School of Technology

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Course Syllabus		

Data Analytics and Visualization

Semester V
B.Tech 2024-2028
School of Technology
4 Credits

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Course Syllabus

Course Code:	Course Title:	Credits:
22CSE519	**Data Analytics and Visualization**	L: 3, T: 0, P: 2, O: 0, Total Credits: 4
Pre-requisite: **22CSE517 Machine Learning**	**Co requisite:** NIL	**Provisions:** NIL

1. Objectives:

This course aims to develop the ability to extract meaningful insights from structured and unstructured data using data mining and visualization techniques. Students will learn to apply analytical methods, perform exploratory data analysis, and create interactive dashboards for decision-making.

2. Course Learning Outcomes (CLO):

CLO	Outcome
CLO 1:	Understand and apply data mining techniques such as classification, clustering, and association analysis.
CLO 2:	Evaluate exploratory data analysis and statistical tools to identify trends, anomalies to make informed judgments
CLO 3:	Team communication with effective, interactive visualization and dashboard design using advanced libraries and tools.

3. Weight of Various Assessment Elements and Alignment of Course Learning Outcomes to Program Learning Outcomes

Assessment	Weights (%)	CLO1	CLO2	CLO3	
		POA1	POA2	POA4	POA5
Written Test (Phase 1)	10	3			
Written Test (Phase 1)	10		2		
[1] Case Study (Phase 2)	10		2	3	2
[1] Project weekly (Phase 3) Sprint (x3)	30	3	2	3	2
[2] External Project Evaluation	40	3	2	3	2

Note: The learning outcomes of this course contribute in meeting one or more of the programs learning outcomes as shown below, with the contribution designated as'H = 3' for "high", 'M = 2' for "Medium" and 'L=1' for "Low"

4. Assessments:

	CLO Alignment	Week number	Weightage	AI Level (0-5)	Description
Written Test (Phase 1)	1	4	10	0	Testing fundamental knowledge
Written Test (Phase 1)	2	7	10	0	Testing fundamental knowledge
[1] Case Study (Phase 2)	2, 3	23	10	2	Presentation
[1] Project weekly (Phase 3) Sprint (x3)	1, 2, 3	14	30	3	Code review and implementation updates
[2] External Project Evaluation	1, 2, 3	17	40	3	Evaluation on projects done by whole class with industrial mentors

Rubrics for project assessments

[1] **Internal Project Evaluation**	**Problem Understanding (10)**	**Code Execution (10)**	**Presentation & Report (5)**	**Leadership/ contribution (5)**	**Modern Technology (10)**
CLO	CLO1	CLO2	CLO3	CLO3	CLO2, CLO3

Note: [1] Internal projects evaluation includes case study and can be complete case studies or real-time industry projects tracked by milestone or weekly progress

[2] **External Project Evaluation**	**Problem Understanding (10)**	**Code Execution / Innovation (10)**	**Presentation Report and Judgment (5)**	**Leadership/ contribution (5)**	**Research output / Product (10)**
CLO	CLO 1	CLO 2	CLO 3	CLO 3	CLO 3

Note: [2] External projects can be case studies or real-time industry projects with team driven experiential product or output. External project (40%) - In class activity for each group of 3 to 4 students or more will be assigned a problem. The group is to submit a output about the solution of the assigned problem and present their results in a professional manner.

5. Educational resources and Technology

Textbooks (T) Per availability in the library	T1	**T1** – *Fundamentals of Machine Learning for Predictive Data Analytics*, 2nd Edition, MIT Press, 2020 — John D. Kelleher, Brian Mac Namee, Aoife D'Arcy
	T2	**T2** – *Data Preparation for Machine Learning*, 1st Edition, 2020 — Jason Brownlee
	T3	**T3** - Pattern Recognition and Machine Learning by Christopher Bishop, Springer-Verlag, 2006.

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Reference Books (R)	R1	**R1** - Introduction to Data Mining, 2nd Edition, 2019 — Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar **R2** – Distributed Machine Learning with Python, 2022 — Guanhua Wang
Journal Articles (J) provide link only	J1	**NA**
Case Material/ Whitepaper provide link only (C)	C1	**NA**
Technology integration (TI)	TI	**Python programming.**
Facilitation (F)	F	**2PhD scholars** **2 Peer learners**

6. Course Content

Weeks	Concept	CLO	Method	Assessment
Week 1-3 (9 lectures and 1 Practical task)	• Data mining basics and challenges • Data analytics lifecycle • Data storage and warehousing • OLTP vs OLAP • Multi-dimensional models and 3-tier architecture	1	LD	Written Exam
Week 4-6 (12 lectures and 2 Practical task)	• Concept and class description • Classification and clustering • Association rule mining • Attribute selection measures • Temporal pattern mining • Types of EDA: univariate, bivariate, multivariate • Data quality issues and outliers • Normalization, sampling, feature selection • Correlation and trend identification	2,3	LD	Written Exam
Week 7-9 (9 lectures)	• Importance of visualization • Scalar, point, and multidimensional techniques • Time series and geospatial data visualization	1, 2, 3	RiC - Case studies / mini projects that cover all the CLOs***	Written exam/presentation
Week 10-15	Basic plotting with Matplotlib and Seaborn Dashboards with Plotly Dash and Power BI	2,3	I/RA***	Weekly sprint

Note: ******Projects undertaken during Weeks 7 to 15 will be carefully selected and designed to comprehensively reflect the entire course syllabus.***

7. *Teaching Methodology*

LP: Lecture mode using power point slides: It is an oral presentation intended to present information or teach people about a particular subject.
LD: Lecture discussion: It uses teacher questioning to involve students actively in the learning process.
PS: Problem solving: This method helps students to gain the ability of scientific problem solving and using it in every area of life.
RiC: Research in class or Case study teaching method: A case is an account of an actual problem or situation which has been experienced by an individual or a group. It includes facts available to those facing the problem, along with a description of perceptions and attitudes of those who are confronted with the problem.
I/RA: Industry/ Research Assistance: Industry assistance – Guest/ Pictures/ Video, Real video, Field-trip (tour), White board expert review, PoC using Computer simulation, Scenario/ experiments, Real research thread for ongoing project.

8. Practical work

Assessment:

- [1] Internal project demonstration of using modern technology.
- [2] External project demonstration and presentation

9. Course policy and attendance

Course policy:
Please refer to the student handbook for student behavior and plagiarism.

Attendance:
Please refer to the student attendance and engagement policy