

**DISCIPLINE SPECIFIC CORE COURSE: STADSC-301**  
**(Applied Statistics)**

**Semester V**  
**(Credits: 4)**

**Contact Hours: 60**

**Full Marks = 100 [End Semester Exam (70) +Internal (30)]**

**Pass Marks = 40 [End Semester Exam (28) +Internal (12)]**

**Learning Objective**

- Develop a comprehensive understanding of quality control principles, including the distinction between chance and assignable causes of variation, and the significance of statistical control charts in maintaining consistent process and product quality.
- Learn how to construct and interpret various control charts for both variables and attribute data. Understand the rationale behind subgrouping, and gain the ability to identify and react to quality variations effectively using control charts.
- Gain insight into acceptance sampling plans, their principles, and their practical applications. Understand the concepts of Operating Characteristic (OC) curves, Average Outgoing Quality (AOQ), and other key performance measures related to acceptance sampling.
- Acquire the ability to analyze time series data, including identifying the different components such as trend, seasonality, cyclic variations, and random fluctuations. Learn methods to decompose time series and estimate these components.
- Develop proficiency in constructing and interpreting index numbers. Learn about various index number formulas, including weighted and unweighted indices, and their application in measuring changes in price levels, with a focus on consumer price index numbers.

**Learning Outcome**

- Gain practical skills in applying statistical techniques to manage and control the quality of processes and products. Learn to distinguish between random and assignable variations and use control charts to maintain consistent quality standards.
- Acquire the ability to analyze and interpret data using statistical tools. Understand how to identify trends, patterns, and irregularities in time series data and make informed decisions based on the analysis.
- Develop the skills to make informed decisions about acceptance sampling plans based on factors such as lot quality, production processes, and desired quality levels. Understand the trade-offs between different sampling strategies.
- Understand the components of time series data and their importance in various fields. Gain the ability to decompose time series and estimate trend, seasonality, and other variations, enabling better forecasting and planning.

- Acquire proficiency in constructing and interpreting index numbers, a crucial tool for measuring economic and price-level changes. Understand the application of index numbers in real-world scenarios and their significance in economic analysis.
- By studying these course students will be well-equipped with the skills necessary to manage quality, analyze time series data, make informed decisions about acceptance sampling, and understand the principles and applications of index numbers in various sectors, contributing to effective decision-making and data analysis.

#### UNIT-I

Statistical Quality Control: Concepts and applications, introduction to Process and Product Controls. Chance and assignable Causes of quality variation. Statistical Control Charts- Construction and Statistical basis of  $3\sigma$  Control charts, Rational sub-group. Control charts for variables: X-bar & R-chart. Control charts for attributes: np-chart, p-chart, c-chart.

(12 hours)

#### UNIT-II

Rates and Ratios of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates. Life Tables: types, assumptions, description, construction and uses. Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

(12 hours)

#### UNIT-III

Introduction to times series data, application of time series in various fields. Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting of various mathematical curves (linear, exponential, polynomial), Method of moving averages.

(12 hours)

#### UNIT-IV

Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to Moving Averages and Link Relative method. Cyclic Component: Harmonic Analysis (concept only). Random Component: Variate difference method.

(12 hours)

#### UNIT-V

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain-based index numbers and vice-versa. Consumer price index numbers-its use and limitations.

(12 hours)

### **SUGGESTED READING:**

1. Montogomery, D. C. (2009). Introduction to Statistical Quality Control (6th Edition). Wiley India Private Ltd.

2. Goon, A.M., Gupta, M.K. & Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I a.& II (8<sup>th</sup> Edition). The World Press, Kolkata.
3. Mukhopadhyay, P. (2011). Applied Statistics (2<sup>nd</sup> edition, revised reprint). Books and Allied(P) Ltd.
4. Montogomery, D. C. & Runger, G.C. (2008). Applied Statistics and Probability for Engineers (3rd Edition, Reprint). Wiley India Pvt. Ltd.
5. Gupta, S.C., & Kapoor, V.K. (2007). Fundamentals of Applied Statistics (4th Edition). Sultan Chand and Sons., New Delhi.
6. Kendall, M.G. (1976). Time Series, Charles Griffin.
7. Chatfield, C. (1980). The Analysis of Time Series –An Introduction. Chapman & Hall.