**Kurukshetra University Kurukshetra**

**Scheme of Examination for Under-Graduate programme under**

**Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to**

**NEP-2020 w.e.f. 2022-23 (in phased manner)**

**Course: Statistics**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sem.** | **Course** | **Paper** | **Nomenclature of paper** | **Credits** | **Contact Hours** | **Internal marks** | **End Term Marks** | **Total****marks** | **Duration of Exams** |
| 1 | CC-1 | B-STA-N101 | Descriptive Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N102 | Probability Theory | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N103 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs |
| 2 | CC-2 | B-STA-N201 | Statistical Methods | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N202 | Probability Distributions | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N203 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs |
| 3 | CC-3 | B-STA-N301 | Elementary Inference | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N302 | Sample Surveys | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N303 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs |
| 4 | CC-4 | B-STA-N401 | Parametric & Non-Parametric Tests | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N402 | Design of Experiments | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N403 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs |
| 5 | CC-5 | B-STA-N501 | Mathematical Analysis | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N502 | Applied Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N503 | Practical  | 2 | 4 | 25 | 25 | 50 | 3hrs |
| CC-6 | B-STA-N504 | Modern Algebra | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N505 | Index Number & Demand Analysis | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N506 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs |
| DSE-1 | B-STA-N507 | Demography & Vital Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N508 | Numerical Analysis  | 2 | 2 | 25 | 25 | 50 | 3hrs |
| B-STA-N509 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-2 | B-STA-N510 | Biostatistics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N511 | Econometrics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N512 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-3 | B-STA-N513 | Statistical Computing Using C | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N514 | Linear Programming | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N515 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-4 | B-STA-N516 | MOOC\*(From Swayam Portal) | \* | 2 |  |  | \* | 3hrs. |
| SEC-1 | B-STA-N517 | Statistical Data Analysis using R | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N518 | Practical | 4 | 8 | 50 | 50 | 100 | 3hrs. |
|  |  |  |
| 6 | CC-7 | B-STA-N601 | Multivariate Analysis  | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N602 | Statistical Methods in Epidemiology | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N603 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| CC-8 | B-STA-N604 | Linear Algebra | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N605 | Financial Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N606 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-5 | B-STA-N607 | Official Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N608 | Operations Research | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N609 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-6 | B-STA-N610 | Linear Models and Estimation | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N611 | Actuarial Statistics | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N612 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-7 | B-STA-N613 | Soft Computing | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N614 | Non-Linear Programming | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N615 | Practical | 2 | 4 | 25 | 25 | 50 | 3hrs. |
| DSE-8 | B-STA-N616 | MOOC\*(From Swayam Portal) | \* | 2 |  |  | \* | 3hrs. |
| SEC-2 | B-STA-N617 | Statistical-Data Analysis Using SPSS | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N618 | Practical | 4 | 8 | 50 | 50 | 100 | 3hrs. |
| 7 | CC-9 | B-STA-N701 | Queueing Theory | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N702 | Reliability Theory | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| B-STA-N703 | Practical | 2 | 2 | 25 | 25 | 50 | 3hrs. |
| GE | B-STA-N704 | Research Ethics | 3 | 3 | 75 | 75 | 150 | 3hrs. |
| B-STA-N705 | Research Methodology | 3 | 3 | 75 | 75 | 150 | 3hrs. |
| GL | B-STA-N706 | Seminar | 2 | - |  | 50 |  |  |
| B-STA-N707 | Synopsis writing and seminar | 2 | - |  | 50 |  |  |
| 8 | GL | B-STA-N801 | Research  | 20 | - |  |  |  |  |
| B-STA-N802 | Mid-term & Pre-submission seminars | 4 | - |  | 100 |  |  |
|  | **Note:** GE: General Elective; GL: Guided learning |  |

**CC-1 Semester-I**

**B-STA-N101 Descriptive Statistics**

**Course Objectives:**

The learning objectives include:

Introduction to Statistics, different measurement scales, various types of data, to analyze and interpret data, to organize data into frequency distribution graphs, including bar graphs, histograms, polygons, and Ogives, Students should be able to understand the purpose for measuring central tendency, dispersion, skewness, kurtosis and should be able to compute them as well, understanding the concept of moments and attributes.

**Course Outcomes:**

Upon successful completion of this course students will demonstrate knowledge of:

* Fundamental concepts of statistics.
* Tabular and graphical representation of data based on variables,measures of central tendency.
* Measures of Dispersion, Skewness and Kurtosis, Moments and their use in studying various characteristics of data.
* Theory of attributes: conditions for the consistency and criteria for the independence of data for attributes.

**CC-1 Semester-I**

**B-STA-N101 Credits: 2**

Time: 3 Hours M.M.: 25+25\*

\*Internal Assessment

**Descriptive Statistics**

**Note**: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-

 B.Sc.8 marks.

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**UNIT-I**

**Introduction of Statistics**: Origin, development, definition, scope, uses and limitations.

**Types of Data**: Qualitative and quantitative data, nominal and ordinal data, time series data, discrete and continuous data, frequency and non-frequency data.

**Collection and Scrutiny of Data**: Collection of primary and secondary data- its major sources including some government publications, scrutiny of data for internal consistency and detection of errors of recording, classification and tabulation of data.

**UNIT-II**

**Presentation of Data**:Frequency distribution and cumulative frequency distribution, diagrammatic and graphical presentation of data, construction of bar, pie diagrams, histograms, frequency polygon, frequency curve and ogives.

**Measures of Central Tendency and Location**:Arithmetic mean, median, mode, geometric mean, harmonic mean; partition values-quartiles, deciles, percentiles and their graphical location along with their properties, applications, merits and demerits.

**UNIT-III**

**Measures of Dispersion**: Concept of dispersion, characteristics for an ideal measure of dispersion. Absolute and relative measures based on: range, inter quartile range, quartile deviation, coefficient of quartile deviation, Mean deviation, coefficient of mean deviation, variance, standard deviation (σ), coefficient of variation and properties of these measures, root mean square deviation and their relationship, variance of the combined series.

**Moments:**  Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard’s correction for moments (without derivation), Charlier’s checks; Pearson’s β and γ coefficients.

**UNIT-IV**

**Skewness and Kurtosis:** Coefficients of Skewness and Kurtosis with their interpretations.

**Theory of Attributes**: Symbolic notations, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule’s coefficient of association and coefficient of colligation and their relationship.

# Books recommended

**S. No. Title of Book Name of author Publisher**

1. Fundamental of Goon A.M., Gupta M.K., World Press,

 Statistics Vol.I Dasgupta B. Calcutta

 2. Statistics Johnson R. Wiley Publishers

 3. Basic Statistics Aggarwal B.L. New Age

 International

 4. Fundamentals of Gupta S.C.& Sultan Chand &

 Mathematical Kapoor V.K. Sons

 Statistics

 5. Programmed Aggarwal B.L. New Age

 Statistics International

**CC-1 Semester-I**

**B-STA-N102 Probability Theory**

**Course Objectives:**

To understand the concepts of probability, its applications, the concept of random variables, probability functions, expectation and generating functions, properties of random variables like expectation, moment generating function, cumulative generating function etc. , introduction to p.m.f, p.d.f and c.d.f.

### Course Outcomes:

After completing this course, students should have developed a clear understanding of:

* The fundamental concepts of Probability Theory, solving probabilistic problems.
* Addition and multiplication laws of probability, Boole’sinequality,Baye’s theorem.
* Random variables and its probability functions, joint, marginal and conditional probability distribution.
* Concept of expectation for the random variables with their distributions and properties.Moment generating function, cumulant generating function and characteristic function.

**CC-1 Semester-I**

**B-STA-N102 Credits: 2**

Time: 3 Hours M.M.: 25+25\*

 \*Internal Assessment

**Probability Theory**

**Note**: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-

 B.Sc.12 marks.

**UNIT-I**

**Concepts in Probability:** Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely, mutually exclusive and independent events; Definition of probability-classical, relative frequency, statistical and axiomatic approach.

**UNIT-II**

Conditional probability.Addition and multiplication laws of probability and their extension to n events.Boole’s inequality; Baye’s theorem and its applications.

**UNIT-III**

**Random Variable and Probability Functions:** Definition of random variable, discrete and continuous random variable, probability function, probability mass function and probability density functions, distribution function and its properties, functions of random variables, joint, marginal and conditional probability distribution function.

**UNIT-IV**

**Mathematical Expectation**: Definition and its properties-moments, addition and multiplication theorem of expectation. Conditional expectation and conditional variance.

**Generating Functions:** Moments generating function, cumulant generating function, probability generating function along with their properties.Characteristic function.

# Books recommended

**S. No. Title of Book Name of author Publisher**

1. Fundamentals of Gupta S.C.& Sultan Chand

 Mathematical Kapoor V.K. & Sons

 Statistics

2. Elementary David S. Oxford Press

 Probability

3. Introduction to Hoel P.G. Asia Pub. House

 Mathematical

 Statistics

4. New Mathematical BansiLal& SatyaPrakashan

 Statistics Arora S.

5. Introduction to Kapoor&Sexena. S.Chand

 Mathematical

 Statistics

**CC-1 Semester-I**

**B-STA-N103 Practical**

**Course Objectives:**

The learning objectives include:

To motivate students towards intrinsic interest in statistical thinking, to represent, analyze and interpret data, also to understand the concept of attributes.

# Course Learning Outcomes:

On completion of this course students will be able to:

1. Tabulate and represent the data graphically.
2. Compute different measures of central tendency, Dispersion, Skewness and Kurtosis along with theirinterpretation.
3. Compute moments and their use in studying various characteristics ofdata
4. Find association for qualitativedata.

**CC-1 Semester-I**

**B-STA-N103 Credit: 2**

**Time:3 Hour M.M.: 50(Ext.:25,Int.:25)**

**Practical**

**Note: Illustrative list of Practical’s is given below. Five questions will be set. The candidate will be required to attempt anythree.**

1. To construct frequency distributions using exclusive and inclusive methods
2. Representation of data using Bar and piediagrams
3. Representation of data using Histogram, Frequency Polygon, Frequency Curve andOgives.
4. To compute various measures of central tendency anddispersion.
5. To obtain first four moments for the given grouped frequency distribution.
6. To apply Charlier’scheckswhile computing the moments for agivenfrequencydistribution.
7. To obtain moments applying Sheppard’scorrection.
8. To obtain various coefficients of skew nessandkurtosis.
9. To toss a coin at least 100 times and plot a graph of heads withrespecttonumber oftosses.
10. To discuss the association of attributes for a 2x2 contingency table using Yule’s coefficient of association andcolligation.

**CC-2 Semester-II**

**B-STA-N201 Statistical Methods**

**Course Objectives:**

The learning objectives include**:**

To understand and compute various statistical measures of correlation, fitting of curve and regression.

### Course Outcomes:

Upon successful completion of this course students will demonstrate knowledge of:

* Correlation, its properties and its implementation in real life problems.
* Principle of least square, curve fitting of different curves.
* Linear Regression analysis, its properties and its implementation in real life problems.
* Multivariate Regression analysis, its properties, partial and multiple correlations.

**CC-2 Semester-II**

**B-STA-N201 Credits: 2**

Time: 3 Hours M.M.: 25+25\*

 \*Internal Assessment

**Statistical Methods**

**Note**: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-

 B.Sc.8 marks.

**UNIT-I**

**Correlation**: Concept and types of correlation, methods of finding correlation - scatter diagram, Karl Pearson’s Coefficient of correlation (r), its properties, coefficient of correlation for a bivariate frequency distribution. Rank correlation with its derivation, its merits and demerits, limits of rank correlation coefficient, tied or repeated ranks.

**UNIT-II**

**Curve Fitting**: Principle of least squares, fitting of straight line, second degree parabola, power curves of the type Y=aXb, exponential curves of the types Y=abX and Y=aebX.

**UNIT-III**

**Linear Regression**: Two lines of regression, regression coefficients, properties of regression coefficients, angle between two regression lines, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values, distinction between correlation and regression.

**UNIT-IV**

**Multivariate Data:** Plane of regression, properties of residuals, variance of the residual. Multiple and partial correlation for three variables: coefficient of multiple correlation and its properties, coefficient of partial correlation and its properties, multiple correlation in terms of total and partial correlations and coefficient of determination.

# Books recommended

**S. No. Title of Book Name of author Publisher**

 1. Introduction to Mood A.M., Graybill McGraw Hill

 Theory of F.A. &Boes D.C.

