

# DEPARTMENT OF STATISTICS

## VISION

- Department aims at the intellectual growth and personal integrity of student.
- To Provide a strong foundation, suitable for further study and offer career in Statistics or a related field, and thereby inspire, energize, motivate and stimulate creativity of students.
- To acquaint students with various statistical methods and its application in different fields.
- To prepare students to compete with the present competitive world.

## MISSION

- Spread knowledge of Statistics and its applications in various fields by conducting workshops and seminars.
- To facilitate a broad and solid base in Statistics by exposing them to go for further study and its application.
- To promote participation in statistical activities at local, regional and national levels.
- Bring awareness about the effective use of Statistics for social concern through a statistical association.

## PROGRAMME OUTCOMES

After the completion of the Programme, the students will be able to

- PO1** assimilate strong foundation of statistics.
- PO2** identify and apply appropriate principles and methodologies to solve a wide range of problems associated with statistics.
- PO3** apply the knowledge of statistics in science, arts and management principles to solve the complex problems.
- PO4** develop language skills by helping them express their ideas and views clearly and effectively and assist students in understanding the statistical skills and develop their ability to work both independently and in groups.
- PO5** involve themselves in various activities thereby apply the moral and ethical standards of statistics in their career.
- PO6** do research projects and apply them for the upliftment of their career and gain proficiency in using statistical software for data analysis.
- PO7** make themselves familiar with the modern concepts in statistics and engage them in self-regulating and life-long learning in the broadest perspective of hi-tech change.

## PROGRAMME EDUCATIONAL OBJECTIVES

The objectives of this Programme are to equip/prepare the students to

- PEO1** understand the basic theoretical and applied principles of statistics to get jobs in this competitive world.
- PEO2** gain proficiency and communicate the key statistical concepts to non-statisticians.
- PEO3** promote application oriented pedagogy by exposing students to the real world data and help them work effectively in teams by exhibiting ethical and professional behaviour.

## PROGRAMME SPECIFIC OUTCOMES

After the completion of the Programme, the students will be able to

- PSO1** understand how to collect, present, analyze and interpret the data.
- PSO2** analyze the data by using advanced MS-Excel and R-Software.
- PSO3** motivate students to pursue career in related disciplines, especially the Data Sciences, Bio-Statistics and Actuarial Sciences.

## GRADUATE ATTRIBUTES

The attributes expected from the graduates of B.Sc., Statistics are

- 1) **Disciplinary Knowledge:** Collect, analyze, interpret and present data to bring out the meaning, correlation and interrelationships.
- 2) **Critical Thinking:** Sharpen the ground-breaking skills amongst the students and make them a knowledgeable professional.
- 3) **Problem Solving:** Examine various hypotheses involved, identify and consult relevant resources to find their rational answers to become a skilled statistician.
- 4) **Communications Skill and Team Work:** Communicate the results of studies undertaken in statistics and to present information in a concise manner to different groups and inculcate the ability to work as a team.
- 5) **Moral and Ethical Awareness:** Identify ethical issues; avoid unethical behaviour such as fabrication, falsification or misrepresentation and misinterpretation of data skills.
- 6) **Self-directed Learning:** Use statistical software for compiling, analyzing, interpreting and writing of project reports independently.
- 7) **Lifelong Learning:** Learn the basic statistical software thereby update themselves to any other modern statistical software in future.

## PROGRAMME STRUCTURE FOR B.Sc. STATISTICS (For those admitted from the academic year 2023-24 and onwards)

| Category              | Course Type                                       | Course Code | Course Title                                 | Contact Hours | Exam Hours | Marks    |          |             | Credits   |
|-----------------------|---|-------------|--|---------------|------------|----------|----------|-------------|-----------|
|                       |   |             |  |               |            | CI A     | ES E     | Total Marks |           |
| <b>Semester – I</b>   |   |             |  |               |            |          |          |             |           |
| PART -I               | Language  | U23TA1L1    | Tamil– I                                     | 6             | 3          | 25       | 75       | 100         | 3         |
| PART -II              | English   | U23EN1L1    | English - I                                  | 6             | 3          | 25       | 75       | 100         | 3         |
| PART -III             | Core-1  | U23ST101    | Descriptive Statistics                       | 5             | 3          | 25       | 75       | 100         | 5         |
|                       | Core-2  | U23ST102    | Probability Theory                           | 5             | 3          | 25       | 75       | 100         | 5         |
|                       | Elective Generic -1 (Allied)                      | U23ST1A1    | Mathematics for Statistics                   | 4             | 3          | 25       | 75       | 100         | 3         |
| PART -IV              | Skill Enhancement Course SEC1(NME -1)             | U23ST1S1    | Mathematics for Competitive Examination - I  | 2             | -          | 50       | -        | 50          | 2         |
|                       | Foundation Course                                 | U23STFC1    | Office Automation                            | 2             | -          | 50       | -        | 50          | 2         |
| <b>TOTAL</b>          |   |             |  | <b>30</b>     | <b>-</b>   | <b>-</b> | <b>-</b> | <b>600</b>  | <b>23</b> |
| <b>Semester – II</b>  |   |             |  |               |            |          |          |             |           |
| PART -I               | Language  | U23TA2L2    | Tamil– II                                    | 6             | 3          | 25       | 75       | 100         | 3         |
| PART -II              | English   | U23EN2L2    | English - II                                 | 6             | 3          | 25       | 75       | 100         | 3         |
| PART -III             | Core-3  | U23ST203    | Matrix and Linear Algebra                    | 5             | 3          | 25       | 75       | 100         | 5         |
|                       | Core-4  | U23ST204    | Distribution Theory                          | 5             | 3          | 25       | 75       | 100         | 5         |
|                       | Elective Generic -2                               | U23ST2A2    | Real Analysis                                | 4             | 3          | 25       | 75       | 100         | 3         |
|                       | Comprehension - I(Self Study Course- Online Exam) | U23ST2C1    | Comprehension in Statistics – I              | -             | 1          | -        | 50       | 50          | 1         |
| PART -IV              | Skill Enhancement Course SEC2(NME – 2)            | U23ST2S2    | Mathematics for Competitive Examination - II | 2             | -          | 50       | -        | 50          | 2         |
|                       | Skill Enhancement Course SEC3 (DSC)               | U23ST2SP    | Programming in C                             | 2             | 2          | -        | 50       | 50          | 2         |
| <b>TOTAL</b>          |   |             |  | <b>30</b>     | <b>-</b>   | <b>-</b> | <b>-</b> | <b>650</b>  | <b>24</b> |
| <b>Semester – III</b> |   |             |  |               |            |          |          |             |           |

|                      |  |           |  |           |          |          |          |            |            |
|----------------------|--|-----------|--|-----------|----------|----------|----------|------------|------------|
| PART -I              | Language   | U23TA3L3  | Tamil– III   | 6         | 3        | 25       | 75       | 100        | 3          |
| PART -II             | English  | U23EN3L3  | English - III  | 6         | 3        | 25       | 75       | 100        | 3          |
| PART -III            | Core-5   | U23ST305  | Estimation Theory  | 5         | 3        | 25       | 75       | 100        | 5          |
|                      | Core-6   | U23ST306  | Sampling Techniques  | 5         | 3        | 25       | 75       | 100        | 5          |
|                      | Elective Generic -3 (Allied)                           | U23ST3A3  | Numerical Methods  | 4         | 3        | 25       | 75       | 100        | 3          |
| PART -IV             | Skill Enhancement Course SEC4 (DSC)                    | U23ST3SP  | Entrepreneurial Based-Statistical Computation Using MS-Excel | 2         | -        | 50       | -        | 50         | 2          |
|                      | Ability Enhancement Compulsory Course                  | U23AE301  | Environmental Studies  | 2         | -        | 50       | -        | 50         | 2          |
| <b>TOTAL</b>         |  |           |  | <b>30</b> | <b>-</b> | <b>-</b> | <b>-</b> | <b>600</b> | <b>23</b>  |
| <b>Semester – IV</b> |  |           |  |           |          |          |          |            |            |
| PART -I              | Language   | U23TA4L4  | Tamil– IV  | 6         | 3        | 25       | 75       | 100        | 3          |
| PART -II             | English  | U23EN4L4  | English– IV  | 6         | 3        | 25       | 75       | 100        | 3          |
| PART -III            | Core-07  | U23ST407  | Testing of Statistical Hypothesis                            | 4         | 3        | 25       | 75       | 100        | 4          |
|                      | Core-08  | U23ST408  | Actuarial Statistics   | 4         | 3        | 25       | 75       | 100        | 4          |
|                      | Elective Generic -4 (Allied)                           | U23ST4A4  | Economic and Official Statistics                             | 4         | 3        | 25       | 75       | 100        | 3          |
|                      | Comprehension – II (Self Study Course- Online Exam)    | U23ST4C2  | Comprehension in Statistics – II                             | -         | 1        | -        | 50       | 50         | 1          |
| PART -IV             | Skill Enhancement Course SEC5 (DSC)                    | U23ST4SP1 | Database Management Systems Lab                              | 2         | 2        | -        | 50       | 50         | 2          |
|                      | Skill Enhancement Course SEC6(DSC)                     | U23ST4SP2 | Data Analysis Using Statistical Software                     | 2         | 2        | -        | 50       | 50         | 2          |
|                      | Ability Enhancement Compulsory Course                  | U23AE402  | Yoga & Value Education                                       | 2         | -        | 50       | -        | 50         | 2          |
|                      | Internship/Institutional Training /Mini Project(carrie | U23ST5IT  | Internship/Institutional Training/Mini Project               | -         | -        | -        | -        | -          | Completion |

|                     |  |             |  |           |          |          |          |            |           |  |
|---------------------|--|-------------|--|-----------|----------|----------|----------|------------|-----------|--|
|                     | d out during II year summer vacation)              |             |  |           |          |          |          |            |           |  |
| <b>TOTAL</b>        |  |             |  | <b>30</b> | <b>-</b> | <b>-</b> | <b>-</b> | <b>700</b> | <b>24</b> |  |
| <b>Semester - V</b> |  |             |  |           |          |          |          |            |           |  |
| <b>PART -III</b>    | Core-09  | U23ST509    | Stochastic Processes                             | 5         | 3        | 25       | 75       | 100        | 4         |  |
|                     | Core-10  | U23ST510    | Regression Analysis                              | 5         | 3        | 25       | 75       | 100        | 4         |  |
|                     | Core-11 (Core Lab-1)                               | U23ST5P1    | Statistics Practical - I                         | 5         | 3        | 40       | 60       | 100        | 4         |  |
|                     | Core Elective-1                                    | U23ST5E1A   | Operations Research                              | 4         | 3        | 25       | 75       | 100        | 3         |  |
|                     |  | U23ST5E1B   | Survival Analysis                                |           |          |          |          |            |           |  |
|                     |  | U23ST5E1C   | Bio-Statistics                                   |           |          |          |          |            |           |  |
|                     | Core Elective-2 (Core Lab-2)                       | U23ST5EP2 A | Foundations of Data Science and Machine Learning | 4         | 3        | 40       | 60       | 100        | 3         |  |
|                     |  | U23ST5EP2 B | Big Data Analysis Lab                            |           |          |          |          |            |           |  |
|                     |  | U23ST5EP2 C | Computer Graphics Lab                            |           |          |          |          |            |           |  |
|                     | Core – 12 Major Project                            | U23ST5MP    | Major Group Project with Viva Voce               | 5         | -        | 40       | 60       | 100        | 5         |  |
| <b>PART -IV</b>     | Skill Enhancement Course SEC7 (DSC)                | U23ST5SP    | Programming in R                                 | 2         | 2        | -        | 50       | 50         | 2         |  |
|                     | Internship/Institutional Training/Mini Project     | U23ST5IT    | Internship/Institutional Training/Mini Project   | -         | -        | 40       | 60       | 100        | 2         |  |
|                     | Proficiency Enhancement Course (Self-Study Course) | U23GS5SS    | General Studies                                  | -         | -        | -        | -        | Completion | 2         |  |
|                     | MOOC/Spoken Tutorial (Self Study Course - online)  |             |  | -         | -        | -        | -        | Completion | 2         |  |
| <b>TOTAL</b>        |  |             |  | <b>30</b> | <b>-</b> | <b>-</b> | <b>-</b> | <b>750</b> | <b>31</b> |  |
| <b>Semester-VI</b>  |  |             |  |           |          |          |          |            |           |  |
| <b>PART -III</b>    | Core-13  | U23ST611    | Design of Experiments                            | 6         | 3        | 25       | 75       | 100        | 4         |  |
|                     | Core-14  | U23ST612    | Demography                                       | 6         | 3        | 25       | 75       | 100        | 4         |  |
|                     | Core – 15 (Core Lab-3)                             | U23ST6P2    | Statistics Practical - II                        | 6         | 3        | 40       | 60       | 100        | 4         |  |
|                     | Core Elective-3                                    | U23ST6E3A   | Statistical Quality Control                      | 5         | 3        | 25       | 75       | 100        | 3         |  |
|                     |  | U23ST6E3B   | Research Methodology                             |           |          |          |          |            |           |  |

