Semester: 7

Type of Course: B.Tech

Prerequisite: Familiarity with programming in Python, Linear Algebra, Probability and Statistics.

Rationale: The objective of the course is to introduce the students with concepts of machine learning, machine learning algorithms and building the applications using machine leaning for various domains.

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
L	T	P		Theory E	Practical V	Theory M	*C.E	Practical P.A	
3	0	0	3	60	0	20	20	0	100

L- Lectures; **T-** Tutorial/Teacher Guided Student Activity; **P-** Practical; **E** - End Semester Theory Exam; **V -** End Semester Viva Exam; **M –** Mid Semester Exam; **P.A.-** Progressive Assessment;

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Introduction to Machine Learning:** Overview of Human Learning and Machine Learning, Types of Learning, Applicationsof Machine Learning, Tools and Technology for Machine Learning.	10	**05**
2	**Overview of Probability:** Statistical tools in Machine Learning, Concepts of probability, Random variables, Discrete distributions, Continuous distributions, Multiple random variables, Central limit theorem, Sampling distributions, Hypothesis space and inductive bias, Evaluation and Cross Validation, Hypothesis testing, Monte Carlo Approximation	10	**05**
3	**Bayesian Concept Learning:** Impotence of Bayesian methods, Bayesian theorem, Bayes' theorem and concept learning, Bayesian Belief Network	10	**04**
4	**Classification and Regression:** Supervised Learning vs Unsupervised Learning, Supervised Learning, Classification Model, Learning steps, Classification algorithms, Clustering, Association rules, Linear Regression, Multivariate Regression, Logistic Regression	25	**10**
5	**Neural Networks**-Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation,Parameter Estimation - MLE, MAP, Bayesian Estimation	15	**06**
6	**Foundations of neural networks and deep learning, Techniques to improve neural networks:** Regularization and optimizations, hyperparameter tuning and deep learning frameworks (Tensorflow and Keras.), Convolutional Neural Networks, its applications, Recurrent Neural Networks and its applications	**20**	**07**

7	Generative Adversarial Networks, Deep Reinforcement Learning, Adversarial Attacks	10	**05**

***C.E-Continuous Evaluation:** It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc

Suggested books:

1) Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2) Pattern Recognition and Machine Learning, by Christopher Bishop
3) The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)

Suggested reference books:

1) Machine Learning with Python for Everyone, Mark E. Fenner, Pearson
2) Deep Learning: Methods and Applications, Li Deng and Dong Yu
3) Neural Networks and Deep Learning, Michael Nielsen
4) Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
5) Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
6) Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing
7) Machine Learning, Mitchell T, McGraw-Hill, 1997
8) A first course in Machine Learning, S. Rogers and M. Girolami, CRC Press, 2011
9) Pattern Classification, Duda, Hart and Stork, Wiley-Interscience.

Online Learning Resources

1. Andrew Ng,"Machine Learning",Stanford University https://www.coursera.org/learn/machine-learning/home/info
2. Sudeshna Sarkar, "Introduction to Machine Learning", IIT Kharagpur. https://nptel.ac.in/courses/106105152/1
3. Prof. BalaramanRavindran,"Introduction to Machine Learning", IIT Madras.https://nptel.ac.in/courses/106106139/1
4. https://www.geeksforgeeks.org/machine-learning/
5. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
6. http://neuralnetworksanddeeplearning.com/

Course Outcome:

After successful completion of this course, students will be able to

1. Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms
3. Evaluate the various Supervised and Unsupervised Learning algorithms using appropriate Dataset.
4. Design and evaluate Deep learning Algorithms
5. Design and implement various machine learning algorithms in a range of real-world applications.