LABORATORY MANUAL FOR

DATA ANALYTICS (315326)

COMPUTER ENGINEERING GROUP

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
(Autonomous)(ISO21001:2018)(ISO/IEC27001:2013)

Vision

To ensure that the Diploma level Technical Education constantly matches the latest requirements of Technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

Mission

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the challenging technological & environmental challenges.

Quality Policy

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

Core Values

MSBTE believes in the following:

- Skill development in line with industry requirements
- Industry readiness and improved employability of Diploma holders
- Synergistic relationship with industry
- Collective and Cooperative development of all stake holders
- Technological interventions in societal development
- Access to uniform quality technical education

A Practical Manual
for

Data Analytics

(315326)

Semester- V

Diploma in Engineering and Technology

CM/ CO/ CW/ IF/ IH/ SE/ TE

Maharashtra State Board of Technical Education, Mumbai

(Autonomous) (ISO21001:2018)(ISO/IEC27001:2013)

'K' Scheme Curriculum

Maharashtra State Board of Technical Education, Mumbai

(Autonomous) (ISO21001:2018)(ISO/IEC27001:2013)

4th Floor, Government Polytechnic Building

49, Kherwadi, Bandra (East), Mumbai – 400051

Maharashtra State Board of Technical Education

Certificate

This is to certify that Mr/ Ms. ………………………………………… Roll No……… of the Fifth Semester of Diploma in …………………. Engineering/ Technology (Program Code - ...….......5K) of the Institute ………………………………………………… (Inst. Code………….) has completed the practical work satisfactorily for the course Data Analytics (Course Code: 315326) for the academic year 20….– 20…. as prescribed in the curriculum.

Place ………………..   Enrollment No ………………..

Date ……………….. .   Exam Seat No ………………..

Course Teacher   **Head of the Department**   **Principal**

Seal of
the
Institute
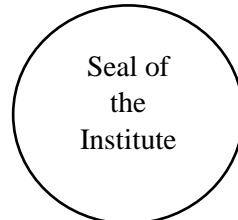
Preface

Data Analytics (315326) laboratory manual is meticulously crafted to equip fifth semester diploma engineering students with valuable practical learning experiences aligned with MSBTE 'K' Scheme Curriculum.

The primary objective of this manual is to create a product that is both aesthetically appealing and easy to interact. To achieve this, each practical is mapped with prescribed theory learning outcomes (TLOs), lab learning outcomes (LLOs) and course outcomes (COs). Course facilitators can adopt suitable pedagogical methods to impart the course with an aim to achieve the prescribed course outcomes effectively.

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read the concerned practical procedure that they will do the next day and understand minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. Students will then become aware about the skills they will achieve through procedure how there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Data Analytics is used to extract meaningful insights from raw data using various tools, techniques, and statistical methods. This course is designed to equip students with foundational principles and practical skills essential for analyzing and interpreting data effectively. By leveraging tools such as Excel and Python, students will learn how to collect, clean, visualize, and draw conclusions from data. The course will help students apply analytical thinking to real-world scenarios and make data-driven decisions.

Program Outcomes (POs) to be achieved through Practical:

PO1	Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
PO2	Problem analysis: Identify and analyses well-defined engineering problems using codified standard methods.
PO3	Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
PO4	Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
PO5	Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PO6	Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
PO7	Life-long learning: Ability to analyses individual needs and engage in updating in the context of technological changes.

Practical Course Outcome Matrix

Course Outcomes (COs)

CO1	Elaborate the fundamental concepts of Data Analytics.
CO2	Apply appropriate statistical techniques to analyze and interpret complex Datasets.
CO3	Analyze numerical data by creating pivot table.
CO4	Represent data in terms of various types of charts.
CO5	Visualize the data using a Python library.

Sr. No.	Title of the Experiment	CO1	CO2	CO3	CO4	CO5
1	*a. Calculate mean, median, and mode for a given dataset using Excel functions(AVERAGE, MEDIAN, MODE). *b. Calculate range, interquartile range (IQR),variance, and standard deviation using Excel functions (STDEV, VAR). *c. Calculate the correlation coefficient between two variables using the CORREL function	✓				
2	*a. Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset. *b. Perform a simple linear regression analysis *c. Conduct a t-test to compare means between two groups *d. Calculate confidence intervals *e. Conduct a Chi-square test		✓			
3	*Create a Data Table a. Import a sample dataset (e.g., sales data) into Excel. b. converts the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles. c. Create a dashboard sheet that summarizes key metrics (e.g., total sales, average sales per region) using tables. *Data Cleaning a. Identify and remove duplicates from a dataset. b. Use functions like TRIM, UPPER, LOWER, and PROPER to clean text data. c. Find and replace values using the Find & Replace feature.	✓	✓	✓		
4	Create a Pivot Table a. A basic pivot table from a dataset b. Specify and filter data in a pivot table			✓		

	c. Add a calculated field to a pivot table d. Group data within a pivot table. Refresh pivot table data after making changes to the source data. Filter and sort a PivotTable a. Apply a Filter to the PivotTable b. Sort Data in the Pivot Table. c. Add slicers to the PivotTable for interactive filtering.					
5	Create a Pivot Chart a. A basic pivot chart from a dataset b. A dynamic pivot chart that updates based on user selection c. Group date items in a pivot table to summarize data by month or year d. Group product categories in a pivot table		✓	✓		
6	*Create a Simple Chart a. A simple bar chart to visualize data sets b. A chart using non-adjacent cells to visualize data from different ranges. *Create a Chart Using the Chart Wizard a Select the chart you created and experiment with the Chart Tools options b. Modifying Charts c. Moving an Embedded Chart d. Sizing an Embedded Chart				✓	
7	*Change the Chart Type a. Create a basic bar chart using a dataset and change its type to a different chart b. Experiment with different data display options, such as adding data labels, changing the axis format, and adjusting the gridlines c. Experiment with position and style of the legend				✓	
8	a. Create a pie chart from a dataset b. Move the pie chart to a new worksheet for better visibility c. Emphasize a specific category by exploding a slice of the pie chart d. Customize the appearance of the pie chart for better presentation				✓	
9	* Create different types of plots. Write a Python script to save the plot in different formats: PNG, PDF, and SVG.					✓
10	Application of data analytics across various industries through case study					✓

Guidelines to Teachers

1. Teachers should align the explanation of the topic to teaching learning outcome (TLOs).
2. Refer to laboratory learning outcome (LLOs) for the execution of the practical to focus on the defined objectives.
3. Promote life-long learning by training the students to equip themselves with essential knowledge, skills and attitudes.
4. If required, provide demonstration for the practical emphasizing on the skills that the student should achieve.
5. Teachers should give opportunity to the students for exhibiting their skills after the demonstration.
6. Provide feedback and/or suggestions and share insights to improve effectiveness.
7. Assess students' skill achievement related to COs of each unit.

Instructions for Students

1. 100% attendance is compulsory for all practical sessions.
2. Students must adhere to ethical practices.
3. Plagiarism is strictly prohibited.
4. Students should accomplish the requisites of Teamwork, Collaboration and Group Dynamics during the practical sessions.
5. Students shall attempt to develop related hands on skills and gain confidence.
6. All the students must follow the schedule of practical sessions, complete the assigned work/activity and submit the assignment in stipulated time as instructed by the course teacher.
7. Follow formal attire and maintain personal appearance.

Content Page

List of Practical and Formative Assessment Sheet

Sr. No	Practical Title	Date of Performance	Date of Submission	Assessment Marks (25)	Dated Sign of Teacher	Remark (if any)
1	*a. Calculate mean, median, and mode for a given dataset using Excel functions(AVERAGE, MEDIAN, MODE). *b. Calculate range, interquartile range (IQR),variance, and standard deviation using Excel functions (STDEV, VAR). *c. Calculate the correlation coefficient between two variables using the CORREL function					
2	*a. Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset. *b. Perform a simple linear regression analysis *c. Conduct a t-test to compare means between two groups *d. Calculate confidence intervals *e. Conduct a Chi-square test					
3	*Create a Data Table a. Import a sample dataset (e.g., sales data) into Excel. b. converts the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles. c. Create a dashboard sheet that summarizes key metrics (e.g., total sales, average sales per region) using tables. *Data Cleaning a. Identify and remove duplicates from a dataset.					

	b. Use functions like TRIM, UPPER, LOWER, and PROPER to clean text data. c. Find and replace values using the Find & Replace feature.					
4	Create a Pivot Table a. A basic pivot table from a dataset b. Specify and filter data in a pivot table c. Add a calculated field to a pivot table d. Group data within a pivot table. Refresh pivot table data after making changes to the source data. Filter and sort a PivotTable a. Apply a Filter to the PivotTable b. Sort Data in the Pivot Table. c. Add slicers to the PivotTable for interactive filtering.					
5	Create a Pivot Chart a. A basic pivot chart from a dataset b. A dynamic pivot chart that updates based on user selection c. Group date items in a pivot table to summarize data by month or year d. Group product categories in a pivot table					
6	*Create a Simple Chart a. A simple bar chart to visualize data sets b. A chart using non-adjacent cells to visualize data from different ranges. *Create a Chart Using the Chart Wizard a Select the chart you created and experiment with the					

	Chart Tools options b. Modifying Charts c. Moving an Embedded Chart d. Sizing an Embedded Chart				
7	*Change the Chart Type a. Create a basic bar chart using a dataset and change its type to a different chart b. Experiment with different data display options, such as adding data labels, changing the axis format, and adjusting the gridlines c. Experiment with position and style of the legend				
8	a. Create a pie chart from a dataset b. Move the pie chart to a new worksheet for better visibility c. Emphasize a specific category by exploding a slice of the pie chart d. Customize the appearance of the pie chart for better presentation				
9	* Create different types of plots. Write a Python script to save the plot in different formats: PNG, PDF, and SVG.				
10	Application of data analytics across various industries through case study				
	Total				

*Total marks to be transferred to proforma published by MSBTE

Note:

- '*' Marked Practicals (LLOs) are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcome

Practical No. 1

*a. Calculate mean, median, and mode for a given dataset using Excel functions (AVERAGE, MEDIAN, MODE).
*b. Calculate range, interquartile range (IQR), variance, and standard deviation using Excel functions (STDEV, VAR).
*c. Calculate the correlation coefficient between two variables using the CORREL function.

