Draft
Common Minimum Syllabus for State Universities and Colleges of Uttarakhand

National Education Policy-2020
Common Minimum Syllabus for all Uttarakhand State Universities/ CollegesSUBJECT: STATISTICS

PROPOSED STRUCTURE OF UG STATISTICS SYLLABUS

Curriculum Design Committee, Uttarakhand

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2.	Prof. O.P.S. Negi Vice-Chancellor , Uttarakhand Open University	Member
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Semester-wise Titles of the Papers in B.Sc./B.A(Statistics)

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Certificate in Elementary Statistics					
1	I		Statistical Methods and Indian Official Statistics	Theory	4
			Statistical Methods Lab	Practical-1	2
	II		Probability Theory and Theoretical Distributions	Theory	4
			Theoretical Distributions Lab	Practical-1	2
Diploma in Basic Statistics					
2	III		Statistical Inference and Sampling Distributions and their related tests of Significance	Theory	4
			Sampling Distributions and their related tests of Significance Lab	Practical-2	2
	IV		Sampling Techniques and Analysis of Variance (ANOVA)	Theory	4
			Sampling Survey and ANOVA Lab	Practical-2	2
Degree in Bachelor of Science					
3	V		Numerical Analysis and Design of Experiment (DOE)	Theory	4
			Multivariate Analysis and Non-parametric Methods	Theory	2
			Non-parametric Methods and DOE Lab	Practical-3	4
			Research Project	Project	Qualifying
	VII		Statistical Quality Control & Computer Programming	Theory	4

			Applied Statistics & Educational Statistics	Theory	2
			Statistical Quality Control & Computer Programming Lab	Practical-3	4
			Research Project	Project	Qualifying

Subject Prerequisites

To study this subject a student must had the subject(s) Mathematics in class 12^{th}.

Program outcomes (Pos)

Students having Degree in B.Sc. (with Statistics) should have knowledge of different concepts and fundamentals of Statistics and ability to apply this knowledge in various fields of industry. They may pursue their future career in the field of Statistics and Research.

Program Specific Outcomes (PSOs)

After completing B.Sc. (with Statistics) the student should have:

- Knowledge of different concepts, principles, methodologies and tools (skills) of Statistics.
- Ability to collect tabulate, represent graphically, analyze and interpret data/information by using appropriate statistical tools.
- Ability to identify and solve a wide range of problems in real life/industry related to Statistics.
- Familiarity with computational techniques and statistical software including programming language (e.g. R) for mathematical and statistical computation.
- Capability to use appropriate statistical skills in interdisciplinary areas such as finance, health, agriculture, government, business, industry, telecommunication and bio-statistics.
- Ability to compete with industrial/private sector demand in the field of data analysis, marketing survey, etc. in professional manner and pursue their future career in the field of Statistics.
- Ability to develop original thinking for formulating new problems and providing their solutions. As a result, they will be able to pursue higher studies or research in the field of Statistics.

PROGRAM SPECIFIC OUTCOMES (PSOS)	
First Year	**CERTIFICATE COURSE IN ELEMENTARY STATISTICS**
	After completing this course a student will have: ✓ Knowledge of Statistics, its scope and importance in various fields. ✓ Ability to understand concepts of sample vs. population and difference between different types of data. ✓ Knowledge of methods for summarizing data sets, including common graphical tools (such as box plots, histograms and stem plots). Interpret histograms and box plots. ✓ Ability to describe data with measures of central tendency and measures of dispersion. ✓ Ability to understand measures of skewness and kurtosis and their utility and significance. ✓ Gain knowledge about Indian Official Statistics ✓ Ability to understand the concept of probability along with basic laws and axioms of probability. ✓ Ability to understand the terms mutually exclusive and independence and their relevance. ✓ Ability to identify the appropriate method (i.e. union , intersection, conditional, etc.) for solving a problem. ✓ Ability to apply basic probability principles to solve real life problems. ✓ Ability to understand the concept of random variable (discrete and continuous), concept of probability distribution. ✓ Gain knowledge about various discrete and continuous probability distributions. ✓ It will enable students to join the diploma course (semester III and IV) in any University or College of Higher education in Uttarakhand
Second Year	**DIPLOMA IN BASIC STATISTICS**
	After completing this course a student will have ✓ Knowledge of the terms like null and alternative hypotheses, two-tailed and one-tailed alternative hypotheses, significant and insignificant, level of significance and confidence, p value etc. ✓ Ability to understand the concept of MP, UMP and UMPU tests ✓ Ability to understand under what situations one would conduct the small sample and large sample tests (in case of one sample and two sample tests). ✓ Ability to understand the difference between parameter & statistic and standard error &standard deviation. ✓ Knowledge of the concept of Point and Interval Estimation and discuss characteristics of a good estimator. ✓ Ability to understand and practice various methods of estimations of parameters. ✓ Knowledge of the concept of Sampling distributions. ✓ Knowledge of the sampling distribution of the sum and mean. ✓ Ability to understand the t,F and chi-square distribution and to identify the main characteristics of these distributions. ✓ Ability to understand the concept of sampling and how it is different from complete enumeration. ✓ Knowledge of various probability and non-probability sampling

	methods along with estimates of population parameters ✓ Ability to identify the situations where the various sampling techniques shall be used. ✓ Knowledge of sampling and non-sampling errors. ✓ Knowledge of the concept of Analysis of Variance(ANOVA). ✓ Ability to carry out the ANOVA for One way and Two way Classification. ✓ Ability to carry out the post-hoc analysis. ✓ It will enable students to join the diploma course (semester V and VI) in any University or College of Higher education in Uttarakhand
Third Year	**DEGREE IN BACHELOR OF SCIENCE**
	After completing this course a student will have ✓ Knowledge of the concept of Design of experiment and its basic principles. ✓ Ability to perform the basic symmetric designs CRD, RBD and LSD with and without missing observations. ✓ Ability of understand finite Differences ✓ Ability of understand Relationship between Δ and E ✓ Ability of understand Stirling &Bessel's formula ✓ Ability of understand Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules ✓ Ability to conduct test of significance based non-parametric tests. ✓ Ability to deal with multivariate data. ✓ Ability to understand the basic concepts of matrices in order to study multivariate distribution. ✓ Ability to understand bivariate normal distribution and its applications ✓ Knowledge of the applications of multivariate normal distribution and Maximum Likelihood estimates of mean vector and dispersion matrix. ✓ Ability to apply distribution free tests(Non-parametric methods) for one and two sample cases. ✓ Ability to understand the Control Charts for variables and attributes ✓ Ability to understand the Single and double sampling plans ✓ Ability to understand the Basics of computer, C and R language ✓ Familiarity with different aspects of Applied Statistics and their use in real life situations. ✓ Ability to understand the concept of Time series along with its different components. ✓ Knowledge of Index numbers and their applications along with different types of Index numbers. ✓ Familiarity with various demographic methods and different measures of mortality and fertility. ✓ Ability to understand the concept of life table and its construction. ✓ Ability to understand the Scaling individual test item in terms of difficulty. ✓ Ability to understand the Z score and Z-scaling. ✓ Ability to understand the T-scores, uses of T-scores

Subject: Statistics							
Year	**Semester**	**Theory Paper**	**Units**	**Practical Paper**	**Units**	**Research Project**	**Total Credits of the Year subject**
1	I	Statistical Methods and Indian official Statistics	1. Descriptive Statistics-I 2. Descriptive Statistics - II 3. Bi Variatedata Analysis 4. Tri Variatedata Analysis 5. Indian Official Statistics	Statistical Methods Lab	1. Problems based on graphical representation of data 2. Problems based on calculation of Measures of Central Tendency. 3. Problems based on calculation of Measures of Dispersion. 4. Problems based on Co relation and Regression	NIL	4+2=6
	II	Probability Theory and Theoretical Distributions	1. Probability Theory-I 2. Probability Theory-II 3. Random Variables-I 4. Random Variables-II 5. Discrete Distributions-I 6. Discrete Distributions-II 7. Continuous Distrbutions-I 8. Continuous Distrbutions-II	Chemical Analysis-II	1. Fitting of Binomial and Poisson and Normal distribution. 2. Computation of conditional probabilities based on Bayes theorem 3. Problems based on order distribution. 4. Problems based on hyper geometric distribution.	NIL	4+2=6
2	III	Statistical Inference & Sampling Distributions	1. Point Estimation 2. Methods of Estimation 3. Testing of Hypothesis 4. Interval Estimation	Sampling Distributions and related tests of significance Lab	1. Problems based on Z tests 2. Problems based on t – test.	NIL	4+2=6

		and related tests of significance	5. Sampling Distribution-I 6. Sampling Distribution-II 7. Large Sample tests 8. Small sample tests		3. Problems based on F-test. 4. Problems based on Chi-square test. 5. Problems based on calculation of power function.		
	IV	Sampling Techniques and Analysis of Variance (ANOVA)	1. Basics of Sample Survey 2. Simple Random Sampling 3. Stratified and Systematic Sampling 4. Ratio and Regression Methods 5. Analysis of Variance	Sampling Techniques and Analysis of Variance Lab	1. Problems based on drawing a simple random sample with the help of table of random numbers. 2. Problems based on estimation of population means and variance in simple random sampling. 3. Problems based on Stratified random sampling for population means (proportional and optimum allocation). 4. Problems based on Systematic random sampling 5. Problems based on Analysis of variance in one-way and two-way classification.	NIL	4+2=6
3	V	Numerical Analysis and Design of Experiment (DOE)	1. Finite Differences 2. Interpolation-I 3. Interpolation-II 4. Numerical Integration 5. Basics of Design of Experiment 6. Basic symmetric designs	Numerical Analysis, DOE and Non Parametric Methods Lab	1. Problems based on Non-parametric tests for one sample. 2. Problems based on Non-parametric tests	Research Project (Qualifying)	4+4+2=10

		Multivariate Analysis and Non Parametric Methods	1. Bivariate Normal Distribution 2. Multivariate Normal Distribution 3. Linear Estimation 4. Non Parametric Methods		for two samples. 3. Problems based on Rank and Inverse of a matrix. 4. Problems based on Relationship between Δ and E 5. Problems based on Stirling &Bessel's formula 6. Problems based on Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules. 7. Problems based on Symmetric designs		
	VI	Statistical Quality Control(SQC) and Computer Programming	1. Basics of SQC 2. Control harts for Variables 3. Control harts for Attributes 4. Sampling Inspection Plans 5. Basics of Computers 6. Flowcharts and Algorithms 7. Basics ofC 8. Basics ofR	SQC, Computer Methods and Applied Statistics Lab	1. Problem based on Control Charts for variables 2. Problem based on Control chart for attributes 3. Problem based on Time Series 4. Problem based on Index Numbers 5. Problem based on Vital Statistics 6. Problem based on application of R as Calculator. 7. Problem based on application of R in simple data 8. analysis Problem	Research Project (Qualifying)	4+4+2=10
		Applied Statistics and Educational Statistics	1. Time Series Analysis 2. Index Numbers-I 3. Index Numbers-II 4. Vital Statistics 5. Educational Statistics				

					based on application of Excel in data analysis		

Subject: Statistics							
Course	**Semester**	**Paper Title**		**Prerequisite for Paper**	**Elective for Major Subject**	**Hours per Semester**	**Total Credits of the Year subject**
Certificate in Elementary Statistics	I	Theory-1	Statistical Methods and Indian Official Statistics	Mathematics in 12th Standard	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-1	Statistical Methods Lab	Mathematics in 12th Standard	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2
	II	Theory-1	Probability Theory and Theoretical Distributions	Passed Sem-I Theory paper-1	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-1	Theoretical Distributions Lab	Opted Sem-II Theory Paper-1	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2
Diploma in Basic Statistics	III	Theory-1	Statistical Inference and Sampling Distributions and their related tests of Significance	Passed Certificate Course in Elementary Statistics.	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-2	Sampling Distributions and their related tests of Significance Lab	Opted Sem-III Theory Paper-1	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2
	IV	Theory-1	Sampling Techniques and Analysis of Variance (ANOVA)	Passed Sem-III Theory Paper-1	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-2	Sampling Survey and ANOVA Lab	Opted Sem-IV Theory Paper-1	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2

Degree in Bachelor of Science	V	Theory-1	Numerical Analysis and Design of Experiment (DOE)	Passed Sem-III and Sem-IV Theory papers	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Theory-2	Multivariate Analysis and Non-parametric Methods	Passed Sem-III and Sem-IV Theory papers	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-3	Non-parametric Methods and DOE Lab	Opted Sem-V Theory Paper-1 &2.	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2
		Research Project			Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	Qualifying
	VI	Theory-1	Statistical Quality Control & Computer Programming	Passed Sem-V Theory papers	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Theory-2	Applied Statistics & Educational Statistics	Passed Sem-V Theory papers Theory papers	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	4
		Practical-3	Statistical Quality Control & Computer Programming Lab	Opted Sem-VI Theory Paper-1 &2	Yes for the students with major Zoo/Bot./Physics/Math/Comp Sci	60	2
		Research Project				60	Qualifying

Pattern of examination theory papers

A. Theory

*Each theory paper shall consist two sections **A** and **B**.*
***Section A**: (Short answers type with reasoning); 45 marks, eight questions of nine marks each, any five have to be attempted).*
***Section B**: (Long answers type);30 marks, two questions of fifteen marks each. Both the questions are compulsory with internal choice.*

B. Internal assessment

For each theory paper internal assessment shall be conducted periodically (in the form of class tests and/or assignments/ group discussion/ oral presentation/ overall performance) during the semester period. Total marks allotted to internal assessment shall be 25. The evaluated answer sheets/assignments have to be retained by the Professor In-Charge for the period of six months and can be shown to the students if students want to see the evaluated answer sheets. The marks obtained by the students shall be submitted to the Head of concerned department/ the Principal of the College for uploading onto the University examination portal.

C. Practical

The laboratory work of the students has to be evaluated periodically. The internal assessment (in the form of lab test, lab record, internal evaluation, assignment/home assignment and attendance) of total 10 marks for each semester shall be conducted during the semester. A minimum of 10 experiments covering all kinds of exercises have to be conducted during a semester. Maximum 5 marks of attendance can be given to the students. In each semester practical examination of 40 marks has to be conducted by two examiners (External and internal) having duration of 2 hours for I to IV Semester and 3 hours for V and VI Semester. The total number of students to be examined per batch should not be more than sixty. Marks obtained in the practical examination have to be submitted to the Head of the department/ Principal of the College. The Head of the Department/Principal of the College will make necessary arrangement for uploading the marks onto the University exam portal. The hard copy of the award list from portal has to be submitted to the Controller of Examination, Kumaun University, Nainital.

Programme/Class: **Certificate**	Year: **First**	Semester: **First**
Subject: **STATISTICS (MAJOR)**		
Course Code:-	Course Title: **Statistical Methods &Indian Official Statistics**	

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of Statistics, its scope and importance in various fields.
- ✓ Ability to understand concepts of sample vs. population and difference between different types of data.
- ✓ Knowledge of methods for summarizing data sets, including common graphical tools (such as box plots, histograms and stem plots). Interpret histograms and box plots.
- ✓ Ability to describe data with measures of central tendency and measures of dispersion.
- ✓ Ability to understand measures of skewness and kurtosis and their utility and significance.
- ✓ Gain knowledge about Indian Official Statistics.

Credits:**04**	Core: **Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No.of Lectures
Paper I:STATISTICAL METHODS &INDIAN OFFICIAL STATISTICS		
I	Definition and Scope of Statistics, Statistical data: Qualitative & Quantitative. Scales of measurement: Nominal, Ordinal, Interval and Ratio. Organization of data, Collection of data, Diagrammatic and Graphical representation of Data. Consistency and independence of data with special reference to attributes.	**08**
II	Measures of Location (Mathematical and Positional). Measures of dispersion, Range, Quartile Deviation, Mean Deviation, Variance, Standard Deviation, Root Mean Square Deviation, Coefficient of Variation, Moments, Factorial moments, Skewness and Kurtosis. Sheppard's corrections and Charlier's Check.	**16**

III	Meaning of Correlation, Scatter diagram, Karl Pearson's Coefficient of Correlation. Assumptions Underlying Karl Pearson's Correlation Coefficient. Correlation coefficient for a Bivariate Frequency Distribution. Probable Error of Correlation Coefficient. Rank Correlation. Linear regression, Properties of Regression Coefficients. Standard Error of Estimate and Residual variance. Correlation Coefficient between Observed and Estimated Values, R^2, Principle of least squares and curve fitting.	**16**
IV	Correlation Ratio, Intra–class Correlation, Multiple and Partial Correlation– Yule's Notation, Plane of Regression, Properties of Residuals- Variance of the Residual, Coeffici nt of Multiple Correlation- Properties of Multiple Correlation Coefficient, Coefficient of Partial Correlation (Tri- Variate).	**12**
V	Indian Statistical System: Present official Statistical System in India, Methods of collection of official Statistics, their reliability and limitation and the principal publications containing such statistics on the topics- population, agriculture, industry, trade, price, labour and employment, transport and communication, banking and finance.	**08**

Suggested Readings:

1. Fundamentals of Mathematical Statistics: S. C. Gupta and V. K. Kapoor.
2. Fundamentals of Statistics Vol- I: A. M. Goon, M. K. Gupta and B. Dasgupta.
3. New Mathematical Statistics: Bansi Lal and S. Arora.
4. Basic Statistics: B. L. Aggarwal.
5. Programmed Statistics: B. L. Aggarwal.
6. An Introduction to Theory of Statistics: G. Udny, M. G, Kendal.
7. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
8. http://mospi.nic.in

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html

- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05marks)**
Class Test-I	**(10marks)**
Class Test-II	**(10marks)**

This course can be opted as a minor elective by the students. Open to all(O t h e r Faculty).

Programme/Class: **Certificate**	Year: **First**	Semester: **First**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Statistical Methods Lab**	

Course outcomes:

After completing this course a student will have:

- ✓ Ability to represent/summarize the data/information using appropriate Graphical methods including common graphical tools (such as box plots, histograms and stemplots) and also to draw inferences from these graphs
- ✓ Acquire the knowledge to identify the situation to apply appropriate measure of central tendency as per the nature and need of the data and draw meaningful conclusions regarding behavior of the data.
- ✓ Acquire the knowledge to identify the situation to apply appropriate measure of dispersion as per the nature and need of the data and draw meaningful conclusions regarding heterogeneity of the data.
- ✓ Ability to measure skewness and kurtosis of data and define their significance.

Credits:**02**	Core: **Compulsory**
Max.Marks:**50**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**0-0-4**.	

	List of Practical	No. Of Lectures

	1. Problems based on graphical representation of data by Histogram ,Frequency polygons ,frequency curves and Ogives, Stem and Leaf Plot, Box Plot. 2. Problems based on calculation of Measures of Central Tendency. 3. Problems based on calculation of Measures of Dispersion.	**30**

Suggested Readings: As suggested for paper I

Suggested Continuous Evaluation Methods:(10Marks)

Continuous Internal Evaluation shall be based on Practical File/Record, Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05marks)**
Class Interaction	**(03marks)**
Report Preparation/Presentation	**(02marks)**

Suggested Practical Examination Evaluation Methods:(40 Marks)

Practical Examination Evaluation shall be based onViva-voce and Practical Exercises. The marks shall be as follows:

Practical Exercise(Major) 01x15Marks	**15Marks**
Practical Exercise(Minor) 01x10Marks	**10Marks**
Viva-voce	**15 Marks**

There shall be 04-05 Practical Exercises in Examination comprising 01 as Major(Compulsory) and 03-04 as Minor(Students have to attend any 01).

Course prerequisites: To study this course, a student must have opted/passed the paper code.

Programme/Class: **Certificate**	Year: **First**	Semester: **Second**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Probability Theory and Theoretical Distributions**	

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of discrete distributions. Discuss appropriate distribution negative binomial, Poisson, etc. with their properties and application of discrete distribution models to solve problems.
- ✓ Knowledge of continuous distributions. Discuss the appropriate distribution (i.e. uniform, exponential, normal, etc.) with their properties and application of continuous distribution models to solve problems.
- ✓ Knowledge of the formal definition of order statistics.
- ✓ Ability to identify the application of theory of order statistics in real life problems.
- ✓ Ability to understand the concept of probability along with basic laws and axioms of probability.
- ✓ Ability to understand the terms mutually exclusive and independence and their relevance.
- ✓ Ability to identify the appropriate method (i.e. union , intersection, conditional, etc.) for solving a problem.
- ✓ Ability to apply basic probability principles to solve real life problems.
- ✓ Ability to understand the concept of random variable (discrete and continuous), concept of probability distribution.

Credits:**04**	Core: **Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical (in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures

Paper I: PROBABILITY THEORY & THEORETICAL DISTRIBUTIONS

Part A: PROBABILITY THEORY

I	Introduction: Brief History, Basic Terminology, and Mathematical (or Classical or 'a Priori') Probability-limitation of Mathematical Probability. Statistical (or Empirical) Probability, Limitation of Empirical Probability. Subjective Probability. Mathematical tools: Preliminary Notations of sets- Elements of sets, Operation on sets, Algebra of sets. Axiomatic approach to probability- Random experiment, Sample Space and Elementary events, Acceptable assignment of probabilities, Natural assignment of probabilities, Axiomatic Probability, Algebra of Events.	**10**
II	Some Theorems on Probability-Addition theorem of Probability, Extension of Addition theorem of Probability to n Events, Boole's Inequality, Conditional Probability, Multiplication Theory of Probability, Independent Events, Multiplication Theory of Probability for Independent Events- Extension of Multiplication theorem of Probability to n Events, Pair Wise Independent Events, Mutually Independent events, Probability of Occurrence of at least one of the events. Bayes' Theorem, Geometrical Probability.	**06**
III	Random variables: Discrete and Continuous, Distribution functions, probability mass function, and probability density function. Joint distribution of two random variables- marginal and conditional distribution, Independence of two random variables. Transformation of random variables. Expectation-theorem on expectation of sum of random variables and product of independent random variables, Conditional Expectation.	**08**
IV	Moments and Moment Generating function, Cumulant Generating function, Characteristic function, Uniqueness and Inversion Theorems (without proof). Chebyshev's inequality, Weak Law of Large numbers (without proof) and Central Limit Theorem (without proof).	**06**
	Part B: THEORETICAL DISTRIBUTIONS: DISCRETE AND CONTINUOUS	

V	Bernoulli distribution and its moments, Binominal distribution: Moments, recurrence relation for the moments, moment generating function (m.g.f.), additive property, characteristics function (c.f.), cumulants, probability generating function (p.g.f.) and recurrence relation for the probabilities of Binominal distribution, Poisson Distribution: Poisson distribution as a limiting case of Binominal distribution, moments, mode, recurrence relation for moments, m.g.f., c.f., cumulants and p.g.f. of poison distribution, additive property of independent poisson variates. Negative Binominal distribution: m.g.f. and p.g.f., deduction of moments of negative binominal distribution.	**08**
VI	Discrete uniform distribution; Geometric distribution: Lack of memory, moments and m.g.f Hypergeometric distribution: Mean and variance. Continuous uniform distribution: Moments, m.g.f. characteristic function and mean deviation.	**08**
VII	Normal distribution as a limiting form of binominal distribution, chief characteristic of Normal distribution: mode, median, m.g.f., c.g.f. and moments of Normal distribution, a linear combination of independent normal variates, points of inflexion, mean deviation about mean, area property of Normal distribution, importance and fitting of normal distribution.	**08**
VIII	Gamma distribution; m.g.f., c.g.f ., additive property. Beta distribution of first and second kind, Moments(Mean and Variance). Exponential Distribution: m.g.f., moments, lack of memory. Log Normal and Cauchy distribution. Order statistics: Introduction, Distribution of the rth order statistic, smallest and largest order statistics.	**06**

Suggested Reading

1. Fundamental of Mathematical Statistics : S.C. Gupta and V.K. Kapoor
2. Mathematical Statistics : Kapoor & Saxsena
3. Mathematical Statistics : O.P Gupta & B.D. Gupta
4. New Mathematical Statistics : Bunshi Lal & S. Arora

5. Fundamental of Applied Statistics : S.C. Gupta & V.K. Kapoor
6. Fundamental of Statistics Vol – II : A.M. Goon, M.K. Gupta & B. Das Gupta

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05marks)**
Class Test-I	**(10marks)**
Class Test-II	**(10marks)**

This course can be opted as a minor elective by the students. Open to all (Other Faculty)

Programme/Class: **Certificate**	Year: **First**	Semester: **Second**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Theoretical Distributions Lab**	

Course outcomes:

After completing this course a student will have:

1. Ability to fit Binomial and Poisson distribution for given data.
2. Acquire the knowledge to compute conditional probabilities based on Bayes Theorem.
3. Problems based on order distribution.
4. Problems based on hyper geometric distribution.

Credits: **02**	Core: **Compulsory**
Max.Marks:**50**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical (in hours per week):**0-0-4**.	

	Topic	No. of Lectures

	1. Fitting of Binomial and Poisson distribution. 2. Computation of conditional probabilities based on Bayes theorem 3. Problems based on order distribution. 4. Problems based on hyper geometric distribution.	**30**

Suggested Continuous Evaluation Methods (10 marks):

Continuous Internal Evaluation shall be based on Practical File/Record, Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05 marks)**
Class Interaction	**(03 marks)**
Report Preparation/Presentation	**(02marks)**

Suggested Practical Examination Evaluation Methods:(40Marks)

Practical Examination Evaluation shall be based on Viva-voce and Practical Exercises. The marks shall be as follows:

Practical Exercise (Major) 01x15Marks	**15 Marks**
Practical Exercise (Minor) 01x10Marks	**10 Marks**
Viva-voce	**15 Marks**

There shall be 04-05 Practical Exercises in Examination comprising 01 as Major (Compulsory) and 03-04 as Minor (Students have to attend any 01).

Course prerequisites: To study this course, a student must have opted/passed the paper code.

Further Suggestions:

In practical classes a series of lectures for any statistical software(e.g. Excel or R) maybe organized for students and they may be asked to use it to perform practical problems assigned to them.

Programme /Class: **Diploma**	Year: **Second**	Semester: **Third**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Statistical Inference and Sampling Distributions and their related tests of Significance**	

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of the terms like null and alternative hypotheses, two-tailed and one-tailed alternative hypotheses, significant and insignificant, level of significance and confidence, p value etc.
- ✓ Ability to understand the concept of MP, UMP and UMPU tests
- ✓ Ability to understand under what situations one would conduct the small sample and large sample tests (in case of one sample and two sample tests).
- ✓ Ability to understand the difference between parameter & statistic and standard error &standard deviation.
- ✓ Knowledge of the concept of Point and Interval Estimation and discuss characteristics of a good estimator.
- ✓ Ability to understand and practice various methods of estimations of parameters.
- ✓ Knowledge of the concept of Sampling distributions.
- ✓ Knowledge of the sampling distribution of the sum and mean.
- ✓ Ability to understand the t,F and chi-square distribution and to identify the main characteristics of these distributions.

Credits:**04**	Core: **Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
	Part A : STATISTICAL INFERENCE	
I	Point Estimation: Introduction, Estimators and Estimate. Characteristics/Properties of Estimators: Unbiasedness, Consistency, Efficiency- Most Efficient Estimator, Minimum Variance Unbiased (MVU) Estimators, Sufficiency- Factorization Theorem(Neyman), Invariance property of Sufficient Estimator, Fisher-Neyman Criterion for Sufficient Estimator. Cramer-Rao inequality and MVB estimators.	**06**

II	Method of Estimation: Method of Moments, Method of minimum Chi-Square, Method of Maximum Likelihood Estimation, Properties of Maximum Likelihood Estimators, Method of Minimum Variance, Method of Least Squares	**08**
III	Testing of Hypothesis: Statistical Hypothesis-Simple and Composite, Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, Two Type of Errors, Level of Significance, Power of the Test, Steps in Solving Testing of Hypothesis Problem, Optimum Test Under Different Situations-Most power test(MP test), Uniformly Most Powerful Test(UMP test), Neyman and Pearson Lemma and its application in testing simple Vs Simple hypothesis, Likelihood Ratio Test-Properties of Likelihood Ratio Test and its solution for testing simple hypothesis against simple alternative hypothesis.	**08**
IV	Interval Estimation: Confidence Interval and Confidence limits-concept of best confidence intervals, Confidence Intervals for Large Samples.	08

Part B: Sampling Distributions and their related Test of Significance		
V	Random sample, parameter and statistic, sampling distribution of a statistic. Sampling distribution of Mean in Normal Population. Exact sampling distribution: definition and derivation of *p.d.f.* of $\chi^2$with n degrees of freedom(d.f) using m.g.f., nature of χ^2 curve for different degrees of freedom, mean, variance, m.g.f., cumulative generating function, mode, additive property and limiting form of χ^2 distribution.	**04**
VI	Exact sampling distributions- Student's t and Fisher t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t	**08**

	distribution. Snedecore's F-distribution: Derivation of p.d.f., Probability curve with different degrees of freedom, mean variance and mode. Distribution of 1/F (n_1,n_2). Relationship between t, F and χ^2 distributions.	
VII	Tests of Significance for Large Sampling of Attributes- Test of Significance for Single Proportion, Test of Significance for Difference of Proportions, Sampling of Variables- Unbiased Estimate for Population mean(μ) and variance(σ^2), Standard Error of Sample Mean, Test of Significance for Single Mean, Test of Significance for Difference of Means, Test of Significance the Difference of Standard Deviations, Test of Independence of Attributes- Contingency Tables, Yate's Correction (for 2x2 contingency Table)-Fisher's Exact test, Brandt and Snedecor Formula for 2Xk contingency Table.	**10**
VIII	Test of Significance for Small Samples: Test for Single Variance, χ^2- test of Homogeneity of Correlation Coefficients, Bartlett's Test for Homogeneity of Several Independent Estimates of the Same Population Variance, t-test for Single Mean, t-test for Difference of Means, Paired t-test for Difference of Means, t-teat for Testing the Significance of an Observed Sample Correlation Coefficient. F-test for Equality of Two Population Variances, F-test for testing the Significance of an Observed Multiple Correlation Coefficient, F-test for Testing the Linearity of Regression. Applications of Z-transformation.	**08**

Programme/Class: **Diploma**	Year: **Second**	Semester: **Third**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Sampling Distributions and their related Test of Significance Lab**	

Course outcomes:

After completing this course a student will have:

1. Ability to conduct test of significance based on t, F tests and Chi-square test.
2. Ability to deal with problems based on large sample tests.
3. Ability to conduct test of significance based on –parametric tests.

Credits:**02**	Core: **Compulsory**
Max.Marks:50	Min. Passing Marks: **……**

Total No. of Lectures-Tutorials-Practical(in hours per week):**0-0-4**.

	Topic	No. of Lectures
	1. Problems based on t –test. 2. Problems based on F-test. 3. Problems based on Chi-square test. 4. Problems based on calculation of power function.	**30**

Suggested Readings:

As suggested for paper code paper I & II.

Suggested Continuous Evaluation Methods (10 marks):

Continuous Internal Evaluation shall be based on Practical File/Record, Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05 marks)**
Class Interaction	**(03 marks)**
Report Preparation/Presentation	**(02 marks)**

Suggested Practical Examination Evaluation Methods: (40Marks)

Practical Examination Evaluation shall be based on Viva-voce and Practical Exercises. The marks shall be as follows:

Practical Exercise (Major) 01x15Marks	**15Marks**
Practical Exercise(Minor) 01x10Marks	**10Marks**
Viva-voce	**15 Marks**

There shall be 04-05 Practical Exercises in Examination comprising 01 as Major (Compulsory) and 03-04 as Minor (Students have to attend any 01).

Course prerequisites: To study this course, a student must have opted/passed the **paper code.**
Further Suggestions:
In practical classes a series of lectures for any statistical software may be organized for students and they may be asked to use it to perform practical problems assigned to them.

Suggested readings:

1. Fundamentals of Statistics. Vol.II: A.M.Goon, M.K. Gupta and B. Dasgupta
2. Applied Statistics: P. Mukhopadhyay
3. Fundamental of Applied Statistics: S.C. Gupta and V.K. Kapoor
4. Sampling Techniques: W.G. Cochran
5. Sampling Techniques: Daroga Singh and F.S. Chaudhary

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Programme/Class: **Diploma**	Year: **Second**	Semester: **Fourth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Sampling Techniques & Analysis of Variance (ANOVA)**	

Course outcomes:

After completing this course a student will have:

- ✓ Ability to understand the concept of sampling and how it is different from complete enumeration.
- ✓ Knowledge of various probability and non-probability sampling methods along with estimates of population parameters
- ✓ Ability to identify the situations where the various sampling techniques shall be used.
- ✓ Knowledge of sampling and non-sampling errors.
- ✓ Knowledge of the concept of Analysis of Variance(ANOVA).
- ✓ Ability to carry out the ANOVA for One way and Two way Classification.
- ✓ Ability to carry out the post-hoc analysis.

Credits:**04**	Core:**Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
PAPER I : Sampling Techniques & Analysis of Variance (ANOVA)		
PART A: SAMPLING Techniques		
I	Introduction, Type of Sampling- Purposive sampling, Probability sampling, Parameter and Statistic-Sampling Distribution of Statistic, Standard Error, Sampling vs complete enumeration, sampling units and frame, sampling and non-sampling errors, precision and efficiency of sampling estimators.	**08**
II	Simple random sampling with and without replacement, definition and procedure of selecting a sample, Estimates of: population mean, total and proportion, variance of these estimates, estimates of their variances and sample size determination.	**08**
III	Stratified random sampling: Technique, estimates of population mean and total, variances of these	**06**

	estimates, proportional and optimum, Neyman allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision, post stratification and its performance. Systematic sampling: Technique, estimates of population mean and total, variances of these estimates(N=nk). Comparison of systemic sampling with SRS and stratified sampling in the presence of linear trend.	
IV	Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size), variance of these estimates and estimates of these variances, variances in terms of correlation coefficient for regression method of estimation and their comparison with SRS.	**08**

PART B: ANALYSIS OF VARIANCE		
V	Introduction to Analysis of Variance (ANOVA) and Definition, Causes of Variation Classification of ANOVA, one way classification with one observation per cell, One way classification with 'm' observations per cell, Two way classification with one observation per cell: Mathematical model, Sum of squares for various causes of variation, Expected value of Sum of Squares, Degrees of freedom for Sum of Squares, ANOVA Table and related tests of Significance.	**30**

Suggested readings:

1. Design and Analysis of Experiments: M.N.Das and N.C.Giri.
2. Fundamentals of Statistics. Vol.II: A.M. Goon, M.K. Gupta and B.Dasgupta.
3. Applied Statistics: P. Mukhopadhyay.
4. Fundamental of Applied Statistics: S.C. Gupta and V.K. Kapoor
5. Sampling Techniques: W.G.Cochram
6. Sampling Theory: Des Raj and Chandok
7. Sample Theory of Surveys with Applications: V.G. Panse and P.V. Sukhatme.
8. Sampling Techniques: Daroga Singh and F.S. Chaudhary
9. Survey Sampling: P. Mukhopadhyay

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx

- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

This course can be opted as a minor elective by the students of following subjects:

Open to all(Other Faculty)

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**

Programme/Class: **Diploma**	Year: **Second**	Semester: **Fourth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Sampling Techniques and Analysis of Variance Lab**	

Course outcomes:

After completing this course a student will have:

2. Ability to perform ANOVA for one way and two classifications.
3. Ability to perform post-hoc analysis.
4. Ability to draw a simple random sample with the help of table of random numbers.
5. Ability to estimate population means and variance in simple random sampling.
6. Ability to deal with problems based on Stratified random sampling for population means (proportional and optimum allocation).
7. Ability to deal with problems based on Systematic random sampling.

Credits:**02**	Core: **Compulsory**
Max.Marks:50	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**0-0-4**.	

	Topic	No. of Lectures

	1. Problems based on drawing a simple random sample with the help of table of random numbers. 2. Problems based on estimation of population means and variance in simple random sampling. 3. Problems based on Stratified random sampling for population means (proportional and optimum allocation). 4. Problems based on Systematic random sampling 5. Problems based on Analysis of variance in one-way and two-way classification.	**30**

Suggested Readings:

As suggested for paper I & II

Suggested Continuous Evaluation Methods(10 marks):

Continuous Internal Evaluation shall be based on Practical File/Record, Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05 marks)**
Class Interaction	**(03 marks)**
Report Preparation/Presentation	**(02marks)**

Suggested Practical Examination Evaluation Methods:(40Marks)

Practical Examination Evaluation shall be based on Viva-voce and Practica l Exercises. The marks shall be as follows:

Practical Exercise (Major) 01x15Marks	**15 Marks**
Practical Exercise(Minor)01x10Marks	**10 Marks**
Viva-voce	**15 Marks**

There shall be 04- 05 Practical Exercises in Examination comprising 01 as Major(Compulsory) and 03-04 as Minor(Students have to attend any 01).

Course prerequisites: To study this course, a student must have opted/passed the paper code.

Further Suggestions:
In practical classes a series of lectures for any statistical software may be organized for students and they may be asked to use it to perform practical problems assigned to them.

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Fifth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Numerical Analysis & Design of Experiment (DOE)**	

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of the concept of Design of experiment and its basic principles.
- ✓ Ability to perform the basic symmetric designs CRD, RBD and LSD with and without missing observations.
- ✓ Ability of understand finite Differences
- ✓ Ability of understand Relationship between Δ and E
- ✓ Ability of understand Stirling &Bessel's formula
- ✓ Ability of understand Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules.

Credits:**04**	Core: **Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**

Total No .of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.

Unit	Topic	No.of Lectures
PAPER I: NUMERICAL ANALYSIS & DESIGN OF EXPERIMENT(DOE)		
I	Finite differences: Definition of Δ and E operations, Relationship between Δ and E, Properties of operators Δ and E with their associated mathematical problems.	**08**
II	Interpolation: Interpolation for equal and unequal interval-Newton's forward and backward formula, Lagrange's interpolation formula, Newton's divided differences formula, Central difference formula, Newton- Gauss forward and backward formula,	**08**
III	Stirling &Bessel's formula- Derivation and problems based on these formulae.	**06**

IV	Numerical integration- Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules.	**08**	
V	Design of Experiments: Introduction, need and principles of design of experiments- Replication, Randomization and Local control and their importance in Design Theory.	**10**	
VI	Completely randomized design- Layout, Statistical Analysis and Efficiency Comparisons with other designs. Randomized Block Design- Layout, Statistical Analysis and Efficiency Comparisons with other designs. Latin square Design-Layout, Statistical Analysis and Efficiency Comparisons with other designs. Missing plot techniques-Analysis of Designs with missing Observations.	**20**	

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Fifth**	
Subject: **STATISTICS**			
Course Code:-	Course Title: **MULTIVARIATE ANALYSIS AND NONPARAMETRIC METHODS**		

Course outcomes:

After completing this course a student will have:

- ✓ Ability to conduct test of significance based non-parametric tests.
- ✓ Ability to deal with multivariate data.
- ✓ Ability to understand the basic concepts of matrices in order to study multivari ate distribution.
- ✓ Ability to understand bivariate normal distribution and its applications
- ✓ Knowledge of the applications of multivariate normal distribution and Maximu m Likelihood estimates of mean vector and dispersion matrix.
- ✓ Ability to apply distribution free tests(Non-parametric methods) for one and tw o sample cases.

Credits:**04**	Core: **Compulsory**	
Max.Marks:**75+25**	Min. Passing Marks: **……**	
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.		

Unit	Topic	No. of Lectures	

PAPER II: MULTIVARIATE ANALYSIS AND NONPARAMETRIC METHODS			
I	Bivariate Normal Distribution- Moment Generating Function of Bivariate Normal Distribution, Marginal Distribution of Bivariate Normal Distribution, Conditional Distribution of Bivariate Normal Distribution.	**10**	
II	Multivariate Normal Distribution: Density function, Derivation and properties of Multivariate Normal Distribution, Linear Combination, Marginal and Conditional distributions, MGF of Multivariate Normal Distribution. Distribution of sample mean and sample Co-variance matrix(without proof), Maximum likelihood estimators of its parameters.	**20**	
III	Theory of Linear estimation, Estimability of linear parametric functions, Multiple Linear Regression Model, Least square estimation of parameters. Test of hypothesis in a linear model.	**10**	
IV	Nonparametric tests: Introduction and Comparison with Parametric Tests, The Single Sample Case- The Chi-Square Goodness-of-Fit Test, The Kolmogorov-Smirnov One-Sample Test, The One Sample Runs Test for Randomness, The Case of One Sample, Two Measures or Paired Replicates- The Sign Test, The Wilcoxon Signed Ranks Test. Two Independent Samples- The Chi-Square Test for Two Independent Samples, The Median Test, The Wilcoxon-Mann-Whitney Test, and The Kolmogorov- Smirnov Two-Sample Test.	20	

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05marks)**
Class Test-I	**(10marks)**
Class Test-II	**(10marks)**

Suggested Readings:

1. An Introduction to Multivariate Statistical Analysis: T.W. Anderson
2. Multivariate Analysis: A.M. Kshirsagar.
3. Multivariate Analysis- Theory & Applications: K.C. Bhuyan
4. Nonparametric Statistical Inference: J.D. Gibbons and S. Chakraborty

5. Linear Estimation and Design of Experiment: D.D. Joshi.
6. Introduction Methods of Numerical Analysis: S.S. Sastry
7. Numerical Analysis: Bhupende r Singh
8. Numerical Analysis: Goyal & Gupta

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Fifth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Non Parametric Methods, Numerical Analysis &DOE Lab**	

Course outcomes:

After completing this course a student will have:

- ✓ Ability to conduct test of significance based non-parametric tests.
- ✓ Ability of understand finite Differences
- ✓ Ability of understand Relationship between Δ and E
- ✓ Ability of understand Stirling &Bessel's formula
- ✓ Ability of understand Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules.

Credits:**02**	Core: **Compulsory**
Max.Marks:50	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours pe r week):**0-0-4**.	

	Topic	No. of Lectures

	1. Problems based on Non-parametric tests for one sample. 2. Problems based on Non-parametric tests for two samples. 3. Problems based on Rank and Inverse of a matrix. 4. Problems based on Relationship between Δ and E 5. Problems based on Stirling &Bessel's formula 6. Problems based on Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules.	**30**

Suggested Readings:

As suggested for paper I & II.

Suggested Continuous Evaluation Methods (10 marks):

Continuous Internal Evaluation shall be based on Practical File/Record, Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05 marks)**
Class Interaction	**(03 marks)**
Report Preparation/Presentation	**(02marks)**

Suggested Practical Examination Evaluation Methods: (40Marks)

Practical Examination Evaluation shall be based on Viva-voce and Practical Exercises. The marks shall be as follows:

Practical Exercise(Major)01x15Marks	**15Marks**
Practical Exercise(Minor)01x10Marks	**10Marks**
Viva-voce	**15Marks**

There shall be 04-05 Practical Exercises in Examination comprising 01 as Major (Compulsory) and 03-04 as Minor(Students have to attend any 01).

Course prerequisites: To study this course, a student must have opted/passed the **Paper code.**

Further Suggestions:
Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Statistical Quality Control and Computer Programming**	

Course outcomes:
After completing this course a student will have:
- ✓ Ability to understand the Control Charts for variables
- ✓ Ability to understand the Control chart for attributes
- ✓ Ability to understand the Single and double sampling plans
- ✓ Ability to understand the Producer's and Consumer's risk
- ✓ Ability to understand the OC,ASN,AOQL and LTPD of Sampling Plans
- ✓ Ability to understand the Basics of computer
- ✓ Ability to understand the Flow Charts and Algorithm
- ✓ Ability to understand the Basics of C Language.
- ✓ Ability to understand the Basics of R Language.

Credits: **04**	Core: **Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
PAPER I: Statistical Quality Control and Computer Programming		
I	Introduction to Statistical Quality Control, Elements of Quality Control and its uses, Process Control and Product Control, 3-σ Control limits.	**08**
II	Control Charts for variables: Control Charts for Mean: (X,R) & (X,σ) Charts-Setting the Control Limits both when standards are given and when standards are not given, Checking the Control of process, Control Charts for Range and Standard Deviation: R & σ-Chart-Setting the Control Limits both when Standards are given and when standards are not given, Checking the Control of process.	**06**

III	Control chart for attributes: p(Fraction Defective), d(Number of Defective)& c(Number of Defects) Chart-Setting the Control Limits both when Standards are given and when Standards are not given, Checking the Control of process.	**06**
IV	Sampling Inspection by Attributes-Single and double sampling plans, Producer's and Consumer's risk, OC,ASN,AOQL and LTPD of Sampling Plans.	**10**
V	Basics of computer- Introduction, origin, Development, Uses and Limitation of Computers. Type of Computers, Computer Structure, Input-unit, Output unit, CPU, secondary storage, High Level and Low Level languages, compiler and interpreter. Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating-point numbers. Number systems- Binary, decimal, octal and hexadecimal number systems and their conversions into each other. Binary arithmetic's,(Addition, subtraction & division).	**06**
VI	Flow Charts and Algorithm: Concepts of chart, algorithm and programming. Flow charts and algorithms for the following: Mean, Standard Deviation, Coefficient of Correlation, Straight line fitting. Trapezoidal rule, Simpson's 1/3 and 3/8th rules.	**10**
VII	Basics of C Language, Simple Statistical Operations using C Programming, History of C Language Variable and Data type: Identifiers in C, Variables and Data types and Constants. Control Flow Statements, Working With Functions, Stack, Queue, Linked List, Tree	**08**
VIII	Basics of R Software: use of sequence, repeat code in R	**06**

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05marks)**

Class Test-I	**(10marks)**
Class Test-II	**(10marks)**

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **APPLIED STATISTICS AND EDUCATIONAL STATISTICS**	

Course outcomes:

After completing this course a student will have:

- ✓ Familiarity with different aspects of Applied Statistics and their use in real life situations.
- ✓ Ability to understand the concept of Time series along with its different components.
- ✓ Knowledge of Index numbers and their applications along with different types of Index numbers.
- ✓ Familiarity with various demographic methods and different measures of mortality and fertility.
- ✓ Ability to understand the concept of life table and its construction.
- ✓ Knowledge to understand the concept of statistical quality control and different control charts for variables and attributes.
- ✓ Ability to understand the Scaling individual test item in terms of difficulty.
- ✓ Ability to understand the Z score and Z-scaling.
- ✓ Ability to understand the T-scores, uses of T-scores

Credits:**04**	Core:**Compulsory**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
	Paper II: APPLIED STATISTICS & EDUCATIONAL STATISTICS	
I	Economic Time Series: Definition, component of time series – trends, seasonal, cyclic and irregular components with their illustrations Additive and multiplicative models, determination of trend- graphic method, semi-averages methods, method of curve fitting by principal of least squares, moving average method. Analysis of seasonal fluctuations, construction of seasonal indices using method of simple averages, ratio	**15**

	to trend method, ratio to moving average method and link relative method.	
II	Index Numbers : Definition, problems involved in the construction of index numbers, calculation of index numbers- simple aggregate method, weighted aggregates method, simple average of price relatives, weighted average of price relatives, link relatives, chain indices, value index numbers, price and quantity index numbers, Laspeyre's, Paasche's, Marshall-Edgeworth and Fisher's index numbers.	**10**
III	Time and factor reversal tests of index number, consumer price index number and its uses. Base shifting, splicing and deflecting of index numbers.	**10**
IV	Vital Statistics: Introduction, measurements 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-birth, death and fertility rates, gross and net reproduction rates, elements of life table.	**15**
V	Scaling individual test item in terms of difficulty, sigma scaling, Z score and Z-scaling, standard scores, normalized scores, T-scores, uses of T-scores, comparison of T-scores and standard scores, percentile scores, scaling of rankings in items of normal probability curve, Reliability of Test scores, methods of determining test reliability, validity of test scores, methods of calculation of validity.	**10**

Suggested Readings:

1. Fundamentals of Applied Statistics: S. C. Gupta and V. K. Kapoor.
2. Fundamentals of Statistics Vol- I & II: A. M. Goon, M. K. Gupta and B. Dasgupta.
3. New Mathematical Statistics: Bansi Lal and S. Arora.
4. Basic Statistics: B. L. Aggarwal.
5. Programmed Statistics: B. L. Aggarwal.

6. An Introduction to Theory of Statistics: G. Udny, M. G, Kendal

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**

Programme/Class: **B.Sc.**	Year: **Third**	Semester: **Sixth**
Subject: **STATISTICS**		
Course Code:-	Course Title: **Statistical Quality Control, Applied Statistics & Computer Programming Lab**	

Course outcomes:

After completing this course a student will have:

1. Ability to solve Problem based on Control Charts for variables
2. Ability to solve Problem based on Control chart for attributes
3. Ability to solve Problem based on Time Series
4. Ability to solve Problem based on Index Numbers
5. Ability to solve Problem based on Vital Statistics
6. Ability to solve Problem based on application of R as Calculator.
7. Ability to solve Problem based on application of R in simple data analysis
8. Ability to solve Problem based on application of Excel in data analysis

Credits:**02**	Core: **Compulsory**
Max.Marks:50	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**0-0-4**.	

	Topic	No. of Lectures

	1. Problem based on Control Charts for variables 2. Problem based on Control chart for attributes 3. Problem based on Time Series 4. Problem based on Index Numbers 5. Problem based on Vital Statistics 6. Problem based on application of R as Calculator. 7. Problem based on application of R in simple data 8. analysis Problem based on application of Excel in data analysis	**30**

Suggested Readings:

As suggested for paper I & I I .

Suggested Continuous Evaluation Methods(10 marks):

Continuous Internal Evaluation shall be based on Practical File/Record , Class Activities and Overall performance. The marks shall be as follows:

Practical File/Record	**(05 marks)**
Class Interaction	**(03 marks)**
Report Preparation/Presentation	**(02marks)**

Suggested Practical Examination Evaluation Methods:(40Marks)

Practical Examination Evaluation shall be based on Viva-voce and Practical Exercises. The marks shall be as follows:

Practical Exercise(Major)01x15Marks	**15Marks**
Practical Exercise(Minor)01x10Marks	**10Marks**
Viva-voce	**15Marks**

There shall be 04-05 Practical Exercises in Examination comprising 01 as Major(Compulsory) and 03-04 as Minor (Students have to attend any 01).

Course pre requisites: To study this course, a student must have opted/passed the **paper code.**

SUBJECT: STATISTICS (MINOR SYLLABUS)

Programme	Year	Course Title		Credits	Teaching Hours
Certificate in Elementary Statistics	I	**THEORY : PAPER I** **Statistical Methods & Probability Theory**	**Statistical Methods & Probability Theory**	**04**	**60**
		Practical : Statistical Methods Lab		**02**	**30**

Programme	Year	Course Title		Credits	Teaching Hours
Diploma in Basic Statistics	II	**THEORY : PAPER I** **Statistical Inference, Sampling Techniques & Analysis of Variance (ANOVA)**	**Statistical Inference, Sampling Techniques & Design of Experiments**	**04**	**60**
		Practical : Sampling Survey, Design of Experiments and Sampling Distributions Lab		**02**	**30**

Programme/Class: **Certificate**	Year: **First**
Subject: **STATISTICS**	
Course Code:-	Course Title: **Statistical Methods & Probability Theory**

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of Statistics, its scope and importance in various fields.
- ✓ Ability to understand concepts of sample vs. population and difference between different types of data.
- ✓ Knowledge of methods for summarizing data sets, including common graphical tools (such as box plots, histograms and stem plots).Interpret histograms and box plots.
- ✓ Ability to describe data with measures of central tendency and measures of dispersion.
- ✓ Ability to understand measures of skewness and kurtosis and their utility and significance.
- ✓ Gain knowledge about Indian Official Statistics.

Credits:**04**	Core: **Elective**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
Paper I:STATISTICAL METHODS & PROBABILITY THEORY		
I	Definition and Scope of Statistics, Statistical data: Qualitative & Quantitaative. Scales of measurement: Nominal, Ordinal, Interval and Ratio. Organization of data, Collection of data, Diagrammatic and Graphical representation of Data.	04
II	Measures of Location (Mathematical and Positional). Measures of dispersion, Range, Quartile Deviation, Mean Deviation, Variance, Standard Deviation, Root Mean Square Deviation, Coefficient of Variation, Moments, Factorial moments, Skewness and Kurtosis. Sheppard's corrections and Charlier's Check.	08

III	Meaning of Correlation, Scatter diagram, Karl Pearson's Coefficient of Correlation. Assumptions Underlying Karl Pearson's Correlation Coefficient. Correlation coefficient for a Bivariate Frequency Distribution. Linear regression, Properties of Regression Coefficients.	05
IV	Index Numbers : Definition, problems involved in the construction of index numbers, Characteristics and uses of index Numbers. calculation of index numbers- simple aggregate method, weighted aggregates method. value index numbers, price and quantity index numbers, Laspeyre's, Paasche's, Marshall-Edgeworth and Fisher's index numbers. Vital Statistics: Introduction, measurements of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates. Measurement of fertility and reproduction: CBR, GFR and TFR. Educational Statistics: Scaling individual test item in terms of difficulty, sigma scaling, Z score and Z-scaling, standard scores, normalized scores, T-scores, uses of T-scores, comparison of T-scores and standard scores, percentile scores, scaling of rankings in items of normal probability curve, Reliability of Test scores, methods of determining test reliability, validity of test scores, methods of calculation of validity.	09
V	Indian Statistical System: Present official Statistical System in India, Methods of collection of official Statistics, their reliability and limitation and the principal publications containing such statistics on the topics- population, agriculture, industry, trade, price, labour and employment, transport and communication, banking and finance.	04
VI	Probability Theory Introduction: Brief History, Basic Terminology, and Mathematical (or Classical or 'a Priori') Probability-limitation of Mathematical Probability. Statistical (or Empirical) Probability, Limitation of Empirical Probability. Subjective Probability. Mathematical tools: Preliminary Notations of sets- Elements of	06

	sets, Operation on sets, Algebra of sets. Axiomatic approach to probability- Random experiment, Sample Space and Elementary events, Acceptable assignment of probabilities, Natural assignment of probabilities, Axiomatic Probability, Algebra of Events.	
VII	Some Theorems on Probability-Addition theorem of Probability, Extension of Addition theorem of Probability to n Events, Boole's Inequality, Conditional Probability, Multiplication Theory of Probability, Independent Events, Multiplication Theory of Probability for Independent Events-Extension of Multiplication theorem of Probability to n Events, Pair Wise Independent Events, Mutually Independent events, Probability of Occurrence of at least one of the events. Bayes' Theorem (without proof).	06
VIII	Random variables: Discrete and Continuous, Distribution functions, probability mass function, and probability density function. Joint distribution of two random variables- marginal and conditional distribution, Independence of two random variables. Transformation of random variables. Expectation-theorem on expectation of sum of random variables and product of independent random variables, Conditional Expectation.	04
IX	Moments and Moment Generating function, Cumulant Generating function, Characteristic function, Uniqueness and Inversion Theorems (without proof). Chebyshev's inequality, Weak Law of Large numbers (without proof) and Central Limit Theorem (without proof).	04
X	Bernoulli distribution and its moments, Binominal distribution: Moments, recurrence relation for the moments, moment generating function (m.g.f.), additive property, characteristics function (c.f.), cumulants, probability generating function (p.g.f.) and recurrence relation for the probabilities of Binominal distribution, Poisson Distribution: Poisson distribution as a limiting case of Binominal distribution, moments, mode, recurrence relation for moments, m.g.f., c.f., cumulants and p.g.f. of poison distribution, additive property of independent poisson variates. Discrete uniform distribution, Continuous uniform distribution: Moments, m.g.f. characteristic	06

	function and mean deviation.	
XI	Normal distribution as a limiting form of binominal distribution, chief characteristic of Normal distribution: mode, median, m.g.f., c.g.f. and moments of Normal distribution, a linear combination of independent normal variates, points of inflexion, mean deviation about mean, area property of Normal distribution, importance and fitting of normal distribution.	04

Suggested Readings:

