration data, use of Whipple's, Myer's and UN indices.	
Unit-II Fertility, Mortality	**14 hrs**
Basic concepts and terms used in the study of fertility. Measures of fertility- Crude Birth Rate (CBR), General Fertility Rate (GFR), Age Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), Birth order statistics, Child Women ratio. Measures of reproduction- Gross Reproduction Rate (GRR)and Net Reproduction rate(NRR). Measurement of population growth rate- simple growth rate and compound growth. Basic concepts and terms used in the study of mortality. Measures of mortality- Crude Death Rate (CDR), Age Specific Death Rate (ASDR), Direct and Indirect Standardized Death rates, Infant Mortality Rate (IMR), Under-five mortality Rate, Neo-natal mortality rate, Post-natal mortality rate; Maternal Mortality Rate (MMR).	
Unit-III Life tables and Population change	**14 hrs**
Life tables: Components of a life table, force of mortality and expectation of life table, types of life tables. Construction of life tables using Reed-Merrell's method, Greville's method. Uses of life tables.	

Basic concepts and definition of population change, migration. Types of migration-internal and international, factors affecting migration. Rates and ratios of Migration-Indirect measures of net-internal migration, national growth rate method, residual method, push-pull factors Population estimates and projections.	

Books recommended.

1. Barclay, G, W(1968). Techniques of Population Analysis, John Wiley and Sons, Incs. New York/London.
2. Keyfitz, H (1968). Introduction to the Mathematics of Population. Addison-Wesley Publishing Co.
3. Pathak, K.B and Ram, F (1991).Techniques of Demographic Analysis, Himalaya Publishing House.
4. Ramakumar. R (1986). Technical Demography, Wiley Eastern Ltd.
5. Srinivasan. K (1998). Basic Demographic Techniques and Applications, Sage Publication, New Delhi.
6. Wunsch G.J. & M.G. Tarmota(1978). Introduction to Demographic Analysis, Plenum Press, N.Y.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A
1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

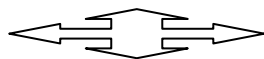2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
     questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in IV semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Year	II	Course Code: 21BSC4C2STS2L		Credits	04
Sem.	IV	**Course Title: STATISTICAL INFERENCE-I**		**Hours**	56
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1   Carryout statistical analysis by identifying families of distributions and the use of order statistics.

CO 2   To find estimators using different methods of estimation and compare estimators.

CO 3   To carryout statistical inference using different tests of hypotheses under different scenarios.

Syllabus- Course 4 (Theory): **21BSC4C2STS2L** : Title- STATISTICAL INFERENCE-I	Total Hrs: 56
Unit-I Point Estimation-I	**16 hrs**
Families of distributions- location and scale families. Single parameter exponential family. Concept of order statistics, Distribution of maximum and minimum order statistics (with proof) and rth order statistic (without proof). Concepts of estimator and estimate. Criteria for estimators: Unbiasedness, Consistency. Invariance property of consistent estimators. Efficiency and relative efficiency. Mean squared error as a criterion for comparing estimators. Sufficient statistics. Statement of Neyman-Factorization theorem.	
Unit-II : Point Estimation-II	**12 hrs**
Fisher information function. Statement of Cramer–Rao inequality and its applications. Minimum Variance Unbiased Estimator and Minimum Variance Bound Estimator. Maximum likelihood and method of moment estimation; Properties of MLE and moment estimators and examples. Method of Scoring, Rao-Blackwell theorem and examples.	

Unit-III Testing of Hypotheses	**18 hrs**
Statistical hypotheses - null and alternative, Simple and composite hypotheses. Type-I and Type-II errors, test functions. Randomized and non-randomized tests. Size, level of significance, Power function, power of tests. Critical region, p- value and its interpretation. Most Powerful (MP) and UMP test. Statement of Neyman-Pearson Lemma and its applications. Likelihood ratio tests. Large and small samples tests of significance. Tests for single mean, equality of two means, single variance and equality of two variances for normal populations. Tests for proportions.	
Unit-IV Interval Estimation	**10 hrs**
Confidence interval, confidence coefficient, shortest confidence interval. Methods of constructing confidence intervals using pivotal quantities. Construction of confidence intervals for mean, difference of two means, variance and ratio of variances, proportions, difference of two proportions and correlation coefficient.	

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.

2. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.

3. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,   10th Edition, Pearson Education, New Delhi.

4. Kale, B.K. (1999). A First Course on Parametric Inference, New Delhi, Narosa Publishing House.

5. Kendall, M.G., et. al., (1996).An Introduction to the Theory of Statistics, Universal Book Stall.

6.   Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.

7. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

Course No.-4 (Practical) : 21BSC4C2STS2P

Year	II	Course Code: 21BSC4C2STS2P		Credits	02
Sem.	IV	Course Title: PRACTICAL		Hours	52
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 25		Summative Assessment Marks: 25		Duration of ESA:.03 hrs.	

Course Outcome (CO):

After completion of course (Practical), students will be able to gain :

CO 1   Practical knowledge of computing the estimates and test statistics using R.

CO 2   Practical knowledge of carrying out statistical inference with different tests of hypotheses.

CO 3   Practical knowledge on carrying out MP and UMP tests using R.

List of the Experiments for 52 hrs / Semesters

Note: The first practical assignment is on R-programming and R packages. Practical assignments 2 to 10 have to be first solved manually (using scientific calculators) and executed using R-programming.

1. Demonstration of R-functions for estimation and testing of hypotheses.

2. Point estimation of parameters and obtaining estimate of standard errors and mean square error.

3. Computing maximum likelihood estimates.

4. Computing moment estimates.

5. Interval estimation: Construction of confidence interval (large and small samples)

6. Evaluation of Probabilities of Type – I and Type – II errors and power of tests.

7. Small sample tests: Tests for mean, equality of means under normality when variance is (i) known (ii) unknown, P-values.

8. Small sample tests: single proportion and equality of two proportions, variance and equality of two variances under normality.P-values for the above tests.

9. Large sample tests: Tests for mean, equality of means when variance is (i) known (ii) unknown, under normality, variance and equality of two variances under normality. P-values for the above tests.

10. MP and UMP tests for parameters of binomial, Poisson distributions, normal and Exponential(scale parameter only) distributions and power curve.

General instructions:

Computation of all the practicals manually and using R

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

Students have to attempt 3 practical questions out of four practical questions given, each carrying 7 marks.

1. **7 Marks**

2. **7 Marks**

3. **7 Marks**

4. **Viva 2 Marks**

5. **Journal 2 Marks**

     Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.

2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, 10th Edition, Pearson Education, New Delhi.

3. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.

4. R for beginners by Emmanuel Paradis (freely available at **https://cran.r-project.org/doc/contrib/Paradisrdebuts_en.pdf**)

B.Sc. Semester – IV

Subject: STATISTICS
Open Elective Course (OEC-4): 21BSC4O3STS4
(OEC for other students)

Year	II	Course Code: 21BSC4O3STS4		Credits	03
Sem.	IV	Course Title: BASICS OF OPERATIONS RESEARCH		Hours	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	

Course Outcomes (CO):

Students will be able to

CO1- Generate mathematical models of business environment.

CO2-Analyze the business situations.

CO3-Use different solution procedures through OR models.

Syllabus- OEC: 21BSC4O3STS4: Title- Basics of Operations Research	Total Hrs: 42
Unit-I Introduction to Operations Research(OR) and LPP	**14 hrs**
Origin and growth of OR, importance of OR in managerial decision making, scope and applications of OR, models and modelling in OR. Linear programming problems(LPP): Formulation of the problem, feasible & infeasible, basic feasible solution, optimal, unbounded and multiple optimal solutions of LPP, solution by graphical method. Slack, Surplus and Artificial variables. Duality in LPP, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality.	
Unit-II Allocation Problems	**14 hrs**
Transportation problems: Formulation, methods of finding initial solution (North West Corner Rule, Least Cost Method and Vogel's Approximation Method), unbalanced transportation problems, maximization transportation problem. Assignment problems: Formulation, methods of solution, Hungarian method, multiple optimal solutions, unbalanced problems, maximization problems.	
Unit-III Decision theory	**14 hrs**
Game theory: Basic concepts. Two – Person Zero Sum Game. Pure and Mixed Strategies. Maximin– Minimax principle, Games with and without saddle points. Principle of dominance.	

Concepts of decision making, decision making environments, Decision making under uncertainty - Decision making under risk, decision tree analysis. Case discussion. Concepts of network analysis, project network models, Critical Path Method, PERT.	

Books recommended.

1. Hillier, F S, et al. Introduction to Operations Research (9/e). Tata McGraw Hill, 2011.

2. Ravindran, A and Don T Phillips. Operations Research: Principles and Practice. John Wiley & Sons, 1987.

3. Sharma, J K. Operations Research: Theory and Applications (5/e). New Delhi: Laxmi Publications, 2013.

4. Taha, Hamdy A. Operations Research: An Introduction (9/e). Prentice Hall, 2010.

5. Vohra, N D. Quantitative Techniques for Management. Tata McGraw Hill Education, 2015.

6. KantiSwarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.

7. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.

8. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

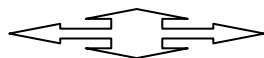2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub
    questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

B.Sc.in Statistics
Effective from2023-24

Sem.	Type ofCourse	Theory/Practical	Course Code	CourseTitle	Instruction onhour/week	Totalhours /sem	Duration ofExam	Marks Formative	Marks Summative	Marks Total	Credits
V	DSCC-9	Theory	035 STA 011	Matrix algebra and Regression analysis	04hrs	56	02hrs	40	60	100	04
	DSCC-10	Practical	035 STA 012	Matrix algebra and Regression analysis	04hrs	56	03hrs	25	25	50	02
	DSCC-11	Theory	035 STA 013	Analysis of variance and Design of experiments	04hrs	56	02hrs	40	60	100	04
	DSCC-12	Practical	035 STA 014	Analysis of variance and Design of experiments	04hrs	56	03hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	035 STA 061	achine Learning with R-programming	04hrs	56	03hrs	25	25	50	02
	Total							**275**	**375**	**650**	**26**
VI	DSCC-13	Theory	036 STA 011	Statistical Inference-II	04hrs	56	02hrs	40	60	100	04
	DSCC-14	Practical	036 STA 012	Statistical Inference-II	04hrs	56	03hrs	25	25	50	02
	DSCC-15	Theory	036 STA 013	Sampling Methods,Official Statistics and Econometrics	04hrs	56	02hrs	40	60	100	04
	DSCC-16	Practical	036 STA 014	Sampling Methods,Official Statistics and Econometrics	04hrs	56	03hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	Internship-1	Practical	036 STA 091	Data Science Internship /Project.				50	0	50	02
	Total							**300**	**350**	**650**	**26**

B.Sc. Semester–V

DisciplineSpecificCourse(DSC)-9

Course Title:Matrix algebra and regression analysis

Course Code:**035 STA 011**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-9	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1 :   Demonstrate and understanding of basic concepts of matrix algebra, including determinants, inverse and properties of various types of matrices.

CO2 :   Apply matrix algebra and linear algebra techniques to solve systems of linear equations, determine the rank of matrix, understanding quadratic forms and their applications in statistics, characteristic roots and vectors.

CO3 :   Develop and understanding of simple and multiple regression models, including the assumptions underlying these models, techniques for inference and hypothesis testing and diagnostics checks and corrections.

CO4 :   Apply regression analysis techniques to real world data sets.

Unit	Title:	56. hrs/sem
UnitI	**Algebra of matrices and determinants :** A review of matrix algebra, theorems related to triangular, symmetric and skew symmetric matrices, idempotent matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix, unitary matrices. Adjoint and inverse of a matrix and related properties. Determinants of Matrices: Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants. Jacobi's Theorem, product of determinants.	14 hrs
UnitII	**Linear Algebra :** Linear algebra: Use of determinants in solution to the system of linear equations, row reduction and echelon forms, the matrix equations AX=B, solution sets of linear equations, linear independence, Applications of linear equations. inverse of a matrix. Rank of a matrix, row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices.	14 hrs

UnitIII	**Simple linear regression :**	14 hrs
	Assumptions, inference related to regression parameters, standard error of prediction, tests on intercepts and slopes, extrapolation, diagnostic checks and correction: graphical techniques, tests for normality, uncorrelatedness, homoscedasticity, lack-of-fit testing, transformations on Y or X (Box-Cox, square root, log etc.), method of weighted least squares, inverse regression.	
UnitIV	**Multiple linear regression :**	14 hrs
	Standard Gauss Markov setup, Gauss-Markov theorem (without proof), least squares (LS) estimation, variance-covariance of LS estimators, estimation of error variance, LS estimation with restriction on parameters. Simultaneous estimation of linear parametric functions. Tests of hypotheses for one and more than one linear parametric functions, confidence intervals, Variable selection problems.	

References:

1. Ramachandra Rao, A. and Bhimasankaram, P. (2000). Linear Algebra.Hindustan Book Agency
2. Searle, S. R. (1982). Matrix Algebra Useful for Statistics, John Wiley, New York.
3. Kumaresan, S. (2000). Linear Algebra: A Geometric Approach, Prentice Hall
4. Gilbert strang (2016) Linear Algebra and its Applications, 5th edition Cengage Learning.
5. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003). Introduction to Linear Regression Analysis, Wiley.
6. Weisberg, S. (2005). Applied Liner Regression, Wiley.
7. Yan, X. and Su, X. G. (2009). Linear Regression Analysis: Theory & Computing, World Scientific.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.Sc. Semester–V

DisciplineSpecificCourse(DSC)-10

Course Title:Matrix algebra and Regression analysis

Course Code:**035 STA 012**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-10	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1:Computation of rank, inverse, and Eigen values of higher order matrix

CO 2 :Express Linear Regression models in Matrix form and model evaluation with software.

CO 3: Identify situation where linear regression is appropriate.

CO4: Build and fit linear regression models with software.

CO5: Interpret estimates and diagnostic statistics.

CO6: Produce exploratory graphs.

Expt. No,	Title:	56.hrs/ sem
1	Calculation of determinant of higher order	
2	Calculation of rank of a matrix	
3	Calculation of equivalent canonical form by using elementary row and column operations	
4	Calculation of inverses of symmetric matrices of higher order by partitioning method	
5	Calculation of inverse of matrices of higher order	
6	Calculation of eigen values and eigen vectors	
7	Solution of simultaneous equations	
8	Simple Linear Regression	
9	Multiple Regression-I	
10	Multiple Regression-II	

Instruction to the Examiners

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.

2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in-charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practical's and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such

cases the marks reserved, for the journal shall be deducted.

3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.

4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.

5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal / external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Solve any three questions out of given four questions manually and execute problems in R software, each carry 07 marks.	21
Viva Voce	2
Certified Journal	2
Total	**25Marks**
Formative Assessment as per UNIVERSITY guidelines are compulsory	

The same shall be used for semester end Examination

B.Sc. Semester–V

DisciplineSpecificCourse(DSC)-11

Course Title:Analysis of variance and Design of experiments

Course Code:**035 STA 013**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-11	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1 :   Can learn Exploratory Data Analysis (EDA) basics for ANOVA appropriate data.

CO2 :   Learn fixed and random effect models and one-way and two-way classified data

CO3 :   Understand different designs (CRD, RBD, LSD) and missing plot techniques.

CO4 :   Understand the different factorial experiments.

CO5 :   Develop complete and partial confounding for factorial experiments.

Unit	Title:	56.Hrs/ sem
UnitI	**ANALYSIS OF VARIANCE:** Meaning and assumptions. Fixed and random effect models. Analysis of One - way and two way classified data with and without interaction effects. Multiple comparison tests: Tukey's method, Critical difference.	14 hrs
UnitII	**EXPERIMENTAL DESIGNS :** Principles of design of experiments. Completely randomized, randomized block and Latin square designs (CRD, RBD, LSD) – layout formation and the analysis using fixed effect models. Comparison of efficiencies of CRD, RBD and LSD. Estimation of one and two missing observations in RBD and LSD and analysis.	14 hrs
UnitIII	**FACTORIAL EXPERIMENT :** Basic concepts – main and interaction effects, and orthogonal contrasts in 2^2 and 2^3 factorial experiments. Yates' method of computing factorial effects total. Analysis of $2^2$and 2^3factorial experiments in RBD.	14 hrs
UnitIV	**CONFOUNDING :** Need for confounding. Types of confounding - Complete and partial, Confounding in a 2^3 - factorial experiment in RBD and its analysis.	14 hrs

References:

1. Goon, A. M., Gupta, M. K., Das Gupta, B.(1991). Fundamentals of Statistics, Vol-I, World Press, Calcutta.
2. Montgomery. D. C. (2014): Design and Analysis of Experiments, Wiley. New York.
3. Joshi. D. D. (1987): Linear Estimation and Design of Experiments, New Age International (P) Limited, New Delhi.
4. Cochran. G and G. M. Cox, G. M. (1992): Experimental Designs, John Wiley and Sons, New York.
5. Mukhopadhyay. P (2015): Applied Statistics, Books and Allied (P) Ltd., Kolkata.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.Sc. Semester–V

DisciplineSpecificCourse(DSC)-12

Course Title:Analysis of variance and Design of experiments

Course Code:**035 STA 014**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-12	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1 :   Learn Perform basic computations of ANOVA with R-programming and interpret the results.

CO2 :   Carry out the Tukey pairwise mean comparison method and Learn about other pairwise mean comparison methods with R-programming.

CO3 :   Construct and evaluate an appropriate statistical model (CRD, RBD, LSD, etc.) in order to answer important scientific or business-related questions with R programming.

CO4 :   Sketch and interpret bar graphs and line graphs showing the results of studies with simple factorial designs with Statistical software's.

CO5 :   Perform analysis to distinguish between main effects and simple effects with Statistical software's and recognize when an analysis of simple effects is required.

CO6   Analyses Confounding, Partial and Total confounding in factorial experiment with Statistical software's.

Expt. No,	Title:	56.hrs/ sem
1	ANOVA for one-way classified data.	
2	ANOVA for two-way classified data.	
3	Analysis of CRD.	
4	Analysis of RBD.	
5	Analysis of LSD.	
6	Missing plot techniques in RBD and LSD.	
7	Analysis of 2^2factorial experiment usingRBD layout.	
8	Analysis of 2^3factorial experiment using RBD layout.	
9	Analysis of 2^3factorial experiment using RBD layout (Complete confounding).	
10	Analysis of 2^3factorial experiment using RBD layout (Partial confounding).	

Instruction to the Examiners

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.

2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in-charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the

Head/Principal shall issue a certificate stating that he/she has attended the regular practical's and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases the marks reserved, for the journal shall be deducted.

3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.

4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.

5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal / external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Solve any three questions out of given four questions manually and execute problems in R software, each carry 07 marks.	21
Viva Voce	2
Certified Journal	2
Total	**25Marks**
Formative Assessment as per UNIVERSITY guidelines are compulsory	

The same shall be used for semester end Examination

B.Sc. Semester–V

Skill Enhancement Course: SEC-3

Course Title:Machine Learning with R-programming

Course Code:035 STA 061

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
SEC-3	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): Attheend ofthecourse,studentswillbeableto:

CO1 : Develop an appreciation for what is involved in Learning models from data

CO2 : Understand a wide variety of learning algorithms

CO3 : Understand how to evaluate models generated from data

CO4 : Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Expt. No,	Title:	56.hrs/ sem
1	Machine Learning Algorithms using Simple Linear Regression Model (Problem 1)	
2	Machine Learning Algorithms using Simple Linear Regression Model (Problem 2)	
3	Machine Learning Algorithms using Multiple Linear Regression Model (Problem 1)	
4	Machine Learning Algorithms using Multiple Linear Regression Model (Problem 2)	
5	Machine Learning Algorithms using Polynomial Regression Model (Problem 1)	
6	Machine Learning Algorithms using Polynomial Regression Model (Problem 2)	
7	Machine Learning Algorithms using Logistic Regression Model (Problem 1)	
8	Machine Learning Algorithms using Logistic Regression Model (Problem 2)	
9	Machine Learning Algorithms using Logit Transformation Model	
10	Machine Learning Algorithms using Decision Tree Learning Methods	

References:

1.	Andreas M and Guido S (O'Reilly) (2016). Introduction to machine learning with Python.
2.	Deborah Nolan and Duncan Temple Lang (2015). Data Science in R- A case studies approach to computational reasoning and problem solving, CRC Press.
3.	Gareth J, Daniel W, Trevor, H and Tibshirani, R (2013). An Introduction to Statistical Learning with Application in R.
4.	Zelterman , D. (2015). Applied Multivariate Statistics with R, Springer.
5.	Nina Zumel and John Mount (2020), Practical Data Science With R, Second Edition, Manning Shelter Island.

Instruction to the Examiners

1. Students have to explain in brief problem and model to be used with machine learning algorithm.

2. Out of the above TEN Machine learning algorithms students has to pick any one and answer it.

3. Execute R code of problem and write the report.

FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Problem and model adequacy description	4 Marks
R-Code writing	4 Marks
R-Code execution	8 Marks
Report Writing	4 Marks
Certified Journal Submission	2 Marks
Viva-Voce	3 Marks
Total	**25Marks**
FormativeAssessmentasperguidelines.	

The same shall be used for semester end Examination

B.Sc. in Statistics

VI Semester

W. e. f.: 2023-24

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-14

Course Title:Statistical Inference-II

Course Code:**036 STA 011**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-14	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):**Attheend ofthecourse,studentswillbeableto:**

CO1 : Understand expected loss, decision rules, decision principles and Bayes and minimax decision rule.

CO2 : Learn about UMP test, MLR property and Likelihood ratio tests.

CO3 : Learn about UMP test, MLR property and Likelihood ratio tests.

CO4 : Explore about sequential inference.

CO5 : Learn about one sample and two sample nonparametric tests.

Unit	Title:	56.hrs/ sem
UnitI	**Statistical Decision Theory :** Basic elements of Statistical Decision Problem. Expected loss, decision rules (nonrandomized and randomized), decision principles (conditional Bayes, frequentist), inference as decision problem, Loss function, squared error loss, Bayes and minimax decision rule.	14 hrs
UnitII	**Testing of Hypothesis-II :** Definition of UMP test, monotone likelihood ratio (MLR) property, Examples of distributions having MLR property, Construction of UMP test using MLR property. UMP test for single parameter exponential family of distributions. Likelihood ratio (LR)tests, LR test for normal, exponential.	14 hrs
UnitIII	**Sequential Inference :** Need for sequential analysis, Wald's SPRT, ASN, OC Functions, examples based on Bernoulli, Poisson, Normal and exponential distributions.	14 hrs
UnitIV	**Nonparametric tests :** Nonparametric and distribution-free tests, one sample problems: Sign test, Wilcoxon signed rank test, Kolmogorov-Smirnov test. Test of randomness using run test. General two sample problems: Wolfowitz runs test, Kolmogorov Smirnov two sample test (for sample of equal size), Median test, Wilcoxon-Mann-Whitney U-test. Several sample problems: Friedman's test, Kruskal Wallis test	14 hrs

	References :
1	Berger, J. O. (1985): Statistical Decision Theory and Bayesian Analysis, 2nd Edition, Springer Verlag.
2	Bernando, J. M. And Smith, A. F. M. (1993): Bayesian Theory, John Wiley and Sons.
3	Robert, C. P. (2007): The Bayesian Choice : A Decision Theoretic Motivation, Springer.
4	George Casella, Roger L. Berger (2020): Statistical Inference, 2nd ed., Thomson Learning.
5	Rohatagi, V. K. : (2010): Statistical Inference, Wiley Eastern, New Delhi.
6	Rohatagi V. K. and A.K.Md.E Saleh(2008) An Introduction to Probability and statistics, 2nd Ed. Wiley .
7	Hogg Mckean and Craig (2009) : Introduction to Mathematical Statistics, 6th Edition, Pearson Prentce Hall.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-15

Course Title:Statistical Inference-II

Course Code:**036 STA 012**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-15	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1**:** construct UMP tests for some discrete and continuous distributions.

CO2: construct sequential probability ratio tests for some discrete and continuous

distributions.

CO3: draw OC and ASN curves

CO4: know some important non-parametric tests

Expt. No,	Title:	56.hrs/ sem
1	Problems on Bayes and minimax estimation.	
2	UMP test based on sample from Bernoulli and Poisson distributions.	
3	UMP test based on sample from Normal and exponential distributions.	
4	Construction of SPRT for Bernoulli and Poisson distributions.	
5	Construction of SPRT for Normal and Exponential distributions	
6	Evaluation of SPRT for Bernoulli and Poisson distributions using OC and ASN function.	
7	Evaluation of SPRT for Normal and Exponential distributions using OC and ASN function.	
8	One sample Nonparametric tests: Kolmogorov-Smirnov test, sign test, Wilcoxon signed rank test,	
9	Two sample Nonparametric tests: Mann-Whitney (Wilcoxon rank sum test), Wald-Wolfowitz Run test,	
10	Several sample Nonparametric tests: Kruskal -Wallis test, Friedman's test.	

Instruction to the Examiners

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.

2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in-charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practical's and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases the marks reserved, for the journal shall be deducted.

3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.

4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.

5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal / external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Solve any three questions out of given four questions manually and execute problems in R software, each carry 07 marks.	21
Viva Voce	2
Certified Journal	2
Total	**25Marks**
Formative Assessment as per UNIVERSITY guidelines are compulsory	

The same shall be used for semester end Examination

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-16

Course Title: Sampling Methods, Official Statistics and Econometrics.

Course Code:**036 STA 013**

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-16	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1 : Understand the principles underlying sampling as a means of making inferences about a population.

CO2 : Understand the difference between probability and nonprobability sampling.

CO3 : Understand different sampling techniques.

CO4 : To learn to estimate population parameters from a sample.

CO5 : Understand official statistical system in India and their functions.

CO6 : Understand the role statistics in national development.

Unit	Title:	56.hrs/ Sem
UnitI	**Introduction to sampling theory :**Objectives and principles of sampling theory; Concept of population and sample; complete enumeration versus sampling; Planning, execution and analysis of a sample survey; practical problems at each of these stages; basic principle of sample survey; sampling and non-sampling errors; Types of sampling: non-probability and probability sampling, pilot survey. **Simple random sampling :**Simple random sampling with and without replacement, definition, and procedure of selecting a sample, estimates of population mean, total and proportion, variances and SE of these estimates, estimates of their variances related proofs, sample size determination.	14 hrs
UnitII	**Stratified sampling and systematic sampling :** Stratification and its benefits; basis of stratification, Technique, estimates of population mean and total, variances of these estimates, proportional, optimum allocations, Neyman's allocation, allocation with cost functions and their comparison with SRS. Practical difficulties in allocation, derivation of the expressions for the standard errors of the above estimators when these allocations are used, estimation of gain in precision, post stratification and its performance. Systematic Sampling: Linear systematic sampling Technique; estimates of population	14 hrs

		mean and total, variances of these estimates (N=n x k). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend and corrections.	
UnitIII	**National development:** An outline of present official statistical system in India, Role, function, and activities of Central and State Statistical organizations. Methods of collection of official statistics, their reliability and limitations. Central Statistical Office (CSO), National Sample Survey Office (NSO), Registrar General Office and National Statistical Commission. Scope and content of Population census of India. Population census methods, economic census. Methods of national income estimation, problems in the estimation of national income. System of collection of Agricultural Statistics. Crop yield, Production Statistics, Crop estimation and forecasting. Statistics related to industries, foreign trade, balance of payment, cost of living, inflation, educational and other social statistics.	14 hrs
UnitIV	**Introduction to Econometrics:** Origin, definition, methodology, scope and limitations of econometrics. Simple Econometrics models : assumptions and analysis. **Analysis of Residuals :** Presence of outliers omitted variables, nonlinear relationship, correlated disturbances, heteroscedasticity, Generalized Least Squares. Multicollinearity: The plausibility of the assumption of non-multicollinear regressors, consequences of multicollinearity, tests for detecting multicollinearity, solutions for multicollinearity.	14 hrs

References	
1.	Cochran, W. G. (2007): Sampling Techniques, Third Edition, Wiley India Pvt. Ltd., New Delhi.
2.	Changbao Wu and Mary E. Thompson (2020): Sampling Theory and Practice, Springer Nature Switzerland.
3.	Raghunath Arnab (2017): Survey Sampling Theory and applications (2017), Elsevier
4	Des Raj and Chandhok P. (1998): Sample Survey Theory, Narosa Publishing House.
5	Goon A.M., Gupta M.K. and Dasgupta B. (2001): Fundamentals of Statistics (Vol.2), World Press
6	Murthy, M. N. (1967): Sampling Theory and Methods, Statistical Publishing Society, Kolkata.
7	Mukhopadhyay P (2008): Theory and methods of survey sampling. Prentice-Hall of India, New Delhi
8	Singh, D. and Chaudhary, F. S. (1986): Theory and Analysis of Sample Survey Designs, Wiley Eastern Ltd., New Delhi.
9	Sukhatme, P.V., Sukhatme, B. V.(1984): Sampling theory of Surveys with Applications, Indian Society of Agricultural Statistics, New Delhi.
10	Sampath S. (2005): Sampling Theory and Methods, Second edition, Narosa, New Delhi.
11	Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi. http://mospi.nic.in/
12	Baltagi B.H. (2000) Econometrics, Springer.

13	Gujarati D.N. (2003) Basic Conometrics, McGraw-Hill.
14	Maddala G.S. (2002) Introduction to Econometrics, John Wiley.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-17

Course Title:Sampling Methods, Official Statistics and Econometrics.

Course Code:036 STA 014

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-17	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1:To select a Simple random sample with and without replacement from a finite population and estimation of the mean and total and the standard error of the estimator.

CO2: To select a Stratified random sampling and Systematic Sampling from a finite population and estimation of the mean and total and the standard error of the estimator.

CO3: Estimation of the proportion, total and the standard errors of the estimators based on a random sample under SRSWR and SRSWOR.

CO4:Compute and analyze Multiple linear regression models with R-codes by addressing the consequences of Multicollinearity and Diagnostics of Multicollinearity.

CO5:Compute and analyze Multiple linear regression models with R-codes by addressing the consequences of autocorrelation and heteroscedasticity.

Expt. No,	Title:	56.hrs/ sem
1.	Drawing of random sample under SRSWOR and SRSWR from a given population and estimation of the mean and total and the standard error of the estimator.	
2.	Construction of Confidence Intervals for mean and total for SRSWR and SRSWOR.	
3.	Estimation of the proportion, total and the standard errors of the estimators based on a random sample under SRSWR and SRSWOR.	
4.	Estimation of the mean, total and the standard error of the estimator under stratified random sampling.	
5.	Exercise on allocation of samples in Stratified sampling. (Proportional Allocation and Neyman Allocation)	
6.	Estimation of the mean, total and the standard error of the estimator under Systematic sampling.	
7.	Estimation techniques in official statistics.	
8.	Fitting of simple and multiple regression model	
9.	Multiple regression model : detecting autocorrelation	
10.	Multiple regression model : detecting multicollinearity	

Instruction to the Examiners

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3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.

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FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Solve any three questions out of given four questions manually and execute problems in R software, each carry 07 marks.	21
Viva Voce	2
Certified Journal	2
Total	**25Marks**
Formative Assessment as per UNIVERSITY guidelines are compulsory	

The same shall be used for semester end Examination

B.Sc. Semester–VI

INTERNSHIP

Course Title: Data Science Internship
Course Code:036STA091

Type ofCourse	Theory /Practical	Credits	Instruction hour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
INTERNSHIP	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**50**	**0**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO1:Accountable for individual and team responsibilities and deliverables.

CO2:Exercise the ability to compromise and problem solve with involved parties.

CO3:Apply computing theory, languages, and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses

CO4:Formulate and use appropriate models of data analysis tolls to solve hidden solutions to business-related challenges

CO 5: Interpret data findingseffectively to any audience, orally, visually, and in written formats.

Expt. No	Title:	56.hrs/ sem
1	Identifying key areas of statistics useful to internship	
2	Develop and deliver engaging training sessions on various data science topics, including statistical analysis, machine learning, and data visualization	
3	Create comprehensive training materials, such as presentations and hands-on exercises, to facilitate effective learning for our students	
4	Provide guidance and support to students, helping them solve complex data science problems and reinforcing their understanding of key concept	
5	Collaborate to enhance and update curriculum, ensuring that it remains current and aligned with industry trends	
6	Conduct assessments and evaluations to measure student progress and identify areas for improvement, adapting teaching strategies accordingly	
7	Stay up-to-date with the latest developments in data science and technology	
8	Contribute to the growth and success of our education programs	
9	Writing visit reports, filing and collecting trial documentation	
10	Report writing	

FormativeAssessmentforPractical	
Assessment	**Distribution of Marks**
Analyze data using models and descriptive statistics	10
Participate in project planning	10
Contribute to project report	10
Collection of raw data	10
Produce tables/ figures/ interpretation	10
Total	**50Marks**
FormativeAssessmentasperguidelines.	

UG Programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks
(Minimum 1 question from each unit and 10 marks question may have sub
questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours Prescribed

Internship for graduate Programme (As per UGC)

Course title	Internship Discipline specific
No. of contact hours	90
No. of credits	2
Method of evaluation	Presentation/Report of submission/Activity etc.,

❖ Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.

❖ Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session).

❖ Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20 hours.

❖ The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.

❖ The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC guidelines.