# DEPARTMENT OF CSE (Artificial Intelligence & Machine Learning)

## LIST OF COURSES OFFERED FOR MINOR PROGRAM (R23)

| S. No. | Course Code | Course Title | Contact hours/week | | | Credits | Scheme of Valuation | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | CIE | SEE | Total |
| **Theory Courses** | | | | | | | | | |
| 1. | 23AMM1 | Principles of Artificial Intelligence | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | 23AMM2 | Foundations of Machine Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | 23AMM3 | Fundamentals of Deep Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | 23AMM4 | Introduction to Software Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | 23AMM5 | Modern Operating Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6. | 23CSM1 | Fundamentals of Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7. | 23AMM6 | Principles of Artificial Intelligence Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8. | 23AMM7 | Foundations of Machine Learning Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |

B.Tech-CSE(AI&ML) **23AMM1 - Principles of Artificial Intelligence**

| L | T | P | Cr. |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite**: Computer Programming, Data Structures.

**Course Objectives:** The main objectives of the course is to

- The student should be made to study the concepts of Artificial Intelligence.
- The student should be made to learn the methods of solving problems using AI.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, ML.

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Enumerate the history and foundations of Artificial Intelligence. (Understand-L2)
- **CO2:** Apply the basic principles of AI in problem solving. (Apply-L3)
- **CO3:** Choose the appropriate logic concepts. (Apply- L3)
- **CO4:** Choose the appropriate representation of Knowledge. (Apply-L3)
- **CO5:** Understand Expert systems techniques in AI (Understand-L2)

**UNIT – I:**

**Introduction:** Definition of AI, The Foundations of AI, The History of AI, The State of the Art, Agents and Environments: Types of environments, Types of agents, PEAS, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

**UNIT – II:**

**Problem Solving:** Problem-Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Hill Climbing, AO*, CSP, Applications of Artificial Intelligence in real word.

**UNIT – III:**

Game Playing, Optimal decision in games, Adversarial Search Algorithm, Min Max algorithm, Alpha Beta Pruning, Evaluation functions, Decision trees, Bayes' probabilistic interferences.

**UNIT-IV:**

**Knowledge Representation:** Knowledge-Based Agents, Logic.

**Propositional Logic:** A Very Simple Logic, Introduction to Predicate Logic and First Order Logic,

Syntax, Substitution, Unification, Deduction, Soundness, Completeness, Consistency, Satisfiability.

**UNIT-V:**

**Expert Systems:** Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

**Text books:**

1. Stuart Russell and Peter Norvig – Artificial Intelligence A Modern Approach, PEARSON Education.
2. Simon Haykin -Neural Networks PHI.

**Reference books:**

1. N. P. Padhy – Artificial Intelligence and Intelligence Systems, OXFORD publication.
2. B. YagnaNarayana - Artificial Neural Networks, PHI

**E-Reources:**

1. https://www.geeksforgeeks.org/artificial-intelligence/problem-solving-in-artificial-intelligence/
2. https://www.geeksforgeeks.org/artificial-intelligence/propositional-logic-in-artificial-intelligence/

**B.Tech-CSE(AI&ML)** **23AMM2 - Foundations of Machine Learning**

| L | T | P | Cr. |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite**: Probability and Statistics, Data Warehousing and Data Mining

**Course Objectives:**

- Understand the fundamental concepts, models, and algorithms in Machine Learning.
- Learn to apply core ML techniques to solve real-world problems using modern software tools.
- Develop the ability to independently explore, implement, and evaluate machine learning models.
- Gain experience through research-oriented tasks and hands-on practice with recent ML frameworks.

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Identify the characteristics of machine learning. (Understand- L2)
- **CO2:** Understand the Model building and evaluation approaches (Understand- L2)
- **CO3:** Apply regression algorithms for real-world Problems. (Apply- L3)
- **CO4:** Handle classification problems via supervised learning algorithms. (Apply- L3)
- **CO5:** Learn advanced learning techniques to deal with complex data (Apply- L3)

**UNIT – I: Introduction to Machine Learning and Preparing to Model**

Introduction to Machine Learning - Introduction, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Preparing to Model- Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

**UNIT – II: Modelling & Evaluation, Basics of Feature Engineering**

Modelling & Evaluation- Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability.

Evaluating Performance of a Model. Basics of Feature Engineering- Introduction.

Feature Transformation – Feature Construction, Feature Extraction, Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Linear Discriminant Analysis (LDA), Feature Subset Selection.

**UNIT – III: Regression**

Introduction to regression analysis, Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the linear regression model, Polynomial Regression Model, Logistic Regression, Regularization, Regularized

Linear Regression, Regularized Logistic Regression.

**UNIT-IV: Supervised Learning: Classification**

Classification- Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps. Common Classification Algorithms - k-Nearest Neighbour (kNN), Support vector Machines (SVM), Random Forest model.

**UNIT-V: Other Types of Learning**

Ensemble Learning- Bagging, Boosting, Stacking and its impact on bias and variance, AdaBoost,Gradient Boosting Machines, XGBoost.

**Reinforcement Learning -** Introduction, Q Learning.

**Text books:**

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition,2015.
2. Tom M. Mitchell, "Machine Learning', MGH, 1997.

**Reference books:**

1. Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge.
2. Peter Harington, "Machine Learning in Action" , Cengage, 1st edition, 2012.
3. Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge university press,2012.
4. Jason Brownlee, "Machine Learning Mastery with Python Understand Your Data, Create
5. Accurate Models and Work Projects End-To-End", Edition: v1.4, 2011.

**E-Reources:**

1. https://www.datacamp.com/blog/what-is-machine-learning
2. https://www.tutorialspoint.com/machine_learning/machine_learning_regression_analysis.htm

B.Tech-CSE(AI&ML) **23AMM3 - Fundamentals of Deep Learning**

| L | T | P | Cr. |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite**: Probability and Statistics, Programming Knowledge

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Computer operating system structure and functioning, understand how Operating Systems
- evolved with advent of computer architecture, and comprehend the different CPU scheduling
- algorithms, page replacement algorithms, disk scheduling and identify best one.

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Apply the fundamentals of linear algebra to machine learning algorithms. (Apply-L3)
- **CO2:** Understand the fundamental building blocks of deep learning (Understand- L2)
- **CO3:** Apply the concepts of Convolutional Neural Networks to computer vision applications. (Apply- L3)
- **CO4:** Apply the concepts of Recurrent Neural Networks to Natural Language Processing. (Apply- L3)
- **CO5:** Apply the regularization techniques to improve the model performance. (Apply- L3)

**UNIT – I: Mathematical foundations of Deep Learning**

Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear dependence and span, Norms, Special kinds of matrices and vectors, Trace operations, Eigen value decomposition

**UNIT – II: Fundamentals of Deep Learning**

Anatomy of Neural Networks: Layers, Models, Loss functions and optimizers, Training Deep Networks: Cost Functions, Optimizers, Types of Deep Neural Networks

**UNIT – III: Convolutional Neural Networks**

Motivation, Convolution Operation, Types of layers, Pooling, LENET5 Architecture

**UNIT-IV: Recurrent Neural Networks**

Architecture of traditional RNN, Types and applications of RNN, Variants of RNNs, Word Embedding using Word2vec

**UNIT-V: Regularization and Autoencoders**

Regularization for Deep Learning: L1 and L2, Dropout, Data Augmentation, Early Stopping, Case study on MNIST data Autoencoders: Architecture, Implementation, Denoising Autoencoders, Sparse Autoencoders, Use cases.

**Text books:**

1. Deep Learning, Ian Goodfellow, YoshuaBengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python, Francois Chollet, Manning Publications, Released December 2017.
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence – Jon Krohn, Grant Beyleveld, AglaéBassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

**Reference books:**

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-HillEducation, 2004.

**E-resources:**

Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc22cs22/previewB.Tech.(Artificial Intelligence and Data Science

| B.Tech-CSE(AI&ML) | 23AMM4 Introduction to Software Engineering | L | T | P | Cr. |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-requisite**: Object Oriented Programming

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Understand various software process models and learn to select an appropriate model based on project requirements.
- Learn to gather, analyze, and document client requirements and translate them into well-defined software specifications.
- Design software architectures using modular approaches, focusing on effective use of components and interfaces.
- Apply different software testing techniques—including unit, integration, and functional testing—to ensure software quality and reliability.

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Understand the fundamentals of software engineering concepts and software process models. (Understand-L2)
- **CO2:** Apply the requirement elicitation techniques for preparing SRS and design engineering. (Apply-L3)
- **CO3:** Understanding the basic building blocks of UML, Class and object diagrams. (Understand-L2)
- **CO4:** Apply the behavioral models for real world applications. (Apply-L3)
- **CO5:** Demonstrate different software testing approaches for testing the real time

**UNIT – I:**

**Software and software Engineering:** The evolving role of Software, Characteristics of Software, Importance of software Engineering, Changing nature of software, Legacy Software, Software Myths.
**Software Process and Process Models:** Layered technology, Process frame work, The process and Product, software process models, the water fall model, incremental model, the spiral and V Model, Component based s/w development, Unified process model.

**UNIT – II:**

**Requirements Analysis and Software design:** Requirements gathering and analysis, software requirements specifications (SRS).
**Design Engineering:** overview of design process, Design Concepts, Architectural Concepts.

**UNIT – III:**

**Design Using UML:** Building Blocks of UML, Defining things, relationships and diagrams, Common Mechanism in UML, Class and Object Diagrams

**UNIT – IV:**

**Behavioral Modeling:** Interactions, Interaction diagrams, use cases, Use case Diagrams, Activity Diagrams, Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams.

**UNIT – V:**

**Testing Techniques:** Software testing fundamentals, Unit testing, Integration testing, Black box testing, white box testing, Debugging, System testing

**Text books:**

1. Roger S. Pressman, "Software engineering- A practitioner „s Approach", TMH International Edition, 6th edition, 2005.
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modelling Language User Guide", PEARSON ,4th Impression, 2012.

**Reference books:**

1. Software Engineering - Concepts and practices: Ugrasen Suman, Cengage learning
2. Object-oriented analysis and design using UML", Mahesh P. Matha, PHI
3. Fundamentals of Software Engineering, Rajib Mall, Third Edition ,PHI

**E-resources:**

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview [1,2,3,4,

B.Tech-CSE(AI&ML) **23AMM5 - Modern Operating Systems**

| L | T | P | Cr. |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite**: Knowledge of Computer fundamentals & Data structures

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Understand the basic structure, components, and functioning of modern computer operating systems.
- Analyze the evolution of operating systems in relation to advancements in computer architecture.
- Learn and compare various CPU scheduling, page replacement, and disk scheduling algorithms.
- Identify and evaluate the most suitable algorithms for different system scenarios based on performance metrics.

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Demonstrate the underlying principles and techniques of operating system. (Understand-L2)
- **CO2:** Interpret scheduling and communication methods of processes handled by operating systems. (Understand-L2).
- **CO3:** Distinguish the process synchronization methods and deadlock handling approaches employed in operating systems. (Understand-L2).
- **CO4:** Classify memory management techniques and virtual memory mechanisms. (Understand-L2).
- **CO5:** Interpret the strategies of disk scheduling algorithms and file system architecture. (Understand-L2).

**UNIT – I: Introduction to Operating System**

**Operating System Structures:** Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation, System Boot.

**UNIT – II: Process Management**

**Processes:** Process concept, Inter-process Communication, Communication in Client-Server Systems. **Threads:** Overview, Multithreading Models Process Scheduling: Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, PRIORITY, ROUNDROBIN)

**UNIT – III: Synchronization and Deadlocks**

**Synchronization:** The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

**Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock

Prevention. Deadlock Avoidance, Deadlock Detection, Recovery from deadlock.

