B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE327: AI in Civil Engineering	L	T	P	Nil
	3	**0**	**2**	

Course objective: This course provides an overview of several Artificial Intelligence techniques and their applications in a variety of civil engineering problems. It aims to develop an understanding of fundamentals, including reasoning, planning, and learning, and their application in engineering decision-making. Students will explore key AI techniques such as **Artificial Neural Networks, Fuzzy Systems**, and **Genetic Algorithms,** focusing on their applications in civil engineering tasks such as classification, clustering, **optimization, predictive modelling, flood forecasting, water quality assessment, etc.** By the end of the course, students will be able to **apply and evaluate AI-based approaches in civil engineering applications**.

S. No	Course Outcomes (CO)
CO1	Learn the fundamental concepts and principles of Artificial Intelligence (AI) and its applications in civil engineering, including stochastic data and pattern recognition, predictive modelling using ARIMA models, and various AI approaches like ANN, fuzzy logic, and Genetic Algorithms.
CO2	Solve real-world civil engineering problems like rainfall-runoff modelling, flood forecasting, river water quality simulation, etc., by applying theoretical knowledge of ARIMA modelling, ANN, fuzzy logic, and Genetic Algorithms.
CO3	Analyse data from the case studies in civil engineering, including the impact of effluent disposal on river quality management, and derive meaningful insights for decision-making and optimization.
CO4	Develop problem-solving skills using appropriate methodologies and AI tools, including simulation techniques, fuzzy linear programming, and Genetic Algorithms.
CO5	Communicate technical findings effectively through reports or technical documentation, including the results of applying AI techniques to civil engineering problems.

S. No	Content	Content hours
UNIT 1	Introduction to artificial intelligence and its applications in civil engineering. Stochastic data & predictive modelling in civil engineering, introduction to ARIMA modelling (Box-Jenkins approach) for univariate data. Limitations of applications of ARIMA modelling.	9

UNIT 2	Fundamentals of ANN, learning algorithms, feedforward with backpropagation for estimating connection weights, various applications of neural networks in civil engineering, including rainfall-runoff modelling and flood forecasting. Limitations of applications of ANNs.	9	
UNIT 3	Estimating the impact of effluent disposal on River Water Quality using simulation, **understanding cause-effect relations** in some case studies of civil engineering. Alternative AI approaches and their applications.	6	
UNIT 4	Classical and fuzzy sets, fuzzification and defuzzification, development of membership functions, and various fuzzy logic applications (like ANFIS) in civil engineering. Limitations of the applications of fuzzy concepts.	9	
UNIT 5	Concepts and basic principles of genetic algorithms (GA), Coding, Fitness function, GA operations, Reproduction, Cross-over, Mutation, and Application of GA in civil engineering. Limitations of the applications of Genetic Algorithms.	9	
	TOTAL	**42**	

REFERENCES		
S. No	**Name of Books/ Authors**	**Year of Publication**
1	Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications; S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI Learning Pvt. Ltd, Delhi.	2003
2	Soft Computing in Water Resources Engineering: Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms; G. Tayfur, Izmir Institute of Technology, Turkey.	2012
3	Artificial Intelligence in Civil Engineering; Pijush Samui and D.P. Kothari	2012
4	Artificial Intelligence and Machine Learning Techniques for Civil Engineering; Pijush Samui, Nagesh R. Iyer, and Sandeep Chaudhary	2022