# SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS)
## SALEM – 16
### Reaccredited with 'B++' Grade by NAAC
### (Affiliated to Periyar University)



## *DEPARTMENT OF STATISTICS*

## OUTCOME BASED SYLLABUS
### B.Sc. Statistics

### (For the students admitted in 2021 – 22)

# B.Sc. STATISTICS PROGRAMME OUTCOMES

*P01*     Acquire the basic knowledge to continue and complete an advanced degree

*P02*     Prepare for lifelong learning and successful careers using their mathematical and statistical skills

*P03*     Apply their knowledge to retrieve, analyze and assimilate information

*P04*     Afford the opportunity to pursue studies in a discipline other than Statistics

*P05*     Develop oral and written communication skills that allow them to present the information effectively

# SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM – 16.
## DEPARTMENT OF STATISTICS
### B.Sc. Statistics
### PROGRAMME STRUCTURE UNDERCBCS
*(For the students admitted in 2021-22)*
### Total Credits: 140 + Extra Credit (Maximum 28)
### I SEMESTER

| Part | Course | Course Title | Code | Hrs./Week | Credits |
|------|--------|--------------|------|-----------|---------|
| I | Tamil/Hindi/Sanskrit | Tamil /Hindi/ Sanskrit Paper- I | 21ULTC1/ 21ULHC1/ 21ULSC1 | 6 | 3 |
| II | English | Communicative English-I | 21ULEC1 | 6 | 3 |
| III | Core Course – I | Descriptive Statistics | 21USTC1 | 4 | 4 |
| III | Core Course – II | Correlation and Regression Analysis | 21USTC2 | 4 | 4 |
| III | Allied Course – I | Mathematics – I | 21USTAC1 | 5 | 5 |
| IV | Skill Based – I | Data analysis using Excel | 21USTSQC1 | 2 | 2 |
| III | Core Practical | Core Practical – I (extended to II Semester) | 21USTQC1 | 2 | - |
| V | Extension Activity | Group Project Based on Extension Activities | 21USCAC | 1 | 1 |
| | **Total** | | | **30** | **22** |
| VI | Articulation and idea fixation skills | | | | |
| | Physical Fitness Practice – 35 Hours per semester | | | | |
| | Advanced Diploma in Statistical Methods Level -1: Certificate Course 100 hours per year | | | | |

### II SEMESTER

| Part | Course | Course Title | Code | Hrs./Week | Credits |
|------|--------|--------------|------|-----------|---------|
| I | Tamil/Hindi/Sanskrit | Tamil /Hindi/ Sanskrit Paper- II | 21ULTC2/ 21ULHC2/ 21ULSC2 | 6 | 3 |
| II | English | Communicative English-II | 21ULEC2 | 6 | 3 |
| III | Core Course – III | Introduction to Probability theory | 21USTC3 | 4 | 4 |
| III | Core Course – IV | Distribution Theory | 21USTC4 | 4 | 4 |
| III | Allied Course – II | Mathematics – II | 21USTAC2 | 5 | 5 |
| IV | Skill Based – II | Data analysis using SPSS | 21USTSQC2 | 2 | 2 |
| III | Core Practical | Core Practical – I (extended from I Semester) | 21USTQC1 | 1 | 2 |
| IV | Environmental Studies | Environmental Studies | 21UEVSC | 2 | 1 |
| IV | Group Project for Environmental Studies | | 21UEVSPC | - | 1 |
| **Total** | | | | **30** | **25** |
| VI | Articulation and Idea Fixation Skills – 1 Extra Credit | | | | |
| | Physical Fitness Practice – 35 hours per Semester – 1 Extra Credit | | | | |
| | Certificate Course in Yoga – 30 hours – 1 Extra Credit | | | | |
| | Advanced Diploma in Statistical Methods Level -1: Certificate Course 100 hours per year | | | | |
| | Extra credits are given for extra skills and courses qualified in MOOC/NPTEL | | | | |

## III SEMESTER

| Part | Course | Course Title | Code | Hrs./ Week | Credits |
|------|--------|--------------|------|-----------|---------|
| I | Tamil/Hindi/Sanskrit | Tamil /Hindi/ Sanskrit Paper- III | 21ULTC3/ 21ULHC3/ 21ULSC3 | 6 | 3 |
| II | English | Communicative English-III | 21ULEC3 | 6 | 3 |
| III | Core Course – V | Introduction to Real Analysis and Linear Algebra | 21USTC5 | 4 | 4 |
| III | Core Course – VI | Sampling Theory | 21USTC6 | 4 | 4 |
| III | Allied Course – III | 'C' Programming - I | 21USTAC3 | 5 | 5 |
| IV | Skill Based – III | Demographic Methods | 21USTSC3 | 2 | 2 |
| III | Core Practical | Core Practical - I (extended to IV$^{th}$ Semester) | 21USTQC2 | 1 | - |
| IV | Non-Major Elective – I | Survey Methodology | 21USTNEC1 | 2 | 2 |
| | | | Total | 30 | **23** |
| VI | Extension Activity | Group Project based on Extension Activity | | | |
| | Life Skill Courses | Course I: Communication Skill | | 2 | 2 (Extra) |
| | Articulation and Idea Fixation Skills | | | | |
| | Physical Fitness Practice – 35 hours per Semester | | | | |
| | Advanced Diploma in Statistical Methods Level -2: Diploma Course 100 hours per year | | | | |
| | Extra credits are given for extra skills and courses qualified in MOOC/NPTEL. | | | | |

| | | |
|--|--|--|
| Non-Major Elective – I For II BA/ B.Sc./ B. Com. | Survey Methodology | 20USTNEC1 |

## IV SEMESTER

| Part | Course | Course Title | Code | Hrs./ Week | Credits |
|------|--------|--------------|------|-----------|---------|
| I | Tamil/Hindi/Sanskrit | Tamil /Hindi/ Sanskrit Paper- IV | 21ULTC4/ 21ULHC4/ 21ULSC4 | 6 | 3 |
| II | English | Communicative English-IV | 21ULEC4 | 6 | 3 |
| III | Core Course – VII | Applied Statistics | 21USTC7 | 4 | 4 |
| III | Elective – I | Numerical Analysis / Bio-Statistics | 21USTEC1/ 21USTEC1A | 4 | 5 |
| III | Allied Course – IV | 'C' Programming - II | 21USTAC4 | 5 | 5 |
| IV | Skill Based – IV | Data analysis using R | 21USTSQC4 | 2 | 2 |
| IV | Core Practical | Core Practical– II (extended from III$^{rd}$ Semester) | 21USTQC2 | 1 | - |
| IV | Non-Major Elective – II | Business Statistics | 21USTNEC2 | 2 | 2 |
| | | | Total | 30 | **24** |
| VI | Extension Activity | Group Project based on Extension Activity | | - | 2 (Extra) |
| | Life Skill Courses | Course II: Professional Skills | | 2 | 2(Extra) |
| | Articulation and Idea Fixation Skills - 1 Extra Credit | | | | |
| | Physical Fitness Practice – 35 hours per Semester – 1 Extra Credit | | | | |
| | Advanced Diploma in Statistical Methods Level -2: Diploma Course 100 hours per year | | | | |
| | Extra credits are given for extra skills and courses qualified in MOOC/NPTEL and societal oriented group projects | | | | |

| Non-Major Elective – II For II BA/ B.Sc./ B. Com. | Business Statistics | 21USTNEC2 |
|---|---|---|

## V SEMESTER

| Part | Course | Course Title | Code | Hrs./ Week | Credits |
|---|---|---|---|---|---|
| III | Core Course – VIII | Theory of Estimation | 21USTC8 | 6 | 4 |
| III | Core Course – IX | Design of Experiments | 21USTC9 | 6 | 4 |
| III | Core Course – X | Operations Research - I | 21USTC10 | 6 | 4 |
| III | Elective – II | Stochastic Processes / Econometrics | 21USTEC2/ 21USTEC2A | 5 | 5 |
| IV | Core Practical-III | Core Practical – III | 21USTQC3 | 4 | 3 |
| IV | Non-Major Skill Based | Non-Major Skill Based – I | | 2 | 2 |
| IV | Common Paper | Value Education | | 1 | - |
| | | | **Total** | **30** | **22** |
| VI | Extension Activity | Group Project based on Extension Activity | | | |
| | Life Skill Courses | Course III : Leadership Skills | | 2 | 2 (Extra) |
| | Articulation and Idea Fixation Skills | | | | |
| | Physical Fitness Practice – 35 hours per Semester | | | | |
| | Advanced Diploma in Statistical Methods Level -3: Advanced Diploma Course 100 hours per year | | | | |
| | Internship Training – 1 Extra Credit | | | | |
| | Extra credits are given for extra skills and courses qualified in MOOC/NPTEL | | | | |

## VI SEMESTER

| Part | Course | Course Title | Code | Hrs./ Week | Credits |
|---|---|---|---|---|---|
| III | Core Course – XI | Testing of Hypothesis | 21USTC11 | 6 | 4 |
| III | Core Course – XII | Statistical Quality Control | 21USTC12 | 6 | 4 |
| III | Core Course – XIII | Operations Research – II | 21USTC13 | 6 | 4 |
| III | Elective – III | Project and Viva Voce | 21USTEPC | 5 | 5 |
| III | Core Practical | Core Practical – IV | 21USTQC4 | 4 | 3 |
| IV | Non-Major Skill Based | Non-Major Skill Based –II | | 2 | 2 |
| IV | Common Paper | Value Education | 21UVENC | 1 | 2 |
| | | | **Total** | **30** | **23** |
| VI | Extension Activity | Group Project based on Extension Activity | | | 2 (Extra) |
| | Life Skill Courses | Course IV: Universal Human Values | | 2 | 2 (Extra) |
| | Articulation and Idea Fixation Skills – 1 Extra Credit | | | | |
| | Physical Fitness Practice – 35 hours per Semester - 1 Extra Credit | | | | |
| | Advanced Diploma in Statistical Methods Level -3: Advanced Diploma Course 100 hours per year | | | | |
| | Extra credits are given for extra skills and courses qualified in MOOC/NPTEL | | | | |

## PAPER HANDLED FOR OTHER DEPARTMENTS

| *1. ALLIED FOR II B.Sc. COMPUTER SCIENCE* | | | |
|---|---|---|---|
| **III Semester**     Statistical Methods – I | **Code** 21UCSAC3 | **Hours/week** 5 | **Credits** 5 |
| **IV Semester**     Statistical Methods – II | 21UCSAC4 | 5 | 5 |

**Programme Title**    : **B.Sc. Statistics**
**Course Title**      : **DESCRIPTIVE STATISTICS**
**Course Code**     : **21USTC1**            **Hours/Week : 4**
**Semester**         : **I**                 **Credits**     **4**

**Course Objective:**
> The course aims to introduce the basic concepts in statistics and presentation of data.

## SYLLABUS

**Unit – I (Hours : 15)**
Definition, scope and limitations of statistics – statistical survey – types of data – methods of collection –framing a questionnaire.

**Unit – II(Hours : 15)**
Frequency distribution – Classification & Tabulation of data – Characteristics – Graphs and diagrams – Bar diagram, Histogram and Pie diagram.

**Unit – III(Hours : 15)**
Measures of Central tendency – Arithmetic mean , Geometric mean, Harmonic mean, median and mode – Inter relationship between AM, GM and HM – Quantiles – Quartiles, Deciles and Percentiles.

**Unit – IV (Hours : 15)**
Measures of dispersion (absolute and relative) – Range, Quartile deviation, mean deviation, standard deviation and coefficient of variation – Interrelationship between QD, MD and SD.

**Unit – V(Hours : 15)**
Moments – raw moments, central moments – Measures of Skewness – Karl Pearson's coefficient of skewness – Bowley's coefficient of skewness – Measures of Kurtosis.

**Books for Study:**
R.S.N. Pillai&Bagavathi: Statistics.

S.P.Gupta: Statistical Methods**.**

**Books for Reference:**
D.C. Sancheti& V.K. Kapoor: Statistics.

**Web Resources:**
https://www.fd.cvut.cz/department/k611/PEDAGOG/THO_A/A_soubory/statistics_firstfive.pdf
http://www.mypolyuweb.hk/machanck/lectnotes/c1_des.pdf

**Course Outcomes (CO):**
On completion of the course, students should be able to

| CO Number CO Statement | Knowledge Level |
|---|---|
| 1. **Know** the basic concepts in sample surveys and data. | K1 |
| 2. **Illustrate** the knowledge of framing Questionnaire. | K2 |
| 3. **Calculate** the various descriptive measures. | K3 |
| 4. organize, present and **analyse** the collected data. | K4 |
| 5. **Visualize** the distribution of data and interpret accordingly. | K5 |

## Mapping of CO with PO:

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | L | M | L | M | |
| CO2 | L | | M | M | M |
| CO3 | L | S | L | | M |
| CO4 | M | | S | M | M |
| CO5 | L | | M | L | L |

**L – Low; M – Medium; S - Strong**

**Programme Title**    : **B.Sc. Statistics**
**Course Title**    : **CORRELATION & REGRESSION ANALYSIS**
**Course Code**    : **21USTC2**           **Hours/Week :4**
**Semester**    :**I**           **Credits**    **4**

**Course Objective:**
     The course aims to study the linear and average relationship between two and more than two variables.

## SYLLABUS

**Unit – I (Hours : 15)**
     Curve fitting – Principle of Least squares – Fitting of first degree and second degree polynomial – Power curve & Exponential curve – Simple problems.

**Unit – II (Hours : 15)**
     Correlation: Definition – Types of Correlation – Methods of studying Correlation – Scatter Diagram method – Karl Pearson's coefficient and Spearman's Rank correlation coefficient – Coefficient of concurrent deviation – Correlation for grouped bivariate data – Mathematical properties and interpretation of the coefficient of correlation.

**Unit – III (Hours : 15)**
     Regression – Definition, uses and its significance – Difference between correlation and regression – Regression equation of Y on X and X on Y – Regression equation for a grouped bivariate data – Mathematical properties of Regression coefficients.

**Unit – IV (Hours : 15)**
     Plane of Regression – Yule's notation – Derivation (only for three variables) – Properties of Residuals – Variance of the residual - Partial & Multiple correlation – Definition with example – Derivation .

**Unit – V (Hours : 15)**
Case Study on Correlation and Regression Analysis

**Books for Study:**
R.S.N. Pillai& Mrs. Bagavathi: Statistics (Unit II & II).
S.C. Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics ( Unit I, IV & V)

**Books for Reference:**
D.C. Sancheti& V.K. Kapoor: Statistics.

**Web Resources :**
https://www.studocu.com/en/document/washington-state-university/statistical-methods-in-research-i/lecture-notes/lecture-notes-lecture-14-correlation-and-regression/776404/view
http://www.personal.kent.edu/~mshanker/personal/Classes/f06/ch13_F06.pdf

**Course Outcomes (CO) :**

**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **recall the** distribution and fitting of the data. | **K1** |
| 2. | **describe** the relationship and the direction of association between two variable | **K2** |

3. **analyse and** predict the future outcomes. **K4**
4. **Differentiate** correlation and regression. **K5**
5. **extend** the acquired knowledge to find relationship **K6**
   between more than two variables.

**Mapping of CO with PO & PSO :**

| CO | PO | | | | | PSO | | | | | | |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1 | M | L | M | M | L | L | L | M | | L | | M |
| CO2 | L | | S | M | L | M | M | S | M | M | S | |
| CO3 | M | L | S | S | M | S | S | M | L | S | M | S |
| CO4 | M | S | M | M | L | L | | S | | L | S | L |
| CO5 | L | L | M | L | | M | M | S | L | M | M | S |

**L – Low; M – Medium; S - Strong**

**Programme Title**    **: B.Sc. Statistics**
**Course Title**      **: SKILL BASED- I: DATA ANALYSIS USING EXCEL**
**Course Code**      **: 21USTSQC1**          **Hours/Week :2**
**Semester**          **:I**                   **Credits    2**

**Course Objective:**
           The course aims to provide data handling experience using MS- Excel

### SYLLABUS
**MS- EXCEL:**

1. Diagrammatic representation.
2. Measures of central tendency
3. Measures of discretion.
4. Moments, Skewness and Kurtosis.
5. Histogram and Boxplot
6. Karl Pearson's correlation – Rank correlation.
7. Multiple and partial correlation
8. construction of regression lines

**Course Outcomes (CO):**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | be **familiar** with presentation of Statistical out put in MS – Excel software. | K1 |
| 2. | **Understand** the basic working of MS–Excel . | K1 |
| 3. | enter, **organize** and save data in suitable way. | K3 |
| 4. | **conduct** descriptive and basic inferential statistics in software. | K4 |
| 5. | **Create and** edit graphical displays of data. | K5 |

**Mapping of CO with PO & PSO:**

| CO | PO | | | | | PSO | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1 | L | M | S | L | | M | M | L | S | L | M | S |
| CO2 | M | M | S | L | L | L | L | S | S | M | M | M |
| CO3 | L | L | M | M | | L | L | S | S | L | S | |
| CO4 | M | M | S | M | M | S | L | S | S | M | M | S |
| CO5 | L | L | S | M | L | | | | M | M | | |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : INTRODUCTION TO PROBABILITY THEORY
**Course Code** : 21USTC3      **Hours/Week : 4**
**Semester** : II      **Credits   4**

**Course Objective:**
     To demonstrate the concepts of probability and the uses of probability theory in day-to-day life.

## SYLLABUS

**Unit – I (Hours : 12)**
     Random experiment – Trial – Sample point – Sample space, Event – Types of Events – Definition of probability – Mathematical, Statistical and Axiomatic approach – Addition theorem – Conditional probability – Multiplication theorem – Baye's Theorem – Simple problems.

**Unit – II (Hours : 12)**
     Concepts of random variable – Discrete random variable, Continuous random variable, Probability mass function, distribution function – Properties of Distribution function – Independence of random events and random variables – Pairwise independence and mutual independence – Simple problems. .

**Unit – III (Hours : 12)**
     Mathematical expectation random variables – Properties of mathematical expectation – Moments – Raw moments, central moments – Measures of location and dispersion of random variables – Chebychev's inequality and its application – Simple problems.

**Unit – IV (Hours : 12)**
     Moment generating function of a random variable – Properties and its uses – Cumulants – Characteristic functions – Properties of characteristic function – Simple examples – Inversion theorem(Statement only) – Weak law of large numbers – Simple problems.

**Unit – V (Hours : 12)**
     Bivariate distribution – Distribution function of bivariate random variable and its properties – Probability mass and density function – Marginal and Conditional distributions – Conditional expectation – Covariance and correlation – Simple problems.

**Books for Study:**
R.S.N. Pillai & Bagavathi: Statistics.

**Books for Reference:**
Murray R. Spiegel : Probability and Statistics. (Schaum's Outline Series)
Walpole, R. H. Myres, S.L. Myres & K.Ye: Probability and Statistics.

**Web Resources :**
http://nptel.ac.in/downloads/111101004/http://www.math.ucsd.edu/~bdriver/280_06-07/Lecture_Notes/N16_2p.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **understand** the axiomatic formulation of modern probability theory and random variables. | K2 |
| 2. | **illustrate** probability models and function of random Variables | K2 |
| 3. | **evaluate** and **apply** moments, characteristic functions and random phenomenon. | K3 ,K4 |
| 4. | **derive** the probability distributions relevant to functions of random variables | K4 |
| 5. | **convert** real-world problems into probability models. | K6 |

## Mapping of CO with PO & PSO:

| CO | PO | | | | | PSO | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1 | M | M | L |  | M | M | L | M |  | M | M | L |
| CO2 | L |  | M | M | L | L | M | L | L | S | M |  |
| CO3 | L | M | M | M | S | S | L | M | M | M | L | L |
| CO4 | M | L | M | M | L | L | M | L | L | L | M | S |
| CO5 | S | M | S | M | S | L | S | S | M | M | S | M |

**L – Low; M – Medium; S – Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : DISTRIBUTION THEORY
**Course Code** : 21USTC4        Hours/Week : 4
**Semester** : II        Credits        4


**Course Objective:**
  To illustrate the concepts of probability distributions and their applications to problems in diversified fields.

## SYLLABUS

**Unit – I (Hours : 12)**
  Bernoulli distribution : Definition only - Binomial distribution : Definition - Physical conditions for binomial distribution - Mean and variance - M.G.F. - Moments using M.G.F. - Additive property - Recurrence formulae for probabilities and moments - Fitting of binomial distribution - Simple problems.

**Unit – II (Hours : 12)**
  Poisson distribution : Definition - Conditions for binomial distribution to tend to Poisson distribution - Mean and variance - M.G.F. - Recurrence relation for probabilities and moments - Fitting of Poisson distribution - Simple problems - Exponential distribution : Definition - M.G.F. - Mean and variance using M.G.F. - Rectangular distribution : Definition - Mean and variance - M.G.F.

**Unit – III (Hours : 12)**
  Univariate normal distribution : Definition - M.G.F. - Additive property - Recurrence relation for the moments - Moments - p.d.f. and M.G.F. of a standard normal variate - Chief characteristics - Fitting of normal distribution by the area method - Simple problems.

**Unit – IV (Hours : 12)**
  Gamma distribution: Definition - M.G.F. - Additive property - Mean and variance using M.G.F - Beta distribution of first kind: Definition - Mean and variance - Beta distribution of second kind: Definition - Mean and variance - Definitions of Cauchy and standard Cauchy distributions.

**Unit – V (Hours : 12)**
  Chi-square distribution: Definition of chi-square statistic - Derivation of the p.d.f. - M.G.F. -
Additive property - t-distribution : Definition of Student's t- Derivation of the p.d.f. - F distribution: Definition of F-statistic - Derivation of the p.d.f. -Relation between t and F distributions -Relation between F and chi-square distributions.

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics.

**Books for Reference:**
R.V. Hogg, Craig & A.T. Craig: Introduction to Mathematical Statistics.
A.M. Mood, P.A. Graybill& D.C. Boes: Introduction to the theory of Statistics.
Wilks. S.S. : Mathematical Statistics.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1 | **recall** the basic properties of probability theory | K1 |
| 2 | **perform** calculations relating to probability distributions for discrete and continuous random Variables | K3 |
| 3 | **evaluate and interpret** various properties of both discrete and continuous distributions | K5 |
| 4 | **apply** distributions theory in real-life problems | K3 |
| 5 | **develop** complex mathematical reasoning | K6 |

## Mapping of CO with PO:

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | L | | M | M | L |
| CO2 | M | M | M | L | L |
| CO3 | M | L | M | M | S |
| CO4 | M | M | S | M | L |
| CO5 | S | S | M | M | L |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : SKILL BASED–II: DATA ANALYSIS USING SPSS
**Course Code** : 21USTSQC2          **Hours/Week** :2
**Semester** :II                                    **Credits**        2


**Course Objective:**

> The course aims to provide data handling experience using SPSS.

## SYLLABUS

**SPSS**

1. Ungrouped frequency data
2. Data validation – Transform, Sorting, Select case.
3. Importing data from Excel.
4. Diagrammatic representation.
5. Measures of Central tendency &dispersion.
6. Karl Pearson's correlation – Rank correlation
7. Simple linear regression.
8. Fitting of Distribution

**Books for Study:**

Stephen A**.** Sweet, and Karen Grace-Martin (2012): Data Analysis with SPSS: A First Course in Applied Statistics, Pearson, 4th Edition.

**Web Resources :**

> https://www.slideshare.net/davidmbwiga2090/spss-lecture-notes
> https://stats.idre.ucla.edu/spss/seminars/notes/

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **review** the Statistical output in SPSS software | **K1** |
| 2. | **Describe** the basic working of SPSS . | **K2** |
| 3. | **organize** and save data in suitable way. | **K6** |
| 4. | **conduct** descriptive and basic inferential statistics in software. | **K3** |
| 5. | **create** and edit graphical displays of data. | **K6** |

**Mapping of CO with PO:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M | M | L | | M |
| CO2 | L | | M | M | L |
| CO3 | L | M | M | M | S |
| CO4 | M | L | M | M | L |
| CO5 | S | M | S | M | S |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : CORE PRACTICAL - I
**Course Code** : 21USTQC1       **Hours/Week** : 3
**Semester** : II       **Credits** : 2

**Course Objective:**
 To develop the skills in applying statistical tools in real life data.

## SYLLABUS

### DESCRIPTIVE STATISTICS:

1. Construction of Univariate and Bivariate frequency tables.
2. Diagrammatic and Graphical representation of data.
3. Computation of Measures of Central tendency.
4. Computation of Measures of Dispersion.
**5.** Measures of Skewness and Kurtosis**.**

### CORRELATION ANDREGRESSION

6. Computation of Simple correlation.
7. Computation of Regression Coefficients.
8. Construction of simple regression lines.

### DISTRIBUTION THEORY

9. Fitting of discrete distributions – Binomial, Poisson.
10. Fitting of Continuous distribution.

**Books for Study:**

S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.
S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics.

**Course Outcomes (CO) :**
 **On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **construct** the frequency table. | K3 |
| 2. | **draw** the diagram and graph based on the data. | |
| 3. | **analyse** the central tendency dispersion of the data. | K4 |
| 4. | **describe** the differences between variables. | K2 |
| 5. | **generate** the regression equations. | K6 |

**Mapping of CO with PO:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | L | L | S | L | M |
| CO2 | | L | M | L | |
| CO3 | L | M | S | L | L |
| CO4 | L | L | M | L | L |
| CO5 | L | | M | | L |

L – Low; M – Medium; S - Strong

| | |
|---|---|
| **Programme Title** | **: B.Sc. Statistics** |
| **Course Title** | **: INTRODUCTION TO REAL ANALYSIS AND LINEAR ALGEBRA** |

| | | | |
|---|---|---|---|
| **Course Code** | **: 21USTC5** | **Hours/Week** | **:4** |
| **Semester** | **:III** | **Credits** | **4** |

**Course Objective:**

      **The course aims to introduce the basic concepts in real analysis and linear algebra**

**SYLLABUS**

**Unit – I : (Hours : 12)**

      Real numbers – order axioms – ordered field – Field axioms – least upper bound – greatest lower bound – Simple problems.

**Unit – II (Hours : 12)**

      Sequences – Bounded and unbounded sequences – Convergent, divergent and oscillatory sequences – limit of a sequence – Monotonic sequence – Simple problems.

**Unit – III (Hours : 12)**

      Functions – Limit of a function – Continuity of a function – properties – Derivatives of a function – Rolle's theorem – Mean value theorem.

**Unit – IV (Hours : 12)**

      Vector space – linear combination of vectors – Linear dependence and Linear independence – Basis and dimension.

**Unit – V (Hours : 12)**

      Linear transformation – Properties – Range of linear transformation – Rank and Nullity of linear transformation..

**Books for Study:**

Bali. N.P. , golden Math Series Analysis (2084), Lakshmi Publication. (Unit – I to Unit - III)

Gupta . P. P.,& Sharma. S.K. , Linear Algebra (2082), S.Chand& Company (Unit – IV to Unit – V)

**Books for Reference:**

Vasishta. A. R. (2005), Matices, Krishna Prakashan Mandir, New Delhi.

Kumeresan (2005) , Linear Algebra Geometric approach, Prentice Hall of India Pvt. Ltd.,

**Course Outcomes (CO) :**

**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Explain** the basic concepts of Real number system | **K2** |
| 2. | **Discuss** the axioms and theorems on sequences. | **K2** |
| 3. | **Solve** the limits for the function. | **K3** |
| 4. | **Explore** the concepts of vector space. | **K4** |
| 5. | **Evaluate** different concepts of linear Transformation | **K5** |

**Mapping of COs with POs:**

| CO | PO | | | | |
|-----|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | L | | M | M | L |
| CO2 | M | M | M | L | L |
| CO3 | M | L | M | M | S |
| CO4 | M | M | S | M | L |
| CO5 | S | S | M | M | L |

**L – Low; M – Medium; S - Strong**

| | | |
|---|---|---|
| **Programme Title** | : B.Sc. Statistics | |
| **Course Title** | : SAMPLING THEORY | |
| **Course Code** | : 21USTC6 | **Hours/Week : 4** |
| **Semester** | : III | **Credits    :4** |

**Course Objective:**

The course aims to equip students with different sampling techniques which are useful in conducting sample surveys.

**SYLLABUS**

**Unit – I (Hours : 12)**

Concept of sampling and population: Need for sampling – Design, Organization and execution of sample survey – Principle steps in sample surveys – preparation of Questionnaire and schedules – Pilot survey – Sampling and Non- Sampling Errors – Limitation of sampling.

**Unit – II (Hours : 12)**

Methods of Sampling – Probability and Non- Probability Sampling – Limitation and advantages of Probability and Non p Probability Sampling.

**Unit – III (Hours : 12)**

Simple random sampling: Definition – Methods of selecting a S.R.S. –Mean and Variance of sample mean of SRSWOR – Comparison of SRSWOR with SRSWR – Merits and Limitation of S.R.S

**Unit – IV (Hours : 12)**

. Stratified Random Sampling: Definition – Advantages – Unbiased estimator of population mean – Variance of the stratified mean – Proportional and optimum allocations of sample sizes – variance of sample mean under proportional and optimum allocation – Comparison of proportional allocation and Neyman's allocation with S.R.S.

**Unit – V (Hours : 12)**

Systematic sampling: Definition – i$^{th}$ systematic sample – Variance of the mean of systematic sample using the mean square $S^2$- Comparison of systematic sampling with

S.R.S. – Proving the result  $\text{var}(\bar{y}_{st}) \leq \text{var}(\bar{y}_{sys}) \leq \text{var}(\bar{y}_n)_R$  when the population consists of a linear trend – Merits and Demerits of systematic sampling – NSSO, CSO and its functions.

**Books for Study:**

S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.

**Books for Reference:**

Cochran W. G. : Sampling Techniques.
Des Raj: Sampling Theory

**Web Resources:**

http://nptel.ac.in/downloads/111104073/ht
tp://home.iitk.ac.in/~shalab/course1.htm

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Explore** the principles and theory of probability sampling. | K2 |
| 2. | **explain** the concepts of sampling variability and strategies for removing them. | K4 |
| 3. | **analyse** data from surveys using various sampling plans . | K4 |
| 4. | **use** appropriate method of sampling. | K3 |
| 5. | **evaluate** the different methodology to estimate population parameters for sampling methods. | K5 |

**Mapping of COs with POs:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | M | | L | M | L |
| **CO2** | L | | | S | L |
| **CO3** | | S | M | | |
| **CO4** | | | | S | |
| **CO5** | M | M | S | | S |

**L – Low; M – Medium; S – Strong**

**Programme Title**    **: B.Sc. Statistics**
**Course Title**    **: SKILL BASED –III: DEMOGRAPHIC METHODS**
**Course Code**    **: 21USTSC3**      **Hours/Week  :2**
**Semester**    **:III**      **Credits    2**

**Course Objective:**
The course aims to study the applications of Statistics in the field of Health statistics.
**SYLLABUS**
**Unit – I (Hours: 6)**
Demography – definition, sources of demographic data – Population Census – Demography surveys – Registration method: vital registration – Population register and other administrative records, registrat
**Unit – II (Hours: 6)**
Measurement of mortality: Crude death rate – Specific death rate – Age specific death rate – Infant mortality rate – Standardized death rate – Direct method of standardization – Indirect method of standardization – Simple problems.
**Unit – III (Hours: 6)**
Measure of fertility: Crude birth rate – General fertility rate – Specific fertility rate – Age specific fertility rate – Total fertility rate – Simple problems..
**Unit – IV (Hours: 6)**
Gross reproduction rate – Net reproduction rate – Simple problems.
**Unit – V (Hours: 6)**
Life tables – Uses of life tables – Curate expectation of life and complete expectation of life – Central mortality – Description of a life table – Construction of a life table – Simple problems .

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.

**Books for Reference:**
D. C. Sancheti&V.K.Kapoor: Statistics
S.P. Gupta: Statistical Methods.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Enumerate** the source of vital statistics. | **K1** |
| 2. | **calculate** basic measures to evaluate vital statistics. | **K3** |
| 3. | **determine** fertility and mortality rates. | **K5** |
| 4. | **derive** information from the life tables. | **K3** |
| 5. | **Extract** information from the life tables. | **K4** |

**Mapping of COs with POs :**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | M | L | S | | S |
| **CO2** | | M | M | L | L |
| **CO3** | M | S | S | M | S |
| **CO4** | S | S | S | S | |
| **CO5** | S | S | M | | M |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : APPLIED STATISTICS
**Course Code** : 21USTC7                        **Hours/Week : 4**
**Semester** : IV                                **Credits       4**


**Course Objective:**
        To learn application of Statistics in the economic field where Statistics plays significant role.

## SYLLABUS

**UNIT- I (Hours: 12)**
        Concept of time series – Components of time series – Additive and multiplicative models of time series- resolving the components of time series – Trend – Methods of measuring trend – Method of least squares(Straight line and parabola) – Semi-average method – Method of moving averages – Simple problems.

**UNIT- II (Hours: 12)**
        Seasonal variation – Methods of measuring seasonal variation – Simple average method – Ratio-to-trend method – Ratio –to-moving method- Link relative method- Cyclical variation- Measurement of cyclical variation- Random Component- Variate difference method- Simple problems.

**UNIT- III (Hours: 12)**
        Index numbers – Definition and importance – problems involved in the construction of index numbers – Types of index numbers – Simple aggregate method – Weighted aggregate method (Laspeyre's, Paasche's, Marshall-Edgeworth's and Dorbish-Bowley's index numbers)- Average of price relatives method- Simple problems.

**UNIT- IV (Hours: 12)**
        Optimum tests of index numbers- Unit test – Time reversal test- Factor reversal test- Circular test- Wholesale price index number- Chain base index number- Conversion of fixed base index number into chain index number and vice versa- Uses of index numbers.

**UNIT- V (Hours: 12)**
        Cost of living index numbers –Main steps in the construction of cost of living index numbers – Methods of constructing cost of living index numbers – Aggregate expenditure method- Family budget method – Simple problems – Index number of industrial production – Splicing and Base shifting – Deflating – Uses of cost of living index numbers – Limitations of index numbers.


