National Education Policy-2020

Common Minimum Syllabus for Uttarakhand State Universities and Colleges

Subject: Statistics

FINAL STRUCTURE OF STATISTICS SYLLABUS

Effective from academic year 2025-2026

DEPARTMENT OF STATISTICS

EXPERT/SYLLABUS PREPARATION COMMITTEE

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Contents

List of Papers (DSC, DSE) with Semester-wise Titles (Major Course)					
Year	**Sem.**	**Course Code**	**Paper Title**	**Theory/Practical**	**Credits (L+P+T)**
Certificate in Elementary Statistics					
1	I	DSC	Statistical Methods	Theory	3+1+0
			Statistical Methods Lab	Practical	
	II	DSC	Probability Theory and Theoretical Distributions	Theory	3+1+0
			Theoretical Distributions Lab	Practical	
Diploma in Basic Statistics					
2	III	DSC	Statistical Inference	Theory	4+0+0
		DSE-1	OfficialStatistics , Psychological and Educational Statistics	Theory	4+0+0
	IV	DSC	Sampling Techniques	Theory	3+1+0
			Sampling Techniques Lab	Practical	
		DSE-2	Applied Statistics	Theory	3+1+0
			Applied Statistics Lab	Practical	
Degree in Bachelor of Science					
3	V	DSC	Linear Estimation, ANOVA and Design of Experiment	Theory	3+1+0
			Linear Estimation, ANOVA and DOE Lab	Practical	
		DSE-3	Numerical Analysis and Computer Methods	Theory	3+1+0
			Numerical Analysis and Computer Methods Lab	Practical	
	VI	DSC	Sampling Distributions, Parametric and Non-Parametric tests	Theory	3+1+0
			Sampling Distributions, Parametric and Non-Parametric tests Lab	Practical	
		DSE-4	Statistical Quality Control	Theory	3+1+0
			Statistical Quality Control Lab	Practical	

Purpose of the Program

The Importance of Statistics is well known. Statistical ideas not only help students to understand the theory of several disciplines of Basic as well as Social sciences but also to enhance their decision-making skills so that they can handle critical situation in a better way. The purpose of the postgraduate program in Statisticsat the university and college level istoprepare our students for all those fields where advanced Statistical and Analytical skill is requiredfor careers as well as professionals in various industries and research institutions.

Program Outcomes

PO 1. Students will have a firm foundation in the fundamentals and applications of Statistics and scientific theories.

PO 2. Students will develop skills in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO 3. Students will be able to explore new directions to pursue higher studies in science subjects.

PO 4. Students will be able to contest and qualify different competitive exams where graduation degree is one of the essential qualifications.

PO 5. Students will be able to function as a member of an interdisciplinary problem-solving team.

Programme Specific Outcomes (PSOs) **After this programme, the learners will be able to:**	
PSO 1	Knowledge of different concepts, principles, methodologies and tools (skills) of Statistics.
PSO 2	Ability to collect tabulate, represent graphically, analyze and interpret data/information by using appropriate statistical tools.
PSO 3	Ability to identify and solve a wide range of problems in real life/industry related to Statistics.
PSO 4	Familiarity with computational techniques and statistical software including programming language (e.g. R) for mathematical and statistical computation.
PSO 5	Capability to use appropriate statistical skills in interdisciplinary areas such as finance, health, agriculture, government, business, industry, telecommunication and bio-statistics.
PSO 6	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.
PSO 7	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.

Pattern of examination theory papers

A. Theory

*Each theory paper shall consist two sections **A** and **B**.*

***Section A**: (Short answers type); 30 marks, eight questions of six marks each, any five have to be attempted).*

***Section B**: (Long answers type); 45 marks, five questions of fifteen marks each. Any three have to be attempted.*

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 and attendance of total 25 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. In each semester practical examination of 75 marks has to be conducted by two examiners (External and internal) having duration of 3 hours for each 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.

Department of Statistics

Semester-I

Undergraduate Certificate in Statistics

DISCIPLINE SPECIFIC COURSE (DSC-1)- Statistical Methods

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSC: Statistical Methods	**4**	**3**		**1**	Passed Class 12th with Mathematics	**Nil**

UNDERGRADUATE CERTIFICATE IN STATISTICS		
Programme/Class: Certificate	**Year: I**	**Semester: I Paper: DSC-1**
Subject: STATISTICS		**Credits:3+1+0**
Course Code:-	**Course Title: Statistical Methods**	

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.
- ✓ Ability to understand Correlation and Regression

Credits: **03**	Core: **Compulsory**
Max.Marks:As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

Unit	**Topic**	**No. of Hours**

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. Theory of Attributes- Definition, Consistency and independence of data with special reference to attributes.	**16**
II	Measures of Location (Mathematical and Positional)-Mean, Median, Mode, Quartiles, Deciles and Percentiles 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. Rank Correlation. Linear regression, Properties of Regression Coefficients. R^2, *Principle* of least squares and curve fitting.	**16**
IV	Multiple and Partial Correlation along with Regression plane (Limited to 3 variables),	**12**

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

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have Mathematics of 12^{th} standard.	

Programme/Class: **Certificate**	Year: **I**	Semester: **I**
Subject: **STATISTICS (Practical)**		
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 stem plots) 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.
- ✓ Ability to deal with problems of Correlation and Regression.

Credits:01	**Core: Compulsory**
Max.Marks:As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	List of Practical	**No. of Hours**
	1. Problems based on graphical representation of data by Histogram,Frequencypolygons, 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. **4.** Problems based on Correlation and Regression	**60**

Suggested Readings: As suggested for Theory papers.

Suggested Continuous Evaluation Methods:(25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise(Major) 03x15Marks	**45Marks**

Viva-voce	**15 Marks**
Practical Record and Attendance	**15 Marks**
Further Suggestions	

Semester-II

Undergraduate Certificate in Statistics

DISCIPLINE SPECIFIC COURSE (DSC-2)- Probability Theory and Theoretical Distributions

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSC:Probability Theory and Theoretical Distributions	**4**	**3**		**1**	Passed Class $12^{th}$with Mathematics	**Nil**

UNDERGRADUATE CERTIFICATE IN STATISTICS		
Programme/Class: Certificate	**Year: I**	**Semester: II Paper: DSC-2**
Subject: STATISTICS		**Credits:3+1+0**
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: **03**	Core: **Compulsory**
Max.Marks:As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

Unit	Topic	No. of Hours
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.	**12**
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.	**10**
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	**10**

	variables. Transformation of random variables. Expectation-theorem on expectation of sum of random variables and product of independent random variables, Conditional Expectation.	
IV	Moments and Moment Generating function, Cumulant Generating function, Probability 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).	**8**
V	Bernoulli distribution, 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.	**10**
VI	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.	**10**

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

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have passed Sem-I Theory DSC-2	

Programme/Class: **Certificate**	Year: **I**	Semester: **II**
Subject: **STATISTICS (Practical)**		
Course Code:-	Course Title: **Theoretical Distributions Lab**	

Course outcomes:

After completing this course a student will have:

1. Ability to fit Binomial, Poisson and Normal distribution for given data.
2. Acquire the knowledge to compute conditional probabilities based on Baye's Theorem.

Credits:01	**Core: Compulsory**
Max.Marks:As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	List of Practical	No. of Hours
	1. Fit Binomial, Poisson and Normal distribution for given data. **2.** Computation of conditional probabilities based on Bayes theorem	**60**

Suggested Continuous Evaluation Methods:(25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise(Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**

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.

Semester-III

Undergraduate Diploma in Statistics

DISCIPLINE SPECIFIC COURSE (DSC-3)- Statistical Inference

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSC: Statistical Inference	**4**	**4**	**-**	**-**	To study this course, a student must have passed Certificate Course in Elementary Statistics.	**Nil**

UNDERGRADUATE DIPLOMA IN STATISTICS		
Programme/Class: Diploma	**Year: II**	**Semester: III Paper: DSC-3**
Subject: STATISTICS		**Credits:4+0+0**
Course Code:-	**Course Title: Statistical Inference**	

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.

Credits: **03**	Core: **Compulsory**

Max. Marks: As per Univ. rule		Min. Passing Marks:As per Univ. rule
Unit	**Topic**	**No. of Hours**
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. Baye's Estimators, Prior and Posterior Distributions, Different types of Priors	**20**
II	Method of Estimation: Method of Moments, Method of Maximum Likelihood Estimation, Properties of Maximum Likelihood Estimators, Method of Minimum Variance, Method of Least Squares	**12**
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 composite alternative hypothesis. A Wald's Sequential Probability Ratio Test for testing of hypothesis.	**20**
IV	Interval Estimation: Confidence Interval and Confidence limits-concept of best confidence intervals, Confidence Intervals for Large Samples.	**8**

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	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**
Course prerequisites: To study this course, a student must have passed Certificate Course in Elementary Statistics.	

Semester-III

Undergraduate Diploma in Statistics

DISCIPLINE SPECIFIC ELECTIVES (DSE-1)- Official Statistics and Present Official Central and State systems, Psychological and Educational Statistics

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSE: Indian Official, Psychological and Educational Statistics	**4**	**4**	**-**	**-**	To study this course, a student must have passed Certificate Course in Elementary Statistics.	**Nil**

UNDERGRADUATE DIPLOMA IN STATISTICS			
Programme/Class: Diploma		**Year: II**	**Semester: III** **Paper: DSE-1**
Subject: STATISTICS			**Credits: 4+0+0**
Course Code:-DSE-1	**Course Title: Indian Official, Psychological and Educational Statistics**		

Course outcomes:

After completing this course a student will have:

- ✓ Gain knowledge about Indian Official Statistics
- ✓ Gain knowledge about Educational Statistics
- ✓ 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 score and Z score.

Credits: **04**	Core: **Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

Unit	Topic	No. of Hours
	Indian Official, Psychological& Educational Statistics	
I	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.	**20**
II	Importance or statistics in psychology and educt1tion. Levels of measurement: nominal ordinal interval and ratio scales. Distinction between psychological and physical measurements. General problems and sources of errors in measurement. Meaning and types of tests in psychology and education. History of psychological measurement and testing. Uses and limitations of test. Varieties of tests. Characteristics of a good test. General steps of test construction. Test administration and scoring. Item writing and item analysis: Meaning and types of test items, Purpose and methods for evaluating test items.	**20**
III	Reliability: definition Methods of determining reliability: Test-retest or parallel forms, Spill half technique, Rational equivalence. Effect upon reliability of lengthening or repeating or test. Reliability coefficient as a measure of true variance. Estimating true scores by way of regression equation and reliability coefficient, Index of reliability. Validity: meaning: Estimation of validity; Types of validity: validity and test length; comparison between reliability and	**20**

	validity	

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	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**
Course prerequisites: To study this course, a student must have passed Certificate Course in Elementary Statistics.	

Semester-IV

Undergraduate Diploma in Statistics

DISCIPLINE SPECIFIC COURSE (DSC-4)- Sampling Techniques

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		

DSC: Sampling Techniques	**4**	**3**		**1**	To study this course, a student must have passed Certificate Course in Elementary Statistics.	**Nil**

UNDERGRADUATE DIPLOMA IN STATISTICS			
Programme/Class: Diploma		**Year: II**	**Semester: IV** **Paper: DSC-4**
Subject: STATISTICS			**Credits:3+1+0**
Course Code:-	**Course Title: Sampling Techniques**		
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.			
Credits: **03**		Core: **Compulsory**	
Max. Marks: As per Univ. rule		**Min. Passing Marks:As per Univ. rule**	

Unit	**Topic**	**No. of Hours**
	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.	**12**
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. Simple Random Sampling of Attributes.	**12**
III	Stratified random sampling: Technique, estimates of population mean and total, variances of these estimates, proportional and optimum, Neyman allocations and their	**12**

	comparison with SRS. Practical difficulties in allocation, estimation of gain in precision, post stratification and its performance.	
IV	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.	**12**
V	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.	**12**

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

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have passed Sem-III Theory DSC-3	

Programme/Class: **Diploma**	Year: **II**	Semester: **IV**
Subject: **STATISTICS (Practical)**		
Course Code:-	Course Title: **Sampling Techniques Lab**	

Course outcomes:

After completing this course a student will have:

Ability to draw a simple random sample with the help of table of random numbers.

1. Ability to estimate population means and variance in simple random sampling.
2. Ability to deal with problems based on Stratified random sampling for population means (proportional and optimum allocation).
3. Ability to deal with problems based on Systematic random sampling.

Credits:01	**Core: Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	List of Practical	**No. of Hours**
	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.	**60**

Suggested Readings: As suggested for Theory papers.

Suggested Continuous Evaluation Methods:(25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise(Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**

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.

