

**III B.Tech I Semester**

23A30503a	<b>DATA VISUALIZATION (Professional Elective-I)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To understand the principles, techniques, and tools of data visualization.
- To develop the ability to transform data into visual insights using different types of charts and plots.
- To introduce the cognitive and perceptual foundations of effective data visualization.
- To apply tools and programming environments (like Python, Tableau, or Power BI) for creating interactive and dynamic visualizations.
- To analyze real-world datasets and effectively communicate data-driven findings visually.

**Course Outcomes:**

After completion of the course, students will be able to:

- CO1: Interpret different types of data and recognize the appropriate visualization methods.
- CO2: Design effective and interactive data visualizations using various tools.
- CO3: Apply visual encoding and perceptual principles in presenting complex data.
- CO4: Analyze and visualize real-world data sets using Python libraries and dashboards.
- CO5: Create visual stories and dashboards for effective communication of insights.

**UNIT I: Introduction to Data Visualization & Perception**

Introduction to Data Visualization, Importance and Scope of Data Visualization, Data Types and Sources, Visual Perception: Pre-attentive Processing, Gestalt Principles, Data-Ink Ratio, Data Density, Lie Factor, Visualization Process and Design Principles, Tools Overview: Tableau, Power BI, Python Libraries

**UNIT II: Visualization Techniques for Categorical & Quantitative Data**

Charts for Categorical Data: Bar Charts, Pie Charts, Column Charts, Charts for Quantitative Data: Histograms, Line Charts, Boxplots, Scatter Plots, Bubble Charts, Heatmaps, Choosing the Right Chart Type, Best Practices in Labeling, Coloring, and Scaling.

**UNIT III: Multidimensional, Temporal and Hierarchical Data Visualization**

Visualizing Multivariate Data: Parallel Coordinates, Radar Charts, Time-Series Visualization: Time Plots, Animation over Time, Geographic Data Visualization: Maps, Choropleths, Hierarchical Data: Treemaps, Sunburst Charts, Network and Graph Visualization.

**UNIT IV: Data Visualization Using Python and Dashboards**

Introduction to Matplotlib, Seaborn, and Plotly, Creating Static and Interactive Charts, Pandas Visualization Capabilities, Dashboards with Dash, Streamlit, Power BI, Case Studies: Real-world Dataset Visualization.

### **UNIT V: Storytelling with Data and Ethical Visualization**

Storytelling and Narrative Techniques in Visualization, Dashboards and Reporting, Misleading Visualizations and Bias, Ethical Principles in Data Visualization, Final Project: Create a Storytelling Dashboard with Real Data.

#### **Textbooks:**

1. Tamara Munzner, **Visualization Analysis and Design**, CRC Press, 2014.
2. Nathan Yau, **Data Points: Visualization That Means Something**, Wiley, 2013.

#### **Reference Books:**

1. Alberto Cairo, **The Truthful Art: Data, Charts, and Maps for Communication**, New Riders, 2016.
2. Cole Nussbaumer Knaflic, **Storytelling with Data: A Data Visualization Guide for Business Professionals**, Wiley, 2015.
3. Claus O. Wilke, **Fundamentals of Data Visualization**, O'Reilly, 2019.
4. Rohan Chopra, **Hands-On Data Visualization with Bokeh**, Packt Publishing, 2019.

#### **Online Learning Resources:**

1. NPTEL: Data Visualization - IIT Madras
2. *Coursera: Data Visualization with Python by IBM*