**BANASTHALI VIDYAPITH**

**Department of Computer Science**

**Course Handout: December 2022 – May 2023**

Date: 21/12/2022

**Course Code:** **CS 317**  **Course Name: Artificial Intelligence and Machine Learning**

Program Name : **B.Tech.(IT) VI Semester (Sections A & B)**

Course Detail : **Theory**

Credit Points : **4 Max. Marks: 100(CA: 40 + ESA: 60)**

Name of Faculty Member**:**  **Dr. Khandakar F. Rahman**

**Learning Outcomes:**

On successful completion of the course students will be able to

* Demonstrate fundamental understanding of artificial intelligence (AI).
* Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
* Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents.
* Apply the concepts for machine learning to develop models for supervised and unsupervised learning.
* Understand the basic concepts of reinforcement learning.

**Syllabus**

**Section A**

Introduction to Artificial Intelligence, History of Artificial Intelligence, Intelligent Agents: Agents and Environments, Structure of Agents.

General Problem Solving, State Space and Graph Model techniques, Uninformed and Informed (Heuristic) Search, Aim Oriented Heuristic Algorithms Versus Solution Guaranteed Algorithms, Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning.

Knowledge Representation: Propositional Logic, First Order Predicate Calculus, Inference and Resolution.

Introduction to Machine Learning and Types, Data Preprocessing, Importance of features in learning, Feature Selection, Feature Extraction Process.

**Section B**

Supervised Learning: Classification and Regression, Regression: Simple, Multiple and Polynomial, Support Vector Machine (Regression and Classification), Decision Tree (Regression and Classification), Naïve Bayes (Classification), Evaluation of Classification and Regression Models.

**Section C**

Unsupervised Learning: Introduction to Clustering, k-Means and Hierarchical Clustering.

Introduction to Reinforcement Learning, Upper Confidence Bound, Thompson Sampling.

Validation methods- k-fold Cross Validation, Model Selection and Boosting, XGBoost.

Applications of Machine Learning with Case Studies.

**Suggested Readings:**

R1. Russell, S. & Norvig, P.(2011). Artificial Intelligence A Modern Approach, 3rd Edition: Pearson Education.

R2. Rich E., Knight K. & Nair S.B. (2011). Artificial Intelligence 3rd Edition. Tata McGraw Hill.

R3. Mitchell T.M. (1997). Machine Learning, McGraw Hill International

R4. Flach, P. (2012). Machine learning: the art and science of algorithms that make sense of data. Cambridge University Press.

R5. Mohri, M., Rostamizadeh, A., & Talwalkar, A. (2018), Foundations of machine learning, MIT press.

R6. Nilsson, N.J., & Nilsson, N.J.(1998). Artificial Intelligence: a new synthesis. Morgan Kaufmann.

R7. Bird, S., Klein, E., Loper, E. (2009), Natural Language Processing with Python. O'Reilly Media, Inc.

**Suggested E-Resources:**

1. IBM’s Cognitive AI Class:

https://cognitiveclass.ai

1. MIT’s Open Courseware on Machine Learning:

http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/

1. Scikit Learn Online Documentation:

https://scikitlearn.org/stable/documentation.html

**Evaluation Scheme:**

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| --- | --- | --- | --- |
| **Component** | **Marks** | **Submission/ Examination date** | **Allotment** |
| Assignment I | 10 | 18 January, 2023 | Topics shall be allotted in the class by 2 January 2023 |
| Periodical test I | 10 | 1-4 February, 2023\* | Lecture no. 1 to 21 |
| Assignment II | 10 | 27 February, 2023 | Topics shall be allotted in the class by 13 February, 2023 |
| Periodical test II | 10 | 15-18 March, 2023\* | Lecture no. 22 to 37 |
| Semester Examination | 60 | 16 April- 4 May, 2023\* | Whole syllabus |

\*subject to change.

**Lecture-Wise Schedule:**

| **Lecture**  **Number** | **Topics to be Covered** | **Suggested Readings** |
| --- | --- | --- |
| 1 | Introduction to Artificial Intelligence |  |
| 2 | History of Artificial Intelligence | R1/ R2/R6 |
| 3 | Intelligent Agents: Agents and Environments, Structure of Agents. | R1/ R2/R6 |
| 4–5 | General Problem Solving | R1/ R2/R6 |
| 6–7 | State Space and Graph Model techniques | R1/ R2/R65 |
| 8–11 | Uninformed and Informed (Heuristic) Search | R1/ R2/R6 |
| 12–14 | Aim Oriented Heuristic Algorithms Versus Solution Guaranteed Algorithms | R1/ R2/R6 |
| 15–17 | Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning. | R1/ R2/R6 |
| 18–20 | Knowledge Representation: Propositional Logic | R1/ R2/R6 |
| 21–23 | First Order Predicate Calculus, Inference and Resolution. | R1/ R2/R6 |
| 24–25 | Introduction to Machine Learning and Types, Data Preprocessing, Importance of features in learning, Feature Selection, Feature Extraction Process. | R3/R4/R5 |
| 26–28 | Supervised Learning: Classification and Regression, Regression: Simple, Multiple and Polynomial | R3/R4/R5 |
| 29–33 | Support Vector Machine (Regression and Classification), Decision Tree (Regression and Classification), Naïve Bayes (Classification) | R3/R4/R5 |
| 34–35 | Evaluation of Classification and Regression Models | R3/R4/R5 |
| 36–37 | Unsupervised Learning: Introduction to Clustering, k-Means and Hierarchical Clustering. | R3/R4/R5 |
| 38 | Introduction to Reinforcement Learning | R3/R4/R5 |
| 39 | Upper Confidence Bound | R3/R4/R5 |
| 40 | Thompson Sampling | R3/R4/R5 |
| 41–43 | Validation methods- k-fold Cross Validation, Model Selection and Boosting, XGBoost. | R3/R4/R5 |
| 44–50 | Applications of Machine Learning with Case Studies. | R3/R4/R5/R7 |

**(Dr. Khandakar F. Rahman)**