PRINCIPLES OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS51**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics concepts like probability.

COURSE OBJECTIVES:

- To Gain a historical perspective of AI and its foundations
- To understand the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- To describe Artificial Intelligence and Machine Learning algorithms and evaluate their performance
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To Illustrate AI and ML algorithm and their use in appropriate applications.
- To Describe the applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
- To apply the classification, clustering and regression-based machine learning algorithms techniques to solve real time problems.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Artificial intelligence: AI Problems, What is AI technique Problems, problem spaces and search: Defining the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in design of search programs, additional problems	**8 Hours**

MODULE - II

Heuristic search techniques: Generate and Test, Hill Climbing, Best First Search, Problem Reduction Knowledge representation issues: Representation and Mapping, Approaches to Knowledge Representation	**8 Hours**
MODULE - III	
Machine Learning Concepts**:** Machine Learning, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating, Performance measures, Concept Learning tasks, Concept Learning as search, Find S algorithm, Version Spaces and Candidate Elimination algorithm. Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.	**8 Hours**

MODULE – IV	
Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptron, Back propagation algorithm. Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Bayesian Belief Network (BBN)	**8 Hours**
MODULE - V	
Unsupervised Learning Techniques: Clustering algorithms: K-Means Instance-Based Learning: Introduction, k-Nearest Neighbor Learning, Locally weighted regression, Linear SVM classification, Nonlinear SVM classification, SVM Regression, Reinforcement Learning	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate the theory of artificial intelligence for various problem-solving techniques.	CL3
CO2	Apply artificial intelligence concepts in Heuristic Search Techniques and knowledge representation.	CL3
CO3	Examine a wide variety of learning algorithms and apply Decision tree learning algorithm for the data.	CL3
CO4	Apply the concept of neural networks for learning linear and non-linear activation functions and Bayesian classifier to label data.	CL3
CO5	Illustrate clustering, instant based and reinforcement learning algorithms and identify its applicability in real life problems.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Demonstrate a simple Chabot with minimum 10 conversations.	CO1	CL3
2	Write a program to implement Tic-Tac-Toe game.	CO1	CL3
3	Write a program to implement A* Algorithm	CO1	CL3
4	Implement and demonstrate the FIND-Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	CO2	CL3
5	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	CO2	CL3

6	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO3	CL3
7	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	CO4	CL3
8	Write a program by using python library to implement K-Nearest Neighbor algorithm to classify the Iris data set. Print confusion matrix for predictions.	CO5	CL3
9	Write a program by using python library to implement Naïve Bayes Algorithm for solving classification problems.	CO5	CL3
10	Demonstrate the working of SVM classifier for a suitable dataset.	CO5	CL3
11	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	CO5	CL3
12	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO5	CL3

CO-PO-PSO MAPPING

CO No.	**Programme Outcomes (PO)**												**Programme Specific Outcome (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	3			1	1	1		2	2	2	2
CO2	3	3	3	2	3			1	1	1		2	2	2	2
CO3	3	3	3	2	3			1	1	1		2	2	2	2
CO4	3	3	3	2	3			1	1	1		2	2	2	2
CO5	3	3	3	2	3			1	1	1		2	2	2	2

3: Substantial (High)	**2: Moderate (Medium)**	**1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	**Assessment Description**	**Weightage (%)**	**Max. Marks**
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Practical Sessions (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Elaine Rich, Kevin K and S B Nair, **"Artificial Intelligence",** 3rd Edition, McGraw Hill Education, 2017
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.
3. Tom M Mitchell, **"Machine Lerning",**1st Edition, McGraw Hill Education, 2017.
4. Saroj Kaushik, Artificial Intelligence, Cengage learning
5. Stuart Rusell, Peter Norving, Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
6. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
8. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press
9. Srinivasa K G and Shreedhar, "Artificial Intelligence and Machine Learning", Cengage

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.youtube.com/watch?v=wnqkfpCpK1g
2. https://www.youtube.com/watch?v=t4K6lney7Zw
3. https://www.youtube.com/watch?v=VOaoabf3LPM