



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Construction Engineering and Management

Subject Code: ME02014081

Subject Name: AI/ML Based Applications In Civil Engineering

w.e.f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Nil
Rationale:	Nil

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Comprehend the basic principles of artificial intelligence (AI) and machine learning (ML) algorithms.
02	Understanding Data collection and management tools and techniques for AI/ML application to Civil Engineering.
03	Derive the need and benefits of using AI/ML algorithms for developing applications in Civil Engineering using big-data analysis.
04	Solve the real-life problems in Civil Engineering using real-time data collection and big-data analysis involving AI/ML tools.
05	Evaluate the performance of different AI/ML algorithms towards a given application in civil engineering.

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



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	INTRODUCTION TO MACHINE LEARNING Machine Learning Basics: Data Collection, Data Management, Big data, taxonomy of machine learning algorithms, Supervised Learning: Classification – Bayesian Classifier, K-nearest Neighbours, Regression-Linear Regression, Multivariate Regression, Logistic regression. Support Vector Machine (SVM) Algorithm. Unsupervised Learning: Clustering-K-means clustering algorithm and Hierarchical clustering algorithm. Reinforcement Learning: Q-Learning algorithm.	08	18
2	DATA COLLECTION APPARATUSES Type of data sources, Types of data, Types of sensors, Edge-devices, Introduction to microcontrollers, data communication protocols, Cloud storage and cloud computing, Local server setup, Cloud server setup, Introduction to Python, Introduction to Django server, Database setup.	08	18
3	APPLICATIONS IN CIVIL ENGINEERING Intelligent Transportation systems, smart mobility, shared mobility, Mobility as a Service (MaaS), Real-time data monitoring, Structural health monitoring, Fire resistance evaluation of structures, automation in water resource management, Water quality monitoring, water distribution system monitoring, air and noise pollution monitoring, Rainfall-runoff modelling, Climate change monitoring, Soil liquefaction, Forecasting foundation related parameters, Building occupancy modelling, Building information modelling, Energy demand prediction, Predictive maintenance of equipment, roads and buildings.	15	32
4	APPLICATION PART I: DATA COLLECTION AND MANAGEMENT Image processing for real time applications in Civil Engineering, Description of available database across specialisations, Selection of sensors and microcontroller, Integration of sensors with Edge-device, Programming of Edge-devices, Programming of server in Django framework, Collection of sensor data and storing to Database, Cloud computing.	07	16
5	APPLICATION PART II: BIG DATA ANALYSIS Selecting the appropriate ML algorithm for analysis, Data Processing, Analysing the importance of each variable in decision making, and Analysis of processed data.	07	16
	Total	45	100



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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	30	10	10	0

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

References/Suggested Learning Resources:

1. Machine Learning using Python, by Manaranjan Pradhan, U Dinesh Kumar, Wiley.
2. A Primer on Machine Learning Applications in Civil Engineering, by Deka P C, Taylor & Francis.
3. Structural Health Monitoring: A Machine Learning Perspective, by Charles R. Farrar, Keith Worden, Wiley.
4. Building Blocks for IoT Analytics, By John Soldatos, Athens Information Technology, Greece, River Publishers.
5. Django - The Easy Way (2nd Edition), By Samuli Natri.
6. The Django Book (Release 2.0), By Adrian Holovaty, Jacob Kaplan-Moss, et al., 2013.
7. Benjamin J. R., Cornell C. A., Probability Statistics and Decision for Civil Engineers, McGraw-Hill, 1970.
8. Simon P. Washington, Matthew G. Karlaftis, Fred, Mannering L., Statistical and econometric methods for transportation data analysis, CRC Press, Second Edition, 2010.
9. Richard A. Johnson, Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, 1992.

Suggested Tutorials / Students Activities :

1. Case Studies
2. Seminar
