1. Name of the Programme:

Annamalai University offers a five year M. Sc. Degree Programme (Semester Pattern) in Statistics with provision for a research project in the fifth year. The term ‘credit’ is used to describe the quantum of syllabus for various programmes in terms of hours of study. Core courses are a set of compulsory courses required for each programme. The minimum credit requirement for five year Masters Programme in Statistics is 225.

2. Eligibility for admission:
Candidates for admission to the First year of the 5-Year Integrated M.Sc. Statistics Degree Programme shall be required to have passed in higher Secondary Course examinations (HSC) (10+2 level) or equivalent thereto with a minimum of 50% marks in any one of the following three combinations.
1. Maths, Physics, Chemistry and Biology
2. Maths, Physics, Chemistry and Computer Science
4. Economics, Statistics, Commerce and Accountancy

3. Duration of the programme:

The five year Programme for the degree of Master of Science in STATISTICS shall consists of Ten semesters, two semesters in every year.

The academic year shall be divided into two semesters, the odd semesters being from July to November and the even semesters from December to April. The University examinations (end semester examinations) in the odd semesters shall be conducted in November and the even semesters examinations shall be conducted in May. A candidate who does not pass the examination in any course(s) of the current semester will be permitted to reappear in such course(s) that will be held in May or November in the subsequent semesters/years.

4. Course Features:

The programme consists of languages, ancillary courses, core courses (CC) and elective courses (EC) distributed among the ten semester periods. The core courses include theory, practical and project work, seminar, project report and viva voce examination.

5. Grading System:

The term grading system indicates a 10-point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

6. Structure of the Programme:
The Masters Programme will consist of:

i. Languages in the first four semesters.
ii. Two ancillary courses on Mathematics in first and second semesters and two ancillary courses on Demography in third and fourth semesters.
iii. Core courses which are compulsory for all students.
iv. Elective courses which students can choose from amongst the courses offered by the other departments of the same faculty as well as by the departments of other faculties of the University or within the Department.
v. Dissertation / Project Work / Practical training / Field work, which can be done in an organization (Government, Industry, Firm, Public Enterprise etc.) approved by the concerned department.
7. Attendance:

Every teaching faculty handling a course shall be responsible for the maintenance of attendance Register for candidates who have registered for the course.

The teacher of the course must intimate the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

Each student should earn 75% attendance in the courses of the particular semester failing which he or she will not be permitted to sit for the End-Semester Examination. The student has to repeat the semester in the next year.

8. Examinations:

The internal assessment for each course theory papers carries 25% marks and is based on two sessional tests and a variety of assessment tools such as seminar and assignment and that for practical examination carries 40% marks. The pattern of question paper will be decided by the respective department. The tests are compulsory.

For internal assessment, the break-up shall be as follows:

<table>
<thead>
<tr>
<th>Theory</th>
<th>Internal Marks</th>
<th>Practical</th>
<th>Internal Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-I</td>
<td>15</td>
<td>Test-I</td>
<td>15</td>
</tr>
<tr>
<td>Test-II</td>
<td>15</td>
<td>Test-II</td>
<td>15</td>
</tr>
<tr>
<td>Seminar and</td>
<td>10</td>
<td>Viva and</td>
<td>10</td>
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<tr>
<td>Assignment</td>
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<td>Record</td>
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</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>Total</td>
<td>40</td>
</tr>
</tbody>
</table>

There will be one End Semester Examination with 75% marks for theory and 60% for practical. The pattern of question paper for theory examination is common for the entire faculty and will be decided by the respective faculty.

9. Evaluation of dissertation:

The dissertation shall be evaluated as follows

- Internal assessment by the Research supervisor: 25 Marks
- Valuation of Dissertation: 50 Marks
- Viva-Voce Examination: 25 Marks

10. Marks and Grading:

A student cannot repeat the assessment of Sessional Test-I and Sessional Test-II. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the head of the Department.

A minimum of 50 % marks in each course is prescribed for a pass. A student has to secure 50% minimum in the end semester examination.

If a candidate who has not secured a minimum of 50% marks in a course shall be asked to reappear for the exam for that specific course.

The student can repeat the End Semester Examination when it is offered next in the subsequent Odd / Even Semesters.
11. Grading:

A ten point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master’s Programme.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Grade Points</th>
<th>Letter Grade</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 and above</td>
<td>10</td>
<td>S</td>
<td>Exemplary</td>
</tr>
<tr>
<td>85-89</td>
<td>9.0</td>
<td>D+++</td>
<td>Distinction</td>
</tr>
<tr>
<td>80-84</td>
<td>8.5</td>
<td>D++</td>
<td>Distinction</td>
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<tr>
<td>75-79</td>
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<tr>
<td>70-74</td>
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<td>65-69</td>
<td>7.0</td>
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<tr>
<td>60-64</td>
<td>6.5</td>
<td>A+</td>
<td>First Class</td>
</tr>
<tr>
<td>55-59</td>
<td>6.0</td>
<td>B</td>
<td>Second Class</td>
</tr>
<tr>
<td>50-54</td>
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<tr>
<td>49 or Less</td>
<td>RA</td>
<td>Reappear</td>
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</tr>
</tbody>
</table>

The successful candidates are classified as follows.

I – Class 60% marks and above in overall percentage of marks (OPM).

II – Class 50-59% marks in overall percentage of marks.

Candidates who obtain 75% and above but below 89% of marks (OPM) and above 90% (OPM) shall be deemed to have passed the examination in FIRST CLASS with Distinction and exemplary respectively provided he/she passes all the courses prescribed for the programme at the first appearance.

12. Course-Wise Letter Grades:

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade. A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA. A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

A letter grade RA in any course implies a failure in that course. The RA Grade once awarded stays in the grade card of the student and will not be deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

If a student secures RA grade in the Project Work / Field Work / Practical Work / Dissertation, he/she shall improve it and resubmit if it involves only rewriting by incorporating the clarifications as per the suggestions of the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours/Week</th>
<th>Marks</th>
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<tr>
<td>19ITAC11</td>
<td>Language-I: Course 1</td>
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<tr>
<td>19IENC12</td>
<td>Language-II: Course 1</td>
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<tr>
<td>19ICEC13</td>
<td>Civics, Environmental and Health Sciences</td>
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<tr>
<td>19ISTC14</td>
<td>Core 1: Descriptive Statistics</td>
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<tr>
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<td>Ancillary-I: Mathematics – I</td>
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<td>Computer Applications – I</td>
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<td>Ancillary-I: Mathematics – II</td>
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<td>3</td>
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<td>19IENC32</td>
<td>Language-II: Course 3</td>
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<tr>
<td>19ISTC33</td>
<td>Core 4: Basic Probability Theory</td>
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<td>5</td>
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<tr>
<td>19ISTC34</td>
<td>Core 5: Introduction to C++</td>
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<td>Core 6: Statistics Practical – I</td>
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<td>Ancillary-II: Demography – I</td>
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<td>Core 8: Statistics Practical – II</td>
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<td>19ISTC51</td>
<td>Core 9: Sampling Techniques</td>
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<td>19ISTC52</td>
<td>Core 10: Statistical Methods For Data Analysis</td>
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<td>Core 11: Statistical Inference</td>
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<td>5</td>
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<td>19ISTC54</td>
<td>Core 12: Elements of Quality Control</td>
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<td>Core 13: Statistics Practical – III</td>
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<tr>
<td>19ISTC61</td>
<td>Core 14: Experimental Designs</td>
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<td>19ISTC62</td>
<td>Core 15: Official and Applied Statistics</td>
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<td>19ISTC63</td>
<td>Core 16: Econometrics</td>
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<td>19ISTC64</td>
<td>Core 17: Optimization Techniques</td>
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<td>Core 18: Statistics Practical – IV</td>
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<td><strong>Total Credits</strong></td>
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| Semester-VII |  |  |  |  |  |
|--------------|------------------|----------|----------|----------|
| 19ISTC71     | Core 19: Linear Algebra and Matrix Theory | 4 | 4 | 25 | 75 | 100 |
| 19ISTC72     | Core 20: Measure and Probability Theory | 4 | 4 | 25 | 75 | 100 |
| 19ISTC73     | Core 21: Sampling Theory | 4 | 4 | 25 | 75 | 100 |
| 19ISTP74     | Core 22: Statistics Practical-V | 6 | 3 | 40 | 60 | 100 |
| 19ISTP75     | Core 23: Statistics Practical-VI | 6 | 3 | 40 | 60 | 100 |
| **Elective 1: Interdepartmental Elective** | 3 | 3 | 25 | 75 | 100 |
| **Total Credits** | 21 |  |  |  |  |

| Semester-VIII |  |  |  |  |  |
|---------------|------------------|----------|----------|----------|
| 19ISTC81     | Core 24: Distribution Theory | 4 | 4 | 25 | 75 | 100 |
| 19ISTC82     | Core 25: Estimation Theory | 4 | 4 | 25 | 75 | 100 |
| 19ISTC83     | Core 26: Statistical Quality Control and Reliability | 4 | 4 | 25 | 75 | 100 |
| 19ISTP84     | Core 27: Statistics Practical-VII | 6 | 3 | 40 | 60 | 100 |
| 19ISTP85     | Core 28: Statistics Practical-VIII | 6 | 3 | 40 | 60 | 100 |
| **Elective 2: Interdepartmental Elective** | 3 | 3 | 25 | 75 | 100 |
| **Elective 3: Department Elective** | 3 | 3 | 25 | 75 | 100 |
| **Total Credits** | 24 |  |  |  |  |

| Semester-IX  |  |  |  |  |  |
|---------------|------------------|----------|----------|----------|
| 19ISTC91     | Core 29: Testing of Statistical Hypotheses | 4 | 4 | 25 | 75 | 100 |
| 19ISTC92     | Core 30: Multivariate Statistical Analysis | 4 | 4 | 25 | 75 | 100 |
| 19ISTC93     | Core 31: Operations Research | 4 | 4 | 25 | 75 | 100 |
| 19ISTC94     | Core 32: Programming in R | 4 | 4 | 25 | 75 | 100 |
| 19ISTP95     | Core 33: Statistics Practical-IX | 6 | 3 | 40 | 60 | 100 |
| 19ISTP96     | Core 34: Statistics Practical-X | 6 | 3 | 40 | 60 | 100 |
| **Elective 4: Interdepartmental Elective** | 3 | 3 | 25 | 75 | 100 |
| **Elective 5: Department Elective** | 3 | 3 | 25 | 75 | 100 |
| **Total Credits** | 28 |  |  |  |  |

<p>| Semester-X   |  |  |  |  |  |
|---------------|------------------|----------|----------|----------|
| 19ISTC101    | Core 35: Design and Analysis of Experiments | 4 | 4 | 25 | 75 | 100 |
| 19ISTC102    | Core 36: Stochastic Processes | 4 | 4 | 25 | 75 | 100 |
| 19ISTP103    | Core 37: Statistics Practical – XI | 6 | 3 | 40 | 60 | 100 |
| 19ISTP104    | Core 38: Statistics Practical – XII | 6 | 3 | 40 | 60 | 100 |
| 19ISTD05     | Project (Dissertation and Viva-Voce/in plant training) | 12 | 6 | 25 | 75 | 100 |
| <strong>Total Credits</strong> | 20 |  |  |  |  |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours/week</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>19STAE806-1</td>
<td>Programming with C++</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>19STAE806-2</td>
<td>Applied Regression Analysis</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>19STAE907-1</td>
<td>Java and Oracle Programming</td>
<td>3</td>
<td>-</td>
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<tr>
<td>19STAE907-2</td>
<td>Advanced Econometrics</td>
<td>3</td>
<td>-</td>
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<td>19STSE815.1</td>
<td>Statistical Methods</td>
<td>3</td>
<td>-</td>
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<tr>
<td>19STSE815.2</td>
<td>Mathematical Statistics</td>
<td>3</td>
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<td>19STSE915.1</td>
<td>Bio Statistics</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:**
1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available.
2. Students may opt for any Value-added Course listed in the University website.

