### Subject Description

**Subject title:** Fundamentals of Artificial Intelligence

**Subject code:**

**Credit value:** 2 credits

**Pre-requisite:** Nil

**Recommended background knowledge:**

Data Structures and Algorithm, Discrete Mathematics (logic, probability, counting)

**Mutual exclusions:** Nil

**Learning approach:**

Lecture 28 hours

**Assessment:**

Examination 100%

**Objectives:**

This course introduces the theoretical and computational techniques that serve as a foundation for the study of artificial intelligence (AI). Specific objectives include:

- understanding basic search algorithms
- understanding algorithms used for logical and probabilistic reasoning
- acquiring the basics of game theory

**Keyword syllabus:**

**PART I: SEARCH**

**Uninformed Search**

Problem solving as search, breadth-first search, depth-first search, uniform-cost search, iterative deepening, bidirectional search

**Informed Search**

Greedy best-first search, admissible heuristics, A*

**Local Search**

Hill-Climbing search, simulated annealing, Davis-Putnam, satisfiability, genetic algorithms

**Constraint Satisfaction**

Backtracking, value and variable selection heuristics, forward checking, constraint propagation, problem encoding as CSPs

**Adversarial Search**

Game playing as search, simple minimax, heuristic minimax, alpha-beta pruning, expectiminimax
PART II: KNOWLEDGE REPRESENTATION AND REASONING

Basics of Knowledge Representation and Reasoning
Knowledge representation, logic, soundness and completeness of proof theory

Propositional Logical Reasoning
Propositional logic, rules of inference, resolution, chaining

First-Order Logical Reasoning
First-order logic, rules of inference, resolution

PART III: PROBABILISTIC REASONING

Review of Probability Theory
Basics of probability theory, uncertainty, the joint probability distribution, conditional independence

Semantics of Bayesian Networks
Bayesian networks, d-separation

Exact Inference
Enumeration, variable elimination

Approximate Inference
Stochastic simulation, likelihood weighting

PART IV: GAME THEORY

Games with Hidden Information
Matrix normal form of games, pure and mixed strategies

Non-Zero Sum Games
Prisoner’s dilemma, Nash equilibrium, tragedy of the commons

Indicative reading list and references: