

G U J A R A T U N I V E R S I T Y
U.G. B.COM (HONS.)
SEMESTER – IV
INDUSTRIAL STATISTICS
COURSE CODE: DSC M STA 244
CREDIT MARK DISTRIBUTION – 04
AS PER NEP 2020 (To be effective from June 2024)

Lecture 04 Hours

Tutorial – 00

Practicum – 00

COURSE OBJECTIVES

- To equip students with the knowledge and skills to apply statistical techniques for analyzing data, predicting trends, and ensuring consistency in quality through various statistical tools, enabling informed decision-making in business and industrial contexts.
- To enhance students' ability to design and implement quality control systems using advanced statistical methods, helping them optimize operational efficiency, improve product quality, and balance inspection costs with quality requirements in production and business processes.

PRE – REQUISITE

The pre-requisites for Industrial Statistics—include a solid foundation in Probability and Statistics for understanding statistical models and quality assessment methods. Calculus is also necessary to grasp the mathematical foundations of model derivations in time series and forecasting. For Business Forecasting, familiarity with Basic Economics is essential to contextualize forecasting techniques within economic and business environments. Additionally, an understanding of Industrial Engineering or Manufacturing Processes is beneficial for Process Control Techniques and Product Control Techniques, as these topics focus on quality control and sampling methods within production and manufacturing contexts. Together, these pre-requisites provide the foundational knowledge needed to effectively analyze, forecast, and control quality in data-driven and industrial settings.

CO – REQUISITE

The co-requisites Industrial Statistics—include Regression Analysis for model building and prediction, which is fundamental to time series and forecasting. For Business Forecasting, Business Analytics provides complementary skills to interpret and act on forecasts effectively. In the areas of Process Control Techniques and Product Control Techniques, Quality Management Systems are important to understand quality frameworks, while Data Analytics for Process Improvement supports the analysis of process performance and enhancement of quality control. Together, these co-requisites enable students to apply theoretical knowledge practically, ensuring robust data analysis, forecasting, and quality management skills across business and industrial applications.

COURSE OUTCOMES

The Course Outcomes for an Industrial Statistics course, covering Time Series Analysis, Business Forecasting, Process Control Techniques (Statistical Quality Control), and Product Control Techniques (Acceptance Sampling), are designed to provide students with practical skills for data analysis, forecasting, and quality management in business and industrial contexts. In Time Series Analysis, students will learn to identify and analyze patterns such as trends, seasonality, and cycles within time-dependent data. In Business Forecasting, students will be able to implement various forecasting methods like moving averages, exponential smoothing, and regression analysis to predict business trends, evaluate forecast accuracy, and refine models based on data feedback, aiding strategic planning and decision-making. In Process Control Techniques (Statistical Quality Control), students will become proficient in using statistical tools such as control charts (e.g., X-bar, R, p-charts) to monitor and maintain process stability and apply corrective actions to ensure consistent quality in production. Finally, in Product Control Techniques (Acceptance Sampling), students will develop the ability to design and implement single, double, and multiple sampling plans for assessing product quality, analyze Operating Characteristic (OC) curves to measure sampling effectiveness, and balance inspection costs with quality standards for optimal resource allocation. By the end of the course, students will be equipped to analyze data, forecast business needs, and apply quality control techniques, empowering them to make informed, data-driven decisions and contribute to continuous improvement in various industrial and business environments.

UNIT	CONTENT	WEIGHTAGE
1	<p>TIME SERIES ANALYSIS</p> <ul style="list-style-type: none"> ➤ Meaning and uses of Time Series ➤ Meaning of Analysis of Time Series ➤ Components of Time Series <ul style="list-style-type: none"> ● Secular Trend ● Seasonal Variations ● Cyclical Variations ● Irregular Variations ➤ Methods for Finding Trend <ul style="list-style-type: none"> ● Graphical Method ● Moving Average Method with Examples ● Method for Finding Seasonal Variations with Examples ● Method for Finding Seasonal Indices with Example <p>Note:</p> <p>1 All topics are using Additive Model Only</p> <p>2 All the graphs in this unit can be provided for illustrative purposes only and will not be included in the examination.</p>	25%
2	<p>BUSINESS FORECASTING</p> <ul style="list-style-type: none"> ➤ Meaning and Importance of Business Forecasting ➤ Statistical methods for Forecasting (Brief explanation of Various methods. Such as Time Series, Index Number, Regression, Extrapolation, Economic Models, Opinion Poll etc.) ➤ Method of Least Squares with Examples <ul style="list-style-type: none"> ● For Linear Trend ● For Second Degree Parabolic Trend ➤ Method of Exponential Smoothing with Examples 	25%
3	<p>PROCESS CONTROL TECHNIQUES (STATISTICAL QUALITY CONTROL)</p> <ul style="list-style-type: none"> ➤ Meaning of Quality and Quality Control ➤ Uses of Quality Control in Industry ➤ Variation in Quality and Causes of Variation ➤ Principle of Control Charts ➤ Process Control Limits ➤ Revised Control Limits ➤ Theory of Runs ➤ Chart of Variables with Examples [Chart of Average (\bar{X}- Chart) and Chart of Range (R - Chart)] ➤ Chart of Attributes with Examples for Constant Sample Size [Chart of fraction defective (p – chart), Chart of Number of Defective Items (np-chart), Chart of per Unit Defects (C- Chart)] ➤ Difference between Chart of Variables and Chart of Attributes 	25%

4	<p>PRODUCT CONTROL TECHNIQUES (ACCEPTANCE SAMPLING)</p> <ul style="list-style-type: none"> ➤ Meaning of Product Control Techniques ➤ Meaning of Single Sampling Plan (SSP) ➤ Acceptable Quality Level (AQL) ➤ Lot Tolerance Proportion Defective (LTPD) ➤ Producer's Risk and Consumer's Risk ➤ Operating Characteristic Curve (OC Curve) ➤ Average Sample Number (ASN) ➤ Average Total Inspection (ATI) ➤ Average Outgoing Quality (AOQ) ➤ Simple Examples based on Hypergeometric and Poisson Distribution only 	25%
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MODE OF EVALUATION

Evaluation will be divided in two parts:

- **Semester End Evaluation (SEE):** Semester End Examination will be conducted by the Gujarat University of 50 Marks
- **Continuous and Comprehensive Evaluation (CCE):** Continuous and Comprehensive Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University time to time

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. "Statistics for Business and Economics"
Author: Paul Newbold, William L. Carroll, Betty Thorne
Publisher: Pearson Education
2. "Applied Multivariate Statistical Analysis"
Author: Richard A. Johnson, Dean W. Wichern
Publisher: Pearson Prentice Hall
3. "Industrial Statistics: A Handbook for Practitioners"
Author: R. K. Gupta, D. S. Hira
Publisher: S. Chand & Co. (Indian Edition)
4. "Business Forecasting"
Author: John E. Hanke, Dean W. Wichern
Publisher: Pearson Education
5. "Quality Control and Industrial Statistics"
Author: A. C. Montgomery
Publisher: Wiley
6. "Time Series Analysis and Forecasting: A Practical Guide for Scientists and Engineers"
Author: A. S. Bovas Abraham, Johannes Ledolter
Publisher: Elsevier Science
7. "Operations Research: An Introduction"
Author: Taha, H. A.
Publisher: Pearson Education
8. "Introduction to Time Series Analysis and Forecasting"
Author: Douglas C. Montgomery, Cheryl L. Jennings, M. Pamela McRae
Publisher: Wiley
9. "Statistical Methods for Quality Control"
Author: G. K. Gupta
Publisher: Tata McGraw-Hill Education (Indian Edition)
10. "Statistical Quality Control"
Author: M. Mahajan
Publisher: Dhanpat Rai & Sons (Indian Edition)
11. "Industrial Engineering and Management"
Author: O. P. Khanna
Publisher: Dhanpat Rai Publications (Indian Edition)
12. "Fundamentals of Applied Statistics"
Author: S. C. Gupta, V. K. Kapoor
Publisher: Sultan Chand & Sons (Indian Edition)
13. "Principles of Statistical Inference"
Author: J. K. Ghosh
Publisher: Springer
14. "Statistics for Management"
Author: Richard I. Levin, David S. Rubin
Publisher: Pearson Education
15. "Process Quality Control: Troubleshooting and Interpretation of Data"
Author: J. D. Sokol
Publisher: Wiley