Semester-IV

Undergraduate Diploma in Statistics

DISCIPLINE SPECIFIC ELECTIVES (DSE-2)- Applied Statistics

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSE: Applied Statistics	**4**	**3**		**1**	To study this course, a student must have passed Certificate Course in Elementary Statistics.	**Nil**

UNDERGRADUATE DIPLOMA IN STATISTICS			
Programme/Class: Diploma		**Year: II**	**Semester: IV Paper: DSE-2**
Subject: STATISTICS			**Credits:3+1+0**
Course Code:-	**Course Title: Applied 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.			
Credits: **03**		Core: **Compulsory**	
Max. Marks: As per Univ. rule		**Min. Passing Marks:As per Univ. rule**	
Unit	**Topic**		**No. of Hours**

Applied 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 to trend method, ratio to moving average method and link relative method.	**15**
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.	**15**
III	Time and factor reversal tests of index number, consumer price index number and its uses. Base shifting, splicing and deflation of index numbers.	**15**
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**

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

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have passed Certificate Course in Elementary Statistics.	

Programme/Class: **Diploma**	Year: **II**	Semester: **IV**
Subject: **STATISTICS (Practical)**		
Course Code:-	Course Title: **Applied Statistics Lab**	
Course outcomes: After completing this course a student will have: 1. Ability to solve Problem based on Time Series 2. Ability to solve Problem based on Index Numbers 3. Ability to solve Problem based on Vital Statistics		
Credits:**01**	Core: **Compulsory**	
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**	

	Topic	**No. of Hours**
	1. Problem based on Time Series 2. Problem based on Index Numbers 3. Problem based on Vital Statistics	**60**

Suggested Readings:As suggested for Theory papers.

Suggested Continuous Evaluation Methods: (25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise (Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**
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.	

Semester-V

BACHELOR OF STATISTICS

DISCIPLINE SPECIFIC COURSE (DSE-3)–Linear Estimation, ANOVA and Design of Experiment

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSE: Linear Inference, ANOVA and Design of Experiment	**4**	**3**		**1**	To study this course, a student must have passed Undergraduate Diploma in Statistics	**Nil**

BACHELOR OF STATISTICS		
Programme/Class: Bachelor of Statistics	**Year: III**	**Semester: V Paper: DSE-5**
Subject: STATISTICS		**Credits:3+1+0**
Course Code:-	**Course Title: Linear Estimation, ANOVA & Design of Experiment**	

Course outcomes:

After completing this course a student will have:

- ✓ Ability to understand linear modeling.
- ✓ Ability to perform ANOVA for one way and two classifications.
- ✓ Ability to perform post-hoc analysis
- ✓ Ability to perform post-hoc analysis
- ✓ 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.

Credits: **03**	Core: **Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

Unit	Topic	No. of Hours
I	Basics of Matrix Theory, Rank of a matrix, Gauss Markoff Theorem (without proof), Simple and Multiple Linear Regression Models, Estimation of Parameters (without proof).	**10**
II	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.	**20**
III	Design of Experiments: Introduction, need and principles of design of experiments- Replication, Randomization and Local control and their importance in Design Theory.	**10**
IV	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**

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: Bhupender Singh
8. Numerical Analysis: Goyal & Gupta
9. Fundamentals of Applied Statistics: S.C Gupta & V.K Kapoor

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have passed Undergraduate Diploma in Statistics	

Programme/Class: **Bachelor of Statistics**	Year: **III**	Semester: **V**
Subject: **STATISTICS (Practical)**		
Course Code:-	Course Title: **ANOVA &DOE Lab**	

Course outcomes:
After completing this course a student will have:

- ✓ Ability to conduct test of significance based on One Way ANOVA
- ✓ Ability to conduct test of significance based on Two Way ANOVA
- ✓ Ability to analyze data in a CRD
- ✓ Ability to analyze data in a RBD
- ✓ Ability to analyze data in a LSD
- ✓ Ability to perform missing plot analysis

Credits:01	**Core: Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	List of Practical	**No. of Hours**
	1. Problems based on One way ANOVA 2. Problems based on Two way ANOVA 3. Problems based on CRD 4. Problems based on RBD 5. Problems based on LSD 6. Problems based on MISSING PLOTS	**60**

Suggested Readings: As suggested for Theory papers.

Suggested Continuous Evaluation Methods: (25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**
Suggested Practical Examination Evaluation Methods:(75 Marks) Practical Examination Evaluation shall be based on Viva-voce and Practical Exercises. The marks shall be as follows:	
Practical Exercise(Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**
Further Suggestions: Students may be asked to perform practical problems assigned to them by using MS-Excel/any Statistical software.	

Semester-V

BACHELOR OFSTATISTICS

DISCIPLINE SPECIFIC ELECTIVES (DSC-5)- Numerical Analysisand Computer Methods

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSC: Numerical Analysis and Computer Methods	**4**	**3**		**1**	To study this course, a student must have passed Undergraduate Diploma in Statistics	**Nil**

BACHELOR OF STATISTICS		
Programme/Class: Bachelor of Statistics	**Year: III**	**Semester: V** **Paper: DSC-5**
Subject: STATISTICS		**Credits:3+1+0**

Course Code:-	Course Title: Numerical Analysis and Computer Methods

Course outcomes:

After completing this course a student will have:

- ✓ Ability of understand finite Differences
- ✓ Ability of understand Relationship between Δ and E
- ✓ Ability of understand Interpolation for equal and unequal interval-Newton's forward and backward formula,
- ✓ Ability of understand Lagrange's interpolation formula,
- ✓ Ability of understand Newton's divided differences formula,
- ✓ Ability of understand Central difference formula,
- ✓ Ability of understand Newton- Gauss forward and backward formula,
- ✓ 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 understand the Basics of computer
- ✓ Ability to understand the Flow Charts and Algorithm
- ✓ Ability to understand the Basics of Excel and R Language.

Credits: **03**	Core: **Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

Unit	Topic	No. of Hours
I	Finite differences: Definition of Δ and E operations, Relationship between Δ and E, Properties of operator's Δ and E with their associated mathematical problems.	**10**
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,Stirling &Bessel's formula- Derivation and problems based on these formulae.	**10**
III	Numerical integration- Trapezoidal rule, Simpson's rule and Weddle's rule and numerical problems based on these rules.	**10**
IV	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. Number systems- Binary, decimal, octal and hexadecimal number systems and their conversions into each other.	**10**
V	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 $3/8^{th}$ rules.	**10**

VI	Basics of Excel and R Software: use of Excel and R as a calculator	**10**

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	**(05 marks)**
Class Test-I	**(10 marks)**
Class Test-II	**(10 marks)**
Course prerequisites: To study this course, a student must have passed Undergraduate Diploma in Statistics	

Programme/Class: **Bachelor of Statistics**	Year: **III**	Semester: **V**
Subject: **STATISTICS (Practical)**		
Course Code:-**DSE-3**	Course Title: **Numerical Analysis and Computer Methods Lab**	
Course outcomes: After completing this course a student will have: ✓ Ability of understand finite Differences ✓ Ability of understand Relationship between Δ and E ✓ Ability of understand Interpolation for equal and unequal interval-Newton's forward and backward formula,		

- ✓ Ability of understand Lagrange's interpolation formula,
- ✓ Ability of understand Newton's divided differences formula,
- ✓ Ability of understand Central difference formula,
- ✓ Ability of understand Newton- Gauss forward and backward formula,
- ✓ 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 solve Problem based on application of R as Calculator.
- ✓ Ability to solve Problem based on application of R in simple data analysis

Credits:**01**	Core: **Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	Topic	**No. of Hours**
	Problems based on Relationship between Δ and E. 1. Problems based on Interpolation for equal and unequal interval-Newton's forward and backward formula, 2. Problems based on Lagrange's interpolation formula, 3. Problems based on Newton's divided differences formula, 4. Problems based on Central difference formula, 5. Problems based on Newton- Gauss forward and backward formula, 6. Problems based on Stirling &Bessel's formula 7. Problems based on Problems based on Trapezoidal rule, Simpson's rule and Weddle's rule 8. Problem based on application of R as Calculator. 9. Problem based on application of R in simple data analysis	**60**

Suggested Readings: As suggested for Theory papers.

Suggested Continuous Evaluation Methods(25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise (Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**

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

Semester-VI

BACHELOR OF STATISTICS

DISCIPLINE SPECIFIC COURSE (DSC)–Sampling Distributions, Parametric and Non-Parametric tests

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSC: Sampling Distributions, Parametricand Non-Parametric Tests	**4**	**3**		**1**	To study this course, a student must have passed Undergraduate Diploma in Statistics	**Nil**

BACHELOR OF STATISTICS		
Programme/Class: Bachelor of Statistics	**Year: III**	**Semester: VI Paper: DSC-6**
Subject: STATISTICS		**Credits:3+1+0**
Course Code:-	**Course Title: Sampling Distributions, Parametric and Non-Parametric Tests**	

Course outcomes:
After completing this course a student will have:

- ✓ 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 various Non Parametric Methods		
Credits: **03**	Core: **Compulsory**	
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**	

Unit	Topic	No. of Hours
I	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.	**12**
II	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 (n_1, n_2). Relationship between t, F and χ^2 distributions.	**12**
III	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.	**12**
IV	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.	**12**
V	Order Statistics: Introduction, Distribution of r th, smallest and largest order Statistics, Applications of Order Statistics, Non-parametric tests: Introduction and Comparison with Parametric Tests, The Single Sample Case- The Chi-Square Goodness-of-	**12**

	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.	

