**Introduction to Artificial Intelligence**

Objectives:

1. Define the concepts of AI and intelligent agents and their role in problem-solving and decision-making.
2. Understand different problem-solving techniques and search algorithms to find optimal solutions.
3. Develop knowledge and reasoning skills to represent, manipulate, and reason with knowledge.
4. Apply logical and planning techniques to develop intelligent agents capable of taking rational decisions in complex environments.
5. Explore different learning approaches and techniques to build adaptive and intelligent agents.

Outcomes:

1. Understand the foundations and history of AI and the role of intelligent agents in solving complex problems.
2. Analyze and compare different search algorithms to find optimal solutions for well-defined problems.
3. Design and implement knowledge-based systems using logical and rule-based representations and inference engines.
4. Develop planning agents capable of generating and executing plans in complex environments.
5. Build intelligent agents using different learning approaches, such as supervised and unsupervised learning, and reinforcement learning.

**Module 1:**

**Introduction to AI**

**Mod 1.1:**

What is AI? , Thinking humanly, Acting rationally, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The gestation of artificial intelligence, AI becomes an industry, Knowledge-based systems, The return of neural networks, The State of the Art

**Mod 1.2:**

Intelligent Agents, How Agents Should Act, Structure of Intelligent Agents, Simple reflex agents, Goal-based agents, Utility-based agents , Environments, Environment programs.

Chap 1, Chap 2

**Module 2:**

**Problem-solving**

**Mod 2.1**

Solving Problems by Searching, Problem-Solving Agents, Formulating Problems, Well-defined problems and solutions, measuring problem-solving performance, Toy problems, Searching for Solutions, Search Strategies, Avoiding Repeated States, Constraint Satisfaction Search

**Mod 2.2**

Informed Search Methods, Best-First Search, Heuristic Functions, Memory Bounded Search, Iterative Improvement Algorithms, Applications in constraint satisfaction problems.

Chap 3, Chap 4

**Module 3:**

**Knowledge and reasoning**

**Mod 3.1**

A Knowledge-Based Agent, Representation, Reasoning, and Logic, Prepositional Logic, An Agent for the Wumpus World, Problems with the propositional agent, First-Order Logic, Syntax and Semantics, Extensions and Notational Variations, Using First-Order Logic, A Simple Reflex Agent, Deducing Hidden Properties of the World, Toward a Goal-Based Agent

**Mod 3.2**

Building a Knowledge Base, Knowledge Engineering, General Ontology, The Grocery Shopping World, Inference Rules Involving Quantifiers, Generalized Modus Ponens, Forward and Backward Chaining, Completeness, Resolution: A Complete Inference Procedure, Completeness of resolution

Chap 6, Chap 7, Chap 8

**Module 4:**

**Acting logically**

**Mod 4.1**

A Simple Planning Agent, From Problem Solving to Planning, Planning in Situation Calculus, Basic Representations for Planning, A Partial-Order Planning Algorithm, Planning with Partially Instantiated   
Operators, Knowledge Engineering for Planning,

**Mod 4.2**

Practical Planners, Hierarchical Decomposition, Analysis of Hierarchical Decomposition, More Expressive Operator Descriptions, Resource Constraints, Planning and Acting, Conditional Planning, A Simple Re-planning Agent, Fully Integrated Planning and Execution

Chap 11, Chap 12, Chap 13

**Module 5:**

**Learning Agents**

**Mod 5.1**

A General Model of Learning Agents, Components of the performance element, Representation of the components, Inductive Learning, Learning Decision Trees, Using Information Theory, Learning General Logical Descriptions, Computational Learning Theory, Learning in Neural and Belief Networks, Neural Networks, Perceptrons, Multilayer Feed-Forward Networks, Applications of Neural Networks, Bayesian Methods for Learning Belief Networks

**Mod 5.2**

Reinforcement Learning, Passive Learning in a Known Environment, Passive Learning in an Unknown Environment, Generalization in Reinforcement Learning, Genetic Algorithms and Evolutionary Programming, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

Chap 19, Chap 20, Chap 21

**Text Book:**

1) Artificial Intelligence, A Modern Approach, Stuart J. Russell and Peter Norvig

<https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf>

List of Practicals:

1. Implementing a simple reflex agent for a basic task, such as vacuum cleaning or navigation.
2. Designing and implementing a search algorithm to solve a toy problem, such as the eight-puzzle problem.
3. Building a knowledge-based agent for a domain-specific task, such as a medical diagnosis system.
4. Developing a planning agent capable of generating and executing plans for a complex task, such as a logistics problem.
5. Implementing a reinforcement learning agent to solve a simple game or control problem, such as the cart-pole problem.