Syllabus

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2015 Course)
410242 : Artificial Intelligence and Robotics

Teaching Scheme :	Credit	Examination Scheme :
TH : 03 Hours/Week	03	In-Sem (Paper) : 30 Marks
		End-Sem (Paper) : 70 Marks

Prerequisite Courses : 210254 - Principles of Programming Languages

Companion Course : 410246 - Laboratory Practice I

Course Objectives

- To understand the concept of Artificial Intelligence (AI)
- To learn various peculiar search strategies for AI
- To acquaint with the fundamentals of mobile robotics
- To develop a mind to solve real world problems unconventionally with optimality.

Course Outcomes

On completion of the course, student will be able to -

- Identify and apply suitable Intelligent agents for various AI applications
- Design smart system using different informed search / uninformed search or heuristic approaches.
- Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem.
- Apply the suitable algorithms to solve AI problems.

Course Contents

Unit I : Introduction

(08 Hours)

Artificial Intelligence : Introduction, Typical Applications. State Space Search : Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search : Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent, Beam Search, Tabu Search. Optimal Search : A* algorithm, Iterative Deepening A*, Recursive Best First Search, Pruning the CLOSED and OPEN Lists. **(Refer Chapter 1)**

Unit II : Problem Decomposition and Planning

(08 Hours)

Problem Decomposition : Goal Trees, Rule Based Systems, Rule Based Expert Systems. Planning : STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework For Planning. Constraint Satisfaction : N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies. **(Refer Chapter 2)**

Unit III : Logic and Reasoning **(08 Hours)**

Knowledge Based Reasoning : Agents, Facets of Knowledge. Logic and Inferences : Formal Logic, Propositional and First Order Logic, Resolution in Propositional and First Order Logic, Deductive Retrieval, Backward Chaining, Second order Logic. Knowledge Representation : Conceptual Dependency, Frames, Semantic nets. **(Refer Chapter 3)**

Unit IV : Natural Language Processing and ANN **(08 Hours)**

Natural Language Processing : Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning : Supervised, Unsupervised and Reinforcement learning. **Artificial Neural Networks** (ANNs) : Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine. **(Refer Chapter 4)**

Unit V : Robotics **(08 Hours)**

Robotics : Fundamentals, path Planning for Point Robot, Sensing and mapping for Point Robot, Mobile Robot Hardware, Non Visual Sensors like : Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, Biological Sensing. Robot System Control : Horizontal and Vertical Decomposition, Hybrid Control Architectures, Middleware, High-Level Control, Human-Robot Interface. **(Refer Chapter 5)**

Unit VI : Robots in Practice **(08 Hours)**

Robot Pose Maintenance and Localization : Simple Landmark Measurement, Servo Control, Recursive Filtering, Global Localization. Mapping : Sensorial Maps, Topological Maps, Geometric Maps, Exploration. Robots in Practice : Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots. **(Refer Chapter 6)**

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UNIT I

Chapter 1 : Intelligence Searching Techniques 1-1 to 1-37

Syllabus : Artificial Intelligence : Introduction, Typical Applications.

State Space Search : Depth Bounded DFS, Depth First Iterative Deepening.

Heuristic Search : Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent, Beam Search, Tabu Search.

Optimal Search : A* algorithm, Iterative Deepening A* , Recursive Best First Search, Pruning the CLOSED and OPEN Lists.

UNIT II

Chapter 2 : Planning and Constraint Satisfaction 2-1 to 2-22

Syllabus : Problem Decomposition : Goal Trees, Rule Based Systems, Rule Based Expert Systems.

Planning : STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework For Planning.

Constraint Satisfaction : N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies.

UNIT III

Chapter 3 : Logic and Reasoning 3-1 to 3-26

Syllabus : Knowledge Based Reasoning : Agents, Facets of Knowledge.

Logic and Inferences : Formal Logic, Propositional and First Order Logic, Resolution in Propositional and First Order Logic, Deductive Retrieval, Backward Chaining, Second order Logic

Knowledge Representation : Conceptual Dependency, Frames, Semantic nets.

UNIT IV

Syllabus : Natural Language Processing : Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning : Supervised, Unsupervised and Reinforcement learning.

Artificial Neural Networks (ANNs) : Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine.