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### GENERIC ELECTIVES (GE-2B): Data Visualization Techniques

#### Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Data Visualization Techniques	4	3	0	1	Class XII Passed with Maths	Basic Knowledge of Python Programming Language	Electronic Science

#### Learning Objectives

This course is all about data visualization, the art and science of turning data into readable graphics. It enables the students to design and create data visualizations based on data available and tasks to be achieved. This process includes data modeling, data processing (such as aggregation and filtering), mapping data attributes to graphical attributes, and strategic visual encoding based on known properties of visual perception as well as the task(s) at hand. Students will also learn to evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding. Students will create their own data visualizations, and learn to use Open-Source data visualization tools.

#### Learning outcomes

**After completion of the course, students will be able to-**

- Design and create data visualizations.
- Conduct exploratory data analysis using visualization.
- Craft visual presentations of data for effective communication.
- Use knowledge of perception and cognition to evaluate visualization design alternatives.
- Design and evaluate color palettes for visualization based on principles of perception.
- Apply data transformations such as aggregation and filtering for visualization.
- Identify opportunities for application of data visualization in various domains.

Tools Required: Open-source Visualization tools, Python, Plotly, Tableau

#### SYLLABUS

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### **UNIT – I Understanding Data Visualization (09 Hours)**

**Introduction to Data Visualization**, Various tools for Data Visualization. Introduction to Numpy, Pandas and Matplotlib. Structured & Semi-structured Dataset, Data Cleaning and Preparation. Handling Missing Data, Data Transformation. Basic Plotting with Matplotlib, Dataset on Immigration e.g. Canada (source: <https://open.canada.ca/>) any other. Univariate and Multivariate Visualization. Introduction to cloud computing.

### **UNIT – II Data Visualization Techniques (12 Hours)**

**Data Visualizations Techniques:** Line Plots, Area Plots, Histograms, Bar Charts, Pie Charts, Box Plots, Scatter Plots, Bubble Plots, Waffle Charts, Word Clouds, Seaborn and Regression Plots, Creating Maps and Visualizing Geospatial Data - Introduction to Folium, Maps with Markers, Choropleth Maps.

### **UNIT – III Creating Dashboards with Plotly (12 Hours)**

Introduction to Seaborn, Basic plotting with Seaborn. Introduction to Plotly. Scatter chart, Bubble Plot, Pie chart, Gantt chart, Contour plotting, Sunburst and Polar charts, Heatmaps.

### **UNIT – IV Data Visualization using Tableau (12 Hours)**

Introduction to Tableau Desktop, connecting to dataset, Data preparation, Filtering and sorting data, Creating basic chart types (bar charts, line charts etc.), Assembling a dashboard layout, Using dashboard filters, Transform the data, Simple calculations in Tableau, Creating advanced chart types. Introduction to Data Story.

### **Practical component (if any) - Data Visualization Techniques Lab – 30 Hours**

(Perform practical on Dataset available at Kaggle / Github / UCI Machine Learning Repository)

1. Visualization of Spreadsheet Models.
2. Visualization of Semi-Structured Data.
3. Interactive Plots in Python and Tableau.
4. Hierarchical and Topographical Data Visualizations in Tableau.
5. Calendar Heatmaps and Flow Data Visualizations in Python.
6. Time Series Data Visualization in Plotly.
7. Creating cloud account Amazon/Azure/Google/IBM to store images /files / programs.
8. Use a dataset that contains immigration details e.g. Canada for a given duration of 30 years (Canada Immigration Dataset, source: <https://open.canada.ca/>) or any other
  - a. Create an area plot for top 6 immigrant countries in a given duration.
  - b. Create and year-wise immigrant bar chart from India to Canada in a given duration.
  - c. Create a boxplot of immigrants for three given countries.

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d. Show the total no. of immigrants using Area Chart and Pie chart for two given countries.

e. Create a scatter Histogram for the immigrants in the given year for two specific countries.

**Note:** Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than seven.

**Essential/recommended readings**

1. Data Visualization with Python for Beginners: Visualize Your Data using Pandas, Matplotlib and Seaborn by AI Publishing. ISBN: 1733042680-978
2. Learn and Practice Data Visualization using Python by Swapnil Saurav, Eka Publishers. ISBN: 8194633426-978
3. Python Data Science Handbook by Jake VanderPlas, Shroff/O'Reilly. ISBN: -978 9352134915
4. Data Visualization with Tableau by Praveen Kumar, Gurucool Publishing. ISBN: 8194746997-978
5. Interactive Dashboards and Data Apps with Plotly and Dash by Elias Dabbas, Packt Publishing Limited. ISBN: 1800568914-978

**Suggestive readings -**

1. Python Data Science Handbook by Jake VanderPlas, Shroff/O'Reilly. ISBN: 9352134915-978
2. Data Science from Scratch: First Principles with Python by Joel Grus, Shroff/O'Reilly. ISBN: 9352138326-978

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.