|                    |   |  |                                   |            |   |     |     |             |            |
|--------------------|---|--|-----------------------------------|------------|---|-----|-----|-------------|------------|
|                    |   | U23ST6E3C  | Time Series analysis              |            |   |     |     |             |            |
|                    | Core Elective-4<br>(Core Lab-4)                             | U23ST6EP4<br>A   | Java Programming                  | 5          | 3 | 40  | 60  | 100         | 3          |
|                    |   | U23ST6EP4<br>B   | PHP Programming                   |            |   |     |     |             |            |
|                    |   | U23ST6EP4<br>C   | HTML Programming                  |            |   |     |     |             |            |
|                    | Comprehension – III (Self Study Course-Online Exam)         | U23ST6C3   | Comprehension in Statistics – III | -          | 1 | -   | 50  | 50          | 1          |
| PART -IV           | Professional Competency Skill Enhancement Course (SEC8)     | U23ST6SP   | Python Lab                        | 2          | 2 | -   | 50  | 50          | 2          |
|                    | Extra Department Course Open Elective – (Self Study Course) | To be selected from the courses offered by other departments | -                                 | 3          | - | 100 | 100 | 3           |            |
| PART -V            | Extension Activities – NSS, YRC, Physical Education         |  |                                   | -          | - | -   | -   | -           | 1          |
|                    | NCC*  |  |                                   | -          | - | -   | -   | -           | -          |
| <b>TOTAL</b>       |   |  |                                   | <b>30</b>  |   |     |     | <b>700</b>  | <b>25</b>  |
| <b>GRAND TOTAL</b> |   |  |                                   | <b>180</b> | - | -   | -   | <b>4000</b> | <b>150</b> |

\*As per UGC norms, those students who opt NCC under extension activities will be studying the prescribed syllabi of the UGC which will include Theory, Practical and Camp components. Such students who qualify the prescribed requirements will earn an additional **24 credits**.

## ESTIMATION THEORY (U23ST305)

|                                 |                    |
|---------------------------------|--------------------|
| Lecture Hours : 70              | Tutorial Hours : 5 |
| Practical Hours : -             | No. of Credits : 5 |
| Contact Hours per Semester : 75 |                    |
| Contact hours per Week : 5      |                    |
| Internal Marks : 25             |                    |
| External Marks : 75             |                    |
| Total Marks : 100               |                    |

### Objectives of the Course

The main objectives of this Course are

- to emphasize on the concept of point estimation and interval estimation.
- to learn properties of a good estimator.
- to understand various methods of estimation.

### Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the Course, the students will be able to

**CO1** estimate population parameter.

**CO2** identify good estimators and its properties.

**CO3** derive interval estimators of a parameter.

**CO4** estimate parameters using various estimation methods and identify the best among the estimators.

**CO5** handle data and can estimate population parameters.

### CO – POs and PSOs Mapping (Course Articulation Matrix)

|  | PO1 | PO2 | PO3  | PO4  | PO5  | PO6 | PO7  | PSO1 | PSO2 | PSO3 |
|--|-----|-----|------|------|------|-----|------|------|------|------|
| <b>CO1</b>   | 3   | 3   | 3    | 3    | 3    | 3   | 3    | 3    | 3    | 3    |
| <b>CO2</b>   | 3   | 3   | 3    | 3    | 2    | 3   | 3    | 3    | 3    | 3    |
| <b>CO3</b>   | 3   | 3   | 3    | 2    | 3    | 3   | 2    | 3    | 3    | 3    |
| <b>CO4</b>   | 3   | 3   | 2    | 3    | 3    | 3   | 3    | 3    | 3    | 3    |
| <b>CO5</b>   | 3   | 3   | 3    | 2    | 2    | 3   | 3    | 3    | 3    | 2    |
| <b>Total Contribution of COs to POs and PSOs</b>         | 15  | 15  | 14   | 13   | 13   | 15  | 14   | 15   | 15   | 14   |
| <b>Weighted percentage of Course Contribution to POs</b> | 100 | 100 | 93.3 | 86.7 | 86.7 | 100 | 93.3 | 100  | 100  | 93.3 |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## Course Content

### **Unit I Characteristics of Estimators (L-14hrs; T-1hr)**

**Characteristics of Estimators** : Point estimation – Estimator – Consistency and Unbiasedness – Efficiency and most efficient estimator – Estimators based on sufficient statistics – Neyman Factorization theorem (statement only) – Simple illustrations.

### **Unit II Minimum variance unbiased estimators (L-14hrs; T-1hr)**

**Minimum variance unbiased estimators** – Minimum variance unbiased estimators – Cramer – Rao Inequality – Rao Blackwell theorem – Simple illustrations.

### **Unit III Methods of Estimation (L-14hrs; T-1hr)**

**Methods of Estimation** – Methods of Estimation – Methods of Maximum likelihood and methods of moments – Properties of maximum likelihood estimators obtained by these methods – Simple illustrations.

### **Unit IV Methods of Estimation (L-14hrs; T-1hr)**

Method of Minimum Chi-Square- Methods of Least squares: Assumptions for estimation, Properties of least squares estimator, simple problems.

### **Unit V Bayes estimation (L-14hrs; T-1hr)**

Interval Estimation: Confidence interval for the mean of the normal population - Confidence interval for the difference between the means of the normal population - Confidence interval for the proportion of the normal population - Confidence interval for the difference between the two proportions of the normal population – Confidence intervals for large samples.

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

### **Recommended Text**

1. Gupta S.C. and Kapoor V.K., *Fundamentals of Mathematical Statistics*, Sultan Chand Sons, New Delhi, 2007.
2. Bhuyan. K.C., *Probability Distribution Theory and Statistical Inference*, New Central Book Agency (P) Limited, Delhi, 2010.

### **Reference Books**

1. Rohatgi, V., *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern., 1976.
2. Vittal. P.R., *Mathematical Statistics*, Margham Publications, Chennai, 2002.
3. Ashok K. Bansal, *Bayesian Parametric Inference*, Narosa Publishing House, 2007.
4. Mood, A.M. Graybill, F.A. and Boes D.C., *Introduction to Theory of Statistics*, McGraw – Hill, 1974.
5. Goon A.M. Gupta M.K. and Das B., *An Outline of Statistical Theory*, Vol II, World Press, Calcutta, 1980.
6. Sanjay Arora and Bansi Lal, *New Mathematical Statistics*, Satya Prakasam, New Delhi, 1989.
7. Hodges, J.L. and Lehman, E.L., *Basic Concepts of Probability and Statistics*, Holden Day, 1964.

### **Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject.

## SAMPLING TECHNIQUES (U23ST306)

|                                 |                    |
|---------------------------------|--------------------|
| Lecture Hours : 70              | Tutorial Hours : 5 |
| Practical Hours : -             | No. of Credits : 5 |
| Contact Hours per Semester : 75 |                    |
| Contact hours per Week : 5      |                    |
| Internal Marks : 25             |                    |
| External Marks : 75             |                    |
| Total Marks : 100               |                    |

### Objectives of the Course

The main objectives of this Course are

- to know the basic operations of sampling.
- to study the theory and applications of SRS.
- to learn practical uses of stratification.
- to apply Systematic and PPS Sampling in real time problems.

### Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the Course, the students will be able to

- CO1** know the difference between census and sampling.
- CO2** understand basic operations and advantages of sampling.
- CO3** understand widely used sampling techniques.
- CO4** know to estimate population information using sampling.
- CO5** apply sampling techniques in real time problems.

### CO – POs and PSOs Mapping (Course Articulation Matrix)

|  | PO1   | PO2   | PO3   | PO4   | PO5   | PO6   | PO7   | PSO1 | PSO2 | PSO3 |
|--|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| <b>CO1</b>   | 3     | 3     | 3     | 3     | 2     | 3     | 3     | 3    | 3    | 3    |
| <b>CO2</b>   | 3     | 3     | 2     | 3     | 2     | 3     | 2     | 3    | 3    | 3    |
| <b>CO3</b>   | 3     | 3     | 3     | 2     | 2     | 3     | 2     | 3    | 3    | 3    |
| <b>CO4</b>   | 3     | 2     | 2     | 2     | 2     | 2     | 2     | 3    | 3    | 3    |
| <b>CO5</b>   | 2     | 2     | 1     | 3     | 2     | 2     | 2     | 3    | 3    | 2    |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14    | 13    | 11    | 13    | 10    | 13    | 11    | 15   | 15   | 14   |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.33 | 86.67 | 73.33 | 86.67 | 66.67 | 86.67 | 73.33 | 100  | 100  | 93.3 |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

### Course Content

### **Unit I Sample surveys**

**(L-14hrs; T-1hr)**

**Basic concepts of sample surveys** – Basic concepts of sample surveys – Advantages of Sampling method – Principal steps in Sample survey, Sampling unit – Sampling frame – Census – Probability Sampling, Alternatives to probability sampling, Mean Square Error.

### **Unit II Simple random sampling**

**(L-14hrs; T-1hr)**

**Simple random sampling**, Simple random sampling, Methods of selection, Sampling with and without replacement – Properties of estimates, Finite population correction, Estimation of Standard error – Simple random sampling for Qualitative characteristics, Sample size determination for proportions and continuous data.

### **Unit III Stratified random sampling**

**(L-14hrs; T-1hr)**

Stratified Random Sampling: Principles of Stratification, Notations - Estimation of the Population mean and its Variance – Estimate of Variance – Allocation techniques -equal allocation, proportional allocation, Neyman allocation and optimum allocation – Estimation of sample size for continuous data.

### **Unit IV Systematic sampling**

**(L-14hrs; T-1hr)**

Systematic Random Sampling: Definition – Sample Selection Procedures – Estimation of Mean and its Sampling Variance – Comparison of Systematic sampling with Stratified random sampling – Systematic sampling in two dimensions.

### **Unit V Varying Probability sampling**

**(L-14hrs; T-1hr)**

**Varying Probability sampling** – procedures of selecting a sample: Cumulative total method and Lahiri's method - Estimation in PPS sampling with replacement total and its sampling variance - Estimator for population mean and its sampling variance.

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

### **Recommended Text**

1. Cochran, W.G., *Sampling Techniques*, John Wiley Eastern, 1978.
2. Singh. D. and Chaudry F.S., *Theory and Analysis of Sample Surveys Design* Wiley Eastern Ltd., 1986.

### **Reference Books**

1. Sampath.S., *Sampling Theory and Methods*, CRC Press, 2001.
2. Murthy M.N., *Sampling Theory and Methods*, Statistical Publishing Society, Calcutta, 1967.

### **Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject.

<http://ocw.jhsph.edu/courses/statmethodsforamplesurveys/pdfs/lecture2.pdf>.

<https://www.questionpro.com/blog/stratified-random-sampling/>

<https://www.scribbr.com/methodology/systematic-sampling/>

<http://home.iitk.ac.in/~shalab/sampling/chapter7-sampling-varying-probability-sampling.pdf>

## **Part-III B.Sc. Statistics / Semester – III / Elective Generic-3: NUMERICAL METHODS (U23ST3A3)**

|                                   |              |                       |            |
|-----------------------------------|--------------|-----------------------|------------|
| <b>Lecture Hours</b>              | <b>: 60</b>  | <b>Tutorial Hours</b> | <b>: -</b> |
| <b>Practical Hours</b>            | <b>: -</b>   | <b>No. of Credits</b> | <b>: 3</b> |
| <b>Contact Hours per Semester</b> | <b>: 60</b>  |                       |            |
| <b>Contact hours per Week</b>     | <b>: 4</b>   |                       |            |
| <b>Internal Marks</b>             | <b>: 25</b>  |                       |            |
| <b>External Marks</b>             | <b>: 75</b>  |                       |            |
| <b>Total Marks</b>                | <b>: 100</b> |                       |            |

## Objectives of the Course

The main objectives of this Course are

- to introduce the study of algorithms that used numerical approximation for the problems of mathematical analysis.
- to solve mathematical problems numerically.

## Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the Course, the students will be able to

**CO1** solve numerically equations that cannot have direct solution.

**CO2** solve system of linear equations.

**CO3** understand the need of interpolation.

**CO4** apply interpolation for unequal intervals.

**CO5** differentiation and integration numerically.

## CO – POs and PSOs Mapping (Course Articulation Matrix)

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO3</b>   | 3          | 3          | 3          | 2          | 3          | 3          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 2          | 3          | 2          | 3          | 3          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 15         | 14         | 13         | 12         | 15         | 12         | 15          | 15          | 14          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3       | 100        | 93.3       | 86.7       | 80         | 100        | 80         | 100         | 100         | 93.3        |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## Course Content

**Unit I Numerical Algebraic and Transcendental Equations (L-12hrs)**  
**The Solution of Numerical Algebraic and Transcendental Equations-** Bisection Method, Iteration Method, Regula Falsi Method, Newton – Raphson Method.

**Unit II Solution of Simultaneous Linear Algebraic Equations (L-12hrs)**

**Solution of Simultaneous Linear Algebraic Equations-**Gauss – Elimination Method, Gauss–Jordan Method, Gauss – Jacobi Method, Gauss –Seidel Method. **Finite Differences-Operators, Interpolation for Equal intervals:** Newton’s forward Interpolation Formula and Newton’s Backward Interpolation Formula.

**Unit III Central Difference Interpolation for Equal Intervals (L-12hrs)**  
**Central Difference Interpolation Formula for Equal Intervals-**Gauss Forward Interpolation Formula, Gauss Backward Interpolation Formula, Sterling’s Formula, Bessel’s Formula, Laplace-Everett’s Formula.

**Unit IV Interpolation with Unequal Intervals (L-12hrs)**  
**Interpolation with Unequal Intervals-**Divided Differences, Newton’s Divided Differences Interpolation Formula, Lagrange’s Interpolation Formula and Inverse Lagrange’s Interpolation.

**Unit V Numerical Differentiation and Integration (L-12hrs)**  
**Numerical Differentiation:** Numerical Differentiation based on Newton’s Forward and Backward Interpolation Formula. **Numerical Integration-**Newton-Cote’s quadrature formula, Trapezoidal Rule, Simpson’s 1/3<sup>rd</sup> Rule, Simpson’s 3/8<sup>th</sup> Rule and Weddle’s Rule.

**NOTE: NUMERICAL AND EXAMPLE PROBLEMS ONLY**

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

**Recommended Text**

1. Arumugam.S ,ThangapandiIssac.A and Somasundaram.A ., *Numerical Methods*, SCITECH Publications(India) Pvt Ltd., 2002.

**Reference Books**

1. Kalavathy, S., and Thomson., *Numerical Methods*, Vijay Nico::le Publications, 2004.
2. Gupta, B.D., *Numerical Analysis*, Konark Publications, 2004.
3. Venkatachalapathy, S.G., *Calculus of Finite Differences and Numerical Analysis*, Margam Publications, 2004.
4. Gerald Wheatley, *Applied Numerical Analysis*, Pearson Education Publications, 1970.
5. Jain, M.K., Iyengar, S.R., Jain, R.K., *Numerical Methods Problems and Solutions*, New Age International Publishers, 1994.

**Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject  
[www.nptel.com](http://www.nptel.com)

**Part-IV B.Sc. Statistics / Semester – III / Skill Enhancement Course SEC4  
(DSC): ENTREPRENEURIAL BASED-STATISTICAL COMPUTATION  
USING MS-EXCEL (U23ST3SP)**

|  |                           |
|--|---------------------------|
| <b>Lecture Hours</b> : -               | <b>Tutorial Hours</b> : - |
| <b>Practical Hours</b> : 30            | <b>No. of Credits</b> : 2 |
| <b>Contact Hours per Semester</b> : 30 |                           |
| <b>Contact hours per Week</b> : 2      |                           |
| <b>Internal Marks</b> : 50             |                           |
| <b>External Marks</b> : -              |                           |
| <b>Total Marks</b> : 50                |                           |

### Objectives of the Course

The main objectives of this Course are

- to train the students in MS-Excel and to solve computational problems that they may encounter solve in their professional life.

### Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the Course, the students will be able to

- CO1** recall the formulas using the fundamentals of MS- Excel.
- CO2** understand the MS- Excel formulas and tools.
- CO3** apply the statistical concepts in MS- Excel tools.
- CO4** analyse the statistical concept using MS-Excel tool.
- CO5** experiment the parametric and non-parametric tests using MS-Excel tool.

### CO – POs and PSOs Mapping (Course Articulation Matrix)

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 2           | 3           |
| <b>CO3</b>   | 3          | 3          | 3          | 2          | 3          | 3          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 2          | 3          | 2          | 3          | 3          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 15         | 14         | 13         | 12         | 15         | 12         | 15          | 14          | 14          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3       | 100        | 93.3       | 86.7       | 80         | 100        | 80         | 100         | 93.3        | 93.3        |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## **List of Practicals**

1. Diagrammatic representation of data.
2. Construction of frequency table and cumulative frequency table.
3. Construction of graphs.
4. Construct the measures of central tendency.
5. Measures of dispersion (Standard deviation, Quartile deviation Co-efficient of variation).
6. Solving a system of equations applying crammer's rule.
7. Calculation of coefficient of simple linear correlation and Karl Pearson's coefficient of correlation.
8. Finding the regression equation with single regression.
9. Construction of confidence interval for difference between means of two normal populations.
10. Hypothesis test for the Population mean (Large sample).
11. Non parametric test one sample (Sign test Kolmogorov –Smirnov test.).
12. Non parametric test for two sample problems – Mann-Whitney U test and Wilcoxon's signed – rank test.

(All the practicals are compulsory.)

**Part-III B.Sc. Statistics / Semester – IV / Core-7:  
TESTING OF STATISTICAL HYPOTHESIS (U23ST407)**

|  |                           |
|--|---------------------------|
| <b>Lecture Hours</b> : 55              | <b>Tutorial Hours</b> :5  |
| <b>Practical Hours</b> : -             | <b>No. of Credits</b> : 4 |
| <b>Contact Hours per Semester</b> : 60 |                           |
| <b>Contact hours per Week</b> : 4      |                           |
| <b>Internal Marks</b> : 25             |                           |
| <b>External Marks</b> : 75             |                           |
| <b>Total Marks</b> : 100               |                           |

**Objectives of the Course**

The main objectives of this Course are

- to make familiar with testing concepts.
- to understand the concept of most powerful test.
- to understand the likelihood ratio tests and their uses.
- to apply tests for samples from unknown distributions.

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the Course, the students will be able to

- CO1** frame hypotheses about population in real life research.
- CO2** identify suitable testing procedure for given hypotheses.
- CO3** compare two populations using samples taken from them.
- CO4** compare populations in its means and variances separately.
- CO5** identify situations to apply parametric and nonparametric.

**CO – POs and PSOs Mapping (Course Articulation Matrix)**

|  | PO1  | PO2 | PO3  | PO4  | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|--|------|-----|------|------|-----|-----|-----|------|------|------|
| <b>CO1</b>   | 3    | 3   | 3    | 3    | 2   | 3   | 2   | 3    | 3    | 3    |
| <b>CO2</b>   | 3    | 3   | 3    | 3    | 2   | 3   | 2   | 3    | 3    | 3    |
| <b>CO3</b>   | 3    | 3   | 3    | 2    | 3   | 3   | 2   | 3    | 3    | 3    |
| <b>CO4</b>   | 2    | 3   | 2    | 3    | 3   | 3   | 3   | 3    | 3    | 3    |
| <b>CO5</b>   | 3    | 3   | 3    | 2    | 2   | 3   | 3   | 3    | 3    | 3    |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14   | 15  | 14   | 13   | 12  | 15  | 12  | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3 | 100 | 93.3 | 86.7 | 80  | 100 | 80  | 100  | 100  | 100  |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## Course Content

### **Unit I Statistical Hypothesis (L-11hrs; T-1hr)**

**Statistical Hypothesis** – Null and Alternative Hypothesis – Simple and Composite hypothesis – Critical region – Type-I and Type-II error – Most Powerful test – Uniformly Most powerful test – Neyman Pearson Lemma – Simple problems.

### **Unit II Likelihood ratio test (L-11hrs; T-1hr)**

**Likelihood ratio test** – Tests of mean of a normal population – Equality of two means of normal populations – test for variance of a normal population – Equality of variances of two normal populations.

### **Unit III Chi-square tests (L-11hrs; T-1hr)**

Large Sample Tests – Sampling distribution of a statistic, standard error, Utility of standard error, Procedure for testing of hypothesis, tests of significance for large samples – Test of significance for single proportion – Test of significance for difference of proportions – standard error of sample mean – test of significance for single mean – standard error of the difference of the means of two samples – Test of significance for difference of means – Test of significance for the difference of standard deviations.

### **Unit IV Tests based on t distribution (L-11hrs; T-1hr)**

Tests based on t and F distributions for single mean, difference between means, variance, ratio of variances, tests for co-efficient of correlation and regression coefficient. Chi-square distribution: Inference about a population variance, goodness of fit, tests the independence of attributes.

### **Unit V Nonparametric methods (L-11hrs; T-1hr)**

Non-parametric tests - Run, Median, Sign and Mann Whitney tests (one sample and two sample) problems. Wilcoxon Signed rank test, test sum test, Kolmogorov's Smirnov one sample test and Kruskal Wallis test.

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

### **Recommended Text**

1. Robert V. Hogg and Allen T.Craig, *Introduction to Mathematical Statistics*, 4<sup>th</sup> edition, Macmillan Publishing Co., Inc. New York, 1978.
2. Rohatgi.V.K, and A.K.Md.EhsanesSaleh, *An Introduction to Probability and Statistics*, John Wiley & Sons, 2001.

### **Reference Books**

1. Gupta S.C. and Kapoor V.K., *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 1991.
2. Goon A.M. Gupta M.K. and Das Gupta B, *An outline of Statistical Theory*, Vol.II World Press Calcutta, 1980.
3. Mood A.M. Graybill F.A. and Boes D.C.B., *Introduction to the Theory of Statistics 3/e*, McGraw Hill, New York, 1980.
4. Gibbons, J.D., *Non-Parametric Statistical Inference*, McGraw Hill, 1971.

### **Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject.

<http://fisher.stats.uwo.ca/faculty/kulperger/SS3858/Handouts/np-lemma.pdf>

<https://www.sciencedirect.com/topics/mathematics/uniformly-most-powerful-test>

[https://www.probabilitycourse.com/chapter8/8\\_4\\_5\\_likelihood\\_ratio\\_tests.php](https://www.probabilitycourse.com/chapter8/8_4_5_likelihood_ratio_tests.php)

<https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/parametric-and-non-parametric-data/>

**Part-III B.Sc. Statistics / Semester – IV / Core-8:  
ACTUARIAL STATISTICS (U23ST408)**

|                                   |              |                       |            |
|-----------------------------------|--------------|-----------------------|------------|
| <b>Lecture Hours</b>              | <b>: 55</b>  | <b>Tutorial Hours</b> | <b>: 5</b> |
| <b>Practical Hours</b>            | <b>: -</b>   | <b>No. of Credits</b> | <b>: 4</b> |
| <b>Contact Hours per Semester</b> | <b>: 60</b>  |                       |            |
| <b>Contact hours per Week</b>     | <b>: 4</b>   |                       |            |
| <b>Internal Marks</b>             | <b>: 25</b>  |                       |            |
| <b>External Marks</b>             | <b>: 75</b>  |                       |            |
| <b>Total Marks</b>                | <b>: 100</b> |                       |            |

**Objectives of the Course**

The main objectives of this Course are

- to develop a greater understanding of statistical principles and their application in actuarial statistics.
- to describe the core areas of actuarial practice and related areas of actuarial principles, theories and models.
- to give an understanding of the application and knowledge of the life insurance environment.

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the Course, the students will be able to

- CO1** explain the utility theory and insurance terminologies.
- CO2** articulate the insurance and annuity benefits through multiple life functions evaluation for special mortality laws.
- CO3** describe the various types of premium and the numerical evaluations.
- CO4** explain implementation of the Life insurance policies.
- CO5** describe Insurance payable at the moment of death and at the end of the year of death-level benefit insurance.

**CO – POs and PSOs Mapping (Course Articulation Matrix)**

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO3</b>   | 2          | 2          | 3          | 2          | 1          | 2          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 1          | 2          | 1          | 3          | 1          | 2           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 14         | 13         | 12         | 8          | 14         | 11         | 14          | 15          | 13          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.33      | 93.33      | 86.67      | 80         | 53.33      | 93.33      | 73.33      | 93.33       | 100         | 86.67       |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## Course Content

### **Unit I Simple and compound interest (L-11hrs; T-1hr)**

**Simple and compound interest**, present value and accumulated values of fixed rate, varying rate of interest.

### **Unit II Mortality (L-11hrs; T-1hr)**

**Mortality**: Gompertz - Makeham laws of mortality - life tables. **Annuities**: Endowments, Annuities, Accumulations, Assurances, Family income benefits.

### **Unit III Policy Values (L-11hrs; T-1hr)**

**Policy Values**: Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

### **Unit IV Contingent Functions (L-11hrs; T-1hr)**

**Contingent Functions**: Contingent probabilities, assurances. Decrement tables. Pension funds: Capitalsums on retirement and death, widow's pensions, benefits dependent on marriage.

### **Unit V Principles of insurance (L-11hrs; T-1hr)**

**Principles of insurance**, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance.

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

### **Recommended Text**

1. Hooker P.F., Longley, L.H.-Cook., *Life and other contingencies*, Cambridge, 1957.
2. Alistair Neill, *Life contingencies*, Heinemann professional publishing, 1977.
3. Gupta and Kapoor, *Fundamentals of Applied Statistics*, 2001.

### **Reference Books**

1. Study material of IAI/IFoA of Actuarial Societies.
2. Hosack I.B., Pollard J.H. and Zehnirith B., *Introductory Statistics with applications in general insurance*, Cambridge University, 1999.

### **Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject.

**Part-III B.Sc. Statistics / Semester – IV / Elective Generic-4:  
ECONOMIC AND OFFICIAL STATISTICS (U23ST4A4)**

|                                   |              |                       |            |
|-----------------------------------|--------------|-----------------------|------------|
| <b>Lecture Hours</b>              | <b>: 55</b>  | <b>Tutorial Hours</b> | <b>: 5</b> |
| <b>Practical Hours</b>            | <b>: -</b>   | <b>No. of Credits</b> | <b>: 3</b> |
| <b>Contact Hours per Semester</b> | <b>: 60</b>  |                       |            |
| <b>Contact hours per Week</b>     | <b>: 4</b>   |                       |            |
| <b>Internal Marks</b>             | <b>: 25</b>  |                       |            |
| <b>External Marks</b>             | <b>: 75</b>  |                       |            |
| <b>Total Marks</b>                | <b>: 100</b> |                       |            |

**Objectives of the Course**

The main objectives of this Course are

- to understand Indian official statistical system and data collection.
- to know Indian economic and agricultural surveys.
- to know index numbers and consumer price index.
- to know time series analysis.
- to learn demand analysis and its concepts.

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the Course, the students will be able to

- CO1** understand Indian official statistics and offices related to it.
- CO2** understand Indian surveys for collecting official statistics.
- CO3** know uses of index numbers.
- CO4** know demand analysis and its need.
- CO5** understand economic India by knowing agricultural and economic surveys.

**CO – POs and PSOs Mapping (Course Articulation Matrix)**

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO3</b>   | 3          | 3          | 3          | 2          | 3          | 3          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 2          | 3          | 2          | 3          | 3          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 15         | 14         | 13         | 12         | 15         | 12         | 15          | 15          | 14          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3       | 100        | 93.3       | 86.7       | 80         | 100        | 80         | 100         | 100         | 93.3        |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## Course Content

### **Unit I Indian Statistical System (L-11hrs; T-1hr)**

**Indian Statistical System-** Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications.

### **Unit II Economic Statistics (L-11hrs; T-1hr)**

**Economic Statistics-**Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data.

### **Unit III Index numbers (L-11hrs; T-1hr)**

**Index numbers:** Basic problems in construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives-Chain base method. Criteria of goodness-Unit test , Time Reversal Factor Reversal and Circular tests. Base Shifting, Splicing and deflating index numbers. Wholesale and Consumer price index numbers. Index of industrial production.

### **Unit IV Time Series (L-11hrs; T-1hr)**

**Time Series:** Measurement of Trend : Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Measurement of Seasonal variation by Ratio-to-Moving average method.

### **Unit V Demand Analysis (L-11hrs; T-1hr)**

**Demand Analysis-** Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand. Types of data required for estimating elasticity. Methods of estimating demand functions: Leontief 's and Pigou's methods. Engel's law and Engel's curves. Pareto's law of law of income distribution. Utility function.

Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour and not to be included in the External Examination question paper).

### **Recommended Text**

1. Gupta S.C. and Kapoor V.K. (2007), *Fundamentals of Applied Statistics*, 4<sup>th</sup> edition, Sultan Chand & Sons Publishers, New Delhi, 2007.
2. Gupta S.P., *Statistical Methods*, Sultan Chand & Sons Publishers, New Delhi, 2011.
3. Spyros Makridakis, Steven C. Wheelwright and Rob J. Hyndman, *Forecasting Methods and Applications*, 3<sup>rd</sup> Edition, John Wiley and Sons Inc., 2003.
4. Websites of Government of India – Ministry of Statistics & Programme Implementation.

### **Reference Books**

1. Spyros Makridakis, Steven C. Wheelwright and Rob J. Hyndman, *Forecasting Methods and Applications*, 3<sup>rd</sup> Edition, John Wiley and Sons Inc., 2003.
2. Irving W. Burr, *Applied Statistical Methods*, Academic Press, 1974.

### **Website and E-learning Sources**

e-books, tutorials on MOOC/SWAYAM courses on the subject.

**Part-IV B.Sc. Statistics / Semester – IV / Skill Enhancement Course SEC 5  
(DSC): DATABASE MANAGEMENT SYSTEMS LAB (U23ST4SP1)**

|  |                           |
|--|---------------------------|
| <b>Lecture Hours</b> : -               | <b>Tutorial Hours</b> : - |
| <b>Practical Hours</b> : 30            | <b>No. of Credits</b> : 2 |
| <b>Contact Hours per Semester</b> : 30 |                           |
| <b>Contact hours per Week</b> : 2      |                           |
| <b>Internal Marks</b> : -              |                           |
| <b>External Marks</b> : 50             |                           |
| <b>Total Marks</b> : 50                |                           |

**Objectives of the Course**

The main objectives of this Course are

- to learn and practice SQL commands and PL/SQL statements in MYSQL.

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the Course, the students should be able to

- CO1** learn the commends for creating and manipulating the databases.
- CO2** construct queries for retrieval of required data from database.
- CO3** understand views, sequences and synonyms concepts of SQL.
- CO4** learn the functions, procedures, triggers and exception handling in SQL.
- CO5** develop GUI based application for storage and retrieval of data.

**CO – POs and PSOs Mapping (Course Articulation Matrix)**

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 2           | 3           |
| <b>CO3</b>   | 3          | 3          | 3          | 2          | 3          | 3          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 2          | 3          | 2          | 3          | 3          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 15         | 14         | 13         | 12         | 15         | 12         | 15          | 14          | 14          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3       | 100        | 93.3       | 86.7       | 80         | 100        | 80         | 100         | 93.3        | 93.3        |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## **List of Practicals**

1. SQL-DDL commends (Create, Drop, Alter, Truncate, Rename).
2. SQL-DML Commands (Insert, Select, Update, Delete).
3. SQL-TCL Commands (Commit, Rollback, Save point).
4. SQL-Built-in functions.
5. SQL-Nested Queries.
6. SQL-Joins.
7. SQL-Views, Sequence and Synonyms.

(All the practicals are compulsory.)

**Part-IV B.Sc. Statistics / Semester – IV / Skill Enhancement Course SEC 6  
(DSC): DATA ANALYSIS USING STATISTICAL SOFTWARE  
(U23ST4SP2)**

|  |                           |
|--|---------------------------|
| <b>Lecture Hours</b> : -               | <b>Tutorial Hours</b> : - |
| <b>Practical Hours</b> : 30            | <b>No. of Credits</b> : 2 |
| <b>Contact Hours per Semester</b> : 30 |                           |
| <b>Contact hours per Week</b> : 2      |                           |
| <b>Internal Marks</b> : -              |                           |
| <b>External Marks</b> : 50             |                           |
| <b>Total Marks</b> : 50                |                           |

**Objectives of the Course**

The main objectives of this Course are

- to train the students in
- SPSS and to solve computational problems that they may have to solve in their professional life.

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the Course, the students should be able to

- CO1** recall the formulas using the fundamentals of SPSS.
- CO2** understand the SPSS formulas and tools.
- CO3** apply the statistical concepts in SPSS tools.
- CO4** analyse the statistical concept using SPSS tool.
- CO5** experiment the parametric and non-parametric tests using SPSS tool.

**CO – POs and PSOs Mapping (Course Articulation Matrix)**

|  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|--|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 3           | 3           |
| <b>CO2</b>   | 3          | 3          | 3          | 3          | 2          | 3          | 2          | 3           | 2           | 3           |
| <b>CO3</b>   | 3          | 3          | 3          | 2          | 3          | 3          | 2          | 3           | 3           | 3           |
| <b>CO4</b>   | 2          | 3          | 2          | 3          | 3          | 3          | 3          | 3           | 3           | 3           |
| <b>CO5</b>   | 3          | 3          | 3          | 2          | 2          | 3          | 3          | 3           | 3           | 2           |
| <b>Total Contribution of COs to POs and PSOs</b>         | 14         | 15         | 14         | 13         | 12         | 15         | 12         | 15          | 14          | 14          |
| <b>Weighted percentage of Course Contribution to POs</b> | 93.3       | 100        | 93.3       | 86.7       | 80         | 100        | 80         | 100         | 93.3        | 93.3        |

**0-No Correlation**

**1-Weak**

**2-Moderate**

**3-Strong**

## List of Practicals

1. Data Entry.
  2. Construction of frequency table and Histogram.
  3. Construct the measures of central tendency.
  4. Measures of dispersion.
  5. Calculation of coefficient of simple linear correlation and Karl Pearson's coefficient of correlation.
  6. Simple linear regression and multiple linear regression.
  7. Chi-Square Test
  8. Hypothesis test for the Population mean
  9. Non parametric test one sample (Sign test Kolmogorov –Smirnov test.).
  10. Non parametric test for two sample problems – Mann-Whitney U test and Wilcoxon's signed – rank test.
  11. Compute analysis of variance in one way and two way classifications, CRD, RBD, LSD.
- (All the practicals are compulsory.)