**Books for Study:**
        Gupta S.C. and Kapoor V.K.: Fundamentals of Applied Statistics

**Books for Reference:**
        Goon A.M., Gupta M.K. and Das Gupta B. : Fundamentals of statistics, Volume II
        Gupta S.P.: Statistical Methods

**Course Outcomes (CO) :**
 **On completion of the course, students should be able to**

1. **Reproduce** with the concepts of  time series                **K1**
2. **forecast** the trends and seasonal variations               **K6**
3. **Explain** the concepts of index numbers                     **K2**
4. **estimate** various index numbers.                           **K5**
5. **Apply** the concepts of time series and index numbers       **K3**
   in real life situation

**Mapping of COs with POs :**

| CO | PO | | | | |
|---|---|---|---|---|---|
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | M L |  | S |  | S |
| **CO2** |  | M | M | L | L |
| **CO3** | M | S | S | M | S |
| **CO4** | S | S | S | S |  |
| **CO5** | S | S | M |  | M |

   **L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : MAJOR ELECTIVE I: NUMERICAL ANALYSIS
**Course Code** : 21USTEC1          Hours/Week :4
**Semester** :IV          Credits     4

**Course Objective:**
The course aims to gain knowledge in Numerical Methods and develop skills for solving different kinds of numerical problems in Science, Engineering and Technology.

**SYLLABUS**

**Unit – I (Hours : 15)**
Defining the operators E, $\Delta$ and $\nabla$ - Difference Table – Newton's forward interpolation formula for equal intervals – Newton's backward interpolation formula for equal intervals – Simple problems.

**Unit – II (Hours : 15)**
Divided difference – Newton's divided difference formula – Lagrange's divided difference formula – Lagrange's formula of interpolation – Simple problems.

**Unit – III (Hours : 15)**
Central difference formulae of interpolation – Gauss forward, Gauss backward, Stirling's and Bessel's formulae – Simple problems.

**Unit – IV (Hours : 15)**
Numerical differentiation – Newton's forward, backward, Stirling's, Newton's divided difference formulae – Simple problems.

**Unit – V (Hours : 15)**
Numerical integration – Trapezoidal rule – Weddle's rule – Simpson's 1/3$^{rd}$ and 3/8$^{th}$ rules – Simple problems.

**Books for Study:**
Balasubramanian P. &Ohers: Numerical Mathematics Vol. I & II.
Kandasamy, Thilagavathy and Gunavathy: Numerical Methods.

**Books for Reference:**
R.Gupta: Numerical Analysis.
S.S. Sastry: Introductory Methods of Numerical Analysis.
H.C. Sexena: Finite Differences and Numerical Analysis.

**Web Resources :**
https://www.math.ust.hk/~machas/numerical-methods.pdf
https://pfortuny.net/uniovi/numerical_methods/notes.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **aware** of using numerical methods in modern scientific computing. | **K1** |
| 2. | **apply** numerical methods to obtain solution to mathematical problem. | **K3** |
| 3. | **determine** appropriate method for approximating numerical results. | **K3** |
| 4. | **compute** various operator such as interpolation, differentiation, integration, etc. | **K2** |

**Mapping of COs with POs :**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| **CO1** | S | L | L | S | |
| **CO2** | | S | M | M | |
| **CO3** | | M | S | S | L |
| **CO4** | L | | S | S | L |

**L – Low; M – Medium; S – Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : SKILL BASED IV: DATA ANALYSIS USING R
**Course Code** : 21USTSQC4                **Hours/Week** :2
**Semester** :IV                           **Credits**    2

**Course Objective:**
The course aims to provide data handling experience using R.
# SYLLABUS

1. Importing data from Excel.
2. Data validation – Transform, Sorting, Select case.
3. Diagrammatic representation.
4. Measures of Central tendency &dispersion.
5. Karl Pearson's correlation – Rank correlation
6. Simple linear regression.
7. Fitting of Distribution

**Books for Study:**
Sandip Rakshit(2017), R Programming for Beginners, McGraw Hill Education;
First edition

**Course Outcomes (CO) :**
 **On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **reproduce** Statistical output in R Programming. | K1 |
| 2. | **Explain** the basic working of R | K2 |
| 3. | **organize** data in suitable way. | K3 |
| 4. | **conduct** descriptive and basic inferential statistics. | K3 |
| 5. | **create** and edit graphical displays of data. | K6 |

**Mapping of COs with POs:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | S | S | L | | |
| CO2 | | S | M | L | |
| CO3 | L | S | S | L | |
| CO4 | | S | S | | M |
| CO5 | M | S | S | | |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : CORE PRACTICAL – II
**Course Code** : 21USTQC2 **Hours/Week : 3**
**Semester** : IV **Credits 2**

**Course Objective:**
To develop the skills in applying statistical tools in real life data.
**SYLLABUS**
**SAMPLING THEORY**

1. Simple random sampling (with and without replacement): Estimation of $\bar{y}$ , var( $\bar{y}_n$ )

2. Stratified random sampling : Estimation of $\bar{y}_{st}$ , var( $\bar{y}_{st}$ )

3. Comparison of proportional and Neymann allocation.

4. Systematic Sampling: Estimation of $\bar{y}_{sys}$, var( $\bar{y}_{sys}$)

5. Comparison of $var(\bar{y}_{st}) \le var(\bar{y}_{sys}) \le var(\bar{y}_n)_R$

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **analyse** data from surveys using various sampling plans . | K4 |
| 2. | **use** appropriate method of sampling. | K3 |
| 3. | **evaluate** the different methodology to estimate population parameters for sampling methods. | K5 |
| 4. | **compare** different sampling methods. | K2 |

**Mapping of COs with POs:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | S | S | L | | |
| CO2 | | S | M | L | |
| CO3 | L | S | S | L | |
| CO4 | | | S | S | | M |
| CO5 | M | S | S | | |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Statistics
**Course Title** : THEORY OF ESTIMATION
**Course Code** : 21USTC8                     **Hours/Week : 6**
**Semester** : V                                     **Credits      4**

**Course Objective:**

This course deals with fundamental concepts and techniques of statistical inference like estimation.

## SYLLABUS

**Unit – I (Hours : 18)**

Point Estimation – Distinction between Estimator and Estimate – Properties of Estimators – Concept of Unbiasedness, consistency, Efficiency and Sufficiency – Statement of Neyman-Pearson Factorization theorem – Simple applications.

**Unit – II (Hours : 18)**

Minimum Variance Unbiased Estimator (MVUE)–Uniqueness property of MVUE–
Proof – Lower bound for variance of estimator – Regularity conditions – Cramar-Rao inequality – Statement and proof – Simple problems – Asymptotic efficiency

**Unit-III (Hours : 18)**

Sufficient statistic and its properties- concept of complete sufficient statistics- simple illustrations-Minimum Variance Bound Estimator (MVBE) - Concept of Blackwellisation-Statement and proof of Rao-Blackwell theorem.

**Unit-IV (Hours : 18)**

Methods of estimation- Maximum likelihood estimator (MLE) and their properties- Simple problems on MLE-Method of moments-Simple illustrations-Methods of minimum chi- square and modified minimum chi-square.

**Unit-V (Hours : 18)**

Interval estimation- Distinction between point estimation and interval estimation-Confidence interval and confidence limits-General procedure of obtaining confidence limits-Construction of confidence intervals for parameters of Binomial, Poisson and Normal distribution- Simple problems.

**Books for study**

GuptaS.C. &V.K.Kapoor      : Fundamental of Mathematical Statistics.
J.N.Kapur&H.C. Saxena : Mathematical Statistics.
B.L.Agarwal : Programmed Statistics.

**Books for reference**

A.M.Mood, P.A. Graybill & D.C.Boes : Introduction to the theory of Statistics.
H.C. Saxenaand P.U. Surendran: Statistical Inference.
S.S. Wilks: Mathematical Statistics.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. **State** the about fundamental principles of statistical inference | | K1 |
| 2. **Explain** the notion of parametric model on point estimation | | K2 |
| 3. **develop** computational skills to implement various statistical inferential approaches. | | K6 |
| 4. **explore** different methods of estimating the parameters | | K3 |
| 5. **Estimate & Interpret** point and interval estimators. | | K5 |

## Mapping of COs with POs :

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | S | S | L | | M |
| CO2 | M | L | | | M |
| CO3 | S | | | L | |
| CO4 | L | | M | | M |
| CO5 | L | | M | | |

**L – Low; M – Medium; S - Strong**

| | | | |
|---|---|---|---|
| **Programme Title** | : B.Sc. Statistics | | |
| **Course Title** | : DESIGN OF EXPERIMENTS | | |
| **Course Code** | : 21USTC9 | **Hours/Week** | : 6 |
| **Semester** | : V | **Credits** | 4 |

**Course Objective:**

The course aims to enhance the theoretical as well as practical skills about the various designing concepts in field experiments.

## SYLLABUS

**Unit – I (Hours : 18)**

Analysis of variance: One-way and two-way classification (without interaction) – Uniformity trials – Determination of shape and size of plots and blocks – Fundamental principles of design: Replication, Randomization and Local control techniques.

**Unit – II (Hours : 18)**

C.R.D.-Definition, advantages , disadvantages and Statistical Analysis of C.R.D.-
R.B.D.-Definition , advantages, disadvantages and its Statistical Analysis .

