

[Subject Code (Major)- 2508000605020003]

[Subject Code (Minor)- 2508000605050005]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.COM SEM -V

Statistics Paper – 5: Statistical Inferential Techniques for Decision (Major &amp; Minor) (4 credit)

As per NEP 2020

To be implemented from the Academic year 2025-'26

| Course code         | MJSTC 505/MESTC 505                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Weightage | Marks |
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| Course title        | Paper – 5: Statistical Inferential Techniques for Decision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |       |
| credit              | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |       |
| Teaching per week   | 4 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |       |
| Effective from      | 2025-'26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |       |
| Purpose of course   | The Purpose of the course is to developed theoretical knowledge and practical applications so learners will develop the skills necessary for effective statistical analysis and interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |       |
| Objective of course | The main objective of this course is to provide students with a comprehensive understanding of hypothesis testing and small sample test. Additionally, the course introduces students to Indian official statistics, including the roles of key organizations such as the Central Statistical Organization, National Sample Survey, and Indian Statistical Institute.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |       |
| Programme Outcomes  | <p><b>PO-01: Knowledge &amp; Conceptual Understanding:</b> Develop a strong foundation in principles and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities.</p> <p><b>PO-02: Analytical &amp; Critical Thinking:</b> Apply critical thinking and analytical reasoning to evaluate data, hypotheses and real-world problems, leading to evidence-based conclusions.</p> <p><b>PO-03: Research &amp; Inquiry-based Learning:</b> Develop investigative skills through experimentation, data analysis to contribute to research and innovation.</p> <p><b>PO-04: Technical Skills:</b> Gain hands-on experience with instrumentation and computational tools relevant to research and industry applications.</p> <p><b>PO-05: Digital &amp; Computational Literacy:</b> Utilize digital tools, computational techniques and emerging technologies such as AI, statistical modelling to enhance learning and problem-solving.</p> <p><b>PO-06: Environmental &amp; Societal Responsibility:</b> Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility.</p> <p><b>PO-07: Effective Communication &amp; Collaboration:</b> Develop proficiency in scientific communication, both written and oral, for-effective dissemination of knowledge while collaborating in multidisciplinary teams.</p> <p><b>PO-08: Innovation &amp; Entrepreneurship:</b> Foster an entrepreneurial mind-set by applying knowledge for innovation, technology development, and industry-oriented applications. Develop sustainable solutions to address real-world challenges in research and environmental management.</p> <p><b>PO-09: Lifelong Learning &amp; Professional Growth:</b> Cultivate curiosity and adaptability for continuous learning, equipping students for higher education,</p> |           |       |

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|                              | research, and professional careers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |      |      |      |      |      |      |      |  |
|                              | <b>PO-10: Ethical Leadership &amp; Value-based Education:</b> Develop leadership qualities, ethical values, and a sense of responsibility in applying societal progress, aligning with Indian knowledge systems and global perspectives.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |      |      |      |      |      |      |      |  |
| Programme specific outcomes, | <b>PSO1: Understanding Statistical Principles</b><br>Graduate Should comprehend the importance and value of statistical principles and be able to convert problem description into testable research hypothesis.<br><b>PSO2: Professional and Entrepreneurial Skills Development</b><br>The program enhances student's professional skills and entrepreneurial capabilities, fostering independent logical and analytical thinking. It also emphasizes teamwork and leadership, preparing students for diverse environments by providing skill enhancement Certificate courses.<br><b>PSO3: Real-World Problem Solving</b><br>Students are trained to investigate, design, and develop practical solutions for real-world challenges, ensuring they can apply theoretical knowledge to practical situations through Experiential Learning and by providing platform for extracurricular activities.<br><b>PSO4: Self-Learning and Problem-Solving Skills</b><br>Students gain hands-on experience with advanced statistical tools and software, enhancing their ability to tackle real-world problems efficiently.<br><b>PSO5: Performing data Analysis</b><br>Graduate should be able to apply analytical and statistical methods to analyze data, interpret results, and provide solutions in various settings.<br><b>PSO6: Develop Communication Skills</b><br>Effectively Communicate Statistical results through clear & informative data visualizations.<br><b>PSO7: Commitment to Lifelong Learning and Research</b><br>The program focuses not only on imparting core education but also to developing interest in research.<br><b>PSO8: Provide Employability</b><br>Identify & explore career opportunities in statistics, including roles in industry, government & academia. |      |      |      |      |      |      |      |      |  |
| Mapping between POs and PSOs |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |  |
|                              | PO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    |      | ✓    |      | ✓    |      |      |      |  |
|                              | PO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    | ✓    | ✓    | ✓    | ✓    |      |      |      |  |
|                              | PO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    |      | ✓    |      |      |      | ✓    |      |  |
|                              | PO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |      | ✓    | ✓    | ✓    |      | ✓    |      |  |
|                              | PO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    |      | ✓    | ✓    | ✓    |      |      |      |  |
|                              | PO6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    |      | ✓    |      | ✓    |      |      | ✓    |  |
|                              | PO7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | ✓    | ✓    |      |      | ✓    |      |      |  |
|                              | PO8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓    | ✓    |      |      |      |      |      | ✓    |  |
|                              | PO9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |      | ✓    | ✓    | ✓    |      | ✓    | ✓    |  |
|                              | PO10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | ✓    | ✓    |      |      | ✓    |      |      |  |

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| Course outcomes               | <b>CO1:</b> Understand the basic concept of testing of hypothesis.<br><b>CO2:</b> Understand the basic concept of small sample test.<br><b>CO3:</b> Understand the basic concept of F-distribution & Analysis of Variance and concept of Fisher's Z transformation.<br><b>CO4:</b> Apply the course content for the further study of statistics and Acquire Knowledge about Indian official statistics.                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   |     |    |
| Mapping between COs with PSOs | <b>CO</b><br><b>CO1</b><br><b>CO2</b><br><b>CO3</b><br><b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>PSO1</b><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO2</b><br><input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO3</b><br><input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO4</b><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO5</b><br><input type="checkbox"/><br><input type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO6</b><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO7</b><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <b>PSO8</b><br><input type="checkbox"/><br><input type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> |     |    |
| Course content                | <b>Unit-I: Testing of hypothesis:</b> <ul style="list-style-type: none"> <li>Statistical hypothesis (Simple &amp; Composite)</li> <li>Test of a statistical hypothesis</li> <li>Null and Alternative hypothesis</li> <li>Critical region</li> <li>Two types of errors</li> <li>Level of significance and power of the test</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   | 10% | 05 |
|                               | <b>Unit-II: Small Sample test:</b><br><b>Test based on <math>\chi^2</math>, <math>t</math> and <math>F</math> distributions:</b> <ul style="list-style-type: none"> <li>Test of population variance</li> <li>Test of goodness of fit</li> <li>Test of independence of attributes</li> <li>Yate's correction</li> <li>Test of single mean</li> <li>Test of difference between two means (for dependent and independent samples)</li> <li>Test of significance of sample correlation coefficient.</li> <li>Confidence intervals for mean and variance for small samples.</li> </ul> <b>Fisher's Z-transformation:</b> <ul style="list-style-type: none"> <li>Fisher's Z-transformation and its application</li> <li>Test of two population variances.</li> </ul> |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   | 50% | 25 |
|                               | <b>Unit-III Analysis of variance:</b> <ul style="list-style-type: none"> <li>One way classifications</li> <li>two way classifications</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   | 20% | 10 |
|                               | <b>Unit-IV: Indian official statistics:</b> <ul style="list-style-type: none"> <li>Central Statistical Organization on (CSO) National Sample Survey (NSS)</li> <li>National Council of Applied Economics and Research</li> <li>Department of Commercial Intelligence and Statistics (D.C.I.S)</li> <li>Indian Statistical Institution (I.S.I)</li> <li>Principal Publications containing data on the topics such as population, agriculture and industry.</li> </ul>                                                                                                                                                                                                                                                                                           |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   | 20% | 10 |
| References                    | <ol style="list-style-type: none"> <li>Goon A.M., Gupta M. K. &amp; Dasgupta (1986): Fundamentals of Statistics Vol-II; Worls Press: Culcutta.</li> <li>Gupta S. C. &amp; Kapoor V. K. : Fundamentals of Mathematical Statistics; Sultan Chand &amp; Sons.</li> <li>George Casella &amp; Roger L. Berger (2024) : Statistical Inference; CRC Press: Taylor &amp; Francis Group</li> </ol><br>Unit I: Testing of Hypothesis<br>Title: Statistical Inference                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                         |                                                                                                                                        |                                                                                                                                        |                                                                                                                                                                         |                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                         |                                                                                                                                                   |     |    |

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|  | <p>Author(s): George Casella &amp; Roger L. Berger<br/> Publisher: CRC Press, Taylor &amp; Francis Group<br/> Publication Date: 2024<br/> Description: Covers theoretical foundations of statistical hypothesis testing in depth.</p> <p>Title: Introduction to the Theory of Statistics<br/> Author(s): Alexander M. Mood, Franklin A. Graybill, Duane C. Boes<br/> Publisher: McGraw-Hill<br/> Publication Date: 1974<br/> Description: Classic reference for probability and hypothesis testing concepts.</p> <p>Title: Theory of Point Estimation<br/> Author(s): Erich L. Lehmann &amp; George Casella<br/> Publisher: Springer<br/> Publication Date: 1998<br/> Description: Mathematical treatment of estimation and hypothesis testing.</p> <p>Unit II: Small Sample Tests<br/> Title: Introduction to Statistical Theory: Part 2<br/> Author(s): Sher Muhammad Chaudhry &amp; Shahid Kamal<br/> Publisher: Ilmi Kitab Khana<br/> Publication Date: 2006<br/> Description: Explains small sample distributions with solved problems.</p> <p>Title: Applied Statistics and Probability for Engineers<br/> Author(s): Douglas C. Montgomery &amp; George C. Runger<br/> Publisher: Wiley<br/> Publication Date: 2020<br/> Description: Provides applied perspective on hypothesis tests including small samples.</p> <p>Title: Biostatistics: A Foundation for Analysis in the Health Sciences<br/> Author(s): Wayne W. Daniel &amp; Chad L. Cross<br/> Publisher: Wiley<br/> Publication Date: 2018<br/> Description: Focuses on statistical testing with applications in biology and health sciences.</p> <p>Unit III: Analysis of Variance<br/> Title: Design and Analysis of Experiments<br/> Author(s): Douglas C. Montgomery<br/> Publisher: Wiley<br/> Publication Date: 2020<br/> Description: Covers theory and application of one-way and two-way ANOVA techniques.</p> |  |  |
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Mr. Arif

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|  | <p>Title: Experimental Design and Analysis<br/> Author(s): Howard J. Seltman<br/> Publisher: Carnegie Mellon University<br/> Publication Date: 2018<br/> Description: Open-access text offering detailed explanation of ANOVA and related methods.</p> <p>Title: Applied Linear Statistical Models<br/> Author(s): Michael H. Kutner, Christopher J. Nachtsheim, John Neter, William Li<br/> Publisher: McGraw-Hill<br/> Publication Date: 2004<br/> Description: Advanced treatment of linear models including ANOVA methods.</p> <p>Unit IV: Indian Official Statistics<br/> Title: Official Statistics: Concepts, Methods and Applications<br/> Author(s): United Nations Statistics Division (UNSD)<br/> Publisher: United Nations<br/> Publication Date: 2018<br/> Description: Detailed guide on official statistical systems globally, including India.</p> <p>Title: Statistical System in India<br/> Author(s): S. C. Gupta<br/> Publisher: Sultan Chand &amp; Sons<br/> Publication Date: 2015<br/> Description: Comprehensive coverage of India's official statistical system and institutions.</p> <p>Title: Fundamentals of Applied Statistics<br/> Author(s): S. C. Gupta &amp; V. K. Kapoor<br/> Publisher: Sultan Chand &amp; Sons<br/> Publication Date: 2020<br/> Description: Includes Indian official statistics along with applied techniques.</p> |  |  |
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