

**Bachelor of Arts/Bachelor of Science**

**OUTCOME BASED EDUCATION**

**Program outcome (POs)**

**Students will be able to:**

<b>PO 1</b>	Acquire knowledge of the discipline and conduct proper academic in various areas of discipline.
<b>PO2</b>	Recognize the social structures in our society.
<b>PO3</b>	Communicate effectively in context which one is operating and develop soft skills
<b>PO4</b>	Leader in teams in multidisciplinary courses and engage in initiatives that encourage growth for all.
<b>PO5</b>	Develop awareness of issues among students
<b>PO6</b>	Recognize and respect different value systems by following the norms of academic integrity.
<b>PO7</b>	Explain awareness of local, regional, national and global needs.
<b>PO8</b>	Work on career enhancement by adapting to professional and social needs engaged in lifelong learning.
<b>PO9</b>	Exhibit capability as lifelong learners adapting new technologies, modern concepts and skills for sustainable development.
<b>PO10</b>	Imbibe qualities of good citizenship, morality and ethics so as to work for the betterment of mankind
<b>PO11</b>	Cultivate a broad array of interdisciplinary knowledge and skills integrating concepts of humanities and social sciences.
<b>PO12</b>	Able to apply critical thinking, creativity, skills, cultural sensitivity, and humanity to to create awareness within society for problem –solving and interpretation..

**Program Specific Outcome (PSOs)**

<b>PSO 1</b>	To familiarize students with basic to high- level statistical concepts.
--------------	---

<b>PSO2</b>	To Apply the concepts of statistics, Probability theory, Time Series, Designs of Experiment, survey sampling etc. in real life problems.
<b>PSO3</b>	To update students with various statistical tools that aid in statistical theory.
<b>PSO4</b>	Practical exercises done will enable students to analyze and interpret data and also to draw valid conclusions. This will enable students to face real time applications

**Eligibility for admission:**

Any candidate who has passed the Plus Two of the Higher Secondary Board of Examinations in any state recognized as equivalent to the Plus Two of the Higher Secondary Board in with not less than 40%/45%-marks in aggregate is eligible for admission, However, SC/ST, OBC and other eligible communities shall be given relaxation as per University rules.

**Duration of the Programme: 3 Years**

**STUDY & EVALUATION SCHEME****Choice Based Credit System****Bachelor of Arts / Bachelor of Science**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BSTC101	Descriptive Statistics & Probability Theory	3	1	0	4	30	70	100
Practical										
1	Statistics Lab	BSTL101	Lab course based on C101	0	0	2	2	30	70	100
<b>Total</b>				3	1	2	6	60	140	200

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Second Semester**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BSTC201	Probability Distribution	3	1	0	4	30	70	100
Practical										
1	Statistics Lab	BSTL201	Lab course based on C201	0	0	2	2	30	70	100
<b>Total</b>				3	1	2	6	60	140	200

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Third Semester**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BSTC301	Statistical Inference	3	1	0	4	30	70	100
2	Skill	BSTS301	Network Analysis & Theory of Sequencing	3	1	0	4	30	70	100
Practical										
3	Statistics Lab	BSTL301	Lab course based on C301	0	0	2	2	30	70	100
<b>Total</b>				6	2	2	10	90	210	300

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Fourth Semester**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BSTC401	Survey Sampling & Design of Experiment	3	1	0	4	30	70	100
2	Skill	BSTS401	Data Analysis using Spread Sheet	3	1	0	4	30	70	100
Practical										
1	Statistics Lab	BSTL401	Lab course based on C401	0	0	2	2	30	70	100
<b>Total</b>				6	2	2	10	90	210	300

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Fifth Semester**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Elective	BSTD501a BSTD501b BSTD501c	i) Demography & Vital Statistics ii) Applied Statistics iii) Statistical Quality Control	3	1	0	4	30	70	100
2	Skill	BSTS501	Statistical Technique for Research Methods	3	1	0	4	30	70	100
Practical										
1	Statistics Lab	BSTL501	Lab course based on D501	0	0	2	2	30	70	100
<b>Total</b>				6	2	2	10	90	210	400

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Sixth Semester**

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Elective	BSTD601a BSTD601b BSTD601c	i) Operation Research ii) Time Series Analysis iii) Non Parametric Methods	3	1	0	4	30	70	100
2	Skill	BSTS601	Understanding Probability & Statistics Through Practical's	3	1	0	4	30	70	100
Practical										
3	Statistics Lab	BSTL601	Lab course based on D601	0	0	2	2	30	70	100
<b>Total</b>				6	2	2	10	90	210	300

L – Lecture, T – Tutorial, P – Practical, C – Credit

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup>Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A/B.Sc.**

<b>Course code</b>	: BSTC101			
<b>Course Name</b>	: Descriptive Statistics & Probability Theory			
<b>Semester /Year</b>	: I Sem/ Ist Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

**Course Objectives:****The objectives of this course are:**

1. To summarize the data and to obtain its salient features from the mass of original data
2. To understand the basic fundamental processes and core Statistics concepts and their applications in everyday life.
3. To understand the concepts of probability and its applications
4. To understand the concept of random variables and law of probability.

**Course Contents****Unit 1**

**Introduction** : Nature of Statistics ,Uses of Statistics, Statistics in relation to other disciplines, Concepts of a statistical population and sample from a population, quantitative and qualitative data, discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods)

**Unit 2**

**Measures of Central tendency:** Mean, Median, Mode, Geometric Mean and Harmonic Mean; their properties **Measures of Dispersion:** Range, Quartile Deviation, Mean Deviation, Standard Deviation and their properties, Coefficient of variation, Moments, Skewness and Kurtosis.

**Unit 3**

**Bivariate data:** Scatter diagram, principle of least-square and fitting of polynomials and exponential curves. Correlation and regression. Karl Pearson coefficient of correlation, Lines of regression.

**Unit- 4**

**Probability :**Random experiment, sample point and sample space, event, algebra of events, Definition of Probability- classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given).Theorem on probability ,conditional probability Independent events Bayes'theorem and its applications.

**Text Books:**

1. Arun Kumar and Alka Chaudhary 2010. Descriptive Statistics, Krishna Prakash, 11, Shivaji Road, Meerut.
2. S.C.Gupta and V.K. Kapoor. 2007. Fundamentals of Mathematical Statistics (11<sup>th</sup> Ed.) Sultan Chand and Sons.

**Reference Books:**

1. R.V.Hogg,A.T.CraigandJ.W.Mckean. 2005.Introduction to Mathematical Statistics (6th Ed.). Pearson Education,
2. A.M. Mood,F.A. Graybill and D.C.Boes. 2007. Introduction to the Theory of Statistics (3<sup>rd</sup> Ed.). Tata McGraw Hill Publication.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the fundamental of descriptive statistics and probability theory.
<b>CO2</b>	Explain the concept of descriptive statistics
<b>CO3</b>	Apply the knowledge of descriptive statistics in the analysis of data.
<b>CO4</b>	Analysis the result of descriptive statistics
<b>CO5</b>	Evaluate the result of descriptive statistics
<b>CO6</b>	Develop the skill and ability to correctly analysis the data.



**CO-PO-PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
CO2	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
CO3	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
CO4	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
CO5	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
CO6	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam )	External (ESE)
Weightage (%)	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A/B.Sc.**

<b>Course code</b>	: BSTL101			
<b>Course Name</b>	: Lab course based on C101			
<b>Semester /Year</b>	: Ist sem / Ist Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To analyse the problem and its solution.
2. To study the average and measures for analysis it.
3. To enrich students' understanding of the influence of dispersion on average
4. To assess the effect of knowledge of the result on the performance of individual for analysis the data.

**Course Contents**

1. Problems based on graphical representation of data: Histograms (equal class intervals and unequal class intervals), Frequency polygon, Ogive curve.
2. Problems based on measures of central tendency and measures of dispersion.
3. Problems based on combined mean and variance and coefficient of variation.
4. Problems based on moments, relationships between moments about origin and central moments.
5. Problems based on Skewness and kurtosis.
6. Pearson correlation coefficient.
7. Lines of regression and regression coefficients.
8. Spearson rank correlation with or without ties.
9. Fitting of polynomials and exponential curves.

**Text Books:**

1. A.M.Goon, M.K.Gupta and B.Das Gupta. 2005. Fundamentals of Statistics, Vol.I, 8<sup>th</sup>Ed., World Press, Kolkatta.
2. S.C Gupta and V.K.Kapoor. 2007. Fundamentals of Mathematical Statistics, 11<sup>th</sup>Ed., Sultan Chand and Sons.

**Reference Books:**

1. V.Hogg, A.T.Craig and J.W.Mckean . 2005. Introduction to Mathematical Statistics (6<sup>th</sup> Ed.). Pearson Education.
- 2 A.M.Mood F.A.Graybill and D.C.Boes. 2007. Introduction to the Theory of Statistics (3<sup>rd</sup> Ed.). Tata McGraw Hill Publication.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A. /B.Sc.**

<b>Course code</b>	: BSTC201			
<b>Course Name</b>	: Probability Distribution			
<b>Semester /Year</b>	: II Sem/ Ist Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To understand the basic probability, concepts, theories, and will be able to apply this knowledge to day to day life.
2. To gain a reasonable knowledge of the concepts like expectation, probability distribution.
3. To learn about the fundamental principles and processes of random variables, its types and properties.
4. To differentiate between discrete probability distributions with their properties and Continuous probability distributions with their properties.

**Course Contents****Unit 1**

**Random variables:** Discrete and continuous random variables p.m.f, p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f. and c.d.f., independence of variables, bivariate transformations with illustrations.

**Unit 2**

**Mathematical Expectation:** Generating Functions: Expectation of single and bivariate random variables and its properties.

**Unit 3**

**Moments and Cumulants, Moment generating function:** Cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications, Conditional expectations.

**Unit 4**

**Point(or degenerate):** Binomial, Poisson, Geometric, negative binomial, Hypergeometric Normal, Uniform, Exponential, Beta and Gama distributions Statement and application of Chebychev's inequality, WLLN and SLLN, Central limit theorem (CLT) for i.i.d. variates and its applications. DeMoivre's Laplace Theorem.

**Text Books:**

1. Arun Kumar and Alka Chaudhary Probability Theory 2008 , Krishna Prakashan Media Pvt Ltd.
2. A.M .Goon, M.K.Gupta and B.Dasgupta (2003): An outline of Statistical Theory (Vol.I),4thEd., World Press, Kolkata.
3. S.C. Gupta and V.K. Kapoor (2007): Fundamentals of Mathematical Statistics 11thEd , Sultan Chand and Sons.

**Reference Book:**

1. R.V. Hogg, A.T. Craig, and J.W. McKean. (2005). Introduction to Mathematical Statistics, (6<sup>th</sup> Ed) Pearson Education.
2. A.M. Mood, F.A. Graybill and D.C. Boes. (2007). Introduction to the Theory of Statistics (3<sup>rd</sup>Ed.) Tata McGraw Hill Publication.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Recognize the key probability concepts.
<b>CO2</b>	Explain the basic of probability and its distribution
<b>CO3</b>	Apply basic concepts of probability to self-analysis various probability distribution..
<b>CO4</b>	Analyse various techniques for fitting the distribution
<b>CO5</b>	Evaluate the probability concept and theories.
<b>CO6</b>	Develop critical analytical abilities.

**CO-PO-PSO Mapping**

<b>Cours e</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO1 0</b>	<b>PO 11</b>	<b>PO1 2</b>	<b>PS O1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL201			
<b>Course Name</b>	: Lab course based on C201			
<b>Semester /Year</b>	: II sem / Ist Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To analyse the distribution and its solution.
2. To study the various distribution and measures for analysis.
3. To enrich students' understanding of the influence of distribution in day to day life.
4. To assess the effect of knowledge of the result on the performance of individual for analysis the data.

**Course Contents**

1. Fitting of binomial distributions computing mean and variance
2. Fitting of binomial distributions computing mean and variance
3. Fitting of Poisson distributions for given  $\lambda$  and after estimating mean.
4. Fitting of negative binomial
5. Fitting of Suitable distribution
6. Application Problems based on Binomial distribution
7. Application problems based on Poisson distribution
8. Application problems based on negative binomial distribution
9. Problems based on Area property of normal distribution
10. Fitting of normal distribution when parameters are given/ not given.



**Text Books:**

1. A.M .Goon, M.K.Gupta and B.Dasgupta (2003): An outline of Statistical Theory (Vol.I),4thEd., World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007): Fundamentals of Mathematical Statistics 11thEd , Sultan Chand and Sons.

**Reference Books:**

1. R.V. Hogg, A.T. Craig, and J.W. McKean. (2005). Introduction to Mathematical Statistics, (6th Ed) Pearson Education.
2. A.M. Mood, F.A. Graybill and D.C. Boes. (2007). Introduction to the Theory of Statistics (3rdEd.) Tata McGraw Hill Publication.
3. V.K. Rohtagi and A.K. Md. E. Saleh. (2009). An Introduction to Probability and Statistics, (2ndEd.) JohnWiley andSons.
4. S.A.Ross (2007). Introduction to Probability Models ( 9thEd. ). Academic Press.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3

<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A/B.S.c**

<b>Course code</b>	: BSTC301			
<b>Course Name</b>	: Statistical Inference			
<b>Semester /Year</b>	: III sem / IInd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To understand the basics concept of statistical inference
2. To drawing inference about the unknown population parameters based on random sample.
3. To gain understanding of estimation about the population using testing of hypothesis.
4. To understand the important tests which are using to draw valid conclusion.

**Course Contents****Unit 1**

**Estimation:** Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency, sufficiency, Minimum variance unbiased estimators. Cramer-Rao inequality (Statement only).

**Unit 2**

**Methods of estimation:** Maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem and lehmann-Scheffe theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution confidence intervals for difference of mean and for ratio of variances.

**Unit 3**

**Testing of Hypothesis:** Statistical Hypothesis, simple and composite hypothesis null and alternative hypotheses. Critical region. Two kind of errors, Level of significance and power of a test. MP test and region. Neyman- Pearson lemma (statement only). Likelihood ratio test, UM test, UMPU test, Critical regions for simple hypothesis for one parameter.

**Unit 4**

**Test of significance:** Null and alternative hypotheses, level of significance and probabilities of Type I and Type II errors, critical region and power of test. Large sample test, use of CLT for testing single proportion and difference of two proportions, Tests of significance based of Chi-square, t and F distributions.

**Text Books:**

1. A.M .Goon, M.K.Gupta and B.Dasgupta (2003). An outline of Statistical Theory (Vol.I), 4thEd. World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007). Fundamentals of Mathematical Statistics 11thEd , Sultan Chand and Sons.

**Reference Books:**

1. G.Casel and R.L.Berger (2002). Statistical Inference ( 2<sup>nd</sup> Ed.). Thomson Duxbury.
2. E.J.Dudewicz and S.N.Mishra(1988). Modern Mathematical Statistics, John Wiley and Sons.
3. R.V. Hogg, A.T. Craig and J.W. Mckean. (2005). Introduction to Mathematical Statistics (6<sup>th</sup>Ed.).Pearson Education.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify fundamental concepts of Point estimation. Properties of estimators and mean square error, Minimum variance unbiased estimators, Rao
<b>CO2</b>	Recognize the Large sample test, Use of central limit theorem to obtain large sample tests for binomial proportions and means of populations, etc., Related confidence intervals.
<b>CO3</b>	Apply the different methods of estimations. Estimating point estimators using different methods. Construction of confidence interval for parameters of different distributions
<b>CO4</b>	Analysis practical utility of various test of significance based on t, F and chi square test.
<b>CO5</b>	Evaluate the various tests based on hypothesis.
<b>CO6</b>	Develop an understanding of the hypothesis in relation to the social world

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTL301			
<b>Course Name</b>	: Lab course based on C301			
<b>Semester /Year</b>	: IIIrd / II nd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To draw inference about the unknown population parameters based on random sample.
2. To Acquire knowledge of estimation about the population using testing of hypothesis.
3. To study the important tests which are using to draw valid conclusion.

**Course Contents**

1. Large Sample Tests (Based on normal distribution)
2. Testing of goodness of fit
3. Testing of independence of attributes based on 2X2 contingency table
4. Testing of equality of two populations variances
5. Applying the paired–test for difference of means
6. Maximum Likelihood Estimation
7. Confidence interval for Binomial proportion
8. Confidence interval for the difference of proportions
9. Confidence interval for difference of population means
10. Confidence interval for ratio of variances
11. Type I and Type II errors

**Text Books:**

1. A.M .Goon, M.K.Gupta and B.Dasgupta (2003). An outline of Statistical Theory (Vol.I), 4thEd. World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007). Fundamentals of Mathematical Statistics 11thEd , Sultan Chand and Sons.

**Reference Books:**

1. G.Casel and R.L.Berger(2002). Statistical Inference ( 2ndEd.). Thomson Duxbury.
2. E.J.Dudewicz and S.N.Mishra(1988). Modern Mathematical Statistics. John Wiley and Sons.
3. R.V. Hogg, A.T. Craig and J.W. Mckean (2005). Introduction to Mathematical Statistics (6thEd.). Pearson Education.
- 4 .V.K.Rohtagi and A.K. Md. E. Saleh (2009). An Introduction to Probablity and Statistics, (2nd Ed.). JohnWiley and Sons.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Cours e	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**



**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTS301			
<b>Course Name</b>	: Network Analysis & Theory of Sequencing			
<b>Semester /Year</b>	: III sem / IInd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To understand the concepts and importance of theory of sequencing
2. To comprehend the process and steps of job sequencing.
3. To learn various strategies to enhance effective decision making in travelling salesman problem.

**Course Contents****Unit 1**

**Flows in networks:** Maximal flow, Shortest path and travelling salesman problem, Construction of minimal spanning tree and its applications.

**Unit 2**

**Project management:** Project management through PERT/CPM, Updating of PERT Charts .Project Crashing,

**Unit 3**

**Sequencing Problems:** Processing n jobs through two/three machines. General n/m jobs problem.

**Unit 4**

**Introduction Salesman problem:** Problems based on travelling, salesman problem.

**Texts Book**

1. Sharma, S.D. Operation Research, Pragati Prakashan Meerut.
2. R.K. Ahuja T. L. Magnanti, B. Orlin. 1993.Network Flows-Theory, Algorithm and Applications, Prentice Hall,NJ,

3. J.D. Wist, F.K. Levy. (2007). A Management Guide to PERT/CPM (2nd Ed.). PHI.

**Reference Books**

1. G.Hadley. 1964. Non linear and Dynamic Programming, Addison-Wesley.
2. A. Ravindran, D.T. Phillips and James J. Solberg.2005. Operations Research-Principles and Practice. John Wiley and Sons.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the fundamentals of network Analysis.
<b>CO2</b>	Explain the concepts of theory of sequencing.
<b>CO3</b>	Apply the various strategies for solving travelling salesman problem.
<b>CO4</b>	Analyse major issues of network analysis.
<b>CO5</b>	Evaluate the importance of network analysis & theory of sequencing.
<b>CO6</b>	Develop the ability and skill of effective network analysis .

**CO-PO-PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	1	1	1	2	1	1	1	1	1	3	2	-	-
<b>CO2</b>	3	2	1	-	1	1	1	-	1	1	1	1	2	1	-	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	1	-
<b>CO4</b>	2	3	2	1	1	1	2	-	1	1	2	2	3	2	-	-
<b>CO5</b>	3	3	2	1	1	1	2	1	2	1	-	-	2	2	-	-
<b>CO6</b>	2	2	2	2	1	1	2	2	2	2	2	3	2	3	1	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
Weightage(%)	15	15	70

**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTC401			
<b>Course Name</b>	: Survey Sampling and Design of Experiment			
<b>Semester /Year</b>	: IV sem / IInd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To comprehend the tools and technique for selecting a sample of elements from a target population
2. To understand the basics of sampling methods.
3. To develop critical thinking in order to use the appropriate design and conduct experiment
4. To analysis and interpret data.

**Course Contents****Unit 1**

**Concepts of census and sample survey:** Basic concepts in sampling. Sampling and Non sampling errors. Principal steps involved in a sample survey; bias, precision and accuracy, advantages of sampling over complete census, limitations of sampling, different methods of data collection. Basic sampling methods: Simpler random sampling (SRS) with and without replacement, use of random number tables, estimation of mean and variance in case of SRS. Simple random sampling of attributes, size of simple random sample.

**Unit 2**

**Stratified random sampling:** Estimation of population mean, variance of the estimate of population mean in stratified random sampling, allocation of sample size, proportional allocation, and optimum allocation. Comparison of Stratified random sampling with SRS. Systematic random sampling, estimation of mean and variance. Comparison of Systematic random sampling with SRS and Stratified random sampling.

**Unit 3**

**Analysis of variance (ANOVA):** Definition and assumptions for ANOVA. Analysis of variance for one-way classification and two-way classifications for fixed effect models with one observation per cell.

**Unit 4**

**Introduction to design of experiments:** Terminology experiment, treatment, experimental unit, blocks, replication, precision, efficiency of a design, need for design of experiments, size and shape of plots and blocks. Fundamental principles of design randomization, replication and local control Completely randomized design (CRD), Randomized Block Design (RBD), their layout Latin square design (LSD) Layout, statistical analysis, applications, merits and demerits of LSD. Factorial designs and Confounding.

**Texts Books:**

1. A.M .Goon, M.K.Gupta and B.Das gupta (2003). An outline of Statistical Theory (Vol.I), 4thEd. World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor. (2007). Fundamentals of Mathematical Statistics 11thEd. Sultan Chand and Sons.

**Reference Books:**

1. D.C. Montgomery. (2001). Designs and Analysis of Experiments. John Wiley and Sons. New York.
2. P. Mukhopadhyay. (1998). Theory and Methods of Surveys Sampling. Prentice Hall of India.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify basic concepts of survey sampling, basic principles in sampling, Simple random sampling, systematic sampling, stratified sampling.
<b>CO2</b>	Explain basic concepts of analysis of variance and appropriately interpret the results of analysis of variance test.
<b>CO3</b>	Apply the design of experiments and analyze the data they yield
<b>CO4</b>	Analysis Completely randomized design, Randomized block design, Latin square design. Factorial experiments with two levels
<b>CO5</b>	Evaluate different quantitative and qualitative statistical methods used in research.
<b>CO6</b>	Develop critical thinking in order to construct the statistical test and use the appropriate statistical analysis in statistics research.

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL401			
<b>Course Name</b>	: Lab course based on C401			
<b>Semester /Year</b>	: IV sem / IInd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To provide tools and technique for selecting a sample of elements from a target population
2. To understand the basics of sampling methods and different sampling techniques.
3. To develop critical thinking in order to use the appropriate design and conduct experiment for Analysis.

**Course Contents**

1. To select a SRS with and without replacement.
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible sample size 2 by wr and wor.
3. For srswor, estimate mean, standard error, the sample size
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's Methods compare the efficiencies of above two methods relative to SRS
5. Estimation of gain in precision in stratified sampling
6. Comparison of systematic sampling with stratified sampling.
7. Analysis of an one way/two way ANOVA
8. Analysis of a CRD, RBD, and LSD
9. Analysis of an RBD and LSD with one missing observation

**Texts Books:**

1. A.M.Goon,M.K.Gupta,andB.Dasgupta(2005):*Fundamentals of Statistics* (Vol. II),8<sup>th</sup>Ed.,WorldPress,Kolkata.
2. A.M.Goon,M.K. Guptaand B.Dasgupta(2005):*An Outline of Statistical Theory* (Vol.II),3<sup>rd</sup> Ed.,World Press, Kolkata.
- 3.S.C.Gupta and V.K.Kapoor,*Fundamentals of Applied Statistics*,4<sup>th</sup> Ed.Sultan ChandandSons,2008.

**Referance Books:**

- 1 D.C. Montgomery(2001):*Designs and Analysis of Experiments*, John Wiley and Sons,NewYork.
2. P. Mukhopadhyay (1998): *Theory and Methods of Surveys Sampling*, Prentice

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Cours e	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated **Examination Scheme:**



<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTS401			
<b>Course Name</b>	: Data Analysis using Spreadsheet			
<b>Semester /Year</b>	: IVth sem / IInd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

The objectives of this course are:

1. To insert and conduct calculations.
2. To analyze and interpret data.

Course Contents:

**Unit 1**

**Graphical Representations**-Role, historical perspective, terminology, types of class interval-inclusive, exclusive, Formula to generate class intervals, types of graphs-Histogram, frequency curve, frequency polygon, pie chart, Ogive-more than and less than, Box plot, stem-leaf.

**Unit 2:**

**Measures of Central tendency**-Arithmetic Mean, Harmonic Mean, Geometric Mean, Median and Mode explanation with example, Measures of Dispersion-Range, Semi Interquartile Range, Standard Deviation, Mean Deviation and explanation with example.

**Unit 3:**

**Curve Fitting** - Principle of least squares Method, fitting of various curves like Straight line, Second degree Polynomial,

**Unit 4:**

**Introduction to Correlation** Analysis, role, uses, its properties and formula, Introduction to Regression Analysis, role, uses, properties of its coefficient and formula to calculate regression coefficient, Regression Line, explain with example

**Texts Book :**

1. Artymiak, J. (2011). Beginning Open Office Calc: From Setting Up Simple Spreadsheets to Business Forecasting. A press Publisher.
2. Billo, E. J. (2007). Excel for Scientists and Engineers Numerical Methods. John Wiley & Sons.
3. Carlberg, C. (2011). Statistical Analysis. Pearsons Education .

**Reference books:**

1. Held, B. (2007). Microsoft Excel Functions and Formulas. Wordware Publishing, Inc.
2. Kanji, G.K. (2006). 100 Statistical Tests (3rded.). Sage Publication.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of statistics and probability through practical does on a computer by using excel.
<b>CO2</b>	Explain the average; dispersion through practical's on a computer by using excelled.
<b>CO3</b>	Apply fitting of binomial, poison and normal distribution through practicals on excel.
<b>CO4</b>	Analyse data by using suitable statistical test.
<b>CO5</b>	Evaluate the importance of data analysis.
<b>CO6</b>	Develop the ways to improve the data analysis by using proper test..

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	1	1	1	2	1	1	1	1	1	3	2	-	-
<b>CO2</b>	3	2	1	-	1	1	1	-	1	1	1	1	2	1	-	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	1	-
<b>CO4</b>	2	3	2	1	1	1	2	-	1	1	2	2	3	2	-	-
<b>CO5</b>	3	3	2	1	1	1	2	1	2	1	-	-	2	2	-	-
<b>CO6</b>	2	2	2	2	1	1	2	2	2	2	2	3	2	3	1	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTD501a			
<b>Course Name</b>	: Demography and vital statistics			
<b>Semester /Year</b>	: Vth / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To introduce the concepts of demography and its types
2. To help students in defining and to collect valid demography data using different methods
3. To gain specific knowledge about basic measures of Mortality , Fertlity and life table.
4. To understand how to construct life Tables.

**Course Contents****Unit 1:**

**Biological theories** : Hypothesis of Fertility, Malthusian theory of population, pearl and reed hypothesis, Herbert Spencer's theory, Jouse Decastro's hypothesis, Robert Ardrey's hypothesis, Analysis of food fertility link.

**Unit 2:**

**Marxian theory of surplus population:** Dumont's hypothesis. The Becker model of fertility, Easterly's hypothesis, Development of transition theory, leading stage of population profile of demographic explosion.

**Unit 3:**

**Introduction** : sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR)and Standardized Death Rates. Stationary and Stable population,. Life(Mortality) Tables Assumption ,description ,construction of Life Tables and Uses of Life Tables.

**Unit 4:**

**Measurements of Fertility:** Crude Birth Rate(CBR),General Fertility Rate(GFR),Specific Fertility Rate(SFR)and Total Fertility Rate(TFR).Measurement of Population Growth Crude rates of natural increase, Pearl’s Vital Index, Gross Reproduction Rate(GRR)and Net Reproduction Rate (NRR).

**Texts Books:**

1. P.Mukhopadhyay( 1999):Applied Statistics, Books and Allied(P)Ltd.
2. A.M. Goon, M.K. Gupta and B.Dasgupta(2008):Fundamentals of Statistics,Vol.II,9<sup>th</sup> Edition, World Press.
3. S.Biswas(1988):Stochastic Processes in Demography&Application,WileyEasternLtd.

**Reference Books :**

- 1.Fredrick E.Croxton, Dudley J.Cowden, andSKlein (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of vital statistics. Mortality rates, fertility rates and their measurements. Have a basic idea about migration and population projection.
<b>CO2</b>	Describe the various measures of mortality and fertility and their practical utility in different fields.
<b>CO3</b>	Apply the concepts of life table, their constructions, uses of time table and their utility for the society.
<b>CO4</b>	Analysis between gross reproduction and net reproduction rate.
<b>CO5</b>	Summarize the fertility and mortality with its measures.
<b>CO6</b>	Develop the abilities and skills to identify data realted to life table.

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A/B.Sc.**

<b>Course code</b>	: BSTD501b			
<b>Course Name</b>	: Applied Statistics			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To understand the concepts of applied statistics
2. To give suitable exposure to applied field of statistics
3. To gain knowledge of fundamental concepts about index numbers and time series

**Course Contents****Unit1**

**Economic Time Series:** Components of time series, Decomposition of time series-Additive and multiplicative model with their merits and demerits, Illustrations of time series. Measurement of trend by method of free-hand curve, method of semi-averages and method of least squares (linear, quadratic and modified exponential). Measurement of seasonal variations by method of ratio to trend.

**Unit 2**

**Index numbers:** Definition, Criteria for a good index number, different types of index numbers. Construction of index numbers of prices and quantities, consumer price index number Uses and limitations of index numbers.

**Unit 3**

**Statistical Quality Control:** Importance of statistical methods in industrial research and practice. Determination of tolerance limits. Causes of variations in quality: chance and assignable. General Theory of control charts, process & product control, Control charts for variables: X-bar and R-charts. Control charts for attributes: p and c-charts



**Unit 4**

**Demographic Methods:** Introduction, measurement of population, rates and ratios of vital events. Measurement of mortality CDR, SDR (w.r.t.Age and sex), IMR, Standardized death rates. Life (mortality) tables definition of its main functions and uses. Measurement of fertility and reproduction: CBR,GFR ,and TFR. Measurement of population growth: GRR,NRR.

**Texts Books:**

1. Gun, A.M.,Gupta, M.K.and Dasgupta,B.(2008):Fundamentals of Statistics, Vol.II,9<sup>th</sup> Edition World Press, Kolkata.
2. Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, 4<sup>th</sup> Edition (Reprint), Sultan Chand & Sons

**Reference Books:**

1. Arun Kumar and Alka Chaudhary (2009) , Krishna Prakashan Media (P) Ltd. Meerut.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of vital statistics. Mortality rates, fertility rates and their measurements. Have a basic idea about migration and population projection
<b>CO2</b>	Explain the concepts of quality control different types of control charts for variables and attributes and their construction
<b>CO3</b>	Apply the concept Index numbers and their applications. Have a clear understanding about the different indices
<b>CO4</b>	Analysis the concepts of time series, different models and measurement of trend and seasonal variations..
<b>CO5</b>	Evaluate the important theoretical perspectives and methodological techniques in applied statistics.
<b>CO6</b>	Develop an ability to identify the various analysis tools for data analysis.

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c.**

<b>Course code</b>	: BSTD501c			
<b>Course Name</b>	: Statistical Quality Control			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To introduce the basic concepts of statistical quality control
2. To Learn techniques and approach of SQC being used in various filed especially industry
3. Describe the concepts of various methods to control quality
4. Describe the concept of sigma and index numbers.

**Course Contents****Unit 1**

**Quality Control:** Definition, dimensions of quality, its concept, application and importance. Introduction to Process and Product Controls. Statistical Process Control - Seven tools of SPC, chance and assignable Causes of quality variation. Introduction to Six-Sigma: Overview of Six Sigma, Lean Manufacturing and Total Quality Management (TQM). Organizational Structure and Six Sigma training plans- Selection Criteria for Six-Sigma roles.

**Unit 2**

**Statistical Control Charts-** Construction and Statistical basis of  $3\text{-}\sigma$  Control charts, Control charts for variables:  $\bar{x}$ -chart, & R-chart, & s-chart. Control charts for attributes: np-chart, p-chart, c-chart and u-chart. Rational Sub-grouping. Comparison between control charts for variables and control charts for attributes. Analysis of patterns on control chart, estimation of process capability.

**Unit 3**

**Acceptance sampling plan:** Principle of acceptance sampling plans. Single and Double sampling plan their OC, AQL, LTPD, AOQ, AOQL, ASN, ATI functions with graphical interpretation, use and interpretation of Dodge and Romig's sampling inspection plan.

**Unit 4**

**Index Numbers:** Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers. Compilation of indices, base shifting, splicing and deflating of index numbers. Uses and limitations of index numbers.

**Text Books:**

1. Suddhendu Biswas (2003) Statistics of Quality Control, New Central Book Agency Kolkata
2. Arun Kumar and Alka Chaudhary (2009), Applied Statistics, Krishna House, 11, Shivaji Road Meerut..

**Reference Books :**

1. David, H. (1995). ISO Quality Systems Handbook, 2nd Ed., Butterworth Heinemann Publication.
2. Montgomery, D. C. (2009). Introduction to Statistical Quality Control, 6th Ed., Wiley India Pvt. Ltd.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of statistical process control tools
<b>CO2</b>	Describe the various tools which are using to control quality
<b>CO3</b>	Apply the statistical product control tools and sampling inspection plan
<b>CO4</b>	Analyse and check whether the process in control or out of control by applying various control charts.
<b>CO5</b>	Evaluate the work attitudes and their impact on quality control.
<b>CO6</b>	Develop the ability & skill to perform statistical quality control.

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL501			
<b>Course Name</b>	: Lab course based on D501a			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

The objectives of this course are:

1. To analysis the various measures of mortality
2. To analysis the various measures of Fertility.
3. To construct Life tables by calculating all components which are using life tables
4. To analysis the various measures for calculation net reproduction rate .

**Course Contents**

1. To calculate CDR and Age Specific death rate for a given set of data
2. To find Standardized death rate by :- (i)Direct method(ii)Indirect method
3. To construct a complete life table
4. To fill in the missing entries in a life table
5. To calculate CBR,GFR, SFR, TFR for a given set of data
6. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set of data.
7. Calculate GRR and NRR for a given set of data and compare

**Texts Books:**

1. P. Mukhopadhyay (1999):Applied Statistics, Books and Allied(P)Ltd.
2. A.M.Goon,M.K. Gupta and B.Dasgupta(2008):Fundamentals of Statistics,Vol.II,9thEdition, World Press

**Reference Books:**

- 1.Fredrick E.Croxton, Dudley J.Cowden, and SKlein (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.

2. N.Keyfitzand John A. Beckman: Demography through Problems, S-Verlag Newyork.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
CO1	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
CO2	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
CO3	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
CO4	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
CO5	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
Weightage (%)	15	15	70

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL501			
<b>Course Name</b>	: Lab course based on D501b			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

The objectives of this course are:

1. Explain the basic concepts of vital statistics. Mortality rates, fertility rates and their measurements. Have a basic idea about migration and population projection.
2. To Have a basic idea about migration and population projection.
3. Able to explain the demand analysis, law of demand and supply, Price elasticity of demand
4. To assess the Pareto distribution, Lorenz curve and Gini's coefficient

**Course Contents**

1. Measurement of trend: Fitting of linear, quadratic trend, exponential curve.
2. Plotting of trend values and comparing with given data graphically.
3. Measurement of seasonal indices by Ratio-to-trend method and plotting of trend values and comparing with given data graphically.
4. Construction of price and quantity index numbers by Lapser's formula, Paasche's formula, Marshall-Edge worth's formula, Fisher's Formula. Comparison and interpretation.
5. Construction of wholesale price index number, fixed base index number and consumer price index number with interpretation
6. Construction and interpretation of X bar & R-chart
7. Construction and interpretation p-chart (fixed sample size) and c-chart
8. Computation of measures of mortality and Life Table



**Texts Books:**

1. Mukhopadhyay, P.(1999):Applied Statistics, New Central Book Agency, Calcutta.
2. Gun, A.M.,Gupta, M.K.and Dasgupta,B. (2008): Fundamentals of Statistics,Vol.II,9<sup>th</sup> Edition World Press, Kolkata.
3. Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, 4<sup>th</sup> Edition (Reprint),Sultan Chand & Sons

**Reference Books:**

1. Arun Kumar and Alka Chaudhary (2009) , Krishna Prakashan Media (P) Ltd. Meerut.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL501			
<b>Course Name</b>	: Lab course based on D501c			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

The objectives of this course are:

1. To analysis various controls charts for controlling quality
2. To understand the statistical product control tools and sampling inspection plan.
- 3 To Analyse and check whether the process in control or out of control by Applying various control charts.

**Course Contents**

1. Construction and interpretation of statistical control charts for
  - a) R-chart
  - b) s-chart
  - c) np-chart
  - d) p-chart
  - e) c-chart
  - f) u-chart
2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves.
3. Calculation of process capability and comparison of 3-sigma control limits with specification limits.
4. Calculate price and quantity index numbers using simple and weighted average of price relatives.
5. To Calculate the Chain Base Index numbers.
6. To Calculate the Consumer Price Index numbers.

**Text Book:**

1. Suddhendu Biswas (2003), Statistics of Quality Control, New Central Book Agency Kolkata
2. Arun Kumar and Alka Chaudhary(2009), Applied Statistics, Krishna House, 11, Shivaji Road Meerut..

**Reference Books:**

1. David, H. (1995). ISO Quality Systems Handbook, 2nd Ed., Butterworth Heinemann Publication.
2. Montgomery, D. C. (2009). Introduction to Statistical Quality Control, 6th Ed., Wiley India Pvt. Ltd.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam)</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTS501			
<b>Course Name</b>	: Statistics Tehnique for Research Methods			
<b>Semester /Year</b>	: Vth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To understand how the principles of research methodology can be applied to the area of research
2. To understand the concepts and theories of research problem, research design..
3. To understand the comparative study of different methods of data collection
4. To learn students how to construct of questionnaires

**Course Contents****Unit 1**

**Introduction:** Meaning, objective and motivation in research, types of research, research Approach, significance of research. Research problems: definition, selection and necessity of research problems.

**Unit 2**

**Survey Methodology:** Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.

**Unit 3**

**Processing:** Data Analysis and Interpretation: Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

**Unit 4**

**Develop a questionnaire:** collect survey data pertaining to a research problem (such as gender discriminations in private/s government sector, unemployment rates, removal of subsidy, and impact on service class v/s unorganized sectors), interpret the results and draw inferences.

**Text Books:**

1. Kothari, C.R.(2009):Research Methodology: MethodsandTechniques,2<sup>nd</sup> Revised Edition reprint New Age International Publishers.

2: Kumar, R(2011): Research Methodology: A Step-by-Step Guide for Beginners, SAGE publications.

**.Reference Books:**

1. Kumar, R(2011):Research Methodology: A Step-by-Step Guide for Beginners, SAGE publications

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts meaning of research and types of research
<b>CO2</b>	Decribe to understand research problems selection and necessity of researchproblems.
<b>CO3</b>	Apply the concepts of survey methodology and how to collect data collection, processing data analysis and interpretations..
<b>CO4</b>	Examine the questionnaire collect survey data and their analysis by using suitable statistical tools.
<b>CO5</b>	Evaluate the research methods for analysis data.
<b>CO6</b>	Develop the ability to use the research concepts.

**CO-PO-PSO Mapping**

Cours e	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	1	1	1	2	1	1	1	1	1	3	2	-	-
<b>CO2</b>	3	2	1	-	1	1	1	-	1	1	1	1	2	1	-	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	1	-
<b>CO4</b>	2	3	2	1	1	1	2	-	1	1	2	2	3	2	-	-
<b>CO5</b>	3	3	2	1	1	1	2	1	2	1	-	-	2	2	-	-
<b>CO6</b>	2	2	2	2	1	1	2	2	2	2	2	3	2	3	1	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal Assignment</b>	<b>II<sup>nd</sup> Internal Written Exam</b>	<b>External (ESE)</b>
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>



**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTD601a			
<b>Course Name</b>	: Operation Research			
<b>Semester /Year</b>	: VIth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To understand the fundamental concepts of operation research.
2. To Acquire the fundamental concepts of linear programming
3. To learn and analysis the transportation problem and assignment problem and to solve it

**Course Contents****Unit 1**

**Objective of O.R.:** nature and definitions of O.R.Scope of O.R Meaning and necessity of O.R.models, classification of O.R.models, Advantages & disadvantages of O.R. models. Steps in model formulation, principles of modeling. Characteristics of a good model, Allocation problems.

**Unit 2**

**Linear programming problem (LPP):** Definition, objective function, constraints, graphical solution of L.P.P.limitations of graphical method,Simplex method to solve L.P.P. concept of initial basic feasible solution,computation procedure for Simplex method.

**Unit 3**

**Artificial variable techniques:** Big-M method, Two-phase method. Duality in Linear Programming; Concept of duality, Fundamental properties of duality

**Unit 4**

**Transportation Problem(T.P.):**Formulation, Basic feasible solution. Different methods to find initial feasible solution: North-West corner rule, Row minima method, column minima method, Matrix minima method (Least cost entry method),

**Text Books:**

- 1.Sharma, S.D (2020).: Operation Research, Kedar Nath and Ram Nath Meerut
2. Taha,H.A.(2007):Operations Research: An Introduction, 8<sup>th</sup> Hall of India. Edition, Prentice

**Reference Book:**

- 1.Ravindran, A, Phillips, D.T., Solberg, J.J.(2005): Operations Research- Principles and Practice, John Wiley & Sons.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of Operation research, Formulation of a linear Programming problem, Obtain graphical solutions to a linear programming problem.
<b>CO2</b>	Describe the concept of linear programming and their procedure for obtaining the best results..
<b>CO3</b>	Apply the concept of basic feasible solution and their different to find initial feasible solution
<b>CO4</b>	Examine transportation and assignment problems as LPP.
<b>CO5</b>	Evaluate the approaches and various techniques used in operation research.
<b>CO6</b>	Develop the qualities and attributes required in research.

**CO-PO-PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam )	External (ESE)
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c**

<b>Course code</b>	: BSTD601b			
<b>Course Name</b>	: Time Series Analysis			
<b>Semester /Year</b>	: VIth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. Enabled to design and conduct the components of time series.
2. To understanding of the process generating a time series
3. To learn forecasting future values of the observed series

**Course Content:****Unit 1**

**Introduction to times series data** : application of time series from various fields, Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.

**Unit 2**

**Trend** : Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend,

**Unit 3**

**Seasonal Component:** Ratio to Moving Averages and Link Relative method, Deseasonalization. Cyclic Component: Harmonic Analysis. Some Special Processes:

**Unit 4:**

**Moving:** (MA) process and Auto regressive (AR) process of orders , Estimation of the parameters of AR(1) and AR (2)–Yule-Walker equations.

**Text Books :**

1. Arun Kumar and Alka Chaudhary(2009), Applied Statistics, Krishna House, 11, Shivaji Road Meerut..
2. ChatfieldC.(1980):TheAnalysisofTimeSeries–AnIntroduction,Chapman&Hall.

**Reference Book:**

- 1 .Mukhopadhyay P.(2011):AppliedStatistics,2<sup>nd</sup>ed. Revised reprint,Books and Allied.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the concepts of time series, the different models, measurement of trend and seasonal variations.
<b>CO2</b>	Describe the fitting a various mathematical curve and growth curve.
<b>CO3</b>	Apply method of moving average and estimation of seasonal component by method of simple averages..
<b>CO4</b>	Analysis the process of moving average and autoregressive process of order one and two..
<b>CO5</b>	Evaluate the approaches and various techniques used in time series analysis.
<b>CO6</b>	Develop the different components of times series.

**CO-PO-PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-
<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam )	External (ESE)
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTD601c			
<b>Course Name</b>	: Non Parametric Methods			
<b>Semester /Year</b>	: Vith sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	3	1	0	4

**L – Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To describe the basic concepts of non parametric test.
2. To understand various tests which are using in non-parametric methods.
3. To learn various ways of analysis the data by using different test.
4. To apply non parametric methods of testing of hypothesis.

**Course Contents****Unit 1**

**Non parametric Tests:** Introduction and Concept, Test for randomness based on total number of runs, Empirical distribution function.

**Unit 2:**

**Kolmogorov Smirnov Tests:** one sample Inference Review of order statistics, Distribution-free statistics over a class, Counting statistics, ranking statistics, Statistics utilizing counting and ranking, Asymptotic distribution of U-statistics.

**Unit 3**

**Measures of Association :** bivariate samples: Kendall's Tau coefficient, Spearman's coefficient of Rank correlation, . Measures of association in multiple classifications

**Unit 4 :**

**Rank tests :** Locally most powerful rank tests, Linear rank statistics and their distributional properties under null hypothesis, Pitman's asymptotic relative efficiency.

**Text Books**

1. Arun Kumar and Alka Chaudhary (2009), Statistical Inference, Krishna House, 11, Shivaji Road Meerut..
2. Gibbons, J.D. and Chakraborti, S. (1992). Nonparametric Statistical Inference, Third Edition, Marcel Dekker.
3. Hettmansperger, T.P. (1984). Statistical inference Based on Ranks, John Wiley & Sons.

**Reference Book:**

1. Randles, R.H. and Wolfe, D.A. (1979). Introduction to the Theory of Nonparametric Statistics, John Wiley & Sons.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concept and importance of non parametric methods
<b>CO2</b>	Describe the concept of empirical distribution function and Kolmogorov goodness of fit test
<b>CO3</b>	Apply parametric and non- parametric test.
<b>CO4</b>	Examine testing of hypothesis using non- parametric test like sign test, mann- Whitney test etc and ability to use them carefully for the testing of given data.
<b>CO5</b>	Evaluate the various methods in non-parametric.
<b>CO6</b>	Write a difference between parametric & non parametric methods.

**CO-PO-PSO Mapping**

<b>Cours e</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO1 0</b>	<b>PO 11</b>	<b>PO1 2</b>	<b>PS O1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>
<b>CO1</b>	3	1	1	-	-	1	2	1	1	1	1	1	3	2	1	-
<b>CO2</b>	3	2	1	-	-	1	1	-	1	1	1	1	2	1	1	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	2	1
<b>CO4</b>	2	3	2	1	-	1	2		1	1	2	2	3	2	1	1
<b>CO5</b>	3	3	3	-	-	1	2	1	2	1	-	-	2	2	1	-

<b>CO6</b>	2	2	2	2	1	2	2	2	2	2	2	3	2	3	2	-
------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

<b>Components</b>	<b>I<sup>st</sup> internal (Assignment)</b>	<b>II<sup>nd</sup> Internal (Written Exam )</b>	<b>External (ESE)</b>
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.Sc.**

<b>Course code</b>	: BSTL601			
<b>Course Name</b>	: Lab Course based on D601a			
<b>Semester /Year</b>	: VIth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To Learn the fundamental concepts of operation research.
2. To Describe the fundamental concepts of linear programming
3. To learn and analysis the transportation problem and assignment problem and to solve it

**Course Contents**

1. Mathematical formulation of L.P. P and solving the problem using graphical method
2. Simplex technique to solve L.P.P and reading dual solution from the optimal table
3. Charne's Big M method involving artificial variables.
4. Identifying Special cases: Degenerate solution, unbounded solution.
5. Allocation problem using Transportation model
6. Allocation problem using Assignment model
7. Networking: Shortest route problem
8. Problems based on game matrix: 2/2 rectangular and Mixed strategy

**Text Books:**

1. Sharma, S.D (2020).: Operation Research, Kedar Nath and Ram Nath Meerut
2. Taha,H.A.(2007):Operations Research: An Introduction, 8th Hall of India.Edition, Prentice
- 3 Swarup Kanti, Gupta,P.K.and Manmohan (2007):Operations Research,13thEdition, Sultan Chand and Sons.

**Reference Book:**

- 1.Ravindran, A, Phillips, D.T., Solberg, J.J.(2005): Operations Research- Principles and Practice, John Wiley & Sons.



**Course outcomes (COs):****Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated****Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c.**

<b>Course code</b>	: BSTL601			
<b>Course Name</b>	: Lab Course based on BSTD601b			
<b>Semester /Year</b>	: VIth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. Describe the components of time series.
2. To Learn the process of generating a time series
3. To learn for casting future values of the observed series.

**Course Contents**

1. Fitting and plotting of modified exponential curve
2. Fitting and plotting of Gompertz curve
3. Fitting and plotting of logistic curve
4. Fitting of trend by Moving Average Method
5. Measurement of Seasonal indices Ratio-to-Trend method
6. Measurement of Seasonal indices Ratio-to-Moving Average method
7. Measurement of seasonal indices Link Relative method
8. Calculation of variance of random component by variate difference method
9. Forecasting by exponential smoothing
10. Forecasting by short term forecasting methods

**Text Books :**

1. Arun Kumar and Alka Chaudhary(2009), Applied Statistics, Krishna House, 11, Shivaji Road Meerut..
2. Chat field C.(1980):The Analysis of Time Series–An Introduction, Chapman & Hall.

**Reference Book:**

1 .Mukhopadhyay P.(2011):AppliedStatistics,2nded. Revised reprint, Books and Allied

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PS O1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
<b>CO2</b>	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
<b>CO3</b>	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
<b>CO4</b>	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
<b>CO5</b>	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
<b>CO6</b>	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
<b>Weightage(%)</b>	<b>15</b>	<b>15</b>	<b>70</b>

**Programme Name: B.A./B.S.c.**

<b>Course code</b>	: BSTL601			
<b>Course Name</b>	: Lab Course based on BSTD601c			
<b>Semester /Year</b>	: Vith sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	2	2

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:****The objectives of this course are:**

1. To understand the difference between parametric and non parametric tests.
2. To analysis the data by using various non-parametric tests.
3. To test the hypothesis by using suitable non parametric tests

**Text Books**

1. Arun Kumar and Alka Chaudhary (2009), Statistical Inference, Krishna House, 11, Shivaji Road Meerut.
2. Gibbons, J.D. and Chakraborti, S. (1992). Nonparametric Statistical Inference, Third Edition, Marcel Dekker.

**Reference Book:**

1. Randles, R.H. and Wolfe, D.A. (1979). Introduction to the Theory of Nonparametric Statistics, John Wiley & Sons.

**Course outcomes (COs):****Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Remember the skill regarding analysis of data.
<b>CO2</b>	Apply the concepts of statistics through experiments.
<b>CO3</b>	Apply suitable technique for analysis data
<b>CO4</b>	Differentiate Quantitative and Qualitative data through practical's.
<b>CO5</b>	Evaluate the concepts of statistics through practical's
<b>CO6</b>	Develop basic tools and techniques for performing experiment

**CO-PO-PSO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	1	2	-	1	1	1	1	1	-	3	2
CO2	1	1	2	1	1	1	1	-	1	1	1	1	2	1	3	2
CO3	1	2	3	1	1	1	2	1	2	1	2	3	1	1	2	3
CO4	1	1	2	1	1	1	2	-	1	1	1	2	3	-	2	3
CO5	1	1	2	1	1	1	2	1	1	1	1	-	2	-	2	2
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	-	3	3

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
Weightage (%)	15	15	70

**Programme Name: B.A./B.S.c.**

<b>Course code</b>	: BSTS601			
<b>Course Name</b>	: Understanding Probability and Statistics Through Practical's			
<b>Semester /Year</b>	: VIth sem / IIIrd Year			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	4	2	0	6

**L - Lecture T – Tutorial P – Practical C – Credit**

**Course Objectives:**

**The objectives of this course are:**

1. To Learn the concepts and analysis of data in excel sheet
2. To analysis various fitting of data by using excel sheet.
3. To analysis correlation, tests based on t, F and Chi square test on excel sheet.

**Course Contents**

1. Fitting of Binomial, Poisson, Negative Binomial, Normal Distributions
2. Applications of Chi-square, t and F Distributions.
3. Calculation of correlation coefficient, Rank Correlation etc
4. Fitting of polynomials and regression curves.
5. Methods of estimation (MLE and method of Moments) Selecting a simple random sample using random number tables.

**Text Books :**

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 (7thEd.)Pearson Education, Asia.

**Reference Book :**

1. Sheldon Ross. 2007. Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to:**

<b>CO1</b>	Identify the basic concepts of statistics and probability through practicals on a computer by using excel
<b>CO2</b>	Explain the concept of Fitting of Binomial, Poisson, Negative Binomial and normal distribution through practicals on a computer by using excel.
<b>CO3</b>	Apply Chi- Square t and F distribution through practicals on excel
<b>CO4</b>	Analyse correlation coefficient through practicals on computer by using excel.
<b>CO5</b>	Evaluate the different methods and theories of probability
<b>CO6</b>	Formulate the different strategies to deal with data analysis.

**CO-PO-PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	3	1	1	1	1	1	2	1	1	1	1	1	3	2	-	-
<b>CO2</b>	3	2	1	-	1	1	1	-	1	1	1	1	2	1	-	-
<b>CO3</b>	3	2	2	1	1	1	2	1	1	2	2	3	3	2	1	-
<b>CO4</b>	2	3	2	1	1	1	2	-	1	1	2	2	3	2	-	-
<b>CO5</b>	3	3	2	1	1	1	2	1	2	1	-	-	2	2	-	-
<b>CO6</b>	2	2	2	2	1	1	2	2	2	2	2	3	2	3	1	-

**3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated**

**Examination Scheme:**

Components	I <sup>st</sup> internal (Assignment)	II <sup>nd</sup> Internal (Written Exam)	External (ESE)
<b>Weightage (%)</b>	<b>15</b>	<b>15</b>	<b>70</b>