I.   Practical Significance

Microsoft Excel is spreadsheet software developed by Microsoft used for organizing, analyzing, and visualizing data. Students will be able to understanding and analyzing numerical data using key Excel statistical functions. AVERAGE, MEDIAN, and MODE are used to identify central tendencies, while STDEV and VAR measure the spread or variability in the data. The CORREL function is used to examine the relationship between two variables.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO1 - Elaborate the fundamental concepts of Data Analytics.

IV.   Laboratory Learning Outcome(s)

LLO 1.1 Perform Statistical Analysis in Excel.

V.   Relevant Affective Domain related Outcomes

   a. Follow precautionary measures.
   b. Follow naming conventions.
   c. Follow ethical practices

VI.   Relevant Theoretical Background

Microsoft Excel provides powerful tools like formulas, charts, and functions to perform calculations and automate tasks.

a) AVERAGE, MEDIAN, and MODE Functions

In Excel, functions like AVERAGE, MEDIAN, and MODE help summarize large amounts of numerical data.
1. Mean (Average)
      Use the AVERAGE function:
      =AVERAGE(A1:A14)
      Example: Values: (2+1+5+6+3+1+2+3+4+5+6+7+8+9) / 14 = 72 / 14 = 5.14

2. Median
      Use the MEDIAN function:
      =MEDIAN(A1:A14)
      This gives you the middle value when the numbers are sorted.

Example: Values: 1, 1, 2, 2, 3, 3, 4, 5, 5, 6, 6, 7, 8, 9
  Middle two values (7th and 8th) = 4 and 5
  Median = (4 + 5) / 2 = 4.5

3. Mode
    Use the MODE.SNGL function (returns the most frequent value):
    =MODE.SNGL(A1:A14)
    If there are multiple modes and you want all of them, use: =MODE.MULT(A1:A14)
    Note: For MODE.MULT, select multiple cells first, then press Ctrl + Shift + Enter.
    Example: Values: 1, 1, 2, 2, 3, 3, 4, 5, 5, 6, 6, 7, 8, 9
        Values that appear twice: 1, 2, 3, 5, 6
        Excel returns the first mode it finds, which is **1**

b) Range, IQR , VAR and STDEV Functions

Following functions helps to measure data spread.
1. Range
    The range is the difference between the maximum and minimum values in a dataset.
    =MAX(A1:A7) - MIN(A1:A7)
    Example: If the values are 2, 1, 5, 6, 3, 1, 2, then: Max = 6 and   Min = 1
        Range = 6 − 1 = **5**

2. IQR
    The Interquartile Range (IQR) is a measure of statistical dispersion, or in simpler
    terms, it tells us how spread out the middle 50% of values in a data set.
    Example:
        Use Excel's QUARTILE.INC function to calculate Q1and Q3.
        =QUARTILE.INC(A2:A11, 1)
        Where, A2:A11 is the range of data, and 1 represents the first quartile.
        =QUARTILE.INC(A2:A11, 3)
        Calculate the IQR by subtracting Q1 from Q3=Q3 - Q1

3. VAR
    Variance measures how far each number in the set is from the mean (average).A high
    variance means data points are spread out. A low variance means they are close to the
    mean.
    =VAR.S for Sample variance
    =VAR.P for Population Variance
    Example: If the values are 5,7,9,10,12 then
        Sample variance = 7.3 and
        Population Variance=5.84

c) CORREL Function

    Excel's CORREL function can be used to identify the relationship between two
variables. Value range: $-1 \leq r \leq 1$,   +1 = perfect positive correlation ,   0 = no correlation,
−1 = perfect negative correlation
Syntax in Excel : =CORREL(array1, array2)
    Example:
        =CORREL(A1:A5, B1:B5)

VII.   Resources required (Additional)

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO
1. **Find the median of this dataset using the MEDIAN function: 5, 8, 12, 14, 18**
2. **Define mode. Can a dataset have more than one mode?**
3. **Find the range of these numbers 25, 30, 35, 40, 45**
4. **What is variance? What does it tell us about a dataset?**
5. **Write the CORREL function to find the correlation between any two sets of numbers**
6. **What does a correlation of 0 indicate about two variables?**

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X. References:

1. https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel

2. https://www.w3schools.com/excel/excel_functions.php

XI. Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 2

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*a. Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset.
*b. Perform a simple linear regression analysis
*c. Conduct a t-test to compare means between two groups
*d. Calculate confidence intervals
*e. Conduct a Chi-square test

I.   Practical Significance

Excel is spreadsheet software developed by Microsoft used for organizing, analyzing and visualizing data. The statistical techniques such as box plots, linear regression, t-tests, confidence intervals, and Chi-square tests help students and developers analyze performance trends, identify anomalies, and make informed decisions during software development and testing.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO2 - Apply appropriate statistical techniques to analyze and interpret complex Datasets

IV.   Laboratory Learning Outcome(s)

LLO 2.1 Construct box plot.
LLO 2.2 Perform the different types of function using linear regression.
LLO 2.3 Perform T-test in Excel.
LLO 2.4 Calculate confidence intervals for the mean of a dataset.
LLO 2.5 Apply Chi-square test for independence

V.   Relevant Affective Domain related Outcomes

    d. Follow precautionary measures.
    e. Follow naming conventions.
    f. Follow ethical practices

VI.   Relevant Theoretical Background

In real-world application development and academic training, **statistical techniques** play a critical role in evaluating and improving software performance and reliability. Theoretical foundations of these techniques include:

a) Box Plot: A data visualization tool that shows the distribution of a dataset through quartiles, helping in identifying outliers in runtime, memory usage, etc.

Steps:
1. **Select your data:** Highlight the cells containing the values you want to plot.
2. **Go to Insert:** On the Excel ribbon, click the "Insert" tab.
3. **Select Recommended Charts:** Click the "Recommended Charts" button in the "Charts" group.
4. **Open All Charts:** In the pop-up window, click the "All Charts" tab.

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5. **Choose Box & Whisker:** Select "Box & Whisker" as the chart type.
6. **Confirm:** Click "OK" to create the box plot. [**Customize if needed**: Under Customize, you can turn on labels for the median, quartiles, and outliers if they are not showing.]
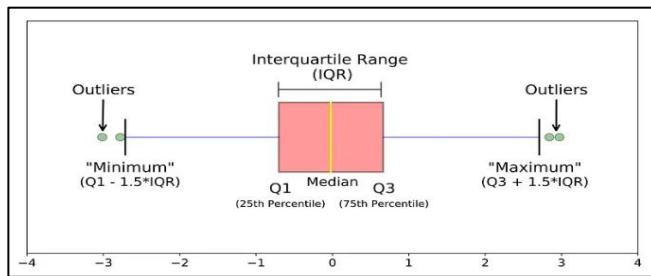
Fig: Box Plot

b) **Linear Regression:**

   Linear regression in Excel is a statistical method used to model the relationship between two variables: An **independent variable (X)** — the predictor and A **dependent variable (Y)** i.e. the outcome.
It fits a **straight line (Y = mX + b)** through your data,
where: **m** is the **slope** (rate of change), **b** is the **intercept** (value of Y when X = 0).

   Steps:

1. Enable the Data Analysis ToolPak: Go to File > Options > Add-Ins. Select "Excel Add-ins" in the Manage list, and click "Go". Check the box for "Analysis ToolPak" and click OK.
2. Open Data Analysis: On the Data tab, click "Data Analysis".
3. Select Regression: Choose "Regression" from the list of analysis tools and click "OK".
4. Input Ranges: Specify the Input Y Range (dependent variable) and Input X Range (independent variable(s)). You can also specify the output range for the regression results.
5. Configure Settings: You can choose to display labels, have the output on a new sheet, and specify other options.
6. Run the Analysis: Click "OK" to generate the regression output.

Fig: Linear Regression

c) **T-Test**:

A hypothesis test used to compare the means of two groups, e.g. comparing execution times between Eclipse and Net Beans.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where, $\bar{x}_1, \bar{x}_2$ = sample means; $s1^2, s2^2$ = sample variances; n1,n2 = sample sizes

Excel Formula for T-Test:

=T.TEST(array1, array2, tails, type)
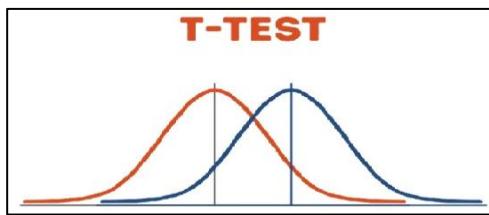
Fig: T –Test to compare two means

d) **Confidence Interval**:

Provides a range in which the true metric (like average runtime) is expected to fall, enhancing decision-making with uncertainty estimates.

