# 25CASE212: Data Analytical Tools

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| **w. e. f. Academic Year:** | **2026-27** |
| **Semester:** | **B.E. 3rd (Computer Engineering / Computer Science and Engineering / Information Technology)** |
| **Category of the Course:** | **PCC** |
| **Prerequisite:** | Students should possess basic programming knowledge (preferably in Python), along with an understanding of statistics and probability fundamentals. They should also be familiar with database concepts and have hands-on experience using tools such as Excel for basic data handling and visualization. |
| **Rationale:** | The Data Analytics Tools course is designed to equip students with essential analytical, statistical, and computational skills required in the data-driven world. With the growing demand for insights from massive datasets, this course bridges theory and practical applications using Python, Power BI, and R. |

## Course Outcomes:

After Completion of the Course, Student will able to:

| CO No. | Course Outcome (CO) | RBT Level (Cognitive Domain) |
|---|---|---|
| CO1 | **To explain** the fundamental concepts, processes, and importance of data analytics in real-world applications. | Understand |
| CO2 | **To apply** data analytical tools such as Python, R, Power BI, and Tableau for data processing and visualization tasks. | Apply |
| CO3 | **To perform** data cleaning, transformation, and exploratory data analysis on structured and unstructured datasets. | Apply, Create |
| CO4 | **To analyse** datasets using statistical and analytical techniques to extract meaningful patterns and insights. | Apply , Analyse |
| CO5 | **To design and develop** interactive dashboards and visual reports for effective data-driven decision-making. Data-driven sustainability insights | Apply, Create |

**Teaching and Evaluation Scheme**:

| Teaching Scheme | | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **C** | **Hrs/Week** | **IE** | **EE** | **CIA** | **Practical** | **Total Marks** |
| - | - | 4 | 2 | 4 | 00 | 00 | 30 | 20 | 50 |

IE: Internal Evaluation EE: External Exam (End Semester)
CIA: Continuous Internal Assessment Practical: Practical Exam (End Semester)

**List of Tutorial and /or Practical:**

| Sr No | Topic | Hrs |
|---|---|---|
| 1 | **Python – Data Loading and Preprocessing**<br>To load and preprocess a dataset using Python libraries. | 02 |
| 2 | **Python – Exploratory Data Analysis (EDA)**<br>To perform exploratory data analysis using Python. | 02 |
| 3 | **Python – Visualization using Matplotlib/Seaborn**<br>To create data visualizations for analysis. | 02 |
| 4 | **Power BI – Importing Datasets**<br>To import data into Power BI from multiple sources. | 02 |
| 5 | **Power BI – Data Transformation using Power Query**<br>To clean and transform data using Power Query Editor. | 04 |
| 6 | **Power BI – Creating Dashboards**<br>To build an interactive dashboard using Power BI. | 04 |
| 7 | **Power BI – DAX Formulas for Calculated Fields**<br>To create calculated fields using DAX. | 04 |
| 8 | **R – Data Import and Manipulation**<br>To import and manipulate data using R. | 04 |
| 9 | **R – Data Visualization with ggplot2**<br>To visualize data using ggplot2 library. | 04 |
| 10 | **R – Correlation and Regression Analysis**<br>To perform correlation and regression analysis in R. | 04 |
| 11 | **R – Hypothesis Testing**<br>To test statistical hypotheses using R. | 04 |
| 12 | **R – Classification or Clustering Model**<br>To implement classification or clustering algorithms. | 04 |
| 13 | **Integration of Python Results with Power BI**<br>To integrate Python analytics results into Power BI. | 04 |
| 14 | **Forecasting using R or Python**<br>To perform predictive analysis using forecasting models. | 04 |
| 15 | **Mini Project: Data Analytics Case Study**<br>To apply data analytics concepts to a real-world case. | 04 |
| 16 | **Capstone Dashboard Development**<br>To develop a comprehensive analytical dashboard integrating all tools. | 04 |
| 17 | **Presentation and Evaluation of Analytical Findings**<br>To present and communicate analytical insights effectively. | 04 |

**Learning Resources:**

1. **Text Books:**

- Wes McKinney – Python for Data Analysis, O'Reilly.
- Alberto Ferrari & Marco Russo – Introducing Microsoft Power BI.
- Hadley Wickham – R for Data Science, O'Reilly.
- Provost & Fawcett – Data Science for Business.

2. **Reference Books:**

- Wes McKinney – Python for Data Analysis, O'Reilly.
- Alberto Ferrari & Marco Russo – Introducing Microsoft Power BI.

### 3. Online References:

- **Anaconda Distribution –** Open-source platform for Python, R, and data science tools. (https://www.anaconda.com/)
- **Jupyter Notebook / JupyterLab –** Interactive environment for writing and executing Python code. (https://jupyter.org/)
- **Microsoft Power BI Desktop (Free Version)** – Used for creating dashboards and reports. (https://www.microsoft.com/en-us/power-platform/products/power-bi/)

**Teaching Learning Method**

- Lecture-based teaching-learning
- Group-teaching and learning
- Individual learning/self-study
- Inquiry-based learning
- Kinesthetic learning / Practicals
- Game-based learning
- Expeditionary learning (Real-world problems)
- Technology-based Learning
- Peer Teaching
- Learning through problem-solving

## Course Outcomes Mapping:

| CO No. | Course Outcome (CO) | POs/ PSOs Mapped | Cognitive Level (RBT) | Knowledge Category | Class Sessions (Lecture) |
|---|---|---|---|---|---|
| CO1 | **To explain** the fundamental concepts, processes, and importance of data analytics in real-world applications. | PO1, PO2, PO5, PO9, PO11, PSO1, PSO2 | Understand | Conceptual | 4 |
| CO2 | **To apply** data analytical tools such as Python, R, Power BI, and Tableau for data processing and visualization tasks. | PO1, PO2, PO3, PO4, PO5, PO9, PO11, PSO1, PSO2 | Apply | Procedural | 8 |
| CO3 | **To perform** data cleaning, transformation, and exploratory data analysis on structured and unstructured datasets. | PO1, PO2, PO3, PO4, PO5, | Apply, Create | Procedural | 12 |

| | | | | | |
|---|---|---|---|---|---|
| | | PO7, PO9, PO11, PSO1, PSO2 | | | |
| CO4 | **To analyse** datasets using statistical and analytical techniques to extract meaningful patterns and insights. | PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO11, PSO1, PSO2 | Apply , Analyse | Procedural | 8 |
| CO5 | **To design and develop** interactive dashboards and visual reports for effective data-driven decision-making. | PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO11, PSO1, PSO2 | Apply, Create | Procedural | 8 |

## Mapping of COs with POs & PSOs:

| CO | PO | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** |
| **CO1** | 3 | 2 | – | – | 2 | – | – | – | 1 | – | 1 | 3 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 3 | – | – | – | 1 | – | 1 | 3 | 2 |
| **CO3** | 2 | 2 | 3 | 2 | 3 | – | 1 | – | 1 | – | 1 | 3 | 3 |
| **CO4** | 2 | 3 | 3 | 2 | 3 | – | 1 | 2 | 1 | – | 1 | 3 | 3 |
| **CO5** | 2 | 2 | 3 | 3 | 3 | – | 1 | 2 | 2 | 1 | 2 | 3 | 3 |

**3: High, 2: Medium, 1: Low**

### Sustainable Development Goals (SDG) Integration

The course is aligned with **SDG 9 (Industry, Innovation and Infrastructure)** by equipping students with modern data analytics and visualization skills required for building intelligent, data-driven systems. It also supports **SDG 13 (Climate Action)** by enabling analysis and interpretation of environmental and climate-related data for informed decision-making. Overall, the course promotes the use of data for sustainable development and responsible innovation.

**SDG Mapping with Course Outcomes**

| CO | Course Outcome | Relevant SDGs | Justification |
|---|---|---|---|
| CO1 | Understand fundamentals of data analytics and preprocessing using Python | SDG 9 | Builds foundational skills required for modern data-driven infrastructure and digital innovation. |
| CO2 | Perform data visualization and reporting using Power BI | SDG 9 | Enables development of industry-relevant dashboards and reporting systems for decision-making. |
| CO3 | Apply statistical and analytical techniques using R | SDG 9, SDG 13 | Supports analytical modeling useful in industrial optimization and environmental data analysis such as climate trends. |
| CO4 | Integrate tools for advanced analytics and interpret data insights | SDG 9, SDG 13 | Encourages development of integrated systems for smart infrastructure and data-driven climate monitoring solutions. |
| CO5 | Develop dashboards and present analytical findings | SDG 9, SDG 13 | Helps in communicating insights for sustainable industrial growth and environmental awareness through data storytelling. |