**DATA ANALYTICS**                                      **Course Code : 315326**

| **Programme Name/s** | : **Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Information Technology/** <br> **Computer Science & Information Technology/ Computer Science/ Electronics & Computer Engg.** |
|---|---|
| **Programme Code** | : **CM/ CO/ CW/ IF/ IH/ SE/ TE** |
| **Semester** | : **Fifth** |
| **Course Title** | : **DATA ANALYTICS** |
| **Course Code** | : **315326** |

## I.  RATIONALE

Data Analytics uses statistical and computational methods to analyze data, aiding informed decision-making. Excel dashboards effectively present vital data at a glance, enhancing user interactivity. A Data Analyst collects, cleans, and visualizes Datasets to solve problems.

## II.  INDUSTRY / EMPLOYER EXPECTED OUTCOME

Perform Data Analytics in various business domains for improved decision making

## III.  COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- 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.

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## IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Paper Duration | Assessment Scheme | | | | | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | | Theory | | | | Based on LL & TL | | | | Based on SL | | |
| | | | | | | | | | | | | | | | | | Practical | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | Max | Min | |
| 315326 | DATA ANALYTICS | DAN | DSE | 4 | - | 2 | - | 6 | 2 | 3 | 30 | 70 | 100 | 40 | 25 | 10 | 25# | 10 | - | - | 150 |

**Total IKS Hrs for Sem. :** 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

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## V.  THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 1 | TLO 1.1 Describe the importance of data analytics.<br>TLO 1.2 Differentiate between types of data analytics.<br>TLO 1.3 Describe the quality and quantity of data.<br>TLO 1.4 Measures the central tendency of given dataset.<br>TLO 1.5 Use various sampling techniques. | **Unit - I Introduction to Data Analytics**<br>1.1 Data Analytics: An Overview, Importance of Data Analytics<br>1.2 Types of Data Analytics: Descriptive Analysis, Diagnostic Analysis, Predictive Analysis, Prescriptive Analysis, Visual Analytics<br>1.3 Life cycle of Data Analytics, Quality and Quantity of data, Measurement<br>1.4 Data Types, Measure of central tendency, Measures of dispersion<br>1.5 Sampling Funnel, Central Limit Theorem, Confidence Interval, Sampling Variation | Presentations Lecture Using Chalk-Board Case Study |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---------------------------------------------------|--------------------------------------------------------------------------|---------------------------------|
| 2 | TLO 2.1 Create a box plot of the test scores and interpret its key components. TLO 2.2 Perform correlation and regression analysis. TLO 2.3 Use various methods to address missing values in Dataset. TLO 2.4 Apply Anova and Chi Square test. TLO 2.5 Use scatter diagrams. TLO 2.6 Test hypothesis. TLO 2.7 Explain the concept of a sampling distribution. TLO 2.8 Analyze the probability distribution. | **Unit - II Statistical Analysis** 2.1 Graphical techniques, box plot, skewness and kurtosis, Descriptive Stats 2.2 Correlation and Regression, Data Cleaning 2.3 Imputation Techniques 2.4 Anova and Chi Square 2.5 Scatter Diagram 2.6 Estimation and Hypothesis Testing 2.7 Sampling Distributions, Counting 2.8 Probability,Probability Distributions | Presentations Lecture Using Chalk-Board Hands-on |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 3 | TLO 3.1 Describe the steps for making excel dashboard. TLO 3.2 Create a pivot Table. TLO 3.3 Sort and filter the pivot tables. TLO 3.4 Create a pivot chart for different types of grouping items. TLO 3.5 Describe various formatting operations on pivot table. | **Unit - III Data Analytics with Excel** 3.1 Excel Dashboard: Tables and Data Grids, Dynamic Filters and Controls, Trend Analysis and Forecasting 3.2 Pivot Tables: Creating a Pivot Table Specifying Pivot Table Data 3.3 Changing a Pivot Tables, Calculation Filtering and Sorting a Pivot Table 3.4 Creating a Pivot Chart, Grouping Items 3.5 Updating a Pivot Table, formatting a Pivot Table using Slicers | Presentations Hands-on Demonstration |
| 4 | TLO 4.1 Create relevant chart based on requirement. TLO 4.2 Describe the process of selecting the data range. TLO 4.3 Explain the features of Chart Wizard. TLO 4.4 Explain the steps to move an embedded chart to a new position within the same worksheet. TLO 4.5 Format various components of given type of chart. | **Unit - IV Data Visualization** 4.1 Creating a Simple Chart, Charting Non-Adjacent Cells 4.2 Creating a Chart Using the Chart Wizard, Modifying Charts, Moving an Embedded Chart, Sizing an Embedded Chart 4.3 Changing the Chart Type, Changing the Way Data is Displayed, Moving the Legend 4.4 Formatting Charts, Adding Chart Items, Formatting All Text, Formatting and Aligning Numbers, Formatting the Plot Area, Formatting Data Markers 4.5 Pie Charts, Creating a Pie Chart Moving the Pie Chart to its Own Sheet Adding Data Labels, Exploding a Slice of a Pie Chart | Presentations Hands-on Demonstration |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 5 | TLO 5.1 Describe the steps for Installing and setting up Matplotlib in Python.<br>TLO 5.2 Create various types of plots.<br>TLO 5.3 Customize Plots.<br>TLO 5.4 Write steps to Export plots in different formats. | **Unit - V Data Visualization using Python**<br>5.1 Overview of Matplotlib and its role in data visualization, Installing and setting up Matplotlib in Python<br>5.2 Basic plotting with Matplotlib, Line plot, Scatter plots, Bar charts, Histograms, adding titles, labels, and legends to plots<br>5.3 Changing figure size and aspect ratio, Customizing axes (limits, ticks, and labels)<br>5.4 Exporting and Saving Visualizations: Saving plots in different formats (PNG, PDF, SVG), Adjusting the resolution and quality of saved plots, creating interactive visualizations using Matplotlib widgets | Presentations<br>Hands-on<br>Demonstration |

## VI.   LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| | | | | |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 1.1 Perform Statistical Analysis in Excel. | 1 | *a. Calculate mean, median, and mode for a given dataset using Excel functions (AVERAGE, MEDIAN, MODE).<br><br>*b. Calculate range, interquartile range (IQR), variance, and standard deviation using Excel functions (STDEV, VAR).<br><br>*c. Calculate the correlation coefficient between two variables using the CORREL function | 2 | CO1 |
| LLO 2.1 Construct box plot.<br>LLO 2.2 Perform the different types of function using linear regression.<br>LLO 2.3 Perform T-test in Excel.<br>LLO 2.4 Calculate confidence intervals for the mean of a dataset.<br>LLO 2.5 Apply Chi-square test for independence. | 2 | *a. Construct a box plot using the Insert Chart feature to identify the median, quartiles, and outliers of a dataset.<br><br>*b. Perform a simple linear regression analysis<br><br>*c. Conduct a t-test to compare means between two groups<br><br>*d. Calculate confidence intervals<br><br>*e. Conduct a Chi-square test | 2 | CO2 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 3.1 Create a table to execute the function using dashboard.<br>LLO 3.2 Perform various operations for data cleaning. | 3 | *Create a Data Table<br><br>a. Import a sample dataset (e.g., sales data) into Excel.<br><br>b. converts the dataset into an Excel Table using the "Format as Table" feature and apply appropriate styles.<br><br>c. Create a dashboard sheet that summarizes key metrics (e.g., total sales, average sales per region) using tables.<br><br>*Data Cleaning<br><br>a. Identify and remove duplicates from a dataset.<br><br>b. Use functions like TRIM, UPPER, LOWER, and PROPER to clean text data.<br><br>c. Find and replace values using the Find & Replace feature. | 2 | CO3 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 4.1 Create a pivot table to analyze the data set.<br>LLO 4.2 Sort and filter the given data set. | 4 | Create a Pivot Table<br><br>a. A basic pivot table from a dataset<br><br>b. Specify and filter data in a pivot table<br><br>c. Add a calculated field to a pivot table<br><br>d. Group data within a pivot table. Refresh pivot table data after making changes to the source data.<br><br>Filter and sort a PivotTable<br><br>a. Apply a Filter to the PivotTable<br><br>b. Sort Data in the Pivot Table.<br><br>c. Add slicers to the PivotTable for interactive filtering. | 2 | CO3 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 5.1 Customize your chart with titles, labels, colors, and legends as desired. | 5 | Create a Pivot Chart<br><br>a. A basic pivot chart from a dataset<br><br>b. A dynamic pivot chart that updates based on user selection<br><br>c. Group date items in a pivot table to summarize data by month or year<br><br>d. Group product categories in a pivot table | 2 | CO3 |
| LLO 6.1 Create a simple chart to visualize the data sets. | 6 | *Create a Simple Chart<br><br>a. A simple bar chart to visualize data sets<br><br>b. A chart using non-adjacent cells to visualize data from different ranges.<br><br>*Create a Chart Using the Chart Wizard<br><br>a Select the chart you created and experiment with the Chart Tools options<br><br>b. Modifying Charts<br><br>c. Moving an Embedded Chart<br><br>d. Sizing an Embedded Chart | 2 | CO4 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 7.1 Change the chart type with adding data labels, axis format, and adjusting the gridlines. | 7 | *Change the Chart Type<br><br>a. Create a basic bar chart using a dataset and change its type to a different chart<br><br>b. Experiment with different data display options, such as adding data labels, changing the axis format, and adjusting the gridlines<br><br>c. Experiment with position and style of the legend | 2 | CO4 |
| LLO 8.1 Design a pie chart. | 8 | a. Create a pie chart from a dataset<br><br>b. Move the pie chart to a new worksheet for better visibility<br><br>c. Emphasize a specific category by exploding a slice of the pie chart<br><br>d. Customize the appearance of the pie chart for better presentation | 2 | CO4 |
| LLO 9.1 Generate and Save the plot in various formats. | 9 | * Create different types of plots.Write a Python script to save the plot in different formats: PNG, PDF, and SVG. | 2 | CO5 |
| LLO 10.1 Analyze data analytics applications across various business domains. | 10 | Application of data analytics across various industries through case study | 2 | CO5 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| **Note : Out of above suggestive LLOs -** | | | | |

- '*' 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 outcomes.

## VII.  SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

**Other**

- NA

**Note :**

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

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## VIII.　LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|-------------------------------------------|---------------------|
| 1 | Microsoft Office ,Office 365 | 1,2,3,4,5,6,7,8,9 |
| 2 | Software: Editor: Python setup | 10,11 |
| 3 | Computer (i5 preferable), RAM minimum 8 GB onwards. | All |
| 4 | Operating system: Windows 10 onward | All |

## IX.　SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------|------|------------|-------------|----------------|---------|---------|---------|-------------|
| 1 | I | Introduction to Data Analytics | CO1 | 10 | 4 | 4 | 8 | 16 |
| 2 | II | Statistical Analysis | CO2 | 8 | 2 | 4 | 10 | 16 |
| 3 | III | Data Analytics with Excel | CO3 | 8 | 2 | 2 | 8 | 12 |
| 4 | IV | Data Visualization | CO4 | 8 | 2 | 4 | 6 | 12 |
| 5 | V | Data Visualization using Python | CO5 | 6 | 2 | 4 | 8 | 14 |
| | | Grand Total | | 40 | 12 | 18 | 40 | 70 |

## X.　ASSESSMENT METHODOLOGIES/TOOLS

**Formative assessment (Assessment for Learning)**

•　Continuous assessment based on process and Product related performance indicator.Each practical will be assessed considering 1) 60% weightage is to process 2) 40% weightage to product

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## Summative Assessment (Assessment of Learning)

- End Semester Examination, Lab Performance ,Viva-voce

## XI.  SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 2 | 2 | 1 | - | 2 | - | 2 | | | |
| CO2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | | |
| CO3 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | | | |
| CO4 | 2 | 2 | 3 | 1 | 1 | 2 | 1 | | | |
| CO5 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

## XII.  SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|---|---|---|---|

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| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--------|-------|-----------------------------|
| 1 | Jinjer Simon | Excel Data Analysis: Your visual blueprint for analyzing data, charts, and PivotTables | Wiley Publication Edition: 3rd ISBN: 978-0-470-59160-4 |
| 2 | A. J. Smalley | Data Analysis with Excel | SAGE Publications Edition: 1st, 2007 ISBN 10: 0070139903 / ISBN 13: 9780070139909 |
| 3 | Fabio Nelli | Python Data Analytics: With Pandas, NumPy, and Matplotlib | Apress pubication ISBN-13 :978-1484239124 ISBN-13978-1484247372 |
| 4 | Jake VanderPlas | Python Data Science Handbook | Shroff/O'Reilly Publication ISBN-10-9355422555 ISBN-13-978-9355422552 |
| 5 | Business Analytics with MindTap | Jeffrey D. Camm \| James J Cochran \| Michael J. Fry \| Jeffrey W. Ohlmann | Cengage Learning India Pvt. Ltd. Publication Edition:4th ISBN: 9789360533533 |

## XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---------------|-------------|
| 1 | https://spreadsheetpoint.com/excel/dashboard-in-excel/ | Advance Excel |
| 2 | https://www.javatpoint.com/how-to-create-a-dashboard-in-excel | Excel Dashboard |
| 3 | https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel | Data Visualization |
| 4 | https://www.freecodecamp.org/news/introduction-to-data-vizualization-using-matplotlib/ | Matplotlib in Python |
| 5 | https://archive.nptel.ac.in/courses/106/107/106107220/ | Introduction to data analytics |

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| Sr.No | Link / Portal | Description |
|---|---|---|
| **Note :** | | |

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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