Bachelor of Science (Hons.) in Statistics
STAT-GE-4: Applied Statistics

Credits: 6 **Marks: 150**

Course Objectives:
The learning objectives include:
- This course will help students to know the applications of Statistics and learn and apply these techniques in the core course of their study.
- This course will give exposure to four applied fields of statistics viz. Time Series, Index Numbers, Statistical Quality Control and Demographic methods.
- They will be having hands on practice of working on the data related to above mentioned fields.

Course Learning Outcomes:
After completing this course, students should have developed an understanding of:
- Time series data, components of time series data, study the behavior and identifying the variation due to different components in the data.
- They will study to identify and measure various components of time series data.
- The fundamental concepts of Index Numbers, Construction of price and quantity Index numbers.
- Construction of Wholesale and Consumer price Index and its significance.
- Statistical Quality Control, Use of Statistical methods in industrial research and practice.
- Chance and Assignable causes of variation in data.
- Statistical process control tools- Control charts for variables and attributes.
- To learn about different demographic methods. Measurement of mortality and fertility rates, reproduction and population growth measures.
- Construction and importance of Life Table.

Contents:

UNIT I

Economic Time Series: Components of time series, Decomposition of time series- Additive and multiplicative model with their merits and demerits, Illustrations of time series.Measurement of trend by method of free-hand curve, method of semi-averages and method of least squares (linear, quadratic and exponential).Measurement of seasonal variations by method of ratio to trend.

UNIT II

Index numbers: Introduction, Construction of price and quantity Index Numbers by Simple and Weighted Aggregate Method. Construction of price and quantity index numbers by Laspeyre's, Paasche's, Marshall-Edgeworth's and Fisher's Formula. Criteria for a good

index number. Construction of wholesale price index number, fixed base index number and Consumer price indexnumber with interpretation. Uses and limitations of index numbers.

UNIT III

Statistical Quality Control: Importance of statistical methods in industrial research and practice. Determination of tolerance limits. Causes of variations in quality: Chance and Assignable. General theory of control charts, Process & Product control, Control charts for variables: $\bar{X}$ and R-charts. Control charts for attributes: p and c-charts.

UNIT IV

Demographic Methods: Introduction, measurement of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates. Life (mortality) tables: definition of its main functions and uses. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.

SUGGESTED READINGS:

1. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008). *Fundamentals of Statistics*, Vol. II, 9th Ed., World Press, Kolkata.
2. Gupta, S.C. and Kapoor, V.K. (2014). *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand.
3. Mukhopadhyay, P. (1999). *Applied Statistics*, New Central Book Agency, Calcutta.
4. Montogomery, D.C. (2009). *Introduction to Statistical Quality Control*, 6th ed., Wiley India Pvt. Ltd.

PRACTICAL/LAB WORK
List of Practicals:

1. Measurement of trend: Fitting of linear, quadratic trend, exponential curve and plotting of trend values and comparing with given data graphically.
2. Measurement of seasonal indices by Ratio-to-trend method and plotting of trend values and comparing with given data graphically.
3. Construction of price and quantity index numbers by Laspeyre's formula, Paasche's formula, Marshall-Edgeworth's formula, Fisher's Formula. Comparison and interpretation.
4. Construction of wholesale price index number, fixed base index number and consumer price index number with interpretation.
5. Construction and interpretation of $\bar{X}$ and R-chart.
6. Construction and interpretation p-chart (fixed sample size) and c-chart.
7. Computation of measures of mortality.
8. Completion of life table.
9. Computation of measures of fertility and population growth.

Week-wise Teaching Plan:

Week 1-2	Introduction to Time Series, Components of time series, Decomposition of time series-Additive and multiplicative model with their merits and demerits.
Week 2-3	Illustrations of time series. Measurement of trend by method of free-hand curve, method of semi-averages. Method of least squares (Linear trend). Practical work.
Week 3-4	Measurement of trend by method of least squares (quadratic and exponential). Measurement of seasonal variations by method of ratio to trend. Practical work.
Week 5-6	Introduction to Index Numbers, Construction of price and quantity Index Numbers by Simple Aggregate Method and Weighted Aggregate Method, Comparison and interpretation. Practical work.
Week 7	Criteria of a good Index number. Construction of wholesale price index numbers, fixed base index numbers and consumer price index numbers with interpretation. Uses and limitations of index numbers. Practical work.
Week 8	Introduction to Statistical Quality Control, Use of Statistical methods in industrial research and practice. Causes of variations in quality: chance and Assignable with illustrations.
Week 9	General theory of control charts, process & product control Determination of tolerance limits. Practical work.
Week 10	Control charts for variables: X- bar and R-charts. Illustrations and Practical work.
Week 11	Control charts for attributes: p and c-charts Illustrations and Practical work.
Week 12	Introduction to Demographic Methods, measurement of population, rates and ratios of vital events.
Week 13	Measurement of mortality: Crude Death Rate, Specific Death Rate (w.r.t. Age and sex), Infant Mortality Rate, Standardized death rates. Practical work.
Week 14	Life (mortality) tables: Assumptions, Description and Construction of Life table. Uses of Life table. Practical work.
Week 15	Measurement of fertility and reproduction rate: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR. Comparison and Interpretation. Practical work.

Facilitating the Achievement of Course Learning Outcomes:

Unit No.	**Course Learning Outcomes**	**Teaching and Learning Activity**	**Assessment Tasks**
I	Time series data, components of time series data, study the behavior and identifying the variation due to different components in the data.	(i) Class room lectures and discussions.	Participation in class discussion.
I	Identify and measure various components of time series data.	(i)Class room lectures and discussions. (ii) Practical problems from	Participation in class discussion. Problem solving, Analyse and Interpret the results.

		the list of practical.	
II	Index Numbers, construction of price and quantity index numbers.	(i) Class room lectures and discussions. (ii) Practical problems from the list of practical.	Participation in class discussion. Problem solving, Analyse and Interpret the results.
II	Construction of wholesale and Consumer price Index and its significance.	(i) Class room lectures and discussions. (ii) Practical problems from the list of practical.	Participation in class discussion. Problem solving, Analyse and Interpret the results.
A*	Understanding basic concepts with relevance and importance of time series and index numbers.	Class Test/ Assignment work.	Extent of clarity of theoretical concepts studied in the course.
III	Statistical Quality Control, Use of Statistical methods in industrial research and practice. Chance and Assignable causes of variation in data.	(i) Class room lectures and discussions.	Participation in class discussion.
III	Statistical process control tools- Control charts for variables, attributes.	(i) Class room lectures and discussions. (ii) Practical problems from the list of practical.	Participation in class discussion. Problem solving, Analyse and Interpret the results.
IV	Different demographic methods. Measurement of mortality and fertility rates, reproduction and population growth measures.	(i) Class room lectures and discussions. (ii) Practical problems from the list of practical.	Participation in class discussion. Problem solving, Analyse and Interpret the results.
IV	Construction and importance of Life Table.	(i) Class room lectures and discussions. (ii) Practical problems from the list of practical.	Participation in class discussion. Problem solving, Analyse and Interpret the results.
B*	Understanding of complete	Class Test/	Extent of clarity of theoretical

	course.	Assignment work	concepts studied in the course.
C*	Application of Time Series, Index Numbers, Statistical Quality Control and Demographic Methods. (optional)	Project Work and its presentation.	Ability to apply concepts of Time Series, Index Numbers, Statistical Quality Control and Demographic Methods on practical data, understanding and giving solutions to a problem.

*As per requirements of Internal Assessment for B.Sc. (Hons.).

Keywords: Components and Decomposition of time series, Index Numbers, Control charts, Demographic Methods, Measurement of mortality, Life Table.