Excel Formula for Confidence Interval:
a. For Known Standard Deviation
=CONFIDENCE.NORM(alpha, standard_dev, size)
b. For Unknown Standard Deviation
=CONFIDENCE.T(alpha, standard_dev, size)
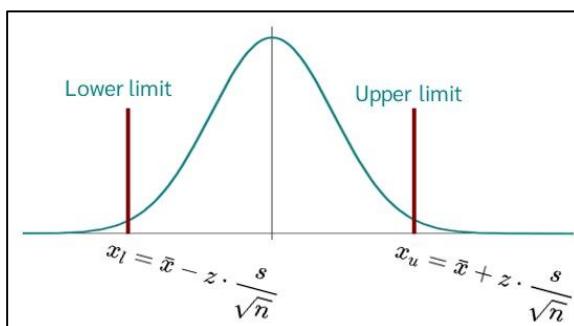
Fig: Confidence Interval

e) **Chi-square Test**:

The **Chi-square (χ^2) test** is a **statistical method** used in **data analytics** to examine the **relationship between categorical variables.** A test that measures how a model compares to actual observed data can be calculated using:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$ where, **O** is Observed Value , **E** is Expected Value

Degrees of Freedom:S

df = (r − 1) (c − 1)   where, **r** is no of rows, **c** is no of columns

Excel Formula for Chi Square Test:

=CHISQ.TEST(actual_range, expected_range)
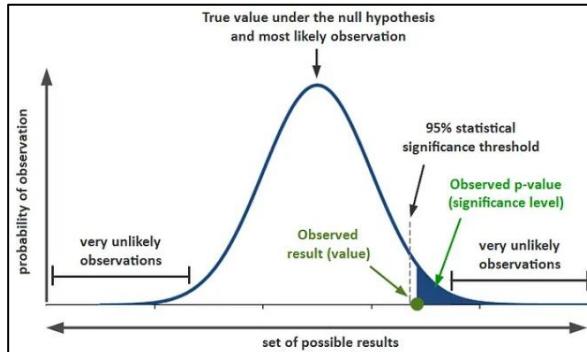
Fig: Chi-Square Test

VII.   Resources required (Additional)

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO

1. **Define Median, Quartiles and outliers of a dataset.**
2. **Create a box plot in Excel using the following dataset of student test scores:**
   78, 85, 88, 92, 67, 73, 85, 90, 95, 100.
3. **What is Degrees of Freedom and how it is calculated?**
4. **What's the difference between linear regression and logistic regression?**
5. **Two sets of students took different versions of a quiz.**
   Group A scored:72, 75, 78, 74, 70 and Group B scored: 68, 65, 70, 67, 66.
   Use Excel's T.TEST function to determine if there is a significant difference between the groups

6. **Conduct a Chi-Square test for given data:**

	Satisfied	Neutral	Dissatisfied	Total
Sales	15	10	5	30
IT	10	15	5	30
HR	5	5	20	30
Total	30	30	30	90

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X.   **References:**

1. https://www.w3schools.com/datascience/ds_linear_regression.asp
2. https://www.datacamp.com/tutorial/chi-square-test-in-spreadsheets
3. https://support.microsoft.com/en-us/office/t-test-function-d4e08ec3-c545-485f-962e-276f7cbed055
4. https://www.datacamp.com/tutorial/how-to-calculate-confidence-intervals-in-excel

XI.   **Assessment Scheme (25 Marks)**

S. No.	**Weightage- Process related: 60%**	**Marks-15**
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 3

*Create a Data Table:
a. Import a sample dataset (e.g., sales data) into Excel.
b. Converts the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles.
c. Create a dashboard sheet that summarizes key metrics (e.g., total sales, average sales per region) using tables.

*Data Cleaning
a. Identify and remove duplicates from a dataset.
b. Use functions like TRIM, UPPER, LOWER, and PROPER to clean text data.
c. Find and replace values using the Find & Replace feature.

I.   Practical Significance

This practical focuses on data organization, cleaning, and summarization using Excel. Data cleaning techniques, including identifying duplicates and using functions like TRIM, UPPER, and PROPER, ensure that the data is consistent and ready for analysis. Students will be able to managing and preparing data in fields such as business analysis, marketing, and finance.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO3 - Analyze numerical data by creating pivot table.

IV.   Laboratory Learning Outcome(s)

LLO 3.1 Create a table to execute the function using dashboard.
LLO 3.2 Perform various operations for data cleaning..

V.   Relevant Affective Domain related Outcomes

    g. Follow precautionary measures.
    h. Follow naming conventions.
    i. Follow ethical practices

VI.   Relevant Theoretical Background

1.   Create a Data table:

a)   Import a Sample Dataset (e.g., Sales Data) in to Excel:

Steps:
1. If you have a CSV(comma separated Values) or Excel file, download and save it to your computer.
2. You can create a sample sales dataset manually with columns like *Date, Product, Region, Sales Amount, Quantity Sold*.

b) Convert the Dataset into an Excel Table:

Steps:
1. Click anywhere inside your dataset.
2. Press **Ctrl + A** to select the full range (or manually highlight it).
3. Go to the **Home** tab and select **Format as Table**.
4. Choose a style that suits your report.
5. Ensure the **"My table has headers"** option is checked.
6. Click **OK**, and your data will be converted into an Excel Table.

c) Create a Dashboard Sheet for Key Metrics:

Steps:
1. Click the + button at the bottom to add a new worksheet.
2. Rename it to **"Dashboard"** (optional but recommended for clarity).
3. Click anywhere inside the table.
4. Go to the **Insert** tab → **Pivot Table** → Select the Table range and click **OK**.
5. Ensure the Table/Range is selected (e.g., Table1).
6. Choose to place the PivotTable in the new **Dashboard** sheet with valid cell and click **OK**.
7. Drag fields to summarize key metrics like Total Sales, Average Sales Per Region, Best-Selling Products.
   [*Note: Students can create dashboard without using pivot table and by using formulas*]

2. **Data Cleaning:**

a) Identify and Remove Duplicates:

Steps:
1. Click anywhere inside your dataset.
2. Press **Ctrl + A** to select the full range (or manually highlight the column/rows to check for duplicates).
3. Go to the **Data** tab and select **Remove Duplicates**.
4. A dialog box will appear—choose the columns where duplicates should be checked.
5. Click **OK**, and Excel will remove the duplicate values.
6. A message will appear showing how many duplicates were removed and how many unique values remain.

b) Use functions to clean text data:

Steps:
1. Use the TRIM Function (Removes Extra Spaces)
       Example: "   abc"
               =TRIM("   abc")
       Output: "abc"
2. Convert Text Case Using UPPER, LOWER, and PROPER
       Example: "abcd"
               =UPPER("abcd")
       Output: "ABCD"
       Example: "Hello World"

=LOWER("Hello World")
Output: "hello world"

Example: "heLlo WoRld"
=PROPER("Hello World")
Output: "Hello World"

c) Find and replace values:

Steps:
1. Press **Ctrl + H** or go to **Home → Find & Select → Replace**.
2. In the **Find What** box, enter the value you want to find.
   a. In the Replace With box, enter the new value.
   b. Click Replace All to apply changes throughout the dataset.
   c. Review the modified dataset to ensure accuracy.

VII. Resources required (Additional)

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII. Conclusion

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IX. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO
1. **How does converting a dataset into an Excel Table improve data organization and analysis?**
2. **Use TRIM, PROPER, LOWER functions and Remove Duplicates to clean text data for Customer Name and Email Id (Consider any sample dataset)?**
3. **Perform following with given dataset:**
   a. **Use Find & Replace to correct the typo "Stationary" → "Stationery".**
   b. **Use UPPER to convert all product names to uppercase.**
   c. **Remove any duplicate product entries.**

Product	Category	Price
Pen	Stationery	1.5
Pencil	Stationary	1
Eraser	Stationery	0.5
Marker Pen	Stationary	2
Pen	Stationery	1.5

4. **Create a dashboard sheet that summarizes key metrics for Class Test Report with student Name, all Subject marks, Total and Percentage.**

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2. https://www.javatpoint.com/how-to-create-a-dashboard-in-excel

3. https://www.ablebits.com/office-addins-blog/data-table-excel-one-variable-two-variable/

4. https://www.geeksforgeeks.org/top-5-excel-data-cleaning-techniques-to-know-in-2023/

XI.   Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 4

Create a Pivot Table
a. A basic pivot table from a dataset
b. Specify and filter data in a pivot table
c. Add a calculated field to a pivot table
d. Group data within a pivot table. Refresh pivot table data after making changes to the source data.

Filter and sort a PivotTable
a. Apply a Filter to the PivotTable
b. Sort Data in the Pivot Table.
c. Add slicers to the PivotTable for interactive filtering.

I.   Practical Significance

Pivot tables allow students to **summarize large datasets** efficiently, turning raw numbers into meaningful insights. Students with **Excel skills** have a competitive edge when applying for internships and jobs. Filtering and sorting allow students to quickly locate specific information in massive datasets.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO3 - Analyze numerical data by creating pivot table.

IV.   Laboratory Learning Outcome(s)

LLO 4.1 Create a pivot table to analyze the data set.
LLO 4.2 Sort and filter the given dataset.

V.   Relevant Affective Domain related Outcomes

    a. Follow precautionary measures.
    b. Follow naming conventions.
    c. Follow ethical practices

VI.   Relevant Theoretical Background

Pivot Table :
A pivot table is a powerful tool used in spreadsheets (like Excel, Google Sheets) to summarize, analyze, and organize data efficiently. It helps in transforming raw data into meaningful insights by allowing users to rearrange and compare information dynamically. Adding calculated fields enhances the analysis with custom metrics, and grouping data provides insights into patterns. Creating a PivotTable allows for quick aggregation and analysis, while filtering and sorting help focus on specific data points.

1. Create a Pivot Table:

a) **A basic pivot table from a dataset:**
 Steps:

1. Open your **Excel** file containing the data.
2. Select any **cell within your dataset**.
3. Go to **Insert** → Click **PivotTable**.
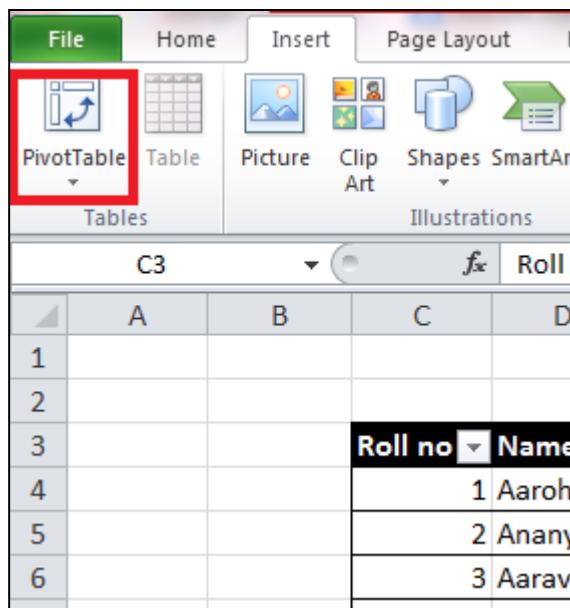
Fig: Inserting Pivot Table

4. Choose whether to place the PivotTable in a **new worksheet** or an **existing one**.
5. Click **OK**—your blank PivotTable is now ready.
6. Use the **PivotTable Fields pane** to drag fields into Rows, Columns, Values, and Filters.

b) **Specify and filter data in a pivot table:**
 Steps:

1. After creating the PivotTable, **drag data fields** into the **Filters** section.
2. Click the drop-down arrow in the Filter field and **select specific items** to display.
3. To remove filters, click **Clear Filter** in the filter menu.

c) **Add a calculated field to a pivot table**
 Steps:

1. Click **any cell** inside the PivotTable.
2. Go to **PivotTable Analyze** → Click **Fields, Items & Sets** → Select **Calculated Field**.
3. In the **Insert Calculated Field** dialog box:
    a. Enter a name for the field.
    b. Define a formula (e.g., =Sales * 1.1 for a 10% increase in Sales).
4. Click **OK**, and the new calculated field will appear in the PivotTable.

d) Group data within a pivot table. Refresh pivot table data after making changes to the source data.

Steps:

1. Select the data you want to group (e.g., dates or categories).
2. Right-click → Choose **Group**.

Fig: Grouping data in Pivot Table

3. Set group parameters (e.g., grouping by months or quarters for dates).
4. Click **OK**—your grouped data appears in the PivotTable.
5. Modify your original dataset.
6. Click inside the PivotTable.
7. Go to **PivotTable Analyze** → Click **Refresh**.

2. Filter and Sort a Pivot Table

a) Apply a Filter to the Pivot table
Steps:

1. Click the drop-down arrow in the **PivotTable Filter** section.
2. Select or deselect values to display specific information.

b) Sort Data in the Pivot Table
Steps:

1. Click any **column header** inside the PivotTable.

2. Go to **Sort & Filter** → Click **Ascending or Descending**.

c) Add Slicers for Interactive Filtering
Steps:

1. Click inside the PivotTable.

2. Go to **PivotTable Analyze** → Click **Insert Slicer**.
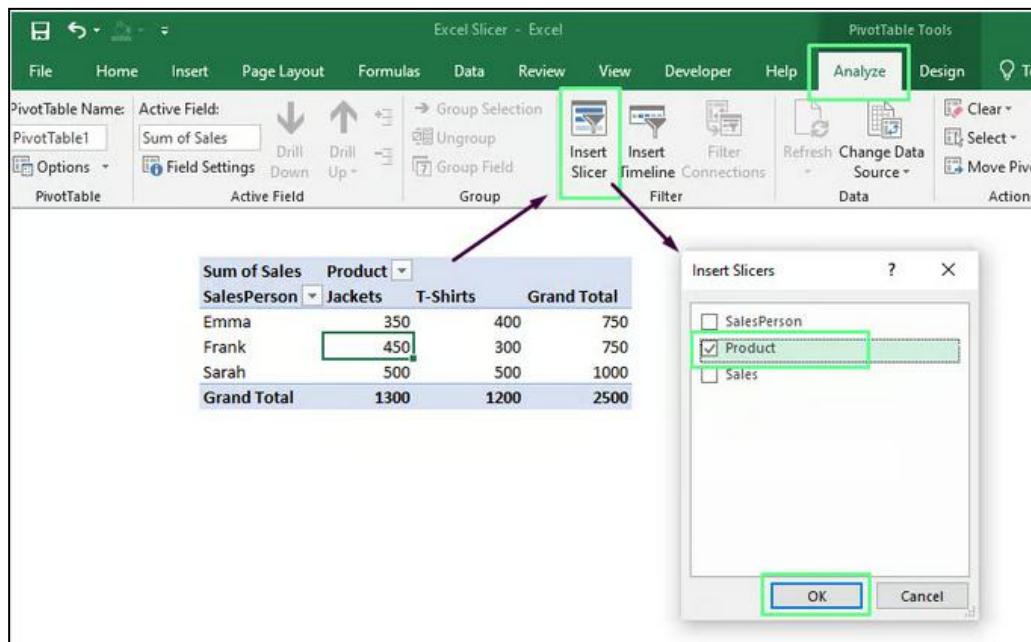
Fig: Inserting Slicer

3. Select the field(s) you want to filter.
4. Click **OK**—the slicer buttons appear for quick filtering

VII.   Resources required (Additional)

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO

1. **What are the benefits of using pivot tables?**

2. How do you create calculated fields in a pivot table write steps with any data set?

3. What are the total sales of each product by region for following data set

Date	Region	Product	Sales
2025-01-01	East	Apple	100
2025-01-01	East	Banana	150
2025-01-02	West	Apple	200
2025-01-02	West	Banana	120
2025-01-03	East	Apple	130
2025-01-03	West	Banana	170

4. Create slicers for given dataset in Q.2 and write how do they work?

5. Perform filtering, sorting and Grouping for given pivot table.

Student	Division	Subject	Marks
Ananya	A	Math	85
Bina	A	Science	78
Chetan	B	Math	92
Dinash	B	Science	88
Esha	A	Math	90
Fareeha	B	Math	75

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X.   **References:**

1. https://www.w3schools.com/excel/excel_table_pivot_intro.php

2. https://www.geeksforgeeks.org/pivot-tables-in-excel/

XI.   **Assessment Scheme (25 Marks)**

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 5

Create a Pivot Chart
a. A basic pivot chart from a dataset
b. A dynamic pivot chart that updates based on user selection
c. Group date items in a pivot table to summarize data by month or year.
d. Group product categories in a pivot table

I. Practical Significance

Pivot charts are incredibly useful for students, especially those working with large sets of data. Students in business, finance, or statistics can use pivot charts to spot trends and make informed conclusions. Students will be able to Creating a basic PivotChart allows for graphical analysis of key metrics, while dynamic charts that update based on user selection provide interactive data exploration..

II. Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III. Course Level Learning Outcomes(s)

CO3 - Analyze numerical data by creating pivot table.

IV. Laboratory Learning Outcome(s)

LLO 5.1 Customize your chart with titles, labels, colors, and legends as desired.

V. Relevant Affective Domain related Outcomes

   a. Follow precautionary measures.
   b. Follow naming conventions.
   c. Follow ethical practices

VI. Relevant Theoretical Background

A **Pivot Chart** in Excel is a powerful tool for data analytics that helps users visualize and analyze large datasets dynamically. It works alongside Pivot Tables, enabling users to present complex data in an interactive and customizable format.
Example: Imagine a student analyzing sales data over different quarters. Instead of going through rows of numbers, a Pivot Chart can instantly show trends like seasonal spikes or product popularity changes.

a) A basic pivot chart from a dataset

Steps:
1. Open your Excel file and select your dataset.
2. Go to the **Insert** tab and click on **PivotTable**.
3. Choose where you want to place the PivotTable (New Worksheet or Existing Worksheet) and click **OK**.
4. Drag fields to the **Rows** and **Values** sections to organize your data.
5. Click anywhere inside the PivotTable, then go to the **Insert** tab and select **PivotChart**.

6. Choose your desired chart type and click **OK**—your Pivot Chart is now ready.
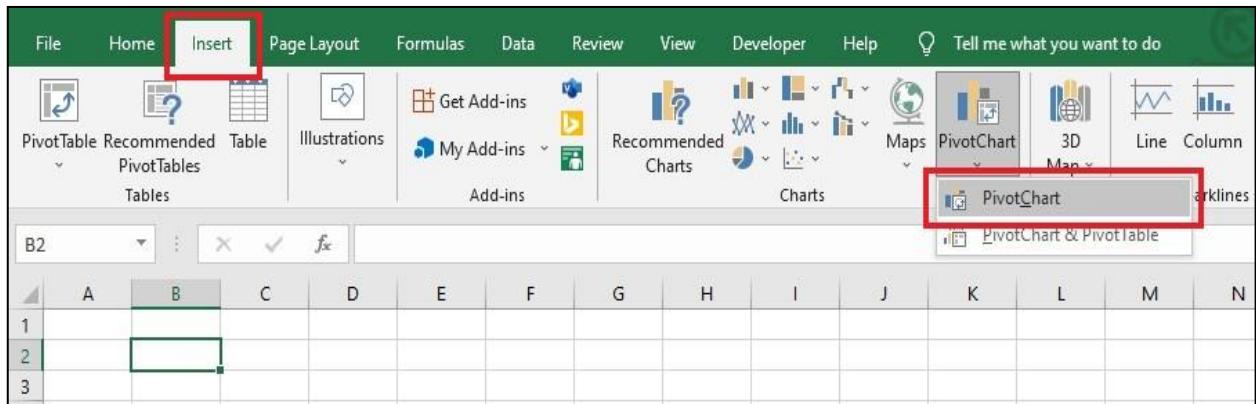
Fig: Inserting Pivot Chart