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)**
Course prerequisites: To study this course, a student must have passed Undergraduate Diploma in Statistics	

Programme/Class: **Bachelor of Statistics**	Year: **III**	Semester: **VI**
Subject: **STATISTICS (Practical)**		
Course Code:-	Course Title: **Sampling Distributions, Parametric and Non-Parametric Tests 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.
4. Ability to solve problems based on Chi Square Goodness of fit

5. Ability to solve problems based on Run Test and Sign Test
6. Ability to solve problems based on Kolmogrov Smirnov Test
7. Ability to solve problems based on Wilcoxons Signed rank test
8. Ability to solve problems based on Median Test
9. Ability to solve problems based on Mann Whitney test

Credits:01	**Core: Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	List of Practical	**No. of Hours**
	1. Problems based on t –test. 2. Problems based on F-test. 3. Problems based on Chi-square test. 4. Problems based on large sample tests. 5. Problems based on Chi Square Goodness of fit 6. Problems based on Run Test and Sign Test 7. Problems based on Kolmogrov Smirnov Test 8. Problems based on Wilcoxons Signed rank test 9. Problems based on Median Test 10. Problems based on Mann Whitney test	**60**

Suggested Readings:As suggested for Theory papers.

Suggested Continuous Evaluation Methods: (25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise(Major) 03x15Marks	**45 Marks**
Practical Exercise(Minor) 03x15 Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**

Further Suggestions:

Semester-VI

BACHELOR OF STATISTICS

DISCIPLINE SPECIFIC ELECTIVES (DSE-4)–Statistical Quality Control

No. of Hours-60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
DSE: Statistical Quality Control	**4**	**3**		**1**	To study this course, a student must have passed Undergraduate Diploma in Statistics	**Nil**

BACHELOR OF STATISTICS			
Programme/Class: Bachelor of Statistics		**Year: III**	**Semester: VI** **Paper: DSE-4**
Subject: STATISTICS			**Credits:3+1+0**
Course Code:-DSE-4	**Course Title: Statistical Quality Control**		
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			
Credits: **03**		Core: **Compulsory**	
Max. Marks: As per Univ. rule		**Min. Passing Marks:As per Univ. rule**	
Unit	**Topic**		**No. of Hours**

I	Introduction to Statistical Quality Control, Elements of Quality Control and its uses, Process Control and Product Control, 3-σ Control limits.	**15**
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.	**15**
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.	**15**
IV	Sampling Inspection by Attributes-Single and double sampling plans, Producer's and Consumer's risk, OC, ASN, AOQL and LTPD of Sampling Plans. Sequential Sampling Plans	**15**

Suggested Readings:

1. Computer Fundamentals: P. K. Sinha
2. Let Us C: Yashwant Kanitkar.

SuggestedOnlineLinks/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)**
Course prerequisites: To study this course, a student must have passed Undergraduate Diploma in Statistics	

Programme/Class: **Bachelor of Statistics**	Year: **III**	Semester: **VI**
Subject: **STATISTICS (Practical)**		
Course Code:**-DSE-4**	Course Title: **Statistical Quality Control 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

Credits:**01**	Core: **Compulsory**
Max. Marks: As per Univ. rule	**Min. Passing Marks:As per Univ. rule**

	Topic	**No. of Hours**
	1. Problem based on Control Charts for variables 2. Problem based on Control chart for attributes	**60**

Suggested Readings: As suggested for Theory papers.

Suggested Continuous Evaluation Methods (25 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	**(10 marks)**
Class Interaction	**(05 marks)**
Report Preparation/Presentation	**(10 marks)**

Suggested Practical Examination Evaluation Methods:(75 Marks)

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

Practical Exercise (Major) 03x15Marks	**45 Marks**
Viva-voce	**15 Marks**
Practical Record and Attendance	**15 marks**

Further Suggestions: