ACADEMIC UNDERGRADUATE STUDIES DIVISION
FIRST SEMESTER 2023-2024
Course Handout Part II

Date: 12-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No	: **CE F417**
Course Title	: **Applications of Artificial Intelligence in Civil Engineering**
Instructor-in-charge	: **JAGADEESH ANMALA**

Scope and Objective of the course

The primary objective of the course is to explain the potentiality and applicability of Artificial Intelligence and Machine Learning to various facets of Civil engineering. The recent developments in the field of neural networks (ANNs), fuzzy logic in decision making, expert systems, genetic algorithms (GAs), clustering, optimization, support vector machine (SVM) and linear programming etc. are explained with case study examples to develop the practical perspective and learning of the student.

Text Books

T1. S.N.Sivanandam, S.N.Deepa (2019), Principles of Soft Computing, 3rd edition, Wiley India Pvt. Ltd, New Delhi.

Reference Books and other sources of reference

R1: Taha, H.A (2019), Operations Research, An introduction, Tenth edition, Pearson Education.
R2: Deb, K. (2010), Multiobjective optimization using Evolutionary Algorithms, Wiley.
R3: Relevant ASCE Journal papers
R4: Patterson, D.W (2015), Introduction to Artificial Intelligence & Expert Systems, First edition, Pearson Education India.
R5: Manaranjan Pradhan, U. Dinesh Kumar (2019), Machine Learning using Python, Wiley.
R6: Aurelien Geron (2019), Hands-on Machine Learning with Scikit-learn, Keras & Tensorflow, 2nd edition, O'Reilly Media Inc.

Course Plan

Lect. No.	Learning Objective	Topics to be covered	Reference
1-3	Role of Artificial Intelligence in Civil Engineering; Brief overview of optimization techniques	Definitions of Artificial Intelligence, various perspectives, civil engineering applications; An outline of traditional and nontraditional optimization techniques	CH-1(T1) CH-1 (R4) Class notes
4-7	Linear Programming	Basics of Linear Programming, Simplex Method; Numerical examples; Applications in Civil Engineering.	CH-2(R1), R3 Class notes
8-18	Neural Networks and its application in functional mapping; flood forecasting	Introduction; Basics of Neural Networks; Learning Algorithms; Feed forward with back propagation, Radial basis functions; Self organizing feature maps; Numerical examples; Applications of Neural Networks in Civil Engineering including flood forecasting; Time-series models; case studies; Introduction to Deep learning.	CH-2,3 (T1) R3, Class notes
19-25	Fuzzy logic and its application in decision making	Introduction; Classical and Fuzzy Sets; Properties of membership functions; Fuzzification and defuzzification; Development of membership functions; Fuzzy Linear Programming; Numerical examples; Applications of Fuzzy logic in Civil Engineering; case studies;	CH- 7,8, 9,10,11,13(T1) R3, Class notes
26-31	Genetic Algorithms and its applications in problem solving and optimization	Introduction, Necessity of non-traditional optimization, Binary coding GA, real coding GA, Multiobjective GA; Applications of Genetic Algorithms in Civil Engineering; case studies;	CH-15 (T1) R2,R3, Class notes
32-34	Multi-Criterion Decision Making and Clustering	Multiobjective Optimization, Cluster Analysis, Applications in Civil Engineering.	Class notes, R2, R3
35-37	Expert Systems	Basics of expert systems, demonstrative examples; case studies;	CH-15 (R4) R3 Class Notes
38-42	Introduction to machine learning: Support Vector Machine;	Support Vector Machine and Applications in Civil Engineering; case studies; Introduction to Decision Trees.	R3, R5, R6 Class Notes

Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Venue	Nature of

					Component
Mid-term Test	90 Min	25	14/10 - 4.00 - 5.30PM		Open Book
Term Paper Project		20	TBA		Open Book
Assignments		20	TBA		Open Book
Comprehensive	3 Hrs.	35	21/12 AN		Open Book

Chamber Consultation Hour: Friday (4PM - 5PM).

Notices: All notices concerning the course will be displayed on Google class room.
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Make up policy: Makeup will be given only to the genuine cases with prior permission.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
CE F417