



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil (Water Resource Engineering)

Course / Subject Code: ME01033041

Course / Subject Name: Data Analytics

w. e. f. Academic Year:	2024-2025
Semester:	1 st Semester
Category of the Course:	PEC

Prerequisite:	Knowledge of linear algebra, calculus, probability theory, statistics and programming
Rationale:	Data analytics involves transforming information into valuable insights by extracting meaning from data through analysis and interpretation. In the modern context, data is prolific, and the significance of data analytics is burgeoning across diverse domains. This course aids in gaining deeper insights into the world of data and often facilitates improved decision-making in various scenarios. Data science helps in managing, analyzing and understanding trends in data leading to design the strategy for better profitability and results.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe the various areas where data analytics is applied.	
02	Identify the data types, relation between data and visualization technique for data.	
03	Explain probability, distribution, sampling, Estimation	
04	Formulate regression models.	
05	Solve regression and classification problems.	

*Revised Bloom's Taxonomy (RBT)



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to Data Analytics: The Science of Data-Driven Decision Making, Descriptive, Predictive, Prescriptive and Diagnostic Analytics, Analytics Techniques, Big Data Analytics, Machine Learning Algorithms, Framework for Data-Driven Decision Making Descriptive Analytics: Data Types and Scales, Population and Sample, Percentile, Decile and Quartile, Measures of Variation, Measures of Shape – Skewness and Kurtosis	10	25%
2.	<i>Probability:</i> Introduction, Probability Theory, Axioms of Probability Application of Simple Probability Rules, Association Rule, Learning Bayes' Theorem, Variables, Binomial Distribution, Poisson Distribution, Geometric Distribution, Parameters of Continuous Distributions, Uniform Distribution, Exponential Distribution, Chi-Square Distribution, Student's t-Distribution, F-Distribution	08	15%
3.	<i>Sampling and Estimation:</i> Population Parameters and Sample Statistic, Probabilistic Sampling, Non-Probability Sampling, Sampling Distribution, Central Limit Theorem (CLT), Sample Size Estimation for Mean of the Population, Estimation of Population Parameters, Method of Moments, Maximum Likelihood Estimation	08	15%



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4.	<i>Simple Linear Regression:</i> Introduction, Simple Linear Regression Model Building, Estimation of Parameters Using Ordinary Least Squares, Interpretation of Simple Linear Regression Coefficients, Validation of the Model, Outlier Analysis, Confidence Interval for Regression Coefficients, Confidence Interval for the Expected Value of Y for a Given X, Prediction Interval for the Value of Y for a Given X	09	20%
5.	<i>Logistic Regression:</i> Classification Problems, Binary Logistic Regression, Estimation and Interpretation of Logistic Regression Parameters, Logistic Regression Model Diagnostics, Classification Table, Sensitivity, and Specificity, Optimal Cut-Off Probability, Variable Selection, Application in Credit Rating, Gain Chart and Lift Chart <i>Decision Trees:</i> Chi-Square Automatic Interaction Detection (CHAID), Classification and Regression Tree, Cost-Based Splitting Criteria, Ensemble Method, Random Forest	10	25%
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	30	20	20	–

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Business Analytics by Dinesh Kumar, Wiley India
2. Data Science & Analytics by V.K. Jain, Khanna Book Publishing, New Delhi
3. Data Science For Dummies by Lillian Pierson, Jake Porway
4. Doing Data Science by Rachel Schutt, Cathy O'Neil, O'Reilly publication
5. Data Science with Jupyter by Prateek Gupta, BPB publication

(b) Open source software and website:

1. www.analyticsvidhya.com
2. www.kaggle.com



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List of Laboratory/Learning Resources Required:

1. Introduction to Data Analytics
2. Descriptive analysis and the data type.
3. Probability
4. Sampling and Estimation
5. Simple Linear Regression
6. Logistic Regression
7. Decision Trees
8. Case study based problem solving

Major Equipment/Softwares:

Computing Hardware

Data Processing Tools

Analytics Software like Excel, Python, R, Tableau, MySQL, SAS

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program .
PO4	An ability to apply advanced knowledge and skills appropriate to civil engineering.
PO5	An ability to think critically and apply appropriate logic, analysis, judgment and decision making and to function as an effective member or leader of engineering teams to achieve common goals.



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PO6	An ability to use appropriate techniques, skills, and modern engineering tools necessary for engineering practice and commit to professional ethics and responsibilities.
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