

# Subject Title: **Basic Statistics (212207)**

Course Teacher: **Md. Humayun Reza (T-03) & Roushan Jahan (T-05)**

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
<b>1. Introduction to Statistics (T-05)</b>	1. Population and Sample; Discrete and Continuous Variables	Realize Population and Sample; Discrete and Continuous Variables.
	2. Random variables.	Explain Random variables.
	3. Statistical Variables; Scope, Importance and Limitations of Statistics.	Explain Statistical Variables; Scope, Importance and Limitations of Statistics.
<b>2. Collection and Presentation of Data (T-05)</b>	4. Construction of a Frequency Distribution	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define key terms related to frequency distribution, such as class interval, frequency, and class limits. <i>(Cognitive Level: Remembering)</i></li> <li>2. Describe the steps involved in constructing a frequency distribution table from raw data. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Analyzing and Creating):</p> <ol style="list-style-type: none"> <li>3. Analyze a raw dataset to determine appropriate class intervals and justify the choices made. <i>(Cognitive Level: Analyzing)</i></li> <li>4. Construct a complete frequency distribution table from a real-world dataset, including cumulative and relative frequencies where appropriate. <i>(Cognitive Level: Creating)</i></li> </ol>
	5. Graphical Representation of Quantitative and Qualitative Data (Histogram, Ogive, Pie-chart)	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Identify different types of graphs used for representing quantitative and qualitative data, such as histograms, ogives, and pie charts. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the purpose and basic construction method of a histogram, ogive, and pie chart. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Evaluating):</p> <ol style="list-style-type: none"> <li>3. Construct appropriate graphs (histogram, ogive, pie chart) based on given datasets, ensuring accuracy in scale and labeling. <i>(Cognitive Level: Applying)</i></li> <li>4. Evaluate and compare different graphical representations for effectiveness in communicating data trends and patterns. <i>(Cognitive Level: Evaluating)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
	6. Graphical Representation of Quantitative and Qualitative Data (Bar Diagram and Frequency Polygon, etc.)	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define and differentiate between various graphical tools such as bar diagrams and frequency polygons. (<i>Cognitive Level: Remembering</i>)</li> <li>2. Describe the appropriate use of bar diagrams and frequency polygons for representing qualitative and quantitative data. (<i>Cognitive Level: Understanding</i>)</li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Construct bar diagrams and frequency polygons from given datasets, using correct scales, labels, and formatting. (<i>Cognitive Level: Applying</i>)</li> <li>4. Analyze datasets to determine the most effective graphical method for representation and justify the selection. (<i>Cognitive Level: Analyzing</i>)</li> </ol>
<b>3. Measures of Central Tendency (T-03)</b>	7. Computation, Application, Advantages and Disadvantages of Different Measures of Central Tendency	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the three main measures of central tendency: mean, median, and mode. (<i>Cognitive Level: Remembering</i>)</li> <li>2. Explain the basic computational methods and typical use cases for mean, median, and mode. (<i>Cognitive Level: Understanding</i>)</li> </ol> <p>Higher-Order Learning Outcomes (Applying and Evaluating):</p> <ol style="list-style-type: none"> <li>3. Apply appropriate measures of central tendency to different datasets and interpret the results in context. (<i>Cognitive Level: Applying</i>)</li> <li>4. Evaluate the advantages and disadvantages of mean, median, and mode about data characteristics such as skewness or presence of outliers. (<i>Cognitive Level: Evaluating</i>)</li> </ol>
	8. Arithmetic Mean	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the term <i>arithmetic mean</i> and identify it as a measure of central tendency. (<i>Cognitive Level: Remembering</i>)</li> <li>2. Explain the formula and basic steps used to calculate the arithmetic mean for both ungrouped and grouped data. (<i>Cognitive Level: Understanding</i>)</li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	<b>Learning Outcomes</b> At the end of the class the students would be able to
		Higher-Order Learning Outcomes (Applying and Analyzing): <ol style="list-style-type: none"> <li>3. Calculate the arithmetic mean for different types of datasets, including real-life numerical data and grouped frequency distributions. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the effect of extreme values (outliers) on the arithmetic mean and assess its suitability in various contexts.</li> </ol>
	9. Geometric Mean, Harmonic Mean	Lower-Order Learning Outcomes (Remembering and Understanding): <ol style="list-style-type: none"> <li>1. Define geometric mean and harmonic mean, and distinguish them from the arithmetic mean. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the appropriate conditions for using geometric and harmonic means in data analysis. <i>(Cognitive Level: Understanding)</i></li> </ol> Higher-Order Learning Outcomes (Applying and Analyzing): <ol style="list-style-type: none"> <li>3. Compute the geometric mean and harmonic mean for both simple and grouped data sets. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze and compare the effectiveness of geometric and harmonic means in solving real-world problems involving rates, ratios, and growth factors. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	10. Median	Lower-Order Learning Outcomes (Remembering and Understanding): <ol style="list-style-type: none"> <li>1. Define the median as a measure of central tendency and distinguish it from the mean and mode. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the steps involved in calculating the median for both ungrouped and grouped data. <i>(Cognitive Level: Understanding)</i></li> </ol> Higher-Order Learning Outcomes (Applying and Evaluating): <ol style="list-style-type: none"> <li>3. Calculate the median for various datasets, including those with an odd or even number of observations and frequency distributions. <i>(Cognitive Level: Applying)</i></li> <li>4. Evaluate the suitability of the median in datasets with skewed distributions or outliers, comparing it with other central tendency measures. <i>(Cognitive Level: Evaluating)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
	11. Mode	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the mode and identify it as the value that occurs most frequently in a dataset. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the procedure for finding the mode in ungrouped and grouped data. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Calculate the mode for both discrete and continuous data, including the use of the modal formula for grouped frequency distributions. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze situations where the mode is the most appropriate measure of central tendency and justify its use over the mean or median. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	12. Relationship between Mean, Median, and Mode	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. State the empirical relationship between mean, median, and mode (i.e., <math>\text{Mode} = 3 \times \text{Median} - 2 \times \text{Mean}</math>). <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the significance of the relationship between mean, median, and mode in a moderately skewed distribution. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Apply the empirical formula to estimate one measure when the other two (mean and median or mode) are known. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze how the shape of a distribution (symmetrical, positively skewed, or negatively skewed) affects the relationship among mean, median, and mode. <i>(Cognitive Level: Analyzing)</i></li> </ol>
<b>54. Measures of Dispersion (T-03)</b>	13. Definition, Importance, Computation, and Application of Different Measures of Dispersion (Absolute and Relative)	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define different measures of dispersion, including both absolute (e.g., range, variance, standard deviation) and relative measures (e.g., coefficient of variation). <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the importance of dispersion in statistical analysis and how it complements measures of central tendency. <i>(Cognitive Level: Understanding)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	<b>Learning Outcomes</b> At the end of the class the students would be able to
