**Code No.: MCA 203** **L T C**
**Paper: Artificial Intelligence and Machine Learning** **3 1 4**

**INSTRUCTIONS TO PAPER SETTERS:**
1. Question No. 1 should be compulsory and cover the entire syllabus. There should be 10 questions of short answer type of 2.5 marks each, having at least 2 questions from each unit.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions to evaluate analytical/technical skills of candidate. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks including subparts, if any.
3. Examiners are requested to go through the Course Outcomes (CO) of this course and prepare the question paper accordingly, using Bloom's Taxonomy(BT) in such a way that every question be mapped to some or other CO and all the questions, put together, must be able to achieve the mapping to all the CO(s), in a balanced way.

**OBJECTIVE:** *In this course, the learner's will be able to develop expertise related to the following:-*

1. *AI principles and approaches.*
2. *Develop basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.*
3. *Understanding nature of problems solved with ML*

**PRE-REQUISITES:**

- Basic knowledge of Mathematical Logic
- Linear Algebra
- Pre-requisite based study material (Website Course Material)
- An Introduction to Artificial Intelligence by Prof. Mausam, IIT Delhi, Link: https://nptel.ac.in/courses/106/102/106102220/
- Machine Learning, NPTEL by Prof. Prof. Carl Gustaf Jansson, Department of Computer Science and Engineering, KTH Royal Institute of Technology, Sweden, Link: https://nptel.ac.in/courses/106/106/106106202/#
- Artificial Intelligence: Knowledge Representation and Reasoning by Prof. Deepak Khemant, IIT Madras, Link: https://nptel.ac.in/courses/106/106/106106140/

**COURSE OUTCOMES:**

After the completion of the theory course, the learners will be able to:

| | |
|---|---|
| CO1 | Define the meaning of Intelligence and recall various models for knowledge representation and reasoning within an AI problem domain. (BTL1) |
| CO2 | Summarize varied learning algorithms and model selection. (BTL2) |
| CO3 | Apply the concept of learning trends and patterns from data to build an appreciation for what is involved in learning from data. (BTL3) |
| CO4 | Analyze and apply a variety of learning algorithms to data. (BTL4) |

| | |
|---|---|
| CO5 | Appraise AI algorithms and assess their performance. Follow standards and ethical practices (BTL 4) |
| CO6 | Develop a strong foundation for a wide variety of state of the art Machine Learning algorithms (BTL 6) |

## UNIT – I

**AI Fundamentals:** Defining Artificial Intelligence, Types of AI, Turing test, Defining AI techniques, Comparison - AI, ML and Deep Learning, Problem characterization and reduction, Defining State Space and AI Search Techniques (Hill Climbing, Breadth first and depth first search, Best first search, A*, AO*, Constraint Satisfaction), MEA, Ethics of AI. **[No. of Hrs.: 10]**

## UNIT – II

**Knowledge Representation and Reasoning:** Approaches to knowledge representation: Propositional Logic, First Order Predicate Logic, Inference Rules (Modus Ponen, Modus Tollen, Resolution, And elimination, Syllogism), Production Rules, Types of knowledge, Reasoning: Forward and backward reasoning, Non-monotonic Reasoning, Reasoning with uncertainties.

**[No. of Hrs. :10]**

## UNIT – III

**Machine Learning:** Introduction to Machine Learning, Why Machine learning, Types of Machine Learning Problems, Applications of machine learning. Supervised machine Learning – Regression and Classification. Regression- Simple, Multiple Regression, Least Squares, Total sum of squares, Sum of Square of Residuals, Sum of square of Regression, odds, odds ratio. Classification: Logistic Regression, Accuracy methods: coefficient of determination, correlation, confusion matrix, Overfitting and underfitting, Bias and variance. Accuracy methods: coefficient of determination, correlation, confusion matrix.

**[No. of Hrs: 10]**

## UNIT – IV

Unsupervised Learning: Dimensionality reduction (Principal component analysis), K-means clustering, Ensemble Learning (Boosting and Bagging). Neural Networks, Types of Neural networks, Activation functions, Feed forward, Back Propagation Algorithm, Recommender Systems, Content based recommendations. **[No. of Hrs.: 10]**

## TEXT BOOKS:


1. Stuart Russel, and Peter Norvig, “Artificial intelligence: A Modern Approach”, Pearson Education Limited, 4th Edition, 2020.
2. T. Hastie, R. Tibshirani and J. Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer, 2nd Edition, 2017.
3. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, Wiley, 2nd Edition, 2012.


## REFERENCES:


1. E. Rich, K. Knight. S. B. Nair, “Artificial Intelligence”, McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2017.
2. Mark Watson, “Practical Artificial Intelligence Programming with Java”, Leanpub, 5th Edition, 2020.
3. Ivan Bratko, “Prolog Programming for Artificial Intelligence”, Pearson Education, 5th Edition, 2011.
4. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education, Indian Edition, 2017.

**Code No.: MCA 263** **L T C**
**Paper: Artificial Intelligence and Machine Learning Lab** **0 2 1**

**OBJECTIVE*:*** In this course, the learners will be able to develop working expertise related to the following:-
1. Design the knowledge base of specific domains.
2. Design intelligent systems.

**COURSE OUTCOMES**
After the completion of the practical course, the students will be able to learn-

| | |
|---|---|
| CO1 | Apply heuristic search based algorithms to solve different puzzles. (BTL3) |
| CO2 | Apply reduction techniques on large datasets and reduce their dimensionality.(BTL3) |
| CO3 | Analyze the datasets for bias and apply regression techniques.(BTL4) |
| CO4 | Practically evaluate the learning techniques for classification.(BTL5) |
| CO5 | Implement the knowledge of inferences rules to design the knowledge base.(BTL6) |
| CO6 | Create a domain specific intelligent application for example chat bots. (BTL6) |