

**Bachelor of Science in Information Technology (B.Sc.IT)****T.Y.B.Sc IT****1. Principles of Artificial Intelligence***at Semester V**(Implemented during Academic Year 2021-22)****Modules at a Glance***

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of lectures</b>
1	Problem solving Search Methods	9
2	Data mining	9
3	Machine Learning	9
4	Introduction to Deep Learning Models	9
5	Case study with MNIST database	9
	Total	45

**Course Objective:**

- To provide the foundations for AI problem solving techniques and knowledge representation formalisms
- To introduce students through some of the latest techniques in deep learning.
- Hands on and the students should be able to design intelligent deep learning systems for solving the problems in the area of their interests

**Course Outcome:**

- Identify and formulate appropriate AI methods for solving a problem.
- Implement AI algorithms
- Compare different AI algorithms in terms of design issues, computational complexity, and assumptions
- Use appropriate search algorithms for any AI problem
- Provide the apt agent strategy to solve a given problem
- Analyze various applications solved through the use of deep learning models

**Detailed Syllabus:**

<b>Module</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games	9
2	Data mining: fundamentals – data reduction - Decision tree algorithms - Association rules, Clustering: K-means, fuzzy c-means, hierarchical, probabilistic clustering methods - Rough set theory: definition – rule induction – feature selection - rough sets in data mining	9
3	Machine Learning: Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees - Regression and Classification with Linear Models - Artificial Neural Networks - Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning	9
4	Introduction to Deep Learning Models: Autoencoder, Convolutional Neural Networks, Recurrent Neural Networks, LSTM, Network Architecture Search (NAS)	9
5	Case Study: Introduction to TensorFlow, Experiment: Training a CNN based hand-written digit recognition model with TensorFlow Dataset: MNIST hand-written digit dataset Lab Handwritten letter recognition Description: learn to recognize handwritten letters with CNN.	9

**Reference Books**

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2009
2. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009
3. Nils J. Nilsson, the Quest for Artificial Intelligence, Cambridge University Press, 2009.
4. A. ZHANG, Z. LIPTON, M. LI, A. SMOLA (2020) Dive into Deep Learning (Release 0.7.1), <https://d2l.ai/d2l-en.pdf>.

**Self-learning Material**

1. Practical Machine Learning with Tensorflow, NPTEL Course Material, Department Computer Science and Engineering, IIT Madras: <https://nptel.ac.in/courses/106106213/>
2. Stanford CS class (CS231n), Convolutional Neural Networks for Visual Recognition: <http://cs231n.github.io/>

**Practical:**

1. Implement Search Strategies: Breadth first and Depth First search algorithm , Iterative deepening search , A\* search algorithm
2. Implementation of basic neural network model with 4 activation functions on Pima Indians onset of diabetes dataset.
3. Performing AND & OR Operations in the Neural Network
4. Prediction Algorithm - Use of different packages on dataset of Cat and Non-Cat images
5. 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.
6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
7. 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.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10. Case Study a CNN based hand-written digit recognition model with TensorFlow.