

[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 & Minor) (4 credit)

As per NEP 2020

To be implemented from the Academic year 2025-'26

Course code	MJSTC 505/MESTC 505	Weightage	Marks
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	PO-01: Knowledge & Conceptual Understanding: Develop a strong foundation in principles and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities. PO-02: Analytical & Critical Thinking: Apply critical thinking and analytical reasoning to evaluate data, hypotheses and real-world problems, leading to evidence-based conclusions. PO-03: Research & Inquiry-based Learning: Develop investigative skills through experimentation, data analysis to contribute to research and innovation. PO-04: Technical Skills: Gain hands-on experience with instrumentation and computational tools relevant to research and industry applications. PO-05: Digital & Computational Literacy: Utilize digital tools, computational techniques and emerging technologies such as AI, statistical modelling to enhance learning and problem-solving. PO-06: Environmental & Societal Responsibility: Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility. PO-07: Effective Communication & Collaboration: Develop proficiency in scientific communication, both written and oral, for-effective dissemination of knowledge while collaborating in multidisciplinary teams. PO-08: Innovation & Entrepreneurship: 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. PO-09: Lifelong Learning & Professional Growth: Cultivate curiosity and adaptability for continuous learning, equipping students for higher education,		

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	research, and professional careers.									
	PO-10: Ethical Leadership & Value-based Education: 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.	PSO1: Understanding Statistical Principles Graduate Should comprehend the importance and value of statistical principles and be able to convert problem description into testable research hypothesis. PSO2: Professional and Entrepreneurial Skills Development 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. PSO3: Real-World Problem Solving 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. PSO4: Self-Learning and Problem-Solving Skills Students gain hands-on experience with advanced statistical tools and software, enhancing their ability to tackle real-world problems efficiently. PSO5: Performing data Analysis Graduate should be able to apply analytical and statistical methods to analyze data, interpret results, and provide solutions in various settings. PSO6: Develop Communication Skills Effectively Communicate Statistical results through clear & informative data visualizations. PSO7: Commitment to Lifelong Learning and Research The program focuses not only on imparting core education but also to developing interest in research. PSO8: Provide Employability 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	CO1: Understand the basic concept of testing of hypothesis. CO2: Understand the basic concept of small sample test. CO3: Understand the basic concept of F-distribution & Analysis of Variance and concept of Fisher's Z transformation. CO4: Apply the course content for the further study of statistics and Acquire Knowledge about Indian official statistics.										
Mapping between COs with PSOs	CO CO1 CO2 CO3 CO4	PSO1 ☒ ☒ ☒ ☒	PSO2 ☐ ☐ ☐ ☒	PSO3 ☐ ☐ ☐ ☒	PSO4 ☒ ☒ ☒ ☒	PSO5 ☐ ☐ ☒ ☒	PSO6 ☒ ☒ ☒ ☒	PSO7 ☒ ☒ ☒ ☒	PSO8 ☐ ☐ ☒ ☒		
Course content	Unit-I: Testing of hypothesis: - Statistical hypothesis (Simple & Composite) - Test of a statistical hypothesis - Null and Alternative hypothesis - Critical region - Two types of errors - Level of significance and power of the test									10%	05
	Unit-II: Small Sample test: Test based on χ^2, t and F distributions: - Test of population variance - Test of goodness of fit - Test of independence of attributes - Yate's correction - Test of single mean - Test of difference between two means (for dependent and independent samples) - Test of significance of sample correlation coefficient. - Confidence intervals for mean and variance for small samples. Fisher's Z-transformation: - Fisher's Z-transformation and its application - Test of two population variances.									50%	25
	Unit-III Analysis of variance: - One way classifications - two way classifications									20%	10
	Unit-IV: Indian official statistics: - Central Statistical Organization on (CSO) National Sample Survey (NSS) - National Council of Applied Economics and Research - Department of Commercial Intelligence and Statistics (D.C.I.S) - Indian Statistical Institution (I.S.I) - Principal Publications containing data on the topics such as population, agriculture and industry.									20%	10
References	- Goon A.M., Gupta M. K. & Dasgupta (1986): Fundamentals of Statistics Vol-II; Worls Press: Culcutta. - Gupta S. C. & Kapoor V. K. : Fundamentals of Mathematical Statistics; Sultan Chand & Sons. - George Casella & Roger L. Berger (2024) : Statistical Inference; CRC Press: Taylor & Francis Group Unit I: Testing of Hypothesis Title: Statistical Inference										

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	Author(s): George Casella & Roger L. Berger Publisher: CRC Press, Taylor & Francis Group Publication Date: 2024 Description: Covers theoretical foundations of statistical hypothesis testing in depth. Title: Introduction to the Theory of Statistics Author(s): Alexander M. Mood, Franklin A. Graybill, Duane C. Boes Publisher: McGraw-Hill Publication Date: 1974 Description: Classic reference for probability and hypothesis testing concepts. Title: Theory of Point Estimation Author(s): Erich L. Lehmann & George Casella Publisher: Springer Publication Date: 1998 Description: Mathematical treatment of estimation and hypothesis testing. Unit II: Small Sample Tests Title: Introduction to Statistical Theory: Part 2 Author(s): Sher Muhammad Chaudhry & Shahid Kamal Publisher: Ilmi Kitab Khana Publication Date: 2006 Description: Explains small sample distributions with solved problems. Title: Applied Statistics and Probability for Engineers Author(s): Douglas C. Montgomery & George C. Runger Publisher: Wiley Publication Date: 2020 Description: Provides applied perspective on hypothesis tests including small samples. Title: Biostatistics: A Foundation for Analysis in the Health Sciences Author(s): Wayne W. Daniel & Chad L. Cross Publisher: Wiley Publication Date: 2018 Description: Focuses on statistical testing with applications in biology and health sciences. Unit III: Analysis of Variance Title: Design and Analysis of Experiments Author(s): Douglas C. Montgomery Publisher: Wiley Publication Date: 2020 Description: Covers theory and application of one-way and two-way ANOVA techniques.		
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	Title: Experimental Design and Analysis Author(s): Howard J. Seltman Publisher: Carnegie Mellon University Publication Date: 2018 Description: Open-access text offering detailed explanation of ANOVA and related methods. Title: Applied Linear Statistical Models Author(s): Michael H. Kutner, Christopher J. Nachtsheim, John Neter, William Li Publisher: McGraw-Hill Publication Date: 2004 Description: Advanced treatment of linear models including ANOVA methods. Unit IV: Indian Official Statistics Title: Official Statistics: Concepts, Methods and Applications Author(s): United Nations Statistics Division (UNSD) Publisher: United Nations Publication Date: 2018 Description: Detailed guide on official statistical systems globally, including India. Title: Statistical System in India Author(s): S. C. Gupta Publisher: Sultan Chand & Sons Publication Date: 2015 Description: Comprehensive coverage of India's official statistical system and institutions. Title: Fundamentals of Applied Statistics Author(s): S. C. Gupta & V. K. Kapoor Publisher: Sultan Chand & Sons Publication Date: 2020 Description: Includes Indian official statistics along with applied techniques.		
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
T.Y.B.COM SEM -V

Statistics Paper – VI: Statistical Inference (Major Paper) (4 credit)

As per NEP 2020

To be implemented from the Academic year 2025-'26

Course code	MJSTC 506	Weightage	Marks
Course title	Paper – VI: Statistical Inference		
credit	4		
Teaching per week	4 Hours		
Effective from	2025-'26		
Purpose of course	The purpose is to make students aware about the application of estimation to find interval of a population parameter.		
Objective of course	The main objective of this course is to provide fundamental knowledge of estimation, methods of estimation and interval estimation.		
Programme outcomes	PO-01: <u>Knowledge & Conceptual Understanding</u>: Develop a strong foundation in principles and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities. PO-02: <u>Analytical & Critical Thinking</u>: Apply critical thinking and analytical reasoning to evaluate data, hypotheses and real-world problems, leading to evidence-based conclusions. PO-03: <u>Research & Inquiry-based Learning</u>: Develop investigative skills through experimentation, data analysis to contribute to research and innovation. PO-04: <u>Technical Skills</u>: Gain hands-on experience with instrumentation and computational tools relevant to research and industry applications. PO-05: <u>Digital & Computational Literacy</u>: Utilize digital tools, computational techniques and emerging technologies such as AI, statistical modelling to enhance learning and problem-solving. PO-06: <u>Environmental & Societal Responsibility</u>: Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility. PO-07: <u>Effective Communication & Collaboration</u>: Develop proficiency in scientific communication, both written and oral, for effective dissemination of knowledge while collaborating in multidisciplinary teams. PO-08: <u>Innovation & Entrepreneurship</u>: 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. PO-09: <u>Lifelong Learning & Professional Growth</u>: Cultivate curiosity and adaptability for continuous learning; equipping students for higher education, research, and professional careers. PO-10: <u>Ethical Leadership & Value-based Education</u>: Develop leadership qualities, ethical values, and a sense of responsibility in applying societal		

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	progress, aligning with Indian knowledge systems and global perspectives.											
Programme specific outcomes	PSO1: Understanding Statistical Principles Graduate Should comprehend the importance and value of statistical principles and be able to convert problem description into testable research hypothesis. PSO2: Professional and Entrepreneurial Skills Development 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. PSO3: Real-World Problem Solving 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. PSO4: Self-Learning and Problem-Solving Skills Students gain hands-on experience with advanced statistical tools and software, enhancing their ability to tackle real-world problems efficiently. PSO5: Performing data Analysis Graduate should be able to apply analytical and statistical methods to analyze data, interpret results, and provide solutions in various settings. PSO6: Develop Communication Skills Effectively Communicate Statistical results through clear & informative data visualizations. PSO7: Commitment to Lifelong Learning and Research The program focuses not only on imparting core education but also to developing interest in research. PSO8: Provide Employability 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		✓	✓			✓					
Course outcomes	CO1: Understand the basic concept of estimation. CO2: Understand the properties of good estimators. CO3: Understand the methods of estimation. CO4: Understand the concept of interval estimation and apply the course content for the further study of statistics.											

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Mapping between COs with PSOs	CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
	CO1	✓	✓		✓	✓	✓				
	CO2	✓	✓		✓	✓	✓				
	CO3	✓	✓	✓	✓	✓	✓				
	CO4	✓	✓	✓	✓	✓	✓	✓	✓		
Course content	Unit-I: Estimation: - Meaning of parameters of probability distributions, discussion of different types of probability distributions and their parameters, Parametric Space. - Definition of Estimator and Estimate.									10%	5
	Unit-II: Properties of a good estimator: - Unbiasedness - Consistency - Efficiency - Sufficiency - Definition of likelihood function.									20%	10
	Unit-III: Application of different methods of Estimation: - Methods for finding estimators - Method of Moments with its limitations. - Method of Maximum Likelihood Estimation procedure. - Properties of MLE (without proof) - Cramer Rao inequalities - Method of Least Square.									40%	20
	Unit-IV: Interval Estimation: - Confidence Interval for Small Sample - Confidence Interval for population mean μ of $N(\mu, \sigma^2)$ (both case when σ is known & unknown) - Confidence Interval for σ^2 - Confidence Interval for Large Sample - Population means - Population correlation coefficient - Proportion of success - Number of successes									30%	15
References	1. H.A.Taha Operation Research, Macmillian Publishing CO.1999. 2. Goon A.M., Gupta M.K. and Dasgupta B. (2000): Fundamentals of Statistics, Vol. I & II, 8 th Edn. The World Press, Kolkata. 3. Elhance D.N. (1986): Fundamental of Statistics, Kitab Mahal Ahmadabad. 4. Johnsons, N.L.andKotz, S. (1977): Distributions in Statistics, John Wiley. 5. Ferguson, T. (1967): Mathematical Statistics; Academic Press. 6. Jaiswal, M. C. (1973): Statistical Distributions; Guj. Uni. Book Pub. Board, Ahmedabad. 7. Rohatgi, V.K. (1984): Introduction to Probability Theory and Mathematical Statistics; Wiley Eastern.										

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