**Unit – III (Hours : 18)**

Missing plot technique for R.B.D (one and two missing values)-Latin Square Design (LSD) - Definition, Standard Latin Square, Advantages, Disadvantages and its Statistical analysis- Missing plot technique- Estimation of missing value in LSD.

**Unit – IV (Hours : 18)**

Factorial Experiments: Concept of main effects and interactions $p \times q$, $2^2, 2^3$ and $2^n$ Factorial Experiment and their statistical analysis.

**Unit – V(Hours : 18)**

Principles of confounding and Partial Confounding in $2^3$ Factorial Experiment and their statistical analysis- Split- plot Design and Balanced Incomplete Block Design (Concept only).

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.
M.N.Das and N.C.: Design and Analysis of Experiments (Unit- V)

**Books for Reference:**
Goon Gupta and Das Gupta: Fundamentals of Statistics.
D.D.vJoshi: Linear Estimation and Design of Experiments.

**Web Resources :**
https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/STAT8200-Fall13-lec1.pdf
http://nptel.ac.in/downloads/111104075

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Review** the concepts of conducting an experiment | K1 |
| 2. | **Explain** the issues and principles of design of experiments | K2 |
| 3. | **Determine** appropriate design to be followed | K3 |
| 4. | **Derive** the analysis for various design. | K3 |
| 5. | **interpret** statistical results from an experiment and report them in non- technical language | K5 |

## Mapping of COs with POs :

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | S | M | | S | M |
| CO2 | S | L | M | M | |
| CO3 | M | S | | | M |
| CO4 | L | M | L | L | |
| CO5 | L | | | | S |

**L – Low; M – Medium; S - Strong**

**Programme Title**    **: B.Sc. Statistics**
**Course Title**    **: OPERATIONS RESEARCH-I**
**Course Code**    **: 21USTC10**      **Hours/Week :6**
**Semester**    **:V**      **Credits    4**


**Course Objective:**
>    This course introduces you to the fundamentals of Operations Research Models including linear programming and applications.

**SYLLABUS**

**Unit – I (Hours : 18)**
>    Origin - Nature of OR- Decision making- Models in OR- Phase of OR - Uses and Limitations of OR- LPP- Definition, Mathematical formulation of LPP- Graphical Method.

**Unit – II (Hours : 18)**
>    General LPP- Canonical form & Standard form of LPP- Slack, Surplus & Artificial variable- Maximization- Minimization- Simplex method- Big-M method- Two phase method.

**Unit – III (Hours : 18)**
>    Duality in LPP- Formulation of Dual LPP- Primal- Dual relationship- Solving LPP using Dual concepts- Dual simplex method.

**Unit – IV (Hours : 18)**
>    Transportation problem- Balanced, Unbalanced T.P. - Initial basic feasible solution- North West Corner Rule- Row minima- Column minima- Matrix minima (LCM)

**Unit – V (Hours : 18)**
>    Vogel's approximation method- Optimum solution- MODI method- Assignment problem- Introduction- Balanced-Unbalanced- Maximization- Minimization- Hungarian method


**Books for Study:**
V. Sundaresan, K.S. Ganapathy and K.Ganesan: Resource Management Techniques.

**Books for Reference:**
KantiSwarup, P.K. Gupta and Man Mohan: Operations Research.
V.K. Kapoor: Operations Research.

**Web Resources :**
http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdfhttp://nptel.ac.in/courses/112006134/14

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **formulate** linear programming problems | **K6** |
| 2. | **2.solve** linear programming problems using optimization methods. | **K3** |
| 3. | **Solve** specialized programming problems like transportation and assignment problems. | **K3** |
| 4. | **identify** best techniques to solve specific problems. | **K4** |
| 5. | **develop** general understanding of operational research approach in decision making. | **K6** |

## Mapping of COs with POs :

| CO | PO | | | | |
|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | M | | M | | M |
| **CO2** | | M | M | M | M |
| **CO3** | M | | | L | |
| **CO4** | L | L | L | M | M |
| **CO5** | L | | M | | |

**L – Low; M – Medium; S - Strong**

| | |
|---|---|
| **Programme Title** | **: B.Sc. Statistics** |
| **Course Title** | **: MAJOR ELECTIVE-II STOCHASTIC PROCESSES** |
| **Course Code** | **: 21USTEC2** **Hours/Week :6** |
| **Semester** | **:V** **Credits 4** |

**Course Objective:**
To analyze the stochastic models and utilities

## SYLLABUS

**Unit – I (Hours:15)**
Stochastic processes – Definition - Classification of Stochastic processes – Examples of Stochastic processes.

**Unit – II (Hours :15)**
Markov Chains – Definition and examples – Higher transition probabilities – F Chapman – Kolmogorov equation – Classification states.

**Unit – III (Hours :15)**
Poisson process – Poisson process and related distributions – Birth and death process.

**Unit – IV (Hours :15)**
Branching Process – Properties of generating functions of branching process.

**Unit – V(Hours :15)**
Stationary process like – Moving average – Autoregressive – Autoregressive moving average processes.

**Books for Study:**
Medhi, J. : Stochastic Processes

**Books for Reference:**
Karlin, S. And Taylor, H.M. : A First Course in Stochastic Processes
Ross, S.M. : Stochastic Processes

**Web Resources :**
https://people.richland.edu/james/lecture/m113/

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **explain** basic concepts of Stochastic processes. | **K1** |
| 2. | **implement** and **apply** appropriate stochastic models. | **K3** |
| **3.** | **explain** various stochastic processes | **K5** |
| 4. | **calculate** transition probability matrix. | **K3** |
| 5. | **illustrate** stochastic models clearly, in verbal form, using appropriate statistical terminology. | **K4** |

**Mapping of COs with POs:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | S | S | | | M |
| CO2 | M | L | S | | M |
| CO3 | S | | M | L | |
| CO4 | L | | M | | M |

**L – Low; M – Medium; S - Strong**

| | |
|---|---|
| **Programme Title** : B.Sc. Statistics | |
| **Course Title** : CORE PRACTICAL -III | |
| **Course Code** : 21USTQC3 | **Hours/Week : 4** |
| **Semester** : V | **Credits    4** |

**Course Objective:**

The course aims to demonstrate the concepts of statistical inference and       Design of Experiments with simple problems.

## SYLLABUS

### STATISTICAL INFERENCE - I:

- Maximum likelihood estimation

- Estimation by the method of moments

- Confidence intervals for large samples – C.I. for proportion, difference of proportions, mean and difference of means

- Confidence intervals for small samples – C.I. for mean and difference of means

### DESIGN OF EXPERIMENTS:

- Analysis of variance for one - way and two-way classifications

- Analysis of CRD, RBD and LSD

- Missing plot techniques in RBD and LSD

- Analysis of $2^2$, $2^3$ factorial experiments with and without confounding.

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics

**Books for Reference:**
V.K. Rohatgi: An Introduction to Probability theory and Mathematical Analysis.

**Web Resources :**
http://www.stat.colostate.edu/~vollmer/stat307pdfs/LN7a_2017.pdf
https://www.wiley.com/college/sc/reid/chap6.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Describe** the concepts of estimation theory and statistics used in agriculture. | K1 |
| 2. | **Analyse** the data based on the designing principle | K4 |
| 3. | **check** the validity of every experimental designs**.** | K4 |
| 4. | **interpret** point and interval estimators. | K5 |
| 5. | **handle** the real challenges in agricultural experiments. | K6 |

## Mapping of COs with POs:

| CO | PO | | | | |
|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M |  |  | L |  |
| CO2 |  | L | M |  | M |
| CO3 | M | M | L |  |  |
| CO4 | L |  | M | M | M |
| CO5 |  | L | M |  | M |

**L – Low; M – Medium; S - Strong**

| | | | |
|---|---|---|---|
| **Programme Title** | : B.Sc. Statistics | | |
| **Course Title** | : TESTING OF HYPOTHESIS | | |
| **Course Code** | : 21USTC11 | **Hours/Week : 6** | |
| **Semester** | : VI | **Credits** | **4** |

**Course Objective:**

The course aims to enable students to gain insight in statistical inference using different methods of testing hypothesis.

## SYLLABUS

**Unit – I (Hours : 18)**

Statistical Hypothesis- Simple, Composite, null and alternative hypothesis- Critical Regions-Types of errors- Level of Significance-Size and Power of the test-Most Powerful(MP) and Uniformly most powerful test(UMP) -Neyman-Pearson Lemma- Simple Problems.

**Unit – II (Hours : 18)**

Sampling distribution of a statistic and its standard error-General procedure for testing of hypothesis-Test of Significance for large sample-Single proportion, Difference of proportions, Single mean, Difference of means Difference of standard deviation-Practical Problems.

**Unit – III (Hours : 18)**

Small sample tests based on Student's t-Assumptions and Applications of Student's t test-General procedure for testing single mean, Difference of means and Paired t test- F- test for equality of two population variances- Practical problems

**Unit – IV (Hours : 18)**

Chi-square test Statistic-Applications-To test the goodness of fit, To test the independence of attributes (r x s contingency table) - Practical problems.

**Unit – V(Hours : 18)**

Non-Parametric test- definition- advantages and disadvantages-Run test , Median test, Sign test-Mann –Whitney-Wilcoxon U test-Practical problems.

**Books for Study:**

S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics.

**Books for Reference:**

R.V. Hogg, Craig & A.T. Craig: Introduction to Mathematical Statistics.
V.K. Rohatgi: An Introduction to Probability theory and Mathematical Analysis.

**Web Resources:**

http://www.stat.colostate.edu/~vollmer/stat307pdfs/LN7a_2017.pdf
http://nptel.ac.in/courses/103106120/LectureNotes/Lec6_1.pdf

**Course Outcomes (CO) :**
 **On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Explore** the concept of hypothesis | K1 |
| 2. | **demonstrate** their understanding of mathematics in statistical inference | K3 |
| 3. | **Examine** appropriate method from various testing procedure | K4 |
| 4. | **derive** the distributional results needed for statistical inference | K3 |

## Mapping of COs with POs :

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M | | | L | |
| CO2 | | L | M | | M |
| CO3 | M | M | L | | |
| CO4 | L | | M | M | M |

**L – Low; M – Medium; S - Strong**

**Programme Title**    **: B.Sc. Statistics**
**Course Title**        **: STATISTICAL QUALITY CONTROL**
**Course Code**      **: 21USTC12**        **Hours/Week :6**
**Semester**          **:VI**            **Credits**     **4**

**Course Objective:**
> The course aims to educate students on the concepts of Statistical Quality Control with their applications in industries.

**SYLLABUS**

**Unit – I (Hours : 18)**

Statistical Quality Control – Need in industry and uses – Chance and assignable causes of variation – Definitions of process control and product control – theory of control charts – Specification and tolerance limits – Comparison of specification and tolerance limits – Modified control limits.

**Unit – II (Hours : 18)**

Control charts for variables: $\bar{X}$ and R charts – Construction and operation of $\bar{X}$ and R charts – Criteria for detecting lack of control in : $\bar{X}$ and R charts – Control charts for attributes: p, np, c and u charts, their construction and analysis. ·

**Unit – III (Hours : 18)**
Acceptance sampling by attributes: Producer's risk and consumer's risk – Concept of AQL, LTPD – Rectifying Inspection plan, AOQ, AOQL, OC curve (Concept only) – Single sampling plan – its OC, ASN and ATI curves (derivation not included).

**Unit – IV (Hours : 18)**
Double sampling plans for attributes – its OC, ASN and ATI curves (derivations not included) – Comparison of single and double sampling plans.

**Unit – V: (Hours : 18)**
Sequential sampling plans for attributes – Expression for the OC and ASN of SPRT (derivation not included) – Continuous sampling plans for CSP-1, CSP-2 and CSP-3.

**Books for Study:**
S.C. Gupta & V.K. Kapoor : Fundamentals of Applied Statistics.
R.C. Gupta: Statistical Quality Control

**Books for Reference:**
Douglas. C. Montgomery: Statistical Quality Control
M. Mahajan: Statistical Quality Control

**Web Resources:**
http://homepages.stmartin.edu/fac_staff/dstout/MEM650/lecture_notes.htm
https://www.wiley.com/college/sc/reid/chap6.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. **Describe** the philosophy and basic concepts of quality improvement. | | K2 |
| 2. **demonstrate** use of methods of statistical process control. | | K3 |
| 3. **interpret** different control charts. | | K6 |
| 4. **handle** the real challenges in industries | | K6 |

**Mapping of COs with POs :**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M | M | M | | |
| CO2 | L | L | L | M | L |
| CO3 | M | | | L | M |
| CO4 | | | L | L | M |

L – Low; M – Medium; S - Strong

**Programme Title** : **B.Sc. Statistics**
**Course Title** : **OPERATIONS RESEARCH-II**
**Course Code** : **21USTC13**          **Hours/Week  :5**
**Semester** : **VI**          **Credits      5**

**Course Objective:**
     The course aims to provide the basic tools of Operations research in solving the management problems using mathematical approach for decision making.

## SYLLABUS

**Unit – I (Hours : 18)**
Sequencing problem- Problems with n-jobs on two machines- problems with n-jobs on three machines- problems with n-jobs on m–machines- simple problems

**Unit – II (Hours : 18)**
     Game Theory- Introduction- Two person zero sum game: - Maximin- Minimax principle- Game's with saddle point and without saddle point- Dominance property- Graphical solutions of 2×n and m×2 Games- simple problems.

**Unit – III (Hours : 18)**
     Network analysis- Basic Concepts- Constraints in Network- Construction of network- Critical path method (CPM) - Program Evaluation Review Technique (PERT) – simple problems.

**Unit – IV (Hours : 18)**
     Replacement problem- Replacement of items that deteriorate with time- Replacement of items whose maintenance cost increases with time & the value of money remains same during the period and the value of money also changes with time- selection of best machine amongst two- simple problems.

**Unit – V(Hours : 18)**
     Decision theory- Introduction-Types of Decision Making Environment- Decision Making under uncertainty- Maximin criterion- Minimax criterion- Laplace criterion-Hurwitz criterion-Decision Making under risk-EMV-EOL-EVPI-Decision Tree Analysis (Concepts only) – simple problems.

**Books for Study:**
V. Sundaresan, K.S. Ganapathy and K.Ganesan: Resource Management Techniques.
V.K. Kapoor: Operations Research.

**Books for Reference:**
Goel B. S. and Mittal S. K.: Operations Research.
KantiSwarup, P.K. Gupta and Man Mohan: Operations Research.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **identify** best strategy using decision making methods under uncertainty and game theory. | **K1** |
| 2. | **solve** problems in the form of networks and graphs. | **K6** |
| 3. | **solve** problems logically, critically, analytically and creatively. | **K3** |
| 4. | **apply** CPM and PERT techniques to plan, schedule and control project activities. | **K3** |
| 5. | **Interpret** the findings in scientific and concise manner. | **K5** |

## Mapping of COs with POs & PSOs:

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | | M | M | M | S |
| CO2 | L | L | | M | |
| CO3 | | | L | | M |
| CO4 | M | | M | L | L |
| CO5 | M | M | | | |

**L – Low; M – Medium; S - Strong**

| Programme Title | : B.Sc. Statistics | |
|---|---|---|
| Course Title | : CORE PRACTICAL –IV | |
| Course Code | : 21USTQC4 | Hours/Week : 4 |
| Semester | : VI | Credits      4 |

**Course Objective:**

The course aims to demonstrate the concepts of statistical inference and Statistical Quality Control with simple problems.

**SYLLABUS**

**TESTING OF HYPOTHESIS**

- t-test for single mean, two means (independent and dependent samples) and correlation coefficient.
- F-test for variance.
- Chi-square test of homogeneity, goodness of fit and independence of attributes.

**STATISTIAL QUALITY CONTROL**

- Control charts for variables: $\bar{x}$ and R charts.
- Control charts for attributes: p , np and c charts.

**Books for Study:**

R.C. Gupta: Statistical Quality Control
S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics

**Books for Reference:**

V.K. Rohatgi: An Introduction to Probability theory and Mathematical Analysis.
Douglas. C. Montgomery: Statistical Quality Control

**Web Resources :**

http://www.stat.colostate.edu/~vollmer/stat307pdfs/LN7a_2017.pdf
https://www.wiley.com/college/sc/reid/chap6.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge |
|---|---|---|
| 1. | **Describe** the concepts of testing of hypothesis and statistics used in industries . | **K2** |
| 2. | **construct** different control charts. | **K5** |
| 3. | **use** appropriate testing procedure. | **K3** |
| 4. | **face** the real challenges in industries. | |

**Mapping of COs with POs & PSOs:**

| CO | PO | | | | |
| --- | --- | --- | --- | --- | --- |
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M | | | L | |
| CO2 | | L | M | | M |
| CO3 | M | M | L | | |
| CO4 | L | | M | M | M |
| CO5 | | L | M | | M |

**L – Low; M – Medium; S - Strong**

| | | |
|---|---|---|
| **Programme Title** | : B.Sc. Computer Science | |
| **Course Title** | : ALLIED: STATISTICAL METHODS –I | |
| **Course Code** | :21UCSAC3 | **Hours/Week** :5 |
| **Semester** | :III | **Credits** 5 |

**Course Objective:**

The course aims to gain knowledge in basic Statistical Methods and their applications.

## SYLLABUS

**Unit – I (Hours : 15)**

Definition of Statistics – Uses and limitations of Statistics – Measures of Central tendency: Criteria of a good average – Mean, Median and Mode – Merits and Demerits – Simple problems.

**Unit – II (Hours : 15)**

Measures of Dispersion: Criteria of a good measures of dispersion – Range – Quartile deviation – Standard deviation – Coefficient of Variation – Simple problems .

**Unit – III (Hours : 15)**

Skewness – Types of skewness – Karl Pearson's and Bowley's coefficients of skewness – Simple problems – Definition of kurtosis – Fitting of linear and Quadratic equations..

**Unit – IV (Hours : 15)**

Correlation: Types of correlation – Scatter diagram – Karl Pearson's correlation coefficient for ungrouped data – Spearman's rank correlation coefficient – Simple problems.

**Unit – V (Hours : 15)**

Regression analysis: Uses of regression analysis – Regression coefficients – Regression equations for ungrouped data- Simple problems.

**Books for Study:**

R.S. N. Pillai& V. Bagavathi: Statistics.

**Books for Reference:**

D. N. Elhance, VeenaElhance& B.M. Aggarwal: Fundamentals of Statistics

S.P. Gupta: Statistical Methods.

DC. Sanchetti& V. K .Kapoor: Fundamentals of Statistics..

**Web Resources :**

https://www.fd.cvut.cz/department/k611/PEDAGOG/THO_A/A_soubory/statistics_firstfive.pdf

**Course Outcomes (CO) :**

**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **Explain** the basic statistical methodologies | **K2** |
| 2. | **apply** a range of statistical techniques based on theory and concepts. | **K3** |
| **3.** | **relate** statistics to real life problems. | **K6** |
| 4. | **deliver** the results meaningfully and productively with others. | **K3** |
| 5. | **construct** a linear model and show how much it is related | **K6** |

**Mapping of COs with POs :**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | L | M | L | M | |
| CO2 | L | | M | M | M |
| CO31 | L | S | L | | M |
| CO4 | M | | S | M | M |
| CO5 | L | | M | L | L |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.Sc. Computer Science
**Course Title** : ALLIED: STATISTICAL METHODS –II
**Course Code** :21UCSAC4      **Hours/Week** :5
**Semester** :I V      **Credits** 5

**Course Objective:**

The course aims to learn about the common methods of sampling, testing of statistical hypothesis and analysis of variance.

## SYLLABUS

**Unit – I (Hours : 15)**

Sampling: Definitions of population and sample – Census method – Merits of Sampling – Methods of Sampling: Simple random sampling – Stratified random sampling – Systematic sampling – Cluster sampling – Judgement sampling – Quota sampling – Convenience sampling.

**Unit – II (Hours : 15)**

Null and alternative hypotheses – Type I and Type II errors – Critical region and acceptance region – Level of Significance – One –tailed and two-tailed tests – Sampling distribution and standard error – Procedure of testing of hypothesis – Large sample tests for single proportion, difference of two proportions, single mean and difference of two means – Simple problems.

**Unit – III (Hours : 15)**

Assumptions in t-test – t-tests for single mean and difference of two means – Paired t-test and t-test for correlation coefficient – Simple problems..

**Unit – IV (Hours : 15)**

Contingency Table – 2x2 contingency table – Conditions for the validity of Chi-square test – Chi-square tests of homogeneity and independence of two attributes – Simple problems.

**Unit – V (Hours : 15)**

Analysis of Variance – Definition and uses – ANOVA for one-way classification – ANOVA for two-way classification – Simple problems.

**Books for Study:**

S. P. Gupta: Elementary Statistical Methods.

**Books for Reference:**

S.C. Gupta and V.K. Kapoor: Fundamentals of Applied Statistics.
S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics..

**Web Resources :**

https://www.fd.cvut.cz/department/k611/PEDAGOG/THO_A/A_soubory/statistics_firstfive.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge level |
|---|---|---|
| 1. | **recall** different statistical methodologies. | K1 |
| 2. | **estimate** the parameters using various methods. | K3 |
| 3. | **examine** suitable statistical tools. | K3 |
| 4. | **conclude** with well-defined inference. | K5 |
| 5. | **integrate** theoretical concepts with real life problems. | K6 |

**Mapping of COs with POs:**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | M | | L | M | L |
| CO2 | L | | | S | L |
| CO3 | | S | M | | |
| CO4 | | | | S | |
| CO5 | M | M | S | | S |

**L – Low; M – Medium; S - Strong**

**Programme Title** : B.A./ B.Sc/ B.Com.
**Course Title** : NME – I : SURVEY METHODLOGY
**Course Code** : 21USTNEC1                     Hours/Week :2
**Semester** :III                                           Credits      2

**Course Objective:**
The course aims to illustrate the various methodologies in statistics**.**
## SYLLABUS
**Unit – I (Hours : 6)**
Definition of Statistics – Statistical survey –Planning a statistical survey – Executing a Statistical survey.
**Unit – II: (Hours : 6)**
Census method and sampling – Methods of sampling: Simple random sampling – Stratified random sampling – Systematic sampling – Judgement sampling – Quota sampling – Convenience sampling. (Concepts only)
**Unit – III (Hours : 6)**
Collection of Data: Primary and secondary data – Collection of primary data – Sources of secondary data – Framing a questionnaire.
**Unit – IV:(Hours : 6)**
Classification – Definition – Objectives, Rules and Types of Classification – Tabulation – Definition – Objectives, Rules and Types of Tabulation – Problems based on Tabulation.
**Unit – V(Hours : 6)**
Simple bar diagram – Multiple bar diagram – Subdivided bar diagram – Pie diagram – Histogram – Time series graph.

**Books for Study:**
R.S.N. Pillai & Bagavathi: Statistics.

**Books for Reference:**
B. L. Agarwal: Programmed Statistics.

**Web Resources:**
http://www.mypolyuweb.hk/machanck/lectnotes/c1_des.pdf

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **describe** the basic concepts in sample surveys and data. | **K1** |
| 2. | **illustrate** the knowledge of framing Questionnaire. | **K3** |
| 3. | **organize**, manage and **process** the collected data . | **K3** |
| 4. | **explore** the data in forms of tables, diagrams and graphs. | **K4** |
| 5. | **interpret** the information from the data collected. | **K5** |

**Mapping of COs with POs:**

| CO | PO | | | | |
|-----|-----|-----|-----|-----|-----|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | M | | L | M | L |
| **CO2** | L | | | S | L |
| **CO3** | | S | M | | |
| **CO4** | | | | S | |
| **CO5** | M | M | S | | S |

**L – Low; M – Medium; S - Strong**

**Programme Title**    : B.A./ B.Sc/ B.Com.
**Course Title**      : NME – II: BUSINESS STATISTICS
**Course Code**     : 21USTNEC2      **Hours/Week** :2
**Semester**        :IV            **Credits**    2

**Course Objective:**
          To learn statistical techniques for business data analysis.

## SYLLABUS

**Unit – I (Hours : 6)**
Measures of Central tendency – Definition and its characteristics – Mean, Median, Mode-Simple problems.

**Unit – II (Hours : 6)**
Measures of Dispersion – Definition and its properties – Range, Quartile deviation, Standard deviation and Co-efficient of variation- Simple problems.

**Unit – III (Hours : 6)**
Correlation – Definition , its types and uses co-efficient of correlation for ungrouped data only – Rank correlation co-efficient (No repeated ranks) – Simple problems- Regression- Definition its types and uses – Simple problems.

**Unit – IV( Hours : 6)**
Time series – Definition and its uses – Components of Time series – Measurement of Trend by fitting a straight line and by the methods of moving average – Measurement of Seasonal variation by simple average method – Simple problems.

**Unit – V (Hours : 6)**
Index Number: Definition and its uses – classification of index number – problems involved in the construction of index numbers – Laspeyre's, Paasche's and Fisher's Index Number – Simple problems- Cost of living index numbers (concept only).

**BOOKS FOR STUDY**
       R.S.N. Pillai and Bagavatti: Statistics
       P.R. Vital                 :Business Statistics
**BOOKS FOR REFERENCE**
       B.L.Agarwal : Programmed Statistics.

**Course Outcomes (CO) :**
**On completion of the course, students should be able to**

| CO Number | CO Statement | Knowledge Level |
|---|---|---|
| 1. | **apply** various statistical techniques related to business | **K3** |
| 2. | **identify** the business data and present it precisely | **K1** |
| 3. | **organize** the business data using descriptive statistics | **K2** |
| 4. | **predict** the relevant relationship between business variables | **K5** |

**Mapping of COs with POs:**

| CO | PO | | | | |
|----|-----|------|-----|-----|-----|
| | PO1 | PO 2 | PO3 | PO4 | PO5 |
| CO1 | L | M | L | M | |
| CO2 | L | | M | M | M |
| CO3 | L | S | L | | M |
| CO4 | M | | S | M | M |
| CO5 | L | | M | L | L |

**L – Low; M – Medium; S – Strong**