INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DIGITAL VISUALIZATION

VI Semester: CSE/CSE(CS)/ CSE(DS)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACCD15	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: There are no prerequisites to take this course								

I. COURSE OVERVIEW:
This course introduces the concepts and techniques of digital visualization, emphasizing graphical data representation, interactive visualization tools, and applications in diverse domains. This topic bridges theoretical understanding with practical applications, enabling students to transform complex data into actionable insights.

II. COURSE OBJECTIVES:
The students will try to learn:

I	The objective is to understand the principles of digital visualization and its significance in data representation
II	The objective is to learn various visualization techniques and tools for effective data communication.
III	The objective is to explore the design and development of interactive visualization systems.
IV	The objective is to analyze the application of visualization in real-world scenarios like business, healthcare, and education.

III. COURSE OUTCOMES:
At the end of the course, students should be able to:

CO1 **Understand** the fundamentals of digital visualization and its role in data analysis.

CO2 **Demonstrate** proficiency in various data visualization techniques and tools.

CO3 **Design** and implement interactive visualization solutions for different datasets.

CO4 **Analyze** case studies to understand real-world applications of visualization techniques.

CO5 **Evaluate** and improve visualization techniques for clarity and effectiveness.

CO6 **Apply** advanced visualization methods to solve domain-specific challenges

MODULE – I: FUNDAMENTALS OF DIGITAL VISUALIZATION (09)
Introduction: Digital Visualization Definitions and Importance, History and Evolution of Visualization, Visual Perception: Basics and Cognitive Principles, Components of Visualization: Data, Tasks, Users, Visualization Taxonomy: Scientific Information, Data Visualization, Principles of Effective, Visualization Design,

MODULE – II: DATA VISUALIZATION TECHNIQUES AND TOOLS (10)
Types of Data: Categorical, Numerical, Temporal, Geospatial, Visualization Techniques: Charts, Graphs, Heatmaps, and Treemaps, Tools and Libraries: Tableau, Power BI, D3.js, and Matplotlib, Data Cleaning and Preprocessing for Visualization, Encoding Data: Colors, Shapes, and Sizes, Interactive Visualizations: Pan, Zoom, Filters, and Drill-Down

MODULE – III: SECURITY SOFTWARE DESIGN AND VISUALIZATION (09)
Introduction to Human-Computer Interaction (HCI) for Visualization, Designing Dashboards and Storyboards, Interaction Models: Selection, Exploration, and Annotation,

Web-Based Visualization using JavaScript Frameworks, Integrating Real-Time Data in Visualizations, Usability Testing and User Experience in Visualization Systems,

MODULE - IV: APPLICATIONS OF DIGITAL VISUALIZATION (10)
Visualization in Business Analytics: KPI Dashboards, Financial Reports, Healthcare Visualizations: Patient Records, Disease Tracking, Educational Visualizations: Adaptive Learning Systems, Scientific Visualization: Simulations, Models, and Projections, Emerging Domains: Virtual Reality (VR) and Augmented Reality (AR) in Visualization, Challenges in Real-World Visualization Projects

MODULE – V: ADVANCED TOPICS IN DIGITAL VISUALIZATION (10)
Big Data Visualization: Challenges and Techniques, Visual Analytics: Combining Automated Analysis with Visualization, Artificial Intelligence in Visualization: AI-Driven Insights and Automation, Privacy and Ethics in Visualization, Future Trends: 3D Visualization, Immersive Technologies, and Beyond, Capstone Project: Designing a Visualization for a Real-World Problem

V. TEXTBOOKS:
1. Tamara Munzner, "Visualization Analysis and Design", CRC Press, 1st Edition, 2014.
2. Colin Ware, "Information Visualization: Perception for Design", Morgan Kaufmann, 4th Edition, 2021.

VI. REFERENCE BOOKS:
1. Edward R. Tufte, "The Visual Display of Quantitative Information", Graphics Press, 2nd Edition, 2001.
2. Scott Murray, "Interactive Data Visualization for the Web", O'Reilly Media, 2nd Edition, 2017.

VII. ELECTRONIC RESOURCES:
1. https://www.datavisualizationsociety.org
2. https://d3js.org/
3. https://public.tableau.com/
4. http://www.thefunctionalart.com/

VIII. MATERIALS ONLINE
1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open-ended experiments

5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)