VI Semester

MACHINE LEARNING			
Course Code	21AI63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Define machine learning and understand the basic theory underlying machine learning.
CLO 2. Differentiate supervised, unsupervised and reinforcement learning
CLO 3. Understand the basic concepts of learning and decision trees.
CLO 4. Understand Bayesian techniques for problems appear in machine learning
CLO 5. Perform statistical analysis of machine learning techniques.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction:
Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML

Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS- Inductive bias.

Text book 2: Chapter 1, Text book 1:Chapter 1 and 2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

End to end Machine learning Project: Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model.

Classification : MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification

Text book 2: Chapter 2, Chapter 3

Teaching-Learning	Chalk and board, Active Learning

Process	
Module-3	
Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression **Support Vector Machine:** linear, Nonlinear , SVM regression and under the hood **Text book 2**: **Chapter 4, Chapter 5**	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability **Ensemble learning and Random Forest**: Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking **Text book 2: Chapter 6, Chapter 7**	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example-Bayesian Belief Network – EM Algorithm **Text book 1: Chapter 6**	
Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

At the end of the course the student will be able to:

- CO 1. Understand the concept of Machine Learning and Concept Learning.
- CO 2. Apply the concept of ML and various classification methods in a project.
- CO 3. Analyse various training models in ML and the SVM algorithm to be implemented.
- CO 4. Apply the ML concept in a decision tree structure and implementation of Ensemble learning and Random Forest.
- CO 5. Apply Bayes techniques and explore more about the classification in ML.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(To have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Textbooks

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors Pvt. Ltd 2019

Reference:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 2019
4. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/playlist?list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
2. https://nptel.ac.in/courses/106/106/106106139/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning