GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3160717
DATA VISUALIZATION
6th SEMESTER

Type of course: Under graduate (Open Elective)

Prerequisite: Working knowledge of Programming Language, DBMS, JavaScript and HTML5

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**Introduction to Data Visualization:** Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization (Control of Presentation, Faster and Better JavaScript processing, Rise of HTML5, Lowering the implementation Bar) Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics). Making use of HTML5 CANVAS, Integrating SVG	3	10
2	**Basics of Data Visualization – Tables:** Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, Increasing readability, Adding dynamic Highlighting), Including computations, Using data tables library, relating data table to a chart	5	15
3	**Visualizing data Programmatically:** Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).	5	25
4	**Introduction to D3.js:** Getting setup with D3, Making selections, changing selection's attribute, Loading and filtering External data : Building a graphic that uses all of the population distribution data, Data formats you can use with D3, Creating a server to upload your data, D3's function for loading data, Dealing with Asynchronous requests, Loading and formatting Large Data Sets	5	15
5	**Advanced Data Visualization:** Making charts interactive and Animated: Data joins, updates and exits, interactive buttons, Updating charts, Adding transactions, using keys Adding a Play Button:	4	15

	wrapping the update phase in a function, Adding a Play button to the page, Making the Play button go, Allow the user to interrupt the play, sequence		
6	**Information Dashboard Design:** Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, Achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, Putting it all together - Unveiling the dashboard.	6	20

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**20**	**20**	**5**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery, "JavaScript and jQuery for Data Analysis and Visualization", WROX
2. Ritchie S. King, Visual story telling with D3" Pearson
3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
4. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly
5. Andy Kirk, Data Visualization: A Successful Design Process, PAKT
6. Scott Murray, Interactive Data Visualization for Web, O'Relly
7. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
8. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

Course Outcome: After learning the course the students will be able to:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Explore various data visualization techniques in order to provide new insight.	20
CO-2	Apply appropriate data visualization techniques to provide trends/insights for the given dataset.	35
CO-3	Apply visualization tools / techniques for various data analysis tasks.	30
CO-4	Given the application context for given data set, Design the information Dashboard for access information based on user criteria.	15

List of Experiments:

1. Setup Environment for All the Tools
2. Develop the following Program Using HTML5 CANVAS and SVG TAG
    a. Develop the Different basic Graphical Shapes using HTM5 CANVAS
    b. Develop the Different Advanced Graphical Shapes using HTM5 CANVAS
    c. Develop the Different basic Graphical Shapes using HTM5 SVG
    d. Develop the Different Advanced Graphical Shapes using HTM5 SVG
3. Develop Following Program Using HTML5 and JavaScript
    a. Develop the simple bar chart usingTML5 CANVAS
    b. Read the data .txt file and draw Data Table
    c. Read the data .txt file and draw Simple Bar Chart
    d. Read the data .csv file and draw Data Table
    e. Read the data .csv file and draw Column Bar Chart
    f. Read the data XML file and draw Data Table
    g. Read the data XML file and draw Simple Chart
    h. Read JSON Data and draw Data Table
    i. Read JSON Data and draw Simple Chart
4. Develop Following Program Using HTML5 and D3.js and Canvas.js
    a. Showing the data as a column chart (simple)
    b. Showing the data as a stacked column chart
    c. Showing the Data as a column chart for four age group
    d. Showing the data as a Line chart (single, fewer and multiple lines)
    e. Showing the data as a Pie Chart (single and multiple pie)
    f. Showing the data as a Bar Chart (Simple and multiple)
5. Develop Following Program Using HTML5 and Google Chats API and Map API
    a. Using Google Charts API Basics draw charts like a Bar chart
    b. Using Google Charts API Basics draw charts like a Line chart
    c. Using Google Charts API Basics draw PieChart.
    d. Using Google Charts API Basics draw Donut Chart.
    e. Using Google Charts API Basics draw Candle Chart.
    f. Using Google Charts API Basics draw other types of Chart.
    g. Using Google API read JSON file and create Google Map.
6. Build interconnected Dashboard using

List of Open Source Software/learning website:

- HTML5 (Canvas and SVG tags)
- D3.js (https://d3js.org/), Canvas.js
- Google API