Course Name: Artificial Intelligence (3 Cr.)
Course Code: CACS410
Year/Semester: IV/VII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of artificial intelligent. It covers fundamental concepts artificial intelligence, problem solving, knowledge representation, neural networks, machine learning, natural language processing, machine vision and expert systems.

Objective:
The objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Upon the completion students will be able to:

- Gain fundamental concepts of principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in expert systems, artificial neural networks and other machine learning models.

Course Contents:

UNIT 1: INTRODUCTION **[6 Hrs.]**

1.1 Intelligence, Intelligent behavior, Artificial Intelligence, Understanding AI based on thought process and behavior, Hard vs. Strong AI, Soft vs. Weak AI
1.2 Foundations of AI
1.3 Applications of AI
1.4 Intelligent Agents: Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents,PEAS description of Agents, Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning agent, Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

UNIT 2:PROBLEM SOLVING METHODS **[12Hrs.]**

2.1 Definition of a Problem, Problem as a state space representation, Problem formulation, Well-defined problems,Constraint satisfaction problem, Water jug problem,N-Queen problem, Cryptarithmetic problem, Graph coloring problem
2.2 Problem solving by searching, types of searching, Measuring problem solving performance, General State Space Search
2.3 Uninformed:Breadth-First Search, Depth-First Search,Depth-Limited Search, Iterative Deepening depth first Search, Bidirectional Search, Using uninformed search techniques for solving N-Queens Problem, Puzzle problem etc.
2.4 Informed search:Greedy Best-First Search,A* Search, Optimality of A*, Local search: Hill Climbing, Simulated Annealing, Using informed search techniques for solving N-Queens Problem, Puzzle problem etc.

2.5 Game Playing, Optimal Decisions in Games, Alpha – Beta Pruning, Minimax Algorithm, Tic-Tac –Toe Problem, Stochastic Games

UNIT 3: KNOWLEDGE REPRESENTATION AND REASONING[15Hrs.]

3.1 Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems, Types of Knowledge, The Role of Knowledge

3.2 Knowledge representation techniques: Rule Based, Semantic Nets, Frames, Logic based

3.3 Propositional Logic, Syntax and Semantic of propositional logic,Proof by Resolution, Conjunctive Normal Form (CNF), Resolution Algorithm,Limitations of Propositional Logic, Forward and Backward Chaining

3.4 Predicate Logic, FOPL, Syntax, Semantics, Quantification, horn clauses, Inference with FOPL: By converting into PL (Existential and universal instantiation), Rules of inference, Unification and lifting, CNF for FOPL, Inference using resolution, Resolution Refutation System (RRS)

3.5 Handling Uncertain Knowledge, Radom Variables, Prior and Posterior Probability, Inference using Full Joint Distribution, Bayes' Rule and its use, Bayesian Networks, Reasoning in Bayesian Networks

UNIT 4: LEARNING **[4 Hrs.]**

4.1 Concepts ofmachine learning

4.2 Rote learning, learning by analogy, inductive learning, Explanation based learning, Supervised and unsupervised learning,learning by evolution (genetic algorithm)

UNIT 5: NEURAL NETWORKS AND NATURAL LANGUAGE PROCESSING [7Hrs.]

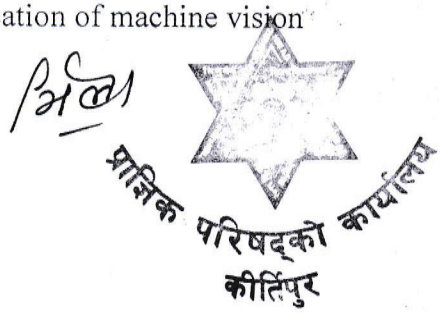
5.1 Introduction to artificial neural network,Mathematical model of neural network, types of neural network: feed-forward, feed-back,Gate realization using neural network, Learning in neural networks: Back propagation algorithm,Hopfield network, Boltzmann machines

5.2 Concepts of natural language understanding and natural language generation, Steps in natural language processing, Syntax analysis, Semantic analysis, Pragmatic analysis

UNIT 6: EXPERT SYSTEM AND MACHINE VISION **[4 Hrs.]**

6.1 Expert System, Architecture of an expert system, Stages of expert systems development.

6.2 Concept of Machine Vision. Steps of machine vision, application of machine vision



Laboratory work:

Laboratory exercises can be conducted in LISP, PROLOG or any other high level programming language. Laboratory exercises must cover theconcepts of rule based intelligent agents, inference and reasoning,search techniques, neural networks, etc.for solving practical problems.

Reference Books:

1. Stuart Russel and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson
2. E. Rich, K. Knight, Shivashankar B. Nair, Artificial Intelligence, Tata McGraw Hill.
3. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Benjamin/Cummings Publication
4. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.
5. P. H. Winston, Artificial Intelligence, Addison Wesley.