**Course Title:** Artificial Intelligence & Machine Learning

**Course Code:** PCC-CS405

# Credit: 2

**Module 1:**

Introduction to Artificial Intelligence: The Foundations of Artificial Intelligence, The History of Artificial Intelligence, and the State of the Art.

Knowledge Representation: A Knowledge-Based Agent, Knowledge Representation, Reasoning & Logic, Propositional Logic, Inference in First-Order Logic

**Module 2:**

Search Techniques: AI-Problem formulation, solving problems by searching, uninformed search strategies: depth first search, breadth first search, depth limited search, iterative deepening search, bi-directional search.

Heuristic search strategies: Basics of heuristics, hill climbing strategy, simulated annealing strategy, best-first search, A\* search, constraint satisfaction problem solving strategy.

Adversarial search: AI-based interactive game playing scheme using the minimax strategy, alpha-beta pruning.

**Module 3:**

Introduction to Machine Learning: Machine learning and it’s types; Applications of machine learning; Different types of data, Issues in machine learning.

**Module 4:**

Linear Regression, Least Square Gradient Descent Method, Goodness of Fit – Bias- Variance Trade off.

Logistic Regression, Sigmoid, Gradient of Logistic Regression – cost function.

**Module 5:**

Lazy Learners, nearest neighbors, Decision Tree, CART, Ensemble Methods, Bagging, Boosting,

Random Forest.

**Module 6:**

Data preprocessing, Normalization, Feature Selection, Feature Reduction, PCA, Performance.

Evaluation of Classifiers, Cross Validation, Receiver Operating Characteristics Curve.

**Module 7:**

Clustering: K-means, K-medoids, Hierarchical methods, Agglomerative Nesting (AGNES)

**Module 8:**

Artificial Neural Networks, Backpropagation – Derivations, Realization of Gates (AND, OR, XOR, NAND)

Introduction to Convolutional Neural Networks – Regularization - CNN architectures – LeNet – VGG Net – Google Net – ResNet.

Introduction to Recurrent Neural Networks – Deep RNNs – Bi-RNNs – Long Short-Term Memory – Vanishing gradient