**UNIT-IV: Memory Management**

**Memory Management Strategies:** Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

**Virtual Memory Management:** Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

**UNIT-V: File System Management**

**Mass-Storage Structure:** Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management.

**Implementing File System:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery.

**Text books:**

1. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007.

**Reference books:**

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, "Unix and shell Programming", Thomson, First Edition, New Delhi, 2003.

**E-resources:**

1. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html
2. https://swayam.gov.in/nd1_noc19_cs50/preview

**B.Tech-CSE(AI&ML)** **23CSM1 - Fundamentals of Data Structures**

| L | T | P | Cr. |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite**: Basic Programming Knowledge

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Understand the core concepts and operations of essential data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
- Develop the ability to choose appropriate data structures for solving specific computational problems.
- Enhance problem-solving skills through algorithmic thinking and structured programming approaches.
- Analyze the time and space complexity of algorithms to evaluate their efficiency and performance.\

**Course Outcomes:** At the end of the course student will be able to

- **CO1:** Understand and apply basic data structures like arrays, linked lists, stacks, and queues. (Apply - L3)
- **CO2:** Implement and analyze tree and graph data structures for hierarchical and networked data representation. (Apply- L3)
- **CO3:** Design efficient sorting, searching, and hashing algorithms to optimize performance. (Apply - L3)
- **CO4:** Evaluate the efficiency of algorithms using complexity analysis techniques. (Evaluate- L5)
- **CO5:** Apply data structures in real-world applications such as database indexing, memory management, and AI-based systems. (Apply - L3)

**UNIT – I: Introduction to Data Structures and Algorithm Analysis**

Definition and classification of data structures, abstract data types (ADTs), complexity analysis, Big-O notation, arrays, strings, and dynamic memory allocation.

**UNIT – II: Linked Lists and Their Applications**

Singly linked lists, doubly linked lists, circular linked lists, skip lists, and their applications in memory management and database indexing.

**UNIT – III: Stacks, Queues, and Their Uses**

Stack operations, queue operations, circular queue, priority queue, deque, recursion, function calls, job scheduling, and buffering techniques.

**UNIT-IV: Trees and Graphs**

Binary trees, binary search trees (BST), tree traversals, AVL trees, B-trees, graph representation, BFS, DFS, shortest path algorithms, and applications in networking and social networks.

**UNIT-V: Sorting, Searching, and Hashing**

Sorting algorithms - Bubble sort, selection sort, insertion sort, merge sort, quick sort, searching techniques - linear search, binary search, hashing techniques, and their applications in databases and cybersecurity.

**Text books:**

1. E. Horowitz, S. Sahni, and S. Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press.
2. Y. Langsam, M. J. Augenstein, and A. M. Tenenbaum, "Data Structures Using C and C++", 2nd Edition, Pearson Education.
3. R. F. Gilberg and B. A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Cengage Learning.

**Reference books:**

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press.
3. Robert Sedgewick and Kevin Wayne, "Algorithms", 4th Edition, Addison-Wesley.
4. Narasimha Karumanchi, "Data Structures and Algorithmic Thinking with Python/C/C++/Java", CareerMonk Publications.

**E-resources:**

1. https://www.scholarhat.com/tutorial/datastructures/abstract-data-type
2. https://www.tutorialspoint.com/data_structures_algorithms/tree_data_structure.htm
3. https://www.tutorialspoint.com/data_structures_algorithms/graph_data_structure.htm

**B.Tech-CSE(AI&ML)** **23AMM6 Principles of Artificial Intelligence Lab**

| L | T | P | Cr. |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**Pre-requisite**: Python

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Understand the core concepts and algorithms of Artificial Intelligence through practical implementation.
- Learn to design and develop intelligent systems using techniques such as search algorithms, logic programming, and machine learning.
- Analyze real-world problems and apply suitable AI techniques to develop effective solutions.
- Develop the ability to work on AI-based projects using programming tools like Python, Prolog, or AI frameworks.

**Course Outcomes:** At the end of the course student will be able to

- CO1: Apply the basic principles of AI in problem solving using LISP/PROLOG. (Apply – L3)
- CO2: Implement different algorithms using LISP/PROLOG.(Apply – L3)
- CO3: Develop an Expert System using JESS/PROLOG(Apply – L3)
- CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

**Experiments:**

1. Developing agent programs for real world problems.
2. Implementation of Constraint satisfaction problems.
3. Implementation of DFS for water jug problem using LISP/PROLOG.
4. Implementation of A* for chess game problem using LISP/PROLOG.
5. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java.
6. Implementation of TSP using heuristic approach using Java/LISP/Prolog .
7. Implementation of Simulated Annealing Algorithm using LISP/PROLOG.
8. Implementation of Hill-climbing to solve 8- Puzzle Problem.
9. Implementation of Monkey Banana Problem using LISP/PROLOG.
10. Implementation of minimax algorithm for an application.
11. Implementation of unification and resolution for real world problems.
12. Implementation of knowledge representation schemes - use cases.

**Text books:**

1. Stuart Russell and Peter Norvig – Artificial Intelligence A Modern Approach, PEARSON Education.
2. Simon Haykin -Neural Networks PHI.

**Reference books:**

1. N. P. Padhy – Artificial Intelligence and Intelligence Systems, OXFORD publication.
2. B. YagnaNarayana - Artificial Neural Networks, PHI

**E-resources:**

1.https://studyglance.in/labprograms/aidisplay.php?url1=ai/week5.pl&url2=&url3=&url4=&title=Write%20a%20program%20in%20prolog%20to%20solve%208%20Puzzle%20problems&opurl1=ai/outputs/w5.txt&opurl2=&opurl3=&opurl4=

2. https://studyglance.in/labprograms/aidisplay.php?url1=ai/week3.pl&url2=&url3=&url4=&title=Write%20a%20program%20in%20prolog%20to%20solve%20Monkey%20banana%20problem&opurl1=ai/outputs/w3.txt&opurl2=&opurl3=&opurl4=

| B.Tech-CSE(AI&ML) | 23AMM7 - Foundations of Machine Learning Lab | L | T | P | Cr. |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**Pre-requisite**: Python

**Course Objectives:** The objective of the course is to provide basic knowledge of

- Understand and implement core machine learning algorithms using appropriate programming languages.
- Apply machine learning techniques to real-world datasets for classification, regression, and clustering tasks.
- Analyze model performance using evaluation metrics and improve results through parameter tuning.
- Develop hands-on experience in using ML libraries and tools such as Scikit-learn, TensorFlow, or PyTorch.

**Course Outcomes:** At the end of the course student will be able to

- CO1: Apply the appropriate pre-processing techniques on data set. (Apply – L3)
- CO2: Implement supervised Machine Learning algorithms. (Apply – L3)
- CO3: Implement advanced Machine Learning algorithms (Apply – L3)
- CO4: Improve individual / teamwork skills, communication & report writing skills with
- ethical values.

**Experiments:**

1. Basic statistical functions for data exploration
2. Data Visualization: Box plot, scatter plot, histogram
3. Data Pre-processing: Handling missing values, outliers, normalization, Scaling
4. Principal Component Analysis (PCA)
5. Singular Value Decomposition (SVD)
6. Linear Discriminant Analysis (LDA)
7. Regression Analysis: Linear regression, Logistic regression, Polynomial regression
8. Regularized Regression
9. K-Nearest Neighbour (kNN) Classifier
10. Support Vector Machines (SVMs)
11. Random Forest model
12. AdaBoost Classifier and XGBoost

**Text books:**

1. "Introduction to Machine Learning," 4th Edition by Ethem Alpaydin
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow," 3rd Edition by

Aurélien Géron

**Reference books:**

1. "XGBoost: A Scalable Tree Boosting System" (Tianqi Chen & Carlos Guestrin, 2016)

**E-resources:**

1. https://www.geeksforgeeks.org/machine-learning/k-nearest-neighbours/
2. https://medium.com/@pingsubhak/boosting-adaboost-gradient-boost-and-xgboost-bdda87eed44e