BANASTHALI VIDYAPITH
Department of Computer Science
Course Handout: B.Tech. (CSE/IT) VI Semester
December 2024 – April/May 2025

Date: 26/12/2024

Course Code: CS 317 **Course Name: Artificial Intelligence and Machine Learning**
Credit Points: 4 **Max. Marks: 100(CA: 40 + ESA: 60)**
Course Instructors:

- Dr. Khandakar F. Rahman, Assistant Professor (Computer Science) B.Tech.(CSE) VI Semester, Batches A & C
- Dr. Kuldeep Kumar Yogi, Assistant Professor (Computer Science) B.Tech.(CSE) VI Semester, Batch B
- Dr. Sneha Asopa, Assistant Professor (Computer Science) B.Tech.(IT) VI Semester

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 Books:

R1. Russell, S. &Norvig, P.(2021). Artificial Intelligence: A Modern Approach, 4th 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-Learning Materials:

1. IBM's Cognitive AI Class:
   https://cognitiveclass.ai
2. MIT's Open Courseware on Machine Learning:
   http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. Scikit Learn Online Documentation:
   https://scikitlearn.org/stable/documentation.html

Assessment Schedule:

Component	Marks	Submission/ Examination Date(s)	Allotment/ Syllabus
Assignment 1[@]	10	27 January, 2025[#]	Topics shall be allotted in the class by 08 January, 2025[#]
Periodical Test 1	10	05-08 February, 2025[*]	Lecture No. 01 to 20
Assignment 2[@]	10	03 March, 2025[#]	Topics shall be allotted in the class by 12 February, 2025[#]
Periodical Test 2	10	21-24 March, 2025[*]	Lecture No. 21 to 37
End-Semester Examination	60	19 April - 05 May, 2025[*]	Lecture No. 01 to 50 (Entire Syllabus)

***** Subject to change, if required. **#** Flexible as per lesson plan.
@ Assignment marks will be based on written document(s)/ any other component(s) as decided by the instructor(s).

Lecture-Wise Schedule:

Lecture Number	Topics to be Covered	Suggested Readings
1	Introduction to Artificial Intelligence	R1/ R2/ R6
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. Sneha Asopa) **(Dr. Kuldeep K. Yogi)** **(Dr. Khandakar F. Rahman)**