b) **A dynamic pivot chart that updates based on user selection**

Steps:
1. Create a PivotTable as described above.
2. Click inside the PivotTable, then go to the **PivotTable Analyze** tab.
3. Select **Insert Slicer** and choose the fields users can filter dynamically.
4. Position the slicers next to the Pivot Chart for interactive data selection.
5. Adjust the Pivot Chart as needed—any changes in the slicers will automatically update the chart.
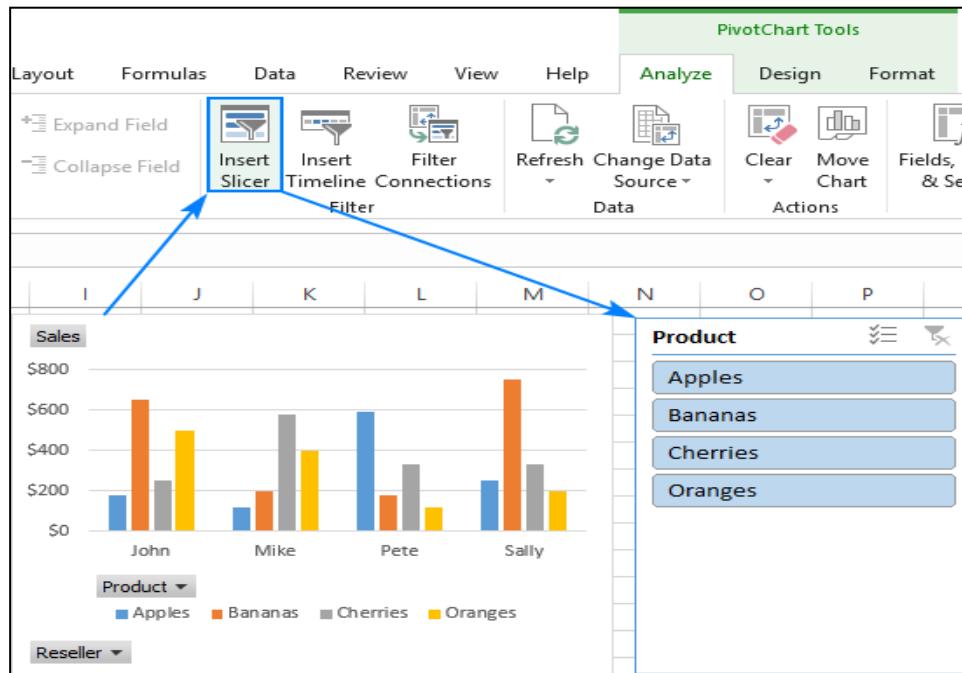
Fig: Inserting Slicer in Pivot Chart

c) **Group date items in a pivot table to summarize data by month or year**

Steps:
1. Create a PivotTable and include a column with date values.
2. Click on any date field inside the PivotTable.

3. Go to the **PivotTable Analyze** tab and select **Group Field**.
4. In the **Grouping** box, select the time intervals (Months, Quarters, Years) you want.
5. Click **OK**—your date values are now grouped for easier analysis.

d) Group product categories in a pivot table

Steps:
1. Set up a PivotTable with product names in the **Rows** section.
2. Select multiple product names you want to group.
3. Right-click and choose **Group**—Excel will create a new group automatically.
4. Rename the grouped field for clarity.
5. Your PivotTable now organizes products by category, making analysis easier
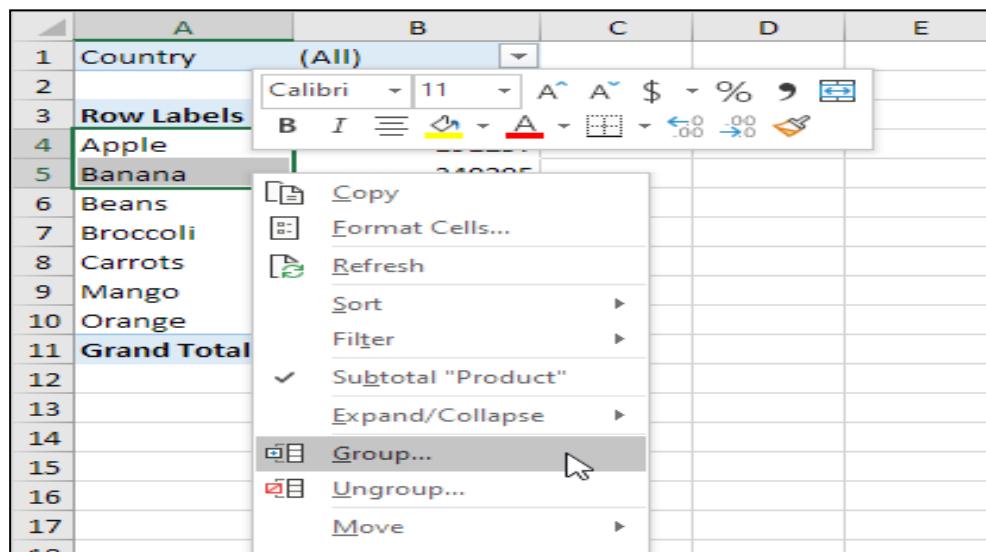
Fig: Grouping in Pivot Table

VII. Resources required (Additional)

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII. Conclusion

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IX.   Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO

1. **Create a basic pivot chart to visualize sales by region and product type, for given dataset in Excel?**

Region	Product Type	Sales
North	Electronics	1000
South	Electronics	1200
North	Furniture	800
South	Furniture	950

2. **Create a dynamic pivot chart that filters data based on a dropdown list on a separate worksheet?**
3. **How would you group specific dates or values in a pivot chart (e.g., group years into decades) Perform and write steps?**
4. **Change the chart type or style of a pivot chart and write steps?**
5. **How can you summarize this in Excel using a Pivot Table with date grouping?**

Date	Product	Sales
21/1/2023	Laptop	1000
15/2/2023	Phone	800
21/3/2024	Tablet	900
19/4/2024	Phone	700
29/5/2025	Laptop	1100

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2. https://support.microsoft.com/en-us/office/create-a-pivotchart-c1b1e057-6990-4c38-b52b-8255538e7b1c

3. https://www.ablebits.com/office-addins-blog/pivot-charts-excel/

XI. Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 6

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*Create a Simple Chart
a. A simple bar chart to visualize data sets
b. A chart using non-adjacent cells to visualize data from different ranges.

*Create a Chart Using the Chart Wizard
a. Select the chart you created and experiment with the Chart Tools options
b. Modifying Charts
c. Moving an Embedded Chart
d. Sizing an Embedded Chart

I.   Practical Significance

Creating a simple chart offers practical benefits by visually summarizing data, making it easier to understand complex information and identify trends. Charts can simplify data, enhance clarity, and improve communication by presenting information in a more accessible and memorable format. This is especially useful for situations where large amounts of data need to be conveyed quickly and effectively.

The Chart Wizard simplifies the creation of charts and allows users to focus on effective data presentation. Since version 8.0 ONLYOFFICE Spreadsheet Editor comes with the Chart Wizard feature that displays a list of the recommended chart types and a preview for all types of charts based on the selected data.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO4 - Represent data in terms of various types of charts.

IV.   Laboratory Learning Outcome(s)

LLO 6.1 Create a simple chart to visualize the data sets.

V.   Relevant Affective Domain related Outcomes

    a.   Follow precautionary measures.
    b.   Follow naming conventions.
    c.   Follow ethical practices

VI.   Relevant Theoretical Background

a. A simple bar chart to visualize data sets

To create a simple bar chart, gather your data, draw or select axes, label them appropriately, and then draw bars representing the values of each category. You can then interpret the data by comparing the lengths of the bars.

- **Steps to Create a Bar Chart:**

   1. **Collect Data:** Gather the data you want to visualize, such as sales figures, customer demographics, or experimental results.
   2. **Draw or Select Axes:** A bar chart typically has two axes: the x-axis (horizontal) and the y-axis (vertical).
   3. **Label the Axes:** Clearly label the x-axis with the categories or groups you want to represent and label the y-axis with the units of measurement (e.g., sales in dollars, number of customers).
   4. **Draw the Bars:** Draw vertical (or horizontal) bars for each category. The height (or length) of each bar should be proportional to the corresponding value in your data.
   5. **Interpret the Data:** Once the bar chart is complete, you can compare the heights (or lengths) of the bars to visually see the relationships and differences between the data categories.

b. A chart using non-adjacent cells to visualize data from different ranges

To create a chart using non-adjacent cells in Excel, select the first set of cells, hold down the Ctrl key (or Cmd key on Mac), and then select the additional non-adjacent cells or ranges. Once all the data is selected, you can then insert a chart as you normally would. Here's a more detailed breakdown:

   1. **Select the First Range:** Choose the first set of cells containing the data you want to include in your chart.
   2. **Hold Ctrl (or Cmd):** Press and hold down the Ctrl key on your keyboard (or Cmd on a Mac).
   3. **Select Additional Ranges:** While holding Ctrl (or Cmd), click and select any other non-adjacent cells or ranges that you want to include in your chart.
   4. **Insert Chart:** Go to the "Insert" tab on the Excel ribbon and choose the desired chart type.
   5. **Customize:** You can then customize the chart as needed, such as adding titles, labels, and formatting the chart elements.

*Create a Chart Using the Chart Wizard

Following steps should be followed while creating a chart using the Chart Wizard:

   1. **Select your data:** Highlight the cells containing the data you want to include in the chart.
   2. **Initiate the Chart Wizard:** Click the "Insert Chart" or similar button (often located on the Insert tab… Click the "Insert" tab and select "Recommended Charts" or "Chart" depending on your Excel version. The Chart Wizard will open.).
   3. **Choose a chart type:** The Chart Wizard will present a variety of chart types (e.g., column, bar, pie, line). Select the one that best represents your data.
   4. **Customize elements:** The Chart Wizard may allow you to adjust data ranges, labels, axes, and other chart elements.
   5. **Place the chart:** The wizard will then create the chart and place it on your worksheet.

*Using Chart Tools (or similar):

1. **Select the chart:** Click on the chart to make it active and display the Chart Tools ribbon (or similar).
2. **Explore formatting options:** The Chart Tools ribbon will provide options for customizing the chart's appearance, including colors, fonts, labels, and other elements.
3. **Experiment with layouts:** You can change the layout of the chart, including the position of the title, legend, and axes.
4. **Refine chart elements:** Modify the chart's elements, such as changing the chart type, adding or removing labels, or adjusting the scale of the axes.

*Modifying Charts:

1. **Change chart type**: Right-click on the chart and select "Change Chart Type" to switch to a different visualization.
2. **Add/remove chart elements:** Use the Chart Tools contextual tabs ("Design" and "Format") to add or remove elements like titles, axis labels, gridlines, trendlines, and error bars.
3. **Format chart appearance:** Within the Chart Tools, modify the chart's colours, fonts, styles, and layout to enhance its visual appeal.
4. **Update data:** If the source data changes, the chart will automatically update. You can also manually refresh the chart by selecting "Data" from the Chart Tools ribbon.

*Moving an Embedded Chart:

1. **Click and drag:** Simply click and hold the chart title or border and drag it to the desired location within the worksheet.

*Sizing an Embedded Chart:

1. **Resize handles:** Hover over the chart's edges until resize handles appear (small squares). Click and drag these handles to adjust the chart's width and height.
2. **Specific size:** Right-click the chart, select "Format Chart Area," and specify the exact dimensions in the "Size" tab.

VII.   Resources Required

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (If Any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. What are the key points about Embedded Charts?
2. How do you change the chart's axis range to display a specific subset of data?
3. Consider your company C wants to visualize its market share compared to competitors (Company X, Y, and Z) over the last year so visualize this using a bar chart, and also explain why is it the best chart type for this data?
4. Create a chart that compares annual revenue (from one range of cells) and annual expenses (from another non-adjacent range) for your company X as well as create a chart that visualizes both these data sets in one chart?
5. Create a chart that represents the pass percentage of the students by year wise. (Consider your department data).
6. Create a spreadsheet with sales data for different products over several months and create a bar chart using the Chart Wizard.
7. Consider you have data on sales figures for different products. You could use the Chart Wizard to create a bar chart, where each bar represents a product's sales. Then, using Chart Tools, perform the following task :-
   a) Add a title like "Product Sales".
   b) Add a legend to identify each bar.
   c) Change the color of the bars to make them visually appealing.
   d) Add data labels to display the actual sales figures on each bar.
   e) Adjust the layout to make the chart more readable and visually pleasing.

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2. https://www.selfstudys.com/uploads/pdf/RltDCxKHwA5qkZv8Hk9e.pdf

3. https://www.extendoffice.com/documents/excel/2217-excel-chart-data-non-contiguous.html

XI. Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 7

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*Change the Chart Type
a. Create a basic bar chart using a dataset and change its type to a different chart
b. Experiment with different data display options, such as adding data labels, changing the axis format, and adjusting the gridlines
c. Experiment with position and style of the legend

I.   Practical Significance

Changing the chart type, adjusting data display options, and experimenting with the legend position and style are all crucial aspects of data visualization, as they significantly impact how effectively your audience interprets and understands the information presented.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO4 - Represent data in terms of various types of charts.

IV.   Laboratory Learning Outcome(s)

LLO 7.1 Change the chart type with adding data labels, axis format, and adjusting the gridlines.

V.   Relevant Affective Domain related Outcomes

a. Follow precautionary measures.
b. Follow naming conventions.
c. Follow ethical practices

VI.   Relevant Theoretical Background

1. Create a basic bar chart:

- **Input your data:** Enter your data into a spreadsheet. This should include categories on one axis (x-axis) and values on the other (y-axis).
- **Select the data:** Highlight the cells containing your data.
- **Insert a chart:** Go to the "Insert" tab in your spreadsheet software and click on "Column" or "Bar" to create a basic bar chart.

2. Change the chart type:

- **Click the chart:** Select the bar chart you just created.
- **Access the chart options:** Depending on your software, there are usually multiple ways to access the chart modification options. You can right-click on the chart, click the "Chart" or "Design" tab, or click a dedicated "Chart Options" button.

Change the chart type: In the chart options panel, look for an option to "Change Chart Type," "Select Chart Type," or similar. Choose a different chart type, such as a line chart, pie chart, or scatter plot, depending on what best represents your data.

3. Experiment with data display options:

- **Add data labels:** Select the chart. Access the chart options (see step 2). Look for an option related to "Data Labels," "Series Labels," or "Values." Choose where you want the labels to appear (above, below, inside the bars, etc.) and customize their appearance (font, size, colour).
- **Change the axis format:**

  - ➢ **Axis Titles:** Add clear titles to your x and y axes to explain what they represent.
  - ➢ **Axis Scale:** Adjust the minimum and maximum values on the axes to better fit your data. You might need to zoom in or out to make the trends clearer.
  - ➢ **Gridlines:** Decide whether to show gridlines on the chart and, if so, how frequently they should appear.
  - ➢ **Chart Title:** Add a clear and concise title to your chart.

4. Experiment with legend position and style:

- **Add a chart legend:** Click the chart to which you want to add a legend, click the Chart Elements button, and then click Legend. To change the location of the legend, click the arrow next to Legend and then click the location that you want.
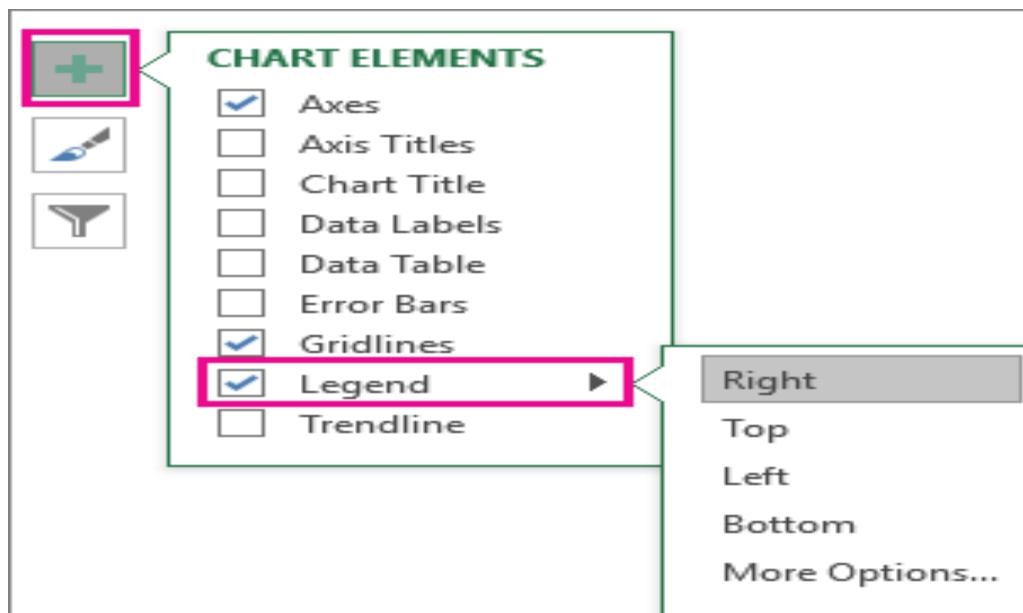
Fig: Add a chart legend

- **Format a chart legend:** Once you add the chart legend, there are many things that you can do to change how it looks.
- **Change font or font size:** Right-click the legend, and then click Font.
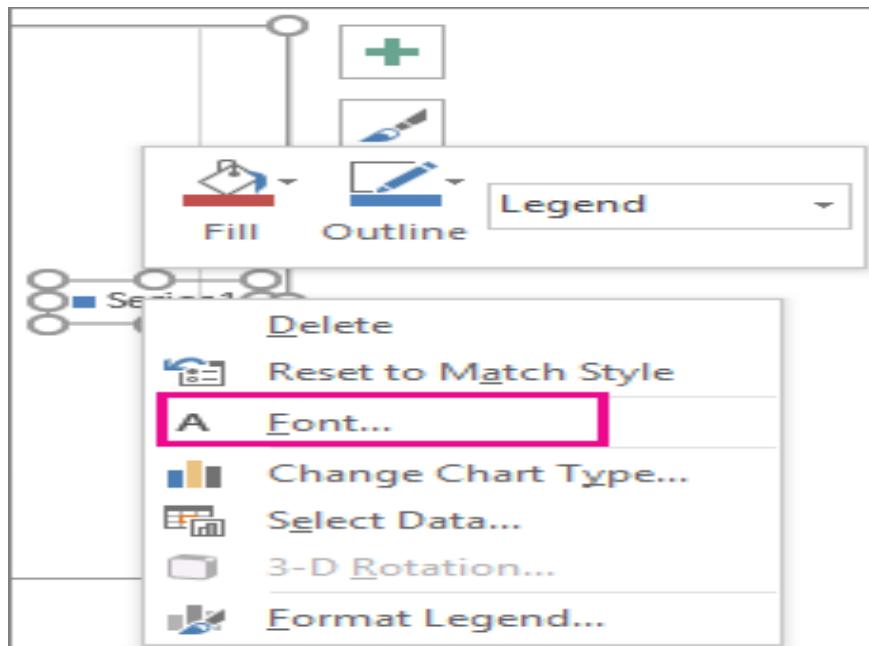
Fig: Change font or font size

- On the **Font** tab, make the changes that you want to the font or font size.
- Change legend border or background
- Right-click the legend, and then click Format Legend.
- In the Format Legend task pane, pick the options that you want.
- Overall, you can perform following steps: -
- **Show/Hide the legend:** You can choose to display the legend or hide it. If displayed, you can control its:
- **Position:** Place the legend above, below, to the side, or within the chart.
- **Style:** Change the legend's text colour, font, and background. You might also want to the legend entries to make them clearer (e.g., using shorter labels or icons).

VII.   Resources Required

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (if any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Create a basic bar chart using data of your department students and change its type to a different chart.
2. How to move all data labels at the same time?
3. Create a dataset using your college/department staff and perform the activities such as adding data labels, changing the axis format, and adjusting the gridlines.
4. How can you ensure that the legend doesn't overlap or obstruct other elements of the plot?
5. What are the best practices for choosing the location and style of a legend in different types of visualizations (e.g., line charts, bar charts, scatter plots)?
6. If you need to display two or more legends on the same plot, how can you do so in a way that doesn't interfere with the overall presentation?
7. Create a chart using sales data of a company and change the data labels to include the category as well as the percentage and position the labels in the outside end location?

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1. https://support.microsoft.com/en-us/office/create-a-bar-chart-14832c6e-0a66-458d-82e2-7fd3bce4d05a

2. https://www.ablebits.com/office-addins-blog/make-bar-graph-excel/

3. https://books.libreoffice.org/en/CG71/CG7103-ChartsAndGraphs.html

XI. Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 8

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a. Create a Pie Chart from a dataset
b. Move the pie chart to a new worksheet for better visibility
c. Emphasize a specific category by exploding a slice of the pie chart
d. Customize the appearance of the pie chart for better presentation

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I.   Practical Significance

Creating a pie chart from a dataset allows for a visual representation of proportional data, where each slice represents a different category and its size relative to the whole. Moving the pie chart to a new worksheet improves readability by isolating it from other elements on the original sheet. Emphasizing a specific category by exploding a slice visually highlights its importance. Customizing the appearance of the pie chart with colours, labels, and formatting enhances its visual appeal and understanding.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO4 - Represent data in terms of various types of charts.

IV.   Laboratory Learning Outcome(s)

LLO 8.1 Design a Pie Chart.

V.   Relevant Affective Domain related Outcomes

   a. Follow precautionary measures.
   b. Follow naming conventions.
   c. Follow ethical practices

VI.   Relevant Theoretical Background

To create a pie chart, move it to a new sheet, emphasize a slice, and customize its appearance in Excel:

1. Create a pie chart:

Highlight the data you want to chart in your spreadsheet. Go to the Insert tab. Select Pie Chart and choose the desired style (e.g., 2D, 3D, and doughnut).
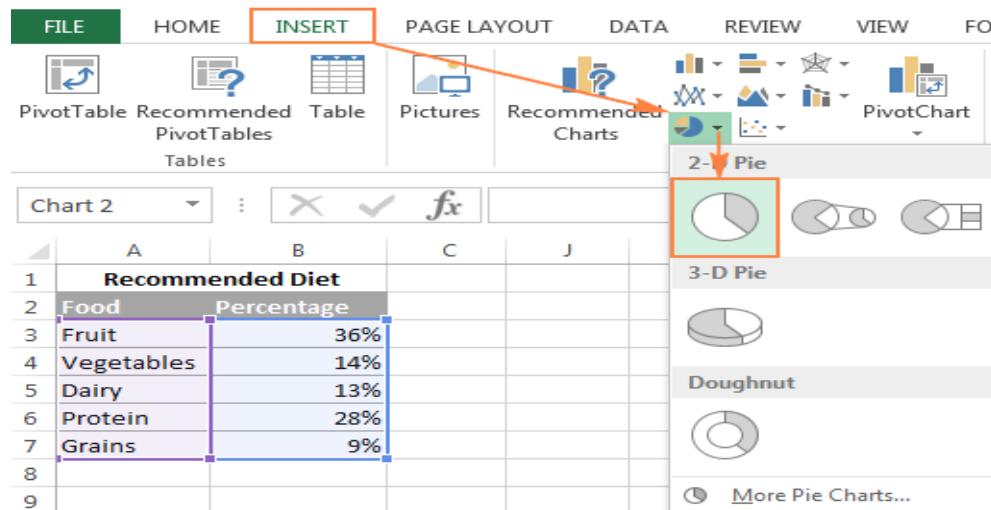
Fig: Create a Pie Chart

2. Move the pie chart to a new sheet:

Click on the pie chart. Right-click and select Cut. Navigate to the new worksheet where you want to place the chart. Right-click and select Paste.

3. Emphasize a slice by exploding it:

To emphasize a slice in a pie chart by exploding it in Microsoft Office 365, you can use the "Pie Explosion" feature in Excel.

- Click on the pie chart to select it.
- Click again on the **slice** you want to emphasize (only that slice should be selected).
- **Drag** the selected slice slightly away from the centre. This will "explode" it. Alternatively, right-click the slice, choose **Format Data Point (or Format Data Series)** and increase the **Point Explosion** or **Pie Explosion.** (In short Right-click the pie chart, then click Format Data Series. Drag the Pie Explosion slider to increase the separation or enter a number in the percentage box.)
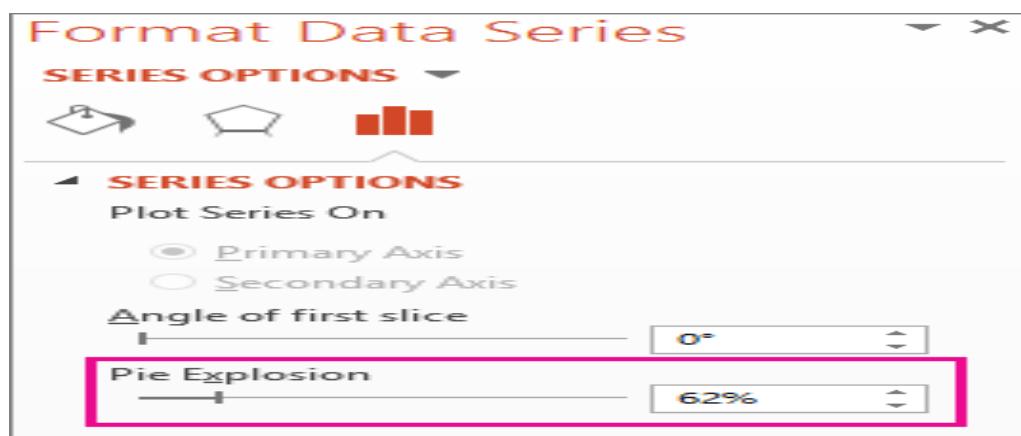
Fig: Emphasize a slice by exploding

4. Customize the pie chart's appearance:

- **Change colours:** Click the pie chart, then go to the Chart Design tab. Select "Color" to choose a new colour scheme or customize individual slices.
- **Add labels:** Click the chart, then go to the Chart Elements section. Select "Data Labels" to add labels with percentages or values directly onto the slices.
- **Add a title:** Click the chart, then add a title in the Chart Title section.
- **Adjust chart style:** Use the Chart Styles options to modify the overall look and feel of the pie chart (e.g., gridlines, legend, etc.).

VII.   Resources Required

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (if any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Microsoft Office, Office 365- Excel		

VIII.   Conclusion

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IX.   Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. **Create a pie chart for using data of your department students to show the attendance of a month.**
2. **What is the explosion effect on a pie chart?**
3. **Create a pie chart for sale of different fruits in a day for a shop and move the pie chart to a new worksheet for better visibility.**
4. **Create a pie chart of unit test result of your class and emphasize a specific category by exploding a slice of the pie chart.**
5. **You have a dataset containing sales figures for four products: Product A (40), Product B (30), Product C (20), and Product D (10). Create a pie chart that shows the sales distribution among these products in Excel and apply a more professional-looking style. Also explain how can you apply a pre-defined style to your pie chart to make it look more polished?**

6. **You have multiple charts in your Excel file and want to organize them better. After creating a pie chart for your sales data, move it to its own worksheet without affecting the rest of the data?**

7. **Create a pie chart showing the distribution of market share among different products, also explode the slice representing the product with the highest market share to make it stand out?**

8. **Create a pie chart for your company's quarterly sales, as well as emphasize the quarter with the highest sales and highlight this quarter in your pie chart?**

9. **The following data distribution depicts the marks of 35 students of a particular standard. Draw a pie chart for the given.**

Marks (in %)	40-50	50-60	60-70	70-80	80-90	90-100
Number of students	5	4	6	8	6	5

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1. https://www.ablebits.com/office-addins-blog/make-pie-chart-excel/

2. https://www.geeksforgeeks.org/how-to-create-pie-of-pie-chart-in-excel/

3. https://www.datacamp.com/tutorial/pie-chart-in-excel

XI.   Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 9

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* Create different types of plots. Write a Python script to save the plot in different formats: PNG, PDF, and SVG.

I.   Practical Significance

In data analysis and visualization, creating different types of plots can help communicate findings clearly and effectively. The practical significance of different types of plots lies in the ability to represent data visually, which aids in uncovering trends, patterns, relationships, and outliers in datasets. Depending on the context, the Line Plot, Bar Plot, Histogram, Scatter Plot, Pie Chart, Box Plot are commonly used.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO5 - Visualize the data using a Python library.

IV.   Laboratory Learning Outcome(s)

LLO 9.1 Generate and Save the plot in various formats.

V.   Relevant Affective Domain related Outcomes

  a. Follow precautionary measures.
  b. Follow naming conventions.
  c. Follow ethical practices

VI.   Relevant Theoretical Background

Steps to Create and Save Different Types of Plots in Python:

Step 1: Install Required Libraries

You need two libraries for this task:

1) **matplotlib** for creating the plots.
2) **numpy** for generating data (such as the sine wave or random values).

To install them, open your terminal or command prompt and run the following code-

pip install matplotlib numpy

Step 2: Import the Necessary Libraries

Start by importing the required libraries for plotting and handling data write following code in Python Editor

---

import matplotlib.pyplot as plt

import numpy as np

matplotlib.pyplot provides a MATLAB-like interface for making plots.

numpy helps in creating arrays and mathematical operations, such as generating the sine wave and random data.

Step 3: Prepare the Data for Plotting

Now, prepare the data that you will plot. For this example, we'll create a sine wave for the line plot, random values for the bar plot, and a scatter plot with random points. Write following code in Python Editor-

 # Data for the plots

x = np.linspace(0, 10, 100)   # Line plot data (X-axis)

y = np.sin(x)   # Line plot data (Y-axis, sine function)

y_bar = np.random.rand(5)   # Bar plot data (random values)

x_bar = ['A', 'B', 'C', 'D', 'E'] # Bar plot categories

x_scatter = np.random.rand(50)   # Scatter plot data (X values)

y_scatter = np.random.rand(50)   # Scatter plot data (Y values)

Explanation:

Line Plot: x is created using np.linspace(), and y is the sine of x.

Bar Plot: y_bar contains random values, and x_bar defines the categories (labels).

Scatter Plot: x_scatter and y_scatter are arrays of random values.

Step 4: Create the Plot with Multiple Subplots

We will use the plt.subplots() function to create a figure with three subplots stacked vertically.

 # Create a figure to hold the plots by witing following code

fig, axs = plt.subplots(3, 1, figsize=(6, 12)) # 3 rows, 1 column

Here 3, 1: Specifies the number of rows and columns (3 rows, 1 column).

figsize: Sets the size of the entire figure.

Step 5: Create the Line Plot

Next, we create a line plot on the first subplot (axs[0]) by writing following code-

 # Line Plot

axs[0].plot(x, y, label="Sine Wave", color='b') # 'b' stands for blue

axs[0].set_title("Line Plot")   # Set title

axs[0].set_xlabel("X-axis")   # X-axis label

axs[0].set_ylabel("Y-axis")   # Y-axis label

axs[0].legend()   # Show legend

Step 6: Create the Bar Plot

For the bar plot, use the second subplot (axs[1]) and write as follows:-

 # Bar Plot

axs[1].bar(x_bar, y_bar, color='g') # 'g' stands for green

axs[1].set_title("Bar Plot")   # Set title

axs[1].set_xlabel("Categories")   # X-axis label

axs[1].set_ylabel("Values")   # Y-axis label

Step 7: Create the Scatter Plot

For the scatter plot, use the third subplot (axs[2]) and write as follows:-

 # Scatter Plot

axs[2].scatter(x_scatter, y_scatter, color='r') # 'r' stands for red

axs[2].set_title("Scatter Plot")   # Set title

axs[2].set_xlabel("X-axis")   # X-axis label

axs[2].set_ylabel("Y-axis")   # Y-axis label

Step 8: Adjust Layout and Display the Plots

We use plt.tight_layout() to automatically adjust subplot spacing, ensuring that titles and labels do not overlap.

 # Adjust layout

plt.tight_layout()

Finally, use plt.show() to display the plots in a window.

 # Show the plot

plt.show()

Step 9: Save the Plots in Different Formats

Now, use plt.savefig() to save the plot in multiple formats: PNG, PDF, and SVG.

 # Save the plot in different formats

plt.savefig('plot.png')   # Save as PNG

plt.savefig('plot.pdf')   # Save as PDF

plt.savefig('plot.svg')   # Save as SVG

Step 10: Run the Script

After setting up the code as shown above, simply run the script in your Python environment or IDE. You should see the plots displayed, and the plot.png, plot.pdf, and plot.svg files will be saved in the same directory where you run the script.

VII.   Resources Required

Sr. No.	Name of Resource	Broad Specification	Quantity	Remark (if any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Editor: Python setup		

VIII.   Conclusion

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IX.   Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Write a Python script to create a simple line plot of the function $y=x^2$ and save it in PNG, PDF, and SVG formats. What is the explosion effect on a pie chart?
2. Write a Python script to create a bar chart displaying the sales of a product over 6 months and save the plot in PNG, PDF, and SVG formats.
3. Write a Python script to create a scatter plot for two variables, x and y, and save it as a PNG, PDF, and SVG file.
4. Write a Python script to create a histogram from a random dataset and save it in PNG, PDF, and SVG formats.
5. Write a Python script to create a pie chart that shows the distribution of market share among 5 companies, and save it as PNG, PDF, and SVG files.
6. Write a Python script to create a heatmap of a 10x10 matrix and save it as PNG, PDF, and SVG files.
7. Write a Python script to create a box plot showing the distribution of 5 different datasets, and save it as PNG, PDF, and SVG files.

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X.   References:

1. https://www.geeksforgeeks.org/how-to-save-a-plot-to-a-file-using-matplotlib/

2. https://mljar.com/blog/matplotlib-save-plot/

3. https://swcarpentry.github.io/python-novice-gapminder/09-plotting.html

XI.   Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 10

Application of data analytics across various industries through case study

I.   Practical Significance

The practical significance of analysing data analytics applications across various business domains lies in the ability to make informed, data-driven decisions that enhance efficiency, reduce costs, improve customer experiences, and ultimately drive growth and profitability. Here's a closer look at the real-world impact of applying data analytics in key business sectors like Retail and E-Commerce, Finance and Banking, Healthcare etc.

II.   Industry / Employer Expected Outcome(s)

Perform Data Analytics in various business domains for improved decision making

III.   Course Level Learning Outcomes(s)

CO5 - Visualize the data using a Python library.

IV.   Laboratory Learning Outcome(s)

LLO 10.1 Analyse data analytics applications across various business domains.

V.   Relevant Affective Domain related Outcomes

  a. Follow precautionary measures.
  b. Follow naming conventions.
  c. Follow ethical practices

VI.   Relevant Theoretical Background

Data analytics has a wide range of applications across various industries, from fraud detection in banking to personalized customer experiences in retail. Here's a look at some key areas:

1. Finance:

- **Fraud Detection:** Banks use machine learning algorithms to identify anomalous transaction patterns, flagging potential fraudulent activities.
- **Risk Management:** Data analytics helps insurance companies assess and manage risks, while financial institutions use it to analyse market trends and predict investment performance.

2. Retail:

- **Customer Segmentation:** Data analytics helps retailers understand customer behavior, personalize shopping experiences, and optimize marketing campaigns.

- **Supply Chain Optimization:** Data analytics helps retailers optimize supply chains, reducing costs and improving efficiency.

3. Manufacturing:

- **Predictive Maintenance:** Data analytics helps manufacturers predict equipment failures, allowing for proactive maintenance and reducing downtime.
- **Production Efficiency:** Companies like Siemens have used data analytics to increase production efficiency and reduce production time.

4. Healthcare:

- **Disease Prediction:** Data analytics helps predict the spread of diseases and personalize patient care, leading to better treatment outcomes.
- **Drug Discovery:** Data analytics accelerates drug discovery and development, helping researchers identify new drug candidates and optimize clinical trials.

5. Government:

- **Crime Prevention:** Data analytics helps security agencies track criminal activities, enhance surveillance, and predict security threats in real time.
- **Program Evaluation:** Governments use data analytics to monitor the performance of welfare schemes and programs, ensuring effectiveness and accountability.

6. Other Industries:

- **Marketing:** Data analytics helps companies understand customer behavior, optimize marketing campaigns, and improve targeting strategies.
- **Telecommunications:** Data analytics helps telecommunications companies optimize networks, improve customer service, and personalize offerings.
- **Transportation:** Data analytics helps transportation companies optimize routes, reduce congestion, and improve safety.

Data Analytics helps to reduce delivery time and Improve Supply Chain

Case Study: - Amazon: Optimizing Supply Chain and Inventory Management

Company: Amazon

Industry: E-Commerce

Challenge: Managing vast inventory and optimizing supply chain logistics.

- **Solution:** Utilizing real-time analytics and machine learning for demand forecasting and inventory management.
- **Overview:** Amazon, a global e-commerce giant, has transformed its supply chain and inventory management through data analytics. The company's ability to predict demand and manage inventory efficiently has been a critical factor in its success.
- **Strategy:**

- ➢ **Real-Time Analytics:** Amazon uses real-time data from its sales, customer behaviour, and supply chain operations to forecast demand and optimize inventory levels.
- ➢ **Machine Learning:** Advanced machine learning models predict future product demand based on historical data, seasonality, and market trends.
- ➢ **Dynamic Pricing:** Amazon implements dynamic pricing strategies, adjusting prices based on demand, competition, and other factors.

- • **Results:**

  - ➢ **Improved Efficiency:** Amazon's data-driven approach has streamlined its supply chain, reduced stock outs, and minimized excess inventory.
  - ➢ **Enhanced Customer Experience:** By ensuring that popular products are readily available and optimizing delivery times, Amazon has enhanced customer satisfaction and loyalty.

VII.   Resources Required

Sr. No.	Name of Resource	Specification	Quantity	Remark (if any)
1	Computer System	Computer (i5 preferable), RAM minimum 8 GB onwards. Operating system: Windows 10 onwards	01 System for each Student	
2	Software	Excel 365 ,Editor: Python setup		

VIII.   Conclusion

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IX.   Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. **Write a case study of how Data Analytics is revolutionizing the Manufacturing Industry?**
2. **Write a case study of how Retailers using data analytics to Personalize the Shopping Experience?**
3. **How Data Analytics is helping Financial Institutions to Combat Fraud? Explain.**
4. **How Data Analytics help to reduce delivery time and Improve Supply Chain? Explain.**
5. **How Telecom Companies are leveraging data analytics to improve various KPI? Explain.**

6. How Insurance companies are using Data Analytics to improve various processes? Explain.

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X.   References:

1. https://www.geekster.in/articles/case-studies-in-data-analytics-success-stories/

2. https://www.sigmacomputing.com/blog/data-analytics-applications

XI.   Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Logic formation:30%	
2.	Debugging ability:20%	
3.	Follow ethical practices:10%	
	Weightage- Product related: 40%	**Marks-10**
4.	Expected output:15%	
5.	Timely Submission:15%	
6.	Answer to sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	