 Statistics

 2. Applied General Croxton F.E., Cowden Prentice Hall

 Statistics D.J. &Kelin S.

 3. Introduction to Kapoor&Sexena. S.Chand

 Mathematical

 Statistics

 4. Statistical Methods Snedecor G.W. & Iowa State Uni.

 Cochran W.G. Press

 5. Fundamentals of Gupta S.C.& Sultan Chand &

 Mathematical Kapoor V.K. sSons

 Statistics

**CC-2 Semester-II**

**B-STA-N202 Probability Distributions**

**Course Objectives:**

The learning objectives include:

Explaining different probability distributions (discrete and continuous) with their properties and applications

### Course Outcomes:

After completing this course, students should have developed a clear understanding of:

* Discrete and continuous distributions.
* Some important discrete probability distributions, with their characteristics, and their implementation at realistic models.
* Some important continuous probability distributions, with their characteristics, and their implementation at realistic models
* Normal distribution, its derivation and different characteristics.

**CC-2 Semester-II**

**B-STA-N202 Credits: 2**

Time: 3 Hours M.M.: 25+25\*

 \*Internal Assessment

**Probability Distributions**

**Note**: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-

 B.Sc.8 marks.

**UNIT-I**

Bernoulli distribution and its moments, Binominal distribution: Moments, recurrence relation for the moments, mean deviation about mean, mode, moment generating function (m.g.f), characteristic function, additive property and recurrence relation for the probabilities of Binominal distribution.

**UNIT-II**

Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, moments, mode, recurrence relation for moments, m.g.f., additive property of independent Poisson variates. Negative Binominal distribution: m.g.f., deduction of moments of negative binominal distribution from those of binominal distribution. Geometric distribution: moments, m.g.f,and lack of memory.

**UNIT-III**

Continuous uniform distribution: Moments, m.g.f., characteristic function and mean deviation. Exponential distribution: m.g.f., moments and lack of memory.

**UNIT-IV**

Normal distribution as a limiting form of binominal distribution, chief characteristics of Normal distribution; mode, median, m.g.f. and moments of Normal Distribution, Fitting of normal distribution Central limit theorem and standard normal variate.

# Books recommended

**S. No. Title of Book Name of author Publisher**

1. Statistics:A Bhat B.R., New Age

 Beginner’s Srivenkatramana T. & International

Text Vol. II RaoMadhava K.S.

2. Fundamentals of Gupta S.C. & Sultan chand

Mathematical Kapoor V.K. & Sons

 Statistics

 3. Introduction to Kapoor&Sexena. S.Chand

 Mathematical

 Statistics

 4. Statistics Johnson R. Wiley

 Publishers

 5. Mathematical Freund’s J.E. Prentice Hall

 Statistics With

 Applications

**CC-2 Semester-II**

**B-STA-N203 Practical**

**Course Objectives:**

The learning objectives include:

To understand the concepts of correlation, regression, probability distributions along with their applicability in real-life situations.

# Course Learning Outcomes:

On completion of this course students will be able to:

1. Calculate various coefficients ofcorrelation.
2. Find line and curve of best fit for givenobservations.
3. Estimate unknown values from known values through regressionequations.
4. Fit different probability distributions such as binomial, Poisson and normal distributions

**CC-2 Semester-II**

**B-STA-N203 Credit: 2**

**Time:3Hours M.M.:50(Ext.:25,Int.:25)**

 **Practical**

**Note: Illustrative list of Practical’s is given below. Five questions will be set. The candidate will be required to attempt anythree.**

1. To compute Karl Pearson’s coefficient of correlation for given bivariate frequencydistribution.
2. To find Spearman’s rank correlation coefficient for givendata.
3. Tofitthestraightlineforthegivendataonpairsofobservations.
4. Tofittheseconddegreecurveforthegivendata.
5. To fit the curve of the type Y=aXbfor the given data on pairs ofobservations.
6. To obtain the regression lines for givendata.
7. To compute partial and multiple correlation coefficients for the given tri-variatedata.
8. To obtain plain of regression for the given tri - variatedata.
9. To fit binomial distribution to givendata.
10. To fit Poisson distribution to givendata.
11. To fit normal distribution to given distribution using area under the normalcurve
12. To fit normal distribution to given distribution using method of ordinates