BCSE 0713: DATA VISUALIZATION

Objective: *This course enables the students to understand the principles of effective data visualization, explore various types of charts and graphs and learn best practices in data design and storytelling.*

Prerequisites: Basics of Python and AI.

CREDITS:03 **L-T-P-J:3-0-0-0**

Module No.	Contents	Teaching Hours
I	**Introduction to Data Visualization**, Importance, applications, and tools, Visual Perception and Cognitive Load, Principles of Good Visualization, Clarity, accuracy, and aesthetics: Choosing the right chart for the data, Chart Types and Use Cases, Bar, Line, Pie, Scatter, Histogram, Boxplot, Heatmap, Bubble, Area charts etc. **Advanced Visualization Techniques:** Interactive Plots with Plotly and Bokeh, Advanced Seaborn Techniques, Pairplots, Catplots, FacetGrid, and Heatmaps, Dashboards with Plotly Dash / Streamlit, Visualizing Multidimensional and Time Series Data, Geo-visualization with Folium and Plotly. Business Analytics, Health Informatics, AI/ML Model Interpretability (SHAP, Partial Dependence), Ethical and Cultural Aspects of Visualization. **Assignments & Activities:** Create visualizations for a given dataset using Matplotlib and Seaborn, Analyze misleading visualizations and redesign them; mini-project: Storytelling with a dataset (e.g., COVID-19, Olympics, GDP)	**20**
II	**Introduction to Business Intelligence (BI).** Overview of Power BI and Tableau, Installation and Interface Tour, Connecting to Data Sources, Importing data (Excel, CSV, SQL Server, Web), Data types and formats, Live vs Extract connections (Tableau), Direct Query vs Import (Power BI), Power Query Editor (Power BI), Data Interpreter & Data Prep (Tableau), Cleaning, filtering, pivoting/unpivoting, Merging and appending data sources, Understanding tables and relationships, Creating calculated columns, measures, Introduction to DAX (Power BI), Introduction to Tableau Calculated Fields,Creating core charts: Bar, Line, Pie, Scatter, Maps, Filters, slicers, and drill-down (Power BI), Quick filters, parameters, sets, groups (Tableau) Tooltips, color, size, labels, and hierarchies, **Dashboards and Storytelling** using PowerBI and Tableau, Designing dashboards and layouts, Using tiles, containers, and formatting, Actions and Interactivity (filters, URL, highlights), Dashboard best practices and storytelling with data. Publishing reports to Power BI Service, Tableau Public and Tableau Server, Exporting dashboards as PDF/images, Scheduled refresh and data update. **Activities:**Build an interactive dashboard for a public dataset; Capstone Project: Data story + dashboard on a chosen theme, Peer review and presentation sessions. Dashboard themes: Business Analytics Dashboard, Sales/Marketing Dashboard, Healthcare/COVID Dashboard, Education or HR Analytics Dashboard.	**20**

Text Book:

- Data Visualization: A Practical Introduction" by Kieran Healy
- Python Data Visualization: An Introduction to Data Visualization in Python with Matplotlib, Seaborn, and Plotly" by Adel Osmani
- The Visual Display of Quantitative Information" by Edward Tufte

Reference Books:

- "Storytelling with Data: A Data Visualization Guide for Business Professionals" By Cole Nussbaumer Knaflic
- "Data Visualization: A Practical Introduction" By Kieran Healy
- "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures" By Claus O. Wilke
- "Interactive Data Visualization for the Web" By Scott Murray
- "Python Data Science Handbook" By Jake VanderPlas
- "Designing Data Visualizations: Representing Informational Relationships" By Noah Iliinsky and Julie Steele
- "Data Visualization with Python and JavaScript"By Kyran Dale
- "Practical Statistics for Data Scientists" By Peter Bruce, Andrew Bruce, and Peter Gedeck
- "Information Dashboard Design: The Effective Visual Communication of Data" By Stephen Few

Course Outcomes (CO): Upon completion of this course students will be able to:

- **CO1**: Understand the Fundamentals of Data Visualization
- **CO2**: Apply Visualization Best Practices to Gain Proficiency with Visualization Tools
- **CO3:** Design and Develop Data Stories and Dashboards
- **CO4:** Analyze Real-World Use Cases and Ethical Considerations.
- **CO5:** Collaborate and Present Visual Data Projects

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1/PSO3
CO2	PO2,PO3/PSO1
CO3	PO4/PSO1,PSO3
CO4	PO2,PO3/PSO4
CO5	PO2,PO4/PSO4
CO6	PO1/PSO2,PSO4