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

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 Ministryof HRD as National Education Policy (NEP)2020 which includes broad based multidisciplinaryundergraduate 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, StatisticalInference, Multivariate Analysis, Linear Models and Regression Analysis and Sample surveysand 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 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 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 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	40	60	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
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

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		
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**	

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	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, Sultan Chand and Co. 12th Edition.
6. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.
7. Joao Mendes Moreira, Andre C P L F de Carvalho, Tomas Horvath (2018), General Introduction to Data Analytics, Wiley.
8. Johnson, R.A. and Bhattacharyya, G.K. (2006), Statistics: Principles and methods. 5th Edition, 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, 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. 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. Howfunctions 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 exceptcolour 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, SultanChand 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 ofStatistics, 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 $\chi 2$ 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.

Course No.-03 (Practical): 21BSC3C3STS1P

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

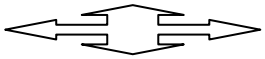
Part-C

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.