CSPE3001 COMPUTATIONAL INTELLIGENCE (3-0-0)

Course Objectives:

- To provide a strong foundation on fundamental concepts in Computational Intelligence.
- To enable Problem-solving through various searching techniques.
- To apply these techniques in applications that involve perception, reasoning, and learning.
- To apply Computational Intelligence techniques for information retrieval.
- To apply Computational Intelligence techniques primarily for machine learning.

Module-I: (12 Hrs)

Introduction of Computational Intelligence (CI)

History, intelligence machine, man-machine interaction, data mining for IoT, Relation between AI, ML, DL, data science, and CI. Types of data analytics – predictive, prescriptive, descriptive, and diagnostic, Big data, Web scrapping.

Introduction of Artificial Intelligence (AI)

Introduction to Artificial Intelligence, Basics: Reasoning, problem-solving, Knowledge Representation, Planning, Learning, Perception, Motion, and manipulation, Heuristic Search, A* algorithm, Game Playing, Alpha-Beta Pruning, Genetic Algorithms.

Module-II: (08 Hrs)

Knowledge Representation and Reasoning

Propositional and first-order logic, Semantic networks and ontologies, Rule-based systems: forward and backward chaining, Supervised learning, Unsupervised learning, Reinforcement learning.

Feature Extraction and Selection

Feature extraction: Statistical features, Principal Component Analysis.

Feature selection: Ranking, Decision tree - Entropy reduction and information gain, Exhaustive, best first, Greedy forward & backward, Applications.

Module-III: (08 Hrs)

Classification and Regression Models

Classification Models - Random Forest, Logistic Regression, Support Vector Regression, K-Nearest Neighbor (KNN), K-Means, Naive Bayes.

Regression Models - Linear regression, Ridge regression, neural network regression, Lasso regression, Gaussian regression, and polynomial regression. Overfitting and underfitting

Module-IV: (10 Hrs)

Uncertainty Handling and Fuzzy Logic

Probability basics, Bayes Rule and its Applications, Bayesian Networks – Exact and Approximate, Fuzzy sets and membership functions, Fuzzy inference systems, Inference in Bayesian Networks, Hidden Markov Models.

Learning

Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm Reinforcement Learning.

Module-V: (07 Hrs)

Applications of Computational Intelligence

Robotics and autonomous systems, medical diagnosis and bioinformatics, financial modeling and forecasting.

Course Outcomes:

The students will be able to,

CO1: Explain the basics of computational intelligence with their applications.
CO2: Demonstrate the applications of artificial intelligence and machine learning.
CO3: Apply a suitable feature extraction technique and select significant features.
CO4: Develop classification and regression models for a given mechanical engineering data set.
CO5: Evaluate the performance of the machine learning models and optimize the model

Books:

1. Konar A., “Computational Intelligence: Principles, Techniques and Applications”, Springer Verlag, 2005
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", Wiley.
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Introduction to Computational Intelligence", Pearson.

Reference:

1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2. Dan W.Patterson, ―Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.