		Higher-Order Learning Outcomes (Applying and Analyzing): <ol style="list-style-type: none"> <li>3. Compute absolute and relative measures of dispersion for various datasets using appropriate formulas. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze and compare datasets using measures of dispersion to conclude variability and consistency in data. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	14. Range, Quartiles, Percentiles, Inter-Quartile Range	Lower-Order Learning Outcomes (Remembering and Understanding): <ol style="list-style-type: none"> <li>1. Define the range, quartiles, percentiles, and inter-quartile range as measures of dispersion in a dataset. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the procedure for calculating the range, quartiles, percentiles, and inter-quartile range from raw data or a frequency distribution. <i>(Cognitive Level: Understanding)</i></li> </ol> Higher-Order Learning Outcomes (Applying and Analyzing): <ol style="list-style-type: none"> <li>3. Calculate the range, quartiles, percentiles, and inter-quartile range for a given dataset, including the identification of outliers using the inter-quartile range. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze and interpret the significance of quartiles, percentiles, and the inter-quartile range in understanding the distribution and spread of data. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	15. Mean Deviation	Lower-Order Learning Outcomes (Remembering and Understanding): <ol style="list-style-type: none"> <li>1. Define mean deviation and explain its significance as a measure of dispersion in a dataset. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the steps involved in calculating the mean deviation for both ungrouped and grouped data. <i>(Cognitive Level: Understanding)</i></li> </ol> Higher-Order Learning Outcomes (Applying and Analyzing): <ol style="list-style-type: none"> <li>3. Calculate the mean deviation for various datasets and interpret the results in terms of data spread and variability. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze and compare the advantages and limitations of mean deviation compared to other measures of dispersion, such as variance or standard deviation. <i>(Cognitive Level: Analyzing)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
	16. Standard Deviation	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define standard deviation and explain its role as a measure of spread or dispersion in a dataset. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the formula and basic steps for calculating standard deviation for both ungrouped and grouped data. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Calculate the standard deviation for a given dataset and interpret the result in terms of data variability and consistency. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the relationship between standard deviation and the shape of a distribution and discuss its advantages over other measures of dispersion. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	17. Variance and Coefficient of Variation	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define variance and coefficient of variation and describe their significance as measures of dispersion. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the process for calculating variance and coefficient of variation for both ungrouped and grouped data. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Calculate the variance and coefficient of variation for a given dataset and interpret the results in terms of data spread and relative variability. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze and compare the coefficient of variation for different datasets to assess their relative consistency or variability, considering the units of measurement. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	18. Properties of Standard Deviation	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the properties of standard deviation and identify its key characteristics, such as non-negativity, and the fact that it is affected by extreme values (outliers). <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain how standard deviation behaves under changes to a dataset, such as shifts in data values or scaling by a constant. <i>(Cognitive Level: Understanding)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
		<p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Apply the properties of standard deviation to determine how changes in the dataset (such as adding a constant to all data points or multiplying by a constant) affect its value. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the impact of outliers on the standard deviation and discuss how it compares to other measures of dispersion, such as the range or interquartile range. <i>(Cognitive Level: Analyzing)</i></li> </ol>
<b>5. Moments, Skewness and Kurtosis (T-05)</b>	19. Concepts of Measures of Moments.	Analyze Concepts of Measures of Moments.
	20. Concepts of Measures of Skewness.	Explain Concepts of Measures of Skewness.
	21. Concepts of Measures of Kurtosis	Explain Concepts of Measures of Kurtosis.
<b>6. Correlation and Regression Analysis (T-03)</b>	22. Types of Correlation, Coefficient of Correlation, Limitations of Correlation	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the different types of correlation (positive, negative, and no correlation) and explain their significance in statistical analysis. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the concept of the coefficient of correlation, including its interpretation and range (from -1 to +1). <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Calculate the coefficient of correlation (e.g., Pearson's correlation coefficient) for a given dataset and interpret the strength and direction of the relationship between variables. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the limitations of correlation, including issues such as causality, the impact of outliers, and the assumption of linearity, and discuss when correlation may not be a valid measure. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	23. Measures of Correlation	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the concept of correlation and describe the different measures of correlation, such as Pearson's correlation coefficient, Spearman's rank correlation, and Kendall's tau. <i>(Cognitive Level: Remembering)</i></li> <li>2. Explain the purpose and interpretation of correlation measures in analyzing the relationship between two variables. <i>(Cognitive Level: Understanding)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
		<p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Calculate and interpret Pearson's correlation coefficient, Spearman's rank correlation, and Kendall's tau for a given dataset, identifying the strength and direction of the relationship between the variables. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the suitability of different correlation measures based on the nature of the data (e.g., linear vs. non-linear relationships, ordinal data vs. interval/ratio data). <i>(Cognitive Level: Analyzing)</i></li> </ol>
	24. Relationship between Correlation and Regression	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define correlation and regression and explain the key differences between them. <i>(Cognitive Level: Remembering)</i></li> <li>2. Describe how the correlation coefficient is used to assess the strength and direction of a linear relationship, while regression is used to predict values based on that relationship. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Apply correlation and regression analysis to a given dataset, using correlation to assess the strength of the relationship and regression to predict values of one variable based on the other. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the relationship between correlation and regression by explaining how a strong correlation does not necessarily imply a causal relationship, and how regression analysis can be used for prediction purposes. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	25. Definition of Regression	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define regression and explain its purpose in identifying and modeling the relationship between two variables. <i>(Cognitive Level: Remembering)</i></li> <li>2. Describe a scatter diagram, including its purpose in visually representing the relationship between two variables and identifying trends. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Construct a scatter diagram for a given dataset and interpret the visual representation to identify potential trends, clusters, or outliers. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the relationship between two variables using regression analysis and a scatter diagram to assess the strength and direction of their linear relationship. <i>(Cognitive Level: Analyzing)</i></li> </ol>

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
	26. Method of Least Squares	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the method of least squares and explain its purpose in finding the best-fitting line for a set of data points in linear regression. <i>(Cognitive Level: Remembering)</i></li> <li>2. Describe the steps involved in applying the method of least squares to compute the regression line in simple linear regression. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Apply the method of least squares to calculate the regression coefficients (slope and intercept) for a given dataset in order to determine the best-fitting line. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the effectiveness of the least squares method in minimizing the sum of squared residuals and interpreting the significance of the regression line in predicting future values. <i>(Cognitive Level: Analyzing)</i></li> </ol>
	27. Estimating with Regression Line	<p>Lower-Order Learning Outcomes (Remembering and Understanding):</p> <ol style="list-style-type: none"> <li>1. Define the regression line and explain its role in estimating values of the dependent variable based on the independent variable. <i>(Cognitive Level: Remembering)</i></li> <li>2. Describe the process of using a regression line to make predictions for new data points based on the estimated equation. <i>(Cognitive Level: Understanding)</i></li> </ol> <p>Higher-Order Learning Outcomes (Applying and Analyzing):</p> <ol style="list-style-type: none"> <li>3. Apply the regression line to estimate the value of the dependent variable for a given value of the independent variable, using the equation of the line. <i>(Cognitive Level: Applying)</i></li> <li>4. Analyze the accuracy and reliability of estimates made using the regression line by evaluating the residuals and assessing the goodness of fit (e.g., R-squared). <i>(Cognitive Level: Analyzing)</i></li> </ol>
7. Index Number (T-05)	28. Three Index Numbers.	Explain Three Index Numbers.
	29. Methods of constructing Index Numbers.	Realize the Methods of Constructing Index Numbers.

<b>Chapter No &amp; Chapter Title</b>	<b>Number of Classes with Class Title</b>	<b>Learning Outcomes</b> At the end of the class the students would be able to
	30. Unweighted Aggregates Index.	Analyze Unweighted Aggregates Index.
	31. Weighted Aggregates Index.	Analyze Weighted Aggregates Index.
	32. Issues in Constructing an Index Number.	Explaining Issues in Constructing an Index Number.
	33. Different Types of Index Numbers.	Analyze Different Types of Tests of Index Numbers.