1. Fundamentals of Mathematical Statistics: S. C. Gupta and V. K. Kapoor.
2. Fundamentals of Statistics Vol- I: A. M. Goon, M. K. Gupta and B. Dasgupta.
3. New Mathematical Statistics: Bansi Lal and S. Arora.
4. Basic Statistics: B. L. Aggarwal.
5. Programmed Statistics: B. L. Aggarwal.
6. An Introduction to Theory of Statistics: G. Udny, M. G, Kendal.
7. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

This course can be opted as a minor elective by the students of following subjects: Open to all(OtherFaculty)
Suggested Continuous Evaluation Methods: Continuous Internal Evaluations hall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**

Programme/Class: **Certificate in Elementary Statistics**	Year: **First**
Subject: **STATISTICS**	
Course Code:-	Course Title: **Statistical Methods Lab**

Programme/Class: **Diploma**	Year: **Second**
Subject: **STATISTICS**	
Course Code:-	Course Title: **Statistical Inference, Sampling Techniques & Design of Experiments**

Course outcomes:

After completing this course a student will have:

- ✓ Knowledge of the terms like null and alternative hypotheses, two-tailed and one-tailed alternative hypotheses, significant and insignificant, level of significance and confidence, pvalue etc.
- ✓ Ability to understand the concept of MP, UMP and UMPU tests
- ✓ Ability to understand under what situations one would conduct the small sample and large sample tests (in case of one sample and two sample tests).
- ✓ Ability to understand the difference between parameter & statistic and standard error & standard deviation.
- ✓ Knowledge of the concept of Point and Interval Estimation and discuss characteristics of a good estimator.
- ✓ Ability to understand and practice various methods of estimation of parameters.
- ✓ Knowledge of the concept of Sampling distributions.
- ✓ Knowledge of the sampling distribution of the sum and mean.
- ✓ Ability to understand the t, F and chi-square distribution and to identify the main characteristics of these distributions.
- ✓ Ability to understand the basic concepts of Sampling Techniques.
- ✓ Gain knowledge about different sampling methods like Simple Random Sampling, Stratified and Systematic random sampling along with Ratio and Regression Methods of Estimation
- ✓ Ability to understand Analysis of Variance
- ✓ Ability to understand the basic concepts of Design of Experiment
- ✓ Learn about various sampling Designs

Credits:**04**	Core: **Elective**
Max.Marks:**75+25**	Min. Passing Marks: **……**
Total No. of Lectures-Tutorials-Practical(in hours per week):**4-0-0**.	

Unit	Topic	No. of Lectures
Statistical Inference, Sampling Distributions and their related test of Significance and Design of Experiments		

I	Point Estimation: Introduction, Estimators and Estimate. Characteristics/Properties of Estimators: Unbiasedness, Consistency, Efficiency- Most Efficient Estimator, Minimum Variance Unbiased (MVU) Estimators, Sufficiency- Factorization Theorem(Neyman).	02
II	Method of Estimation: Method of Moments, Method of minimum Chi-Square, Method of Maximum Likelihood Estimation, Properties of Maximum Likelihood Estimators, Method of Minimum Variance, Method of Least Squares.	04
III	Testing of Hypothesis: Statistical Hypothesis-Simple and Composite, Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, Two Type of Errors, Level of Significance, Power of the Test, Steps in Solving Testing of Hypothesis Problem, Optimum Test Under Different Situations-Most power test(MP test), Uniformly Most Powerful Test(UMP test), Neyman and Pearson Lemma and its application in testing simple Vs Simple hypothesis.	04
IV	Interval Estimation: Confidence Interval and Confidence limits-concept of best confidence intervals, Confidence Intervals for Large Samples.	02
V	Exact sampling distribution: definition and derivation of *p.d.f.* of $\chi^2$with n degrees of freedom(d.f) using m.g.f., nature of χ^2 curve for different degrees of freedom, mean, variance, m.g.f., cumulative generating function, mode additive property and limiting form of χ^2 distribution.	04
VI	Exact sampling distributions- Student's t and Fisher t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution. Snedecore's F-distribution: Derivation of p.d.f., Probability curve with different degrees of freedom, mean variance and mode. Distribution of 1/F (n1,n2). Relationship between t, F and $\chi 2$ distributions.	04

VII	Tests of Significance for Large Sampling of Attributes- Test of Significance for Single Proportion, Test of Significance for Difference of Proportions, Sampling of Variables- Unbiased Estimate for Population mean(μ) and variance($\sigma 2$), Standard Error of Sample Mean, Test of Significance for Single Mean, Test of Significance for Difference of Means, Test of Significance the Difference of Standard Deviations, Test of Independence of Attributes- Contingency Tables.	04
VIII	Test of Significance for Small Samples: Test for Single Variance, $\chi 2$- test of Homogeneity of Correlation Coefficients, Bartlett's Test for Homogeneity of Several Independent Estimates of the Same Population Variance, t-test for Single Mean, t-test for Difference of Means, Paired t-test for Difference of Means, t-teat for Testing the Significance of an Observed Sample Correlation Coefficient. F-test for Equality of Two Population Variances, F-test for the equality of k population means.	04
IX	Nonparametric tests: Introduction and Comparison with Parametric Tests, The Single Sample Case- The Chi-Square Goodness-of-Fit Test, The Kolmogorov-Smirnov One-Sample Test, The One Sample Runs Test for Randomness, The Case of One Sample, Two Measures or Paired Replicates- The Sign Test, The Wilcoxon Signed Ranks Test. Two Independent Samples- The Chi-Square Test for Two Independent Samples, The Median Test, The Wilcoxon-Mann-Whitney Test, and The Kolmogorov- Smirnov Two-Sample Test.	06
IX	Sampling Theory Introduction, Type of Sampling- Purposive sampling, Probability sampling, Parameter and Statistic- Sampling Distribution of Statistic, Standard Error, Sampling vs complete enumeration, sampling units and frame, sampling and non-sampling errors, precision and efficiency of sampling estimators.	02
X	Simple random sampling with and without replacement, definition and procedure of selecting a sample, Estimates of: population mean, total and proportion, variance of these estimates, estimates of their variances and sample size determination.	04

XI	Stratified random sampling: Technique, estimates of population mean and total, variances of these estimates, proportional and optimum, Neyman allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision, post stratification and its performance. Systematic sampling: Technique, estimates of population mean and total, variances of these estimates(N=nk). Comparison of systemic sampling with SRS and stratified sampling in the presence of linear trend.	04
XII	Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size), variance of these estimates and estimates of these variances, variances in terms of correlation coefficient for regression method of estimation and their comparison with SRS.	04
XIII	Introduction to Analysis of Variance (ANOVA) and Definition, Causes of Variation Classification of ANOVA, one way classification with one observation per cell, One way classification with 'm' observations per cell, Two way classification with one observation per cell: Mathematical model, Sum of squares for various causes of variation, Expected value of Sum of Squares, Degrees of freedom for Sum of Squares, ANOVA Table and related tests of Significance.	06
XIV	Design of Experiments: Introduction, need and principles of design of experiments- Replication, Randomization and Local control and their importance in Design Theory. Completely randomized design- Layout, Statistical Analysis and Efficiency Comparisons with other designs. Randomized Block Design- Layout, Statistical Analysis and Efficiency Comparisons with other designs. Latin square Design-Layout, Statistical Analysis and Efficiency Comparisons with other designs.	06

Suggested readings:

1. Design and Analysis of Experiments: M.N.Das and N.C.Giri.
2. Fundamentals of Statistics. Vol.II: A.M. Goon, M.K. Gupta and B.Dasgupta.
3. Applied Statistics: P. Mukhopadhyay.
4. Fundamental of Applied Statistics: S.C. Gupta and V.K. Kapoor

5. Sampling Techniques: W.G.Cochram
6. Sampling Theory: Des Raj and Chandok
7. Sample Theory of Surveys with Applications: V.G. Panse and P.V. Sukhatme.
8. Sampling Techniques: Daroga Singh and F.S. Chaudhary
9. Survey Sampling: P. Mukhopadhyay

Suggested Online Links/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

This course can be opted as a minor elective by the students of following subjects:

Open to all(OtherFaculty)

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluations hall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Quiz/Assignment	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**

Programme/Class: **Diploma**	Year: **Second**
Subject: **STATISTICS**	
Course Code:-	Course Title: **Sampling Survey, ANOVA, Design of Experiments and Sampling Distributions Lab**