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**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 Learningto 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**

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| --- | --- | --- | --- |
| **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:**

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| **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. .

**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**