### Elective Courses

**Department Electives (DE)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours/week</th>
<th>Marks</th>
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</thead>
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<tr>
<td></td>
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<td>Programming with C++</td>
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<td>Applied Regression Analysis</td>
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<td>Java and Oracle Programming</td>
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<td>Statistical Methods</td>
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<tr>
<td>19STSE915.1</td>
<td>Bio Statistics</td>
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</tbody>
</table>

**Interdepartmental Electives (IDE)**

**VALUE ADDED COURSE FOR INTERDISCIPLINARY STUDENTS**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours/week</th>
<th>Marks</th>
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</tr>
<tr>
<td>VAC</td>
<td>Statistical Methods for Data Analysis</td>
<td>3</td>
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</tr>
</tbody>
</table>
Programme Objectives

This Master Degree programme in Statistics (M.Sc., (Integrated) (Statistics)) has been designed according to the latest requirements of statistical data analysis. Initially, it provides courses on languages for four semesters, two courses on basic mathematics for first two semesters as ancillary courses and two courses on demography in third and fourth semesters as ancillary courses. Subsequently the various statistical theory and methods such as probability models, distributions, sampling techniques, estimation methods, hypothesis testing, multivariate techniques of data analyses, statistical quality control, stochastic modeling and optimization techniques are included with latest updation. Further the latest computer languages such as C++, R, Java programming are included and practical sessions are allotted to have training on various statistical softwares that includes SPSS, SAS, SYSTAT, STATGRAPH. The students are well equipped to enable to analyze the data statistically and interpret them with their self confidence.

Programme Outcomes

PO1: The students will gain knowledge in the concepts of statistical methods and models
PO2: The students will be trained for data collection on various fields of survey enabling them to classify and analyze them statistically.
PO3: Students will be familiarized in C++ and R programming languages and various statistical softwares.
PO4: The students will be able to solve any problems in data relating to industrial applications to maintain the quality and improvement of the manufactured product.
PO5: The students will be able to formulate any kind of design problems for application in the field of laboratory and agricultural field experiments.

Programme Specific Outcomes

At the end of the programme, the student will be able to

PSO1: Understand mathematical statistical and computer software concepts.
PSO2: Prepare programs using the C++ and R languages.
PSO3: Utilize the appropriate distributions on their problems, applying probability in real life problems and able to estimate the parameters based on the knowledge gained.
PSO4: Apply various multivariate data analyses using statistical softwares.
PSO5: Apply SQC techniques which will be faced in industrial applications.
PSO6: Analyze the data on agriculture field experiments using various types of designs they learned.
### Outcome Mapping

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semester-I  19ITAC11 – தமிழ் கல்வியானர் பாணி Credits:3  Hours:3

இலகிய முதலில் இரண்டு பிரிவுகளாக முதலில் அறிக்கை விளக்கம். பின்னர் இலகியாக முதலில் இலகியம் வளர்ச்சி - முதலில் இலகியாக ஒதுக்கி - நான்கு இலகியாக வளர்ச்சி - முதலில் இலகியாக ஒதுக்கி - பின்னர் இலகியாக ஒதுக்கி - பின்னர் வளர்ச்சி வளர்ச்சியின் விளக்கம்.

பாடல்கள் இலகியாக செய்யப்பட்ட விளக்கத்தைக் கூறி விளக்கம்.

அகுதி - 1 நேரடி

1. பாரதியா பாரதியாகப் பாத்திரமாயிற்று - பங்கும் தலங்கு விளக்கம்
2. பாரதிதாசப் பாரதிதாசப் பாத்திரமாயிற்று - மணிவாசகா் பதிப்பு
3. பிரமணிய மணிவாசகா் பதிப்பு
4. சத்தசமிதாதசமிதி - மணிவாசகா் பதிப்பு
5. அராபியா தமிழ் பாதுகாப்பு (18ம் 20 மணிக்கு)

அகுதி - 2 முன்னாண்கள்

1. பாரதியா பாரதியாகப் பாத்திரமாயிற்று - பங்கும் தலங்கு விளக்கம்
2. பாரதிதாசப் பாரதிதாசப் பாத்திரமாயிற்று - மணிவாசகா் பதிப்பு
3. சத்தசமிதாதசமிதி - மணிவாசகா் பதிப்பு

அகுதி - 3 நாடகங்கள்

1. இலா எனினை - பங்கும் தலங்கு விளக்கம்

அகுதி - 4 முடிவு

1. என்பது அல்லது - முடிவு

அகுதி - 5 தினசரி நாடகம்

தினசரி நாடகம் முடியும் குலாகம் - முதலில் தினசரிக் கல்வியானர் முதலில் கல்வியானர் - முதலில் கல்வியானர் முதலில் கல்வியானர் - முதலில் கல்வியானர் முதலில் கல்வியானர் - முதலில் கல்வியானர் முதலில் கல்வியானர் - முதலில் கல்வியானர் முதலில் கல்வியானர் - முதலில் கல்வியானர் முதலில் கல்வியானர். பாடல்கள்:

1. பாரதியா - பாரதியாகப் பாத்திரமாயிற்று, நான்கு ஒரு முதலில் முடியும், முடியும்
2. பாரதிதாச - பாரதிதாசப் பாத்திரமாயிற்று, மணிவாசகா் பதிப்பு
3. சத்தசமிதாதச - சத்தசமிதாதசப் பாத்திரமாயிற்று, மணிவாசகா் பதிப்பு
4. பிரமணிய பிரமணிய பாத்திரமாயிற்று - மணிவாசகா் பதிப்பு
5. இலா எனினை - பங்கும் தலங்கு விளக்கம் மணிவாசகா் பதிப்பு, முடியும் விளக்கம்
Learning Objectives: By introducing the course, it is intended to:

- LO1: Develop the Language ability of the students
- LO2: Enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing
- LO3: Make the students proficient in the four language skills
- LO4: Make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice
- LO5: Develop their inquiry skill

Unit-1
Stephen Leacock  “With the Photographer”
Winston S. Churchill  “Examinations”
Grammar: Introduce the Parts of speech Nouns, Verbs, Adjectives, and Adverbs

Unit-2
G.B. Shaw  “Spoken English and Broken English”
M.K. Gandhi  “Voluntary Poverty”
Grammar: Articles

Unit-3
Robert Lynd  “On Forgetting”
Virginia Woolf  “Professions for Woman”
Grammar: Pronouns

Unit-4
A. G. Gardiner  “On Umbrella Morals”
R.K. Narayan  “A Snake in the Grass”
Grammar: Prepositions

Unit-5
Martin Luther King (Jr.)  “I Have a Dream”
George Orwell  “The Sporting Spirit”
Grammar: Conjunctions & Interjections
Course Outcomes:

At the end of the course, the students will be able to:

CO1: Competency in communication both in written and oral skills
CO2: Fluency in the English language
CO3: Knowledge about construction of sentence structures
CO4: English Vocabulary to use the English language effectively
CO5: Proficiency in the four communication skills

Semester-I 19ICEC13 - Civics, Environmental And Health Sciences Credits:3

(A) Civics Hours:3

Unit–1 Introduction
Indian Constitution, Preamble – Basic Features – Citizenship – Fundamental Rights – Fundamental Duties.

Unit–2 Political System

Book for Study and Reference:-
3) R.C. Agarwal, Indian Political System. New Delhi, S. Chand & Company, 2000

B) Environmental Sciences

Unit–1 Ecosystems :

Unit–2 Environment

Books for Study and Reference:

(C) Health Sciences

Unit–1
Physical Health – Introduction to health – Food, Meaning of balanced diet, Sources, Common nutritional deficiencies and prevention.

Personal Health – Cleanliness of body, Care of Skin, Nails, Eye, Hair, Oral Health, Clothing, Body Posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc.
Population explosion and Family Planning – Importance, Common Methods of family planning for Men & Women.
Mothers and Children – Immunisation of children (importance, schedule) care of mothers during pregnancy and after delivery.
Communicable Diseases – Symptoms and prevention.

Unit–2

Book for Study and Reference:-

Semester-I 19ISTC14 - Descriptive Statistics Credits:5 Hours:5

Learning Objectives: To emphasis and enchance the basic statistical knowledge of the fresh students.

Unit–1
Introduction; Origin and Scope of Statistics; Definition of Statistics; Functions of Statistics; Applications of Statistics; Limitations of Statistics; Various types of Data; Nominal, Ordinal, Ratio Scale and Interval; Primary and Secondary Data; Methods of Collecting Primary Data; Drafting the questionnaire.

Unit–2
Classification of Statistical Data - Object of classification; Types of Classification; Formation of a Discrete Frequency Distribution; Formation of Continuous Frequency Distribution; Tabulation of data; Diagrammatic presentation of data; Graphs of Frequency Distribution; Histogram; Frequency Polygon; Ogives.

Unit–3
Univariate measures - Measures of Central Tendency; OBJECTIVESs of Averaging; Requisites of a Good Average; Mean; Median; Mode; Geometric Mean; Harmonic Mean; Computation of Quartiles; Percentiles; Measures of Dispersion –Range; Mean Deviation; Standard Deviation; Co-efficient of Variation – Lorenz curve.

Unit–4
Moments – non-central moments; Central moments; Relationship between non-central and central moments; Measures of skewness; Karl Pearson’s coefficient of skewness ; Bowley’s co-efficient of skewness ; Measures of Kurtosis ; Types of Kurtosis.

Unit–5
Bi-variate measures – Scatter diagram Correlation; Types of Correlation; Methods of studying correlation; Karl Pearson’s coefficient of correlation; Properties of coefficient of correlation; Rank correlation coefficient; Regression; regression equations; types of regression; uses of regression.

Book for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Study the basic concepts of statistics and data.
CO2: Have knowledge on various diagrams and graphs.
CO3: Calculate various measures of averages and dispersion.
CO4: Study the various measures of skewness and kurtosis.
CO5: Study the measures of bivariate data.

Semester-I

Learning Objectives: To build the basis knowledge on series, matrices and differentiation.
Unit – 1
Series, Comparison test, Integral test, Comparison of ratios, D’Alembert’s ratio test, Cauchy’s root test, Alternating series, Convergence of exponential series, Uniform convergence.

Unit – 2
Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

Unit - 3
Expansion of \( \sin n\theta \), \( \cos n\theta \), \( \tan n\theta \) in powers of \( \sin \theta \), \( \cos \theta \) and \( \tan \theta \), Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

Unit - 4
Differentiation, Successive differentiation, Meaning of derivative.

Unit – 5
Maxima and minima, Rolle’s theorem and Mean value theorem, Expansions of functions, Partial differentiation.

Text Book:
   Unit I Chapter 9 Sections 9.3 to 9.17 except 9.14
   Unit II Chapter 2 Sections 2.5 to 2.9 and 2.14 to 2.17
   Unit III Chapter 19 Section 19.6 to 19.11
   Unit IV Chapters 2, 3 and 4
   Unit V Chapters 5, 6, 7 and 8 (Sections 1.1 to 1.7)

Book for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Study the series of number system.
CO2: Understand the various the matrix operations and types.
CO3: Study the trigonometric and hyperbolic functions.
CO4: Understand the differentiations methods.
CO5: Study the maximum and minimum.

Semester-II
19 ITAC 21 – பதிப்பு மையியல் பொருளியல்
Credits:3
Hours:3

விளக்கம்: குறிப்பிட்டு பல்வேறு பொருளியல்வகைகள் நூற்றாண்டுகளுள்ள அறிஞர் கூட் விளக்கம். பல்வேறு பொருளியல்வகைகளின் காரணங்கள் - பயன்பாடு - குறிப்பிட்டு கருத்துக்கான தொடர்பு பொருள் பயன்பாடு காரணம் குறிப்பிட்டு மட்டும் என்று பெருக்கும். பொருளியலியலாயிய அளவு விளக்கம் விளக்கம் செய்யும் குறிப்பிட்டு பல்வேறு பொருள் விளக்கம்

அலு - 1
1. பதிப்பு மையியல் - குறிப்பிட்டு மையியல் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)
2. குறிப்பிட்டு மையியல் (முலக்கூறு 5 மரப்புவரை)
3. நூற்றாண்டுகள் (முலக்கூறு 5 மரப்புவரை)

அலு - 2
1. பதிப்பு மையியல் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)
2. நூற்றாண்டுகள் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)

அலு - 3
1. பதிப்பு மையியல் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)
2. நூற்றாண்டுகள் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)

அலு - 4
1. பதிப்பு மையியல் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)
2. நூற்றாண்டுகள் - மூலக்கூறு மையியல் (முலக்கூறு 5 மரப்புவரை)

அலு - 5
பல்வேறு பொருளியலியல் வகைகள் - மூலக்கூறு மையியல் பயன்பாடு - காரணம் காரணம் வைத்து வேண்டும் பயன்பாடு. மூலக்கூறு மையியல் பயன்பாடு மூலக்கூறு மையியல் - பயன்பாடு பயன்பாடு மூலக்கூறு மையியல் பயன்பாடு - பயன்பாடு பயன்பாடு மூலக்கூறு மையியல் பயன்பாடு - பயன்பாடு பயன்பாடு - மூலக்கூறு மையியல்

முன்னோடி:
1. தவுண்டுகள் மையியல் பயன்பாடு - பயன்பாடு பயன்பாடு பயன்பாடு, விளக்கம் (முலக்கூறு 5 மரப்புவரை).
2. தவுண்டுகள் மையியல் பயன்பாடு - பயன்பாடு பயன்பாடு பயன்பாடு, விளக்கம் (முலக்கூறு 5 மரப்புவரை).
Semester-II  
19IENC22 – English Through Literature – II (Poetry)  
Credits:3  
Hours:3

Learning Objectives: By introducing the course, it is intended to:

LO1: Develop the ability of the learner to comprehend and appreciate poems in English
LO2: Enhance the competence of the learner in using the English language
LO3: Improve the interest of the learner in human values and perceptions
LO4: Enable students to study and analyze the use of language in poetry
LO5: Provide learners with the theoretical and practical understanding of grammar

Unit-1
William Shakespeare “Sonnet 116”
William Blake “Lamb”
Robert Burns “A Red, Red Rose”
Grammar Finite & Non-finite verbs

Unit-2
PB Shelley “To Wordsworth”
John Keats “Sonnet to Sleep”
Thomas Hardy “Neutral Tones”
Grammar Strong and Weak Verbs, Auxiliaries and Modals

Unit-3
Robert Frost “Stopping By Woods on a Snowy Evening”
Wilfred Owen “Anthem for Doomed Youth”
Emily Dickinson “A Narrow Fellow in the Grass”
Grammar Transitive, Intransitive Verbs, Active and Passive Voice

Unit-4
Sri Aurobindo “The Tiger and the Deer”
AK Ramanujan “Obituary”
Sarojini Naidu “Queen’s Rival”
Grammar Concord
Unit-5

Roger Mc Gough
“My Bus Conductor”
Maya Angelou
“Still I Rise”
Langston Hughes
“The Negro Speaks of Rivers”

Grammar
Tenses and their forms

Supplementary Reading


Course Outcomes

At the end of the course, the student will be able to

CO1: Competency in communication, both in written and oral skills
CO2: Fluency in English language
CO3: Knowledge about construction of sentence structures
CO4: Vocabulary to use the English language effectively
CO5: Acquire the aesthetic sense for appreciating poetry

Semester-II

19ICAC23 - Computer Applications-I

Credits: 3
Hours: 3


Unit – 1

Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output divices, data storage divices, software, the definition, the role of software, house keeping.

Unit – 2

The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software. Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, brawsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – 3

Introduction to internet, client server basics, E-mail, Telnet and Archie, FTR – Gopher, Jughead and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – 4

Issues involved in web site management, addressing, designing web sites with front page.

Unit – 5

Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies, fundamental and use of hypertext, hypermedia, sound, images, animation, video. Using multimedia, multimedia interface, planning and development of multimedia projects.
Book for Study and Reference:-

Semester-II 19ISTC24 - Real Analysis And Matrices Credits:5
Hours:5

Learning Objectives: To build the basis for promoting the aspects of Statistics.

Unit–1
Function; Real valued function; Equivalence; Countability; Real numbers; Least upper bounds; Sequence of Real numbers; Definition of sequence and subsequence; Limit of a sequence. Convergent sequence; Divergent sequence Bounded sequence; Monotone sequence; Operations on convergent sequences.

Unit–2
Series of real numbers; Convergence and divergence; series with non negative terms; Alternating series; Conditional convergence and absolute convergence; Rearrangements of series; Tests of absolute convergence; Series whose terms form a non increasing sequence.

Unit–3
Limits and uniform Continuity; Metric spaces; Limits in metric spaces; Function of metric spaces; Uniform continuity; differentiability and integrability.

Unit–4
Algebra of matrices: Transpose of a matrix; Determinant of a matrix; Adjoint of a matrix; Use of inverse of a matrix to solve system of linear equation; Rank of a matrix and its properties. Orthogonal and unitary matrices; Problems.

Unit–5
Characteristic equation; eigen values; eigen vectors; Simple properties; Cayley - Hamilton theorem; Verification of the theorem; Finding the inverse of matrix using Cayley - Hamilton theorem.

Book for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the sequence of real numbers and related results.
CO2: Understand the series of real numbers and related results.
CO3: Study the limits and continuity.
CO4: Understand the operations of matrix algebra.
CO5: Solve problems of linear homogeneous equations.
Semester-II  19ISTA25 - Ancillary-I : Mathematics–II  Credits:4
Hours:4

Learning Objectives: To build the basis knowledge on integration.

Unit - 1 Integration
  Introduction, Definite integral, Methods of integration, Integrals of the form
  (i) \[ \int \frac{f'(x)}{f(x)} \, dx \]  \hspace{1cm} (ii) \[ \int f'(x)f(x) \, dx \]  \hspace{1cm} (iii) \[ \int \frac{dx}{a^2 + bx + c} \]
  (iv) \[ \int e^{ax} \, dx \]  \hspace{1cm} (v) \[ \int \cos^n x \, dx \]  \hspace{1cm} (vi) \[ \int \sin^n x \, dx \]

Unit - 2 Integration
  Properties of definite integrals, Integration by parts, Reduction formula for the following types
  (i) \[ I_n = \int x^n e^{ax} \, dx \]  S n→+ve integer \hspace{1cm} (ii) \[ I_n = \int \cos^n x \, dx \]  n. positive integer
  (iii) \[ I_n = \int \sin^n x \, dx \]  \hspace{1cm} (iv) \[ I_{mn} = \int \sin^n x \cos^m x \, dx \]  Bernoulli’s formula.

Unit - 3
  Area under plane curves, Area of a closed curves, Area between two intersecting curves,
  Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of
  revolution.

Unit – 4
  Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector,
  Differentiations formulas, Differentiation of dot and cross products, The Vector differential operator
  Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector,
  Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

Unit – 5
  Vector integration, The line integral, Green’s theorem in two dimensions-verification, Gauss
  divergence theorem (without proof)-verification and evaluation of integrals, Stoke’s theorem
  (without proof)-verification and evaluation of integrals.

Text Book:
1) Content and treatment as in the book “Calculus (Major)” Vol. II by S. Narayanan and T.K.
   Unit I Chapter 1 Sections 1 to 8
   Unit II Chapter 1 Sections 11 to 15.1
   Unit III Chapter 2 Sections 1.1 to 1.4, Sections 3 to 5
2) Content and treatment as in the book “Vector Calculus and Fourier Series” by M.K.
   Unit IV Chapter 2 Sections 2.2 to 2.4, 2.6, 2.7.
   Chapter 3 Sections 3.2, 3.3, 3.4, 3.7, 3.9, 3.11, 3.12, 3.15.
   Unit V Chapter 4 Sections 4.1, 4.3, 4.9 and 4.12

Book for Study and Reference:-
1) G.B.Thomas, R.L.Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edn, Mass,
   (Indian Print, 1998.
3) P. R.Vittal, Vector Calculus, Fourier series and Fourier Transform, Margham Publications,

Course Outcomes
At the end of the course, the student will be able to
CO1: Solve exercise of integration of type I
CO2: Solve exercise of integration of type II
CO3: Understand the plane curves
CO4: Solving problems of vector differentiations.
CO5: Solving problems of vector integrations.
Semester-III

19ITAC31 - அறிவியல்சான்றுரை
Credits:3
Hours:3

Learning Objectives: By introducing the course, it is intended to:
LO1: Enhance the conversational competence of the learners by introducing drama in English.
LO2: Make the students understand characteristics of the Elizabethan Age.
LO3: Make the students appreciate Shakespearean drama.
LO4: Make the students learn the key elements of sentence structures
LO5: Make the students master the mechanics of writing

Unit-1
William Shakespeare  
Grammar  
*The Tempest* (Act I)  
“Phrases and Clauses”

Unit-2
William Shakespeare  
Grammar  
*The Tempest* (Act II)  
“Simple, Compound, and Complex Sentences”

Unit-3
William Shakespeare  
Grammar  
*The Tempest* (Act III)  
“Transformation of Sentences”

Unit-4
William Shakespeare  
Grammar  
*The Tempest* (Act IV)  
“Sequence of Tenses and Reported Speech”

Unit-5
William Shakespeare  
Grammar  
*The Tempest* (Act V)  
“Punctuation and Capitals”

Text Books:

Supplementary Reading:

Course Outcomes
At the end of the course, the student will be able to

- CO1: Obtain a literary acumen to answer MCQs of NET/SET Examinations and other competitive examination
- CO2: Appreciate conversational English
- CO3: Recognize the dramatic elements of Shakespearean dramas
- CO4: Use punctuations and capitals effectively in their composition
- CO5: Recognize the elements of the spoken discourses

Semester-III  
19ISTC33 - Basic Probability Theory  
Credits: 5  
Hours: 5

Learning Objectives: To study the basic concepts for promoting theoretical as well as applications of statistics.

Unit-1
Unit–2

Unit–3
Multiple Random Variables: Joint, marginal and conditional distributions- independence of random variables – Transformation of random variables (one and two dimensional) and determination of their distributions.

Unit–4
Mathematical Expectation: Expectation – Properties, Cauchy-Schwartz inequality, conditional expectation and conditional variance – theorems on expectation and conditional expectation. Moment generating function, cumulant generating function, characteristic function, probability generating function and their properties. Tchebychev's inequality.

Unit–5
Limit Theorems: Convergence in probability, weak law of large numbers - Bernoulli's theorem, Khintchine's theorem (Statements only) – Simple form of Central limit theorem for i.i.d random variables.

Book for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Study the various concepts of probability
CO2: Understand a random variables probability functions.
CO3: Study the bivariate probability functions.
CO4: Understand the mathematical expectations and related functions.
CO5: Study the law of large numbers.

Semester-III 19ISTC34 - Introduction To C++ Credits:5
Hours:5

Learning Objectives: To get in depth knowledge in C++ Programming and to write programs effectively for solving any statistical problems.

Unit–1

Unit–2
Functions by Reference. Introduction to Pointers and Structures - File handling. Simple programs need to be written based on above concepts.
Arrays – User defined functions – Calling functions by Value – Calling
Unit–3
Object Orient Programming(OOP): Class – Objects – Member data – Member functions -
Constructors – Destructors – Function overloading – Function overriding – Calling functions
using objects as arguments.

Unit–4
Inheritance – Simple, Multiple and Multi-Level inheritance with public, private and protected
access modifiers. Polymorphism - Virtual functions – Friend functions. Introduction to I/O
streams.

Unit–5
C++ Programs for Statistical Data Analysis:
Formation of frequency distribution – Computation of mean, median, mode, minimum,
maximum, range, quartiles, variance, standard deviation, co-efficient of variation, Fitting of
Binomial and Poisson distributions.

Book for Study and Reference:-
New Delhi.

Course Outcomes
At the end of the course, the student will be able to
CO1: Study the variables and expressions of C++.
CO2: Understand the concepts of pointers and structures.
CO3: Study the objects and functions of C++
CO4: Study the inheritance of C++
CO5: Develop programs related to statistical problems.

Semester-III
19ISTP 35 - Statistics Practical – I
(Calculator Based Practical)
Credits:6
Hours:6

Learning Objectives: To acquire the knowledge of basic statistics in the form computation.

Statistics Practical Schedule:-
Descriptive Statistics
1) Calculation of Mean, Median, Mode, Geometric Mean and Harmonic Mean for raw data.
2) Calculation of Mean, Median and Mode.
3) Calculation of Mean, Median and Mode for frequency distribution with Class Intervals.
4) Calculation of raw and central moments for raw data.
5) Calculation of raw and central moments for frequency distribution.
6) Calculation of range, Quartile Deviation, Standard Deviation, Mean Deviation, Coefficient of
Variation and Variance for raw data.
7) Calculation of range, Quartile Deviation, Standard Deviation, Mean Deviation, Coefficient of
Variation and their relative measures for frequency distribution.
8) Calculation of Pearson’s and Bowley’s Coefficient of Skewness.
9) Calculation of Simple Correlation and Regression coefficients.
10) Forming of Regression Lines and Predictions from Bivariate Data.

Matrices
1) Matrix operations.
2) Inverse of Matrix using adjoint Matrix.
3) Inverse of Matrix using Sweepout Process for a 4X4 Matrix.
4) Solving system of linear equations using matrix method.
5) Solving system of linear equations using Cramer rule.
6) Solving system of linear equations using Gauss Doolite’s Method.
7) Finding the Rank of a Matrix.
Fitting Of Distributions
1) Fitting of Binominal distribution.
2) Fitting of Poisson distribution.
3) Fitting of Normal distribution

Course Outcomes
At the end of the course, the student will be able to
CO1: Calculate variate statistical measures.
CO2: Solve problems of matrices.
CO3: Fit binomial, Poisson and normal distributions.

Semester-III 19ISTA36 - Ancillary-II : Demography-I Credits:4 Hours:4

Learning Objectives: To acquire the knowledge of demographic methods applicable to statistical data analysis.

Unit-1
Population Change and Components of Population Change, Demographic Data and Sources of Demographic Data. Importance of the Quality of Demographic Data in the Formulation of Policies and Programmes. Types of Errors in Different Sources of Demographic Data. Techniques for Evaluation and Adjustment of Demographic Data in Different Sources. Importance of Balancing Equation and Age-Sex Pyramids. Computer Applications in the Evaluation and Adjustment of Demographic Data.

Unit-2

Unit-3

Unit-4
Life Table. Different Types of Life Tables: Cohort Life Table and Period Life Table. Complete Life Table and Abridged Life Table. Different Methods of Construction of Complete Life Table and Abridged Life Table. Mathematical interrelationships of different life table functions and its utility in Mortality Analysis. Uses of Life Tables in Demographic Analysis.

Unit-5

Book for Study and Reference:-
1) R.Ramakumar (1986), Technical Demography
2) K.B.Pathak & F.Ram (2005), The Techniques of Demographic Analysis
3) B.D.Misra (1980)- The Study of Population
Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the basic concepts of demography.
CO2: Study the area of fertility.
CO3: Have thorough knowledge mortality and morbidity.
CO4: Understand the use of life table.
CO5: Have idea on migration concepts.

Semester-IV

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Course Text:


Semester-IV

| 19ITAC41    | சகில கியெசெமாழிவரலா              | Credits:3 | Hours:3 |

Course Text:

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At the end of the course, the student will be able to:

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CO2: Study the area of fertility.
CO3: Have thorough knowledge mortality and morbidity.
CO4: Understand the use of life table.
CO5: Have idea on migration concepts.
### Semester-IV  
**19IENC42 – English Through Literature – IV (Short Story)**  
**Credits: 3**  
**Hours: 3**

**Learning Objectives:** By introducing the course, it is intended to:

- **LO1:** Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing
- **LO2:** Enable the students to know about the origin and development of short story
- **LO3:** Write objectively, avoiding vague, prejudice, and exaggeration
- **LO4:** The broad aim of this course is to enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc
- **LO5:** It also aims at different levels of a short story, such as discovering an author's purpose, drawing conclusions about certain events, evaluating cause and effect, and understanding point of view

**Unit-1**

1. O’ Henry  
   “The Gift of The Magi”
2. Ken Liu  
   “The Paper Menagerie”
   Grammar  
   Synonyms and Antonyms

**Unit-2**

1. Flora Annie Steel  
   “Valiant Vicky”
2. Oscar Wilde  
   “Happy Prince”
   Grammar  
   Words often confused

**Unit-3**

1. R. K. Narayan  
   “The Martyr’s Corner”
2. Mahasweta Devi  
   “Draupati”
   Grammar  
   Paragraph-Writing

**Unit-4**

1. Leo Tolstoy  
   “How much Land Does a Man Need?”
2. Somerset Maugham  
   “The Verger”
   Grammar  
   Letter-Writing
Unit-5
1. Langston Hughes  “On the Road”
2. Premchand “BakthiMarg”
Grammar Precis-Writing

Supplementary Reading:

Course Outcomes
At the end of the course, the student will be able to
- CO1: Use more vocabularies while writing
- CO2: Learner can ensure about the history and development
- CO3: The learner has a development in flow of writing
- CO4: Students can come up with new ideas while reading stories from different perspectives.
- CO5: Write in a style appropriate for communicative purposes

Semester-IV 19ISTC43 - Probability Distributions Credits:5 Hours:5

Learning Objectives: To build probability models for non mathematical forms of real life problems into mathematical forms and emphasize relevance statistical tools to make decision on the real life problems.

Unit–1
Discrete Distributions: One-point distribution, Bernoulli Distribution, Binomial distribution, Poisson distribution, Recurrence relations for probabilities, Geometric distribution. Moments, Moment generating function, Characteristic function, Cumulant Generating Function. Fitting of Binomial and Poisson Distributions.

Unit–2
Negative binomial distribution Hypergeometric distribution, Multinomial distribution and Discrete Uniform Distribution - Moments, Moment generating function, Characteristic function, Cumulant Generating Function.

Unit–3
Continuous Distributions: Continuous Uniform, Normal Distribution, Exponential distribution, Moments, Moment generating function, Characteristic function, Cumulant Generating Function. Fitting of Normal Distribution.

Unit–4
Gamma distribution, Beta distribution of First kind and second kind – Moments, Moment generating function, Characteristic function, Cumulant Generating Function.

Unit–5
Distributions of Functions of Random variables: Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationships).

Book for Study and Reference:-


Course Outcomes

At the end of the course, the student will be able to

CO1: Understand the binomial Poisson distributions.
CO2: Study the various discrete distributions.
CO3: Study the various continuous distributions.
CO4: Study the beta and gamma distributions.
CO5: Study the t,F and chi-square distributions.

Semester-IV 19ISTP44 - Statistics Practical – II Credits:6
(Computer Based Practical) Hours:6

Learning Objectives: To acquire the knowledge in the creation of documentation and write a programme in C++.

Statistics Practical Schedule:

M.S. Word
1. Creation of Documents.
2. Creation of Documents with Special functions.
3. Creation of Documents with Maths Equation Editor.
4. Creation of Documents with Maths Equation Editor
5. Creation of PDF from Word Documents.

Programs Using C++
1. Finding the mean, median, mode and standard deviation for raw data.
2. Finding the mean, median, mode and standard deviation for discrete case.
3. Finding the mean, median, mode and standard deviation for continuous case.
5. Finding the correlation co-efficient.
6. Finding the regression equations.
7. Testing for difference of means
8. Analysis of variance one-way classification.
10. Multiplication of matrices.

Course Outcomes

At the end of the course, the student will be able to

CO1: Understand the various documentation commands of MS-WORD
CO2: Prepare programs using C++ for statistical problems
CO3: Prepare programs using C++ for matrix operations.

Semester-IV 19ISTA45 - Ancillary-II : Demography-II Credits:4
Hours:4

Learning Objectives: To acquire the knowledge of advanced concepts of demographic techniques and applications.

Unit-1
Model Life Tables: United Nations Model Life Tables, Coale and Demeny Regional Model Life Tables, Ledermann’s System of Model Life Tables, Brass-Logit Life Table System, United

Unit-2


Unit-3


Unit-4

Migration Models. Indirect Estimation of Migration and its need in Demographic Analysis. Estimations of Inter-Censal Migration using Data on Place of Birth, Duration of Residence, Place of Last Previous Residence and Place of Residence at a Fixed Prior Date. Indirect Estimations of Inter-Censal Migration using Vital Statistics Method, Life Table Survival Ratios Method, Census Survival Ratios Method and National Growth Rate Method. Direct and Indirect Methods for Estimating of Rural-Urban Migration.

Unit-5


Book for Study and Reference:-
1) R.Ramakumar (1986), Technical Demography
2) K.B.Pathak & F.Ram (2005), The Techniques of Demographic Analysis
3) B.D.Misra (1980)- The Study of Population

Course Outcomes

At the end of the course, the student will be able to

CO1: To study the use and applications of life table.
CO2: Estimate and fitting of fertility models.
CO3: Estimate the adult mortality and child mortality.
CO4: Fit migration models using vital statistics method.
CO5: Study the population projections in demographic analysis.
Learning Objectives: To learn the basic concepts and Applications of Sampling techniques for real life situations.

Unit–1
Basic concepts of sample surveys – Principles of samples theory; sampling Unit; sampling frame; complete enumeration versus sampling; Merits and demerits; Basic concepts of sampling distribution; Unbiasedness; Mean square error and relative standard error.

Unit–2
Simple random sampling with and without replacement; Lottery method - Use of random number tables; Estimation of population parameters; Mean; Variance and proportion; simple random sampling for proportion.

Unit–3
Stratified random sampling - Principle of stratification; Estimation of population mean and variance; Allocation techniques; equal allocation; proportional allocation; Neyman’s allocation and optimum allocation.

Unit–4
Systematic sampling Estimation of mean and its sampling variance – Comparison of simple; stratified and systematic sampling.

Unit–5
Functions of NSS and CSO; Sampling errors; Non – sampling errors; Sources of non – sampling errors.

Book for Study and Reference :-
7) MN Murthy ( ) Sampling: Theory and Methods, ISI Publications, Calcutta.

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the concepts of census and sample surveys.
CO2: Study the concepts of simple random sampling.
CO3: Study the concepts of stratified random sampling.
CO4: Study the concepts of systematic sampling
CO5: Study the functions of national sample survey.

Learning Objectives: To enlight the students to acquire skills for adopting statistical tools and techniques of data analysis.

Unit–1
Tests of significance- population and sample; parameter and statistic standard error and sampling distribution of a statistic; Utility of Standard error; Steps involved in any test of significance; Basic concepts; Large sample tests- Tests for mean and difference of means; single proportion and equality of proportions; difference of standard deviations ; testing the correlation coefficient; equality of two correlation coefficients.
Unit–2
Exact tests- Test for mean; equality of means and for paired samples; observed partial and multiple correlation and regression coefficients; test for one population variance and test for equality of two population variances; test for observed sample correlation ratio.

Unit–3
Chi-square test for goodness of fit- contingency tables; test for independence of attributes; Yate’s correction for contingency table; Bartlett’s test for homogeneity of several population variances; test for homogeneity of several population proportions.

Unit–4
Multiple regressions- interpretation of $R^2$; interpretation of partial regression coefficients; test for linearity of regression; test for intercept in a regression. Application of Multivariate tests- Test for population mean vector (for covariance matrix known and unknown). Test for equality of two population mean vectors when the covariance matrices are equal; (known and unknown) Mahalanobis $D^2$ test.

Unit–5
Non parametric methods; Advantages and disadvantages over parametric methods. Sign test for medians,Median test for two populations, Wald-Wolfvitz run test, Kruskall-Wallis Rank sum Test (H-Test), Mann-Whitney- Wilcoxon rank sum test, U-test, Kolmogorov – Smirnov, Test for goodness of fit, Test for comparing two populations, Test for randomness, Friedman’s test.

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the various concepts of statistical tests and to apply large sample tests.
CO2: Apply the exact tests for research problems.
CO3: Apply the various chi-square tests.
CO4: Apply the multiple regression analysis and multivariate tests for real life problems
CO5: Apply the non-parametric tests for sample data.

Semester-V

Learning Objectives: To enhance the knowledge of making inference using different types of estimation.

Unit–1
Point estimation - Estimator and Estimate; Criteria of point estimation; Consistency; sufficient condition for consistency; Invariance property of consistency; unbiasedness; sufficiency; Neyman’s Factorization Theorem; sufficient statistic; Efficient estimator; relative efficiency; Simple problems.

Unit–2
Minimum variance unbiased estimator; Rao Blockwell Theorem; Cramer-Rao Inequality; Methods of estimation; Maximum likelihood method; Properties of Maximum likelihood method (without proof); Deriving the Maximum likelihood Estimators of standard distributions; Method of Moments; Simple problems.
Unit–3
Interval Estimation- Confidence Intervals and confidence coefficient; Interpretation; Pivotal quantity method; Confidence Interval for parameters of standard distributions; Confidence interval for large samples ; Simple problems.

Unit–4
Tests of Statistical Hypotheses - Null and Alternative; Simple and Composite hypothesis ; Critical region; Two types of errors; Level of significance and power of the test; simple problems to obtain the size of the test and power of the test; Simple problems.

Unit–5
Neyman-Pearson fundamental lemma; Most powerful test and Best Critical Region (BCR); Deriving the BCR; Power of the tests . Unbiased test, UMP critical region; Simple problems.

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the basic concepts and criteria of point estimators.
CO2: Study the various types and methods of estimation.
CO3: Understand the concepts of interval estimation.
CO4: Study the basic concepts of statistical hypotheses testing.
CO5: Understand the Neyman-Pearson Lemma and solving problems.

Semester-V 19ISTC54 - Elements Of Quality Control Credits:5 Hours:5

Learning Objectives: On successful completion of the course the students should have understood the need of quality improvement, total quality management and statistical plots and tools such as SPC, CUSUM and ISO.

Unit–1
Control charts for variables: Need for Statistical Quality Control techniques in Industry – Causes of Quality variation – Uses of Shewart Control charts – specifications, tolerance limits – 3σ limits – warning limits — $\bar{X}, R$ and $\sigma$- charts – Basis of sub grouping – Interpretation of $\bar{X}$ and R charts.

Unit–2

Unit–3
Acceptance Sampling: Sampling inspection – inspection by attributes and variables - concepts of Producer’s risk, Consumer’s risk. AQL, LTPD, AOQ, AOQL, ATI and ASN. Rectifying inspection plans.

Unit–4
Acceptance sampling for attributes: Single and Double sampling plans. OC, AOQ, ATI and ASN curves for Single and Double sampling plans.
Unit–5
Acceptance sampling for variables: Known and unknown sampling plans (one sided specification only). Determination of n and k for one sided specification of OC curve.

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the concepts of control charts for variables.
CO2: Understand the concepts of control charts for attributes.
CO3: Study the concepts of acceptance sampling.
CO4: Study the single and double sampling plans.
CO5: Study the acceptance sampling for variables.

Semester-V
19ISTP55 - Statistics Practical – III
(Calculator Based Statistics Practical)
Credits:6
Hours:6

Learning Objectives: To solve the problems in test of significance, sample selection, time series and index numbers.

Statistics Practical Schedule

Tests Of Significance
1) Testing the significance of population mean when σ is known.
2) Testing the significance of population mean when σ is unknown.
3) Testing the significance of population variance when μ is known.
4) Testing the significance of population variance when μ is unknown.
5) Testing the significance of equality of population means when σ₁, σ₂ are known.
6) Testing the significance of equality of population means when σ₁, σ₂ are unknown.
7) Testing the significance of population proportion.
8) Testing the significance of equality of population proportions.
9) Paired t- Test.
10) Chi-Square test for goodness of Fit.
11) Chi-Square test for independence of attributes.
12) F- Test for equality of population variances.
13) Bartlett’s Test for homogeneity of several variances.
14) Test for population correlation coefficient.
15) Test for population regression coefficient.

Sampling
1) Simple random sampling with replacement.
2) Simple random sampling without replacement.

Time Series
1) Measurement of Trend – Method of Moving average, Method of Least Square
2) Measurement of Seasonal Variation – Simple average method.

Index Numbers
1) Construction of Price Index number – Laspeyres, Paasche, Fisher, Bowley and Marshal Edgeworth methods.
2) Fisher idle Index number – Time reversal test and Factor reversal test.
3) Construction of Cost of Index number – Simple aggregate method, Family budget method.
Anova

1) Analysis of variance - One - way Classification.
2) Analysis of variance Two - way Classification.

Course Outcomes

At the end of the course, the student will be able to

CO1: Apply various statistical tests for sample data  
CO2: Observe data using simple random sampling.  
CO3: Calculate time series components.  
CO4: Calculate problems of index numbers.  
CO5: Carryout anova tests for given data.

Semester-VI 19ISTC61 - Experimental Designs Credits:5 Hours:5

Learning Objectives: To enable the students to learn basic concepts of design and its applications.

Unit–1


Unit–2

Analysis of Variance and Basic Designs: Concept of Cochran’s Theorem. One-way and Two-way analysis of variance. Completely Randomized Design and its analysis – Randomized block design (RBD) and its analysis – RBD – More than one but equal number of observations per cell – Latin Square Design (LSD) and its analysis.

Unit–3


Unit–4

Missing plot techniques – Meaning – Least Square method of estimating one missing observation – RBD and LSD – Two observations missing in RBD and LSD – Analysis of covariance technique in CRD and RBD (without derivation).

Unit–5

Factorial experiments – Definition – \(2^2\), \(3^2\) and \(3^3\) factorial experiments and their analysis – Principles of confounding – Partial and complete confounding in \(2^3\) – Split plot design and its analysis.

Book for Study and Reference :-


Course Outcomes

At the end of the course, the student will be able to

CO1: Understand the basic concepts of experimental designs.
CO2: Study the various basic designs.
CO3: Understand the use of various multiple comparison tests.
CO4: Study the missing plot techniques of basic designs.
Learning Objectives: To apply statistics in multi disciplinary sciences for making decisions.

Unit–1
Official Statistics

Unit–2
Vital Statistics
Introduction - Uses of vital statistics; Methods of obtain vital statistics; Measurement of Population; Measurement of mortality; Crude death rate; Standardized death rate; Mortality Table; Abridged life table; Fertility; Measurement of population growth.

Unit–3
Index Numbers
Index numbers and their definitions - construction and uses of fixed and chain based index numbers-simple and weighted index numbers - Laspeyre's, Paasche's, Fisher's, and Marshall-Edgeworth index numbers – optimum tests for index numbers-Cost of living index numbers.

Unit–4
Time Series

Unit–5
Time series
Concept –Components of Time series – Additive and Multiplicativce models-Resolving components of a time series-measuring trend: Graphic, semi-averages, moving average and principle of least squares methods.

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the present official statistical system.
CO2: Study the various concepts of vital statistics.
CO3: Study the various types of index numbers.
CO4: Study the various components of time series models.
Learning Objectives: To enrich the skills of students to understand the nature and functioning of economic systems.

Unit–1
Model with one explanatory variable: Definition, scope and OBJECTIVESs of Econometrics. Linear model with one independent variable - Least squares estimators of regression coefficients, properties of least squares estimators - analysis of variance to regression model.

Unit–2
Model with more variables: Linear model with more than one explanatory variables – assumptions – estimation of model parameter - Least squares estimators and their properties. Hypothesis testing – test the overall significance of the regression – Testing the individual regression coefficients.

Unit–3

Unit–4

Unit–5

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the basic concepts of econometric models.
CO2: Study the linear model.
CO3: Study the adequacy and checking of models.
CO4: Study the concept of autocorrelation and their tests.
CO5: Study the concept of multicollinearity.
Learning Objectives: To impart basic knowledge of various optimization techniques.

Unit–1

Unit–2

Unit–3
Theory of Games: Basic definition – Maximin and Minimax criterion – Solution of Games with saddle points – Two–by–Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.

Unit–4
Replacement problems: Replacement policy for items whose maintenance cost increases with time and the value of money remains constant – Replacement policy for items whose maintenance cost increases with time and the value of money also changes with time – Replacement of items that fail completely – Group replacement policy.

Unit–5
Network analysis by CPM/PERT: Basic Concept – Constraints in Network – Construction of the Network – Time calculations – Concept of slack and float in Network Analysis – Network crashing – Finding optimum project duration and minimum project cost.

Books for Study and Reference :

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand to solve the problems of LPP.
CO2: Study the concepts of transportation and assignment problems.
CO3: Study the different types of problems of game theory.
CO4: Study the concepts of replacement problems.
CO5: Understand the concepts of network analysis.
Learning Objectives: To acquire knowledge of computation of statistics through statistical packages.

Statistics Practical Schedule

Excel:
1. Descriptive Statistics
2. Correlation and regression.
3. Chi-Square Test.
4. ANOVA – One way and Two way Classification.
5. Analysis of Multiple Regression.
6. Test for Single mean.
7. Test for difference of mean.
8. Paired t- Test.

SX and SPSS
9. Descriptive Statistics
10. Correlation and regression.
11. Chi-Square Test.
12. ANOVA – One way and Two way Classification.
13. Analysis of Multiple Regression.
15. Test for difference of mean.
16. Paired t- Test.
17. CRD
18. RBD
19. LSD
20. Hotteling-$T^2$

Power Point
1. Preparation of power point for a word document.
2. Preparation of power point with special features.

Course Outcomes
At the end of the course, the student will be able to

CO1: Solve statistical problems using excel
CO2: Solve statistical problems and carryout analysis using SX and SPSS.
CO3: Prepare power point presentations

Learning Objectives: To enrich the skills of students for learning the concepts and methods of matrices, Linear Algebra.

Unit-1

Unit-2


Unit-3


Unit-4


Unit-5

Eigen values and eigen vectors of an LT – left eigen vectors, right eigen vectors, Diagonalizable, LT – Lambda matrix, Composition of lambda matrices, Operator polynomial, Cayley-Hamilton theorem and minimal polynomial for an LT – Eigen values of matrix polynomials.

Book for Study and Reference:-

Course Outcomes

At the end of the course, the student will be able to

CO1: Solve problems in matrices and quadratic forms
CO2: Understand the concepts of vector space
CO3: Understanding various matrix transformations
CO4: Solving problems in linear equations
CO5: Obtain the eigen values and eigen vectors

Semester-VII 19ISTC72 - Measure And Probability Theory Credits:4 Hours:4

Learning Objectives: To build a foundation for the measure and applications of Probability Concepts.

Unit-1


Unit-2


Unit-3

Unit–4
Convergence of random variables – almost sure, in law, in probability, in rth mean and their interrelations – Characteristic function – Inversion formula, Convergence of distribution functions and characteristic functions – Helly-Bray theorem – Continuity theorem.

Unit–5
Law of large numbers – Weak law of large numbers – Kolmogorov’s strong law of large numbers – Glivenko – Cantelli Theorem – Central limit theorems – Lindeberg–Cramer - Levy theorem, Liapounov’s theorem.

Books for Reference:

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the various types of measures
CO2: Study the theorems relating to measures
CO3: Apply the use of zero one laws
CO4: Application of theorems on random variables
CO5: Utilize the law of large numbers in research studies

Semester-VII 19ISTC73 - Sampling Theory Credits:4
Hours:4

Learning Objectives: To enrich the skills of students to get more specialization in various sampling procedures and for adopting the appropriate sampling technique in real life application and survey.

Unit–1
Population and Sample; Notions of sampling and non-sampling errors; Sampling Unit--and sampling frame. Simple random sampling (SRS); from finite populations with and without replacement; Estimates of Mean, total and proportion and their standard errors; confidence intervals; Pooling of estimates; determination of sample size.

Unit–2
Systematic Sampling (SYS); Method of estimation of population total and mean; Estimation of their sampling variances; Case of linear trends; comparison of SRS and SYS; circular systematic sampling; Stratified random sampling (STRS): Need for stratification; detailed study of Allocation problems; Stratified random sampling with and without replacement; Estimates of population total, mean and proportion and their standard errors, Gain due to stratification and its estimate from a sample. Comparison of Simple Random Sample, Systematic sample and Stratified sampling in the presence of linear trend.

Unit–3
Varying probability sampling; PPS sampling with and without replacement; stratified PPS sampling; Gain due to PPS sampling; Selection procedures; ordered and unordered estimators; Desraj, Horvitz Thompson and Murthy’s Estimators.

Unit–4

Use of auxiliary information to estimating parameters; Two phase sampling. Ratio estimators; Notion of Ratio estimation: Bias in ratio estimator; Mean square error; Ratio estimators under the cases of simple random sampling and stratified random sampling. Regression estimators; Bias and variance; Regression estimators in the cases of simple random sampling and stratified random sampling.

Unit–5

Cluster sampling: Need for cluster sampling; Sampling with equal clusters, simple random sampling with varying probabilities under varying cluster sizes; their relative efficiency compared to SRS; optimum cluster size. Multistage sampling; Estimates of population mean and its sampling variance in two stage sampling with SRS.

Books for Study and Reference:-


Course Outcomes

At the end of the course, the student will be able to

CO1: Study the various criteria of estimators
CO2: Understand the concepts of sufficiency and completeness
CO3: Derive different inequalities
CO4: Understand the various methods of estimation and interval estimation
CO5: Study the Bayes estimation

Semester-VII

19ISTP74 – Statistics Practical – V
(Calculator Based Practical)
Credits:3
Hours:6

Learning Objectives: To have practical knowledge on solving problems in matrices, sampling techniques.

Practical Schedule

Matrix Theory

- Arithmetic operations on matrices
- Determinant of matrices
- Solution of simultaneous equations
- Cramer’s rule
- Sweep-out methods
- Inverse of a matrix
- Rank of matrices
Eigen values and eigen vectors

**Sampling**
Estimation of sample mean and sample variance under simple random sampling without replacement.
- Estimation of sample mean and sample variance under SRSWR.
- Estimation of Proportion under SRSWOR.
- Estimation of Population total, mean and variances under systematic sampling.
- Estimation of mean, variances under stratified random sampling.

**Course Outcomes**
At the end of the course, the student will be able to

CO1: Operations of matrices using practical applications
CO2: Problems solving for simultaneous equations
CO3: Estimation of parameters using sampling techniques

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Semester-VII  
[19ISTP75 – Statistics Practical – VI]  
Credits: 3  
(Computer Based Practical)  
Hours: 6

**Learning Objectives:** To Gain The Knowledge of Basic Statistical Computation through using SPSS and SIGMAPLOT.

**Practical Schedule**

**SPSS**
- Descriptive Statistics.
- Test for Single mean.
- Test for difference of mean.
- Paired t-Test.
- ANOVA One-way Classification.
- Two way ANOVA.
- Chi-Square Test.
- Principal Component Analysis.
- Correlation and Regression (Simple and Multiple).
- Factor Analysis.
- Discriminant Function.
- Cluster Analysis.

**SIGMAPLOT**
- Descriptive Statistics: mean, Median, Mode.
- Skewness and Kurtosis
- Correlation and Regression.

**Course Outcomes**
At the end of the course, the student will be able to

CO1: Familiarize in SPSS and SIGMAPLOT to
CO2: Calculate the various statistical measures
CO3: Test the significance of the parameters
CO4: Apply ANOVA test for appropriate data
CO5: Analyze the data using various multivariate analyses
CO6: Draw diagrams and graphs
Learning Objectives: Soft skills evolve the personality of a person and prepare for competition in the changing employment market elsewhere.

Unit-1 Personality Development
Personal Effectiveness Skills- Managerial and Supervisory Skills – Leadership Skills- Creativity Skills- Problem Solving Skills – Team Sprit – Culture Building.

Unit-2 Effective Listening

Unit–3 Interpersonal Communication

Unit–4 Public Speaking

Unit-5 Writing Skills

Books for study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Develop skills of personality development.
CO2: Understand the effective listening.
CO3: Communicate interpersonal relationships.
CO4: Shine in public speaking.
CO5: Develop writing skills.
Learning Objectives: To know the basic ideas of continuous and truncated distributions and to study the concepts of Bivariate distribution, Non-central $t$, $F$ and $\chi_2$ and Beta distributions, Order statistics and quadratic forms.

Unit-1

Unit-2
Truncated distributions – left truncated binomial – left truncated Poisson – left and right truncated Normal distributions – Non central $t$, $\chi^2$ and $F$ distributions.

Unit-3
Bivariate Normal distributions – M.G.F. – Moments – Distribution of correlation coefficient when population correlation coefficient is equal to zero – Distribution of Regression coefficients.

Unit-4
Distributions of order statistics - median, range and mid-range. Distribution of Quantiles–Sample cumulative distribution function and its properties, Kolmogorov–Smirnov one sample statistic.

Unit-5
Distribution of quadratic forms in normal random variables, their mean and variance, independence of quadratic forms, independence of linear and quadratic forms, Fisher-Cochran’s theorem.

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to

CO1: Study the various discrete and continuous distributions
CO2: Study the various truncated distributions
CO3: Understand the biivariate distributions
CO4: Study the distributions of order statistics
CO5: Understand the distributions of quadratic forms
Learning Objectives: To enhance the methods of diagnosis of statistical estimation of parameters.

Unit-1
Unbiasedness and Consistency – Point Estimation, Highest Concentration Criterion, Minimum MSE Criterion, Unbiased Estimators, Quenoulli’s Method of Reducing the Bias in Stages, Consistent Estimator, BAN Estimator and Case of Several Parameters. Problems and Exercises. (Contents as in Chapter -2 of Book-1)

Unit-2

Unit-3
Minimum Variance Unbiased Estimators: Case of a single parameter, Lower Bounds for Variance of Unbiased Estimators (Cramar-Rao Inequality) UMVUE, Bhattacharya Inequality, Chapman-Robin’s Inequality, Rao-Blackwell theorem, Lehman- Sheffee Theorem. Use of Sufficient and Complete Statistics, Case of Several Parameters. Problems and Exercises. (Contents as in Chapter -4 of Book-1)

Unit-4

Interval Estimation : Concept , A general Method of Constructing Confidence Intervals (CIs), and Shortest Confidence Intervals . Problems and Exercises. (Contents as in Chapter -6 of Book-1)

Unit-5
Bayesian Estimation: Concept of prior distribution – Classifications of prior: Informative, Non informative and Restricted classes of priors – Non-informative priors for location and scale problems Conjugate prior distributions: Posterior distribution and Estimation.

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Study the various criteria of estimators
CO2: Understand the concepts of sufficiency and completeness
CO3: Derive different inequalities
CO4: Understand the various methods of estimation and interval estimation
CO5: Study the Bayes estimation
Learning Objectives: To enhance the knowledge of statistical applications in industries.

Unit–1
Meaning and scope of statistical quality control; causes of quality variation, statistical basis for control charts, choice of control limits, sample size and sampling frequency, rational subgroups, specification, tolerance and warning limits. Construction and operations of $\overline{X}$, R and $\sigma$ charts, np, p, c and u charts, Operating Characteristic curves for control charts.

Unit–2
Principles and construction of modified control charts, cumulative sum control chart, Basic principles and design of CUSUM charts, concept of V-mask, one and two sided decision procedures. Moving-average and geometric moving-average control chart, sloping control charts.

Unit–3
Acceptance sampling plans, Rectifying inspection, Sampling Inspection by Attributes, Concept of OC, ASN, ATI, AOQ functions of sampling plans, AQL, LTPD, producer’s risk and consumer’s risk on OC curve. Operation and use of single, double and multiple sampling plans. MIL STD-105D Standard, Dodge and Romig Sampling Plans.

Unit–4
Sampling inspection by variables - known and unknown sigma, Variable sampling plan, merits and demerits of variable sampling plan, derivation of OC curve. Determination of parameters of the plan. Continuous sampling plans by attributes, CSP-1, CSP-2 and CSP-3. Concept of AOQL in CSPs and Multi-level continuous sampling plans, Indian Standards ISO 2000 (concepts only).

Unit–5

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to

CO1: To draw and obtaining results of various control charts.
CO2: To study the Cusum, V-mask and moving average control charts.
CO3: Understanding the concepts of acceptance sampling plans and their functions.
CO4: Apply the various sampling inspections in real life situations.
CO5: Understand the various concepts of reliability and their applications.
Learning Objectives: To have practical knowledge on solving problems in matrices, sampling techniques and estimation of parameters.

Practical Schedule

**Estimation**
- Unbiased estimator
- Maximum Likelihood Estimation method
- Method of least squares
- Confidence intervals

**Statistical Quality Control**
- Control Chart for $\bar{X}$ and R
- Control Chart for $\bar{X}$ and $\sigma$
- Np – Control Chart
- P – Chart
- C – Chart
- U – Chart
- Single sampling plan – OC, ASN, ATI and AOQ.

**Operation Research**
- Linear Programming Problem – Simplex Method.
- Two Pearson Zero Sum Games.
- Network – CPM.
- Network – PERT.

**Stochastic Processes**
- Estimation - TPM
- Stationary Probability
- M/M/1 queueing model

**Course Outcomes**
At the end of the course, the student will be able to

CO1: Calculate problems relating to estimation methods.
CO2: Construction of various charts in SQC
CO3: Solving problems in operation research by LPP, Game theory and network.
CO4: Solve problems of stochastic processes

Learning Objectives: To have practical knowledge on solving problems using SYSTAT, STATGRAPH and DBMS.

**SYSTAT**
- Descriptive Statistics.
- Correlation and Regression.
- Chi-Square Test.
- Single mean, Two mean-Z- Test
- Student t-Test: single mean
- Independent two sample
- Pared t-Test
- ANOVA One-way Classification.
ANOVA Two-way Classification.

STATGRAPH
- Diagrams: Bar, Multiple, Component, Pie diagram
- Graphs: related to Statistical Data.
- Q-Q plot and P-P plot
- Statistical Applications.

DBMS
- Creation of data base file
- Use simple command

Course Outcomes
At the end of the course, the student will be able to
CO1: Familiarize in SYSTAT, STATGRAPH and DBMS to
CO2: Calculate the various statistical measures
CO3: Test the significance of the parameters
CO4: Apply ANOVA test for appropriate data
CO5: Analyze the data using various multivariate analyses
CO6: Draw diagrams and graphs

Semester-VIII 19 MATE 815.2 Elective-II - Numerical Methods Credits:3 Hours:3

Learning Objectives: The role of numerical analysis is to develop and analyze the numerical techniques.

Unit–1
The solution of Numerical Algebraic and Transcendental Equations:

Unit–2
Simultaneous Linear Algebraic Equations:
- Gauss Elimination method, Computation of the inverse of a matrix using Gauss elimination method, Method of Triangularisation (Method of Factorization), Crout’s method, Iterative methods, Jacobi method of iteration (Gauss-Jacobi Method), Gauss Seidal method of iteration.

Unit–3
Interpolation:
- Introduction, Linear interpolation, Gregory Newton Forward and Backward interpolation Formula, Equidistant terms with one or more missing values.
- Interpolation with unequal intervals:
  - Divided Differences, Properties of Divided differences, Newton’s interpolation formula for unequal intervals, Lagrange’s interpolation formula, Inverse interpolation.

Unit–4
Numerical Differentiation and Integration:
- Introduction, Newton’s forward difference formula to compute the derivatives, Newton’s backward difference formula to compute the derivatives, Derivatives using Stirling’s formula.
- Trapezoidal rule, Simpson’s rule, Statistics Practical applications of Simpson’s rule, Trapezoidal rules.

Unit–5
Numerical Solution of Ordinary Differential Equations:

Text Book

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the problems of numerical algebraic equations.
CO2: Solve problems in linear algebraic equations.
CO3: Understand the various methods of interpolation.
CO4: Understand the various methods of numerical differentiation and integration.
CO5: Solve problems of ordinary differential equations.

ELECTIVE-III – DE-1 19STAE806-1 or 19STAE806-1
Semester-IX 19ISTC91 - Testing Of Statistical Hypotheses Credits:4 Hours:4

Learning Objectives: The object is to acquire knowledge on advancements for making decisions based on statistical hypotheses.

Unit-1
Tests of Hypotheses – Concepts, Test functions Non-randomized and randomized tests, Critical region, Two types of errors, level of significance, size and power of the test Neyman-Pearson Theory and Lemma, Test Functions or Critical Functions, MP tests when H and K are simple, Uniformly Most Powerful Tests, monotone Likelihood Ratio Property, Problems and Exercises. (Contents as in Chapter -7 of Book-1)

Unit-2
UMP Tests - Monotone likelihood ratio property, Generalized NP lemma, Tests for One Parameter Exponential Family of Distributions, Locally Most Powerful Tests, UMPU Tests for Multi-Parameter Exponential Family of Distributions, Tests with Neyman’s Structure, Problems and Exercises. (Contents as in Chapter -8 of Book-1)

Unit-3
Likelihood Ratio Method of Test Construction- Likelihood Ratio (LR) Test, Asymptotic Distribution of the LR test Criterion, LR test for testing the mean and variance of the Normal distribution based on K-samples(K≥1),Test Consistency, LR Test when Domain of RV Depends on Parameter, Problems and Exercises. (Contents as in Chapter -9 of Book-1)

Unit-4

Unit-5
Sequential Procedures: Sequential Estimation, Sequential Hypothesis Testing, SPRT, Determination of the Constants of B and A for the SPRT, OC and ASN function of the SPRT. Certain Basic Results for SPRT, SPRTs When the Hypotheses are Composite, Basic results of SPRT, Decision intervals under SPRT for Binomial, Poisson and Normal distribution, Problems and Exercises. (Contents as in Chapter -13 of Book-1)

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the various concepts of testing of hypotheses.
CO2: Study the use of NP lemma and locally most powerful tests.
CO3: Study the various likelihood ratio tests.
CO4: Apply the various non-parametric methods in practical problems.
CO5: Understand the sequential methods of hypotheses testing.

Semester-IX 19ISTC92 - Multivariate Statistical Analysis Credits:4 Hours:4

Learning Objectives: To understand the basic concepts of Multivariate analysis for applying more than two dimension situation.

Unit–1
Multivariate Normal Distribution, Properties, Singular and Non-singular matrices, Marginal and Conditional Distributions. Estimation of the Mean vector and the covariance matrix in Multivariate normal distribution: Maximum likelihood estimates of the Mean vector and the covariance matrix, distribution of the sample mean vector, inference concerning the mean when the covariance matrix is known.

Unit–2
Wishart distribution: Distribution (No derivation), characteristic function, properties, Marginal distributions, Linear transformation, sum of Wishart Matrices.

Unit–3
Classification of observations: The problem of classification, standards of good classification, procedure of classification into one of two populations with known probability distributions, classification into one of two known multivariate normal populations, discriminant function, classification into one of several populations, classification into one of several multivariate normal populations.

Unit–4
Principal components: Introduction, definition of principal components in the population, MLE of the principal components and their variances, computation of the MLE of the principal components. Canonical correlations and canonical variables: Introduction canonical correlations and variables in the population, estimation of canonical correlations and variables, computation.

Unit–5
Factor Analysis: The Basic model common and special factor; communality; Estimation of factor loading principal factor method; maximum likelihood method; Factor Rotations; Cluster Analysis: Similarity and distance measures hierarchical clustering techniques.

Book for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the use of multivariate normal tests.
CO2: Apply the multivariate tests using $T^2$ statistics.
CO3: Understand the problems of classification of observations.
CO4: Apply the multivariate analyses such as principal components, canonical correlations in real life problems.
CO5: Apply the multivariate analyses such as factorial analysis and cluster analysis in real life problems.

Semester-IX 19ISTC93 : Operations Research Credits:4 Hours:4

Learning Objectives: To import knowledge of various optimization techniques that makes use of statistical concepts abundantly.

Unit–1
The General Linear Programming problem (GLPP)- properties and solutions of the LPP; generating development of optimal feasible solutions; theory and computational algorithms of simplex method; degeneracy procedures and perturbation technique; Primal and dual LPP and duality theorem; Methods using artificial variables.
Unit–2
Introduction; Limitation of integer LP; Methods of Integer programming; Cutting plane method; search methods-Branch and Bound techniques; Mixed Integer programming problem; Goal programming- formulation of problem and optimum solution.

Unit–3
Theory of games- zero sum two person games; pure and mixed strategies; saddle points; LPP and games; graphical solutions of 2xn and mx2 games; dominance property; minimax and maximin and saddle point theorems.

Unit–4
Network analysis by CPM/PERT-Basic Concept; Constraints in Network; Construction of the Network; Time calculations; Concept of slack and float in Network Analysis; Network crashing; Finding optimum project duration and minimum project cost.

Unit–5
Concept of scientific inventory management and analytical structure of inventory problems; The ABC inventory system-Costs associated with inventory-Deterministic inventory models- Economic lot size models-Stochastic inventory models with and without lead time.

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the general LPP
CO2: Apply the integer programming problem.
CO3: Solve game problems in real life study.
CO4: Apply CPM/PERT techniques practically.
CO5: Apply the inventory system in economic problems.

Semester-IX 191STC94 - Programming In R Credits:4 Hours:4

Learning Objectives: To understand the concepts and applications of R Programming in Statistics.

Unit–1
Introduction to R – Using the help facility. R data types and objects, reading and writing data import and export. Data structures: vectors, matrices, lists and data frames – Built-in data-
Reading data from other sources – Merging data across data sources.

Unit–2

Unit–3
Dealing with Missing values – Data Cleaning and Transforming, Exploring and Visualizing – Writing your own functions – Statistical models in R.

Unit–4
Descriptive statistics – Frequency and contingency tables – correlations – t-tests, Nonparametric tests of group differences: Comparing two groups – Comparing more than two groups.

Unit–5
Distributions and Modeling – Regression – ANOVA – General linear models – Principal component analysis and factor analysis.

Books for study and Reference:-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the various basic concepts of R
CO2: Study the various functions and rules of R.
CO3: Understand the data cleaning and transformation.
CO4: Solve problems in statistical methods using R.
CO5: Obtaining inferences for statistical analysis using R.

Semester-IX
19ISTP95 - Practical – IX Credits:3
(Calculator Based Practical) Hours:6

Learning Objectives: To familiarise the students in solving problems in testing of hypotheses, non-parametric tests.

Practical Schedule

Testing Of Hypotheses
1. Most powerful test Estimation of power and size.
3. Sequncial curve
4. SPRT- OC and ASN cure using binomial, poission and normal distribution

Non-Parametric Tests
1. One sample Kolmogorov – Smirnov test.
2. Sign test
3. Wilcoxon signed rank test.
4. Mann – Whitney U – test
6. Median test
8. SPRT – OC and ASN curve for Binomial Distribution.

Course Outcomes
At the end of the course, the student will be able to
CO1: Solve problems in testing of hypotheses.
CO2: Solve problems in non-parametric tests

Semester-IX
19ISTP96 – Statistics Practical – X
(Computer Based Practical)
Credits:3
Hours:6

Learning Objectives: To acquire knowledge of computation of statistics through R software and C++ programming language.

Practical Schedule
Programs Using R
- Finding the mean and standard deviation for raw data.
- Finding the mean and standard deviation for discrete type frequency distribution.
- Finding the mean and standard deviation for continuous type frequency distribution.
- Finding the median for raw data.
- Finding the Skewness and kurtosis based on moments.
- Finding the correlation – coefficient.
- Finding the regression equations.

Course Outcomes
At the end of the course, the student will be able to
- CO1: Able to develop programs using R for descriptive statistics.
- CO2: Calculate various statistical measures using R
- CO3: Analyse and interpret using sample data in R
- CO4: Apply various statistical test and interpret using R.

Semester-IX
19 MATE 915.1 Elective-IV Differential Equations
Credits:3
Hours:3

Learning Objectives: This course aims to provide logical skills in the formation of differential equations, to expose to different techniques of finding solutions to these equations and in addition stress is laid on the application of these equations in geometrical and physical problems. It also aims to provide logical skills in the formation and solutions techniques of partial differential equations.

Unit-1 Ordinary Differential Equations

Unit-2 Ordinary Differential Equations [Contd…]
- Method of Variation of Parameters – 2nd order Differential Equations with Constant Coefficients for finding the P.I’s of the form e^{ax}V, where V is sin(mx) or cos(mx) and x^n.

Unit-3 Laplace Transform
- Laplace Transform, Inverse Laplace transform, Application to the first and second order linear differential equations.

Unit-4 Partial Differential Equations
- Partial differential equations: Formation of P.D.E. by eliminating arbitrary constants and arbitrary functions, Complete, Singular and General integral. Solution of equations of standard types: f(p,q)=0, f(x,p,q)=0, f(y,p,q)=0, f(z,p,q)=0, f(x,p)=f(y,q), and Clairaut’s form. Lagrange’s equation Pp+Qq=R, Simple problems.

Unit-5 Series Solution
- Series solutions of first order equations, Second order linear equations, Ordinary points, Regular Singular Points
**Books for Study and Reference:**

4. Ordinary and Partial Differential Equations by M.D. Raisinghania, S. Chand, 2006

**Course Outcomes**

At the end of the course, the student will be able to

CO1: The skill of the formation of differential equations and partial differential equations,

CO2: The skill to expose different techniques of finding solution of differential equations and partial differential equations.

**ELECTIVE-V – DE-1 19STAE907-1 or 19STAE907-2**

**Semester-X**

19ISTC101 - Design And Analysis Of Experiments

**Credits:** 4

**Hours:** 4

**Learning Objectives:** To enrich the basic principles of design of experiments, general designs, multiple comparison tests, factorial and incomplete block designs and their applications.

**Unit–1**

Principles of Scientific experimentation; Replication, Randomization and Local control; Various concepts, definitions in experimental designs, Notion of a design matrix, Inter and intra block analysis for general designs models, Orthogonality; connectedness and resolvability.

**Unit–2**

Detailed analysis of CRD, RBD, LSD, GREACO LSD - Expected values of the various sum of squares to be obtained, comparison of CRD, RBD and LSD –Analysis of Higher order orthogonal LSD, Analysis of covariance (one concomitant variable) in CRD, RBD.

**Unit–3**

Multiple comparison tests; meaning and need; Detailed description of CD, SNK, DMR and Tukey tests. Missing plot analysis of RBD and LSD; Mixed plot analysis of RBD (with one observation per cell); Cross- over designs and their analysis.

**Unit–4**

Factorial Experiments; their needs and advantages, definition of symmetric factorials; meaning of main effects and interactions in $2^n$ and $3^n$ experiments; Complete analysis of such Experiments laid out in CRD and RBD. Need and meaning of confounding; total and partial confounding; Construction and analysis of such designs. Split plot design in RBD.

**Unit–5**

Balanced and partially balanced incomplete Block design (with two associate classes only); their meaning, definition, classifications and analysis. Youden square design, its description and analysis; Lattice design, its definition, construction and Analysis of simple and Balanced Lattices.

**Books for Study and Reference:**

Course Outcomes

At the end of the course, the student will be able to

CO1: Understand the various basic concepts of experimental designs.
CO2: Analyse the basic designs and interpretation.
CO3: Apply the various comparison tests and missing observations for experimental data.
CO4: Apply the factorial designs in field experiments.
CO5: Understand the incomplete block designs

Semester-X 19ISTC102 - Stochastic Processes Credits:4 Hours:4

Learning Objectives: To acquire the standard concepts and methods of Stochastic Modelling and applications.

Unit–1

Stochastic Processes: Definition and examples; Classification of stochastic processes with illustrations. Gambler’s ruin problem Markov chains; Definition and examples; One and two dimensional random walk; Transition probabilities; Classification of states; Recurrent Markov Chains; Necessary and sufficient condition for a state to be recurrent; Basic limit theorems on recurrence. Statistical Inference for Markov chains.

Unit–2

Basic limit theorems of Markov chains. Theorem establishing the stationary probability distribution of a positive recurrent, a periodic class a states; Absorption probabilities; Criteria for recurrence, examples.

Unit–3

Continuous time Markov chains; Examples, General pure birth process; Poisson process. Definition; and properties; Birth and death process with absorbing states; Finite state continuous time Markov chains.

Unit–4


Unit–5

Queuing processes; General Description M/M/1 models with finite and infinite capacities Waiting time and busy period for both steady state transient behavior; Birth and Death Processes in queuing theory; Multi-channel model M/M/S; Embedded techniques applied to M/G/1.
**Books for Study and Reference:**
3) Prabhu , N.U (1965) Stochastic processes, McMillan

**Course Outcomes**
At the end of the course, the student will be able to
CO1: Understand the basic concepts and classifications of stochastic processes.
CO2: Study the theorems of stationary probability distributions.
CO3: Analyse the birth and death processes and their applications.
CO4: Study the branching processes and their related concepts.
CO5: Apply and analyse the various queueing systems in real life situations.

**Semester-X**
19ISTP103 - Practical – XI  
(Calculator Based Practical)  
Credits:3  
Hours:6

**Learning Objectives:** To familiarise the students in solving problems in exprimental designs and multivariate analysis.

**Practical Schedule**

**Design Of Experiments**
1) Completely Randomized Design.
2) Randomized Block Design.
3) Latin Square Design.
4) Missing Plot Analysis in CRD, RBD and LSD.
5) Multiple Comparison Test – DMRT, LSD and CD.
6) $2^2$ - Factorial Experiment .
7) $2^3$ - Factorial experiment with complete confounding.
8) $2^3$ - Factorial experiment with partial confounding.
9) $3^2$ - Factorial Experiment.

**Multivariate Analysis**
1) Estimation of Mean vector and Covariance Matrix.
2) Test for the Mean vector when Covariance Matrix is known.
3) Test for Equality of Mean vector.
4) Test for the Mean vector when Covariance Matrix is unknown.
5) Test for Covariance Matrix.
6) Test for Equality Covariance Matrices.

Course Outcomes
At the end of the course, the student will be able to
CO1: Carryout the analyses for various experimental designs and interpretation.
CO2: Apply the multivariate statistical tests.

Semester-X 19ISTP104 - Practical – XII Credits:3
(Computer Based Practical) Hours:6

Learning Objectives: To familiarise the students in solving problems in using C++.

Practical Schedule

Programs Using C++
- Programs for mean and standard deviation
- Correlation coefficient
- Testing for population mean.
- Testing for difference of means.
- Paired t – Test.
- Chi-Square test for testing the independence of attributes.
- F – Test for equality of Variances.
- Fitting of Binomial Distribution and goodness of Fit.
- Fitting of Poisson Distribution and goodness of Fit.
- Fitting of Normal Distribution and goodness of Fit.
- Analysis of variance One-way Classification.
- Addition and Subtraction of Matrices.

Course Outcomes
At the end of the course, the student will be able to
CO1: Prepare programs for various statistical measures.
CO2: Prepare programs for various statistical tests.
CO3: Prepare programs for various matrix problems

Department Elective Courses

19STAE806-1 Programming With C++

Credits:3
Hours:3

Learning Objectives: This paper aims at introducing the language C++ in a systematic manner to make the students to have knowledge in program writing and developing the software.

Unit–1
C++: Introduction, Data types, Operators, Statements; Declaration of variables, Statements, simple C++ programs, Features of I/O stream, manipulation function, I/O stream flags.

Unit–2
Control Statements: Conditional expression, Switch statement, loop statements, Breaking control statements; Functions and Program structures; Introduction, definition, Types of functions, Actual and Formal arguments, Default augments, Storage class specifies, Recursive function, Pre-processors, Header files and standard function.

Unit–3
Arrays: Notation, Declaration, Initialization, Processing, Arrays and Functions, Multidimensional arrays. Pointers; Declaration, Arithmetic; Pointers and Functions, Pointers and Arrays; Strings, Array of Pointers, Pointers to Pointers.

Unit–4
Structures: Declaration, Initialization, Functions, Array of structures, Arrays within a structure, Nested Structures, Pointers and Structures, Unions and Bit fields, Enumerations.

Unit–5
Classes and Objects: Introduction, Structures and classes, Declaration, Members Functions, Object a class, Array of class objects, Pointers and Classes, Unions and Classes, nested Class, Constructors and Destructors, Inline Members functions and Friend Functions. C++ programs for Descriptive Measures of Statistics, ANOVA- One way and Two way Classifications.

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the fundamental concepts of C++ programming
CO2: Understand the various statements of C++
CO3: Study the arrays and pointers in C++
CO4: Familiarize in structures, classes and objects of C ++
CO5: Write programs using C++

19STAE806-2 Applied Regression Analysis

Credits:3
Hours:3

Learning Objectives: To study the various regression models and their applications.

Unit–1
Linear regression: Fitting a straight line, Precision of the estimated regression Coefficient of regression equation, lack of fit and pure error, simple Correlation, inverse regression.

**Unit–2**

Fitting of straight line by matrix method (General Linear model), Analysis of variance, The general regression situation with and without distributional assumptions. General linear hypothesis testing in regression situation weighted least squares bias in regression estimates, restricted least squares.

**Unit–3**

Multiple regression analysis: Estimation of parameters, Three variable model, partial regression Coefficient, OLS and ML estimation, Coefficient of multiple $R^2$ and adjusted $R^2$. Cobb-Douglas production function, polynomial regression models, partial correlation coefficients.

**Unit–4**

Multiple regression analysis: Hypothesis testing about individual regression coefficients, testing the overall significance of the sample regression, testing the equality of two regression coefficients, restricted least squares, Chow test, prediction with multiple regression, testing the functional form of regression.

**Unit–5**

Dummy variable regression models: ANOVA and ANACOVA models, The dummy variable alternative to the Chow test, interaction effects using dummy variables, use of dummy variables in seasonal analysis, piecewise linear regression, panel data regression models.

**Books for Study and Reference:**


**19STAE907-1 Elective – V Java and Oracle Programming**

**Credits:** 3  
**Hours:** 3

**Learning Objectives:** To understand the concepts and preparing programs using JAVA and also highlights the concept of ORACLE and its functions.

**Unit-1**

Introduction to JAVA, Data types, variables and arrays, control statements, looping statements. Classes, Methods, Data structures, Inheritance, packages and Inheritance. Exception handling. Multispread programming, I/O classes, String Handling, Utility classes and file stream.

**Unit-2**


**Unit-3**

Unit-4

Unit-5

Book for Study and Reference:

19STAE907-2 Advanced Econometrics
Credits: 3
Hours: 3

Learning Objectives: To enrich the skills of students to get more applied knowledge in Econometrics.

Unit–1

Unit–2
Heteroscedasticity: The nature of heteroscedasticity, OLS Estimation in the presence of heteroscedasticity, the method of generalized least squares (GLS), Consequences, Detection, remedial measures, caution about overreaching to heteroscedasticity.

Unit–3

Unit–4
Model selection criteria, Types of specification error, consequences of model specification errors, Test of specification of errors, errors of measurements, Model selection criteria.

Unit–5
Simultaneous-Equation Models: The nature, examples of simultaneous equation models. Identification problem, rules for identification, Estimation, ILS, 2SLS, Estimation using LIM, instrumental variables, K-class estimators, FIML, 3SL.
Inter Department Elective Courses

19 STSE 815.1– Statistical Methods

Credits:3
Hours:3

Learning Objectives: To enable the students of other discipline to understand the basic concepts of statistical methods.

Unit – 1
Definition, scope, functions and limitations of Statistics – Collection, Classification, Tabulation of data, Diagrammatic representation of data – Simple, Multiple and Percentage Bar diagram, Pie diagram and Graphical representation of data – Histogram, frequency polygon, frequency curve and ogives. Primary and Secondary data – Questionnaire method.

Unit – 2

Unit – 3

Unit – 4
Tests of Significance with their important concepts. Tests for large samples - Test for mean, difference of means, proportion and equality of proportions. Small sample tests – Test for mean, difference of Means, paired samples, test for correlation and regression coefficients.

Unit - 5
Chi square test for goodness of fit and independence of attributes. F-test – Analysis of variance, Assumptions, Applications, one way anova and two way anova classifications.

Note: The emphasis is only on the application of the methods. The derivations of the formulae are not necessary.

Books for Study and References :

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the various diagrams and graphs for statistical data.
CO2: Calculate the various statistical methods.
Learning Objectives: To impart basic knowledge about random variables and various distributions.

Unit-1

Unit-2

Unit-3
Generating Functions – Moment Generating Function- Limitations, Properties, Uniqueness Theorem, Cumulants - Properties, Characteristic Function- Properties of Characteristic Function, Necessary and Sufficient Conditions for a Function \( \phi(t) \) to be Characteristic Function, Some Important properties – Inversion Theorem, Uniqueness Theorem of Characteristic Functions, Problems and Exercises. (Content as in Chapter-7 of Book 1)

Unit-4
Discrete Probability Distributions - Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric, Multinomial Distributions and theirs –Moments, Recurrence, MGF, Additive Properties, Characteristic Functions, PGF, Problems and Exercises. (Content as in Chapter-8 of Book 1)

Unit-5
Continuous Probability Distributions – Normal, Rectangular, Gamma, Beta, Exponential, Standard Laplace, Cauchy Distributions, Sampling Distributions of t,F, Chi-Square and their Derivations, Additive Properties, Characteristic Functions, MGF, PGF. (Content as in Chapter-9 of Book 1)

Books for Study and Reference:-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understanding concepts random variables and probability distributions.
CO2: Study the expectation and related results.
Learning Objectives: To enable the students of other discipline to understand the basic concepts of Bio statistics in Biological applications.

Unit – 1
Definition, scope, functions and limitations of Statistics – Collection, Classification, Tabulation of data, Diagrammatic representation of data – Simple, Multiple and Percentage Bar diagram, Pie diagram and Graphical representation of data – Histogram, frequency polygon, frequency curve and ogives. Primary and Secondary data – Questionnaire method.

Unit – 2

Unit – 3

Unit – 4
Tests of Significance with their important concepts. Tests for large samples - Test for mean, difference of means, proportion and equality of proportions. Small sample tests – Test for mean, difference of Means, paired samples, test for correlation and regression coefficients. Applications to Biometric experiments.

Unit – 5
Chi square test for goodness of fit and independence of attributes. F-test – Analysis of variance, Assumptions, Applications, one way anova and two way anova classifications. Applications to Clinical experiments.

Note: The emphasis is only on the application of the methods. The derivations of the formulae are not necessary.

Books for Study and References:

Course Outcomes
At the end of the course, the student will be able to

CO1: Understand the various diagrams and graphs for statistical data.
CO2: Calculate the various statistical methods.
CO3: Calculate the measures for bivariate data.
CO4: Understand the use of tests of significance.
CO5: Understand the use of chi square and anova tests.
Value Added Course For Inter Disciplinary Students
VAC - Statistical Methods For Data Analysis

Learning Objectives: To enlight the students to acquire skills for adopting statistical tools and techniques of data analysis.

Unit–1
Tests of significance- population and sample; parameter and statistic standard error and sampling distribution of a statistic; Utility of Standard error; Steps involved in any test of significance; Basic concepts; Large sample tests- Tests for mean and difference of means; single proportion and equality of proportions; difference of standard deviations ; testing the correlation coefficient; equality of two correlation coefficients.

Unit–2
Exact tests- Test for mean; equality of means and for paired samples; observed partial and multiple correlation and regression coefficients; test for one population variance and test for equality of two population variances; test for observed sample correlation ratio.

Unit–3
Chi-square test for goodness of fit- contingency tables; test for independence of attributes; Yate’s correction for contingency table; Bartlett’s test for homogeneity of several population variances; test for homogeneity of several population proportions.

Unit–4
Multiple regressions- interpretation of \( R^2 \); interpretation of partial regression coefficients; test for linearity of regression; test for intercept in a regression. Application of Multivariate tests- Test for population mean vector (for covariance matrix known and unknown). Test for equality of two population mean vectors when the covariance matrices are equal; (known and unknown) Mahalanobis \( D^2 \) test.

Unit–5
Non parametric methods; Advantages and disadvantages over parametric methods. Sign test for medians,Median test for two populations, Wald-Wolfowitz run test, Kruskall-Wallis Rank sum Test (H-Test), Mann-Whitney- Wilcoxon rank sum test, U-test, Kolmogorov – Smirnov, Test for goodness of fit, Test for comparing two populations, Test for randomness, Friedman’s test.

Book for Study and Reference :-

Course Outcomes
At the end of the course, the student will be able to
CO1: Understand the various concepts of statistical tests and to apply large sample tests.
CO2: Apply the exact tests for research problems.
CO3: Apply the various chi-square tests.
CO4: Apply the multiple regression analysis and multivariate tests for real life problems.
CO5: Apply the non-parametric tests for sample data.