



## ARTIFICIAL INTELLIGENCE LAB

**Course Code:** CSL325

**Credit Hours:** 1

**Pre-requisite:** Object Oriented Programming

## Course Objectives

The key objectives of this course include:

- To learn basic program constructs of AI development tool, such as an AI language (Python) & expert system shell (Prolog).
- To learn basics of intelligent agents and their environment.
- To learn implementation of search algorithm with their real world perspective.
- To learn concepts of knowledge based systems: representation and reasoning.
- To implement basic machine learning models.

## Course Learning Outcomes

After successful completion of this course, the students should be able to:	PLO	BT Level
1. <b>Demonstrate</b> proficiency in developing AI applications in python and Prolog	5	P3
2. <b>Apply</b> basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and reasoning	2	C3
3. <b>Demonstrate</b> proficiency in developing and applying models of machine learning	4	C3

## Course Contents

The course includes the introduction and then building the proficiency in the python programming language and prolog for understanding and experimenting the AI techniques. The course includes the understanding and experience of the language variables, expressions, operands and operators, loops, control structures, debugging, error messages, functions, strings, lists, basic graphics and some libraries in the language. Python & Prolog programming languages will be used to explore and illustrate various techniques in Artificial Intelligence towards Knowledge Based Systems, Problem Solving by Searching (Informed searching, Uninformed searching, Heuristics, Local searching, adversarial searching) and machine Learning.



### Mapping of CLOs to PLOs

PLOs/CLOs	CLO 1	CLO 2	CLO 3
PLO1 (Academic Education)			
PLO2 (Knowledge for Solving Computing Problems)		✓	
PLO3 (Problem Analysis)			
PLO4 (Design/Development of Solutions)			✓
PLO5 (Modern Tool Usage)	✓		
PLO6 (Individual and Teamwork)			
PLO7 (Communication)			
PLO8 (Computing Professionalism and Society)			
PLO9 (Ethics)			
PLO10 (Life-long Learning)			

### Resources

1. Russell, S. and Norvig, P. "Artificial Intelligence. A Modern Approach", 4th ed, Prentice Hall, Inc., 2020.
2. Denis Rothman, "Artificial Intelligence By Example ", 2<sup>nd</sup> Edition, 2020
3. Ivan Bratko, "Prolog Programming for Artificial Intelligence?", 4<sup>th</sup> edition, Pearson Addison-Wesley, 2012
4. Dennis Merritt, Expert Systems in Prolog, springer, 2017

### Weekly Plan

Week	Topics to be Covered	Learning Outcomes	Tools/Modules for Implementation	Remarks
1	Installation & Introduction to Python, Loops & Control Structures, Classes & Inheritance, Modules in python	Be able to install python, Learn to code in python, Understanding the concepts of OOP in Python	Anaconda Navigator, IDE (Spyder, Jupyter Notebook, Pycharm)  ***They can use any one of them	<b>Topic (Classes &amp; Modules) has been added</b>
2	Lists, Tuples, & Dictionary, Numpy, Pandas	Understanding different data structures in python, learning to use Modules such as	Spyder, Numpy, Pandas	<b>Topic (Numpy &amp; Pandas) has been added</b>



		numpy and pandas		
3	Simple Reflex Agents, Model Based Reflex Agents	Reflex Agents Able to relate problems with artificial agents and environments	Spyder	Tasks have been revised/enhanced
4	Graphs in Python, NetworkX, Matplotlib	Learn to model graphs as data structures in python & use them to solve problems. Understanding built in modules for implementing and plotting graphs	Spyder, Matplotlib	Topic (Matplotlib) has been added
5	Uninformed searching (DFS, IDS, DLS) Informed searching (A*)	Learn to use search algorithms as a problem-solving agent.	Spyder	Topic (Informed Seaches) has been added
6	Adversarial Search (Minmax, Alpha beta Pruning)	Understanding how multi agent environment works, implementing adversarial search strategies in python	Spyder	No Changes
7	Graphical User Interface using Tkinter	Learn to create GUI in python	Spyder, Tkinter	Tasks have been revised
	Lab Mid Term Exam			
<b>Mid Term Semester Exam</b>				
8	Introduction to Machine Learning, Clustering (K-means, Agglomerative, DBSCAN)	Applying Concepts of Machine Learning	Spyder, Numpy, Sklearn	Topic (Agglomerative Clustering) has been added
9	Dimensionality Reduction (PCA)	Applying Concepts of Dimensionality reduction	Spyder, Numpy, PCA, Matplotlib	This new lab is added
10	Classification, Artificial Neural Network (Perceptron & MLP)	Applying concepts of Classification	Spyder, Keras, Tensorflow, Numpy	This new lab is added
11	Classification: Naïve Bayes & K-nearest neighbor	Applying concepts of Classification	Spyder, GaussianNB, Label Encoder, Sklearn	Two lab topics are merged
12	Introduction to Prolog, Propositional Logic, First order logic (syntax and semantic)	Introduction to propositional logic and representing it in Prolog. Understand how to represent real world knowledge as FOL.	Swish, Swipl, SwiPrologEditor Spyder, Pytholog	No Changes
13	Forward Chaining & Backward Chaining in prolog	Understanding the concepts of forward and backward chaining in prolog.	Swish, Swipl, SwiPrologEditor Spyder, Pytholog	Topic (Prolog in Python) has been added



14	Constraint Satisfaction Problem	Developing concepts of CSP and identification of CSP in real world.	Spyder, Numpy, Pandas	<b>No Changes</b>
	Lab Final Term Exam			
<b>Final Term Semester Exam</b>				