FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University Marwadi Chandarana Group NAAC A+

Artificial Intelligence & Machine Learning For Civil Engineering

01CI0715

Objective of the Course:

- To understand the concepts and techniques of AI and ML.
- To explore the applications of AI and ML in civil engineering.
- To case studies showcasing the integration of AI and ML in civil engineering projects.
- To develop skills in implementing AI and ML algorithms for solving preliminary civil engineering problems.

Credit Earned:04

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Identify the basics of Artificial Intelligence and Machine Learning.
2. Indicate how AI and ML can improve different activities in civil engineering.
3. Apply AI and ML algorithms to solve problems in civil engineering.
4. Develop skills to apply AI and ML algorithms for solving problems in civil engineering.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
04	00	00	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No	Topic name	Hours
1	**Introduction to AI and ML**	**10**
	1.1 Scope of the Course, Introduction to AI and ML, Brief review of History of AI and ML, Related fields	03
	1.2 Introduction to Artificial Neural Networks: Biological Neurons and Biological Neural Networks, Artificial Neural Networks, Activation Functions, Perceptron NN, Multilayer Perceptron NN, Back-propagation Neural Networks, Training Methods, Basic definition of supervised and unsupervised Learning.	04
	1.3 Introduction to Machine Learning: Introduction (Different Types of Learning) Hypothesis Space, Inductive Bias, Evaluation and Cross Validation	03
2	**Structural Analysis and Design Optimization**	**10**
	2.1 Application of AI/ML in Structural Analysis	05
	2.2 Design Optimization Techniques using Genetic Algorithms and Neural Networks, Case Studies: Predictive Maintenance and Optimal Design Solutions, Structural health monitoring with AI techniques, Case studies: predictive modeling for structural integrity assessment	05
3	**Design Optimization using Machine Learning**	**14**
	3.1 Introduction to design optimization, Genetic algorithms and optimization techniques	05
	3.2 Neural network-based optimization	04
	3.3 Application of ML in optimal design of civil engineering structures	05
4	**AI and ML in Construction Management**	**10**
	4.1 Introduction to construction management, Schedule optimization using ML algorithms, Resource allocation and risk management with AI, Predictive analytics for infrastructure maintenance	5
	4.2 Case studies: AI-driven construction project management systems	5
5	**Infrastructure Monitoring and Management**	**12**
	5.1 Introduction to infrastructure monitoring, IoT and sensor data integration with ML, Implementation of AI and ML algorithms using Python	06
	5.2 Ethical considerations in AI and ML applications, Regulatory challenges and standards in civil engineering, Future trends and emerging technologies in AI and ML for civil engineering	06
	TOTAL	**56**

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	30%	30%	15%	10%

Instructional Method and Pedagogy:

1. Prerequisite of the course and its pattern shall be discussed on the commencement of the course.
2. Lectures shall be conducted in class room using various teaching aids.
3. Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4. At the end of each unit/topic an assignment based on the course content shall be given to the students which shall carry 5% weight age for timely completion and submission of the assigned work.

Recommended Study Material

1. Machine Learning with Python for Everyone, Mark Fenner, Pearson
2. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
3. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
4. Neural Networks, Fuzzy Logic, and Genetic Algorithms : Synthesis and Applications By S. Rajshekharan, G. A. Vijayalakshmi Pai, PHI
5. KishanMehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
6. Tom Mitchell, Machine Learning, TMH
7. AthemEalpaydin, Introduction to Machine Learning, PHI
8. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication

Web Links

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm